STUDY OF SOIL CONSERVATION PROGRAMME FOR AGRICULTURAL LAND

PROGRAMME EVALUATION
ORGANISATION,
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PREFACE

Soil conservation is the only land improvement measure applicable to the vast un-irrigated areas particularly in the drier parts of India. The techniques and methods of conservation have been devised in the country comparatively recently and are in need of further development to suit local and regional conditions. While a national programme for soil conservation was conceived and initiated in the First Plan, it was only towards the later part of the Second Plan that the programme got sufficiently organised. In the Third Five-Year Plan, it has been taken up on a larger scale with a target more than five times that in the Second Plan. There has also been a very large increase in the programme for dry farming.

The soil conservation programme includes a large number of schemes of different types and for different areas. The agencies of the Government involved in the formulation and execution of these schemes are also quite a few. A comprehensive evaluation of the programme had not been conducted in the past. The Planning Commission, therefore, felt that a study of this programme as far as it relates to agricultural land would be both timely and useful. The Programme Evaluation Organisation accordingly conducted in 1961-62 a study of the problems and difficulties faced in the formulation, administration and extension of this programme at different levels, legislative, promotional and organisational support devised for it, the general impact of the programme and its acceptance by the cultivators. The findings of this study are presented in this volume along with suggestions for improvement, and indication of areas for further study.

Soil conservation is one of the more difficult programmes not only to demonstrate and execute but also to evaluate. The P. E. O. has, therefore, approached this assignment with caution. Technical and other help had to be sought from various sources and has been offered generously. Special mention deserves to be made of the cooperation and help received from the Soil Conservation Wing and the Deputy Adviser on Soil Conservation of the Agriculture Department of the Ministry of Food and Agriculture. The assistance extended by the officers of the State Governments at different levels and the cooperation received from the respondent farmers have made the study possible. All the help received from these and other sources is gratefully acknowledged.

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CHAPTER I
INTRODUCTION AND METHODOLOGY

Meaning and Importance of Soil Conservation

1.1. Together with moisture, soil provides the physical base of agricultural production. Quantity, quality and frequency of economic output from any piece of land are conditioned in a large measure by the nature and characteristics of the soil in its upper layer, a suitable depth of which takes about a hundred years or more for its natural formation. The loss of this valuable top soil results in a deterioration of the quality of land so much so that its use pattern has to undergo a complete change for the poorer. The loss of the top soil is a slow, gradual process which can, however, be accelerated by injudicious or ignorant human action in the form of neglectful or faulty methods of husbandry that tend to interfere with the cyclical process of nature and, in particular, accentuate the destructive part of it. During the period that the top soil is being removed or lost, the affected land suffers from a regular process of depletion of fertility, which it is possible to replenish with appropriate anti-erosion measures and conservation farming practices. Soil conservation in its broad sense, thus, means adoption of measures not only for protecting lands from the process of fertility depletion but also for saving them from deterioration in quality. It does not, however, mean complete stoppage of all exploitation and use of lands, but the regulation of use in a manner which is most economical from the point of view of the individual and the society over time. Soil conservation constitutes a part—an important part —of the wider issue of conservation of natural resources.

1.2. The historical and archaeological evidences show that the land resources are exhaustible and nations that have not taken care of their lands have had to face extinction. Quantitative data to show the magnitude of the deterioration of land and depletion of fertility that have taken place in the past are not available. There are, however, one or two broad estimates to show the gravity of this menace in India. A survey in an area in the Chota Nagpur region of Bihar which is subject to erosion showed that during about 45 years since the beginning of this century, approximately 17 per cent of the surveyed area have been lost to cultivation through gully erosion[1]. This gives a measure of the rate of deterioration in the quality of land. It is estimated that in the Sholapur district of Maharashtra State, 17% of land of medium depth (more than 18 inches) deteriorated into shallower soils (less than 18 inches) in the 75 years from 1870 to 1945[2]. This shows the extent of sheet erosion which results in depletion of fertility. On the Dry Farming Station at Sholapur, it was observed that on deep soil, the grain yield of Jowar was 242 lbs. per acre while it was 169 lbs. in medium soil and only 69 lbs. in light soil (less than 9″ depth).

Social and economic issues involved in soil conservation[3]

1.3. Individual cultivators are prone to be shortsighted in exploiting land as they care more for immediate gain than for future consequences. This shortsightedness creates a wide divergence and

even a conflict between the present and the future needs of the people. The poorer the cultivators, greater is likely to be their desire for immediate increase in income from land, and in consequence they may discount the future income much more than the richer cultivators. Under these circumstances, deterioration of land and depletion of fertility become matters of concern to the society much more than to the individual. If the cultivators are made sufficiently conscious of the dangers of soil erosion and are convinced of the higher income from land-use in future, both the society and the individuals can participate in a well-devised scheme of investment on soil conservation measures. The ability of the individual cultivators to pay a part of the cost of soil conservation measures depends upon the period of maturity of the economic gains from these measures and his resource position for the adoption of soil conservation treatment and farming practices. From the point of view of the individual cultivator, the crucial problems are his time-preference between the present and the future, as conditioned by natural risks and price uncertainties in future. The present value of future income would be smaller, the more distant is the expectation of this income, and the higher the rate of discount. The State can play an important role in reducing the period required for realising future increment in income by introducing suitable conservation farming measures for early increase in net return from land. For the successful adoption of conservation farming practices, the State should be able to assume responsibility for guaranteeing price maintenance at desired levels, extension services will have to be strengthened and resources and credit will have to be provided to the cultivators in required magnitude. It is in these ways that the uncertainty about the future and the rate of discounting of future income may be kept at a level low enough to enable soil conservation treatment and conservation farming practices to be taken up as economic measures.

Objective of Soil Conservation

1.4. The objective of soil conservation can be briefly stated as the adoption of long-lasting as well as recurring measures with a view to preventing the ultimate deterioration of land and providing for its exploitation and use in a manner designed to reduce the loss of soil and conserve fertility to the point most economical in the interests of the society as well as the individual. The aim is to regulate the present use of land as to result in a progressive rise in its productivity and to preserve and enhance its quality for the posterity. The method of achieving this objective is, in simple but scientific words, to use each piece of land according to its capability and treat it according to its needs.

1.5. In this approach to soil conservation, land use and management, whether for agriculture or for forestry, form part of an integrated and comprehensive plan, the aim of which is to equate use with capability and treatment with need. For each particular type of use, an ideal picture of the soil, moisture and other requirements of land is built up, and treatments and practices evolved in this direction. Thus for agricultural (arable) lands, the characteristics of 'ideal soil' have been described as follows :

1. An adequate rooting zone so that roots can range over a large volume of soil for water and nutrients;

2. Good tilth for root extension, water penetration and air movement;
3. Adequate water in the soil, as supplied and stored from rain or irrigation, and without excess that excludes air;
4. Surface protection from soil blowing, erosion or excessive run off;
5. A balanced supply of plant nutrients in relation to other growth factors and specific plant requirements;
6. Freedom from harmful pests and weeds that harbour in the soil and
7. Freedom from excess of salts and from harmful acidity or alkalinity.'

Any attempt to build up and maintain soil so that it may have as much of the above characteristics as possible, will require improvements in practices, management and husbandry in a number of directions and over a period of time. Soil conservation is, a package programme, unlike improved practices of a single demonstrable type, all items of which, to the extent they are necessary, are together essential for obtaining a sustained increase in agricultural production and achieving the long-term objective. The range of measures includes treatments like bunding, gully plugging, grassing of waterways and spillways, as well as methods of husbandry like contour cultivation, strip-cropping, suitable rotations and cultural practices. In its logical sense, it implies the adoption of the conservation farming system. Theoretically, this can be interpreted as the most desirable system of farming and land management. Because soil conservation is such a comprehensive programme, it has, however, certain disadvantages in the matter of extension. Since a number of items are involved, the benefits of each or of the whole are difficult to demonstrate.

Land Use Planning and Soil Conservation

1.6. It is not, however, possible for any country or nation to adopt conservation methods and farming practices on an ideal scale. The reality is always one of compromises worked out in the light of availability of resources to the nation and to the cultivators, attitudes of cultivators toward the taking of risks and bearing of uncertainty, the structure and the dynamics of the pricing system including interest rates etc. It is these variables that determine the level of soil conservation that a country can afford, and for which land use planning is feasible. In scientific land use planning, the potential use of land is ascertained, and its optimum use determined. In the special report published by the U.S. Government entitled *Land classification in the United States,* five types of land classification are enumerated in terms of (i) inherent characteristics, (ii) present use, (iii) use capabilities, (iv) recommended use and (v) programme effectuation. The inherent characteristics of land given to it by nature are determined by the soil, the slopes, the mineral and other surface and sub-surface features. The second type of land classification is concerned with the present uses of land. Major land uses such as agriculture, forestry, recreation, settlement, transportation including economic, social and political features of the area are classified. Thirdly land is classified in terms

of its capability for use. In this type of classification, areas are demarcated according to productivity as measured broadly in terms of expected yields of crops. There are four grades ranging from 'most productive' to 'least productive'. Another classification takes into consideration the recommended use on the basis of the inherent characteristics of each body of land, its present use and capability in terms of each use to which it might be put. It is possible that one or more possible uses may exist for the same body of land. Finally, the land classification activities in the U.S. also take into account possibilities of programme effectuation. In this approach, lands are classified to show when and how each body of land would come under the recommended land-use pattern.

1.7. Because of the importance of water for tree and crop growth, live stock use, human consumption, power generation, navigation and sanitation, and equally because of its destructive power in floods and as an agency of erosion, river basin is generally considered the most logical unit for land classification, planning and development. Such a unit makes it possible to show the value of forests on head-water lands as a means of absorbing water and regulating the flow in streams so as to reduce the danger of floods and erosion. In any case, even if a whole river basin may not be made the unit in all cases because of the vast area to be covered, smaller catchment basins are almost invariably used as the unit for all operational purposes. It is against this brief background of the nature of soil conservation and the systems and the unit used for land classification that an attempt will now be made to present a short historical account of the problem of soil conservation as it has come to be recognized in India.

Awareness of the Erosion and Conservation Problem in India

1.8. The Royal Commission on Agriculture (1928) recognised soil erosion as a problem of "special importance in the sub-mountain districts of Northern India generally and particularly in the United Provinces and Western Bengal where extensive areas on the banks of large rivers such as the Jamuna and the Chambal have lost all agricultural value by the formation of the net work of ravines" The report notes that "the action of the Monsoon rains on the sloping hill sides in upland tracts in peninsular India and more especially in the Southern districts of the Bombay Presidency and in Chhota Nagpur produce the same results (of soil erosion) though not in such a striking degree (as the formation of ravines in Northern India). The Report also takes note of the work done in some parts of the country. "In the United Provinces the main remedy for soil erosion has been sought in the afforestation of the ravine tracts. In Bombay, the measures adopted to prevent soil erosion are terracing of land and the construction of earth and stone embankments (*tals*)". The Royal Commission recommended that "it is desirable that the exact extent of the evil should be investigated and that on the scale on which erosion is proceeding is found to justify such a course, schemes for preventing it should be prepared".

1.9. Dealing with the problem of water logging and the formation of alkali lands, the Royal Commission noted that "it would appear that many of the problems which have arisen in the irrigated

tracts of India in regard to waterlogging and the formation of alkali lands have been due to failure properly to correlate a new irrigation system with the natural drainage of the tract". The Commission therefore, recommended preparation of drainage maps to give an insight into agricultural problems. ".....once such maps have been constructed, it will be easy to control all such undertakings as the construction of roads, railways, canals and embankments and to see that nothing interferes with crop production.[5]

1.10. The Famine Enquiry Commission (1945) did not deal with this question in detail, but recognised the fact that the large-scale experiments conducted in Bombay had produced results sufficiently satisfactory to warrant contour bunding on larger scale.[6]

Conservation Measures and Legislation in Early Years

1.11. One of the first enactments for the prevention of soil deterioration was passed in 1900 in the Punjab as the Land Preservation Act. It provided for such measures as *wat bandi,* contour trenching, gully plugging, terracing, tree planting, preservation of forests etc., for preventing the havoc caused by *cho* (mountain stream) torrents.

1.12. In Bombay, soil conservation work started in 1939 when the scheme for bunding and dry farming survey and development was sanctioned. The work was further strengthened in 1942 when the Land Improvement Schemes Act was passed and the Cusrow Wadia Fund created with a view to subsidizing the bunding work. A similar Act was passed in Madras in 1949 for contour bunding and trenching. The former Hyderabad State also started anti-erosion and soil conservation measures such as contour trenching, gully plugging and bunding etc. In U.P., soil conservation measures were started as early as 1884, when ravines and waste lands were taken over from *zamindars* for the purpose of control of erosion and creation of fuel and fodder reserves. Till 1950, however, it was only in the Maharashtra area of the erstwhile Bombay State (Province) that pioneering work was done on a considerable scale not only to study the problems of erosion and methods of conservation but also to extend conservation measures on the agricultural land of cultivators.

Nature and Extent of the Soil Conservation Problem in India

1.13. The awareness of the devastation caused by erosion and the steps taken to combat it were far from extensive till the beginning of the fifties. In fact, the approach in the earlier years was one of anti-erosion measures. It was only in the experiments and demonstrations conducted in Bombay in the forties that the more positive and comprehensive approach inherent in soil conservation was first adopted. It is for this reason that we have a slightly better idea of the extent of the problem of soil erosion than of the need for soil conservation in the country. The nature of the latter problem can be broadly assessed by an analysis of the land use position in the country. This is briefly attempted in this section with the help of data for the period of the fifties.

Land Use in India

1.14. The data on land use provide a clue to the prevalent imbalance in the utilization of land and the adjustments necessary to ensure a balanced utilization. Broadly speaking, the pattern of the land utilization in a country or a region is partly the result of mutual interaction of the demands for food, fodder, forest produce, fuel and raw materials for industries, and partly the result of the limitations imposed by natural factors. Statistics of the ninefold classification of land used in India are given below in Table 1.1 for 1951-52, 1955-56 and 1958-59.

TABLE 1.1

Land Use Statistics of India, 1951-52 To 1958-59

Categories	1951-52	1955-56	1958-59 (Provisional)
	(Million hectares, Million acres in brackets)		
Geographical area (Survey of India)	326.3 (806.3)	326.3 (806.3)	326.3 (806.3)
Reporting area	287.8 (711.2)	291.2 (719.6)	293.0 (724.1)
	Percent of reporting area		
1. Forests	17.0	17.4	17.7
2. Land put to non-agriculture uses	4.4	4.5	4.6
3. Barren and uncultivable land	13.0	11.9	11.3
4. Culturable waste	8.3	7.6	7.0
5. Permanent pastures and other grazing lands	3.0	4.0	4.7
6. Land under misc. tree crops and groves	2.7	1.9	2.0
7. Fallow lands other than current fallows	5.3	4.3	4.1
8. Current fallows	4.8	4.2	4.1
9. Net sown area	41.5	44.2	44.7

The 'barren and uncultivable land' and 'land put to non-agricultural use' were, in earlier classification, grouped together as 'land not available for cultivation'. Similarly, 'culturable waste', 'permanent pastures and other grazing lands' and 'land under miscellaneous tree crops and groves' were lumped together as 'other uncultivated lands excluding fallow lands'. The category 'culturable waste' is defined to include all lands available for cultivation but not taken up for cultivation or abandoned after a few years for one reason or the other. Such lands may be fallow for more than five years and may be covered with shrubs and jungles. They may be assessed or unassessed and may lie in isolated patches or blocks or within cultivated holdings. Fallows of one year are classified as 'current fallows', while those remaining so for 2 to 5 years are classed as 'fallows other than current fallows'.

1.15. In interpreting the data in Table 1.1, a good deal of caution has to be exercised in view of the nature of the statistics. The classification of lands into cultivable waste, pastures, and land

under miscellaneous tree crops and groves was made at the time of the survey and settlement operations which in most areas had been conducted some decades back. Changes in the use, class of land subsequent to the survey and settlement operations have not been incorporated in the records generally. The Waste Land Survey and Reclamation Committee noted during its enquiry that lands which had been classified as 'culturable waste' at the time of the settlement some years ago still continued to be shown as such in the revenue records, even though these could not be made culturable even after incurring a reasonable level of expenditure. On the other hand, some lands though culturable are shown as barren and unculturable or pasture lands. In some other cases, the pasture lands have been included in the category of 'culturable waste'. The category 'other uncultivated lands excluding fallows' is treated as a sort of residual class in which are included all lands not accounted for and any other class.'

1.16. With these qualifications in mind, an attempt may be made to highlight some of the more glaring of the imbalances in our land use. The forest area increased from 17% of the reporting area to 17.7% in eight years from 1951-52 to 1958-59. According to the forest policy resolution of 1952, India as a whole should aim at maintaining one-third of its total area under forests. "As an insurance against denudation, a much larger percentage of the land, about 60% should be kept under forests for their protective functions in the Himalayas, the Deccan and other mountaneous tracts liable to erosion. In the plains where the ground is flat and erosion is normally not a serious factor, the proportion to be attained should be placed at 20%; and in view of pressure on agriculture, efforts for the expansion of tree lands should be concentrated on river banks and other convenient places not suitable for agriculture".[8] The gap between the aim outlined in the Resolution and the actual area under forests is very wide.

1.17. The net sown area is about 45% of the total land area. Among the large countries of the world, India has about the highest percentage of land under cultivation. The arable land including current fallows and orchards forms 30, 10 and 11.4 per cent of the land area in Europe, USSR, and USA—Canada, respectively.[9] The farmers in most parts of India have thus pushed cultivation as far as they could with the technological means and resources at their command.

1.18. The land put to non-agricultural uses like house sites, roads, factories or mines etc. has been just below 5%. In future, as the country develops, this proportion may increase slightly. But this is not likely to result in any imbalance in arable land, forests and pasture.

1.19. Neither the relatively lower proportion of the area under forests nor the comparatively high proportion of land in arable class is as much disturbing as the high proportion, 22%, under 'barren and uncultivated land', 'culturable waste' and 'fallow lands other than current fallow'. In area, such lands account for 163 million acres. The proportion was about 27% in 1951-52. The 'barren and uncultivable lands', excluding rocky lands are probably severely

eroded lands. The 'culturable waste' lands and 'fallow lands other than current fallows' indicate neglect and careless land management. These areas afford an opportunity to the planners to correct the imbalance among the different uses of lands in different regions and States. However, the areas will have to be properly surveyed for their best utilisation. The Planning Commission in its First Plan suggested such a survey: "We suggest that an immediate reconnaissance survey be made of waste land with a view to evolving a system of balanced and complementary land use".[10]

1.20. It was in 1959 that the Government of India constituted the Waste Land Survey and Reclamation Committee for the purpose of undertaking a survey of these lands, and locating large blocks that could be brought under cultivation. The Committee has submitted reports for some States. In practically all the States, the Committee came to the conclusion that the area that could be offered for reclamation in blocks of 250 acres and above formed hardly 2% of the total area under the categories "other uncultivated land excluding fallows" and "fallows other than current fallows".[11] The Committee while agreeing with the programme of State Governments for disposal of waste lands by allotting them to landless labourers and members of the Scheduled Castes and Scheduled Tribes, suggested a rapid reconnaissance survey to ensure that marginal lands were not allotted for arable cultivation.

Soil and Land Use Survey

1.21. It was stated in the First Plan that ".....for the wider object of improving land use and increasing crop yields, a soil and land utilization survey of the country is most essential".[12] The Plan did not, however, recommend any method or unit or even machinery for such survey. The years 1952 to 1957 were taken up in preparatory work. It was in March 1958 that the Central Soil Conservation Board started an integrated scheme for All-India Soil and Land Use Survey. Since then the work is being carried out under the supervision of a Chief Soil Survey Officer, through regional centres located at Delhi, Nagpur, Calcutta and Bangalore, each under the charge of a Soil Correlator. By 1960-61 about 12 million acres were surveyed, of which 2 million acres are in the catchment areas of river valley projects. The total area that is likely to be covered would be about 200 million acres by the end of the Fifth Plan.

1.22. The work done by the All-India Soil and Land Use Survey is essentially spade work. It will have to be used for understanding the existing land use and for suggesting alternative optimum use. No significant attempt has yet been made to use, the data of the All India Soil and Land Use Survey Organisation. The analysis of land-use planning undertaken during the formulation of the Third Plan was directed toward locating mal-adjustments in land use and their rectification. The land resources of the country have already been distributed among the broad categories of use, namely, arable farming, forestry and grazing. And in the absence of detailed data based on intensive survey all that could be attempted was to locate major areas of imbalance where mis-use of land was palpably evident even from the available land use statistics. The imbalance in the broader categories of land use has already been discussed in the previous section. It was generally recognised that fundamental changes in land

use may be made in the short period only in areas where programmes relating to land improvement such as those of irrigation, soil conservation and reclamation were being or to be implemented.

Nature and Extent of the Problem

1.23. It will appear from the account given above that factual data on the extent of the problem of erosion of land needing conservation treatment are inadequate. In terms of the conservation needs of agricultural land, the problem areas in India have yet to be scientifically surveyed and fully demarcated. There has, over the decade of planning in the fifties, some progress made in the carrying out of these surveys. But the full picture has yet to emerge. What can at this stage be attempted is to indicate broadly the areas badly needing conservation measures. These areas are distributed in India as fallows :—

1. Peninsular India comprising of Central India plateau and Deccan plateau excluding the narrow strip about 30-40 miles in width along the Western Ghats and a broader strip of about 100 miles width along the Eastern Ghats. Most of this area receives low and erratic rainfall.
2. Himalyan and Sub-Himalayan region of Punjab, U.P., Jammu & Kashmir and Himachal Pradesh.
3. Southern Plateau land of Bihar mainly in the districts of Palamau, Hazaribagh, Santhal Parganas, Ranchi, Singh-Bhum and Dhanbad.
4. Comparatively dry and undulating areas of red and laterite soils in Orissa and West Bengal. The areas needing soil conservation in West Bengal are the districts of Darjeeling, portions of the districts of Murshidabad, Bankura, Birbhum, Purulia, Burdwan and Western half Midnapur, comprising the tract known as the *rarh* region having the appearance of a plateau. This is comparatively a dry region and has relatively low precipitation. In Orissa a major soil conservation problem exists in the areas comprising Angul sub-division, Sambalpur district together with Koraput and Ganjam. The general characteristics of this area are more or less the same as the adjoining division of Chota Nagpur in Bihar. It is in the latter region that because of the general undulating topography, that soil erosion is a serious problem.

1.24. In the regions noted above, almost all areas except those that are under paddy or receive irrigation need protection. Excluding these areas, the cultivated area in these regions would be about 143 million acres as shown below :—

(In million hectares, acres in brackets)

1. Peninsular India	
(a) Deccan Plateau	37.2 (92.0)
(b) Central India Plateau	15.1 (37.2)

2. Himalayan & Sub-Himalayan area	4.2 (10.3)
3. Red and Laterite soils	1.5 (3.7)
	58.0 (143.2)

This area when properly tackled is capable of increasing the yield of crops by 50 to 100 percent or by about 12 to 22 million tons of food grains.

1.25. The Third Plan estimates that about 200 million acres of land in the country are suffering from soil erosion and deterioration. These lands are classified into six groups according to the nature of the problem they are affected with. In the first place it is stated that however much irrigation may spread in the country, there will still be left about 140 to 150 million acres on which increase in yield will have to be obtained mainly through contour bunding, soil conservation and dry farming techniques. Secondly, it is essential that the catchment areas of rivers are afforested for prolonging the life of the reservoirs, augmenting the supply of timber and fuel, moderating floods, and checking the erosion of land. Out of 37 million acres of land in the catchment areas of the major river valley projects so far taken up, 15 million acres need to be treated with soil conservation measures. Thirdly, the Plan estimates an area of 12 million acres where the rise in the sub-soil water level of irrigated lands has led to problems of water-logging, and salinity and alkalinity in soils. Most of the area is in Punjab, U.P., Mysore, Gujarat, Maharashtra, Rajasthan and Delhi. Fourthly, there are the problems of ravine lands along the rivers, mainly the Yamuna, the Chambal, and the Mahi. About 3.5 million acres in U.P. and about 8 lakh acres each in Madhya Pradesh, Rajasthan and Gujarat are badly affected by ravine erosion. The deserts in India, extending from the Rann of Kutch to large stretches of arid tracts in Gujarat and Rajasthan have their own problems of reclamation. Over-grazing, shifting cultivation and indiscriminate felling of trees in hilly areas and waste lands have led to denuded forests and consequent acceleration of soil erosion which need to be controlled by afforestation and pasture development programmes.[13]

Objective of the Survey and the Plan of the Report

1.26. It is against this overall perspective of the problem of soil erosion and soil deterioration that this evaluation study of the *programme of soil conservation on agricultural land* was undertaken. The objective of the study has been (a) to examine, in the context of the Third Plan, the progress achieved in soil conservation extension on agriculture land; (b) to analyse at different levels from the State to the field, the hinderances and difficulties encountered in administering the programme including making legislative, promotional and organizational arrangements for it; (c) to assess in a general way

the impact of the programme and its acceptance by the cultivators; and (d) to suggest lines of improvement and highlight areas needing attention and issues requiring further consideration. The field study has been broadly confined to areas in States where some work has actually been done. Special problems in certain States have also been generally enquired into. Analysis and inferences have been based on data obtained and collected at different levels.

1.27. The results of this study are presented in eight chapters. The second chapter persents an examination of the progress achieved in the two Plans and provisions made in the Third Plan under different heads *viz.* extension, demonstration and training. The part played by the Central and the State Governments in this programme has also been discussed. The third chapter deals with the preparation made for the soil conservation programme in different States and the legislative and executive arrangements enforced for implementing the programme. The analysis has been mainly based on the data collected from the Soil Conservation Departments of the State Governments. The fourth and the fifth chapters seek to discuss the nature and extent of soil conservation treatments and measures actually carried out and soil conservation and dry farming practices extended on the field. The impact of soil conservation measures on the beneficiaries and on their lands has been examined in chapter six. Relevant information for the purpose of the analysis in these chapters was collected from the selected districts and soil conservation divisions or sub-divisions. These have been supplemented with data collected from the selected villages and respondent cultivators. The special problems of land improvement in Punjab, Assam and West Bengal have been discussed in chapter seven. The eighth chapter summarises the observations and findings of the study and offers suggestions for consideration.

Method of Study

1.28. The general method followed in this study has been to start with an analysis of the objectives, approach and contents of the currently recommended programme for soil conservation, with a view to deriving the basic framework of hypothesis and reference. It is against this framework that attempts have been made to find out whether and to what extent the plans and programmes, as laid down, have been accepted in principle, followed in practice at different levels, found to be technically feasible and have achieved results in the field. The treatment of the different topics proceeds from a statement of plans and schemes of different States and then goes down to the soil conservation district, village and household levels for an analysis of the position on the field.

1.29. *Selection of districts, villages and Households.*—In a few States like Maharashtra, Madras, Gujarat, A.P., U.P. and Mysore, S.C. was either a fairly old programme or had achieved significant coverage on agricultural lands. In each of these States two districts, one being 'good' and the other 'Not so good' were selected for investigation. In other States, only one district, the best in coverage, was selected for study as the programme of S. C. had started on a systematic basis very recently. A total of 22 districts was thus selected. In each district, 4 villages were selected where S. C. work had been

taken. Two control villages were also selected in each district except in the case of those districts in which the programme was found more or less, in a demonstration stage. In all 87 villages covered by S. C. and land improvement programme in 21 districts and 36 control villages in 18 districts, were selected for the study. In each village, 10 owner households were selected for canvassing with them the household schedules. Thus in all, 1203 households were selected and canvassed in 123 villages. Details of the methodology of the study are given in the Appendix C.

1.30. *Schedules, questionnaires, etc.*—The analysis embodied in the subsequent chapters of the report are based on data collected from officials, records and cultivators on the basis of schedules, guide points and questionnaires designed for various levels *viz.*, State, district, village and household. The copies of the schedules and questionnaires designed for collecting data at different levels are given in the Appendix D.

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1. c. f. Dr. J. P. Bhattacharjee : "Soil conservation and Farm Planning and Management", *Farm Planning and Management* (Government of India, 1958), pp. 158-59.

2. Indian Council of Agricultural Research-Handbook of Agriculture, p. 572.

3. c. f. Dr. J. P. Bhattacharjee, *op. cit.* This paper presents a brief yet original analysis of these problems and is reprinted in full in Appendix A.

4. 'Report on India's Food Crisis and Steps to meet it' by the Agricultural Production Team sponsored by the Ford Foundation. p. 141.

5. Royal Commission on Agriculture: pp. 79-80 .

6. The Famine Enquiry Commission, Final Report (1945) p. 140.

7. Waste Lands Survey and Reclamation Committee (Ministry of Food and Agriculture, Government of India), December 1960- *Reports on location and utilization of waste land in India*—Introduction p. iii.

8. The First Five-Year Plan : p. 285.

9. Indian Society of Agricultural Economics—*Readings in land utilization*: pp. 151-52.

10. The First Five-Year Plan : pp. 285-86.

11. The total area under "other uncultivated lands excluding fallows" and "fallows other than current fallows" in eight States of Andhra, West Bengal, Kerala, M. P., Punjab, Mysore, Madras and Bihar comes to 556.3 lakh acres, while the area for reclamation in blocks of 250 acres or more comes to 10.14 lakh acres or 2%.

12. The First Five-Year Plan : p. 301.

13. c. f. Third Five-Year Plan : pp. 367-73.

CHAPTER II

PROGRESS IN THE FIRST TWO PLANS AND THE PROGRAMME FOR THE THIRD

2.1. The broad objective of the national policy for soil conservation is to govern, regulate and administer the use of land both under private and public ownership, so as to facilitate the optimum use of land resources in the interest of the present and the future generations. It is this policy that has found expression in the First two Plans and the Third which is under way. The report on the First Plan contains elaborate statements bearing on the scope of problems to be tackled, as well as the approach to be adopted to the soil conservation programme for the country. In fact, it is in the First Plan that the issues were clearly stated, the broad objectives of policy laid down and a national programme for soil conservation initiated. The Second and the Third Plans have carried forward the same policy, defining the problems in sharper focus and spelling out the areas of action and the contents of the programme in greater detail. A discussion of the policy and the programmes laid down in the plans will, therefore, serve to outline the framework of hypothesis for this evaluation study. The first part of this chapter seeks to do this, while the second part discusses the plans and programmes as implemented in different States.

Policy and Programme in the First Plan

2.2. *Approach.*—The report on the First Plan acknowledged the extensiveness and gravity of the menace of erosion, the inadequacy of steps taken till then, and the urgency of a conservation programme. It was recognised that the aim of soil conservation was not only to control erosion but also to maintain the productivity of the soil at a high level. The programmes in the plan were, however, largely of the anti-erosion type, probably because of greater urgency being attached to erosion problems. Four-fold measures for controlling erosion and restoring the productivity of eroded lands have been discussed in the report, as summerised below:

(i) Regulation of land use, including all measures for securing such alterations in the existing patterns of land use as are necessary to ensure that the different types of lands are used according to their land use capability *i.e.* the use for which their physical characteristics make them best suited.

(ii) Afforestation and preservation of forests through scientific forest management.

(iii) Improvement of land use practices on farm lands: This includes such measures as ploughing along the contours and strip cropping on slopping lands; proper crop rotations; application of adequate manures and fertilizers; care of fallows and other uncultivated lands.

(iv) Engineering measures: Under this are included construction of bunds and terraces, check dams, channels for drainage of surplus water, gully plugging etc.

The exact composition of the programme in terms of these groups of measures was to depend on the particular conditions of each area.

2.3. *Legislative and administrative arrangements.*—Recognising the vast magnitude of the problem, the inadequacy of knowledge and data even about the nature of the problem and methods suitable for tackling, and the lack of preparedness in the country to launch a mass programme, the First Plan concentrated, on the first hand, on research and administrative aspects and on the other, on building up the social overheads necessary for undertaking a large programme. Emphasis was, therefore, placed on the enactment of soil conservation legislation in States, the setting up of appropriate administrative machinery at the Central and State levels, building up of survey and research organisations and activities, and suitable formation of association of cultivators. The specific recommendations in each of these respects may briefly be discussed here.

2.4. *Legislation.*—The legislation for soil conservation in each State should provide for "(i) Powers to execute specified improvements on the farmers fields and allocation of the cost of these improvements between the farmers and the State; (ii) Constitution of cooperative associations of farmers for soil conservation work; (iii) Powers to restrict usage practices in certain areas, which may be declared 'protection areas' *i.e.*, areas in which restriction of such practices is necessary for protection of much larger areas from erosion, floods, silting and desiccation".

2.5. *Organisation.*—For carrying out the programme and generally for formulation and implementation of suitable policies in the field of land utilisation and soil conservation, the plan recommended the constitution of "(a) a Central Land Utilisation and Soil Conservation Organisation at the Centre and (b) a Land Utilisation and Soil Conservation Board in every State." The important functions of the Central Board included (i) assessment of soil erosion problems on the basis of reconnaissance surveys; (ii) framing a common policy for the control of erosion and for soil conservation in the country; (iii) bringing together State Governments concerned for evolving agreed programmes of soil conservation in river valley project areas and for checking the advance of the Rajasthan desert; (iv) organising and guiding central research institutions, soil conservation demonstrations and soil survey organisation; and (v) arranging for publicity and training.

2.6. The main functions of the State Boards outlined in the Plan were: (i) assessment of the soil erosion problem in the State on the basis of reconnaissance surveys; (ii) preparation of plans for control of erosion and soil conservation; (iii) drawing up suitable legislation for the execution of the programmes; (iv) Execution of plans and measures through concerned departments and through aids to cultivators; (v) promoting formation of soil conservation associations, and (vi) framing suitable programmes for demonstration and research, publicity and training of personnel.

Soil Conservation extension and role of the people

2.7. "As a large part of the soil conservation work has to be done by the farmers, proper understanding on their part of the nature of the erosion problem and their active participation in soil conservation programmes are essential for the success of these programmes." The function of the Government is to offer extension services, organize demonstrations and provide financial assistance in the shape

of supplies at reduced rates or in other forms. Engineering measures to be adopted mostly on the farmers' field may be taken by the farmers, individually or in cooperation, with technical or financial assistance from the Government; or the work may be done by the Government and the cost (or a part thereof) recovered from the farmers. "Education for soil conservation, publicity and demonstration aimed at creating among the general public and especially among the farmers an awareness of the erosion problem, its causes and effects and what they can do to control it" were stressed as a very important part of the soil conservation programmes. For the purpose of activating the farmers to undertake soil conservation work, constitution of cooperative associations of farmers in accordance with provisions of appropriate legislation was strongly recommended.

2.8. *Research and survey.*—The First Plan provided for the establishment of a Soil Conservation Branch at the Forest Research Institute, Dehra Dun, a Desert Research Station at Jodhpur and six research and demonstration centres in other parts of the country. These centres were to be engaged in collecting data on soils, land use, rainfall, run-off, soil-wash under different conditions, and effectiveness of various types of vegetation cover in arresting soil erosion, besides undertaking demonstrations of improved landuse and soil conservation practices in their respective areas. Finally, the Plan recommended that, with a view to improving landuse and increasing crop yields, an All-India survey of soils and land utilisation would be instituted, and, in the interests of uniformity in methodology, should be carried out by a central agency.

2.9. *Selection of areas.*—A programme of soil conservation was to be taken up in the catchment area of every river valley project. The Plan also recommended that certain States might suitably select one or more community project areas for their soil conservation programmes.[1]

Policy in the Second and Third Plans

2.10. The Second Plan drew attention to the urgent need for a systematic implementation of the policies laid down in the First Plan. Certain aspects of the national policy which were not adequately emphasized in the First Plan were clarified. The importance of the training of personnel was specially stressed; and it was estimated that the soil conservation programme to be undertaken during the Second Plan period would require 4,000 persons of different grades and experience. The training centres already established by the Government of India and those of some of the States were to prepare and train these persons. A special provision of Rs. 65 lakhs was made for surveying, classifying and mapping out about 10 million acres of land in areas presenting special problems. Further, the Plan drew attention to the human problems involved in all soil conservation efforts, particularly in the tribal areas where people have to be weaned away from shifting cultivation and unscientific grazing practices. The Plan emphasized the need for developing local institutions to undertake responsibility for the adoption of soil conservation programmes on cultivators' lands and on the village common lands. In particular, village panchayats were expected to take the responsibility for these measures and also "for ensuring minimum standards of land management by individual cultivators".[2]

2.11. The Third Plan while introducing little change in the national policies enunciated in the first two plans has, however, attempted to estimate more clearly the extent of the problem.

Progress in the first two Plans and the programme for the Third

2.12. For the successful implementation of soil conservation programme, adequate financial resources, trained technical personnel, research work, organizational set-up and a well-informed body of farming population form the basic requisites. The progress made in the first two Plans and the programmes included in the Third cover a number of schemes and items of activity. The details of these will be examined in the later sections. An attempt is, however, made to present an over-all picture for the country as a whole in Table 2.1 given below:

TABLE 2.1

Achievements under important programmes in the first two Plans and the programmes for the Third

Sl. No.	Items	First Plan		Second Plan		Third Plan (Targets)	
		*Category A Schemes	†Category B Schemes	Category A Schemes	Category B Schemes	Category A Schemes	Category B Schemes
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Regional Research-*cum*-Demonstration Centres (Nos).	8	..	..	..	2**	..
2.	Central Arid Zone Research Institute (Nos). . .	1	..	..	..	..	..
3.	Pilot Soil Conservation Demonstration Projects (Nos).	..	11	..	..	..	..
4.	Personnel trained in soil conservation methods (Nos). .	250	..	170 (Officers) 900 (Assistants)	..	350 (Officers) 1700 (Assistants)	..
5.	Afforestation and soil conservation in catchment areas (Lakh acres) . . .	..	..	..	1.40	10.00	..
6.	Planting of trees along the roads (Miles) . . .	..	150	..	..	..	..
7.	Area under pasture improvement and experimental plantations (Sq. miles) . .	..	100	..	..	..	..

*Centrally executed and sponsored schemes are category 'A' schemes. [TABLE—*contd*

†State Plan schemes are category 'B' schemes.

**For studying problems of red soils.

TABLE 2.1—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
8.	Soil conservation and Land use survey (Lakh acres) .	..	..	120.00***	..	150.00	..
9.	Area covered under contour bunding and terracing (Lakh acres) . . .	..	..	..	20.00	..	110.00
10.	Demonstration projects of 1,000 acres each (Nos.) .	..	..	21	..	19	..
11.	Paddocks of 200 acres each developed on pasture improvement and management (Nos.) . . .	..	..	50	..	..	..
12.	Dry farming techniques (Lakh acres) . . .	..	..	..	..	..	220.00
13.	Reclamation of water logged, saline and alkaline lands (Lakh acres) . . .	..	..	..	..	..	2.00
14.	Reclamation of ravine lands (Lakh acres) . . .	..	..	..	..	..	0.40
15.	Soil conservation measures in desert areas including afforestation and pasture development (Lakh acres) .	..	..	..	..	..	1.00
16.	Extension of afforestation and pasture development to cover hilly areas, denuded forests and waste lands (Lakh acres) . . .	..	..	..	..	..	7.00

***Include 20 lakh acres in the catchment areas of river valley projects.

Source : Second Five Year Plan; pp. 306-7 and Third Five Year Plan pp. 368-372.

2.13. The data given in Table 2.1 for soil conservation programme in the Plans include centrally-executed and sponsored schemes generally known as category A schemes and the State Plan schemes known as category B schemes. These range from research and surveys to contour bunding and extension of dry farming practices. The principal programmes had been the extension of soil conservation measures, organizing demonstrations for convincing the cultivators about the usefulness of soil conservation measures, organizing research on soil conservation and training personnel for undertaking the programme. The progress of Central and State schemes under these heads has been examined in the remaining sections of this Chapter.

Centrally-executed and sponsored schemes

2.14. The Central Government directly executed some schemes in the first two Plans. Besides, certain schemes were also centrally sponsored in the Second Plan such as the soil conservation in river valley project areas, dry farming demonstrations and survey of ravine

lands. These were wholly financed by the Central Government. The progress of the Centrally-executed and sponsored schemes in the Second Plan and the outlay in the Third are given in the Table 2.2.

TABLE 2.2

*Progress of the Centrally executed and sponsored schemes in the Second Plan and their programme in the Third Plan***

(Rs. in lakhs)

Schemes	Outlay		Expenditure
	2nd Plan	3rd Plan	2nd Plan
(1)	(2)	(3)	(4)
Part A : Centrally-executed schemes :			
1. Central Arid Zone Research Institute Jodhpur	140·00	40·00	108·91*
2. Soil Conservation Research, Demonstration & Training Centres		50·00	
3. Extension Centre in Rajasthan (Pasture Development)	28·00	2·00	18·14
4. All-India Soil & Land-Use Survey	41·00	25·00	40·29
Sub-Total	209·00	117·00	167·34
Part B : Centrally-sponsored schemes :			
1. Soil Conservation in River Valley	20·00	1100·00	19·28
2. Dry Farming Demonstration	42·00	28·00	6·57
3. Survey of Ravine Lands	..	50·00	..
Sub-Total	62·00	1178·00	25·85

*The sum of Rs. 9·73 lakhs on account of building expenditure included here is provisional.

It is clear that the Central Government has increased its outlay on these programmes considerably in the Third Plan; whereas the outlay was Rs. 2·71 crores or a little above 10% of the total outlay on soil conservation programme in the Second Plan, in the Third Plan it has been increased to nearly Rs. 13 crores or 18% of the total oulay of about Rs. 72 crores.

**At present, the development schemes in the Agricultural Sector are divided into three categories :

(i) Central Plan schemes;

(ii) Centrally sponsored schemes; and

(iii) State Plan schemes.

The financial provisions in respect of the first category schemes, which are implemented directly by the Centre or through its Attached or Subordinate Offices or through private institutions, are made in the Central Plan of the Ministry, while those for the third category of schemes, which are implemented by the States, are made in the State Plans. The Centrally sponsored schemes are implemented by the States and the Central share of assistance is shown in the Central Plan, while the States' share is shown in the State Plans. Most of the Centrally sponsored schemes in the Agricultural Sector under the Third Plan, however, involve 100% Central assistance. The implied intention is that if these schemes are financed outside the State Plan ceilings, the States will be willing to take them up.

2.15. *All India Soil and Land Use Survey.*—In the Second Plan period the all-India Soil and Land use Survey organisation surveyed about 12·5 million acres including 2·5 million acres in the catchment about 12·5 million acres including 2·5 million acres in the catchment Plan, about 2.4 million acres were intensively surveyed, and the remaining areas covered only by reconnaissance surveys. Most of the area surveyed in the river valley catchments was intensively surveyed.

2.16. *Soil Conservation in river valley project areas.*—In the second Plan the Central Government had sponsored a soil conservation scheme in the Bhakra Catchment Area of Punjab and Himachal Pradesh; the expenditure on it was about Rs. 19·3 lakhs, and the area covered 6,000 acres. In the Third Plan an outlay of Rs. 11 crores has been provided for soil conservation schemes in river valley project areas. These schemes are given below in Table 2·3.

TABLE 2·3

State-wise allocations in the Third Plan on Centrally sponsored schemes of soil conservation in the catchment of river valley projects

Name of the State	Outlay in the Third plan (Rs. in lakhs)	Name of Project
(1)	(2)	(3)
Andhra Pradesh	66·00	Machkund
Bihar/West Bengal	300·00	D. V. C. (Rs. 250 lakhs) Mayurakshi (Rs. 25 lakhs) Kosi (Rs. 25 lakhs)
Gujarat	10.00	Dantiwada
Kerala	2.00	Peechi
Madhya Pradesh	200·00	Hirakud (Rs. 150 lakhs) Chambal (Rs. 50 lakhs)
Madras	25·00	Kundah
Mysore	25·00	Tungabhadra
Orissa	83·00	Machkund (Rs. 33 lakhs) Hirakud (Rs. 50 lakhs)
Punjab	152·00	Bhakra Nangal
Himachal Pradesh	128·00	
Rajasthan	25·00	Chambal
Uttar Pradesh	50·00	Ramganga
Jammu & Kashmir	25·00	Pohru
TOTAL	1091·00	

2.17. *Dry Farming Demonstrations.*—For the Centrally sponsored scheme of 40 dry farming demonstrations, the Second Plan made a provision of Rs. 42 lakhs. Only 21 dry farming demonstrations could

be started and most of them towards the end of the plan. As such an expenditure of Rs. 6·47 lakhs was incurred on this programme. The Third Plan includes a provision of Rs. 28 lakhs for centrally sponsored dry farming demonstrations; this was the anticipated unspent balance of Rs. 42 lakhs at the time of the formulation of the Third Plan.

Central assistance for soil conservation schemes in the States

2.18. The Central Soil Conservation Board finances State Plan schemes also. It has a well-defined policy of financial assistance for soil conservation schemes. Rules have been made to govern the lines on which the aid is to be given to State Governments and other authorities in the form of loans and subsidies. Basis of extending financial assistance during the Second Plan and the first year of the Third Plan is given below:—

(a) *Loans*:

(i) Loans may be given to meet the entire expenditure on a scheme, provided the State Government takes the responsibility for its repayment with interest within the stipulated period.

(ii) Loans would be recoverable with interest within a maximum period of 15 years.

(b) *Grants*:

Subsidy or grant will be given by the Central Soil Conservation Board to the State Governments in order to meet a part of the net expenditure on a scheme of soil conservation. The State Government is expected to meet most of the expenditure on soil conservation schemes. There appears to be some flexibility as far as quantum of assistance to be given is concerned. It may vary and is expected to depend on the merits of each case. However, the Central Soil Conservation Board has laid down certain principles for giving financial assistance to States. A few of the more important ones are given below :

(i) Total subsidy for a particular scheme should not exceed 25% of the total cost of the scheme. Central Board's share will be 12½% of the total cost subject to at least an equal amount being given by the State Government.

(ii) In the case of schemes of afforestation subsidy upto 50% can be given by the Central Board depending on their remunerative character. The grant may vary from Rs. 35 per acre in Deccan, Arid Zones and Tropical wet areas to Rs. 55 per acre for afforestation in sub-mountain areas.

(iii) For Pilot demonstration schemes (including those in River Valley projects) a subsidy upto 100% can be given for the works part of the expenditure including the cost of work-charged staff. Dry farming demonstration schemes are eligible for 50% of the cost of work charged-staff as subsidy.

(iv) Soil Conservation research on local problems, expansion of existing research facilities and running of training centres etc. are eligible for grant on a 50:50 basis of the approved expenditure.

(v) Soil Conservation schemes in tribal areas will get 75% grant from the Central Soil Conservation Board and the remaining 25% of the cost will be met by the State Government.

2.19. From the second year of the Third Plan the Central Soil Conservation Board has laid down the pattern of assistance as follows :

Schemes	Pattern of Central assistance
1. Strengthening of soil conservation organisation . . .	Grant 50%
2. Training, research and survey schemes	Grant 50%
3. Soil Conservation in agricultural lands and connected afforestation and pasture development schemes	Loan 75% Subsidy 25% to be shared equally between Centre and State.
4. Soil conservation in hilly areas	Loan 50% Subsidy 50% to be shared between Centre & State.

Progress of the Soil Conservation Programme in the States

2.20. Soil Conservation programme for agricultural land includes diverse schemes. One group of schemes may be said to relate to contour bunding, soil conservation measures on agricultural lands, terracing and soil conservation treatments in river valley project areas. Reclamation of saline and alkaline lands, gully reclamation and reclamation of ravines form another group of schemes. The third group comprises schemes such as construction of field embankments, pilot scheme in 10-acre plots, and dry farming on bunded or unbunded lands. The plantation of trees or cash crops on hilly slopes and on the banks of the rivers and soil conservation in desert areas form yet another group of schemes.

2.21. In some States some other schemes are also included under the soil conservation programme for agricultural land. These are: improvement of pasture lands, irrigation facilities for terraced lands, afforestation and its maintenance, control of stream bank erosion, soil conservation in coastal sand dunes, soil conservation in mine spoils, soil and land capability survey, construction of surface percolation tanks and high level bunds, rotational grazing, land utilisation survey of Government waste land, maintenance of bunds, survey of ravine etc.

2.22. This apparent lack of uniformity in the classification of what is categorized as soil conservation programme probably originates from the method of treatment of each individual problem area. It has not yet been possible to draw a composite scheme for each specific problem area or watershed area. The approach of drawing up individual schemes was considered practical in the Second Plan and has been continued in the Third Plan. During this study, data were collected from the Director of Agriculture in the States, on the problems and progress of soil conservation programme on agricultural land with particular reference to outlay, expenditure, targets

and achievements in the two Plans and the programme for the Third Plan. The data were not comparable with similar data furnished by the States to the Ministry of Food and Agriculture and the Planning Commission. After scrutiny of all the available data on the subject, it was decided to use in this chapter the published data contained in the Third Five Year Plans and supplement it by data collected by the Ministry of Food and Agriculture from the States, wherever necessary.

2.23. *First Plan.*—In the First Plan period the soil conservation programme on agricultural land could not be taken up in many States. Some progress had been reported from Andhra, Gujarat, Kerala, Madras, Maharashtra and Mysore but the bulk of the achievement in the First Plan was in the erstwhile Bombay State and Madras in which the total of 7 lakh acres of agricultural land was brought under soil conservation treatment.

2.24. *Second Plan.*—In the Second Plan there was a considerable element of error in the fixation of targets and outlays. This state of affairs was most probably due to the inadequacy of experience and paucity of data relating to the execution of soil conservation programme in different States. The estimated expenditure in the Second Plan on Soil Conservation programme and the agricultural land covered by soil conservation treatments are given in the table 2.4.

TABLE 2.4

Total expenditure on soil conservation programme in the Second Plan, proportion of it expended on soil conservation on agricultural land and area covered by soil conservation treatment on agricultural land

Sl. No.	States	Total estimated expenditure (lakh Rs.)	% expenditure on mainly agri. land	Area treated (lakh hectares, acres in brackets)
(1)	(2)	(3)	(4)	(5)
1.	Andhra Pradesh	77	24·92	0·15(0·37)
2.	Assam	10	..	..
3.	Bihar	161	17·83	0·29(0·72)
4.	Gujarat	149	84·50	1·49(3·61)
5.	Himachal Pradesh	N.A.	N.A.	0·002(0·006)
6.	Kerala	22	96·73	0·05(0·12)
7.	Madhya Pradesh	95	48·09	0·19(0·47)
8.	Madras	134	*	0·49(1·22)
9.	Maharashtra	604	89·01	5·27(13·02)
10.	Mysore	152	60·63	1·09(2·70)
11.	Orissa	50	..	..
12.	Punjab	53	8·20	0·20(0·06)

[TABLE—*contd.*]

TABLE 2.4—*contd.*

(1)	(2)	(3)	(4)	(5)
13.	Rajasthan	40	33·69	0·06(0·16)
14.	U.P.	127	40·61	0·29(0·71)
15.	West Bengal	53	*	N.A.
16.	Jammu & Kashmir	38	..	
	TOTAL .	1,765	63·73	9·41(23·26)
	TOTAL for all States and Union Territories	1,773	63·04	9·41(23·25)

Source : Col. 3 : Third Five Year Plan pp. 740-748.

Cols. 4 & 5 : Data collected by the Ministry of Food and Agriculture from the States.

*About Rs. 96·12 lakhs and Rs. 4·46 lakhs are reported to have been spent in Madras and West Bengal respectively.

2.25. Of the total estimated expenditure on soil conservation programme in all States and Union Territories, about 34% was in Maharashtra alone. The expenditure in each of the States of Gujarat, Madras, Mysore, Bihar and U.P. was between 7 and 9% of the total expenditure. The programme of soil conservation treatment on mainly agricultural land accounted for nearly 63% of the total expenditure on all soil conservation schemes. The remaining expenditure was on soil conservation in agricultural and forest lands in river valley project area, in the ravine affected areas, in hilly areas, in waste lands, desert areas and for demonstration, research and training. The bulk of the expenditure in Gujarat, Kerala, Maharashtra and Mysore was soil conservation treatment on mainly agricultural land. In Madras also this proportion is reported to be very high.

2.26. About 2.3 million acres of mainly agricultural land were covered by soil conservation treatment in the Second Plan. Of this, more than 50% was in Maharashtra and between 5% and 16% each in Madras, Mysore and Gujarat.

2.27. The soil conservation treatment in hilly areas, in river valley projects, ravines, waste lands and deserts also covered some agricultural lands. It has been roughly estimated that the expenditure on the agricultural land in these areas was to the extent of 7% of the total estimated expenditure and the agricultural land treated was about 1·37 lakh acres. In the forest lands of these areas, the expenditure on soil conservation was to the extent of 23% and the area treated was about 12 lakh acres.

2.28. In Assam and J. & K. nearly all the expenditure on soil conservation programme was in hilly areas. A sizeable proportion of the expenditure on soil conservation was in hilly areas in Bihar, Punjab and U. P. also. As regards the programme of soil conservation treatment in the ravines, some expenditure is reported in Madhya Pradesh and U.P. only. Soil Conservation measures on waste land were reported in Bihar, Madhya Pradesh, Maharashtra, U. P. and West Bengal and soil conservation in desert areas in Gujarat, Punjab and Rajasthan.*

*Appendix Table B-2 gives the area covered by soil conservation treatment in agricultural land, in river valley projects, etc. by States.

2.29. *Demonstration, Research and Training.*—The soil conservation programmes in the States included some schemes of soil conservation demonstration, research and training. The estimated proportion of expenditure on these programmes in each State are given in Table 2·5.

TABLE 2.5

Proportion of the total expenditure on soil conservation programme in the Second Plan, spent on Demonstration, Research & Training

Sl. No.	States	% expenditure on		
		Demonstration	Research	Training
(1)	(2)	(3)	(4)	(5)
1.	Andhra Pradesh	6·25	2·84	3·11
2.	Bihar	..	0·96	..
3.	Gujarat	1·15	..	2·25
4.	Kerala	..	3·27	..
5.	Madhya Pradesh	3·56	4·56	2·76
6.	Maharashtra	1·22	0·19	1·40
7.	Mysore	4·17	2·59	1·90
8.	Orissa	11·88	1·84	2·68
9.	Punjab	..	0·22	..
10.	Rajasthan	2·66	..	1·92
11.	Uttar Pradesh	6·58	10·26	4·79
	All States	1·95	1·05	1·46
	All States & Union Territories	1·94	1·04	1·44

Source : Data collected by the Ministry of Food and Agriculture from the State Governments.

About 2% of the total expenditure on all schemes of soil conservation in the States and Union Territories together, was spent on soil conservation demonstrations. The agricultural land covered by these demonstrations was about 25,000 acres. In addition to the demonstration on agricultural land, some soil conservation demonstrations on forest lands were also undertaken in the Second Plan. The expenditure on them was about 1·25% of the total estimated expenditure and the area covered was 19,000 acres.

2.30. About 12% of the total expenditure in Orissa was reported to have been spent on soil conservation demonstration projects. In U.P., Andhra Pradesh, Mysore and Madhya Pradesh this expenditure ranged from 4 to 7 per cent. Expenditure on research formed a very insignificant proportion in the total expenditure on all soil conservation programmes. It ranged between 1 to 3 percent in most of the States and was about 10% in U.P. Similarly, the proportion of the total expenditure on soil conservation programme utilised for the training of staff was between 1 to 2 percent in most States, 3% in

Andhra Pradesh and about 5% in U.P. Taking all the States and Union Territories together, the expenditure on demonstration, research and training formed about 5% of the total expenditure.

Soil Conservation Programme of the States in the Third Plan

2.31. In relation to the Second Plan, the Third Plan provision has been increased by about four times and the targets of achievement by five times. The figures for outlay and targets in the Third Plan clearly show that the State Governments had by the end of the Second Plan period developed better and more consistent norms and yard-sticks for planning soil conservation programme on agricultural land. The overall outlay for the soil conservation programme in the Third Plan and the targets drawn for soil conservation on agricultural land, dry farming and reclamation of saline and alkaline land are given in Table 2·6 below :—

TABLE 2.6

Third Plan provision for soil conservation programme and the physical targets for soil conservation on agricultural land, Dry farming and reclamation of saline and alkaline land

(Area in lakh hectares, lakh acres in brackets)

Sl. No.	State	Third Plan provision (Rs. in lakhs)	Physical targets for		
			S. C. on agri. lands	Dry farming	Reclamation of saline & alkaline land
(1)	(2)	(3)	(4)	(5)	(6)
1.	Andhra Pradesh	163·00	2·23 (5·50)	8·09 (20·00)	..
2.	Assam	50·00	0·12 (0·29)	0·004 (0·01)	..
3.	Bihar	250·00	1·17 (2·88)	0·04 (0·10)	..
4.	Gujarat	827·00	4·77 (11·79)	4·86 (12·00)	0·18 (0·45)
5.	Maharashtra	2,084·00	20·23 (50·00)	12·79 (31·60)	0·15 (0·37)
6.	Kerala	120·00	0·28 (0·70)	--	--
7.	Madhya Pradesh	300·00	5·63 (13·92)	18·21 (45·00)	--
8.	Madras	250·00	1·38 (3·40)	1·62 (4·00)	0·004 (0·01)

[Table—*contd.*]

TABLE 2.6—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)
9.	Mysore	300·00	1·09 (2·70)	2·19 (5·50)	0·15 (0·38)
10.	Orissa	84·00	1·21 (3·00)	2·02 (5·00)	0·03 (0·08)
11.	Punjab	189·00	0·19 (0·46)	2·02 (5·00)	0·20 (0·50)
12.	Rajasthan	140·00	0·72 (1·78)	19·63 (48·50)	0·04 (0·10)
13.	Uttar Pradesh	409·00	4·32 (10·67)	16·20 (40·04)	0·04 (0·10)
14.	West Bengal	466·00	0·46 (1·14)	0·40 (1·00)	..
15.	Himachal Pradesh	198·00	0·07 (0·18)	0·08 (0·20)	..
16.	Jammu & Kashmir	100·00	0·03 (0·07)	..	..
	TOTAL	5930·00	43·90 (108·48)	88·16 (217·85)	0·80 (1·99)
	Total for all States & Union Territories	5978·00	43·90 (108·48)	88·18 (217·90)	0·82 (2·03)

Source : Third Five Year Plan pp. 325 & 740—748.

The total provision for all the soil conservation schemes in the Plans of the States and Union Territories is of the order of Rs. 60 crores. The Plan provision for Gujarat and Maharashtra accounts for nearly 50% of the outlay in the Third Plan. U.P., Madhya Pradesh, Madras and Mysore each account for between 4 and 6 per cent of the total Plan provision of all the States and Union Territories. Of the total target for soil conservation on agricultural land for all States and Union Territories, the target for Maharashtra alone forms 46% and that for Gujarat, U.P. and M.P. is between 10 and 13 per cent.

2.32. The targets for soil conservation in the Third Plan have undergone a few revisions. Some State Governments scaled down their original target and published a lower figure in the State Plans. At the time of the review of the Third Plan targets in 1961-62, the States were asked to raise their targets by atleast 20%. Later, with the coming in of the state of emergency in the country, the Ministry of Food and Agriculture intimated to the State Governments on 17th December, 1962 the decision of the National Development Council to step up the targets of soil conservation by 50%. In April-May 1963, the Central Agricultural Teams of the Government of India visited all the States and discussed with the State Governments the revision of soil conservation targets in the Third Plan. Table 2·7 gives the original targets stated in the Planning Commission's report on the Third Plan, the reduced targets fixed by the State Governments as indicated in their Third Plans, and the revised targets as recommended by the Central Agricultural Teams.

TABLE 2.7

Third Plan original targets of Soil Conservation on agricultural land, Reduced targets as fixed by the States and targets as recommended by the Central Agricultural Teams

(Area in lakh hectares, lakh acres in brackets)

Sl. No.	Name of the State	Original Third Plan targets	Revised reduced targets	Targets recommended by Central Teams	Col. 4 as % of Col. 3	Col. 5 as % of Col. 3	Col. 5 as % of Col. 4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Andhra Pradesh	2.23(5·50)	0·97(2·40)	1·62(4·00)	43·6	72·7	166·7
2.	Assam	0·12(0·30)	0·12(0·30)	0·12(0·30)	100·0	100·0	100·0
3.	Bihar	1·17(2·90)	1·17(2·90)	1·64(4·05)	100·0	139·6	139·6
4.	Gujarat	4·78(11·80)	3·43(9·72)	5·38(13·29)	82·4	112·6	136·7
5.	Jammu & Kashmir	0·04(0·10)	--	--	..	--	--
6.	Kerala	0·28(0·70)	0·93(0·56)	0·31(0·76)	80·0	108·6	135·7
7.	Maharashtra	20·23(50·00)	14·16(35·00)	21·25(52·50)	70·0	105·0	150·0
8.	Madhya Pradesh	5·62(13·90)	3·16(7·80)	5·85(14·45)	56·1	104·0	185·2
9.	Madras	1·38(3·40)	1·34(3·30)	1·74(4·30)	97·1	126·5	130·3
10.	Mysore	1·09(2·70)	1·09(2·70)	2·63(6·50)	100·0	240·7	240·7
11.	Orissa	1·21(3·00)	1·21(3·00)	1·21(3·00)	100·0	100·0	100·0
12.	Punjab	0·16(0·40)	0·16(0·40)	0·51(1·25)	100·0	312·5	312·5
13.	Rajasthan	0·73(1·80)	0·68(1·69)	0·72(1·78)	93·9	98·9	105·3
14.	Uttar Pradesh	4·33(10·70)	3·86(9·53)	4·39(10·85)	89·1	101·4	116·3
15.	West Bengal	0·44(1·10)	0·44(1·10)	0·44(1·10)	100·0	100·0	100·0
16.	Himachal Pradesh	0·08(0·20)	0·44(0·10)	0·08(0·20)	50·0	100·0	200·0
	Total for all States including all Union Territories	43·91(108·50)	32·58(80·50)	47·88(118·33)	74·2	109·1	147·0

2.33. It is not clearly known as to why the State Governments showed in their State Plans, target figures lower than those given in the Planning Commission's document on the Third Five Year Plan. As far as the State Governments were concerned, they were going by the target figures published by them, which meant, in effect, a reduction of the national target by 25 per cent. This was the position when this report was first released. There was, however, no corresponding reduction in outlay by the States. Thus the States had, through this process, revised upward their cost estimates.

2.34. With the onset of the Emergency in October, 1962, the position changed. The National Development Council decided that for stepping up agricultural production in the country the targets for soil conservation should be raised from 11 million acres to 16 million acres and for dry farming from 22 million acres to 50 million acres. The Central Agricultural Teams tried to work out the revised target for each State on this basis. But Table 2.7 shows that the revised target recommended by the Central Agricultural Teams is only 9% above the original target, but 47% above the reduced target accepted by the States. The States could thus claim that they had raised targets upwards by nearly 50% after the Emergency. It is significant that all these changes in the physical targets for soil conservation were made without basically disturbing the outlay figures provided for in the Third Plan soil conservation programme. However, additional provision, if needed, is being made for soil conservation in the Annual Plan of each State Government at the time of plan discussions every year.

2.35. In this exercise of fixing Third Plan Targets and revising them over and over again, a few broad patterns are noticeable. There are a few States—Assam, Orissa and West Bengal—which have not deviated at all from their original Third Plan targets. In the case of two States, *viz.* Andhra Pradesh and Rajasthan though the final revised targets are higher than the targets fixed by the State Governments in the State Plans, these are still lower than the original Third Plan targets. The remaining States, even if they had reduced their targets in the State Plans or maintained them at the same level as the original targets, have finally after discussion with the Central Agricultural Teams raised their target a little higher or significantly higher than the original Third Plan targets. The States which have now raised their targets significantly are Punjab, Himachal Pradesh, Mysore and Andhra Pradesh.

Dry Farming Programme in the Third Plan

2.36. The original target for the programme of dry farming measures was 22 million acres; Kerala and J. & K. had no targets for dry farming measures. As in the case of soil conservation, some State Governments accepted lower targets than those given in the Third Plan, the extent of this decrease being only 7 per cent. Later, some raised their original targets significantly on the recommendation of the Central Teams. Tables 2.8 (Page 29) shows the original Third Plan targets, reduced targets and targets recommended by the Central Agricultural Teams.

2.37. From Table 2.8 also it appears that the final target for dry farming has been raised only by 22·5% over the original Third Plan target. This increase works out to nearly 32% if related to the reduced targets as published in the State Third Five Year Plans. Andhra Pradesh, Bihar, Orissa, West Bengal and Himachal Pradesh did not change their targets for dry farming at any time. And Punjab, Gujarat, Madras and Madhya Pradesh have raised their targets for dry farming by 50% to 150% over the original Third Plan targets.

TABLE 2.8

Third Plan original targets of Dry Farming, reduced targets as fixed by the States and targets as recommended by the Central Agricultural Teams

(Area in lakh hectares, lakh acres in brackets)

Sl. No.	Name of the State	Original Third Plan targets	Revised reduced targets	Targets recommended by Central Team	% of Col. 4 with Col. 3	% of Col. 5 with Col. 3	% of Col. 5 with col. 4
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Andhra Pradesh	8·99(20·00)	8·09(20·00)	8·09(20·00)	100·0	100·0	100·0
2.	Assam	(n)	..	..	..	..	..
3.	Bihar	0·04(0·10)	0·04(0·10)	0·04(0·10)	100·0	100·0	100·0
4.	Gujarat	4·86(12·00)	4·86(12·00)	8·09(20·00)	100·0	166·7	166·7
5.	Jammu & Kashmir	..	..	..	..	..	..
6.	Kerala	..	..	..	..	..	..
7.	Maharashtra	12·79(31·60)	9·75(24·10)	12·79(31·60)	76·3	100·0	131·1
8.	Madhya Pradesh	18·21(45·00)	18·21(45·00)	36·42(90·00)	100·0	250·0	250·0
9.	Madras	1·62(4·00)	1·62(4·00)	4·05(10·00)	100·0	250·0	250·0
10.	Mysore	2·18(5·40)	0·51(1·25)	2·18(5·40)	23·2	100·0	432·0
11.	Orissa	2.02(5·00)	2·02(5·00)	2·02(5·00)	100·0	100·0	100·0
12.	Rajasthan	19·63*(48·50)	19·63*(48·50)	8·09@(20·00)	100·0	41·2	41·2
13.	Uttar Pradesh	16·19(40·00)	16·19(40·00)	20·64(51·00)	100·0	127·5	127·5
14.	Punjab	2·02(5·00)	0·65(1·60)	5·06(12·50)	80·0	250·0	781·2
15.	West Bengal	0·41(1·00)	0·41(1·00)	0·41(1·00)	100·0	100·0	100·0
16.	Himachal Pradesh	0·08(0·20)	0·08(0·20)	0·08(0·20)	100·0	100·0	100·0
	Total for all States including Delhi	88·18(217·90)	82·06(202·77)	18·80(266·90)	93·1	122·5	131·6

*This includes 16·19 lakh hectares for '*Medh Bundi*' programme also.

@Excluding 16·19 lakh hectares for '*Medh Bundi*' programme.

n=negligible.

The Third Plan provision for Demonstration, Research and Training

2.38. In the State Plans for soil conservation, there is also some provision for demonstration, research and training schemes. These schemes as recorded in the Third Five Year Plans of the States are given in Table 2.9

TABLE 2.9.

Demonstration, Research and Training Schemes in the State Third Plans

Sl. No.	State	Schemes			
		Demonstration	Research	Training	Combined schemes
(1)	(2)	(3)	(4)	(5)	(6)
1.	Andhra Pradesh	--	1. Soil Conservation Research Centre, Sahibnagar (Andhra area). 2. Reaserch in fast growing species. 3. Soil Conservation Research Centre, Sahibnagar (Telangana area).	1. Training of personnel in soil conservation. 2. Training of sub-assistants in soil conservation.	
2.	Assam	--	--	3. Training of officers outside the State. 4. Training School.	1. Soil conservation-*cum*-agricultural Research Station.
3.	Bihar	1. Scheme for demonstration of agricultural waste and eroded lands. 2. Soil conservation Demonstration on Projects on water-land basis.	4. Expansion of Soil Conservation Research Stations at Araraea and Kanke.	5. Scheme for training in soil conservation.	..
4.	Gujarat	3. Demonstration of soil conservation practices.	5. Soil Conservation Research.	6. Training.	..

(1)	(2)	(3)	(4)	(5)	(6)
5.	H. P.	4. Programme for demonstration.	..	7. Programme for training	2. Establishment of Research-*cum*-demonstration Centre.
6.	Kerala	5. Demonstration	..	..	3. Research-*cum*-demontration Centre for land use.
					4. Research and training in soil conservation.
7.	M. P.	--	6. Soil Conservation Research.	8. Soil Conservation Training.	5. Dry farming pilot demonstration and research.
8.	Madras	6. New Demonstration Centres	7. Research	9. Training of personnel	--
9.	Maharashtra	..	--	10. Training in soil conservation.	--
10.	Mysore	--	8. Soil Conservation Research in local problems.	11. Opening of Soil Conservation Training Centres to train Agricultural Assistants.	6. Pilot demonstration-*cum*-research.
			9. Soil Conservation Research (Hebbal).		
11.	Orissa	7. Soil Conservation demonstration centres.	10. Soil Conservation Research and laboratory.	12. Training of Junior Soil Conservation Assistants.	..
			11. Soil Conservation Research Farm.	13. Training of personnel in soil conservation.	

(1)	(2)	(3)	(4)	(5)	(6)
12.	Punjab	8. Soil Conservation Demonstration (Dry farming centres) Agl. lands. 9. S.C. demonstration.	12. Soil Conservation Research.	14. Training in soil conservation.	..
13.	Rajasthan	..	..		7. Research, Demonstration and Training.
14.	U. P.	10. Scheme of reclamation of user and eroded lands and setting up of demonstration soil conservation projects.	..	15. Scheme for establishing soil conservation training centres.	8. Scheme for the final stage development of the State Soil Conservation Research, Demonstration and Training Centre-Rehmankhera.
		11. Pilot soil conservation projects to demonstrate the various soil conservation measures.	..		
15.	West Bengal	12. Soil Conservation demonstration projects in the plains and on the hills. (i) Demonstration schemes in the plains. (ii) Teesta tributaries originating in Darjeeling hills. (iii) Catchment area of Lish, Gheesh, Chel, Nasra and Relle.	13. Soil Research Station in late-rite soil zone and other hills.		
16.	J. & K.	13. Water Conservation Research Demonstration.	..	16. Training of technical personnel.	

2.39. In the State Plans there are in all 13 schemes of demonstration for which a total outlay of Rs. 122·5 lakhs has been provided. The research and training schemes number in all 13 and 16 respectively, for which provision of Rs. 36·50 and Rs. 115.39 lakhs have been made in the Third Plans of the States. The schemes which cover more than one programme are grouped as combined schemes and their total number in different States is 8 with a total provision of Rs. 49·88 lakhs. The Table 2.10 (Page 34) gives data on the total plan provision as given in the Third Five Year Plans of the States and the allocation made for demonstration, research and training in each State. The State Plans of Rajasthan, Himachal Pradesh, Punjab and U.P. show separately the Plan provision for soil conservation programme of the Forest Departments. In Table 2.10, the Plan provision for soil conservation programme of the Forest Departments has been included in col. 3, Rs. 65 lakhs in Rajasthan, Rs. 128.32 lakhs in Himachal Pradesh, Rs. 73 lakhs in Punjab and Rs. 65 lakhs in U.P. The Table also shows that the programme in Assam becomes much larger, if the funds provided by the Home Ministry for the programme in the Tribal areas are taken into account. It may also be noted that the outlay given in the State Plan for Maharashtra is somewhat lower than the original outlay. The original outlay was Rs. 2,084 lakhs, whereas the State Plan gives an outlay of Rs. 1,973·25 lakhs. In the case of Gujarat, Orissa, Madhya Pradesh and West Bengal some schemes were either added to or dropped from the schemes originally included for the Third Plan.

2.40. The total plan provision for demonstration, research and training schemes, including combined schemes covered 5·41% of the total provision for soil conservation in 16 States. The Third Plan provides a little less than 1% of the total outlay for research, and for training and demonstration about 2% each. Among the States, a relatively larger provision for soil conservation demonstrations has been made in Bihar, Kerala, Orissa and Punjab. In the case of State Research Schemes, about 8% of the provision on soil conservation programmes in Orissa has been earmarked for this programme. In other States the proportion is between 1 and 2 per cent. It is less than 1% in Gujarat, Madhya Pradesh, Madras and Punjab. The schemes drawn up for the training of soil conservation staff account for 13 and 10 per cent of the total provision in Orissa and J. & K. respectively. In U. P. and Punjab, it is between 6 and 8 per cent. In seven States this provision is between 1 and 5 per cent and in Bihar and Maharashtra it is less than 1%. . . . .

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2.41. It is difficult to comment on the right proportion of outlay for different soil conservation programmes in the States. The norms are yet to be fully developed and more of attention needs to be given to this matter. . . . . .

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(1) Information in paras 2·2 to 2.9 is drawn from pp. 298-303 of the First Five Year Plan, Planning Commission, Govt. of India.

(2) c. f. The Second Five Year Plan, Planning Commission, Govt. of India, p. 312.

TABLE 2.10

Total Plan provision on soil conservation and the provisions for Demonstration, Research and Training Schemes in the State Third Plans

(Rupees in Lakhs)

Sl. No.	Name of State	Total State Plan provision on soil conservation	Plan provision under the schemes of							
			Demonstration	Col. 4 as % of col. 3	Research	Co. 6 as % of col. 3	Training	Col. 8 as % of col. 3	Combined schemes	Col. 10 as % of col. 3
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	Andhra	163·00	..	..	2·70	1·66	1·71	1·05	..	..
2.	Assam*	177·50	..	..	..	..	5·50	3·10	15·00	8·4
3.	Bihar	250·04	30·00	12·00	4·22	1·69	2·32	0·93	..	..
4.	Gujarat	825·51	5·00	0·61	2·50	0·30	10·00	1·21	..	..
5.	H. P.*	198·00	10·20	5·15	..	..	4·26	2·15	2·88	1·45
6.	Kerala	120·00	11·00	9·17	..	..	..	..	12·00	10·00
7.	M. P.	349·10	..	..	1·30	0·37	15·00	4·30	1·01	0·29
8.	Madras	250·00	10·00	4·00	2·00	0·80	5·00	2·00	..	..
9.	Maharashtra	1,979·25	..	..	..	..	8·00	0·41	..	..
10.	Mysore	300·00	..	..	6·10	2·03	5·00	1·67	5·00	1·67
11.	Orissa	76·00	7·50	9·87	6·04	7·95	10·00	13·16	..	..
12.	Punjab	189·00	14·50	7·67	1·50	0·79	14·36	7·60	..	..
13.	Rajasthan	140·00	..	..	..	..	..	..	7·00	5·00
14.	U. P.	408·99	15·63	3·82	..	..	24·24	5·93	6·99	1·71
15.	West Bengal	470·91	17·68	3·75	10·14	2·15	..	..	..	..
16.	J. & K.	100·00	1·00	1·00	..	..	10·00	10·00	..	..
	TOTAL	5,991·30	122·51	2·04	36·50	0·61	115·39	1·93	49·88	0·83

Source : Third Five-Year Plans published by the State Governments.

*For Assam and Himachal Pradesh data has been collected from the office of the Adviser Soil Conservation, Ministry of Food and Agriculture. In the case of Assam, the Plan provision includes Home Ministry's funds amounting to about Rs. 130 lakhs.

Note : The State Plans of Rajasthan, Himachal Pradesh, Punjab and U. P. show separately, the provision for soil conservation programme of the Forest Departments, Rs. 35 lakhs in Rajasthan, Rs. 128.32 lakhs in Himachal Pradesh, Rs. 73 lakhs in Punjab and Rs. 65 lakhs in U. P. In col. 3 of the above Table, these amounts have been included.

CHAPTER III

PLANNING AND EXECUTION OF SOIL CONSERVATION MEASURES

3.1. It was pointed out in Chapter 2 that the approach to the soil conservation programme in the First Plan was dictated largely by the need to build up in the country the administrative, technical and social overheads necessary for launching a nation-wide programme. These overheads—the infra-structure did not exist in the States and at the Centre in pre-plan era and have been established only during the last five to ten years. An evaluation of the progress achieved in these directions will, therefore, be useful and is attempted in this chapter. Planning and execution of soil conservation measures, mainly at the State level, forms the focus of this chapter. Surveys, investigations and research conducted, legislative provisions made, role of Soil Conservation Boards envisaged, administrative arrangements set up for carrying out soil conservation works, coordination achieved among various departments dealing with soil conservation in the States, financial assistance given for soil conservation work, linking of consolidation of land with soil conservation, the role played by the Block agency and involvement of people's institutions in soil conservation work are the topics discussed in this chapter.

Survey and Investigation

3.2. *Types of surveys for assessing the extent of the soil erosion problems.*—No detailed land and soil survey appears to have been carried out in any State for assessing the nature and extent of the problem of soil erosion. Reconnaissance surveys have, however, been carried out in States like Andhra, Kerala, Madras, Maharashtra, Gujarat, Orissa, Rajasthan and West Bengal. In other States even reconnaissance surveys have not been undertaken.

3.3. *Third Plan targets and surveys.*—In the States where reconnaissance surveys have been carried out, the targets for the Third Plan have been based mainly on such surveys. But in other States where no such surveys have been carried out, the targets are based on rough estimates and/or the extent of funds available. In Assam, for instance, the available funds have been taken into consideration in drawing up the schemes. From Bihar and Madhya Pradesh it is reported that the problem is so vast that the work can be carried out for a number of years without the necessity of searching out areas requiring soil conservation measures.

Soil, land use and capability surveys

3.4. For the execution of a long term programme of soil conservation as also for the wider object of improving land use and increasing crop yields, a soil and land utilization survey is most essential. In 1958, an integrated all-India soil conservation and land use survey was initiated by the Central Soil Conservation Board. This scheme was to combine different activities of soil survey, which were being carried out for different purposes. This standard all-India integrated survey is expected to use uniform methods and nomenclature.

3.5. Under the All-India integrated soil survey and land use planning scheme, priority for survey is given to catchments of major river valley projects. There is an immediate need for a comprehensive survey of the agricultural land, for identifying problem areas and for adoption of proper land use practices. This problem is perhaps more relevant for the States. According to the plan of action, the survey of such areas is expected to be carried out by the States as a part of the integrated All-India scheme on Standard Pattern and according to the procedure laid out on an All-India basis. The work is to be done under the technical supervision and scrutiny of the integrated scheme, at least partly. But in actual practice most of the surveys undertaken by the States are not effectively supervised by the Central Survey Organisation. To the extent, this is not done the quality of the survey suffers, lack of uniformity may creep in, and the purpose of having a standard scientific soil survey is not served. About 12 million acres have been surveyed under the programme by the end of Second Five Year Plan.

3.6. In addition to this, some other surveys have been attempted by the State Governments. The Maharashtra Government, for instance, surveyed and classified an area of about 5.5 lakh acres of Government waste land during 1948-51. In Mysore also, a scheme of land utilization survey of Government waste lands has been in operation in the districts of Bijapur, Belgaum, Dharwar and North Kanara. Upto the end of 1960-61, more than a lakh acres of Government waste lands have been surveyed and classified under the scheme. In Bihar, a land use capability survey has been conducted of the Tajna Pilot Project (Ranchi District) by the Agriculture Department and of the Harharo Pilot Project (Hazaribagh District) by the Forest Department. In the Damodar Valley Corporation area, the Corporation's Soil Conservation Department has undertaken surveys for its own programmes.

3.7. Difficulties in the way of carrying out such surveys have been reported from 12 States (exceptions being West Bengal, Madras and Kerala). Lack of technical personnel and lack of funds are the two major obstacles pointed out by the reporting States as coming in the way of carrying out soil and land-use capability surveys. Ten States have pointed out one or the other of these two difficulties, of which seven again have mentioned both. There are only two States which have pointed out problems other than the two mentioned above. The other problems stated are the vast magnitude of the task and the non-availability of maps and records.

Area affected by soil erosion in the States

3.8. No comprehensive survey to determine the area affected by soil erosion has been conducted in any of the States. For West Bengal, Rajasthan, Kerala and Madras, even rough estimates of the area affected by erosion are not available. For some of the other States like Assam, Madhya Pradesh, Orissa and Punjab, the data furnished are incomplete as the break-up for the different types of erosion is not given. In all cases the figures given are rough estimates.

3.9. The basis for calculating the area affected by soil erosion varies from State to State. In Andhra, for example, the entire dry land has been taken as an affected area in one way or the other; in

Himachal Pradesh, on the basis of total cultivated area less the area under paddy and less 5% of the remaining area; in Maharashtra, by deducting the area under sugarcane, fruits, vegetables, cotton and paddy from the cropped area; in Madhya Pradesh, on the basis of 2/3rd of the net cultivated area; in Uttar Pradesh, on the basis of old revenue records. It is because of the imprecise nature of these estimates that the extent of different problems is not known precisely. Under the circumstances, the planning and execution of the soil conservation programme have an element of trial and approximation. The data available about the area affected by soil erosion are given in Table 3.1.

TABLE 3.1

Area affected with the main soil erosion problems in different States

(Area in lakh hectares, lakh acres in brackets)

Sl. No.	States	Area affected by soil erosion				
		Water erosion	Wind erosion	Water-logging	Salinity and alkalinity	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Andhra	80·94 (200·00)	..	..	..	80·94 (200·00)
2.	Assam	2·12* (5·25)	..	N.A.	..	N.A.
3.	Bihar	19·44 (48·04)	0·17 (0·41)	..	..	19·61 (48·45)
4.	Gujarat	73·02 (180·43)	..	..	..	73·02 (180·43)
5.	Himachal Pradesh	2·18 (5·40)	..	..	..	2·18 (5·40)
6.	Madhya Pradesh	N.A.	..	N.A.	N.A.	101·58@ (251·00)
7.	Maharashtra	138·61 (342·52)	..	..	..	138·61 (342·52)
8.	Mysore	80·94 (200·00)	..	0·20 (0·50)	0·20 (0·50)	81·34 (201·00)
9.	Orissa	31·13** (76·92)	..	..	N.A.	N.A.
10.	Punjab	20·23 (50·00)	8·09 (20·00)	N.A.	N.A.	N.A.
11.	Uttar Pradesh	36·42 (90·00)	6·07 (15·00)	12·14 (30·00)	12·34 (30·50)	66·97 (165·50)

NOTE.—The extent of area affected is not available for Kerala, Madras, Rajasthan and West Bengal.

*About 2·12 lakh hectares are affected annually, mainly due to shifting cultivation.

**Roughly 31·13 lakh hectares suffer from water erosion in the hilly areas, because of shifting cultivation.

@Problem-wise area is not available; estimates for total affected area are available.

3.10. Water erosion is a major problem in all the States. Among States for which data are available, the largest area affected by water erosion is in Maharashtra, 342·52 lakh acres. In Andhra as well as in Mysore, the area affected is 200·00 lakh acres, while 180·43 lakh acres is the estimate for Gujarat.

3.11. The other problems of soil erosion are confined to a few States. Wind erosion, for instance, is most prevalent in Rajasthan, and to a lesser extent in Punjab, Uttar Pradesh, Madras and the coastal areas of Orissa. The problems of water-logging and salinity and alkalinity are similarly to be found generally in Assam, Madhya Pradesh, Madras, Mysore, Orissa, Punjab, Uttar Pradesh and West Bengal. The exact magnitude of the problems is, however, not available for most of the States. Its gravity in Punjab and Western Uttar Pradesh is, however, a common legend.

Soil Conservation Research, Extension-Education and Demonstration

3.12. *Central and Regional Research.*—The Central Soil Conservation Board has the responsibility of initiating, conducting and coordinating research on the various problems of soil and water conservation in the country. Since its inception, the Board has established eight Regional Research-*cum*-Demonstration-*cum*-Training centres. These centres are to carry out research in specific regional problems with a view to develop criteria for erosion hazards and establish standards of efficiency of the various soil and water conservation practices, individually and in combination; to carry out fundamental research in the hydrological laws governing the watershed behaviour under different management practices; and to serve as demonstration centres for developing the proper know-how for the soil conservation measures.

3.13. A good beginning has already been made at these Regional Soil Conservation Stations. The research carried out at these various research centres has yielded results of practical utility. Methods for reclamation of shallow ravines for agricultural purposes were worked out for Gujarat ravines. Experiments conducted in deep black soils have proved that contour cultivation increased the yields by 60 to 70 lbs. of Jowar grain and about twice that much quantity of fodder per acre. At Jodhpur, techniques to stabilise the moving sand dunes and shifting sands have been developed. The studies on pasture development have indicated that closure and rotational grazing helped to increase materially the yield of grasses.

3.14. The eight Regional Soil Conservation Research Centres, established by the Central Soil Conservation Board, are located at Dehradun, Chandigarh, Bellary, Kotah, Agra, Vasad, Ootacamund and Chatra. Besides, there is a Central Research Institute at Jodhpur, originally started in 1952 as Desert Afforestation Research Station and reorganised in 1959 as an Arid Zone Research Institute with the collaboration of the UNESCO. Details about the main problems to be studied, the important experiments conducted and the results achieved at the Regional Soil Conservation Research Centres are given in Appendix B-3.

3.15. *Research by State Governments.*—As far as Research and Demonstration are concerned, the Central Soil Conservation Board is expected to concentrate on the major regional problems of the country *e.g.* those of the desert, the ravines, the hilly areas including

the foothills of the Himalayas and the Siwaliks, the black cotton soil and red and laterite soil regions. Apart from these major regional problems of research and demonstration there would be specific local problems of soil conservation which will vary from State to State or from one area to another within a State due to varying conditions of rainfall, topography, economic and social factors. It is precisely in this area of research that the States can fill up the gap by playing an effective role.

3.16. In order to know the position about research and experimentation in various States, data were collected from the State Governments. Replies received brought out that only in Maharashtra, Mysore, Orissa, Uttar Pradesh and the DVC area in Bihar, soil conservation measures were experimented in the Research Stations and afterwards demonstrated. In Maharashtra and Mysore, the technique of contour bunding was experimented and demonstrated for the light and medium soils. The problem is, however, still evading solution for deep black soils. In Orissa also, measures like contour bunding and tree plantation were established and demonstrated. In Uttar Pradesh, a number of mechanical and agronomic measures have been experimented on, and subsequently demonstrated. Mechanical measures like bunding, levelling, and outlets, agronomic measures like contour cultivation, strip cropping, application of manure and fertilizer, etc. and other measures like afforestation and planting of grass over bunds, have been tried out and demonstrated in the State. The Rehmankhera Research Centre in Uttar Pradesh is doing some very useful research work on different measures of soil conservation.

3.17. In other States, no research work has been undertaken by the State Governments, to study the measures needed for control of soil erosion and other problems. Soil Conservation measures and programmes have been introduced in these States mainly on the basis of observations made or experience gained at other soil conservation centres in the country. For instance, the soil conservation measures experimented at Sholapur and Bijapur research stations were extended in different districts of the Gujarat State. The reason why the majority of the States have not taken up experimentation with soil conservation measures is that either there is no research station there, as for example, in Andhra Pradesh, Assam, or Gujarat, or such stations are still in their infancy, as in Bihar, Kerala and Madhya Pradesh.

3.18. *Research by the DVC.*—In 1950, the DVC established its own research station at Deochanda. The methods evolved at the research station are made known to the farmers through the extension staff of the Soil Conservation Department. In 1953-54, a pilot scheme was taken up by the Department on 250 acres of land to study different types of engineering structures and their effectiveness. In 1954, a research-*cum*-demonstration station on 100 acres was set up on the peripheral land of Tilayya for finding out suitable soil conservation measures in foreshore lands. Five more demonstration farms were established later for the same purpose. The experiment station at Sewani, near Tilayya dam, conducts studies in different crops and crop-patterns synchronizing the rise and fall of water level in the reservoir. Similar demonstrations are also conducted on the farmers'

fields where farmers take such lands on lease. In 1956, a research-*cum*-demonstration station was set up on 210 acres at Panagarh. The object of the station is to study the problems of irrigation farming *viz.* proper utilization of irrigation water, different irrigation techniques, effect of irrigation water on physical and chemical properties of the soil, irrigation requirements of various crops, cultural and manurial requirements of irrigated areas, etc.

3.19. The research station at Deochanda has an area of 355 acres of badly eroded land representing the conditions prevailing in the region. Studies at this centre have revealed that soil loss, from a 50 ft. long cultivated field on a 2% slope, ranges from 1 to 14 tons or even more per acre per year, depending upon the different farming practices. Besides finding out the optimum fertilizers and cultural requirements of the common crops, the investigations carried out at the Deochanda experiment station have yielded some useful results bearing on soil and water conservation through different crop rotations and practices like contour and ridge sowing, graded terracing and mulching.

3.20. *Progress and gaps in Research.*—From the data available, it appears that the Central Research Stations have made appreciable progress in the field of research work by the end of the Second Plan. Not much of progress could, however, be achieved by the State Governments with research work on soil conservation measures. Many States did not have any research station or centre, by the end of Second Plan, to undertake research on various problems of soil conservation of a local nature. Bihar, Kerala, Madhya Pradesh, Maharashtra, Mysore, Orissa and Uttar Pradesh are the States having their own soil conservation research stations. In some of these States, those stations have not yet started functioning effectively for one reason or the other. In Kerala, for instance, no research work could be initiated in the centre during the Second Plan, because the laboratory was still being equipped. In Mysore, non-availability of trained personnel was the chief reason for the holding up of the work of the research station at 'Kondikot' in Dharwar district. This centre actually started functioning at the beginning of the Third Plan. Thus, one could say that during the Second Plan the research programme of the States was not fully established. It is expected that during the Third Plan the programme will become more effectively established and yield useful results.

3.21. The soil conservation research conducted so far has been mainly concerned with erosion and run-off studies, hydrological investigations and engineering measures to tackle problems of erosion. Research on problems connected with conservation farming methods seems to have been relatively neglected. Similarly, one finds that the research conducted so far is applicable to the red and laterite soils and to a lesser extent to alluvial soils in the north. However, one major problem that is still evading solution relates to techniques for conservation of deep black and clayey soils in Maharashtra, Mysore, and Gujarat. Research to tackle this problem was initiated in Maharashtra towards the end of the Second Plan and has reportedly started in Mysore during the Third Plan. There are also differences of opinion regarding the effectiveness of field bunding or *medhbandi* for conservation purposes. It is hoped that by the end of the Third Plan period some recognized and acceptable

solution to these problems may be found. Still another problem on which research has not made much headway relates to the methodology and approach to a complete soil and water conservation programme on a watershed basis in various agroclimatic zones.

Extension-education and Demonstration

3.22. In 1959 the Central Soil Conservation Board approved forty-six demonstrations in different States. Of these, six demonstrations were in the catchment of the Bhakra, in Punjab and Himachal, at an estimated cost of Rs. 20 lakhs. Other 40 were dry farming demonstrations, each expected to cover a catchment of about 1000 acres. These demonstrations were started as an intensive education programme for large scale adoption of soil conservation and dry farming practices in semi-arid areas. They were approved for a period of two years at an estimated expenditure of Rs. 42 lakhs. However, due to administrative delays and organisational problems in the States not much progress was made in the first year. Some progress was made in 1960-61. The demonstrations have been extended over to Third Five Year Plan. By the end of Second Plan, six Pilot Demonstration Projects in the Bhakra catchment area and 21 out of 40 dry farming demonstrations were in execution.

3.23. Besides what is being done by the Central Soil Conservation Board, it is important to know the part which the States are playing as far as extension-education and demonstrations are concerned. Information received from the State Governments is rather scanty. No information has been received for Kerala. Three other States, Assam, West Bengal and Orissa, have reported that there is no regular programme for educating the farmers in soil conservation and dry farming methods. Of the remaining States, the number using various methods of educating farmers is given in the following table :—

TABLE 3.2

No. of States using various extension methods in educating farmers in soil conservation and dry farming programme

Extension method	No. of States using the extension method
Demonstration	5
Personal contact	3
General meetings	3
Sight seeing	3
Pamphlets	3
Training of farmers	2
Film shows	1
Farmers' unions	1

3.24. In these States, the methods of educating the farmers varied from one to three in different States. The main methods of extension education was 'demonstration' reported by five States,

'Personal contact,' 'general meeting,' 'sight seeing' and 'issuing of pamphlets' were the other important methods reported by three States each. 'Training of farmers' was also reported from two States and 'showing of films' by one. 'Farmers Union' in Maharashtra was a method used for educating farmers in soil conservation programme and conservation farming techniques.

3.25. *Nature and effectiveness of demonstrations.*—We have tried to assess on the field the types of demonstrations laid out and their effectiveness. It was found that in Maharashtra, Gujarat, Mysore and Andhra the demonstrations laid out were both result and method demonstrations. As far as Assam, West Bengal, Orissa Punjab and Rajasthan are concerned it is understood that only method demonstrations are organised. In Punjab, demonstration projects were started very recently and data on economics of soil conservation is still meagre.

3.26. In most of the States, these demonstrations are not pursued to obtain data on the economics of soil conservation. It is, however, reported from the States in the Western Region that data on the economics of soil conservation are collected in respect of demonstrations on research farms.

3.27. The object of a soil conservation demonstration should be to convince the cultivators in the demonstration project area and those in the neighbouring area, about the usefulness of soil conservation engineering measures and conservation farming (including dry farming) methods recommended. These demonstrations are likely to serve the purpose which is expected of them, if an attempt is made to convince the farmers about the advantages that may accrue quantitatively, like increase in crop yield, increase in net income and reduction of soil loss.

3.28. Information has been received from most of the States about the effectiveness of these demonstrations. Only from Andhra Pradesh it is reported that the demonstration projects have, by and large, served their purpose. The cultivators there are given the chance to get convinced about the advantages that may accrue quantitatively; and the Department has also taken care to ensure the adoption of post- engineering measures. In some other States the objective of convincing the farmers of the usefulness of the farming practices is stated to be outside the scope of the demonstration projects. The farmers in Maharashtra, Gujarat and Mysore have taken to large scale contour bunding without being actually convinced of the quantitative advantages, as the programme affords immediate employment and helps in the conservation of moisture. In the case of Bihar (excluding DVC area), Orissa, Assam, West Bengal, Punjab and Rajasthan, no efforts are reportedly made to convince the farmers.

3.29. In all states from which information has been obtained, it is reported that after the engineering measures are adopted in the demonstration projects, the areas are left to be managed by the farmers themselves. In other words, the very important aspect of conservation farming methods or follow-up practices is neglected as far as demonstration projects are concerned. Engineering measures themselves are not likely to yield desirable results unless

these are adopted in combination with conservation farming techniques and practices recommended for an area. As a consequence, the demonstrations set up are not usually found to be fully effective; and this in turn means that these projects are not fully serving the purpose which they are expected to fulfil.

3.30. *Extension and Demonstration in the DVC area.*—The Soil Conservation Department of the DVC works through direct contact with individual farmers. The Soil Conservation staff approach the individual farmers and explain to them the benefits of soil conservation; and occasionally meetings are also held for this purpose. Villagers are also given a chance to see demonstrations. In case farmers in an area do not agree to undertake soil conservation measures, demonstrations are laid on part of their holding in order to convince them. Demonstrations are an important method of extension education as far as the DVC is concerned.

Preparation for Soil Conservation Work on Agricultural Land

3.31. *Legislative provisions.*—Enactment of suitable legislation for soil conservation by the States was recommended in the First Five Year Plan. Some of the States like the Punjab, Bombay and Madras already had soil conservation acts, while in some other States legislation with an indirect bearing on soil and water conservation was already in force. The earliest soil conservation legislation in India is the Punjab Land Preservation Act, 1900, subsequently amended in 1942, 1944, 1951 and 1958. It was enacted primarily for afforestation work in the forests of the Siwalik hills. There is no provision for work on agricultural lands, reclamation of waste lands and other aspects of soil conservation.

3.32. The Bombay Land Improvement Schemes Act, 1942 as amended in 1948 has provided the broad pattern for soil conservation legislation in many States as well as for the Model Soil Conservation Bill. This Act provides for the establishment in each district of a District Soil Conservation Board under the chairmanship of the Deputy Commissioner or the Collector to coordinate the programme. Some of the other salient features are the laying down of a detailed procedure for planning and execution of the programme, and accommodating the majority opinion by providing that a scheme is to be sanctioned if not less than 33% of the total number of the land owners owning in the aggregate not less than 33% of the land included in the scheme have not raised objection to the scheme. Owners of land not included in a scheme but benefiting from the scheme are also liable to pay a contribution to the executing agency. There is provision for advancing loan to individual cultivator in the scheme, the loan being recoverable in 15 years. The Act fixes the responsibility for maintenance on the land owner, failing which the same can be undertaken at Government expense and the cost recovered from the person concerned. The Act, however, does not provide for a land development or soil conservation board at the State level to coordinate the activities of different departments concerned with soil conservation at the State level, and of the various district boards.

3.33. In the First Five Year Plan it was stated that, in the main, legislation should provide for:

(i) Powers to execute specified improvements on the farmers' fields and allocate the costs of these improvements between farmers and the State.

(ii) Constitution of cooperative associations of farmers for soil conservation work.

(iii) Powers to restrict usage practices in certain areas, which may be declared "protection areas".

Accordingly, the Central Soil Conservation Board prepared a draft Model Bill after studying the existing legislation and in consultation with the Law Ministry. Copies of this draft bill were sent to the State Governments in December, 1955; and they were requested to enact legislation on this basis. States where legislation was already in force, were asked to consider whether any amendment could be made on the lines of the Model Bill. Some of the States have subsequently taken action on the lines suggested by the Central Soil Conservation Board. The present position with regard to enactment of soil conservation legislation in the various States is given below in Table 3.3.

TABLE 3.3

Present position of Soil Conservation legislation in the various States

Sl. No.	Name of the State	Present position of Soil Conservation legislation
(1)	(2)	(3)
1.	Andhra Pradesh	The Madras Land Improvement Schemes (Contour Bundings and Contour Trenching) Act, 1949 in areas of old Madras State before formulation of Andhra Pradesh. The Hyderabad Land Improvement Act, 1953 in Telengana districts of the erstwhile Hyderabad State before 1956. Integrated Bill is also under consideration.
2.	Assam	No legislation.
3.	Bihar	No legislation but bill is under consideration.
4.	Gujarat	The Bombay Land Improvement Schemes Act of 1942 has also been extended to this State.
5.	Himachal Pradesh	Himachal Pradesh Land Development Act, 1954 is in force.
6.	Kerala	The Travancore-Cochin Land Development Act, 1959 and Madras Land Improvement (Contour Bundings and Contour Trenching) Act, 1949 are in force in respective areas as they were prior to the formulation of present Kerala State in 1956. Integrated Bill is under consideration.
7.	Madhya Pradesh	The Madhya Pradesh Land Improvement Schemes Act, 1957 is in force.

[TABLE-contd]

TABLE NO. 3.3—*contd.*

(1) (2)	(3)
8. Madras	The Madras Land Improvement Schemes (Contour Bundings and Contour Trenching) Act, 1949 has now been replaced by the Madras Improvement Schemes Act, 1959.
9. Maharashtra	The Bombay Land Improvement Schemes Act, 1942 as amended in 1948.
10. Mysore	The Bombay Land Improvement Schemes Act, 1942, is in force in Bombay-Karnatak area. There was no Act for ex-Mysore State areas and Hyderabad Act was not made applicable to Hyderabad Karnatak. The Mysore Land Improvement Bill of 1961 has now received the assent of the President and rules are being framed thereunder.
11. Orissa	No legislation specifically for soil conservation. However, Orissa Agriculture Act, 1951 as amended by Orissa Agriculture (Amendment) Act, 1956 has some provision for Soil conservation which has not been given effect to.
12. Punjab	Punjab Land Preservation Act, 1900 as amended in 1942, 1944, 1951 and 1958 is in force.
13. Rajasthan	The Rajasthan Land Improvement Schemes Bill is under consideration.
14. Uttar Pradesh . . .	The Uttar Pradesh Soil Conservation Act, 1954.
15. West Bengal . . .	No legislation passed or under consideration.

3.34. There is no soil conservation legislation yet in the statute books of the States of Assam, Bihar, West Bengal and Rajasthan. However, in Bihar and Rajasthan a bill is under consideration of the legislature. As far as Orissa is concerned, there is the Orissa Agriculture Act, 1951, which was amended in 1956. It is not actually a soil conservation act; and there is only a brief mention of soil conservation in it. But so far no action has been taken even on the basis of the limited provisions of this Act. It is understood that the Punjab Government are considering the enactment of a comprehensive Act on the basis of the Model Bill circulated by the Central Board.

3.35. The Madhya Pradesh Land Improvement Schemes Act, 1957 and the Uttar Pradesh Soil Conservation Act, 1954 are both, more or less, on the pattern of the Model Bill circulated by the Central Soil Conservation Board.

Soil Conservation Boards

3.36. The importance of having statutory bodies at the Centre and in the States has been emphasized by various authorities. Sir John Russel in his report to the Imperial Council of Agricultural Research stated that provincial organisations should look after the provincial aspects and the organisation at the Centre should take up matters of interest to more than one province, coordinate work being done in the provinces and States, act as a clearing house for the pooling and exchange of information, foster researches and arrange for advice where needed. It should also have the power and funds

to supplement the activities of state and provincial Boards. Similar stress was laid by Dr. J. N. Mukerjee*, who stated that 'for the purposes of coordination and formulation and working out of programmes of conservation, statutory organisations which may be called Land Development Boards are necessary both at the Centre and in the Provinces and States'. It has clearly been stated by them that such an organisation should not merely be an advisory body but should initiate measures and control and guide them. Rather they go further and say that this body should function through a number of committees like a Committee on Soil Conservation, which should deal with soil surveys, soil maps, conservation of soil fertility and reclamation, separate committees for anti-erosion, afforestation, irrigation and drainage, and other activities. The First Five Year Plan report also recommended the setting up of a Central Soil Conservation Board and specified its functions.

3.37. *Central Soil Conservation Board.*—After considering various aspects of the question, the Government of India set up the Central Soil Conservation Board in 1953 with the Union Minister of Agriculture as Chairman. Secretary, Ministry of Food and Agriculture (or his nominee), Agricultural Commissioner, I.C.A.R., Inspector General of Forests, Member (Waterways, Irrigation and Navigation) of the Central Water and Power Commission, Deputy Financial Advisor, Ministry of Finance and Secretary, Ministry of Irrigation and Power are members of the Board. An officer of the Ministry of Food and Agriculture is its Secretary.

3.38. The functions of the Board are:—

(i) to organise, coordinate and initiate research in soil conservation, (ii) to assist States and River Valley Projects in drawing up schemes, enactment of legislation and rendering of such technical advice as may be required from time to time, (iii) to act as a clearing-house of information on soil conservation and as a store-house of experience, (iv) to arrange for the training of the technical personnel, (v) to provide assistance in carrying out reconnaissance surveys or detailed surveys, (vi) to recommend financial assistance, (vii) to coordinate inter-State soil conservation projects and (viii) to undertake such cognate measures as are germane and relevant to the Board.

3.39. *State Soil Conservation Board.*—There is also a need for State Board, for assessing the soil erosion problems, preparing plans for control of erosion and soil conservation in the States, drawing up suitable legislation for the execution of improvement of land use and soil conservation programmes, executing plans, framing suitable programmes for demonstration, research, publicity and training of personnel. The First Plan, suggested that the Minister-in-charge of Agriculture or Forestry should be the Chairman and Secretary, Development Department, Chief Conservator of Forests, Chief Engineer, Irrigation, Director of Agriculture and head of the Revenue Department in the State should be the members of the State Board. The Board should have a full time Member-Secretary who should be a senior officer with experience of agriculture or forest management work.

*J. N. Mukerjee, Part I, General soil Conservation and Afforestation, published by the National Planning Committee, pp. 52-55.

3.40. Six State Governments, *viz.*, Assam, Gujarat, Maharashtra, Mysore, West Bengal and Jammu and Kashmir, have not yet set up any State level Board, directly or indirectly concerned with the soil conservation programme. Of these Maharashtra, Gujarat and Mysore are following the same pattern, as the Bombay Land Improvement Schemes Act of 1942 has been adopted by all the three States. Mysore has recently passed its own soil conservation legislation and will be constituting a Soil Conservation Board. In the remaining 10 States, State-level Boards are there; but with different nomenclature. Andhra, Himachal Pradesh, Orissa, Rajasthan and Uttar Pradesh are the five States which have named their Boards as Soil Conservation Boards. Bihar has a State Land Use Board. Kerala and Madras have Land Development Boards. Madhya Pradesh has named it Land Improvement Board. Punjab is having two types of Boards. One is the Soil Conservation and Land Utilisation Board for the State. The other is the Inter-State Soil Conservation and Coordination Board for Punjab and Himachal Pradesh in respect of River Valley Projects.

3.41. There are marked variations in the functions and scope of these institutions in various States. Secondly, these Boards are not in all cases based on any legislative provision in the soil conservation Acts. Assam, Bihar, Rajasthan and West Bengal are the States which do not have any legislation on soil conservation so far. However, Bihar and Rajasthan do have Boards at the State level. On the other hand, States like Gujarat, Maharashtra, Mysore and Jammu and Kashmir do have some legislation but have not formed any State level Board so far. The existing Soil Conservation Acts in Maharashtra, Gujarat, Mysore and Punjab do not contain any provision for setting up soil conservation Boards at the State level.

3.42. Detailed information about the structure of these State-level Boards was not available for the States of Orissa, Punjab and Rajasthan. The Model Bill circulated by the Central Board suggested the constitution of State Boards with the Minister of Agriculture as Chairman. Bihar has the State Land Use Board, with Development Commissioner as Chairman. Similarly, in Himachal Pradesh, Development Commissioner is Chairman of the Board. In some other States like Madhya Pradesh, Madras, Andhra Pradesh and Uttar Pradesh, the Minister of Agriculture is the ex-officio Chairman of the Soil Conservation Board, as suggested in the Model Bill.

3.43. Other members represented on the Boards can be grouped in two categories, *viz.*, officials and non-officials. Among official members are heads of the Departments that are concerned with the soil conservation programme in the State. Director of Agriculture, Chief Conservator of Forests and Head of the Irrigation Department are the three Departments which are invariably represented on the Board, though this may not be explicitly stated in the legislation. The Uttar Pradesh Soil Conservation Act of 1954 vests powers with the State Government to have up to five persons nominated on the Board, whereas the Madras Land Improvement Schemes Act of 1959 and the Madhya Pradesh Land Improvement Act of 1957 clearly list the various Departments to be represented on the Board. The non-official members of the Board are usually members of the State legislative Assembly and/or Council; and their strength varies from two

in Himachal Pradesh to seven in Uttar Pradesh. It may be said that the structure of the State Board shows a fairly uniform pattern except in two or three States.

3.44. The functions of these Boards vary somewhat in different States. In some States, the functions are those of advisory and coordinating type. But in States like Madhya Pradesh, Madras, Kerala and Uttar Pradesh, besides being advisory and coordinating bodies, these institutions are also responsible for execution of soil conservation schemes. In other words, the Boards are to initiate, either on their own or on the order of the State Government, the preparation of schemes by district level bodies, approve these finally, and devise ways and means for the execution of the approved schemes. Functions as vested in the State Soil Conservation Boards of Madhya Pradesh, Uttar Pradesh, Kerala and Madras, are in accordance with the suggestions made in the Model Soil Conservation Bill, circulated by the Central Soil Conservation Board for the guidance of the States.

3.45. In States of the Western Region *viz.*, Maharashtra, Gujarat and Mysore there are no State level Boards; but these States are having Boards at the district level. It may be added that there are a few other States, Madhya Pradesh, Madras and Uttar Pradesh, which also have District Committees.

3.46. An important function of a Soil Conservation Board is expected to be the coordination of the activities of different departments which are connected with the soil conservation programme. In a large measure, the effectiveness of a Board would depend on how well it performs this function. We have tried to ascertain how effectively this important function is being performed in the States where Soil Conservation Boards exist. No information has been received in this respect for Kerala. There is no Soil Conservation Board in Assam, West Bengal, Maharashtra, Gujarat, Mysore and Jammu and Kashmir and therefore, the question does not arise for these States. In Himachal Pradesh and to a lesser extent Rajasthan, the State Boards have been effective in achieving this coordination. In the remaining States, however, the Soil Conservation Boards are not effective in coordinating the activities of the different departments connected with soil conservation programme in these States.

Administration of soil conservation programme in States

3.47. There appears to be an urgent need to establish an adequate soil conservation organisation in the States. Experience in the Second Plan, according to the Central Soil Conservation Board, was that due to lack of effective organisation in most States there was a considerable time lag in the assessment of the need for training facilities and in the creation of such facilities for soil conservation programmes. There was also considerable lag between the soil survey and the soil conservation extension. The Third Plan targets are nearly 5 times that of Second Plan. The magnitude of the programme in the Third Plan is such that it cannot be successfully carried out unless the organisation in the States is properly geared for this task. The Third Plan Report has also emphasized this point in the following statement. "Each State requires a strong soil conservation organisation, for initiating, planning and executing soil conservation programmes. Whether it takes the form of a Department or of a Wing

in an existing Department, it is essential that a full-time officer at an appropriate level should be responsible for its work and direction. The organisation should include in it personnel with requisite qualifications and training in the fields of agriculture, engineering and forestry. There is also need at the State Headquarters of a coordination committee which includes the heads of the Departments of Agriculture, Irrigation, Forests and Soil Conservation as its members. Such a committee can assist in obtaining policy decisions expeditiously and in providing expert guidance and coordination in activities relating to soil conservation."(1).

3.48. The organisational pattern in the States varies considerably. Generally speaking, at the State level, there is not yet a single organisation of the type recommended by the Planning Commission, to assume responsibility for soil conservation work as a whole. Different departments such as Agriculture, Forest and Irrigation attend to items of work which fall within their purview and in which they specialise. Because of organisational deficiency, there is a general lack of coordinated approach to soil conservation problems, assessment of soil conservation needs, requirements for training, research, extension and perspective planning.

3.49. The pattern of organisation with respect to soil conservation work on agricultural lands also varies somewhat in different States. The existing organisational pattern for soil conservation work at various levels in the States is given in the Appendix B-4. The facts given in the Table are as furnished by the States.

3.50. In all the States, except Assam, and Jammu and Kashmir, the Agriculture Department has been entrusted with soil conservation work on agricultural lands. In Assam and Jammu & Kashmir, the Forest Department is looking after this programme. In Bihar, the Conservator of Forests has been given charge of the Soil Conservation Wing of the Agriculture Department and has been additionally designated Director of Soil Conservation. In the States like Andhra, Gujarat, Kerala, Madhya Pradesh, Madras, Maharashtra, Orissa, Punjab and Rajasthan, where the Agriculture Department is responsible for the planning and execution of the Soil conservation programme on agricultural land, officers of the status of Joint Director or Deputy Director have been provided for assisting the Director of Agriculture in looking after the Soil Conservation programme. Andhra Pradesh has a Superintending Engineer to assist the Director of Agriculture. In Mysore, the Assistant Soil Conservation Officer assists the Director of Agriculture at the State-level.

3.51. Other departments like Forest, Irrigation, P.W.D. and Development are running this programme in specified areas or in their special spheres. The Forest Department is primarily concerned with afforestation in States like West Bengal, Orissa, Rajasthan, and with some other Soil Conservation measures in most of the remaining States. The Irrigation Department is also responsible for soil conservation along with the Agriculture and Forest Departments in States like Maharashtra for river valley projects, and for drainage works in Punjab, Uttar Pradesh, Assam, Orissa and West Bengal. In Gujarat State, the P.W.D. is entrusted with the work of reclamation of

(1) Third Five Year Plan Report, pp. 372.

Bhal lands along the coast in the erstwhile Saurashtra area. The DVC is responsible for soil conservation work in its area in Bihar. The Development Department is also concerned with the soil conservation programme in some States; but the work under the control of this Department is supervised by the technical field staff of the Agriculture Department, either posted under the charge of the Development officials for day-to-day working or having a separate existence from them but offering all facilities to the Development Department authorities.

3.52. As far as the set-up below the State level is concerned, there are two broad patterns noticeable. These are discussed below. An assessment of the two systems in terms of effectiveness, etc. will be attempted later. One pattern may be said to obtain in Kerala, Punjab, Rajasthan, Uttar Pradesh, Bihar and West Bengal, where no separate administrative-territorial units like divisions or sub-divisions have been created for soil conservation works. The activities in these States except Punjab and Bihar, are carried out through the District Agriculture Officers. In Punjab, a separate officer designated as Assistant Soil Conservation Officer has been posted at the district level. In Bihar, except in areas allotted to the DVC, the Block agency is executing the work with its own funds under the technical supervision of the Assistant Director, Soil Conservation, of the Agriculture Department, who is in charge of the programme in the districts. In all these States, the administrative district is the unit. The district level officers are assisted by Soil Conservation Assistants, Overseers, Soil Conservation Field-men and other staff in field work and operations.

3.53. The second pattern is to be found in States like Andhra, Gujarat, Maharashtra, Mysore, Madhya Pradesh, Madras, Orissa and Himachal Pradesh, where there are soil conservation divisions below the State level. A division may extend in area to one district or more. These Soil Conservation divisions are further divided into a number of sub-divisions, comprising of one district or a part of it, depending on the extent of the work. States like Gujarat, Himachal Pradesh and Orissa have further sub-divided these sub-divisions into units which may comprise of one taluk or revenue unit or a larger area. This last unit of operation is called 'charge' in Gujarat, 'section' in Himachal Pradesh and 'range' in Orissa. In the field, at the village or at the lowest level, different functionaries are working under the direct supervision of the Soil Conservation Assistants or Agricultural Engineering Supervisors in Andhra Pradesh and Madras, the Agricultural Supervisor in Gujarat and Maharashtra, and the Agricultural Demonstrator in Mysore. The work of the Soil Conservation Assistant, Agricultural Supervisor and Agricultural Demonstrator is supervised by the Sub-divisional Officers. The Soil Conservation Sub-divisional Officer occupies a key position and is responsible for the preparation of estimates and the execution of soil conservation work within his jurisdiction.

3.54. *Administrative set-up in the DVC.*—The Soil Conservation Department of the DVC is under the charge of the Director of Soil Conservation and has six sections, each under the charge of one Class I Officer. The sections are (i) Research and Investigation, (ii) Soil Conservation Extension, (iii) Engineering, (iv) Forestry, (v)

Irrigation Farming and (vi) Foreshore Farming. Field work is actually done by the Forestry, the Engineering and the Soil Conservation Extension sections. The DVC area has been divided into three zones, each zone being placed under the charge of a Class II Officer. There are ten units under each Zonal Officer. Each unit has one Soil Conservation Assistant, two field Assistants, two 'Amins' and two Chainmen, and is allotted an area of 500 acres for soil conservation work every year. Upto 1959, the works were being executed through the Block agency, though planning, technical guidance and supervision was provided by the DVC staff. It was, however, felt that the BDOs did not take adequate interest in this work. Besides, there were some procedural delays. Hence the DVC decided in 1959 to work independently on its own. However, for obtaining people's cooperation the DVC has been taking the help of the Block agency even after 1959.

Inducement and assistance for soil conservation

3.55. As a rule, the amount which the individual farmers can spend in conserving their land resources is limited by the present value of anticipated returns from expenditure. In other words, the cost-price structure and future expectations are important factors in determining how much a farmer can spend. Farmers frequently find it uneconomic to safeguard future productivity, with the result that "economic exploitation" prevails. In other words, it does not pay or is not "good business" for the individual to practise conservation. The interests of the society are somewhat different from that of the individual; and there are other considerations to justify public expenditure for conservation investment. Two important conditions and/or situations under which social action to achieve conservation would be desirable are:

(i) When or where it would be economic for the individual farmer to conserve; but he fails to do so.

(ii) When or where conservation is uneconomic for the individual farmer; but is economic for the society.

In the first case, social action is fully justified as it will increase both individual and social net returns. Society can afford to spend money so long as it results in increasing the social net income. Such funds would normally be limited to education and subsidies for specific improvement. In the second situation, a sound Government policy and action-programme can be formulated only when the basic reasons are understood by the farmers following an exploitative system. Society is justified in taking steps to eliminate such exploitation, by directing the action programme at the basic causes operating in the area, and educating the farmers in social purpose.

3.56. Apart from educational and promotional efforts, there are two financial methods of achieving the desired results by the Government. They are (i) granting loans and (ii) giving subsidies or grants to farmers for the adoption of soil conservation measures. These measures are a type of economic compulsion. The Central Soil Conservation Board has a well defined policy for financial assistance for soil conservation schemes. Rules have been laid down to govern the lines on which aid is to be extended to the State Governments and other

authorities in the form of loans and subsidies. These have already been discussed in Chapter II and need not be repeated. We shall, therefore, describe here the policy followed by the State Governments in extending facilities and financial assistance to the cultivators for soil conservation works.

3.57. In Bihar and West Bengal, only demonstration work has been taken up at Government cost. During the Second Plan period, the entire soil conservation programme was demonstrated on a 100% subsidy basis. In Orissa, the programme has been executed on a 100% subsidy basis within the selected catchments. For any work taken up outside these selected catchments the entire cost is expected to be borne by the individuals who get only technical guidance from the Government.

3.58. Besides technical aid which has been provided in all the States, help in materials is also given to a varying degree by the State Governments. In a few States like Himachal Pradesh, Madhya Pradesh and Maharashtra, tools and implements (*e.g. kenis* or bund-farming implements in Maharashtra) have been supplied by the Agriculture Department, though in most of the States this facility has not been provided to the farmers participating in the programme.

3.59. On the financial side, a subsidy of 25% of the total cost has generally been granted by the Government to the beneficiaries of the soil conservation extension programme in the majority of the States. Of this subsidy, the share of the State is 50% while the remaining 50% of the grant is met by the Central Soil Conservation Board.

3.60. In Andhra Pradesh, Gujarat, Maharashtra and Mysore, to the cost of mechanical measures or work, is added an amount equal to 33-1/3 per cent of it as establishment charges in order to arrive at the total cost of the soil conservation work. Of this total cost, 25% is given as subsidy and the balance is treated as a loan to the cultivators at the rate of interest of 4½% per annum. This means that no subsidy is actually given toward the cost of the mechanical measures. The subsidy given only covers the cost of establishment, added to the variable cost of the work. This procedure has come in for a good deal of criticism from some sections of the farmers who apparently feel that the aid actually given to them is in reality a book adjustment. We are mentioning it specifically because of the seriousness we have noticed in these complaints. The extent of subsidy to be given to the farmers and the manner of its calculation raises issues of policy which we are not going into. The matter may stand some re-examination at the appropriate level at the Centre.

3.61. In Assam, 50% of the total amount advanced during the first four years of plantation, are treated as a subsidy, and the rest as a loan to the beneficiaries. In Himachal Pradesh and the Nilgiris district of Madras State also, a 50% subsidy on the total cost is advanced and the other half treated as a loan. The higher rate of grant in these areas is due to the high cost of soil conservation measures recommended.

3.62. The period of recovery of loan from the cultivators varies among the States. In Assam, the loan is to be recovered in six yearly instalments, the first instalment starting from the fifth year of plantation. In Gujarat, Maharashtra, Mysore and Kerala it is recoverable in 15 equated annual instalments. In Madras, the loan is recovered in equated annual instalments not exceeding 20 after the third year of completion of the works. In Madhya Pradesh, it is recovered in 10 or 15 yearly instalments.

Agencies for bund construction

3.63. In the selected districts soil conservation work has been mostly undertaken on a sub-catchment basis. The construction work is either executed directly by the department, or given on contract or is undertaken by the individual beneficiaries under the guidance of the department. In Andhra Pradesh and Madras, the work is undertaken either directly by the department on a piece rate system or through contractor. In Kerala, the work is executed by the department or by the individual beneficiaries under the technical supervision of the department. In Maharashtra and Gujarat, earthwork is done directly under the supervision of the department. It is reported that Farmers' Unions in Maharashtra help in mobilizing labour for earthwork. In Rajasthan and to some extent in Himachal Pradesh, the work is undertaken by individual beneficiaries under the guidance of the soil conservation staff. In Madhya Pradesh, 'bunding on crop lands' is done by the beneficiaries under the guidance of the block; but contour bunding is done with the help of bull-dozers. In the State Government area of Hazaribagh, the panchayats are expected to undertake the earthwork; but in the selected two villages, the earthwork was done by the department directly by employing hired labour. In Uttar Pradesh, *ad-hoc* soil conservation village committees are formed; soil conservation plan is discussed by these committees and earthwork done by the beneficiaries under the guidance of the department. In the DVC area of Hazaribagh, the people are associated with the programme from the planning stage onwards. Each beneficiary is allotted work in proportion to his holding, its slope etc. and he constructs the terraces and bunds at his own cost. In lieu of this, the beneficiary is supplied free fertilizer, keeping in view the holding and the crop to be raised on the land.

3.64. *Experience of coordination in States.*—An attempt was made to understand how the soil conservation programmes of different departments in a State are coordinated and what problems, if any, are being encountered. The State Governments of Andhra, Kerala, Madras and Assam have reported that as only one department (whether Agriculture or Forest) is responsible for carrying out soil conservation programme on agricultural land, there is no problem of coordination. States like Gujarat, Maharashtra, Mysore, Orissa and West Bengal have reported that there is no need of any coordination as there are no conflicts of area, agency or funds between the Departments concerned with the execution of the programme. It is not clearly understood as to why there is no need of coordination in the States where more than one department are dealing with the soil conservation programme. Even for demarcating areas, allocating funds and entrusting responsibilities for work

in particular areas, there is a definite need for a coordinating agency at the State level. Besides, formulation of policies and priorities, and pursuit of research and demonstration and training programmes are matters which require a good amount of coordinated thinking and action.

3.65. We may mention here some of the instances where lack of coordination has come to our notice. In Maharashtra and the Karnatak areas of Mysore, soil conservation work before the 1942 Act was passed, used to be more of an integrated programme of afforestation and agriculture than after the Act. In the unreserved forest areas bordering on agricultural lands the soil conservation programme before 1942 included afforestation and grass development on the foothills and contour bunding on agricultural lands. The Land Improvement Officers were drawn from both the Agriculture and the Forest Departments. The Forest Department was represented on the State Land Improvement Board. Since 1942, there are only District boards and the Forest or the Cooperative or the Revenue Department is not represented on the District Board. The absence of coordination is nowhere as evident as in the case of distribution of waste lands. Both the Maharashtra and the Mysore Governments carried out surveys to determine the land capability classes of waste lands. These yielded useful data and recommendations about appropriate soil conservation measures on different classes of land. But these recommendations have not apparently been taken into account in actual distribution of such lands. The cooperative or collective farms started on these lands have also not taken these recommendations into consideration.

3.66. States like Punjab, Rajasthan, Uttar Pradesh and Himachal Pradesh fall in another category, since they report that effective coordination is being achieved at the State level through their State level Boards. In Madhya Pradesh and Bihar, there is lack of coordination both at the State and at lower levels. As far as Madhya Pradesh is concerned, there appears to be lack of coordination even within the Agriculture Department. Problems due to lack of coordination in Madhya Pradesh are (i) that adequate priority is not given to the follow-up programme in the areas already covered by contour bunds, by the extension wing of the Agriculture Department (Soil conservation programme being carried out by the Soil Conservation Wing); (ii) that the agricultural extension wing of the Department and the C. D. Blocks are offering loans out of their own funds, for ordinary bunding or field embankments, though the Soil Conservation Wing is laying stress on contour bunding; and (iii) that Multipurpose Tribal Welfare Blocks are carrying out contour bunding in their areas independently without reporting such areas to the Soil Conservation Wing of the Agriculture Department.

3.67. As far as Bihar is concerned the different departments and agencies, *viz.*, Agriculture, Forest and Waste land Reclamation and the DVC do not have a common meeting ground; and there is a general lack of coordination among them. Perhaps, one reason for this lack of coordination is the absence of proper legislation on soil conservation in the State. One aspect of this problem is that the different agencies undertaking this programme have provided for

different scales of expenditure per acre of land. This creates a certain amount of confusion in the minds of farmers. This is particularly true of the Hazaribagh area where the DVC and the State Government are working side by side.

3.68. In the districts selected for study, some instances came to our notice where there had been an integrated approach to the soil erosion problem. One may cite the soil conservation programme in the DVC area of Hazaribagh district as the best example of this approach. The DVC soil conservation work is carried out by its Forestry, Engineering and Soil Conservation Extension Sections under one Director. The officers of the different sections meet and discuss common problems. They make joint field trips. Upland area is tackled by the Soil Conservation Extension Section; in the highly eroded area where cropping is not possible, afforestation work is undertaken in consultation with the Forestry Section and gullied areas are treated by the Engineering Section which constructs check dams, small earth dams, etc. All soil conservation schemes are planned and well-coordinated, and care is taken to ensure that the proposed measures are applied in proper combination to meet the needs of different kinds of lands in the watershed. The soil conservation demonstration at Harharo in Hazaribagh district under the charge of the District Forest Officer, is also an integrated demonstration programme. Afforestation, grass land development and construction of contour bunds are taken up in a coordinated way on the demonstration project area.

3.69. In Ahmednagar soil conservation work taken up before 1947 used to include a programme of treating unreserved forest lands. Soil conservation work on agricultural land was taken up in a coordinated way. The progress of soil conservation work after 1947 in the State was confined to construction of contour bunds on agricultural lands. In the other districts selected for study, such an integrated approach to the soil erosion problem did not come to our notice. There is, however, a recognition that the treatment of only agricultural lands to the exclusion of other lands in the same catchment or watershed will not produce as satisfactory results as may be had if the whole catchment area including agricultural and other lands is treated as one problem with a coordinated approach by different departments. Land Improvement or Soil Conservation Acts or Bills in Bihar, Madras, Mysore, Andhra and Kerala do include a provision to the effect that soil conservation schemes should be discussed jointly by different departments concerned in the District Soil Conservation Committees. But actual evidence of such coordination was lacking in the field.

Coordinating consolidation of holdings with soil conservation

3.70. Effective land consolidation in close cooperation with the soil conservation programme and consistent with soil conservation needs would improve agricultural efficiency and result in increased production from land. Mr. Charles E. Kellogg, in his report on "Soil Conservation and Soil Survey in India", 1958 has recommended that "special effort and priority be given to the consolidation or partial consolidation, of holdings in the villages, especially where run-off and erosion control are significant problems. In a great many

villages such adjustments are the first necessity to the design and application of those water-control measures necessary for increased and sustained production*".

3.71. In order to ascertain the policy of the State Governments about the linking of consolidation with soil conservation, information was collected as to whether consolidation has been made a necessary part of the soil conservation programme and if this was not so, whether States had any plans to link the two. From the data received it appears that only in Maharashtra and the DVC area in Bihar some effort has been made to link up consolidation of holdings with soil conservation measures. In Maharashtra, the work of consolidation of holdings is taken up under the Agriculturists (Consolidation of Holding & Prevention of Fragmentation) Act. To link consolidation with soil conservation, the Government have issued orders that where soil conservation measures are taken, consolidation should be given first priority and that in such areas holdings should follow the alignments of contour bunds as far as possible. It has been observed, however, that there is, in actual practice, a general lack of coordination between the two programmes in Maharashtra. In the upper Siwani catchment in the DVC area, consolidation of holdings has been made a necessary part of soil conservation measures. It is reported that there is excessive fragmentations in the area and in the absence of consolidation many fragments would go under bunds, roads or grass waterways.

3.72. As regards the future plan of those State Governments which have so far not linked up the two programmes, there was no response from Andhra Pradesh and Madras. Eight other States *viz.*, Assam, Gujarat, Himachal Pradesh, Kerala, Madhya Pradesh, Orissa, Punjab and West Bengal have stated that they have no plan for linking consolidation of holdings with soil conservation measures. In Uttar Pradesh and Rajasthan, an attempt is being made on a limited scale to link the two programmes. From Uttar Pradesh it is reported that wherever consolidation operations are taken up in areas already covered by soil conservation measures, efforts are made to link and coordinate the work of the two departments. Holdings are expected to be consolidated keeping in view the contour bunds. However, it has been pointed out that the effort to link up these two programmes has not been a success so far. In Bihar and Mysore, proposals to make consolidation an integral part of soil conservation programme are under the consideration of the State Governments. In Bihar (non-DVC area), consolidation of holdings was attempted on a voluntary basis in the Pilot Demonstration Project at Harharo (Hazaribagh). It was accomplished through persuasion and mutual understanding of the farmers who surrendered their rights in land to the Deputy Commissioner under the provisions of Chhotanagpur Tenancy Act of 1942. Contour bunds were the guiding factor for consolidation operations.

Role of C. D. Block and People's Institutions in soil conservation programme

3.73. *Role of C. D. Blocks.*—Human problems involved in conservation are as important as research on technical aspects of soil

*'Soil Conservation and Soil Survey in India' by Charles E. Kellogg—pp. 9.

conservation. It is, therefore, necessary to develop methods, procedures, and institutions through which knowledge of conservation practices is carried to rural people and they can be helped to adopt such practices. One important institution for extending assistance and education is the Block Extension agency. The importance of the soil conservation programme for the extension agency will be apparent from the fact that the adoption of soil conservation mechanical measures in combination with conservation farming methods is imperative for raising agricultural productivity on unirrigated lands which form a significant proportion of the total cultivated land in the country.

3.74. The Block agency have, therefore, an important role to play in the planning and execution of the soil conservation programme, at the field level if such a programme is to achieve success. The agency ought to be able to prepare the villagers for soil conservation schemes like contour bunding. It should also play an effective role as far as adoption of conservation farming methods by the cultivators are concerned. The Block staff should be responsible for educating the farmers in soil conservation measures and conservation farming techniques through various extension methods. Use of fertilizers, compost and green manure, adoption of contour ploughing and strip cropping etc., can be widely extended through effective extension education of cultivators by the Block agency.

3.75. An attempt was made to ascertain from the State Governments the type of soil conservation programmes taken up by the C. D. Blocks and the nature of supervision exercised by the Department in such works. In Gujarat, Madhya Pradesh, Madras, Mysore and Maharashtra, the entire soil conservation programme is operated by the Agriculture Department, and the participation of the Block agency is negligible. In West Bengal, there is no programme of soil conservation in C. D. Blocks. In Punjab, the Adviser, Soil Conservation, is not aware of any programme taken up in C. D. Blocks except those recently undertaken under pilot projects for the utilisation of rural man-power. But it is understood that measures like *watt bundi*, levelling of lands, etc. which according to technical experts are not considered as soil conservation measures, are taken up by the Block agency. In the remaining eight States namely, Andhra Pradesh, Assam, Bihar, Himachal Pradesh, Kerala, Orissa, Rajasthan and Uttar Pradesh, the programme has been taken up in C. D. Blocks as a distinct Block programme according to the needs of the area. However, as far as Andhra Pradesh is concerned, it is reported that the Block programmes are not very effective. The Block agency is advancing loans to individual cultivators, who construct field bunds with the loan. The work in the Blocks in this State is supervised by the soil conservation staff of the Agriculture Department. Terracing of hilly areas is the programme usually undertaken in S. M. Tribal Blocks in Assam. It is reported that enough of attention is not paid by the Blocks to this type of work. The programme is expected to be technically supervised by Soil Conservation staff of the Forest Department but it is observed that there is no proper technical supervision in the field. In Bihar, contour bunding is taken up in the Block areas and this work is executed through the Block agency. The work is supervised by the Officers of soil conservation wing posted in the Block and who, in

turn, receive guidance from Soil Conservation Officers at the district level. In Himachal Pradesh, programmes like bunding and terracing are taken up. Some programmes of soil conservation were taken up with Block funds on a 100% subsidy basis in Chamba district. The programme is supervised by the Agricultural Extension Officer of the Block.

3.76. In Kerala small schemes in the form of construction of contour bunds have been taken up by the Blocks. Technical guidance for the execution of programme is provided by the District Agriculture Officer. In Orissa, the programmes taken up in block areas are contour bunding, tree planting, gully plugging, etc. The programme is technically supervised by the soil conservation section of the Agriculture Department. In Rajasthan, the soil conservation programme for contour farming, terracing, dry farming, reclamation of saline/alkaline soil, etc. are taken up in a few panchayat samiti areas. The programme is technically supervised by the Agriculture Department. As far as Uttar Pradesh is concerned, soil conservation machanical measures and conservation farming techniques are extended through the Block agency in some selected Blocks only. In these selected Blocks, additional staff is provided for this purpose. One additional ADO (Agriculture Extension Officer) who is specially trained in soil conservation is provided in each such Block. Besides 10 additional VLWs known as Assistant Soil Conservation Inspectors are also provided. The work of ADO in the Block is supervised by the District Soil Conservation Officer. In other Blocks, a 'Prantiya Raksha Dal' worker is provided to mobilise the rural manpower to carry on *medhbandi* programmes. The ADO (Agriculture) and the usual strength of 10 VLWs help the 'Prantiya Raksha Dal's, Zonal worker in this work. These bunds are temporary structures which may last up to three years after which they have to be reconstructed. The measure is supposed to conserve moisture in the fields. It is doubtful whether, technically speaking, *Medhbandi* can be considered a soil conservation measure.

3.77. Efforts were also made to obtain information about the role played by the Block extension agency in preparing the people for taking up recommended soil conservation measures and persuading them to follow conservation or dry farming methods. The data received on these points is neither complete nor comprehensive. However, from the limited data available it is clear that in most States the Block agency does not play any part in preparing the people for taking up soil conservation measures. As far as follow-up of conservation or dry farming methods is concerned, these should essentially form a part of the duties of the Agriculture Extension Officers and VLWs in the Blocks. Follow-up measures are nothing else but improved cultural practices for conserving soil and moisture which if followed would result in higher agricultural production in the area. Soil conservation measures of the engineering type without appropriate cultural practices are not likely to yield the desired results. From almost all the States it has been reported that the Block extension agency is not looking after the follow-up programme. On the whole, it may be said that the Blocks are not playing their proper role yet in the soil conservation extension programme. Lack of coordination and understanding and inadequate

inter-departmental cooperation are factors standing in the way. In fact, the role of blocks in this pogramme does not seem to have been properly thought out yet in the majority of the States.

3.78. *Role of People's Institutions and local Leadership.*—Soil conservation is essentially a people's programme. If it is to succeed, the farmers have to accept the measures on their land and they have to maintain them if they are to protect and preserve the land for sustained production. In the execution of soil conservation programmes the aim should be to obtain on as large a scale as possible, the participation of people on a voluntary basis. The more local leadership can be developed in soil conservation, the more will cultivators take up the work and more lasting it will be. To achieve large scale voluntary participation, an intensive educational programme should be undertaken by the Block Extension agency and the people's institutions and other voluntary organisations. People's institutions particularly Block Samitis and village Panchayats have a significant role to play in soil conservation pogrammes. They can help in developing more consciousness and know-how about the programme, among the farmers, and thereby create more favourable conditions for cooperation from the people in making the programme a success.

3.79. Information collected by us about the role played by people's institutions in the execution of soil conservation programmes shows that bodies like panchayats, cooperatives etc. have not been associated with the programme in a majority of the States. Panchayat is the only institution associated with the programme in a few States, and its role has mainly been that of persuading the farmers to accept bunding or adopt the recommended soil conservation programme. But it has not been assigned any positive role in the execution of the soil conservation programme. In Uttar Pradesh, also, village Soil Conservation Committees, of all the beneficiaries, have been formed for this purpose. The role of such unions or committees has, however, not been very effective as they have lacked interest in the programme. With the new set up of 'Panchayati Raj' in different States, the role of the panchayats with respect to development work, including soil conservation programme, is bound to increase. In Rajasthan, where this system was introduced earliest among the States, the Panchayat Samitis and Zila Parishads have been actively associated with the soil conservation programme right from the planning stage. In some other States also, the panchayats are likely to be associated with this programme in the near future.

3.80. *Role of Farmers' Unions in Soil Conservation work in Maharashtra.*—A special feature of the soil conservation programme in Maharashtra State has been the organization of Farmers' Unions for the planning and execution of the bunding programme. Farmers' Unions were organised in 1957-58, first at the revenue circle level and later at the village level, with a view to ensuring the bunding work which was till then being done on an individual basis mainly as a relief measure in scarcity areas, might be reoriented into 'a self-help and social purpose programme'. A study about the role of Farmers' Unions has, however, shown that they did play some role in Western Maharashtra in obtaining consent from the people and mobilizing them for the bunding work. However, after the bunding work was over and wages were paid, they ceased to be effective. In

any case, it must be said to the credit of the Maharashtra Government that they have dispensed with the system of using contractors for executing the bunding programme. The role of the farmers unions in the bunding programme in Vidarbha and Marathwada regions has been much less than in the Ahmednagar-Sholapur region. They have not even spread numerically in these regions as in Western Maharashtra. The existence of these Unions, which are nominal in most cases, also appears to have created confusion in the minds of the village people, as to the relative importance of a more permanent institution like the Panchayat and an *ad-hoc* body like the Farmers' Unions.

Training of personnel : Achievement & future requirements

3.81. *Staff for soil conservation unit and the annual target for soil conservation work.*—Suitable jurisdictions like divisions, subdivisions, ranges and sections have been demarcated for convenience and efficiency in the administration, supervision and execution of soil conservation work. Each such unit is provided with soil conservation staff of different grades, for the execution of the programme. In Kerala* and West Bengal where a separate staffing pattern for soil conservation work has not yet been evolved, the district agricultural officers are in additional charge of the soil conservation work. In a number of States, a norm of work (or achievement) in terms of acres to be covered per year under the soil conservation programme has been determined for each operational unit and for the staff employed in it. Table 3·4 gives such norms, as fixed by the State Governments.

TABLE 3·4

Norms of achievement for staff in the soil conservation unit and the annual target fixed for it

Sl. No.	State	Operational unit	Designation of the personnel employed in the unit	Strength of the unit	Target† (Acres per year)
(1)	(2)	(3)	(4)	(5)	(6)
1.	Andhra Pradesh	Soil conservation sub-division.	1. Asstt. Agri. Engineer	1	5,000
			2. Soil Con. Asstt.	5	
			3. Sub-Assistants	15	
2.	Bihar	C. D. Block	1. Block Dev. Officer	1	
			2. Soil Con. Extension Supervisor	1	1,000
			3. Field Assistants	2	

*Since April 1962 the additional District Agricultural Officer in Kerala who had been responsible for soil convservation work in addition to his other duties has been given the assistance of one Soil Conservation Assistant. The Soil Conservation Assistant has got two units each consisting of one overseer, one draftsman, one surveyor, five work superintendents and three laskars. There is no norm as such in respect of the area to be covered under soil conservation in a year for this staff in the district.

†(1) In Madhya Pradesh the target has been raised to 7500 acres per year from 1963-64.

(2) In Kerala, before April 1962, the Additional District Agricultural Officer was allotted an annual target of 500 acres.

TABLE NO. 3.4—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)
3.	Gujarat	Soil Conservation Sub-division.	1. Sub-divisional Soil Conservation Officer	1	
			2. Agricultural Supervisor	5	8,000
			3. Agri. Assistants	25	
4.	Himachal Pradesh	Soil Conservation Sub-division.	1. Asstt. Soil Conservation Officer (Survey)	1	
			2. Agri. Inspectors	4	800
			3. Agri. Sub-Inspectors	12	
5.	Madras	Soil Conservation Sub-division.	1. Asstt. Agri. Engineer	1	
			2. Agri. Supervisor	3	7,500 (Plains)
			3. Soil Con. Assistants 4. Sub-Assistants	12	750 (Hills)
6.	Madhya Pradesh	Soil Conservation Sub-division.	1. Asstt. Soil Conservation Officer	1	
			2. Agri. Assistants	5	5,000
			3. Sub-Asstts. (Surveys)	20	
7.	Maharashtra	Soil Conservation Sub-division.	1. Sub-Divisional Soil Conservation Officer	1	
			2. Agri. Supervisors	5	12,500
			3. Agri. Assistants	25	
8.	Mysore	Soil Conservation Sub-division.	1. Sub-Divisional Soil Conservation Officer	1	
			2. Agri. Demonstrators	6	6,000
			3. Agri. Assistants	30	
9.	Uttar Pradesh	C. D. Block	1. Asstt. Soil Con. Officer (Block Dev. Officer)	1	
			2. Soil Con. Inspector	1	3,000
			3. Asstt. Soil Conservation Inspector & VLWs.	10	

For Assam and Orissa details about the size of the administrative-*cum*-operational unit, its staffing pattern and the annual target are not available. In Punjab, soil conservation work on agricultural land was started during the year 1961-62; the strength of field staff under each Assistant Soil Conservation Officer and the area targets have not been fixed so far. In Rajasthan, the operational unit is the block; targets of the area (norm) to be covered by the staff in the district or the block have not been worked out. It has been their experience in Rajasthan that the actual execution of work depends on the willingness of the people to work and invest their share of expenditure. It may be restated here that the construction work in Rajasthan is undertaken by the beneficiaries. It may be possible to fix norms when the Soil Conservation Act is brought into force.

3.82. It may be seen from Table 3.4 that in all the ten States, the unit level staff comprise of three grades of personnel, *viz.* officers, assistants and sub-assistants, though the designation of these functionaires differ from State to State. The table shows that there is no uniformity among the States in the area coverage of the unit, in the strength of the different categories of staff and the annual target fixed for them. In Gujarat, Maharashtra and Mysore where the administrative-*cum*-operational units are more or less of a uniform size, the annual target for the same staff in the three States varies from 6,000 acres in Mysore to 12,500 acres in Maharashtra. The pertinent point in this connection is that the cost of establishment per acre of land brought under soil conservation will be lower where the area norm is higher than where it is lower. It is difficult to comment how far these variations in the strength of different categories of staff and the target area assigned to them reflect differences in the kind or type of soil conservation work in different areas. This question requires some further examination.

3.83. *Establishment charges in the cost of Soil Conservation work.*—In Para 3.60, it has been mentioned that in some States, a margin of 33·3% is added to the actual cost of soil conservation treatment (earth work and masonary work, if any) to provide for the establishment charges. This amount which then works out to 25% of the total unit cost, is given as subsidy to the cultivator, shared equally by the Central Government and the State Government concerned. This method of accounting enables the State Government, in some situations, to meet a part of their cost of establishment from out of the Central grant. In such situations, the cultivators do not get the subsidy claimed to have been passed on to them, as will be clear from the calculations shown below.

3.84. In the following table an attempt has been made to examine closely how this arrangement works in the States where it is practised.

TABLE 3·5

Cost of Soil Conservation staff charged to the cultivators and the actual cost of work-charged staff

(In Rs.)

States	Cost of s.c. work per acre to the cultivator	Annual target of each s.c. operational unit (acres)	Cost of Annual target of s.c. work			Subsidy on s.c. work		Actual annual cost of work charged staff*
			Total	S.C. work (earth work, etc.)	Cost of work charged staff	Central share	State share	
(1)		(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Mysore . .	60	6,000	3,60,000	2,70,000	90,000	45,000	45,000	62,760
2. Maharashtra .	48	12,500	6,00,000	4,50,000	1,50,000	75,000	75,000	40,464

[TABLE—Contd.]

TABLE 3·5—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
3. Gujarat	50	8,000	4,00,000	3,00,000	1,00,000	50,000	50,000	36,636
4. Andhra Pradesh.	46	5,000	2,30,000	1,72,000	57,500	28,750	28,750	47,040

*This is the average annual pay of the staff in the soil conservation operational unit worked out with the help of the formula given by Shri S. K. Sanyal in his book Notes on General Financial Rules, 196-, p. 176.

Column 2 of Table 3·5 shows the cost of soil conservation work per acre as charged (before subsidy) to the cultivator; it includes, the cost of work-charged staff which is 33-1/3% of the actual cost of the work. Col. 6 shows this cost of work-charged staff for the operational unit as a whole, whereas col. 9 shows the actual annual cost of the staff. The table brings out two important points; firstly, the cost of establishment (col. 6) as charged to the cultivators in the soil conservation operational unit far exceeds the actual cost of establishment in the unit (col. 9). Secondly, the actual cost of work-charged staff is less than the Central share of the subsidy in two out of four States.

3.85. In this connection the method of adding establishment cost to the cost of soil conservation work in U.P. and Madras may be mentioned. In U.P., the cost of soil conservation work includes the cost of soil conservation staff; but each soil conservation project gets a definite portion of the cost of the staff; hence equal amount is added to the cost of work of each project. The subsidy is calculated with reference to the actual cost of the work and not on the basis of total cost including establishment charges. In Madras also, the actual establishment charges are added to the cost of the work. But subsidy of 25% is available on the total cost of soil conservation work-charged staff. The cost of other staff, contingencies, and 10% of the cost of equipment are added to the cost of work.

3.86. It appears from the account given above that in reality the cultivators in some States are not receiving the subsidy given for soil conservation work. In some cases they are paying higher charges for soil conservation work than what they would have paid if the actual cost of work-charged staff only had been included in the cost of soil conservation work. Another point is that the accounting procedure enables some States to divert a portion of subsidy to the State Exchequer. The chances of this diversion of subsidy to the State Exchequer are greater in States which cover large areas under soil conservation per soil conservation operational unit.

3.87. *Requirement of trained staff for achieving the Third Plan Target.*—The requirement of trained staff for achieving the Third Plan target has been assessed, more or less, on the basis of the norms indicated above. The total staff available during the Third Plan will consist of the trained and untrained staff available for work at

the beginning of the Third Plan and the staff to be trained in the course of the Third Plan period. It may be assumed that the untrained staff in position by the beginning of the Third Plan, though available for work all through this period would also have to be trained in the course of the Third Plan. The new staff to be recruited and trained from year to year will not, however, be available for each year of the Third Plan. On an average, about 3/5ths of them would be available for work in each year of the Third Plan. For analysing the requirements of trained personnel, the States were requested to indicate whether their targets for training of staff for soil conservation work related to the additional staff to be recruited or only to the untrained staff which had been available for work in the Second Plan but had not been trained so far. While States like Andhra, Bihar, Himachal Pradesh and Orissa have included in their targets for training programmes, untrained staff carried over from the Second Plan alongwith the additional staff to be recruited in the Third, other States like Gujarat, Madras, M.P., Maharashtra, Mysore, Rajasthan and Uttar Pradesh have in their calculations provided for the training of new personnel only. Table 3.6 (p. 65) gives data on the trained and untrained staff at the end of the Second Plan, the Third Plan target for training and the estimated staff years available for soil conservation work in the Third Plan.

Performance norms and targets, and achievements in 1960-61 *and* 1961-62

3.88. Table 3·6 shows the Soil Conservation personnel available for the work in 1961-62 (cols. 3 to 8), the personnel to be recruited in the Third Plan (cols. 9 to 11) and the estimated staff years available for achieving the Third Plan target (cols. 12 to 14). In table 3·7 (page 66) the area coverage by conservation treatment that each category of soil conservation officer actually achieved in 1960-61 and 1961-62, and that which will have to be covered (target area divided by available staff years) in each year of the Third Plan in order to achieve the target have been compared with the area norms adopted by the State Governments (given in Table 3.4).

3.89. Table 3·7 shows that the achievements per head of each category of staff (Officer, Assistant and Sub-Assistant) in the two years 1960-61 and 1961-62 were lower in A.P., H.P., M.P., Mysore and U.P. than the norm fixed for them by these State Governments. In the case of officers, the area covered in 1960-61 and 1961-62 was lower than the norms in all States except Bihar and Gujarat. In the case of Asstts., the achievement in both the years had been lower than the norm in all States except Bihar, Gujarat and Maharashtra. However, the achievements of Sub-Assistants have been somewhat higher than the norm in quite a few cases.

TABLE 3·6

Staff (trained and untrained) available for soil conservation work during the Third Plan

Sl. No.	State	Trained staff available at the end of the Second Plan			Untrained staff available at the end of Second Plan			Third Plan target for training			Staff years available for work in the Third Plan*		
		Officers	Asstts.	Sub-Asstts.	Officers	Asstts.	Sub-Asstts.	Officers	Asstts.	Sub-Asstts.	Officers	Asstts.	Sub-Asstts.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1.	Andhra Pradesh	7	32	113	9	31	43	9	31	192	80	315	1,225
2.	Bihar	4	58	..	..	..	20	13	50	20	60	440	100
3.	Gujarat	17	85	442	..	..	..	14	60	300	125	605	3,110
4.	Himachal Pradesh	5	4	2	1	5	16	5	40	70	40	150	255
5.	Madras	14	67	95	1	..	19	12	50	50	110	485	720
6.	Madhya Pradesh	11	53	197	2	..	..	50	500	1,650	215	1,765	5,935
7.	Maharashtra	57	242	1,213	..	..	..	..	300	150	285	2,110	6,515
8.	Mysore	12	63	190	..	..	..	10	80	760	90	555	3,230
9.	Orissa	10	40	100	7	15	..	40	168	500	185	735	2,000
10.	Rajasthan	4	14	49	..	..	..	11	31	176	55	165	775
11.	Uttar Pradesh	13	52	203	..	..	..	7	1,300	1,300	84	4,160	4,915
12.	West Bengal	3	2	..	1	..	..	9	20	..	45	70	..

*Third Plan target minus untrained staff (to be trained in the Third Plan) × 3/5 plus trained and untrained staff already working × 5.

TABLE 3·7

Norms of area achievement per head fixed for each type of soil conservation staff, achievement per head in 1960-61 and 1961-62 and the target per head per year in the Third Plan on the basis of estimated staff *

(In Acres)

Sl. No.	State	Achievement Norms fixed by the State Govts. per			Area covered per head in						Target per year per head in the Third Plan		
					1960-1961			1961-1962					
		Officer	Asstt.	Sub-Asstt.	Officers	Asstts.	Sub-Asstts.	Officers	Asstts.	Sub-Asstts.	Officers	Asstts.	Sub-Asstts.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1.	Andhra Pradesh	5,000	1,000	333	2,274	481	715	1,712	435	176	6,875	1,746	44
2.	Bihar	1,000	1,000	500	18,450	1,025	..	12,225	843	2,445	4,800	654	2,880
3.	Gujarat	8,000	1,600	320	14,372	2,874	553	8,176	1,635	314	9,432	1,949	379
4.	H. P.	800	200	67	145	54	34	117	78	37	450	120	71
5.	Madras	7,500	2,500	625	6,041	1,431	1,553	4,893	1,096	644	3,091	701	472
6.	M. P.	5,000	1,000	250	522	219	46	2,894	710	191	6,474	789	234
7.	Maharashtra	12,500	2,500	500	9,878	2,305	459	10,842	2,554	509	17,544	2,370	767
8.	Mysore	6,000	1,000	200	4,197	839	221	3,075	586	194	3,000	486	84
9.	Orissa	——Not given——			1,530	638	522	1,407	435	239	1,622	408	250
10.	Rajasthan	——Target not fixed——			5,628	2,251	938	4,733	1,352	386	3,236	1,079	230
11.	U. P.	3,000	3,000	300	1,690	478	126	1,545	386	99	12,553	256	217
12.	W. Bengal	——Not given——			333	500	..	213	426	..	2,533	1,629	..

*The area covered by soil conservation programme in 1960-61 and 1961-62, and the trained and untrained staff available for work in 1960-61 are given in Appendix Table B-5.

3.90. Columns 12, 13 and 14 show what a unit of each category of staff would have to achieve in each year in order to fulfil the Third Plan Target. Comparing this with the norm fixed by the State Government we find that in Andhra, Bihar, Gujarat, M.P., Maharashtra and U.P., each officer will have to cover in a year a larger area than the norm to achieve the Third Plan target. The exceptions are H.P., Madras and Mysore. This can be seen from the figures in Table 3·8.

3.91. These observations indicate that the norms have not been based on past experience. For achieving the Third Plan target either the norm will have to be raised or more staff provided as well as trained for soil conservation work than what has been shown in the Plan. An estimate of the additional requirements of manpower as well as of training facilities may be had from the data in Table 3·8. If the norms are taken as indices of achievement, the staff and training requirements will have to be expanded considerably for officers (between 18 per cent in Gujarat and 380% in Bihar) except in H.P., Madras and Mysore. Much larger provision will also have to be made for assistants in Andhra and Gujarat, and even more for Sub-Assistants in Andhra, Bihar, Gujarat, H.P. and Maharashtra. Of course, it is possible to raise the achievements above the norms and if this can be brought about, the shortage of staff will to the extent be mitigated. That there is scope for raising the achievements and revising the norms upwards is also indicated by the relatively lower figures of norms for Andhra, Madras, Mysore and Gujarat as compared to Maharashtra, even though the nature of conservation problems and treatments in these areas may not be as different.

TABLE 3·8

Target of area per year for each category of officer in the Third Plan as per cent of the area norm fixed for each by the State Government

State	Officers	Assistants	Sub-Assistants
1. Andhra Pradesh	137·5	174·6	134·8
2. Bihar	480·0	65·4	572·0
3. Gujarat	117·9	121·8	118·4
4. Himachal Pradesh	56·2	60·0	106·0
5. Madras	41·2	28·0	75·5
6. Madhya Pradesh	129·5	78·0	93·6
7. Maharashtra	140·4	94·8	153·4
8. Mysore	50·0	48·6	42·0
9. Rajasthan	Target not fixed		
10. Uttar Pradesh	418·4	8·5	72·3

CHAPTER IV

SOIL CONSERVATION PROBLEMS, TREATMENTS AND MEASURES

4.1. The analysis presented in the last three chapters have been based very largely on information obtained and discussions held at the State level. Certain sections of the last chapter (Chapter III) did, however, go into administrative and organisational problems observed at lower levels. By and large, the attempt in the earlier chapters has been to present a picture of the soil conservation programme for agricultural land, as it has been planned and administered in the different States, and the general problems and difficulties faced by the State Governments. The remaining part of the study is, in contrast, based on data collected in the districts selected for investigation. This chapter deals with the problems of erosion and conservation in selected districts against the background of their rainfall, topography, land use and cropping pattern, and with the conservation treatments and measures taken up in these areas. The criteria used for the selection of the districts for the purpose of this study have been briefly indicated in the last section of Chapter I and described in greater detail in the appendix.

Rainfall and slope of land

4.2. Rainfall and slope of land in an area are two of the most important characteristics determining the type of treatment and measures required to control erosion problems. The selected districts (21 in number) may be grouped, according to the average annual rainfall, under three broad categories; (i) those with low rainfall, receiving less than 65 cms. or 25·6″; (ii) medium rainfall areas with a precipitation between 65 cms. and 130 cms., or 25.6″ and 51.2″; and (iii) heavy rainfall areas receiving more than 130 cms. or 51.2″. The distribution of the districts in these three groups is given in Table 4·1.

TABLE 4·1

Rainfall in selected districts

Rainfall	No. of districts	Name of the districts (Rainfall in c.m. in brackets)
(1) 0—65 cms. (0″—25·6″)	4	Anantapur (56·8), Jaipur (59·3), Rajkot (65·0), Ahmednagar (66·2).
(2) 65 c.ms.—130 cms. (25·6″—51·2″)	11	Dharwar (67·1), Tumkur (67·8), Mathura (69·2), Hyderabad (78·7), Coimbatore (83·8), Baroda (88·9), Amraoti (91·1), Hazaribagh (101·6), Hoshiarpur (104·7), Mirzapur (107·4), Gwalior (110·8).
(3) 130 cms. and above (51·2″ and above)	6	Bilaspur (133·9), Midnapur (144·8), United Mikir and North Cachar Hills (147·3) Koraput (126·4 to 205·9), Nilgiris (177·8), Trichur (347·5).

NOTE.—The data relate to average rainfall in the districts during the last 10 years, except in the case of Jaipur, Gwalior, Dharwar and Amraoti for which the figures relate to 8, 5, 4 and 3 years respectively.

Of the 21 districts in our sample, 11 or 52% are in the medium rainfall category, while 6 or 29% are in the heavy rainfall areas. Ahmednagar (Maharashtra) having 66·2 cms. of average annual rainfall has, however, been included in the first category. In a number of districts in the above categories, *e.g.* Ahmednagar (Maharashtra), Coimbatore (Madras) and Koraput (Orissa), the rainfall is not well distributed over the year and is also subject to large fluctuations from year to year.

4.3. The data regarding the slope of the agricultural land were not available for four districts, United Mikir and North Cachar Hills (Assam), Trichur (Kerala), Koraput (Orissa) and Jaipur (Rajasthan). The remaining districts have been grouped in Table 4·2, according to different ranges of the slope of the land used for agricultural purposes.

TABLE 4·2

Slope of Agricultural land in selected Districts

Slope in %	No. of districts	Name of the districts
(*a*) Below 5 . . .	16	Rajkot, Mathura, Dharwar, Gwalior, Ahmednagar, Baroda, Amraoti, Hazaribagh, Tumkur, Mirzapur, Anantapur, Coimbatore, Hoshiarpur, Midnapur, Hyderabad and Nilgiris.
(*b*) 5—10	6	Rajkot, Anantapur, Coimbatore, Hoshiarpur, Hyderabad, Nilgiris.
(*c*) 10—25 . . .	2	Bilaspur, Nilgiris.
(*d*) 25—40 . . .	2	Bilaspur, Nilgiris.
(*e*) Above 40 . . .	2	Bilaspur, Nilgiris.

Seven districts appear in Table 4·2 in more than one slope-range. Figures showing the range in the slope of the land in these districts are given below:

Name of the district	Range in slope (%)
1. Rajkot	0—6
2. Anantapur	1—6
3. Coimbatore	1—7
4. Hoshiarpur	1—8
5. Hyderabad	2—6
6. Nilgiris	2—82
7. Bilaspur	20—86

In Bilaspur (Himachal Pradesh) and Nilgiris (Madras), the slope of agricultural land is much higher than that usually considered suitable or advisable for cultivation purposes. Lands with a slope up to 60% are considered possible of development as contour strips for

plantation purposes. In Nilgiris (Madras), probably most of the land on the higher slopes are under plantation crops. Bilaspur (Himachal Pradesh), however, does not grow plantation crops. The revenue authorities in the district were faced with the problem of re-settling persons displaced from the agricultural land submerged in the Govindsagar lake created by the Bhakra dam. It is reported that sometimes land with a slope as high as 86% was allotted to these persons for agricultural use.

Land Use in selected districts

4.4. Considerable importance is attached to the land use pattern, particularly the distribution of the geographical area among some of the broad use categories like forest, cultivation and non-agricultural uses, in the determination of land capability classes. Similarly, a knowledge of the detailed land utilisation and cropping pattern,—of the relative importance of wide row crops which are erosion permitting, close-growing crops which are not so erosion permitting, and soil enriching crops like legumes, etc.—is essential for a study of land-use from the soil conservation perspective. Data for 1960-61 on the land use and cropping pattern in the selected districts are broadly examined below with this soil conservation bias. The statistical data are presented in Appendix tables B-6 and B-7.

4.5. *Area under forest.*—Forests provide a protective cover to the agricultural land and are very useful for preserving the natural precipitation. The Forest Policy Resolution of the Government of India has recommended that as an insurance against denudation, about 60% of the area should be kept under forests in the Himalayas, the Deccan and other mountainous tracts liable to erosion. In the plains where the ground is flat and erosion is normally not a serious factor, the proportion to be attained should be 20%*. In the majority of the districts selected in the plains, the forest area has been found to be less than 13% of the geographical area. In the predominantly hilly districts, *viz.* Nilgiris (Madras), Bilaspur (Himachal Pradesh), Trichur (Kerala), Koraput (Orissa) and United Mikir and North Cachar Hills (Assam), the area under forest is much below the recommended 60%. The Nilgiris with a proportion of 54% come closest to this norm.

4.6. *Proportion of land under cultivation.*—The other side of the same picture is the extent to which land is cultivated for growing field and plantation crops. According to some authorities, the proportion of arable land which forms about 45% of the geographical area in India is very high. In India, cultivation has been extended as far as it could go with the technological means and resources at the command of the cultivators. In 13 of the 21 districts, cultivated area has been found to account for more than 45% of the geographical area. Districts where it is less than 30% are mostly hill districts which have a higher proportion of their area under forest.

4.7. *Uncultivated land excluding fallows.*—Another important category of land use is 'uncultivated land excluding fallows'. This group includes culturable waste, permanent pastures and other grazing lands and land under miscellaneous tree crops and groves. Among

*The First Five Year Plan p. 285.

these, culturable waste forms the largest category. Of 21 districts, 16 have less than 14% of the geographical area under 'uncultivable lands excluding fallows'. On most of such lands, the scope for extending arable farming or pasture is limited. The districts where such lands account for 14% or more of the area are mainly hilly districts or those in which the area under pastures or miscellaneous tree crops and groves is proportionately high.

4.8. *Fallow land other than current fallow.*—Lands in this category have a bearing on the problem of soil conservation, as they are usually left fallow from two to five years, mainly because of low productivity which can be on account of soil erosion. In 50% of the selected districts, the proportion of the geographical area in this category is less than 3%. But in Jaipur (Rajasthan), Anantapur (Andhra Pradesh), Hoshiarpur (Punjab), Midnapur (West Bengal) and Tumkur (Mysore), fallow lands other than current fallows from a relatively high proportion of the geographical area.

4.9. *Cropping pattern.*—The distribution of the cultivated area among erosion permitting and erosion resisting crops provides some useful perspective to an understanding of the soil conservation problems and measures. This information may be useful for the purpose of crop planning. The crops may be broadly grouped under :

1. Wide row crops;
2. close-growing crops;
3. legumes;
4. mixed crops ;
5. miscellaneous crops;
6. plantation crops.

Wide-row crops in general are more erosion-permitting than the close-growing crops. Legumes form a group of crops which have the soil binding property. Their effect on soil fertility due to their deep penetrating roots, ability to fix Nitrogen and their value as a soil cover are well-known. However, the method of cultivation and the stage of the crop in its growth are important in this respect. Wide-row crops sown by broadcast method serve the same purpose as the close-growing crops. Some of the close-growing crops like sugarcane would be erosion-permitting in the first stages of their growth, but not so later. If, sugarcane is, however, sown in furrows along the contour, this would restrict the flow of water and erosion of soil. Similarly, tur (Arhar) has the quality of controlling erosion only in the latter stages of its growth. The distribution of the selected districts according to the proportion of the gross cropped area under wide-row crops, close-growing crops and legumes is shown in Table 4.3. Detailed data on distribution of the districts in respect of each of the above six categories of crops, and according to levels of irrigation and intensity of cropping are given in the Appendix B-8.

TABLE 4.3

Distribution of Selected Districts in respect of Wide-row, Close-growing and Legume crops

Category of Crops	No. of districts according to proportion of gross cropped area put under each category			
	Below 20%	20—40%	40—60%	Above 60%
Wide row crops	10	4	4	3
Close growing crops	4	7	6	4
Legumes	14	6	1	—

4.10. The intensity of cropping is not very high in most of the districts. Only in Bilaspur (Himachal Pradesh) and Trichur (Kerala) it is high, the figures being 172% and 150% respectively. Among the wide-row crops, close-growing crops and legumes, the proportion of the gross cropped area is usually very low under legumes. Similarly, nearly 50% of the districts have less than 20% of the area under wide-row crops. The area under close-growing crops is less than 20% of the gross cropped area in only 4 out of 21 districts. It is quite possible that in certain areas of the district one category of crop is grown more than the other. The right balance between the different categories of crops may have to be decided with reference to a specific catchment area and the rainfall, slope of land and soil characteristics there. In Anantapur, the area under wide-row crops and close-growing crops accounts each for 32% of the gross cropped area, and that under legumes 30%. In Nilgiris, (Madras) the area under each of these three categories is less than 20%, and that under plantation crops is 57% of the gross cropped area. In other districts, a large proportion of the gross cropped area is under wide-row crops or close-growing crops or under these categories together. In Rajkot (Gujarat), nearly 50% of the gross cropped area is under legumes, mostly under groundnut and 41% under wide-row crops. The close-growing crops are irrigated in Trichur (Kerala), Gwalior (Madhya Pradesh), Jaipur (Rajasthan), Coimbatore (Madras), Mathura and Mirzapur (Uttar Pradesh). In other districts also some area under close growing crops is irrigated. This, however, is not so in the case of wide-row crops or legumes. In Coimbatore, however, nearly 33% of the wide-row crops area is irrigated.

4.11. Mixed crops such as wheat and gram, cotton and Arhar, Jawar-bajra and Arhar etc. are important in Hoshiarpur, Mathura and Mirzapur where these occupy between 25% and 31% of the gross cropped area. Plantation crops are grown in Nilgiris, United Mikir and North Cachar Hills, Trichur and Tumkur. In Nilgiris, about 57% of the gross cropped area are under plantation crops. In Trichur and united Mikir and N. C. Hills the proportion is 38 and 10 per cent, respectively. Miscellaneous crops are there in all the districts. These include turmeric, garlic, vari, spices, fruits, vegetables etc.

Soil conservation problems and treatments

4.12. The checking of rain erosion and the conservation of moisture are the two major problems in the selected districts. Erosion may be moderate or severe, depending on the slope of the land, the

amount and severity of rainfall and its distribution. In areas of moderate and heavy rainfall, the important problem is rain erosion. If the land is slopy, the formation of rills and gullies is a common feature. In areas receiving a rainfall of less than 65 cms., if the land is undulating and the rain comes in heavy showers lasting only a few minutes, both erosion by rain and conservation of moisture pose serious problems. If the soils are shallow the capacity to retain moisture is poor; and moisture conservation assumes greater importance, especially so if there is also a cycle of years of insufficient rainfall.

4.13. Other problems like wind erosion, salinity and alkalinity, water-logging and shifting cultivation have been reported from some of the districts. Table 4.4 gives a statement of the problems of soil conservation on agricultural lands in each selected district, the total area affected and the recommended soil conservation treatments (mechanical measures). The figures given in col. 5 relate to the total area affected by all the problems enumerated for the district. Though an attempt was made to collect data on the area affected by each problem, it could not succeed as such statistics have not been compiled. Even the estimates of the total affected area requiring soil conservation treatment are not based on scientific investigations and surveys. Such surveys have not been carried out in the selected districts. Under these circumstances, the estimates of the area affected by the soil erosion problem have been built up on certain hypotheses. For instance, the District or Sub-divisional soil conservation officers considered that all the dry area in the district or a certain proportion of it requires soil conservation treatment. Usually, the irrigated area and the area under paddy are excluded from the estimates of the area requiring soil conservation measures. Some of the District Officers have given details of the method adopted for estimating the area affected by the erosion problem. In the case of Rajkot and Amraoti, the estimate of the bundable area is arrived at by deducting the heavy black cotton soil from the net sown area. In Bilaspur, the area requiring soil conservation measures has been calculated after deducting from the cultivated area the area under rice cultivation plus another five per cent, which, it is felt, do not require soil conservation treatments.

TABLE 4·4

Soil Conservation problems, area affected and recommended mechanical measures

Sl. No.	State	District	Problems of soil conservation on agricultural land	Total area affected (in Hectares)	Recommended Soil conservation treatment (Mechanical measures)
(1)	(2)	(3)	(4)	(5)	(6)
1.	Andhra Pradesh	Anantapur	Rain erosion (severe)	15,36,307·30 (37,96,293·00)	(1) Contour Bunding. (2) Contour Trenching. (3) Diversion drains. (4) Check dams. (5) Waste water weirs.
		Hyderabad	Severe rain erosion conservation of rain water, raising the ground water table.	3,64,217·40 (9,00,000·00)	(1) Graded bunds with grassed water ways.

[TABLE—*Contd.*]

TABLE 4.4—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)
2.	Assam	United M. & N.C. Hills.	Conservation of water in low rainfall areas, terracing, shifting cultivation.	29,137·40 (72,000·00)	(1) Contour Bunding. (2) Terracing. (3) Cash crop plantation.
3.	Bihar	Hazaribagh	Moderate and severe sheet, rill & gully erosion.	2,12,400·66 (5,24,853·00)	(1) Contour Bunds. (2) Graded contour bunds. (3) Rectangular bunds. (4) Gully control structures : (a) Earthen check dams. (b) Brush wood check dams. (c) Easing out gully heads & plantation.
4.	Gujarat	Baroda	Rain erosion, conservation of moisture.	83,340·22 (2,05,938·00)	(1) Contour bunding.
		Rajkot	Rain erosion (Slight to severe) conservation of water.	4,50,108·36 (11,12,241·00)	(1) Contour bunding.
5.	Himachal Pradesh	Bilaspur	Rain erosion (severe nature)	25,090·53 (62,000·00)	(1) Diversion drains at the top. (2) Bench terracing. (3) Contour strips for above 40% gradation.
6.	Kerala	Trichur	Sheet erosion (severe on hill slopes).	1,01,995·04 (2,52,035·00)	(1) Contour bunding.
7.	Madhya Pradesh	Gwalior	Sheet and gully erosion, Saline and Alkaline land, Ravine formation.	N.A.	(1) Contour Bunding. (2) Field bunding and embankments.
8.	Madras	Coimbatore	Sheet and gully erosion, sheet and rill erosion (Both are due to water and wind).	4,24,920·30 (10,50,000·00)	(1) Contour bunding with surplus weirs. (2) Contour trenching. (3) Gully plugging and stream protection, construction of brush wood earthen or masonary structure. (4) Planting of wind belts and shelter belts-sand dunes fixation.

TABLE 4.4—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)
		Nilgiris	Rain erosion (severe).	48,562·32 (1,20,000·00)	(1) Contour Trenching. (2) Diversion drains (1 in 400 grade). (3) Bench terracing. (4) Gully protection. (5) Meandering streams.
9.	Maharashtra	Ahmednagar	Rain erosion (moderate to severe).	76,10,77·18 (18,80,661·00)	(1) Contour bunding. (2) Terracing. (3) Nallah bunding.
		Amraoti	Rain erosion (slight and moderate).	1,46,576·06 (3,62,197·00)	(1) Contour bunding with drainage till 59-60. (2) Graded bunds with drains from 60-61. (3) Stone outlets.
10.	Mysore	Dharwar	Wind erosion, gully erosion, sheet erosion, water logging.	4,69,435·76 (11,60,000·00)	(1) Contour bunding and gully plugging. (2) Terracing. (3) Levelling.
		Tumkur	Conservation of water in low rainfall areas, Gully erosion (where steep slope), sheet erosion (where moderate slope).	1,25,452·66 (3,10,000·00)	(1) Levelling. (2) Draining.
11.	Orissa	Koraput	Rain erosion (slight, moderate, severe).	9,34,824·66 (23,10,000·00)	(1) Contour Bunding. (2) Terracing (a) Bench terracing (b) Stone terracing. (3) Gully plugging. (4) Planting of cashewnut, coffee and fruit trees and agave along the slopes in the shifting cultivation area.
12.	Punjab	Hoshiarpur	Rain erosion (moderate to severe), water logging. Sheet erosion, gully erosion, salinity & Alkalinity.	1,71,350·12 (4,23,415·00)*	(1) Contour bunding. (2) Check dams. (3) Waste water weirs. (4) Graded bunds. (5) Chutes. (6) Spilways.
13.	Rajasthan	Jaipur	Heavy slope, gully erosion, wind erosion, Alkaline, Saline lands.	1,68,564·67 (4,16,532·00)	(1) Contour bunding. (2) Medhbundi.

TABLE 4.4—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)
14.	Uttar Pradesh	Mathura	Rain erosion, water logging, Wind erosion.	55,853·14 (1,38,016·00)@	(1) Contour and Marginal bunding. (2) Check dams. (3) Masonry structures. (4) Levelling. (5) Field Bunding.
		Mirzapur	Rain erosion, moisture conservation.	N.A.	(1) Contour and marginal bunding. (2) Check dams. (3) Masonry structures. (4) Levelling.
15.	West Bengal	Midnapur	Sheet and gully erosion, wind erosion.	N.A.	(1) Contour bunding (2) Gully plugging.

*Area affected by choes.

@The figure relates to only water erosion problem on Agricultural lands.

NOTE.—The figures within brackets under column 5 indicate the corresponding area in acres.

Area covered by soil conservation measures, and the year when the programme started

4.14. Table 4·5 gives data on the proportion of the geographical area excluding forests affected by soil erosion and allied problems, the area covered by soil conservation mechanical measures and the year when this work was initiated in the selected districts.

TABLE 4.5

Area affected, area covered by soil conservation measures and the year when the programme started in selected districts

Sl. No.	Districts	Area affected as % of geographical area minus forest area	Area covered by S.C. measures upto 1960-61		Year when the S.C. Programme started
			Total in Hectares, acres in brackets	% to the area requiring S.C. measures	
(1)	(2)	(3)	(4)	(5)	(6)
1.	Anantapur	89.30	4,498.9 (11,117.10)	0.29	58-59
2.	Hyderabad	55·37	2,586.0 (6,390.08)	0.71	56-57
3.	United M. & N. C. Hills . .	2.34	2,998.4 (7,409.00)	4.05	55-56

[TABLE—*Contd.*]

TABLE 4.5—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)
4.	Hazaribagh	23.31	6,179.6 (15,270.00)	0.29	57-58
5.	Baroda	11.39	12,210.2 (30,172.00)	14.65	50-51
6.	Rajkot	42.70	20,200.3 (49,916.00)	4.49	56-57
7.	Bilaspur	24.22	195.0 (481.89)	0.78	59-60
8.	Trichur	63.72	743.8 (1,838.00)	0.73	56-57
9.	Gwalior	N.A.	8,503.3 (21,012.00)	--	54-55
10.	Coimbatore	36.33	21,078.9 (52,087.00)	4.96	52-53
11.	Nilgiris	41.81	3,021.4 (7,466.00)	6.22	53-54
12.	Ahmednagar	50.53	1,88,652.5 (4,66,170.00)	24.79	42-43
13.	Amraoti	16.85	11,476.5 (28,359.00)	7.83	58-59
14.	Dharwar	37.08	13,316.6 (32,906.00)	1.90	43-44
15.	Tumkur	12.22	593.7 (1,467.48)	0.16	59-60
16.	Koraput	87.64	27,192.5 (67,194.00)	2.91	55-56
17.	Jaipur	12.29	1,203.1 (2,973.00)	0.71	59-60
18.	Mathura	15.07	2,937.0* (7,254.00)	5.26	58-59

*This is the total area covered on Agricultural lands affected by rain erosion only.

NOTE.—The figures within brackets under col. 4 indicate the corresponding area in acres.

In Table 4.5 the area affected by soil erosion and allied problems has been shown as a proportion of the geographical area excluding forests. This gives a broad idea of the magnitude of the problem in the selected districts. Out of the 17 districts for which data for area affected by soil erosion and allied problems were available, in three (Anantapur, Trichur and Koraput) more than 60% of the geographical area excluding forests required soil conservation measures. In Hyderabad, Ahmednagar, Rajkot, Nilgiris, Dharwar and Coimbatore between 36% and 56% of the geographical area excluding forest, were reported to be affected by soil erosion and allied problems. In the remaining districts, this proportion was lower than 25%.

4.15. The area so far (till 1960-61) covered by soil conservation measures is not significant in almost all the districts. In Ahmednagar, nearly 25% of the area requiring soil conservation measures had received suitable treatment. In Baroda, Amraoti, Nilgiris and

Mathura this proportion works out 15, 8, 6 and 5 per cent respectively. In 12 or 71% of the districts, the proportion so far covered of the area requiring soil conservation measures is less than 5%; and in 41% of the districts it is less than 1%.

4.16. The achievement or coverage of area by soil conservation measures has been low because the programme was started very recently. Among the selected districts, the programme was started earliest, around 1943, in Ahmednagar and Dharwar and was taken up between 1951 and 1953 in Baroda, Coimbatore and Nilgiris. In other districts the programme was started either in the last year of the First Plan or in the 3rd or 4th year of the Second Plan.

Progress of Soil Conservation Extension Programme in the two Plan Periods

4.17. *Area covered and target.*—The Soil Conservation programme was started, as has already been stated in most of the districts, in the Second Plan period. Only in six of the districts this work was initiated in the First Plan or earlier. The soil conservation extension treatment extended during the First Plan period were contour bunding in Baroda, Ahmednagar and Dharwar, contour bunds with waste weirs in Coimbatore, bench terracing in Nilgiris and field bunding and embankments in Gwalior.

4.18. Information on the coverage in Coimbatore during the First Plan period is not available separately. Data on the area covered by soil conservation measures in the other five districts during the First Plan period and its proportion to the area requiring such measures are indicated below in Table 4.6.

TABLE 4.6

Coverage of five districts with soil conservation measures in the First Plan period

Sl. No.	District	Area covered by s.c. measures (hectare, acres in brackets)	Area covered as percentage of the area requiring s.c. measures
(1)	(2)	(3)	(4)
1.	Baroda	3,939 (9,733)	4·73%
2.	Gwalior	2,749 (6,793)	N.A.
3.	Nilgiris	124 (306)	0.25%
4.	Ahmednagar	46,237 (1,14,255)	6.08%
5.	Dharwar	2,189 (5,410)	0.47%

Since the estimated area requiring soil conservation measures in Gwalior is not known, it is not possible to relate the area covered to the total eroded area. It appears from Table 4.6 that the coverage achieved in the First Plan period was very small in three of the five districts. It was only in Ahmednagar that the achievement might be said to have been significant to some extent.

4.19. During the Second Plan period, the tempo of work has been somewhat faster, and the programme was extended to almost all the districts selected for our study. The experience of the achievement during the Second Plan period has led to the fixation of much higher targets for the Third Plan. Table 4.7 gives an idea of the total achievement during the two Plan periods as proportion to the area requiring soil conservation measures in the selected districts. Data are also given of the targets fixed for the Second and the Third Plans and the proportion of the eroded area likely to be covered by the end of the Third Plan.

TABLE 4.7

Area covered by S. C. measures in the first two Plans and the target for the Third in selected districts

Sl. No.	District	Total area covered during First and Second Plan period (In hectares acres in brackets)	Col. (3) as % to the area requiring S.C. measures	Targets		Col. 6 as % of Col. 5	Total area likely to be covered by the end of the 3rd Plan as % of the are requiring S.C. measures
				Second Plan (In hectares, acres in brackets)	Third Plan (In hectares, acres in brackets)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Anantapur	4,498.93 (11,117.10)	0.29	4,046.86 (10,000.00)	10,117.15 (25,000.00)	250.00	0.95
2.	Hyderabad	1,795.38 (4,436.48)	0.49	2,751.86 (6,800.00)	5,058.58 (12,500.00)	183.82	1.88
3.	United M. and N. C. Hills.	2,244.39 (5,546.00)	7.70	1,456.87 (3,600.00)	N.A.	..	..
4.	Baroda	11,235.30 (27,763.00)	13.49	(not fixed)	N.A.	..	..
5.	Rajkot	19,700.11 (48,680.00)	4.38	31,565.50 (78,000.00)	N.A.	..	..
6.	Bilaspur	195.01 (481.89)	0.78	(not fixed)	N.A.	..	..
7.	Trichur	743.81 (1,838.00)	0.73	1,214.06 (3,000.00)	N.A.	..	..
8.	Gwalior	8,503.26 (21,012.00)	N.A.	N.A.	27,518.65 (68,000.00)	..	..

[TABLE—*Contd.*]

TABLE 4.7—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
9.	Coimbatore	21,089.30 (52,087.00)	4.96	N.A.	15,175.72 (37,500.00)	..	8.53
10.	Nilgiris	3,021.23 (7,465.61)	6.22	2,630.46 (6,500.00)	3,035.14 (7,500.00)	115.38	12.47
11.	Ahmed-nagar.	1,88,652.47 (4,66,170.00)	24.79	1,42,415.07 (3,51,915.00)	1,82,108.70 (4,50,000.00)	127.87	48.69
12.	Amraoti	10,909.93 (26,959.00)	7.44	12,140.58 (30,000.00)	N.A.	..	..
13.	Dharwar	10,337.70 (25,545.00)	2.21	12,140.58 (30,000.00)	16,187.44 (40,000.00)	133.33	5.66
14.	Jaipur	1,201.51 (2,969.00)	0.71	2,695.21 (6,660.00)	1,29,094.83 (3,19,000.00)	4,789.79	77.29
15.	Mathura	2,937.00 (7,254.00)	3.81	4,734.80 (11,700.00)	10,440.90 (25,800.00)	220.51	23.95

The soil conservation programme in Hazaribagh, Tumkur and Midnapur districts has been purely one of demonstration; and as such, these districts have not been included in Table 4.7. In Hoshiarpur, the work was started only in 1961-62; and for Koraput and Mirzapur districts the data were not available.

4.20. From the figures in Table 4.7, it appears that the soil conservation extension programme achieved appreciable progress in Ahmednagar and Baroda. By the end of the Second Plan period, the proportion of the eroded area covered by soil conservation measures in these districts went up to 25 and 14 per cent, respectively. Data on the target in respect of the area to be covered in the Third Plan are not available for Baroda; but in Ahmednagar, 49% of the eroded area are planned to be covered by 1965-66. The achievements in respect of coverage have been significant also in United Mikir and North Cachar Hills, Nilgiris and Amraoti, the proportion covered of the area requiring conservation being 8, 6 and 7 per cent respectively. In Rajkot, Coimbatore, Dharwar and Mathura, the achievement ranges between 2 and 6 per cent. In the remaining districts, the area covered by the end of the Second Plan was less than one per cent.

4.21. An attempt has been made by us to work out the proportion of the area likely to be covered by the end of the 3rd Plan for eight districts only. These figures, given in the last column of Table 4.7 show that remarkable progress is visualised in the districts of Jaipur (Rajasthan) and Ahmednagar (Maharashtra). In Jaipur, the Third Plan target is about 48 times larger than that in the Second Plan. This is so, because of the relatively high target (2,14,000 acres), under the programme of field bunding and levelling and of the inclusion in this category of another 80,000 acres targeted for dry farming measures. During the Second Plan, however, the work in this district was confined to contour bunding. In Ahmednagar, the targets laid down for the Third Plan are commensurate with the achievements during the Second; and coverage of the eroded area by soil conservation measures is likely to go up to

about 49%. In Mathura, more than two-fold progress as compared to the achievement during the Second Plan is visualised in the Third Plan and 24% of the area requiring soil conservation measures are proposed to be covered. In Dharwar, the achievement is likely to be less than 6%. The achievement in relation to the affected area in Nilgiris and Coimbatore by the end of Third Plan has been planned at 12 and 9 per cent, respectively. In Anantapur and Hyderabad, though the targets laid down for the Third Plan are 250 and 184 per cent respectively of those for the Second, the proportion of the eroded area likely to be covered by soil conservation measures would amount to less than two per cent.

Outlay and Expenditure per acre

4.22. Figures of outlay and expenditure on the soil conservation programme are not available for all the districts. Even where these are available the figures are not very reliable and may be said to be only rough estimates of the allotments made. For Anantapur, the outlay figures have been estimated on the basis of wages paid to 20 labourers for contour bunding an acre at Rs. 30 per day. The cost of waste water-weirs was excluded from these estimates. For Ahmednagar and Rajkot also, these are reported to be rough estimates. As for Hyderabad, the outlay and expenditure figures relate to the Hyderabad division, the jurisdiction of which has changed from time to time covering the Hyderabad district, besides a few other districts. On the basis of whatever data could be obtained in respect of outlay, expenditure, area targetted to be covered and actually covered by soil conservation measures, it has been possible to work out some rough estimates of the outlay per acre during the Second and Third Plans and the expenditure per acre during the Second. These are presented in Table 4.8.

TABLE 4.8

Estimates of Second Plan outlay and expenditure per acre and Third Plan outlay per acre of soil conservation in selected districts

Sl. No.	District	Second Plan		Col. (4) as % of Col. (3)	Third Plan outlay per hectare, per acre in brackets	Col. (6) as % of Col. (3)
		Outlay per hectare, per acre in brackets (Rs.)	Expenditure per hectare, per acre in brackets (Rs.)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Anantapur . . .	177.57 (71.86)	140.14 (56.71)	78.92	N.A.	..
2.	Hyderabad . . .	N.A.	N.A.	..	145.89 (59.04)	..
3.	Baroda	N.A.	103.96 (42.07)	..	N.A.	..
4.	Rajkot	N.A.	102.85 (41.62)	..	N.A.	..

[TABLE—*Contd.*]

TABLE 4.8—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)
5.	Bilaspur . . .	N.A.	1,197.40 (484.56)	..	N.A.	..
6.	Trichur	296.53 (120.00)	194.40 (78.67)	65.56	N.A.	..
7.	Coimbatore . . .	129.83 (52.54)	100.67 (40.74)	77.54	98.84 (40.00)	76.13
8.	Nilgiris	1,150.56 (461.56)	783.44 (317.04)	68.69	988.44 (400.00)	86.67
9.	Ahmednagar . . .	129.34 (52.34)	129.34 (52.34)	100.00	161.09 (65.19)	124.55
10.	Amraoti . . .	98.84 (40.00)	86.12 (34.85)	87.12	175.08 (70.85)	177.13
11.	Dharwar . . .	195.29 (79.03)	103.32 (41.81)	52.90	147.03 (59.50)	75.29
12.	Jaipur	29.26 (11.84)	65.63 (26.56)	224.32	N.A.	...
13.	Mathura . . .	27.23 (11.02)	43.10 (17.44)	158.26	125.93 (50.96)	462.43

4.23. The Second Plan expenditure per acre in Bilaspur and Nilgiris has come out the highest at Rs. 485 and Rs. 317, respectively. In these two districts, the slopes are very steep and terracing of the land very costly. In Bilaspur, the soil conservation programme consists of bench terracing, and in the Nilgiris, of contour trenching and bench terracing.

4.24. In the other districts, the programme consists only of contour bunding, except in Jaipur and Mathura where field bunding is also included. The expenditure per acre in Mathura is the lowest, though higher than the outlay provided per acre. In Jaipur the expenditure per acre is Rs. 26·56 or 224% of the outlay. The respondents in the villages, however, reported that they received or expected to receive Rs. 10 per acre as subsidy whereas their actual cost of contour bunding executed exclusively through hired labour worked out to Rs. 5 per acre. The expenditure per acre of contour bunding in Anantapur, Baroda, Rajkot, Coimbatore, Ahmednagar, Amraoti and Dharwar has been between Rs. 35 and Rs. 57. Trichur being a hilly area, and the slopes being comparatively steep and the topography undulating, the cost of contour bunding has been higher, about Rs. 80 per acre.

4.25. Expenditure per acre has been less than the outlay allotted in many of these districts, Ahmednagar and Mathura being among the exceptions. Probably, this experience has resulted in a more realistic approach to the outlay in the Third Plan, which shows a lower per acre figure in many districts. In Mathura, Ahmednagar and Amraoti, however, the estimate of outlay per acre has been raised, Mathura showing the highest proportionate increase (by nearly 3½ times). The reason usually given is that the nature of the measures will change. The justification in the case of Amraoti is that graded bunding programme has been introduced from 1960-61 onwards.

Loans given to the Beneficiaries during the Plan periods and their Repayment

4.26. Available statistics of loans issued and amounts repaid relates to the loans for which recovery statements are prepared by the soil conservation staff and handed over to the Revenue Department for follow-up. In the First Plan period, loans were issued to beneficiaries in Baroda, Gwalior, Coimbatore, Nilgiris, Ahmednagar and Dharwar. Information on the number of such beneficiaries in Gwalior, Coimbatore and Ahmednagar is, however, not available. Those who received loans for carrying out soil conservation work in Baroda, Nilgiris and Dharwar number 3,555, 537 and 1,146 respectively; and the average amount received per beneficiary works out to Rs. 65·83, Rs. 177·02 and Rs. 108·43, respectively. The average amount received per beneficiary during the Second Plan period in Baroda and Dharwar is Rs. 90·36 and Rs. 219·97, respectively, thus showing some increase over the level in the First Plan. The figure of the number of beneficiaries in the Nilgiris during the Scond Plan period is not available; but a total sum of Rs. 23 lakhs was disbursed as loan.

4.27. Comparable data on the number of beneficiaries receiving loan during the two Plan periods and the total amount received are available for eight districts only. Table 4.9 gives information on the number of beneficiaries, the amount issued to them as loan, the amount repaid by them and the amount paid after it is due as percentage of the amount received as loan.

TABLE 4.9

Amount of loan issued to beneficiaries in the two Plan periods and the repayment of the loans in selected districts

Sl. No.	District	Total No. of beneficiaries during the two plan periods	Total loan issued to them (Rs.)	Amount repaid (Rs.)	Average issued per year (Rs.)	Average amount repaid per year (Rs.)	Col. 7 % of Col. 6
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Anantapur	917	6,30,432.64	Nil	2,10,144.21	..	..
2.	Hyderabad	308	1,19,544.00	Nil	23,908.80	..	..
3.	Baroda	9,851	8,02,948.00	10,079.00	72,995.27	1,007.90	1.38
4.	Rajkot	32,453	15,20,000.00	Nil	3,04,009.00	..	..
5.	Bilaspur	274	1,16,751.37	Nil	58,375.68	..	..
6.	Dharwar	3,279	5,93,450.56	56,110.00	32,969.48	3,300.59	10.01
7.	Jaipur	26	11,240.00	N.A.	5,620.00	..	..
8.	Mathura	441	99,000.00	1,600.00	33,000.00	800.00	2.42

The position in respect of recoveries seems to be very weak. No recoveries have been reported from the beneficiaries in Anantapur, Hyderabad and Rajkot even though these were due. In Bilaspur, however, the loans advanced become due for recovery only in 1964-65. For Jaipur, information on the amount repaid is not available. Among the remaining three districts, the recovery position seems to be satisfactory only in Dharwar. In Baroda and Mathura, presuming the recovery position to be up-to-date, at the present pace of recovery it may take 72·46 and 41·32 years respectively to recover the full amount of loans advanced. More of attention needs to be given to this aspect of the programme.

Soil Conservation Demonstrations

4.28. Soil conservation and Dry farming measures are reported to have been demonstrated in 12 of the selected districts. These districts are Hyderabad, United Mikir and North Cachar Hills, Hazaribagh, Rajkot, Coimbatore, Nilgiris, Amraoti, Tumkur, Koraput, Jaipur, Mirzapur and Midnapur.

4.29. In Hazaribagh (State Government area), Tumkur and Midnapur the soil conservation programme has been purely on a demonstration basis. In Hazaribagh, the programme was integrated with the community development programme. The action programme mainly comprising of contour bunding was executed through the Local Panchayats. The total number of cultivators who undertook the work on their lands was 250 and a total area of 15,270 acres is reported to have been covered. The cost of contour bunding was fully subsidised and amounted to Rs. 60 per acre. However, the subsidy per acre likely to be given during the Third Plan has been fixed at 50% of the cost. In Tumkur, a demonstration programme was taken up in 1959-60 and by the end of 1960-61 a total area of 1,368.3 acres was covered in 8 blocks. The number of beneficiaries is reported to be 274. The cost of soil conservation work was entirely borne by the Government, the beneficiaries being obliged to maintain the bunds. In Midnapur, the anti-erosion measures and agronomical practices have been adopted on Government waste lands. The programme that started in 1956-57 is in the nature of reclamation of such lands, and consisted of contour bunding, formation of improved pasture blocks and demonstration of improved crop rotations and agricultural practices. The lands thus reclaimed and conserved have been allotted to refugees from East Pakistan. The data on the number of beneficiaries are not available; but the area covered under the demonstration programme is 5,800 acres.

4.30. Details showing the type of demonstration programme, the year when it started, the area on which demonstration has been given and the number of beneficiaries involved, if demonstration done on private land, for 8 districts are given in Table 4.10.

TABLE 4.10

Details of the Demonstration Programme in eight Districts

Sl. No.	District	Type of demonstration	Year when it started	Area under demonstration (hectares, acres in brackets)	Government/Private land	If private land, No. of owners involved
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Hyderabad	Contour bunding and dry farming practices.	1959-60	790.60 (1,953.60)	Private	121
2.	United Mikir & North Cachar Hills.	Cash crop plantation and terracing.	1955-56	306.62 (757.67)	Govt.	NR
3.	Rajkot	Contour bunding, and afforestation.	1958-59	500.19 (1,236.00)	Private & Panchayat land.	707
4.	Coimbatore	Contour bunding.	1960-61	526.09 (1,300.00)	Private	40
5.	Amraoti	Contour bunding, grass outlets, plantation and afforestation.	1956-57	566.56 (1,400.00)	Private	100
6.	Koraput	Contour bunding, afforestation, bench terracing, plantation of fruit trees, trial of different grasses and legumes, gully control measures, trial of species of plants for afforestation.	1955-56	84.17 (208.00)	Govt.	NR
7.	Jaipur	Terracing	1958-59	1.62 (4.00)	Private	1
8.	Mirzapur	Dry farming measures	1959-60	362.60 (896.00)	Private	175

N.B.—In Rajkot afforestation was done on 100.00 acres on Panchayat land.

It should be noted that in United Mikir and North Cachar Hills, and Koraput, the demonstrations were conducted on Government land, whereas in the remaining 6 districts these were held on private lands. In Rajkot, however, the total area covered, as shown in Table 4.10, includes 100 acres of Panchayat land on which an afforestation programme was taken up.

4.31. The type of measures demonstrated in each district are listed in the table under Col. 3. In the Nilgiris, a research-cum-demonstration programme was taken up in 1955-56 on 200 acres of Government land. The programme was to conduct research on soil conservation problems of the region by collecting and analysing hydrological data and studying the effect of different vegetative covers on runoff and soil-loss; to evolve soil conservation techniques based on agronomic, engineering and forestry aspects under varying slope conditions and work out the economics of such measures; and to demonstrate the most effective system of hill land management for lands in different land capability classes. Besides this, one Pilot scheme was started in the First Plan on 66 acres. This

was intended to be an ocular demonstration and propaganda scheme. On the basis of the experience of this pilot scheme, soil conservation measures were extended to other contiguous catchments or sub-catchments.

4.32. The cultivators are generally not obliged to enter into any terms and agreements before a demonstration programme is taken up on their lands. They get the benefit of the programme in exchange of their whole-hearted cooperation. However, in Hyderabad, it is reported that the beneficiaries have to maintain the bunds in good condition failing which the Department can repair the work and recover the costs from them. It is also provided that the cultivators should follow all recommended improved practices under departmental supervision.

Selected villages in the Districts

4.33. The analysis presented so far in this Chapter, has been based on the data that could be obtained for the districts selected for study. The remaining part of this chapter will deal with soil conservation measures, treatment etc. as observed in the selected villages. Out of 22 districts selected in 15 States for the study of soil conservation and allied problems of land improvement, the probles in Hoshiarpur in Punjab and in 24-Paraganas in West Bengal gal and United Mikir and North Cachar Hills in Assam are both local and special in character. In Midnapur (West Bengal), soil conservation work has been taken up mainly on Government waste land and the private beneficiaries are very few. The problems of land improvement in the first three districts are discussed separately in Chapter VII. In the remaining 18 selected districts, 73 villages covered by soil conservation programmes were selected for intensive study at the village level and on the basis of selected respondents. In addition to these, two control villages were also selected in each district.

Soil Conservation Problems, Area affected by them and Area Covered by Soil Conservation Measures

4.34. The most important problem of land improvement mentioned by the knowledgeable people in the villages is rain or water erosion, which includes the problem of conservation of water or moisture, sheet erosion and rill formation. This was mentioned in 83% of the villages covered by the soil conservation programme and 97% of the control villages. Besides this principal land improvement problem, gully formation was also mentioned in 56% of the villages; wind erosion in 10%, water-logging in 5% and improper drainage and levelling of land each in 6% of the villages. Obviously, more than one problem existed in many selected villages. Other land improvement problems indicated in the selected villages are alkalinity and salinity in one village of Dharwar, development of new lands in three villages of Bilaspur, shifting cultivation in seven villages of United Mikir and North Cachar Hills and Koraput, *nullah* bunding in one village of Dharwar, denudation of forests in one village of Koraput, and road debris sliding on the agricultural land in three villages in Bilaspur.

4.35. Data on the area requiring soil conservation measures of all types and the proportion of it covered by such measures have been given in Table 4.11. The table also shows the year when the soil conservation work was started and the area affected in the control villages.

TABLE 4·11

Area affected by soil erosion and allied problems, the area covered by soil conservation measures and the first year when S. C. work was taken up

Serial No.	District	Selected villages covered by soil conservation Programme					Control village	
		Area affected		Area covered upto 1960-61		Year when work started	Area affected	
		Total (hectares, acres in Brackets)	% to total Geog. area excluding forest	Total (hectares, acres in Brackets)	% to area affected		Total (hectares, acres in Brackets)	% to total Geog. area excluding forest
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	Anantapur.	7,891·38 (19,500·00)	75·52	2,750·92 (6,797·66)	34·86	58–59	3,358·89 (8,300·00)	44·45
2.	Hyderabad	1,234·29 (3,050·00)	42·49	809·62 (2,000·62)	65·59	56–57	384·45 (950·00)	41·58
3.	United M. & N. C. Hills.	N.A.	..	155·60 (384·50)	..	58-59	..	..
4.	Hazaribagh	404·60 (1,000·00)	16·05	160·31 (396·14)	39·61	55-56	47·27 (116·80)	13·62
5.	Baroda	N.A.	..	787·81 (1,946·72)	..	51–52	N.A.	..
6.	Rajkot	2,549·52 (6,300·00)	50·11	327·34 (808·88)	12·84	56–57	680·92 (1,682·60)	53·40
7.	Bilaspur	109·67 (271·00)	22·36	35·22 (87·02)	32·11	59–60	6·07† (15·00)	26·32†

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
8.	Trichur	N.A.	..	825·67 (2,040·28)	..	56–57	N.A.	..
9.	Gwalior	928·77 (2,295·05)	20·67	311·09 (768·73)	33·50	55–56	333·16 (823·25)	19·51
10.	Coimbatore	7,594·37 (18,766·00)	71·10	3,570·54 (8,823·00)	47·01	52–53	4,532·48) (11,200·00)	77·31
11.	Nilgiris	2,177·21 (5,380·00)*	13·01	739·43 (1,827·18)	33·96	53–54	343·98 (850·00)	3·63
12.	Ahmednagar	2,751·86 (6,800·00)	62·71	1,931·57 (4,773·02)	70·21	52–53	1,699·00 (4,200·00)	71·44
13.	Amraoti	3,381·42 (8,200·00)	44·02	816·22 (2,016·93)	24·60	58–59	526·09 (1,300·00)	53·62
14.	Dharwar	2,954·21 (7,300·00)	43·36	881·61 (2,178·50)	29·84	55–56	2,631·77 (6,503·25)	79·18
15.	Tumkur	2,013·31 (4,975·00)	54·24	284·96 (704·14)	14·14	59–60	295·42 (730·00)	56·19
16.	Koraput	772·70 (1,909·39)	60·06	607·89 (1,502·13)	78·67	56–57	298·93 (738·67)	57·58
17.	Jaipur	1,085·77 (2,683·00)	35·64	571·82 (1,413·00)	52·66	59–60	301·49 (745·00)	62·98
18.	Mathura	1,533·36* (3,789·00)	67·01*	452·48 (1,118·11)	29·51	59–60	653·57 (1,615·00)*	61·69*
19.	Mirzapur	254·85 (629·75)	37·24	106·53 (263·25)	41·80	59–60	72·84 (180·00)	7·73

*In *Mathura* Geog. excluding forest area relates to 55-56, Revenue Records.

†*Bilaspur* data relates to one village only.

The data in table 4:11 show clearly that the selected villages in the districts have a fairly large area requiring soil conservation measures and a good proportion of it has been already covered by suitable measures. In the control villages also, the problem of land improvement is as important as in the villages where soil conservation measures have been taken up. The proportion of the geographical area excluding forests requiring soil conservation measures in the control villages follows closely the corresponding proportion in the villages where soil conservation measures have already been taken except in the villages of Anantapur, Dharwar, Jaipur and Mirzapur.

4.36. An appreciable proportion of the lands requiring conservation measures has been covered in the selected villages. Compared with the area requiring soil conservation measures, the area covered by these is smaller in the villages in Tumkur and Rajkot. It may also be noted that the programme of soil conservation was taken up in the beginning of the First Plan in the selected villages in Baroda, Coimbatore, Ahmednagar and Nilgiris. In the other villages, the programme was initiated towards the end of the First Plan or in the Second Plan.

4.37. *Soil conservation projects in selected villages.*—In 79 villages, 197 soil conservation projects were undertaken covering a total area of 44,102 acres. There was at least one soil conservation project in each selected village. In the four selected villages in Ahmednagar, the number of soil conservation projects was 41. The average area per project ranges between 17.40 acres in Bilaspur and 2495.50 acres in Coimbatore. Table 4.12 gives a summary picture of the progress of soil conservation work in the selected villages.

TABLE 4:12

Soil conservation projects, area covered by soil conservation measures, etc. in the selected villages

Sl. No.	District	No. of projects	Soil conservation Project area (in hetares, acres in brackets)	Area covered upto 1960-61 (in hectares, acres in brackets)	Average area of the project (in hectares, acres in brackets)	Area covered as % of project area	Years taken to cover the area
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Anantapur .	4	2860·07 (7,067·37)	2750·92 (6,797·66)	715·02 (1,766·84)	96·18	4
2.	Hyderabad .	7	809·62 (2,000·62)	809·62 (2,000·62)	115·66 (285·80)	100·00	5
3.	United M. & N.C. Hills .	NR	155·60 (384·50)	155·60 (384·50)	NR	NR	3
4.	Hazaribagh .	9	160·31 (396·14)	160·31 (396·14)	17·81 (44·02)	100·00	6
5.	Baroda . .	11	787·81 (1,946·72)	787·81 (1,946·72)	71·62 (176·97)	100·00	6

TABLE 4·12—*contd.*

(1) (2)	(3)	(4)	(5)	(6)	(7)	(8)
6. Rajkot . .	11	380·95 (941·35)	327·34 (808·88)	34·63 (85·58)	85·93	7
7. Bilaspur* . .	5	35·22 (87·02)	35·22 (87·02)	7·04 (17·40)	100·00	2
8. Trichur . .	4	825·67 (2,040·28)	825·67 (2,040·28)	206·42 (510·07)	100·00	2
9. Gwalior . .	6	372·66 (920·85)	311·09 (768·73)	62·11 (153·48)	83·48	4
10. Coimbatore . .	4	4039·58 (9,982·00)	3570·54 (8,823·00)	1009·89 (2,495·50)	88·39	7
11. Nilgiris* . .	7	739·43 (1,827·18)	739·43 (1,827·18)	105·73 (261·26)	100·00	8
12. Ahmednagar .	41	1937·29 (4,787·14)	1931·57 (4,773·02)	47·25 (116·76)	99·71	7
13. Amraoti* . .	17	1222·84 (3,021·71)	816·22 (2,016·93)	71·93 (177·75)	66·75	3
14. Dharwar* . .	22	1172·97 (2,898·47)	881·61 (2,178·50)	53·32 (131·75)	75·16	6
15. Tumkur . .	5	284·96 (704·14)	284·96 (704·14)	56·99 (140·83)	100·00	2
16. Koraput . .	28	607·89 (1,502·13)	607·89 (1,502·13)	21·71 (53·65)	100·00	6
17. Jaipur . .	4	751·50 (1,857·00)	571·82 (1,413·00)	187·88 (464·25)	76·00	2
18. Mathura* . .	7	617·35 (1,525·51)	452·48 (1,118·11)	88·19 (217·93)	73·31	3
19. Mirzapur . .	5	241·19 (596·00)	106·53 (263·25)	48·24 (119·20)	44·17	2
Total excluding United M. & N.C. Hills .	197	17847.31 (44,101·63)	15971.06 (39,465·31)	90.59 (223·86)	89·49	1951-52 1960-61 10 years.

*(i) Nilgiris, Bilaspur :

Col. 3: Soil conservation project areas are not clearly demarcated, covered area is shown as project area.

(ii) Dharwar :

Col. 2 : Out of 22 projects, one is under planning and the work on another was started in 1961-62.

(iii) Amraoti :

Col 2 : Out of 17 projects, work on 9 projects is still under progress.

(iv) Mathura :

Col. 2 : Out of 7 projects, work on 5 is still under progress.

Selected respondents

4.38. The sample drawn for canvassing household schedules includes 765 owner-cultivator households on whose holdings soil conservation measures have been undertaken in 79 villages of 19 districts and 360 households in 36 villages whose holdings require soil conservation measures. Table 4.13 shows the distribution of respondents according to the period when soil conservation measures were initiated in the selected villages covered by the programme.

TABLE 4.13

Distribution of respondents according to the period when the soil conservation work was initiated in the village

Sl. No.	State	Districts	Total respondents	Soil conservation work initiated in			
				1st Plan 1956-59 (In % of total respondents)		1959-60	1960-61
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Andhra Pradesh	Anantapur	40	..	75	25	..
		Hyderabad	40	..	25	75	..
2.	Assam	United M. & N.C. Hills	47	..	100	..	..
3.	Bihar	Hazaribagh	40	25	75	..	..
4.	Gujarat	Rajkot	38	26	74	..	..
		Baroda	40	25	75	..	..
5.	Kerala	Trichur	40	..	75	25	..
6.	Madhya Pradesh	Gwalior	40	25	75	..	..
7.	Madras	Coimbatore	40	25	75	..	..
		Nilgiris	40	25	75	..	..
8.	Maharashtra	Ahmednagar	40	25	15	..	..
		Amraoti	46	..	100	..	..
9.	Mysore	Dharwar	40	25	75	..	..
		Tumkur	40	..	100	..	..
10.	Orissa	Koraput	39	..	100	..	..
11.	Rajasthan	Jaipur	38	..	..	21	79
12.	Uttar Pradesh	Mirzapur	40	..	100	..	..
		Mathura	40	..	..	100	..
13.	Himachal Pradesh	Bilaspur	37	..	..	100	..

4.39. Evidently about 25% of the respondent households in eight districts belonged to villages where soil conservation measures were initiated during the 1st Plan period. In the case of respondent households in five districts and about 75% of them in 10 districts, soil conservation measures were initiated in the three early years of the Second Plan period. Seventyfive per cent of the households in one district (Hyderabad) and all of them in two other districts (Mathura & Bilaspur) belonged to villages where soil conservation measures were taken up during 1959-60. And in one district (Jaipur) 79% of the respondents belonged to villages where soil conservation measures were initiated in 1960-61.

4.40. *Size of owned holding.*—Data showing the average size of owned holding and the proportion of its area lying within the village are presented in Table 4.14.

TABLE 4.14

Average owned holding of the selected respondents in the villages covered by Soil Conservation Programme

Sl. No.	State	District	Average size of owned holding (Hectares, acres, in brackets)	% inside the village
(1)	(2)	(3)	(4)	(5)
1.	Andhra Pradesh	Anantapur	8·38 (20·72)	99·5
		Hyderabad	7·35 (18·16)	82·0
2.	Assam	United M. & N.C. Hills	2·88 (7·11)	100·0
3.	Bihar	Hazaribagh	2·66 (6·57)	99·6
4.	Gujarat	Baroda	4·80 (11·86)	92·4
		Rajkot	16·10 (39·79)	100·0
5.	Kerala	Trichur	1·29 (3·19)	100·0
6.	Madras	Coimbatore	4·14 (10·23)	99·2
		Nilgiris	1·19 (2·93)	100·0
7.	Madhya Pradesh	Gwalior	9·28 (22·92)	76·2
8.	Maharashtra	Ahmednagar	6·85 (16·93)	96·5
		Amraoti	10·79 (26·66)	73·8
9.	Mysore	Dharwar	7·08 (17·49)	84·1
		Tumkur	3·19 (7·89)	83·0
10.	Orissa	Koraput	6·89 (17·03)	97·9
11.	Rajasthan	Jaipur	12·92 (31·93)	100·0
12.	Uttar Pradesh	Mathura	7·41 (18·30)	97·9
		Mirzapur	4·22 (10·42)	87·1
13.	Himachal Pradesh	Bilaspur	1·72 (4·24)	76·1

Respondents in the covered sample village have on an average more than 20 acres of owned land in 5 districts, 10 to 20 acres in eight districts, 5 to 10 acres in three districts, and less than five acres in the remaining three districts. The respondents in Rajkot district, (Gujarat) own on an average the largest sized holding (about 40 acres) among the respondents in different districts. Those in Jaipur, in Rajasthan came next with about 32 acres. The respondents in Nilgiris (Madras) and Trichur (Kerala) have on an average only three acres of owned holding, the lowest among the selected districts. Almost the entire owned holding of the respondents in 11 districts is within the village itself; whereas in the remaining eight districts some portion is located outside the village. This has been found to be particularly so in Amraoti (26%), Bilaspur and Gwalior (24% each), Hyderabad (18%), Tumkur (17%), Dharwar (16%) and Mirzapur (13%).

4.41. There is a great variation in the size of holdings of owners of land in Koraput and Nilgiris. If the owners of land are arranged in the descending order of their owned holding, the average size of the owned holding of the first 20% of the owners (first section) in Koraput comes to 32 acres. But the average size of the owned holding of the last 20% owners (fifth section) is only five acres. In the Nilgiris, where the average holding is only three acres in size, the owners in the first section have an average holding of nine acres, and the fifth section only 0.27 acres. In Gwalior, Amraoti and Hyderabad also there is a great disparity in the size and distribution of owned holdings. The owned holdings of the first 20% of owners of land account for more than 10 times the holding of the owners in the last section. Table 4.15 shows the average size of the owned holding of the respondents in the first and the fifth sections.

TABLE 4.15

Average owned holding of the owners in the first and the fifth sections (quintiles)

Sl. No.	Selected districts	Average owned holding of the respondents in		Ratio of col. 4 to col. 3
		Quintile I or Section I	Quintile V or Section V	
		(Hectares, acres in brackets)		
(1)	(2)	(3)	(4)	(5)
1.	Anantapur	20·30 (50·16)	2·29 (5·65)	8·9
2.	Hyderabad	20·46 (50·55)	1·95 (4·81)	10·5
3.	United M. & N.C. Hills	5·03 (12·42)	1·41 (3·49)	3·2
4.	Hazaribagh	6·60 (16·31)	0·79 (1·95)	8·4
5.	Baroda	11·04 (27·28)	1·34 (3·31)	8·2

TABLE 4.15—*contd.*

(1)	(2)	(3)	(4)	(5)
6.	Rajkot	28·66 (70·83)	7·78 (19·23)	3·7
7.	Trichur	2·87 (7·10)	0·31 (0·77)	9·2
8.	Coimbatore	9·38 (23·17)	0·98 (2·42)	9·6
9.	Nilgiris	3·75 (9·26)	0·11 (0·27)	34·3
10.	Gwalior	27·34 (67·57)	1·65 (4·07)	16·6
11.	Ahmednagar	9·80 (24·21)	4·68 (11·57)	2·1
12.	Amraoti	26·25 (64·87)	1·79 (4·43)	14·6
13.	Dharwar	15·29 (37·79)	3·03 (7·58)	5·1
14.	Tumkur	8·16 (20·17)	1·04 (2·57)	7·8
15.	Koraput	13·02 (32·18)	2·20 (5·44)	5·9
16.	Jaipur.	24·80 (61·29)	7·11 (17·56)	3·5
17.	Mathura	15·24 (37·66)	1·87 (4·61)	8·2
18.	Mirzapur	8·79 (21·73)	0·93 (2·30)	9·4
19.	Bilaspur	4·04 (9·98)	0·60 (1·48)	6·7

4.42. *Coverage of holding by Soil Conservation measures.*—Soil conservation measures have naturally been undertaken on the holdings which required such measures. Data showing the average net operational (not owned) holding of the respondents within the village, the proportion of it requiring Soil Conservation measures and the area covered by such measures are presented in Table 4.16.

TABLE 4.16

Average net (possession) holding in the village of the respondents

Sl. No.	State	District	Average net holding within the village (hectares, acres in brackets)	Percentage requiring soil conservation measures	Area on which soil conservation work done as	
					% to area requiring	% to average net holding
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Andhra Pradesh	Anantapur	8·30 (20·52)	88·1	64·3	56·6
		Hyderabad	6·15 (15·20)	76·3	76·3	58·2
2.	Assam	United M.&N.C.Hills	2·90 (7·17)	49·1	75·8	37·2

TABLE 4.16—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)
3.	Bihar	Hazaribagh	2·63 (6·49)	28·9	78·8	22·8
4.	Gujarat	Baroda	4·44 (10·96)	84·3	80·8	68·1
		Rajkot	16·10 (39·79)	42·3	93·8	39·7
5.	Kerala	Trichur	1·61 (3·99)	67·7	94·8	64·2
6.	Madras	Coimbatore	4·10 (10·13)	71·1	99·3	70·6
		Nilgiris	1·19 (2·93)	100·0	100·0	100·0
7.	Madhya Pradesh	Gwalior	7·07 (17·47)	72·3	82·1	59·3
8.	Maharashtra	Ahmednagar	6·99 (17·28)	99·7	84·8	84·5
		Amraoti	8·13 (20·10)	81·6	71·3	58·2
9.	Mysore	Dharwar	6·61 (16·34)	72·9	52·9	38·5
		Tumkur	2·70 (6·68)	77·4	86·5	66·9
10.	Orissa	Koraput	6·35 (15·70)	72·7	86·7	63·0
11.	Rajasthan	Jaipur	12·97 (32·04)	82·5	90·1	74·4
12.	Uttar Pradesh	Mathura	7·33 (18·12)	92·6	62·5	57·8
		Mirzapur	3·67 (9·07)	38·5	44·6	17·2
13.	Himachal Pradesh	Bilaspur	1·31 (3·23)	88·7	66·0	58·0

NOTE.—Net holding includes land owned *plus* land leased in and excludes land leased out. It includes both cultivated and uncultivable area.

The entire operational holding of the respondents in the Nilgiris and Ahmednagar districts was found to require soil conservation measures. The proportion of the operational holding requiring such measures was very high in twelve other districts also (Anantapur 88%, Baroda 84%, Amraoti 82%, Jaipur 83%, Bilaspur 89%, Mathura 93%, Hyderabad 76%, Coimbatore 71%, Gwalior 72%, Dharwar 73%, Tumkur 77% and Koraput 73%). The lowest proportion has been reported from Hazaribagh (29%), Mirzapur (38%), Rajkot (42%) and United M. & N. C. Hills (49%).

4.43. The whole of the area requiring Soil Conservation measures on the holdings of sample cultivators has been covered in the Nilgiris. In 13 other districts (Rajkot, Trichur, Coimbatore, Gwalior, Ahmednagar, United M. & N. C. Hills, Hazaribagh, Tumkur, Koraput, Jaipur, Hyderabad, Baroda and Amraoti, the proportion of area

covered to area requiring works out above 70%. In districts like Bilaspur, Mathura and Anantapur, it comes to about 63% to 66%. The lowest coverage of area requiring Soil Conservation measures have been reported from Mirzapur (45%) and Dharwar (53%).

Soil Conservation Mechanical Measures

4.44. *Traditional measures.*—Cultivators everywhere are aware of, and follow to some extent, certain measures for preserving the fertility of the soil and increasing its productivity. Common among these measures are the construction of field bunds to serve both as property boundary and the purpose of preservation of moisture. In certain districts, like Anantapur and Ahmednagar cultivators have also constructed check dams with waste-weirs. In one or two districts, plantation of green manure crops on field boundaries and keeping a small patch of land under grass have also been reported as traditional soil conservation practices. In the hilly areas of Nilgiris, Bilaspur and Hazaribagh, cultivators have been terracing their lands and bunding them for growing paddy. In Bilaspur, these terraces have outward gradation without divergent channels.

4.45. These traditional measures, however, do not conform to the scientific standards of modern soil conservation treatment. Moreover, the traditional construction measures are usually carried out by individual cultivators, and seldom as a co-operative or community effort on a catchment basis. If the big marginal bunds, field dams or check dams get damaged or breaches occur in them, the crops on other cultivators' lands also suffer some loss. Another feature of the traditional construction measures is that these never extend to treatment of lands highly eroded or gullied.

4.46. It may be of interest here to quote what the Ford Foundation Study Team had to say about such measures. "It has been said that field bunds are better than no bunds. For many good sloping soils that respond greatly to contour bunding, field bunds are actually far inferior. Field bunds on such soils can even lead to harmful water-logging or erosion by concentrating the water where it lies to spoil the crop or breaks through the bund to cause a gully. The promotion and construction of field bunds can have the effect of seriously delaying the proper bunding schemes"....."Field bunds on nearly level soils are useful when the areas they enclose are levelled for uniform water distribution and penetration, provided also that drainage is adequate to avoid water-logging."* In short, field bunds are not scientific. Scientific soil conservation treatment proceeds with the survey of the catchment or a sub-catchment, drawing the contour alignments and mapping different engineering measures based on the knowledge of the slope, rainfall and soil. It also emphasizes timely repairs and maintenance of bunds for the benefit of the project area as a whole.

4.47. *Recommended measures.*—Contour bunding and allied measures have been recommended, in most of the selected districts, for the plains areas with modifications like provision of waste water weirs, drains, graded bunds, etc. Dry lands are invariably subject to erosion as their undulating terrain is seldom levelled as in the case of lands under irrigation. Conservation of moisture in such areas

*Report on India's Food Crisis and Steps to meet it by the Agricultural Production Team sponsored by Ford Foundation (1959) page 151.

is of prime importance, and contour bunds help moisture preservation. Terracing has been recommended in United Mikir and North Cachar Hills, Koraput and in certain areas in Dharwar and Ahmednagar. Bench terracing has been recommended in Bilaspur, Nilgiris and Koraput. Contour trenching and contour strips are also recommended where the slope of land is high.

Agronomic practices for soil conservation

4.48. *Crop Rotation.*—The importance of crop rotation for the general maintenance of soil fertility is well known. Growing the same crop year after year, decreases the plant nutrients in the soil. A proper rotation of crops helps to control erosion, lessen the soil erosion and preserve its fertility. The actual choice of rotation depends on the use capability of the land, the climate, soil types, slope, type and degree of erosion and also the economic and social conditions of the people.

4.49. Certain crop rotations are reported to be traditionally followed in 20 of the selected 21 districts. In quite a number of cases, the rotations followed traditionally have been later recommended or recognized as useful by the soil conservation officers. In Anantapur, Hyderabad, Amraoti and Dharwar district, the rotations traditionally followed are considered quite satisfactory as conservation farming crop rotations. In United Mikir and North Cachar Hills and Koraput, plantation crops are recommended for weaning away the tribals following the practice of Jhuming. In Baroda, Trichur, Gwalior, Tumkur and Koraput, no crop rotations have been recommended by the soil conservation officers. In Mirzapur, great emphasis is laid on the use of green manure and cover crops such as Sanai, Dhaincha, Urad, Mung, etc. and also on sowing of leguminous crops. The crop rotations traditionally followed and those recommended are given separately for each district in the Appendix B-9. The following table (Table 4.17) gives a brief summary of it.

TABLE 4.17

Crop rotations, traditional and recommended

Period of rotation	Traditional rotations		New recommended rotations
	Not recommended	Recommended	
(1)	(2)	(3)	(4)
One year	28	16	4
Two years	15	17	7
Three years	5	5	1
Four years	2	..	..
	50	38	12

4.50. The total number of traditional crop rotations reported are 88, of which 38 are also recommended as conservation farming rotations. As far the 50 traditional crop rotations, that are not on the recommended list, the soil conservation departments have not taken any stand. In other words, they have recommended neither their continuance nor discontinuance. In the case of United Mikir and North Cachar Hills and Koraput, however, the traditional cultivation practices (shifting cultivation known as Jhuming and Podu cultivation respectively) are discouraged.

4.51. It was also reported that 12 new crop rotations (4 one year and 7 two year and one three year ones) have been recommended by the soil conservation officials. Details of these rotations are given in Table 4.18.

TABLE 4.18

New crop rotations recommended by Soil Conservation Officials, in Selected Districts

Sl. No.	Districts	No. of new rotations	Crop rotation		
			Sl. No.	Period of rotation (Years)	Sequence of rotation
(1)	(2)	(3)	(4)	(5)	(6)
1.	Hazaribagh	1	1	1	Cereals-legumes.
2.	Rajkot	3	1	1	Fallow-wheat and/or gram Cotton+Jowar+pulses-groundnut-fallow.
			2	2	
			3	2	Bajra - pulses - groundnut fallow.
					Terraced area :
3.	Nilgiris	2	1	2	Potato - green manure crop-fallow - cereals - green manure crop-fallow.
					Non-terraced area :
			2	1	Potato-cover crops such as cowpea or horse gram etc. (for slopes less than 2%).
4.	Ahmednagar	2	1	2	Fallow-jowar+safflower - fallow-gram.
			2	2	Bajra + tur-fallow-groundnut-fallow.
5.	Hoshiarpur	2	1	1	Green manuring and maize-wheat.
			2	3	Green manuring -wheat - fodder-fallow-maize-wheat.
6.	Jaipur	1	1	2	Castor-fallow-Bajra + moth+ moong (mixture)-fallow.
7.	Mathura	1	1	2	Groundnut and Arhar and Gram-fallow-Barley and gram.

These twelve rotations are recommended for both bunded and unbunded lands. In the Nilgiris, for non-terraced land having a slope less than 2%, a one year rotation of erosion permitting crop like potato followed by a crop able to provide good ground cover such as cowpea or horse-gram is recommended. For slopes steeper than 33%, tree plantation and plantation crops after contour trenching is recommended. Inclusion of legumes in rotation is recommended in Hazaribagh, Rajkot, Ahmednagar, Jaipur and Mathura. In Mathura, gram is to be sown when the Arhar crop is already standing in the field. Green manuring is included in the recommendations in Nilgiris and Hoshiarpur. In Hoshiarpur, maize is to be sown after a green manure crop in the kharif season and wheat in the rabi. In United M. & N. C. Hills, cash crops like cashewnut and blackpepper are not raised by the cultivators; but these are recommended in place of Jhuming. In Koraput also, planting of cashewnut, coffee, fruit-trees and agave along the slopes are recommended for the area under Podu cultivation. In Midnapur, inclusion of a leguminous crop once in three years and avoidance of wide-row crops on unbunded areas is also a new recommendation.

Period of transition from exploitative to conservation farming

4.52. It appears from the list of crop rotations traditionally followed by the cultivators and those officially recommended that the crop rotations currently followed on good lands are quite satisfactory for the soil conservation area. Improved crop rotations are already known to the cultivators, and as the soil conditions in the conservation area improve, the cultivators gradually take to them. In most of the districts, no particular steps have been taken to propagate improved crop rotations. In Mathura, it is reportedly assumed that in two years following the adoption of the soil conservation measures the cultivators would switch over to the crop rotations now adopted on good lands. In Dharwar, this estimated period of transition is eight years. From some districts reports have been received that inducements are offered to the cultivators for changing their crop rotations. In Bilaspur, for instance, green manures or fertilizers, improved seed and improved implements are supplied to the farmers at subsidized rates, to induce them to switch over to the improved cropping pattern already in existence on a very small area in the district. In United Mikir and North Cachar Hills, loans and subsidies are offered to the cultivators for growing cash crops. Out of the savings effected in the construction cost per acre, improved seeds and, in rare instances, fertilizers are provided to the cultivators in Bihar. In the DVC area of Hazaribagh, fertilizers are given free in the first year.

4.53. In the case of new crop rotations which depend for their adoption partly on favourable weather conditions and partly on the financial resources of the cultivators, it has been reported from Rajkot and Ahmednagar that the cultivators would take as long as ten years to switch over to the new cropping pattern. The new crop rotations are not explained to the cultivators in Ahmednagar; and the Agricultural Extension Officers in the blocks are not even aware of some of them. In other districts, the period required for switching over to new crops is not expected to exceed three years.

Conservations farming or dry farming practices

4.54. As a part of the general programme of agricultural improvement, improved cultural practices have been recommended, in all the districts. These mainly relate to use of improved seed, line sowing, use of farmyard manure and use of chemical fertiliers. Specific conservation farming practices recommended in place of traditional practices of the cultivators are very few. Traditional cultivation practices include ploughing of land without regard to its slope, ploughing more than once without regard to the depth of the soil, broadcast method of sowing and heavy seed rate. These have been definitely discouraged. In their place, line sowing, low seed rate, cultivation along the contour and ploughing of land once in two or three years in the case of light, shallow and medium soils are the practices recommended.

4.55. In addition to these, green manuring, strip cropping, raising of grasses on the bunds, a specified number of intercultures are other conservation farming practices recommended in the districts. In United Mikir & North Cachar Hills and in Koraput, growing of plantation crops has been recommended in place of shifting cultivation. The appendix table B-9 gives relevant information on the traditional practices of the cultivators, improved practices followed by the cultivators generally both on bunded and unbunded lands in response to general extension programme of the Agricultural Department and the specific conservation farming practices recommended by the Department.

4.56. In Baroda, Trichur and Amraoti, there are no specific conservation farming practices recommended to the people. In Baroda, cultivators have been adopting improved agricultural practices on both bunded and unbunded lands. The Soil Conservation Department approves these practices and has not recommended any specific conservation farming practices for bunded areas. In Trichur, tapioca is the main crop grown on the land covered by soil conservation measures. It is planted on specially prepared ridges. There are no specific recommendations in respect of this crop. In Amraoti, the improved agricultural practices followed by the cultivators, are considered satisfactory as conservation practices. In addition to these, the dibbling method of sowing has been recommended as a conservation practice.

4.57. Improved cultural practices are recommended either as conservation farming practices or as dry farming practices. As dry farming practices, these are recommended in Rajkot, Gwalior, Coimbatore, Ahmednagar, Dharwar and Tumkur. The important features of the dry farming practices are: (1) lesser emphasis on ploughing the land every year, and emphasis on a (2) specified number of harrowings, and (3) a specified number of interculturing, (4) lower seed rate, and (5) strip cropping. It is in these districts also that the recommendation are more specific. In other districts *viz.*, Anantapur, Hyderabad, Hazaribagh, Hoshiarpur and Jaipur, the recommended conservation practices are mainly green manuring, contour cultivation, strip cropping, growing of grass on the bunds, etc. In Mathura and Mirzapur, emphasis is on cover crops, green manure crops, reduced seed rate, eradication of weeds and planting of grass on bunds. In none of the districts, however, there is any follow-up programme for propagating conservation farming or dry farming practices.

4.58. In Ahmednagar, Maharashtra the Agricultural Assistants (Soil Conservation) are also designated as Dry Farming Assistants. They are expected to lay some demonstration plots for dry farming methods. In these plots, demonstrations of reduced seed rate and sowing with a spacing of 18" and inter-culturing of jowar crop are given. Strip cropping is not, however, demonstrated to the cultivators. It has also been observed that the services of dry farming assistants are mainly utilized for engineering surveys and for the execution of bunding work. In the absence of an adequate effort to propagate conservation farming or dry farming practices, the benefits of soil conservation mechanical measures are not realized fully by the cultivators. The danger in such a situation is that the cultivators may lose faith in the programme. The block agency, which has practically done nothing for the follow-up programme nor has in many states been brought into the programme, as well as the Soil Conservation Division would have to give serious attention to conservation farming and dry farming practices if the soil conservation programme is to achieve full success.

CHAPTER V

PROBLEMS OF EXTENSION OF SOIL CONSERVATION AND DRY FARMING PRACTICES

5.1. *General Approach to soil conservation works.*—The history of the progress of soil conservation work in the selected districts has been discussed in relevant sections of the last chapter. Soil conservation work in Ahmednagar, Dharwar, Coimbatore and Baroda was first taken up as a famine relief measure to provide employment to the people. At present, however, the work is taken up in most of the districts as an intensive programme in selected areas. In Maharashtra, the Revenue officials were also associated with the programme during the intensive soil conservation period, 1958-60. In Uttar Pradesh and Bihar, certain blocks are selected for intensive soil conservation work. In Koraput and M. & N. C. Hills, it is directed at the special problem of shifting cultivation. In Himachal Pradesh, the soil conservation programme got linked up with land reclamation which was undertaken for settling the cultivators whose lands got submerged under the Govindsagar reservoir. Similarly, in West Bengal, excluding the drainage scheme in 24-Parganas undertaken in 1952-53, the soil conservation work in Midnapur district was taken up on Government waste land with the objective of resettling displaced persons thereon. In Ahmednagar, Amraoti, Dharwar, Baroda, Coimbatore and Nilgiris, soil conservation had developed into a regular programme of the Agricultural Department by the beginning of the Second Plan. In the remaining districts, the programme received importance only during the Second Plan period.

5.2. *Selection of villages for soil conservation work.*—Our enquiry reveals that villages had been selected for soil conservation work mostly by the Department; 93% of the sample villages having been selected by them. The remaining 7% of the villages were taken up after the villagers approached the Department with a request for undertaking conservation treatment of their lands. The manner of selection of villages for soil conservation work as described in our sample areas is indicated in Table 5.1.

TABLE 5:1

Manner of Selection of Villages for Soil Conservation Work

Manner of Selection	% sample villages
(*a*) Selected by Department	93·2
(i) as part of bunding scheme	65·8
(ii) due to nearness to road	19·2
(iii) nearness to block	5·5
(iv) severe erosion	2·7
(*b*) Selection at the instance of the people	6·8

All the villages in Coimbatore, Jaipur, Mirzapur, Rajkot, Dharwar, Trichur, Anantapur and Ahmednagar and three of the sample villages in Bilaspur and two each in Hazaribagh, Tumkur and Koraput had been selected by the Department under their intensive soil conservation programme. Nearness to the block headquarters prompted the selection of two villages in Hyderabad and one village each in Mathura and Amraoti.

5.3. Interested cultivators from three villages in Coimbatore and two in Gwalior had contacted the soil conservation staff and requested that their villages might be taken up for bunding work. Some cultivators from two villages each in Amraoti and Baroda also had approached the departmental staff to get their individual lands included in the soil conservation project.

5.4. *C. D. Block and Soil Conservation.*—In the two districts of Uttar Pradesh and in the State Government's soil conservation area in Hazaribagh, community development blocks are directly involved in the soil conservation programme. Similarly, the multi-purpose tribal blocks in M. & N. C. Hills are associated with this work. In Jaipur, the panchayat samitis selected areas for soil conservation work. In Gwalior, the C. D. blocks suggest villages for soil conservation work, and the Agricultural Department generally selects them. The Blocks also advance loans for bunding on cropped lands which is a soil conservation scheme. In the other districts, the block is associated with the programme only rarely and that too for obtaining the cooperation and consent of the people. In most of our selected districts, the C. D. block does not generally come into the soil conservation programme, and is not associated either with the survey, planning and execution of the engineering works or with the follow-up programme in respect of repairs and maintenance of bunds, and propagation of improved cultural practices or crop rotations. The Department provides special staff for carrying out surveys and for planning and executing the engineering works.

5.5. The association of the block with the soil conservation programme in Mathura and Mirzapur deserves some elucidation. In the districts in Uttar Pradesh, certain blocks are selected for intensive soil conservation extension work, on the basis of the urgency of the problems in the field. These blocks are then provided with special soil conservation staff. The regular VLWs of the block are expected to receive training in soil conservation. Village level workers specially appointed for soil conservation work and the regular VLWs of the block, if trained, work together on the programme. The soil conservation projects are approved by the Block Development Committee. The block soil conservation staff, however, continuously get guidance and assistance from the District Soil Conservation Officer and the Surveyor. In the other blocks where the programme is not taken up intensively, the Prantiya Raksha Dal, a voluntary organization, carries out field bunding with the help of the people. The Bihar Government also execute the programmes in their area entirely through the block agency. With the help of the block staff, sites are selected, people won over and work executed on a 100% subsidy basis. The Assistant Soil Conservation Supervisor for the district with the help of his Soil Conservation Officer provides technical guidance and scrutinizes soil conservation schemes. On the

other hand, in the DVC area of Hazaribagh in Bihar, the Soil Conservation Department of the DVC executes the work independently of the block. Till 1959-60, the DVC tried to associate itself with the C. D. Block, though the work of surveying, planning and execution was done by the staff of the DVC. The block was not directly involved in the programme; there were procedural delays in executing soil conservation work and the DVC disassociated itself from the block agency. The DVC staff, however, takes the help of the block agency for getting people's cooperation for the work.

5.6. *Association of the people with the soil conservation work.*— In the selected districts soil conservation work has been mostly undertaken on a sub-catchment basis. Construction work executed directly by the department, is given on contract or undertaken by the individual beneficiaries under the guidance of the department. In the selected districts of Andhra Pradesh and Madras, the works are executed by the department by issuing contracts for the earth work. There has, however, been a growing realization that the works should be executed *directly* by the department without the help of contractors or else should be got done through the panchayats.

5.7. In 59% of the selected villages, these works were reported to have been executed by the department directly; and in 17% of the villages through contractors engaged by the department. In the remaining 24% of the villages, these were carried out by the individual cultivators under the guidance of the department. The last group of villages are in the districts of Mathura, Mirzapur, Bilaspur and Jaipur. It is significant that in three of these four districts, the C. D. block is directly associated with the programme.

5.8. People's institutions have not been associated with the work in most of the selected districts. In the districts of Maharashtra, Gujarat and Mysore, earthwork is done directly under the supervision of the department. It is reported that Farmers' Union in Maharashtra help in mobilizing labour for earthwork. But in none of the nine selected villages in the two districts of Maharashtra such association of the Farmers' Union with soil conservation work was reported. What was reported was that there was a concerted official drive in the period 1958-60 to organize such unions and associate them with the bunding work. For a time, the unions tried to play some role, but after some time virtually became defunct. In Jaipur and Bilaspur, the works are undertaken by individual beneficiaries under the guidance of the soil conservation staff. In Bilaspur, when some cultivators showed reluctance to undertake earthwork, it was entrusted by the department to contractors. In Uttar Pradesh, *ad hoc* soil conservation village committees are formed; the plan and programme are discussed by these committees; and the earthwork done by the beneficiaries under the guidance of the department. In Gwalior, "bunding of crop lands" on sub-catchment basis is done by the beneficiaries under the guidance of the Block and soil conservation staff. But contour bunding is done with the help of bull-dozers. In the four selected villages in Gwalior, however, the work had been done by the department directly. In the State Government project area in Hazaribagh, panchayats are excepted to undertake the earthwork; but in the selected two villages it was executed through contractors.

In the DVC area of Hazaribagh, people are associated with the programme from the planning stage onwards. Each beneficiary is allotted work in proportion to his holding, its slope, etc.; and he constructs the terraces and bunds at his own cost. In lieu of this, the beneficiary is supplied free fertilizers in accordance with the need for his holding and the crop to be raised on the land.

5.9. *People's consent for soil conservation work.*—In Ahmednagar, Rajkot, Baroda and Dharwar where the Bombay Land Improvement Act is in operation, consent of the owners of land covering 66% of the area is obtained before executing soil conservation works. In the other districts, consent of all the cultivators is obtained before implementing the programme. If in a subcatchment area some cultivators oppose, they are left out and their lands are not covered by soil conservation measures. In the districts of Uttar Pradesh, though the Soil Conservation Act 1954 provides for compulsory implementation of measures on the lands of the recalcitrant minority, the department usually obtains the consent of all the cultivators. If some culivators oppose the programme their lands are left out. In a similar situation, where the farmers in an area do not agree to undertake soil conservation measures, the Soil Conservation section of the DVC demonstrates these measures on a part of their holdings to win them over. In the State Government area of Hazaribagh district and in Tumkur where the work has been taken up more or less, as a demonstration programme on a 100% subsidy basis, there has been no opposition from the cultivators. However, in one selected village in Hazaribagh district, the people were very apathetic towards soil conservation measures and destroyed the fencing provided round the cashewnut plantation and even uprooted the plants.

5.10. There has been no opposition to the programme from the cultivators in the selected villages in six districts, *viz.*, Anantapur, Trichur, Gwalior, Dharwar, Koraput and Bilaspur. Another seven districts—Tumkur, Hyderabad, Rajkot, Amraoti, Mathura, Mirzapur and Coimbatore—had each in its sample of villages one village where the cultivators had opposed the soil conservation programme. But they were ultimately won over through the efforts of the village leaders and the soil conservation staff. In the remaining districts there had been opposition to the programme in more than one of the sample villages. The reasons for opposition to the programme were: (i) suspicion that the Government had taken up the programme with a view to acquiring land, (ii) inconvenient location of water outlets, (iii) zig-zag nature of bunding which stood in the way of cultivation of land, (iv) loss of land under the bunds and loss of top soil due to bunding and levelling. Among these reasons, 'suspicion that the Government may acquire the land' was reported from 40% of the sample villages which had recorded opposition to the programme. This reason was cited by the cultivators opposing the programme in the selected villages of Hazaribagh, Tumkur, Jaipur and Ahmednagar.

5.11. Consent of the cultivators is obtained before undertaking soil conservation measures on their land. However, about 65% of the respondents in Anantapur and all in Koraput stated that no such consent was obtained from them before the measures were taken up.

In Anantapur where written consents are obtained from all the cultivators, it appears that they were not aware of having done so. In Koraput, the department had taken up the programme in areas which required soil conservation measures. General consent of the cultivators was not obtained; and being backward and tribal they had not raised any objection to the work done by the department. A few respondents in Ahmednagar, Amraoti and Coimbatore had also not given consent to the work. In the first two of these districts, work on the lands of the respondents might have been undertaken under the provisions of the Land Improvement Act; and in Coimbatore the respondent cultivators might not be aware that they had given written consent for the work before it was undertaken on their lands.

5.12. *Preparing people for soil conservation measures.*—In order to induce the cultivators to adopt soil conservation treatments on their lands, they have been contacted individually and in groups. Mass meetings and film shows have also been organized. Response of the cultivators was reported by the officials to have been usually favourable. In some villages in Mathura and Rajkot, visits by the cultivators to areas covered by soil conservation measures were arranged. In Mirzapur, pamphlets were distributed in all the selected villages. District officers in the Nilgiris and Coimbatore reported that special village leaders' training camps were organized and about 320 cultivators trained in simple techniques of soil conservation. In the sample villages in these two districts, however, none had attended these camps or training course. In the selected villages in Jaipur and Dharwar, village leaders' camps for soil conservation were also held.

5.13. In all the selected villages, meetings were held for convincing the cultivators of the advantages of soil conservation measures. Only in Koraput, Bilaspur and Trichur, no such meetings were reported. In all these areas, however, some cultivators were contacted individually or in groups. In Trichur, the hilly area on which soil conservation measures were carried out, belongs to the forest department and some migrating cultivators settled on this land. They thought that by cooperating with the department their right on the land would be confirmed. In Koraput, all the selected villages fall within the Machkund basin where soil conservation measures were adopted to prevent a rapid silting of the reservoir. In Bilaspur, two of the selected villages are in the catchment of the Bhakra Dam and in the other two villages most of the owners were those who were allotted land after their eviction from the site of the new township of Bilaspur.

5.14. In 45% of the villages, the reaction of the audiance attending such meetings was, according to the officials, good or fair towards the soil conservation programme; the cultivators in 16% of the villages were reportedly enthusiastic and liked the programme. In another 31% of the villages, the people were indifferent or their reaction poor. In 7% of the villages, people thought that there was some mischief at the root of the programme, but later were won over by individual contacts or persuasion by members of the Panchayats or leading villagers.

5.15. The information and evidence presented in the last few paragraphs present somewhat of a confusing picture about the nature and effectiveness of the extension effort in the sphere of education and promotion that has gone into the soil conservation programme. It is obvious that the extension techniques adopted in some areas are theoretically the known ones, namely, individual and group contact, sometimes even mass contact and in a few areas even training camps. The extent to which these have been effective will be assessed in the light of the reactions and attitudes of the respondent cultivators, to be analysed in the later sections. One thing, however, stands out, namely, that there has been a general inadequacy of effort directed at extension education through the medium of demonstrations. Sufficient attention does not seem to have been paid to activities in this field. Very little of demonstration of the utility and economics of mechanical measures and agronomic practices is or has been organised in most of the sample areas with the result that the cultivators do not appear to develop any deep conviction about the advantages of the bunds and other treatments, inspite of meetings, individual and group contacts. Since they are left to wander in the area of uncertain knowledge, skepticism grows and eventually turns into suspicion, taking away their sense of identification with the programme and their desire for maintenance and follow-up work. This is not, however, the full picture in some areas. In the hilly tribal areas like Koraput, the need for winning the confidence of the tribals and keeping them properly informed does not seem to have been attended to. To the extent this has happened, it points to a rather serious lapse.

5.16. *Knowledge and adoption of soil conservation measures. Mechanical measures.*—In the sample villages covered by the soil conservation programme, all the selected respondents had a knowledge of mechanical treatments. The main source of knowledge obviously is the soil conservation department or the agricultural department or the block agency. The selected respondents in 11 out of 18 districts reported that they had come to know about contour bunding, graded bunding, terracing or bench terracing, as the case might be, from the officers of the soil conservation department or block officials. The selected respondents in seven districts reported that they had seen this type of work in their own village or in the neighbouring villages. These respondents were from Anantapur, Baroda, Ahmednagar, Amraoti, Dharwar & Tumkur.

5.17. In the control villages in 18 districts, 86% of the respondents reported that they had a knowledge of the mechanical soil conservation measures. It appears that in the control villages also, there is a fairly extensive familiarity with the soil conservation mechanical measures. Such awareness of soil conservation mechanical measures is lowest in the control villages, in Bilaspur with only 30% of the respondents claiming it. The cultivators in control villages came to know about the soil conservation mechanical measures after seeing them in neighbouring villages. Table 5·2 summarises the data showing the importance of the two main sources of knowledge in the selected districts.

TABLE 5.2

Important agency responsible for knowledge of soil conservation mechanical measures.

Selected villages	Distribution of districts according to media of knowledge			
	Soil Conservation Department and Block Officials etc.		Seen in the villages	
	Respondents reporting the medium in percentage groups		Respondents reporting the medium in percentage groups	
	80 to 100%	50 to 80%	80 to 100%	50 to 80%
Covered by soil conservation measures.	1. Hyderabad 2. Trichur 3. Nilgiris 4. Jaipur 5. Mathura 6. Mirzapur 7. Bilaspur	1. Hazaribagh 2. Rajkot 3. Coimbatore 4. Koraput	1. Anantapur 2. Amraoti 3. Dharwar 4. Tumkur	1. Baroda 2. Ahmednagar
Control villages.	1. Hazaribagh	1. Hyderabad 2. Rajkot	1. Anantapur 2. Gwalior 3. Nilgiris 4. Ahmednagar 5. Amraoti 6. Dharwar 7. Tumkur 8. Koraput 9. Jaipur 10. Mathura 11. Mirzapur 12. Bilaspur	1. Baroda 2. Trichur 3. Coimbatore

5.18. In Gwalior, 52% of the selected respondents reported that they came to know about contour bunding from other villagers or after seeing these measures in other villages. Nearly all the remaining cultivators came to know of these measures from the soil conservation and/or agricultural officers or through the block agency. In Ahmednagar, the single important source disseminating knowledge about contour bunding was the sight of such works "in the villages"; but quite a large proportion of the respondents in the selected villages also reported that they came to know about contour bunding after they had worked as wage labourers on earth work in another village.

5.19. *Adoption of mechanical measures by the non-convinced.*— Since our sample was drawn from the cultivators whose lands were covered by soil conservation measures, all the respondents had adopted such measures. It is of interest, therefore, to know whether the cultivators were fully convinced of the usefulness of these treatments. Table 5·3 shows the extent to which respondents were not convinced of the soil conservation engineering measures and the reasons why they allowed these to be executed on their lands inspite of the lack of conviction.

TABLE 5.3

Proportion of respondents convinced of the utility of soil conservation engineering measures and main reasons for carrying these out by those not convinced

Sl. No.	District	Percent respondents reporting			Percent reporting reasons for adoption even if not convinced of soil conservation measures (% of col. 4)			
		Convinced of soil conservation measures	Non convinced of soil conservation measures	Cannot say	No right to object as done by Govt.	Extension worker of soil conservation department	100% Govt. subsidy	Other reasons
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1.	Anantapur	55·0	42·5	2·5	58·8	..	..	58·8*
2.	Hyderabad	42·5	57·5	..	43·5	39·1	..	17·3†
3.	Hazaribagh	..	100·0	..	42·5	50·0	50·0	..
4.	Baroda	85·0	15·0	..	..	..	..	100·0‡
5.	Rajkot	100·0	..	..	..	..	..	..
6.	Trichur	87·5	12·5	..	40·0	..	..	60·0
7.	Gwalior	100·0	..	..	..	..	..	..
8.	Coimbatore	77·5	22·5	..	100·0	..	..	..
9.	Nilgiris	100·0	..	..	..	..	..	..
10.	Ahmednagar	72·5	22·5	7·5	100·0	..	..	..
11.	Amraoti	6·5	93·5	..	100·0	..	..	..
12.	Dharwar	47·5	30·0	22·5	100·0	..	..	..
13.	Tumkur	55·0	45·0	..	5·6	..	94·4	..
14.	Koraput	41·0	56·4	2·6	95·5	..	4·5	..
15.	Jaipur	34·2	..	65·8	..	..	..	..
16.	Mathura	100·0	..	..	..	..	..	..
17.	Mirzapur	100·0	..	..	..	..	..	..
18.	Bilaspur	91·9	8·1	..	..	..	..	..

*Others,, did not object' (23·5%), 'not aware that his consent was needed' (17·6%), 'thought ittoibesimilar to traditional bunds'(11·8%), and 'thought bunds will be made according to his wishes' (5·9%).

†Trial1(3%)and 'thought bunds will be made according to his wishes' (4·3%).

‡'Taken up as relief and employment measure'.

§'Stone bunds are not built' (40%) and 'others adopting' (20%).

All the respondents in five districts and the large bulk of them (about 70%) in five other districts were convinced of the usefulness of soil conservation measures. In Nilgiris, observations of the field officers in these villages were, however, different; the people were not satisfied with the bench terraces with inward slopes constructed on their lands. They were in favour of a flat bench or even a bench with an outward slope. Lack of conviction has been voiced by respondents from Hazaribagh, Amraoti, Hyderabad, Koraput, Tumkur and Anantapur. In Dharwar also, about 30% were not convinced and 22·5% were uncertain. The largest proportion of cultivators who had not made up their mind is from Jaipur (65·8%). It may, therefore, be said that in 8 of the 18 selected districts, either a majority of the respondent cultivators or at least 45% of them were not yet convinced of the utility of these measures. In the other 10 districts, the position is satisfactory.

5.20. The reasons for getting soil conservation treatment done on their lands by the non-convinced cultivators are, in order of importance, (1) no right to object as the work was undertaken by the government; (2) work had to be undertaken due to the pressure of the extension worker of the Soil Conservation Department, and (3) work was undertaken because of the 100% subsidy. Some respondents in Anantapur and Hazaribagh gave more than one reason for getting the work done, though they were not convinced of it.

5.21. The first reason has been advanced by all those who expressed lack of conviction in Coimbatore, Ahemdnagar, Amraoti, Dharwar and almost all from Koraput. Large proportions of those not convinced in Anantapur (58·8%), Hyderabad (43·5%), Hazaribagh (42.5%) and Trichur (40%) thought that they had no right to object to the measure undertaken by the government. All those who were not convinced of the utility of soil conservation measures in Bilaspur and 39% in Hyderabad carried out the measures because of the presure of the extension staff of the soil conservation department; this argument along with the fact that the work was done free was stated as the reasons for adoption of measures by 50% of the respondents not convinced in Hazaribagh. Almost all those who were not convinced at Tumkur went in for the measures as these were carried out free by the Government. In Baroda, the work was taken up as a relief operation; and so the people even if they had no faith in the programme allowed it to be carried out on their land. In Trichur, 40% of the respondents were not convinced of the measures because 'stone bunds are not built' and another 40% thought that they had no right to object as the work was executed by the government. About 13% of all those who were not convinced in Hyderabad mentioned that they allowed the work to be carried out as they wanted to try out the programme.

5.22. *Respondents views with regard to cost, efficiency and technique of bunding.*—The respondents in our sample of soil conservation villages were asked to comment on the efficiency of the works executed by the Department, their cost and the technique of bunding done on their lands. The responses are summarised in Table 5.4.

TABLE 5.4

Respondents views regarding efficiency, cost and technique of soil conservation work executed by the department

Sl. No.	District	Per cent of respondents reporting views regarding									
		Efficiency in executing the work			Cost			Technique			
		Good/ efficient	Not satis-factory/ No proper supervision	Cannot say/not known	Satisfac-tory/fair/ reasonable/ economic	High	Cannot say/not known	Good/ Highly useful/ satisfactory	Not satis-factory	Cannot say/Not known	Other reasons
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1.	Anantapur	25·0	15·0	60·0	..	45·0	55·0	50·0	25·0	10·0	5·0*
2.	Hyderabad	65·0	20·0	15·0	..	97·5	2·5	37·5	30·0	32·5	..
3.	Hazaribagh	10·0	2·5	87·5	..	7·5	92·5	..	5.0	90·0	5·0
4.	Baroda	100·0	..	..	..	27·5	72·5	82·5	15·01	2·5	..
5.	Rajkot	100·0	..	..	..	..	100·0	..	..	100·0	..
6.	Trichur	37·5	35·0	27·5	35·0	40·0	25·0	27·5	17·5	25·0	30·0†
7.	Gwalior	37·5	62·5	..	100·0	..	..	40·0	60·0	..	..
8.	Coimbatore	27·5	72·5	..	..	2·5	97·5	27·5	72·5	..	..
9.	Nilgiris	100·0	..	..	55·0	45.0	..	100·0	..	..	..
10.	Ahmednagar	67·5	10·0	22·5	37·5	40·0	22·5	65·0	17·5	10·0	2·5
11.	Amraoti	17·4	52·2	30·4	19·6	39·1	41·3	10·9	58·7	2·2	..
12.	Dharwar	92·5	2·5	5·0	62·5	32·5	5·0	92·5	..	..	2·5
13.	Tumkur	95·0	2·5	2·5	100·0	..	..	95·0	5·0	..	..
14.	Koraput	28·2	..	71·8	25·6	2·6	71·8	35·9	20·5	43·6	..
15.	Mathura	100·0	..	..	100·0	..	..	100·0	..	..	..
16.	Mirzapur	25·0	75·0	..	12·5	87·5	..	90·0	10·0	..	..
17.	Bilaspur	54·0	18·9	27·0	32·4	51·3	16·2	86·5	..	13·5	..

NOTES.—(1) *Height of bund not satisfactory. † 17·5% height of bund not satisfactory and 12.5% bund should be made of stone.
(2) In Jaipur, the beneficiaries carried out the work eli gruclvstt anheye had no specific comments to make on efficiency and cost, whereas most of them are satisfied with the alignments given by the department constructing the bunds.

A large majority of the respondents in Hazaribagh, Koraput and Anantapur, and 30% in Amraoti could not express any view about the efficiency of departmental execution of soil conservation construction work. In Baroda, Rajkot, Nilgiris and Mathura, all the respondents considered the departmental execution of soil conservation measures as having been efficiently done. More than 50% but less than 95% of the respondents in Dharwar, Tumkur, Ahmednagar, Hyderabad and Bilaspur also thought the execution of the programme quite efficient. In Amraoti, Mirzapur, Coimbatore, Gwalior and Trichur, less than 37% of the respondents only thought the execution of the programme efficient. A large proportion of the respondents in these five districts were critical of the efficiency of departmental execution and lack of supervision of soil conservation construction work.

5.23. All the respondents from Gwalior and Mathura and a large proportion from Dharwar and Nilgiris thought the cost of soil conservation work reasonable or economical. The cost of the work was considered high by a large majority of respondents in Hyderabad and Mirzapur. Between 40% and 51% of the respondents in Anantapur, Trichur, Nilgiris, Ahmednagar and Bilaspur also considered the cost high. Almost all the respondents from Rajkot, Hazaribagh and Tumkur and between about 40% and 70% in Amraoti, Anantapur, Koraput and Baroda did not know the cost of the work done on their lands.

5.24. As regards the technique of bunding, all the respondents in Rajkot, 90% in Hazaribagh, 44% in Koraput and 32% in Hyderabad could not make any comments. The technique of bunding was adjudged to be good and satisfactory by all the respondents in the Nilgiris and Mathura, and by a high proportion in Tumkur, Dharwar, Mirzapur, Bilaspur, Baroda and Ahmednagar. It was considered unsatisfactory by 72% of the respondents in Coimbatore, 60% in Gwalior, 59% in Amraoti and between 20% and 30% in Hyderabad, Anantapur and Koraput.

5.25. This view of the respondents about the efficiency in execution of soil conservation mechanical measures, the cost of the works and the technique of bunding reveal that in Coimbatore, Gwalior and Amraoti, people are dissatisfied both with the execution of the measures and the techniques adopted. Respondents in Amraoti and Coimbatore described their discontent in some detail. In Coimbatore, respondents were not satisfied with the quality of work done by the contractors; they felt that too many bunds were constructed and that there were defects in the waste weirs and breaches in the bunds. In Amraoti, respondents complained about breaches of the bunds in the first year itself, water-logging in the fields and fragmentation of their lands. The fact that a significant proportion of the respondents in quite a number of districts is not satisfied with or is critical of the efficiency of execution of soil conservation works, their cost and the technique of bunding, suggests that the soil conservation departments should pay serious attention to those complaints and rectify the defects and remove the grievances if they are found to be genuine. In the event the complaints are not all found to be true, there is still a lesson to be learnt. The very fact of their existence, though without substance, shows that the people are not well informed and educated. Such a situation calls for intensification of efforts to improve public relations and extension education.

5.26. *Difficulties and limitations of cultivators in the control villages.*—The respondent cultivators in the control villages were found to be generally aware of the soil erosion problems on their lands; and most of them had also seen soil conservation treatments undertaken in the neighbouring villages. They mentioned certain limiting factors and difficulties in the way of their undertaking soil conservation construction treatments. Lack of finance, and lack of the technical know-how about contour alignments and the specification of the bunds are the difficulties mentioned as standing in the way of their undertaking soil conservation construction treatments. The respondents in Hazaribagh, Mirzapur, Anantapur and Tumkur expressed the views that they would adopt soil conservation construction measures only if others in their village decided to do so. All the respondents in Rajkot stated that as they did not know the cost of the works and also did not like the departmental design of contour alignment, they were not prepared to undertake them on their lands. In Anantapur, the respondents were unwilling to undertake the work because land was wasted under the bunds. In Trichur, though most of the respondents admitted their lack of finance and technical knowledge, about 20% felt that as they were not sure about their ownership right in the land encroached upon by them, they were not in a position to undertake bunding work on their lands.

5.27. *Facilities needed by respondents in the control villages.*—The respondents in the sample of control villages mentioned certain conditions and facilities that would have to be met before contour bunding and/or bench terracing could be taken up on their lands. The important ones among them were that (1) the Government should undertake the work; (2) the benefits of the measures including likely increase in yield should be explained, if not demonstrated, to them; (3) adequate technical and financial assistance should be extended to them. Table 5·5 presents data showing the importance of the conditions/facilities mentioned by respondents in the control villages, in terms of frequency among districts and proportion of respondents reporting.

TABLE 5.5

Important conditions/facilities reported by respondents for the adoption of soil conservation construction measures in control villages

Per cent of respondents reporting (in class interval)	No. of districts where per cent of respondents report the facility/condition as							
	Should be done by Govt.	Should be convinced	Financial assistance	Should be subsidized	Cost should be known	Technical assistance	Not needed	If others adopt
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
25—50%	1(10)	..	1(8)	1(17)	..	1(17)	1(1)	1(1)
50—75%	2(7,14)	1(11)	2(2,15)	1(7)	1(5)	1(6)	..	..
75% and above	4(4, 9, 12,13)	..	1(16)	1(3)	..	2(16,18)	..	..

NOTE.—The figures outside the brackets indicate the number of districts and those inside the brackets give the serial number, of the district as indicated in the note on page 115.

5.28. *Knowledge of conservation farming or dry farming practices.*—Improved agricultural practices are propagated in all districts but specific dry farming or conservation farming practices are few among them. We have mentioned in Chapter IV the crop rotations and cultural practices recommended in the selected districts. These practices are propagated in a routine way; and no special effort appears to be made to follow them up. This point is illustrated and elaborated in the following paragraph.

5.29. In Maharashtra, some of the Soil Conservation Assistants posted in each soil conservation sub-division are also called Dry Farming Assistants, having the responsibility for propagating the Bombay method of dry farming. The Dry Farming Assistant has the duty to conduct a specified number of demonstrations. He is, however, expected also to help in the execution of the soil conservation bunding work. In most cases, he is reported to find very little time to lay out and conduct the demonstrations. What he usually does is to talk to some farmers about inter-culturing, reduced seed rate and line sowing with 18" spacing. He has, however, nothing to do with the agricultural extension programme of the blocks. In the selected districts of U. P., special meetings are held by the block staff to propagate improved cultural practices on land covered by soil conservation measures. In Rajkot also, it is reported that dry farming measures are demonstrated on cultivators' fields. In Dharwar, cultivators are trained in dry farming methods in the Nargund Research Station. In Jaipur, *Medhbundi* is an important dry farming measure on unbunded areas. In other districts, specific efforts for propagating dry farming or conservation farming methods are not indicated except the fact that these improved cultural practices are to be spread among the cultivators by the usual agricultural extension effort of the block staff. In Amraoti, Trichur and Koraput districts, in particular, there have been no soil conservation or dry farming practices recommended for the bunded or unbunded areas. The traditional cultural practices, some of which are in use, are considered good enough in Amraoti; and in the other two districts, no efforts are made to spread improved or conservation farming practices. In the DVC area of Hazaribagh, fertilizers are given free in the first year, and the cost of fertilizers subsidized to the extent of 50% in the second year; but more often the cultivators do not use fertilizers in the second year. In the State Government area of Hazaribagh, it was reported from one of the two selected villages that the State Government supplied seeds and fertilizers; but people did not accept them and the officials had to put the seeds and fertilizers on the lands against the wishes of the cultivators.

5.30. *Knowledge of dry farming practices.*—The respondent-cultivators in the sample villages of selected districts were also asked as to whether they knew about some of the dry farming and conservation farming practices recommended in their area. Table 5·6 gives data on the knowledge of these practices among the respondent-cultivators in the selected districts.

TABLE 5.6

Knowledge of Soil Conservation farming practices in the covered villages

Soil conservation farming practices	No. of districts where practices recommended	Distribution of districts according to proportion of respondents reporting knowledge			
		0—25%	25—50%	50—75%	75% and above
(1)	(2)	(3)	(4)	(5)	(6)
1. Crop rotation	14(1,2,3,5, 8, 9, 10, 11, 12,14,15, 16,17,18).	..	..	1(10)	3(9,11,16)
2. Contour cultivation	14(1,2,3,4, 5,7,8,10, 12,14,15, 16,17,18).	2(4,17)	..	1(10)	2(1,16)
3. Strip cropping	11(1,3,5,8, 9,10,12,15, 16,17,18).	2(1,10)	1(18)	..	1(16)
4. Use of fertilizers	8(3,7,8,9, 13,16,17, 18).	..	1(7)	1(3)	4(9,16,17,18)
5. Low seed rate	4(7,10,12, 16).	..	3(7,10,16)	..	..
6. Green manuring	7(3,7,8,13, 16,17,18).	..	..	1(17)	2(16,18)
7. Growing grass on bund	8(1,7,9,12, 13,16,17, 18).	..	..	..	5(1,9,16,17, 18)
8. Cover crops	4(8,9,16,17)	..	1(17)	..	1(16)

NOTE.—(1) No practice is recommended in Trichur.

(2) Figures in brackets indicate the Sl. Nos. of the districts given below:—

Anantapur 1, Hyderabad 2, Hazaribagh 3, Baroda 4, Rajkot 5, Trichur 6, Gwalior 7, Coimbatore 8, Nilgiris 9, Ahmednagar 10, Amraoti 11, Dharwar 12, Tumkur 13, Koraput 14, Jaipur 15, Mathura 16, Mirzapur 17, Bilaspur 18.

5.31. The information in Table 5·6 shows that the knowledge of the recommended soil conservation and dry farming practices was reported in a varying measure by respondents from a total of 10 out of 18 districts. In Rajkot, Coimbatore, Dharwar, Tumkur, Koraput and Jaipur, though some soil conservation practices are recommended for adoption, none of the respondents reported knowledge about them. Among the eight practices listed in the table, use of fertilizers and growing of grass on bund are more widely known. In Nilgiris, Mathura, Mirzapur, and Bilaspur, more than 75% of the cultivators know about these practices. In Anantapur, knowledge of the practice of growing grass on the bund is equally extensive. Knowledge about contour cultivation, strip cropping and recommended crop rotation is very poor and confined to 2 to 4 districts though these have been recommended in 11 to 14 districts.

5.32. *Important agencies responsible for the spread of knowledge of practices.*—The replies of the respondents reveal that those who came to know of soil conservation or dry farming practices either already had knowledge about them or got it from other villagers or received it from soil conservation and block staff. Table 5·7 shows the importance of these three agencies in spreading the knowledge of soil conservation or dry farming practices.

TABLE 5.7

Important agency responsible for knowledge of soil conservation farming practices in covered villages

Soil conservation farming practices	No. of districts according to proportion of respondents reporting the agency indicated below				
	Soil Conservation and Block officers		Deptt. staff	Traditionally known	Through other villagers
	35-50%	50-80%	80% & above	95% and above	45-60%
(1)	(2)	(3)	(4)	(5)	(6)
1. Crop rotation . .	..	1(9)	..	3(10,11,16)	..
2. Contour cultivation* .	..	..	1(16)	2(1,10)	..
3. Strip cropping . .	..	1(10)	2(16,18)	1(1)	..
4. Use of fertilizer . .	..	1(17)	4(3,7,16,18)	..	1(9)
5. Low seed rate . .	2(7,10)	..	1(16)	..	..
6. Green manuring . .	1(17)	..	2(16,18)	..	..
7. Grass on bund . .	..	..	4(9,16,17,18)	..	1(1)
8. Cover crops . .	..	..	1(16)	1(17)	..

NOTE.—(1) *Seen in the villages reported 42·9% in Baroda and 100% in Mirzapur.
(2) For serial no. of districts given within brackets see note on page 115.

Those who had knowledge of the practices of strip cropping, use of fertilizers, growing of grass on bunds and green manuring, had it mainly from the staff of the soil conservation department, as has been reported by the cultivators from Hazaribagh, Gwalior, Nilgiris, Mathura, Mirzapur and Bilaspur. The practices traditionally known which are also recommended by the soil conservation department, are crop rotation and contour cultivation. The data in Table 5·7 tend to show the inadequacy of the efforts put in by the soil conservation or block staff in spreading knowledge of practices like strip cropping, contour-cultivation, crop rotation, low seed rate, etc.

5.33. *Adoption of soil conservation or dry farming practices.*—Where the gap in knowledge of the recommended practices is so wide, it is but natural that the extent of adoption of soil conservation and dry farming practices would be lower than that of knowledge. The gap as between the practices recommended on the one hand,

those about which respondent-cultivators reported knowledge and the extent of their adoption of these is particularly striking in the case of strip cropping. The extent of adoption among farmers is invariably lower than their knowledge. Adoption has been reported by varying sections of the respondents from a fewer number of districts. In most of such districts, the adoption of soil conservation and dry farming practices has been reported by less than 25% of the respondents. In three districts only, adoption of one or more soil conservation or dry farming practices has been reported by more than 75% of the respondents. These practices are crop rotation and contour cultivation in Mathura, contour cultivation in Anantapur, and use of fertilizers in Nilgiris. The position is brought out in the Table given below:

TABLE 5.8

Percent of respondents reporting adoption and non-adoption of soil conservation farming practices in the covered villages

Soil Conservation farming practices	No. of districts reporting no adoption	No. of districts according to proportion o respondents reporting adoption			
		0—25%	25—50%	50—75%	75% and above
(1)	(2)	(3)	(4)	(5)	(6)
1. Croprotation . .	..	1(9)	2(10,11)	..	1(16)
2. Contour cultivation . .	1(17)	1(4)	..	1(10)	2(1,16)
3. Strip cropping . .	4(1,10,17,18)	..	..	..	..
4. Use of fertilizer . .	..	2(7,16)	2(17,18)	1(3)	1(9)
5. Low seed rate . . .	1(16)	1(10)	1(7)	..	..
6. Green manuring . .	..	2(16,18)	1(17)	..	..
7. Grass on bund . .	..	2(16,17)	..	3(1,9,18)	
8. Cover crops . . .	1(16)	1(17)	..	..	

NOTE.—For serial no. of districts given within brackets see note on page 115.

5.34. *Knowledge and adoption of soil conservation farming practices.*—One aspect of the effectiveness of the soil conservation extension programme may be assessed in terms of the proportion of cultivators adopting practices at different times after having had the knowledge of them. Some of the soil conservation or dry farming practices are propagated after the soil conservation treatment or bunds have been constructed. Some improved cultural practices known and adopted since long are considered good enough as conservation farming practices. The extension of these practices presents no problem at all. Some other practices may have been known earlier but are adopted somewhat later. These aspects of the soil conservation extension programme are brought out in Table 5·9, with emphasis on the time-lag in adoption.

TABLE 5 9

Knowledge and adoption of soil conservation farming practices in covered villages

Soil conservation farming practices	No. of districts according to proportion of respondents reporting knowledge and adoption								
	Knowledge and adoption in the year when soil conservation work done			Traditionally known and adopted		Knowledge before Soil conservation work but adoption later	Knowledge and adoption after soil conservation work is done		
	0–25%	40–70%	90 and above	0–25%	60% & above	Below 25 %	0–25%	25–50%	85% & above
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Crop rotation	..	..	1(9)	..	3(10,11, 16)	..	..	..	..
2. Contour cultivation	..	1(16)	..	..	3(1,4,10)	..	1(16)	..	..
3. Use of fertilizers	4(3,7,9, 17)	2(16,18)	..	1(18)	2(9,17)	3(3,9,17)	1(9)	3(3,16,18)	1(7)
4. Low seed rate	..	..	..	..	1(7)	..	..	1(7)	1(10)
5. Green manuring	1(17)	1(18)	..	..	1(17)	..	..	1(18)	1(16)
6. Grass on bund	1(1)	2(9,16)	1(18)	2(9,17)	..	..	1(18)	2(9,16)	1(16)
7. Cover crops	..	..	..	..	1(17)	..	..	..	..

NOTE.—For serial numbers of districts given within brackets see note on page 115.

5.35. The information in Table 5·9 brings out a number of points. In the first place, an important practice like contour cultivation was not adopted by a large proportion of cultivators. Those who have done so had been knowing and adopting this practice for long. Crop rotations have been recommended in a number of districts. But knowledge of these is reported only in a few; and those who had been adopting recommended crop rotations had been knowing them and adopting them for long. It also appears that quite a few practices came to be known and adopted in the same year *i.e.*, the year when the soil conservation treatments were adopted (bunds constructed). Use of fertilizers is the only recommended practice, knowledge of which had been obtained by the cultivators earlier but which was followed somewhat later after the treatments were carried out. In Mathura, green manuring and the growing of grass on bund were known practices, but were adopted after the soil conservation construction work. In Ahmednagar, knowledge and adoption of low seed rate has been reported after the soil conservation treatments were carried out.

Other recommended practices in the selected districts

5.36. The analysis attempted in the last four tables related to the eight important soil conservation or dry farming practices mentioned in Chapter IV. Some other cultural practices were also recommended in the selected districts. Of particular interest among them are ploughing of burrow pits in Anantapur, and ploughing of light and shallow lands not every year but once in two or three years in Rajkot, Ahmednagar, Dharwar and Tumkur. In Gwalior, land is recommended to be ploughed in the summer instead of after the first rains. "Mulching" has been recommended in Coimbatore and Nilgiris, dibbler sowing in Amraoti and cashew-nut plantation in Koraput. Though these recommendations are specific to the districts mentioned above, in the course of the enquiry it was observed that the relevant recommendation were neither known nor followed in Rajkot, Dharwar, Tumkur, Gwalior, Koraput, Amraoti, Nilgiris and Coimbatore.

5.37. It is only in two districts that these other practices were known and to a large extent followed. In Anantapur, knowledge of ploughing of burrow pits was reported by all respondents; and the practice was followed or observed by 50% of them. In Ahmednagar, knowledge of the practice of ploughing the land once in two years is reported by all the respondents and its adoption by 95% of them. It is understood that the cultivators had been ploughing their land once in two or three years even before the soil conservation programme was undertaken in their villages.

5.38. *Time-lag in the adoption of conservation farming practices.*—As regards the engineering and mechanical treatments, all the cultivators in a particular project area have to fall in line and carry them out. But the adoption of conservation farming practices depends on the awareness, willingness and preparedness of the cultivators. Hence the adoption of conservation farming practices or dry farming practices other than the traditional ones depends to a large extent on the extension work done in the area and the effectiveness of the demonstration of these measures carried out in or near the

village. Some cultivators may adopt these practices immediately after soil conservation treatment have been completed on their land; others may take two or three or more years. An understanding of the period of this lag is of some importance. Table 5·10 presents data on the time-lag in the adoption of important conservation farming practices in the selected districts.

TABLE 5·10

Timelag between the adoption of soil conservation construction measures and soil conservation farming practices

Soil Conservation practice/ districts	Percent of respondents reporting adoption			Of col. 4 percent reporting adoption after			
	Before adoption of soil conservation treatment	Same year as soil conservation treatment	After soil conservation treatment	One year	Two years	Three years	Four years
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I. *Use of fertilizer :*							
1. Hazaribagh	..	25·0	75·0	100·0	..	..	..
2. Gwalior	..	12·5	87·5	14·3	42·9	28·6	14·3
3. Nilgiris	62·5	20·0	17·5	28·6	57·1	14·3	..
4. Mathura	..	57·1	42·9	100·0	..	..	..
5. Mirzapur	61·1	16·7	22·2	100·0	..	..	..
6. Bilaspur	11·1	44·4	44·4	100·0	..	..	..
II. *Low Seed rate :*							
1. Gwalior	70·0	..	30·0	..	66·7	..	33·3†
2. Ahmednagar	..	..	100·0	..	..	..	100·0
III. *Green manuring :*							
1. Mathura	..	..	100·0	100·0	..	..	..
2. Mirzapur	93·7	6·7	..	..	..	..	..
3. Bilaspur	..	66·7	33·3	100·0	..	..	..
IV. *Grass on bund*							
1. Anantapur	..	17·4	82·6	94·7	5·3	..	..
2. Nilgiris	4·5	50·0	45·5	80·0	20·0	..	..
3. Mathura	..	50·0	50·0	100·0	..	..	..
4. Mirzapur	11·9	..	88·9	100·0	..	..	..
5. Bilaspur	..	95·5	4·5	100·0	..	..	..

NOTE : (1) *5 years. †8 years.

(2) Crop rotation was adopted wholly before soil conservation in Ahmednagar, Amraoti and Mathura while in the same year in Nilgiris.

(3) Contour cultivation was adopted wholly before s.c. in Anantapur, Baroda and Ahmednagar while in Mathura 71·1% in s.c. year and 28·9% after one year.

5.39. The data in Table 5·10 relate only to cultivators who reported adoption of the relevant recommended meaures. By and large, the cultivators adopted the measures after the soil conservation treatments were carried out on their lands. The most common period of lag is one year, though in one or two districts it has extended even upto four years. The figures also show that in respect of a few practices in one or two districts, the adoption by the majority was in the same year as the treatments or earlier. This category includes use of fertilizers in Nilgiris, Mathura and Mirzapur, low seed rate in Gwalior, green manuring in Bilaspur and Mirzapur, and turfing of bunds in Bilaspur and Nilgiris.

5.40. *Reasons for non-adoption of soil conservation farming or dry farming practices.*—More than one reason have been given for the non-adoption of different conservation farming practices. Table 5·11 presents data to show the order of importance of the main reasons advanced for non-adoption of specified practices.

TABLE 5:11

Important reasons for non-adoption of soil conservation farming practices in the villages covered by soil conservation programme

Soil conservation farming practices	No. of districts according to proportion of respondents reporting as reason for non-adoption					
	Not convinced in respect of yield and income	Not interested/not needed	No knowledge	Lack of finance	Lack of irrigation	Fear of adverse effect on plant growth
	50-80%	Above 50%	Above 50%	40-50%	60-70%	80% and above
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Crop rotation* .	1(9)	..	..	1(11)	..	..
2. Contour cultivation†	..	1(16)	2(10,17)	..	..	..
3. Strip Cropping .	1(10)	2(1,18)	..	..	..	1(16)
4. Use of fertilizer‡ .	1(18)	..	..	1(17)	1(16)	..
5. Low seed rate .	..	..	2(7,10)	..	..	1(16)
6. Green manuring .	..	1(18)	..	..	2(16,17)	..
7. Grass on bund** .	1(1)	1(16)	..	..	..	1(9)
8. Cover crops . .	..	1(17)	..	..	..	1(16)

NOTE : (1) *Need for fodder 35%Ahmednagar.†N.A. 100% Baroda, 50% lack of time in Anantapur.

‡N.A. 100% Hazaribagh, 33% soil unsuitable in Gwalior.

**Lack of time 50-60% in Mirzapur and Bilaspur.

(2) For sl. no. of districts, *see* note on pp. 115.

Significant among the important reasons for non-adoption of soil conservation farming practices are the following:—

(1) the respondents in the villages were not convinced of the favourable effect of the measures on yield and income;

(2) They were afraid that the measures would adversely affect the growth of the plants;

(3) they were not interested in, or they did not feel the need for the measures; and

(4) they did not know about these.

All these reasons indicate need for a more intensive extension programme for the propagation of soil conservation farming practices. It may be of particular interest to note that the cultivators in Mathura were afraid that the adoption of strip cropping, low seed rate and cover crops would adversely affect the growth of plants and the yield of the crop. In Ahmednagar, the crop rotations recommended have not been adopted by 35% of the respondents because they were in need of more fodder which was not adequately provided for in the rotation. Lack of finance appears to be not a significant reason for the non-adoption of soil conservation farming practices.

5.41. *Conditions or facilities required for adoption of soil conservation practices.*—On the other side of the 'reasons for non-adoption' are the conditions to be satisfied or the facilities required for adoption. Obviously, those who are not interested in adopting soil conservation practices and fear that these would obstruct the growth of the plants mentioned no facilities or conditions for adoption. Other respondents specified some facilities, etc. A summary picture of the views of the respondents is presented in Table 5·12.

TABLE 5·12

Important conditions or facilities needed for the adoption of soil conservation farming practices in the covered villages

Soil Conservation farming practices	No. of districts according to proportion of respondents reporting the following facilities as needed							
	If convinced in respect of superiority and yield		Adequate/cheap and local supply of seeds, fertilizers etc.		Free supply of seeds, fertilizers etc.	Substitute crop of fodder		Irrigation facilities
	50-60 %	90-100 %	25-50 %	100%	100%	36%	75-90 %	100%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Crop rotation .	..	1(9)	1(11)	..	..	1(10)	..	..
2. Contour cultivation.	..	1(10)	..	..	..	..	..	..
3. Strip cropping	..	1(10)	..	..	..	..	..	..
4. Use of fertiliser	..	..	1(17)	..	1(18)	..	1(7)	1(16)
5. Low seed rate .	1(10)	1(7)	..	..	..	..	..	..
6. Green manuring	..	..	..	1(18)	..	..	1(17)	1(16)
7. Grass on bund*	..	1(9)	2(17,18)	..	..	..	..	..
8. Cover crops .	..	..	..	..	..	..	..	1(17)

NOTE : (1) *N.A. Anantapur 100%.

(2) For sl. no. of districts. *see* note on pp. 115.

The data in Table 5·12 reveals that the non-adopting cultivators are very largely those who have not been convinced yet of the favourable effect of the measures on yield and income. These farmers do not want any facility; all they need is extension education. The facilities needed by the other farmers are free or cheap supply of seeds and fertilizers in adequate quantity and provision of irrigation facilities. These are facilities that should not be difficult to provide at this stage of development of agricultural extension work in India.

5.42. The nature of facilities needed or conditions to be met before the adoption of soil conservation practices, as reported by the farmers, tell the same story that has come out in a number of places in this chapter. It is that proper extension efforts supported by supplies of seeds, fertilizers etc., would go a long way in helping the cultivators to adopt recommended soil conservation farming practices. The present arrangements and programmes seem to suffer from deficiencies in a number of directions. There is no coordination of effort and activity between the soil conservation and the block staff in most States. The emphasis has been almost solely on the construction side, on bunding, terracing and other treatments. And even in respect of these, not enough of demonstration and extension educational work have been carried out. As for soil conservation or dry farming or follow-up practices, these have yet to be fully integrated into extension programme.

CHAPTER VI

IMPACT OF SOIL CONSERVATION TREATMENTS AND MEASURES

Experimental data

6.1. Experiments have been conducted in different research stations in the country to estimate the impact of soil conservation treatments and measures on the productivity of land, the conservation of moisture, and the control of soil erosion. Notable among these are the experiments conducted at Sholapur in Maharashtra, Deochanda by the DVC and Rehmankhera in U.P.

6.2. The results obtained at the Sholapur Research Station indicate that contour bunding alone raises the yield of rabi jowar by 35%. Experiments conducted at Hagari in erstwhile Madras State show that the increase in the yield of jowar as a result of contour bunding is to the extent of 17% in grain and 16% in straw.* Studies conducted at the pilot soil conservation project at Halwapur in Lucknow district in 1959-60 and 1960-61 indicate that the increase in the yield of wheat-barley-gram mixture on bunded and levelled lands over unbunded and unlevelled lands was between 86 and 139 per cent. At the same research station, it was observed that the percentage of moisture in the soil in different fortnights after sowing on bunded and levelled land was higher than on fields which were not bunded or levelled†. At the Deochanda Research Station of the DVC, it was established that sowing of ridge crops like maize, sweet potato, peanut, etc. on slightly graded contours gives higher yield with less erosion than the sowing of the same crops on dead contours. A study of different types of terraces has shown that broad-based graded channel terraces are the most suitable ones for upland cropping in the Hazaribagh area. An enquiry into the economic benefits of contour bunding was conducted in North Mysore in the year 1955-56 by the then Bombay State. The enquiry revealed that the increase in yield from land after bunding varied from 25·2% in the case of rabi jowar to 8·5% in the case of wheat. The Department of Agriculture of the erstwhile Bombay State also conducted some crop-cutting experiments between the years 1946-47 and 1955-56. The results of the experiments showed that the increase in the productivity of land due to bunding was more than 25%.

6.3. Crop-cutting experiments were conducted by the District Statistical Officer, Coimbatore, to estimate the increase in the yield of crops on contour-bunded fields. It was observed that the increase in the yield of bajra (Cumbu) on contour-bunded fields amounted to 11% in grain and 26% in straw; and for jowar (Cholam), the corresponding increase was 16 and 32 percent, respectively. The experiments conducted at Dhakauni Usar Reclamation Centre, U.P., showed that the average yield of paddy and wheat on conservation treated land could be increased by 223 and 193 per cent, respectively, over that on control unleached plots.

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*c.f. Kanitkar and others, "Dry Farming in India" pp. 357 and 360.

†"Measurement of Increase in Productivity by adopting soil conservation practice" by A. D. Khan.

6.4. Experiments have also been conducted to assess the advantages of dry farming methods, over local methods. At the Sholapur Agricultural Research Station it was estimated that dry farming methods increased, on an average, the yield of jowar grain by 200% and that of fodder by 149%. There were similar results obtained at the Agricultural Research Station at Jeur in Sholapur District and at Chas in Ahmednagar district.* It was found in Rehmankhera in U. P. that a strip of 40 feet of row crop alternated by a strip of 20 feet of close-growing crop, resulted in the minimum of soil loss and the highest crop output. It was also found that if EPC maize was grown alone there was the maximum soil loss—8·67%. But strip cropping with ERC Anjna grass on 8 feet strips in between 72 feet strips of maize reduced the soil loss to 1·02% which is within the safe limit and, at the same time, did not reduce the yield of grain appreciably. The effect of different crop rotations on soil-loss and run-off was also studied; and it was found that soil loss and run-off were minimum under the Sanai-barley rotation, the soil loss being 3·16 tons per acre and run-off 28·41%. The soil loss was maximum at 6·47 tons per acre when jowar and arhar were grown; and the run-off was maximum at 44.20% when a til-gram rotation was followed.**

Impact of the soil conservation programme

6.5. The impact of soil conservation treatments and measures has been studied by us broadly under the following topics, each having a time dimension:

(i) Impact on employment both at the time of construction of bunds, etc. and in subsequent years on account of repairs and maintenance of the works;

(ii) Impact on land-use and cropping pattern;

(iii) Changes in irrigation and cultural practices as a result of follow-up measures ;

(iv) Impact on the fertility and productivity of land as measured by the yield of crops; and

(v) Impact on the value of land.

This list of topics is not exhaustive, and can certainly be extended to include the effect on net returns derived by the farmers. But in an evaluation study of this type, it has not been possible to go into all aspects of the impact. Whatever data could be collected and whatever analysis attempted in respect of the above five topics are presented in this chapter.

Impact on Employment

6.6. Soil conservation involves at the initial stage labour intensive engineering and construction works which are also of the productive type. That is why it is one of the types of schemes approved

*c.f. Kanitkar and others : "Dry farming in India" pp. 451-453.

**Annual Report of the Research work done at the State Soil Conservation Research, Demonstration and Training Centre, Rehmankhera, for the year 1960-61. pp. 4 and 45-46.

for the programme of rural works for the utilization of manpower. Even as an extension programme during the Second Five-Year Plan, soil conservation works were executed in most of the selected districts during the slack agricultural seasons to provide employment to the unemployed rural labour force. However, in some of the selected districts like Ahmednagar, Anantapur, Nilgiris and Bilaspur, soil conservation works were carried out during the peak seasons also. The peak season works in Gwalior were confined to bunding on cropped land by individual beneficiaries. In general, the works are usually executed during the months of January to March and June to September in most of the selected districts.

6.7. In Coimbatore, the soil conservation programme executed upto the end of the Second Five-Year Plan has been estimated to have generated employment to the extent of 7,85,000 man-days. This has considerably helped in providing employment to the idle man-power in the rural areas. Similarly, in the Nilgiris district where the programe has been in operation for about a decade now, the employment generated has been estimated at 20,00,000 man-days. The soil conservation works which were taken up in 1949 and subsequently in 1952-53 to 1955-56 as relief measures and as an intensive programme from 1958 onwards in Ahmednagar district have created employment opportunities during the major part of each year. This has enabled some of the beneficiaries in that district to invest their earnings in productive assets like land and bullocks and also to clear their old debts.

6.8. In some areas of the districts of Rajkot, Gwalior, Dharwar and Ahmednagar, where adequate labour force was not available for doing earth-work, labour-saving devices were used. In Gwalior and Dharwar bull-dozers were utilized for laying contour bunds. Keni or bund-farming implements which are drawn by bullocks and can do the work of almost five labourers are used in Ahmednagar and have become a standard equipment in bunding operations.

6.9. The wage component forms a significant proportion of the total expenditure on soil conservation works. In Anantapur and Jaipur, the wage component of the total expenditure incurred on soil conservation works in four of the selected villages works out to about 64% and 66% respectively. It comes to about 53% in the Pavagada Block of Tumkur district where work on soil conservation is under execution as a part of the works programme for the utilization of rural manpower. In Gobi block, Coimbatore district, the proportion of wage bill to the total expenditure on soil conservation is estimated to be 49%.

Employment on soil conservation work in selected villages

6.10. Attempts were made to collect detailed data on employment provided by the soil conservation work in selected villages upto 1960-61. Table 6.1 gives an analysis of the employment generated in the selected villages till the end of 1960-61.

TABLE 6·1

Employment on soil conservation work in the selected villages upto 1960-61

Sl. No.	District	No. of years work continued	Average number of months of employment (work) per year	Average employment on soil conservation work (man-days)		
				Total per s.c. acre	Per year	
					Per s.c. acre	Per village
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Anantapur	4	7·25	20·60	5·15	8750
2.	Hyderabad	5	3·80	19·97	3·99	1998
3.	Hazaribagh†	2	4·50	26·41	13·20	1400
4.	Baroda*	2	9·00	30·38	15·19	8244
5.	Rajkot	7	7·00	8·34	1·19	241
6.	Coimbatore	7	6·14	17·20	2·46	5421
7.	Nilgiris	8	11·00	272·55	34·07	15563
8.	Ahmednagar	7	7·43	17·61	2·52	3002
9.	Amraoti	3	5·00	13·74	4·58	1847
10.	Dharwar	6	7·33	25·75	4·29	2337
11.	Tumkur	2	7·00	33·22	16·61	2924
12.	Jaipur	2	3·00	3·11	1·56	549
13.	Mathura	3	2·33	21·02	7·01	1958
14.	Mirzapur	2	3·50	5·64	2·82	186
15.	Bilaspur	2	7·50	224·66	112·33	2447
16.	Gwalior	4	1·75	N.A.	N.A.	N.A
17.	Trichur	2	8·00	N.A.	N.A.	N.A
18.	Koraput	6	3·50	N.A.	N.A.	N.A.

NOTE : (1) *Data relate to one village only.
(2) †Data relate to two villlages only.

The execution of the soil conservation programme in the selected villages in some of the districts like Nilgiris, Rajkot, Coimbatore, Ahmednagar, Dharwar and Hyderabad extended over five years or more. The average number of months per year, over which the soil conservation work was continued and employment provided, shows a considerable variation among the sample areas of the different districts. At one extreme are the selected villages in the Nilgiris where the execution of the works on an average covered nearly 11 months per year; and at the other extreme is Gwalior where the works on an average extended over only 1·75 months per year. The districts where employment has been provided by these works for a period of more than 6 months number 10 (of the 18 districts). It is

in these districts, particularly Nilgiris, Baroda, Trichur, Bilaspur, Ahmednagar, Dharwar, Anantapur, Rajkot and Coimbatore, that the programme may be said to have provided employment at the constructional stage over a period larger than or at least equal to the length of the slack seasons. In the selected areas of most of the other districts, the employment provided has usually been spread over about 3 months of the slack season.

6.11. The average employment generated per acre of treated land in the selected villages gives an estimate of the employment potential of such works, which naturally depends on the intensity of the work and the type of problems and treatments needed. That is why the figures of employment per acre show a variation from 3·11 mandays to 272·5 mandays per acre. It appears from a scrutiny of the figures that employment is correlated with the expenditure and the intensity of the works per acre. That is why the sample villages of Nilgiris and Bilaspur districts show as high an employment content in soil conservation works as 272·6 and 224·7 mandays per acre respectively. Another group of areas where the employment content per acre varies from 25 to about 35 mandays are in districts like Tumkur, Baroda, Hazaribagh and Dharwar. In districts like Anantapur, Hyderabad, Coimbatore, Ahmednagar and Mathura, the figures vary between 17 and 22 mandays per acre; while in the remaining areas the employment content is below 15 mandays. It may be worthwhile to note here that the employment content is very low 3 to 8 mandays per acre in Rajkot, Mirzapur and Jaipur. Rajkot is an area which is badly affected by soil erosion and requires extensive bunding. The soil conservation works have been executed there not only with manual labour, but also with the help of labour-saving machinery like bull-dozers, which explains the relatively low employment content of 3 to 8 mandays per acre. In Mirzapur, however, the bulk of the work consist of strengthening and raising the existing bunds. In Jaipur the employment content is very low because the quantum of work required is small and the land does not have much slope.

6.12. The employment generated per acre per year shows a slightly different pattern of variation among the districts. Bilaspur records the highest figure (112 mandays) followed by Nilgiris (34), Tumkur (17), Baroda (15), Hazaribagh (13), etc. At the lower end of the scale are Mirzapur (2·8), Ahmednagar (2·5), Jaipur (1·6). The employment content per acre of the works has been affected in the above figures by the period over which these have been executed.

6.13. It also appears from Table 6·1 that the employment provided by soil conservation treatments per village per year was the highest in the sample villages of Nilgiris (15,563 mandays), followed by Anantapur (8,750), Baroda (8,244), Coimbatore (5,421), Ahmednagar (3,002), Tumkur (2,924), Bilaspur (2,444) and Dharwar (2,337). Mirzapur recorded the smallest volume of total employment per year per village (186); while Rajkot recorded a slightly higher figure (241). An interesting thing to notice is the relatively lower figure (2,444) of employment per village per year recorded in the villages of Bilaspur, in spite of a very high employment content per acre per year. The explanation is simple and holds true for all areas. The extent

of employment provided per village is dependent not only on the per-acre employment content of the works, but also on the level of acreage covered per village. In areas like Bilaspur while the former is high, the latter has been very low. This has been analysed in Table 4.12 in Chapter IV.

6.14. *Employment benefits to villagers and outsiders.*—An attempt has been made in Table 6·2 to go deeper into the employment data shown in Table 6·1 and analyse the extent to which the average employment provided per day has benefitted the labour force in the sample villages.

TABLE 6.2

Average employment on soil conservation work derived by the residents of sample villages and other villages

Sl. No.	District	Mandays of employment per day of work per village covered by soil conservation works				
		Total (Mandays)	Employment obtained by residents of sample villages		% of total employment going to residents of other villages	Total employment as % to the village labour force*
			% to total employment	% to labour force in the villages		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Anantapur	40·23	44·9	4·1	55·1	9·2
2.	Hyderabad	17·53	53·3	4·8	46·7	9·0
3.	Hazaribagh	10·37	71·4	1·7	28·6	2·3
4.	Baroda	68·73	75·0	6·8	25·0	9·1
5.	Rajkot	1·15	76·4	3·7	23·6	4·8
6.	Coimbatore	29·42	71·8	2·2	28·2	3·1
7.	Nilgiris	47·16	4·2	0·1	95·8	2·1
8.	Ahmednagar	13·47	72·7	7·5	27·3	10·3
9.	Amraoti	12·31	68·9	2·4	31·1	3·5
10.	Dharwar	10·62	50·1	1·5	49·9	2·9
11.	Tumkur	13·92	39·6	2·7	60·4	6·8
12.	Jaipur	6·10	100·0	N.A.	..	N.A.
13.	Mathura	28·00	71·4	19·9	28·6	27·8
14.	Mirzapur	1·75	28·6	0·4	71·4	1·3
15.	Bilaspur	10·86	16·7	N.A.	83·3	

*This is a computed figure to show the extent to which the labour force within the village would have been employed per day if the total employment on soil conservation works had been availed of by them.

The extent of employment provided per day of work per sample village covered by soil conservation works varies from 1·15 man-days in Rajkot to 68·75 man-days in Baroda. These figures may be said to correspond approximately to the number of persons who worked per day in these areas. There are only three districts, Baroda, Nilgiris and Anantapur, where this figure has exceeded 40, two districts—Mathura and Coimbatore with a figure between 20 and 30 and seven with a figure between 10 and 20. In Rajkot and Mirzapur, the employment provided per day has been nominal *i.e.* between 1 and 2 persons.

6.15. Of the total employment thus provided, a portion has been availed of by the residents of the concerned villages, the rest going to people of other villages. From Table 6·2, it appears that more than 50% of the employment provided per day of work were availed of by the labour force within the village in Dharwar, Hyderabad, Hazaribagh, Baroda, Rajkot, Coimbatore, Ahmednagar, Amraoti, Mathura and Jaipur. In the other districts, the larger proportion of the employment was availed of by the labourers outside the village. In the Nilgiris, 96% of the employment per day of soil conservation work in the villages were availed of by the labourers outside the village, and in Tumkur and Mirzapur between 60 and 71 per cent. In these districts, the employment benefits of the works have not been fully taken by the local people (in the strict sense). People of the neighbouring villages as well as outsiders have been employed to a large extent on the execution of the works.

6.16. In Baroda and Ahmednagar, about 7% and in Mathura 20% of the labour force in the village derived employment on soil conservation work when it was in progress. Except in these districts, the impact of the works on the employment of the labour force in the village has been much below 5%. If, however, all the employment generated had been absorbed by the labour force in the concerned villages, the impact would have been considerable. The proportion that could have been employed would have been between 1 and 5 percent in seven districts and 9 to 10 percent in four districts out of 13 districts for which information is available. It should be noted in this connection that one of the major reasons for labourers from outside being employed on soil conservation works on a large-scale in areas like Nilgiris, Tumkur, Bilaspur, Anantapur and Hyderabad is the system of appointing contractors for executing the works. It is reported from Bilaspur and Nilgiris that local labour is also unwilling to work.

6.17. *Respondent-cultivators and employment on soil conservation work.*—The analysis of the employment impact of soil conservation measures will now be pursued from the village to the household level, in order to understand the benefits that were derived by the cultivators' families on whose lands the treatments were carried out. The nature and extent of employment obtained by respondent-cultivators on soil conservation work till the end of 1960-61, are analysed in Table 6·3.

TABLE 6:3

Employment of respondent-cultivators households on soil conservation works

Sl. No.	District	% of respondents reporting employment on soil conservation work	Employment obtained by households till 1960-61 (Man-days)				
			Total for all households		Employment per household as		% wage labour to total
			Over the whole period	Average per year	Wage labour	Self-employed	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Hazaribagh	50·0	612	102	13·5	17·1	44·1
2.	Baroda	72·5	9,190	1,532	310·8	6·1	98·1
3.	Trichur	30·0	4,235	2,117	315·8	37·1	80·1
4.	Ahmednagar	50·0	1,968*	656	96·4	2·0	98·3
5.	Amraoti	2·2	150	50	150·0	..	100·0
6.	Jaipur	100·0	2,882	1,441	24·0	51·9	31·6
7.	Mathura	100·0	8,801	2,934	111·0	109·0	50·4
8.	Mirzapur	100·0	905	452	16·5	6·1	72·9
9.	Bilaspur	100·0	17,327	8,663	440·6	27·7	94·1

*Employment for the last three years.

In 9 districts not included in the table 6.3 the respondent-cultivators could not indicate the quantum of employment they obtained on soil conservation work. In eight districts *viz.* in Anantapur, Hyderabad, Rajkot, Koraput, Nilgiris, Coimbatore, Dharwar and Tumkur the work was mostly executed by the department either by employing hired labourers or through contractors and in Gwalior data were not available at the village level nor could it be collected from the respondents as they could not remember correctly the information desired.

6.18. All the respondents and the working members of their households in four districts (Jaipur, Mathura, Mirzapur and Bilaspur) worked either as hired labourers or on their own account on soil conservation work. In the remaining five districts between 2 and 73% of the respondents got employment on soil conservation work. The average employment per year in the nine districts ranged from 50 mandays in Amraoti to 8663 mandays in Bilaspur. Wage labour accounted for a sizeable proportion of the total employment. All the respondent-cultivators in Amraoti worked as wage labourers and nearly all in Ahmednagar and Baroda. In these districts the beneficiaries along with outside labour worked together on the bunding project without confining their work to their own holding. In Trichur also for 80% of the days the respondents were employed as wage labour. In Hazaribagh about 56% of the days, the respondents worked as self-employed labour. It is only in Jaipur that the proportion of wage labour is very low, 32%. Here, most of the cultivator-households worked on bunding on their own holdings.

6.19. *Recurring employment on major repairs and maintenance.* —The employment impact of soil conservation measures is not only confined to the initial work on construction of bunds, terraces, etc., but also has a recurring secondary component. One part of it arises from the work-opportunities generated by major repair and maintenance work on the bunds, terraces, etc. Another part may be called the indirect effect on the requirement of labour inputs as a result of the adoption of conservation farming. We shall be analysing here only the first component, data on which are given in Table 6.4.

TABLE 6:4

Employment on major repairs and maintenance of soil conservation work

District	Acreage and employment involved in repairs and maintenance								
	One year after treatment				Two years after treatment				Employment per acre on treated land in two years
	Relevant area		Man-days of employment		Relevant acrea	% of soil conservation area	Man-days of employment		
	Acres	% of total area treated	Total	Avr. per acre of repaired area			Total	Avr. per acre of repaired area	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Anantapur	15·0	3·2	37	2·5	..	..	..	..	0·08
2. Hyderabad	25·0	7·1	41	1·6	22·25	6·3	168	7·6	0·5924
3. Trichur .	73·26	71·5	235	3·2	..	..	..	..	2·288
4. Jaipur .	230·0	25·4	26	0·1	..	..	..	..	0·0254
5. Gwalior .	79·76	19·2	164	2·1	19·24	4·6	62	3·2	0·5484
6. Mathura .	72·80	17·4	141	1·9	..	..	..	..	0·4306
7. Bilaspur .	26·85	38·4	557	20·7	..	..	..	..	7·9488

Only seven districts figure in Table 6.4, since no major repair or maintenance work was reported to have been carried out in the sample areas of the remaining 11 districts.

6.20. It appears from the figures in Table 6.4 that the proportion of the treated area on which repair work was done in the first year was highest in Trichur (71·5%). Bilaspur came next with a figure of 38.4%; while in the other districts it was 25% or less. As regards employment on repair work in the first year, Bilaspur recorded the highest figure at 20.7 man-days of work per acre. In the other districts, it was considerably less, three mandays or less. The reason why Bilaspur and Trichur show high figures of acreage and employment involved in repairs may be that in a steep terrain heavy rains tend to wash off the works newly executed to a greater extent than in other areas. The work done at Jaipur, on the contrary, appears to be the least labour-intensive; the average number of man-days per acre works upto 0·1. No bullock labour has been utilised in any repair work.

6.21. Repair works after 2 years of soil conservation was reported from two districts only (Hyderabad and Gwalior). In Hyderabad, about 8 man-days of work had to be put in during the second year and 3 days per acre in Gwalior. Both these figures are higher than the ones for the first year. Evidently, repair or maintenance work has been limited to a few districts and to a small area.

6.22. The last column of Table 6.4 gives an estimate of the employment content in the first two years of repair and maintenance work on soil conservation treatments in terms of an acre of land treated with soil conservation measures. The estimate varies from 0.025 man-days per acre in Jaipur to 8 in Bilaspur. It is 2 man-days per acre in Trichur and half a day or less in the remaining districts excluding Bilaspur.

6.23. *Employment impact of conservation farming.*—Secondary employment is also generated on the soil conservation holding, if conservation farming practised on the treated lands leads to more of intensive cultivation. If crop failures are rendered less frequent due to soil conservation measures, and changes in the cropping pattern are effected on the conserved area, the cultivator may experience a larger and better utilization of his family and/or bullock labour. This aspect was investigated into a general way in the course of the enquiry; and the qualitative assessment of the impact by the cultivators ascertained. The responses are summarised in Table 6.5. Collection of objective data bearing on this question would have involved an elaborate farm management enquiry and has not been attempted.

TABLE 6.5

Respondents' views on changes in the utilization of bullock and family labour as a result of soil conservation work (all Districts); 1960-61 as compared to pre-conservation year

Year in which soil conservation work completed	Per cent of respondents reporting change in labour input on conservation treated land in their holding (1960-61 *vis-a-vis* pre-conservation year)					
	Bullock labour			Family labour		
	Increase	Decrease	Constant	Increase	Decrease	Constant
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. 1959-60 . .	25·1	0·6	69·5	24·2	..	71·3
2. 1958-59 . .	5·5	2·7	82·7	24·5	..	73·6
3. 1957-58 . .	12·5	6·3	81·3	12·5	5·2	82·3
4. 1956-57 . .	3·8	5·0	65·0	18·8	5·0	70·0
5. 1955-56 . .	27·3	9·1	63·6	27·3	9·1	63·6
6. 1954-55 . .	..	..	100·0	..	..	100·0
7. 1953-54 . .	..	..	100·0	..	..	100·0
8. 1952-53 . .	27·3	..	72·7	36·4	..	63·6
9. 1951-52 . .	..	..	100·0	..	..	100·0

The data in Table 6·5 relate only to those cultivator-respondents on whose holdings soil conservation work was completed in 1959-60 or earlier, and have been presented separately for groups of respondents according to year of conservation treatment. Nearly 35% of the respondents on whose holdings the work was carried out in 1960-61 could not, therefore, be considered for this response.

6.24. The bulk of the respondents in all year groups expressed the view that employment for their family labour or for their bullocks have not increased but remained constant even after the adoption of soil conservation measures on their land. Some increase in the input of bullock labour has been mentioned by 25 to 27% of the respondents on whose land soil conservation measures had been carried out in 1959-60, 1955-56 and 1952-53. Decrease in the input of the bullock labour has been mainly reported by the respondents on whose land soil conservation work was completed between 2 to 5 years before 1960-61. The explanation given for the decrease is that the soil conservation treatments have rendered ploughing of land easier.

6.25. The same pattern of responses has been noticed in the case of family labour. Large proportions (usually more than 70%) in the various year groups have uniformly indicated that the input of family labour has remained "constant", in spite of soil conservation measures. But 24% of those in the first (1959-60) and second year (1958-59) groups and 27 and 36 per cent of those in 1955-56 and 1952-53 year groups have stated that there was more employment for them and other members of their family on their holdings as a result of soil conservation measures. The proportions reporting increase in the input of family labour are somewhat higher than those reporting increase in the use of bullock labour. Decrease in employment has also been reported by a very small proportion of the respondents in Gwalior. On the whole, the evidence tends to show a negligible impact of whatever conservation farming practices the respondents adopted on the employment of family or bullock labour. The extent to which the respondents adopted a digerent type of farming is analysed in the next few sections.

6.26. *Impact on land-use and cropping pattern.*—In a study conducted by the Soil Conservation Department of the Damodar Valley Corporation in two villages in Hazaribagh, it was observed that after soil conservation treatment the cultivated area in a block of land increased by 27% and the area under fodder and grass increased by 249%. At Haraharo in the same district, the integrated soil conservation demonstration project of the Bihar State Government showed the following change in land-use over the five-year period, 1954 to 1959-60. These data show an increase in forest area from 0·3 to 27.7 per cent, in pasture from 0 to 7.7 per cent, and in regularly farmed area from 46·5 to 57.0 per cent. All this increase was achieved by reducing the proportion of fallow and waste lands.

	1954	1959-60
	(% area under)	
1. Village site	7·6	7·6
2. Terraced paddy fields	34·0	38·5
3. Regularly cultivated uplands	12·5	18·5
4. Sloping uplands cultivated at interval	14·2	nil
5. Undulating waste land	17·5	nil
6. Eroded and gullied lands	12·5	nil
7. Rock out crops and hills	1·4	nil
8. Existing forest	0·3	27·7
9. Pastures	nil	7·7
Total	100·0	100·0

An enquiry into the economic effects of contour bunding was conducted in some of the areas of the erstwhile Bombay State during the years 1955-56 to 1959-60. The results of this study indicate that there had been an increase in the area under cultivation to the extent of 3% and an increase in the water level in the existing wells to the extent of 19% in April-May and 29% in October-November.

6.27. *Net cultivated area after soil conservation treatment.*—In the light of the findings of these studies, it would be interesting to know what the cultivators in the sample villages thought about the impact of the soil conservation treatments on the net cultivated area. Figures showing proportion of respondents reporting some change (increase or decrease) in the relevant districts are given in Table 6.6.

TABLE 6.6

Proportion of respondents reporting increase or decrease in net cultivated area

District	% respondents reporting increase (+) or decrease (−)
Hyderabad	10(−)
Hazaribagh	5(−)
Gwalior	2·5(−), 10(+)
Nilgiris	2·5(+)
Bilaspur	32·4(+)

The majority of the respondents in Bilaspur, Gwalior, Nilgiris, Hazaribagh and Hyderabad and all the respondents in the remaining districts reported that there had been no change in the net cultivated area on their treated land. A relatively small proportion of the respondents in Gwalior (10%), Nilgiris (2.5%) and Bilaspur (32%), however, indicated that their net cultivated area had increased after the soil conservation treatment. It is only in Hazaribagh and Hyderabad that 5 and 10 per cent respectively of the respondents stated that their net cultivated area had somewhat decreased. In the former three districts some uncultivated area was reportedly brought under

cultivation as a result of bunding; while in the latter two districts the decrease in the net cultivated area was attributed to the loss of area under bunds.

6.28. *Area lost to bunds.*—Soil conservation treatment may, on the one hand, convert some uncultivated area into cultivated land, and on the other, reduce the area under cultivation due to the construction of bunds, laying of grass waterways and reservation of area for pasture, forests etc. The extent to which such changes occurred in the sample areas is indicated in Table 6.7.

TABLE 6.7

Area lost to bunds and the proportion of respondents reporting such loss

Sl. No.	District	Area lost to bunds and % of respondents reporting such loss			% of col. 5 to col 4
		% reporting	Cultivation holding of those reporting (hectares, acres in brackets)	Area lost to bunds (hectares, acres in brackets)	
(1)	(2)	(3)	(4)	(5)	(6)
1.	Anantapur	100·0	282·40 (697·83)	6·90 (17·06)	2·44
2.	Hyderabad	100·0	237·00 (585·63)	5·09 (12·59)	2·15
3.	Hazaribagh	65·0	46·20 (114·17)	3·51 (8·68)	7·60
4.	Rajkot	100·0	610·61 (1508·86)	2·78 (6·86)	0·45
5.	Trichur	100·0	63·64 (157·25)	5·16 (12·74)	8·10
6.	Gwalior	82·5	131·89 (325·90)	8·42 (20·81)	6·39
7.	Coimbatore	30·0	34·28 (86·19)	1·31 (3·24)	3·76
8.	Ahmednagar	100·0	231·48 (572·01)	7·39 (18·25)	3·19
9.	Dharwar	20·0	39·72 (98·15)	0·83 (2·06)	2·10
10.	Tumkur	100·0	95·88 (236·92)	1·27 (3·15)	1·33
11.	Jaipur	71·1	324·56 (802·00)	1·60 (3·95)	4·93
12.	Bilaspur	89·2	30·27 (74·81)	1·81 (4·48)	5·99
	TOTAL	88·2	2128·54 (5259·72)	46·08 (113·87)	2·16

All the cultivator-respondents in Anantapur, Hyderabad, Rajkot, Trichur, Ahmednagar, Tumkur and Mirzapur reported that some area of their cultivated holding had been used up in the construction of bunds. The respondents in Baroda, Nilgiris, Amraoti, Koraput and Mathura were not sure whether they had lost any area due to the construction of bunds. And those in Mirzapur were sure of the loss of land but could not indicate its extent.

6.29. Table 6.7 also gives figures of the approximate area lost to the bunds in the districts where the respondents could indicate the extent of such area. About 114 acres or 2·2% of the cultivated area on the holdings of the respondents were lost under bunds. Whereas, one extreme, only 0·45% of the area was reported to have been lost to bunds in Rajkot, the proportion was as high as 8% in Trichur and Hazaribagh and a little lower, about 6%, in Gwalior and Bilaspur. In the other districts the proportion was less than 5% of the cultivated holdings.

6.30. *Fragmentation of holdings due to soil conservation treatment.*—In the erstwhile Bombay State where the soil conservation programme was initiated in the early forties, bunds were constructed strictly on the contours. There was considerable dissatisfaction with and agitation against this technique of bunding; and the programme had to be suspended. The Land Improvement Enquiry Committee appointed by the Government of Bombay (1946) went into grievances of the cultivators and examined the technique of bunding. Mainly on the recommendations of this Committee, the bunding work taken up after 1947 followed the principle generally known as 'approach contour', signifying a compromise of strict contour bunding with the existing field and property boundaries. In most of the districts of Maharashtra, the wishes of the cultivators have since then been taken into consideration in aligning contour bunds, marginal deviations in which are effected as far as possible to conform to the property boundaries or earlier embankments and bunds. All the same, the sample respondents in some of the districts held the view that there had been fragmentation of their holdings as a result of contour bunding. Table 6.8 gives data on the views of the respondents on this question.

TABLE 6.8

Increase or decrease in the number of sub-fragments of soil conservation holdings

Districts	Per cent of respondents reporting change in number of sub-fragments		
	Increase	Decrease	Constant
1. Anantapur	45·0	..	55·0
2. Hyderabad	15·0	..	85·0
3. Hazaribagh	42·5	25·0	32·5
4. Baroda	5·0	..	95·0
5. Rajkot	100·0	..	..
6. Gwalior	30·0	..	70·0
7. Ahmednagar	50·0	..	50·0
8. Amraoti	17·4	..	82·6
9. Dharwar	17·5	..	82·5
10. Jaipur	89·5	..	10·5
11. Mirzapur	5·0	..	95·0

Among the selected districts there were no changes reported in the number of fragments in the soil conservation holdings of the respondents in Trichur, Coimbatore, Nilgiris, Tumkur, Koraput, Mathura and Bilaspur. In the remaining districts also, a larger proportion of the respondents reported that the number of fragments did not change as a result of the treatments. The exceptions are Rajkot and Jaipur where a large majority held the view that the soil conservation treatments had resulted in an increase of sub-fragments on their holdings. A decrease in the number of fragments has been reported from Hazaribagh; and that too from one of the two villages selected in the DVC soil conservation areas.

6.31. *Impact on cropping pattern.*—Conservation farming methods, on the one hand, emphasise less exploitative uses of land and, on the other, claim that as a result of decrease in the rate of soil erosion and the consequent increase in the fertility of land, new and superior crops can be raised on treated land. It was noted during the course of the enquiry that in Parner taluka of Ahmednagar district, about 65% of the cultivated land had been covered by the bunding programme by 1960-61. An attempt was made to examine the change in the cropping pattern in this taluka as between the triennium beginning 1950-51 and that ending 1960-61. The data collected are given in Table 6.9.

TABLE 6.9

Change in cropping pattern in Parner Taluka, Ahmednagar

Crops	Average of three years from 1950-51	Average of the last three years ending 1960-61
	(hectares, acres in brackets)	
1. Gross cropped area	1,40,674(3,47,612)	1,39,462(3,44,529)
2. Area under crops	(In per cent of gross cropped area)	
(a) Bajra	35·45	30·47
(b) Jowar	43·23	43·26
(c) Ground Nut	0·41	1·28
(d) Gram	0·85	1·28
(e) Math (Vegetables)	2·25	2·05

Between the three-year periods ending 1952-53 and 1960-61, the proportion of the cropped acreage under Bajra decreased from 35.5

to 30·5 per cent. The decrease was particularly marked in 1960-61 when only 20% of the crop area was reported under this crop. There was no difference in the proportion of the total area under Jowar between the two periods. In 1960-61, however, about 57% of the gross cropped area was reported under this crop. It may be that 1960-61 was a specially good year when jowar replaced bajra rather extensively. Improvement of about one per cent in the proportion of crop area is noticed in the case of groundnut and gram. Broadly, it appears that in the Parner taluka where 65% of the area had been bunded by 1960-61, there had not been any significant change in the pattern of acreage under food crops except for marginal changes in the case of some crops. There had, however, been increase in cotton acreage from 20 acres under unirrigated cotton in 1951-52 to 1879 acres under irrigated cotton in 1960-61.

6.32. The majority of the respondents in all the selected districts reported that they had not raised any new crops on their treated lands nor had they made any shifts in the area under different crops. This will be evident from the data in Table 6.10 (page 140) on the proportion of respondents reporting introduction of new crops and shifts in the area under different crops. In order to examine the change over a period of years, the respondents reporting some change or the other have been grouped according to the year when soil conservation measures were completed on their lands. It will be seen from the Table 6.10 which gives data for 65% of the respondents that only about 12% of the respondents had introduced new crops and about 9% effected shifts in the area under different crops on the treated lands in 1960-61. This obviously indicates a small impact. As for the other 35% of the respondents who had their lands treated only in 1960-61, they had had no time to effect any such change when the investigations were conducted. Nearly 79% of the respondents in the first category had, therefore, no change to report in respect of cropping pattern. The new crops grown by the 12% of the respondents (relevant) fall in the category of legumes, the total area under which works out to one per cent of their gross cropped area. The small proportion who reported a change either in respect of introduction of new crops or shift in the area under different crops, attributed it mainly to the improvement in soil and moisture conditions brought about by the soil conservation measures. Some among them, particularly the respondents who had shifted the area under different crops, attributed the change to the creation of new irrigation facilities and not directly to the soil conservation measures, though in some areas of Maharashtra the two are interdependent.

6.33. *Area under crops on soil conservation holdings before and after soil conservation treatment.*—The views of the respondents thus indicate very little change in the cropping pattern as a result of soil conservation treatment on their lands. This position is also reflected in the data on the relative share of the area under different crops-cereals, millets, pulses and legumes, oilseeds, etc. between the period before soil conservation measures and in 1960-61. These data are given in Table 6.11 (Page 141).

TABLE 6.10

Introduction of new crops and shift in area under different crops in 1960-61 with reasons.

Soil conservation work completed in	Percent of respondents reporting								Percent of respondents reporting only shift in the area under different crops					Percent of respondents reporting no change
	Introduction of new crops	Reasons for new crops (Codes)*							Shift in area under different Crops	Reasons for shift (codes)*				
		01	02	03	04	05	06	07		01	02	03	08	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1959-60 . .	17·36	..	5·39	8·98	0·60	1·80	..	..	10·87	..	0·60	9·58	0·60	71·86
1958-59 . .	12·73	..	..	..	0·91	4·54	..	0·91	5·45	0·91	5·45	..	..	80·91
1957-58 . .	2·08	..	..	..	..	..	1·04	1·04	11·46	1·04	6·25	1·04	..	86·46
1956-57 . .	8·75	5·00	2·50	1·25	..	..	..	..	11·25	11·25	..	..	..	80·00
1952-53 . .	22·73	22·73	..	..	..	..	..	..	..	..	..	..	..	77·27
TOTAL .	11·72	1·81	2·22	3·23	0·40	1·62	0·20	0·40	8·89	2·22	2·63	3·43	0·20	79·39

NOTE : (1) In one year group 4·24% did not report any reason for new crops (2) In two years 6·36% no reason given for new crops. (3) In three years group 3·09% did not give any reason for change in area.

CODE * : 01 = Rise in soil moisture as a result of treatments; 02—Irrigation facilities available; 03—Suitability of land after soil conservation; 04—Newly cultivated land; 05—Lower yield from the crops grown previously; 06—adoption of new rotation of crops; 07—experimenting; 08—Shifted the area to vegetables after pest attack on the previous crops.

TABLE 6.11

Cropping pattern on soil conservation holding before and after soil conservation treatment

Crops	Proportion of the acreage under specified crops to the gross cropped area in																			
	Anantapur		Hazaribagh		Baroda		Rajkot		Trichur		Gwalior		Nilgiris		Ahmednagar		Koraput		Jaipur	
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
Jowar	31·59	23·95	..	..	7·44	13·95	25·37	23·32	..	..	17·97	13·53	..	..	56·95	62·40	..	..	..	..
Wheat	..	..	..	..	..	..	..	..	..	..	2·04	..	3·18	3·14	1·97	1·71	..	..	..	..
Bajra	..	..	..	..	..	..	7·58	7·03	..	..	..	..	..	..	18·55	14·45	..	..	50·53	51·93
Maize Gram	..	..	..	..	3·04	2·96	..	..	..	..	..	..	..	..	0·09	0·03	..	..	..	..
Horse gram	6·70	6·07	6·50	5·61	0·51	1·32	1·32	..	..	..	5·33	2·95	..	..	8·27	5·70	..	0·09	..	..
Other pulses	..	..	..	..	..	0·43	3·04	0·10	..	..	..	..	..	..	0·59	0·41	..	..	3·66	6·47
Oilseeds	0·08	1·21	2·25	19·41	..	..	..	..	..	..	3·21	13·43	..	..	..	..	..	..	..	..
Groundnut	42·56	45·02	..	..	7·51	11·37	61·08	68·12	..	..	..	..	..	..	0·60	0·75	..	..	..	..
Ragi	..	..	..	..	..	..	..	..	..	..	..	..	10·86	13·96	..	..	37·09	40·32	..	..
Tapioca	..	..	..	..	..	..	..	..	66·63	62·04	..	..	..	..	..	..	..	..	..	..
Minor Millets	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	28·62	33·92	..	..
Potato	..	..	..	..	..	..	..	..	..	..	..	..	78·34	75·94	..	..	..	..	..	..
Gowar	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	26·26	24·96
G.C. area in 1960-61	96·42		105·28		106·34		111·02		99·26		126·47		101·26		102·54		108·44		99·08	

NOTE : (1) In Hyderabad, Coimbatore, Amraoti, Dharwar, Tumkur, Mathura, Mirzapur, and Bilaspur there was no significant change in the cropping pattern.

(2) a—% of cross cropped area in the average of the year before and the year of soil conservation.
b—% of cross cropped area in 1959-60 and 1960-61.

In eight of the selected 21 districts, there was no change in the average gross cropped area between the period before soil conservation measures and in 1960-61. Gross cropped area decreased somewhat in Anantapur where there had been famine conditions continuously during the preceding 2 or 3 years. The nominal decrease in two other districts, Trichur and Jaipur is insignificant. Similarly, the slight increase in Nilgiris and Ahmednagar may not be very significant yet. In five districts, however, the increase was fairly large. The gross cropped area increased by about 5 to 8 per cent in Hazaribagh, Baroda and Koraput. The increase in the gross cropped area was much higher (11%) in Rajkot and highest in Gwalior (27%).

6.34. Noticeable changes in the proportion of the area under crops had taken place in Baroda, Rajkot and Ahmednagar. The proportion of the area under groundnut increased considerably in 1960-61 over the period before soil conservation measures in the first two districts; while that under jowar increased somewhat in Baroda and Ahmednagar. Other changes in the relative area under crops are decrease in jowar area and increase in groundnut in Anantapur, increase in oilseeds in Hazaribagh and Gwalior, increase in minor millets and ragi in Nilgiris and Koraput.

6.35. *Change in the area under crops over time after soil conservation treatment.*—Table 6.11 seeks to show whether there has been any significant change in the crop areas of the respondents as between two periods of time, before soil conservation treatment and 1959-61. In order to examine the impact of soil conservation measures on the relative area under different crops over a period of years, a separate analysis has been attempted in respect of two districts, Ahmednagar and Baroda. In both these districts, the respondents in the sample had undertaken soil conservation measures in different years. The data in Table 6.11 show that there had been some change in the cropping pattern in these two districts as between the pre-conservation period and 1959-61. The time sequence of such changes in Baroda and Ahmednagar has been analysed in Table 6.12.

TABLE 6.12

Impact on the crop area in different years after the completion of soil conservation work in Ahmednagar and Baroda

Ahmednagar

Years after soil conservation treatment	% of respondents	Per cent increase (+) or decrease (—) in crop area over pre-conservation period				
		Gross cropped area	Jowar	Bajra	Safflower	Horsegram
(1)	(2)	(3)	(4)	(5)	(6)	(7)
One year . . .	90.0	+2.76	+12.62	—20.22	+18.38	—63.28
Two years . .	65.0	+9.22	+38.53	—67.62	+54.53	—96.55
Seven years . .	20.0	+24.04	+41.64	+ 7.41	+64.74	..

[TABLE—*Contd.*]

TABLE 6.12—*contd.*

Baroda

Years after soil conservation treatment	% of respondents	Gross cropped area	Paddy	Cotton	Groundnut	Jowar	Maize
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
One year . . .	100.0	+ 2.49	—28.41	—18.61	+145.56	+125.62	+10.56
Two years . . .	72.5	+ 1.19	—25.76	+10.10	+116.91	+57.93	—14.14
Three years . . .	25.0	+ 4.16	+30.61	—24.50	+174.75	+69.82	..
Seven years . . .	25.0	+23.34	— 4.14	..	+116.43	..	—38.14

6.36. It should be noted that the respondents in the year groups shown in Table 6.12 are not exclusive. Irrespective of the agricultural year for which the data related, the area under crops after one or more years of soil conservation treatment has been compared with the area under crops in the year before soil conservation measures. The cultivators who had undertaken soil conservation treatment earlier appear as many times as the number of years they had grown crops on their lands after the treatment.

6.37. In Ahmednagar district, the gross cropped area on lands classified according to years after soil conservation treatment records an increase over the corresponding area in the pre-conservation period by 3% in the first year, 9% in the second year and 24% in the 7th year. For the intervening years, data on the area under crops was not collected from the respondents. The area under jowar and safflower records a progressive and consistent increase with the passage of years after the treatment, the increase from 12 and 18 per cent for jowar and safflower in the first year to 42 and 65 per cent respectively in the seventh year. To compensate for this increase, the area under horsegram and bajra tends to show a decline, the former very sharply.

6.38. In Baroda, the lands on which soil conservation treatment had been carried out in the earlier years show a relatively greater increase in the gross cropped area than the land on which this treatment was taken in recent years. As regards changes in crop areas, groundnut and jowar record a progressive increase in their acreage, while paddy registers a decline. Cotton gets introduced and its acreage fluctuates. Maize does not show any consistent trend. As the conservation treatment becomes older and improves the soil and its fertility, the inferior crops tend to get replaced by superior crops. The data in Table 6.12 illustrate this pattern of shift.

Crop rotations and cultural practices

6.39. It was noted in Chapter V that though crop rotations were recommended in as many as 14 districts there was knowledge about them in four and adoption of them in only three districts. In view of this restricted extension of recommended crop rotations in the areas covered by soil conservation measures there is not much scope for examining the impact in terms of areas under different crop rotations. It was, however, noted that in 1960-61 a significant section of

the respondents had changed over to different crop rotations previously known to them. The data on the proportion of respondents who changed over to some other crop rotation, the area of the soil conservation holding involved in such change and the most important rotations followed by the majority of the cultivators are given in Table 6.13.

TABLE 6.13

Changes in crop rotations effected by respondent cultivators

Sl. No.	District	%respondents reporting change	%area affected by change	Rotation adopted by the largest number of respondents	
				Description	Area under it as % of area affected by change
(1)	(2)	(3)	(4)	(5)	(6)
1.	Anantapur	22.5	20.95	Kora—Fallow—Groundnut—Fallow (2 years).	27.
2.	Hyderabad	2.5	5.24*	..	..
3.	Baroda	30.0	7.82	Cotton—Groundnut—Fallow (2 years).	10.2
4.	Rajkot	44.7	54.90	Groundnut—Fallow—Jowar—Fallow (2 years).	54.4
5.	Gwalior	15.0	30.60	Jowar—Mustard (1 year)	63.5
6.	Nilgiris	25.0	12.62	Potato—Fallow—Ragi—Fallow (2 years).	38.6
7.	Ahmednagar	22.5	6.79	Fallow—Jowar (1 year)	57.5
8.	Amraoti	10.9	8.67	Cotton (1 year)	77.7
9.	Dharwar	2.5	1.20*	..	..
10.	Jaipur	7.9	2.93	Bajra—Fallow—Til—Fallow (2 years).	52.6
11.	Mathura	7.5	3.50	Arhar—Gram—Fallow—Barley+Gram (2 years)	51.1
12.	Mirzapur	25.0	37.77	Paddy—Wheat or Wheat+Gram (1 year).	62.3
13.	Bilaspur	32.5	12.93	Maize—Fallow (1 year)	54.8

*Only one cultivator each in Hyderabad and Dharwar changed over to a new crop rotation.

It may be noted that all the rotations shown in Table 6.13 are the ones traditionally followed and do not figure among the rotations specifically recommended by the soil conservation department under conservation farming practices. The significance of the data in Table 6.13 lies in the fact that they indicate the extent to which cultivators can and do change their rotations and cropping programme, even on their own. In Rajkot, Bilaspur, Baroda, Mirzapur, Ahmednagar, Anantapur and Nilgiris, a significant proportion varying between 20 and 45 per cent of respondents affected changes in crop rotations; and the acreage affected by such changes, was as high as 55% of the holding in Rajkot, 38% in Mirzapur, 31% in Gwalior, 21% in Anantapur and 13% in Bilaspur. The new rotations are still the traditional ones.

6.40. Adoption of the recommended cultural practices was also found to be poor in the selected districts. An assessment of the impact of conservation farming on the area under each improved cultural practice before and after soil conservation measures did not, therefore, yield any useful results. An attempt was made to collect data to show the increase in area under irrigation after soil conservation farming treatment. In only three districts, Mathura, Mirzapur and Bilaspur, some portion of the soil conservation holding of the respondents was irrigated before the treatment. It was only in Mirzapur that the proportion of holding irrigated recorded an increase from 15% before the treatments to 32% in 1960-61. This was attributed to new irrigation facilities created in the area and was not the impact of soil conservation measures. In Ahmednagar where the Maharashtra Government have an 'Operation Well Scheme', the area under irrigation was not reported to have increased in the selected villages after soil conservation treatment. In one village, 21 wells had been sunk under the scheme but only four could be completed and the other 17 remained incomplete because the taccavi loan granted was inadequate.

6.41. *Operation well scheme in Maharashtra.*—It has been estimated by the Agricultural Department of the Maharashtra Government that one irrigation well can be sunk for every 70 acres of bunded land. In the unbunded area, the corresponding estimate is one well for every 200 acres. The State Government, therefore, sponsored an 'Operation Well Scheme' in the area where contour bunding had been completed. Under this scheme, taccavi loan to the extent of Rs. 2,500 per well is advanced to cultivators, the loan being repayable in ten annual instalments. The disbursement of loans is handled by the Revenue Department, although the funds are debited to the Agricultural Department. In locating sites and in other matters relating to the construction of wells, the advice of soil conservation officers working in the area is reportedly not taken into account by the Revenue Department officials or by the cultivators who construct wells mainly at the instance of the Revenue officials. Under this scheme in Sholapur district, taccavi loans for 8,508 wells were granted; but only 3,416 wells or 40% could be completed by March 1962. Table 6·14 gives data showing the progress and achievement under the operation well scheme in Sholapur district. The data show that the estimated norm of one well for every 70 acres of bunded land has not been adhered to in executing the scheme. The average bunded area per well works out to 49.10 acres; and in 53% of the villages, the norm of 70 acres per well has not been adhered to. These data show the results of lack of coordination in the execution of the scheme.

TABLE 6·14

Achievement under the 'Operation Well Scheme' in Sholapur

1. No. of wells for which taccavi loan was granted	8508
2. % of wells completed	40.15
3. Villages with wells as % of bunded villages	98.37
4. Average bunded area per well	49.10
5. % villages where the average area is less than 70 acres	52.85

6.42. *Impact on the fertility of soil and quality of crops.*—The respondent cultivators were asked on the basis of their experience, to comment on the fertility of the soil and the quality of crops raised on their lands after the soil conservation treatment. Table 6.15 summarizes the responses of the cultivators who had completed soil conservation measures in different years.

TABLE 6.15

Views of respondents about effect of soil conservation treatments on fertility of soil and quality of crop

Soil conservation work completed in	No. of respondents	Percentage reporting			
		Fertility of Soil		Quality of crop	
		Improved	Deteriorated	Improved	Deteriorated
(1)	(2)	(3)	(4)	(5)	(6)
1. 1959-60	150	38.7	12.7	12.7	4.7
2. 1958-59	100	31.0	9.0	20.0	1.0
3. 1957-58	96	59.4	1.0	31.3	1.0
4. 1956-57	80	27.5	10.0	25.0	10.0
5. 1955-56	11	54.5	27.3	50.0	27.3
6. 1954-55	4	75.0	..	50.0	0.0
7. 1953-54	5	0.01	0.01	0.01	0.0
8. 1952-53	22	31.8	0.01	22.7	0.01

It is interesting to note that a fairly large proportion of beneficiaries have stated that the fertility of their land improved after bunding. The maximum proportion of respondents, 75%, reporting such improvement had completed soil conservation treatment on their lands

in 1954-55. Among these who had completed the soil conservation treatment in 1953-54 and 1952-53, only a few stated that tne fertility of soil improved after the treatment.

6.43. There appears to be consistent trend in the replies given by the respondents in respect of effect on the quality of the crop. The greater the time lag when the soil conservation treatment was carried out, the higher the proportion of respondents who stated that the quality of crop improved as a result of soil conservation measures. Only the respondents who had completed soil conservation measures in 1953-54 and 1952-53 did not comment as favourably about the improvement in the quality of the crop as others who had completed conservation treatments on their lands later. Probably, the respondents who had conservation treatments completed as early as in 1952-53 or 1953-54 could not quite clearly recall either the fertility of soil or the quality of crop before the lands were treated. On the whole, therefore, the respondent-cultivators' reactions in respect of effect on fertility of soil and quality of crop show a progressive realization and admission of the benefit by them.

6.44. *Impact on yield of crops.*—Information on the yield of important crops on their holdings before and after soil conservation treatments was collected from the respondent-cultivators. In the control villages, specific questions were asked to the respondents about their assessment of the yield rates in the areas covered by soil conservation treatment in the neighbouring villages. Of the 360 respondents in the control villages, 40% stated that they had noticed an increase in yield on land covered by soil conservation treatment; 21% reported that they did not see any such improvement; while the rest could not give any definite response. Data on the yield rates of different crops reported by respondents as realised by them are presented in Table 6.16 (page 148) to give some idea about the impact of soil conservation treatments on yield rates. The table gives the yield rates of jowar, groundnut, wheat and horse-gram in the villages covered by soil conservation measures and in control villages. In the villages covered by soil conservation treatment, the data are given separately for the area treated by soil consrvation measures and the area not so treated.

6.45. Respondents in quite a few areas have reported greater increase in the yield per acre on treated land than that on the unconserved area and in control villages. The yield of jowar crop per acre of treated land in 1960-61 in Baroda, Rajkot, Coimbatore and Ahmednagar was reported to be higher than the yield per acre in unconserved areas and in control villages. A similar trend of higher yield per acre on the area covered by soil conservation measures than that on unconserved areas and in control villages is observed in respect of wheat in Gwalior and Mathura, and horsegram in Coimbatore. The yield per acre on the area covered by soil conservation measures is higher than that on unconserved area in a few other areas. Taking all these facts into account, it may be concluded that the soil conservation treatment has succeeded in some measure, in raising the yield of crops.

TABLE 6.16

Yield in Kgm. per hectare of important crops on unirrigated land in 1960-61 in covered villages as reported by respondents

Sl. No.	District	Jowar			Groundnut			Wheat			Horsegram		
		Covered villages		Control villages	Covered villages		Control villages	Covered villages		Control villages	Covered villages		Control villages
		Soil conservation area	Unconserved area		soil conservation area	Unconserved area		Soil conservation area	Unconserved area		Soil conservation area	Unconserved area	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1.	Anantapur	74 (66)	74 (66)	65 (58)	244 (218)	244 (218)	112 (100)	..	..	..	56 (50)	56 (50)	58 (52)
2.	Hyderabad	205 (183)	196 (175)	196 (175)	..	..	..	..	..	..	119 (106)	119 (106)	134 (120)
3.	Baroda	238 (212)	219 (195)	247 (220)	239 (213)	347 (310)	224 (200)	..	..	..	..	..	..
4.	Rajkot	622 (555)	459 (410)	196 (175)	594 (530)	370 (330)	420 (375)	..	..	..	..	..	..
5.	Gwalior	337 (301)	446 (398)	390 (348)	..	..	..	1103 (984)	797 (711)	482 (430)	..	..	..
6.	Coimbatore	297 (265)	269 (240)	157 (140)	247 (220)	230 (205)	314 (280)	..	..	..	317 (283)	254 (227)	112 (100)
7.	Ahmednagar	183 (163)	171 (153)	140 (125)	168 (150)	140 (125)	..	..	..	..	276 (246)	276 (246)	84 (75)
8.	Amraoti	338 (302)	392 (350)	359 (320)	603 (538)	790 (705)	538 (480)	336 (300)	325 (290)	359 (320)	..	..	..
9.	Dharwar	465 (415)	465 (415)	364 (325)	476 (425)	476 (425)	336 (300)	134 (120)	123 (110)	..	78 (70)	78 (70)	..
10.	Tumkur	..	..	..	729 (650)	729 (650)	..	..	..	..	574 (512)	574 (512)	527 (470)
11.	Jaipur	..	..	..	..	..	..	..	..	..	..	..	..
12.	Mathura	..	..	..	..	..	..	919 (820)	827 (738)	735 (656)	..	..	..
13.	Mirzapur	..	..	..	..	..	..	807 (720)	852 (760)	538 (480)	..	..	..
14.	Bilaspur	..	..	..	..	..	..	338 (302)	324 (289)	504 (450)	..	..	..

NOTE:—Figures within brackets are lbs. per acre.

6.46. A comparison may also be attempted from a different angle, namely, comparing the yield rates on area covered by soil conservation measures with those on area not so covered as between the pre-conservation period and 1960-61. The data given in Table 6.17 show that the treated area is better placed in respect of yield of jowar crop in Hyderabad, Rajkot, Coimbatore and Ahmednagar. Similarly, increase in the yield level of wheat in 1960-61 as compared with the pre-treatment period is higher in the treated area than in the unconserved area in Gwalior, Mathura and Bilaspur. The yield of horsegram increased by 125% in 1960-61 over that in the pre-treatment period in Coimbatore; but the yield of the crop remained at the same level in the unconserved area. The two important districts growing groundnut show greater increase in yield of the crop in the treated area than on the unconserved area. In Coimbatore and Ahmednagar also, the yield of groundnut per acre of treated land recorded an increase in 1960-61 over the pre-treatment period larger than on the unconserved area.

TABLE 6.17

Change in yield per acre of unirrigated land in the covered villages

District	Yield per acre in 1960-61 of important crops as % of the yield in the year before soil conservation treatment							
	Jowar		Wheat		Horsegram		Groundnut	
	Unconserved area	Soil conservation area	Unconserved area	Soil conservation area	Unconserved area	Soil conservation area	Unconserved area	Soil conservation area
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Anantapur .	65.4	65.4	..	..	53.3	53.3	..	..
2. Hyderabad .	100.0	104.8	..	..	94.4	94.4	..	..
3. Baroda . .	..	..	..	..	..	..	119.2	132.0
4. Rajkot . .	107.2	143.8	..	..	..	..	100.0	175.8
5. Gwalior. .	93.8	60.8	75.4	104.3	..	..	..	..
6. Coimbatore .	100.0	110.4	..	..	100.0	125.0	100.0	107.3
7. Ahmednagar	108.9	116.0	..	..	100.0	100.0	125.0	150.0
8. Amraoti .	100.0	86.3	100.0	100.0	..	..	100.0	83.0
9. Dharwar .	103.8	103.8	100.0	100.0	100.0	100.0	106.9	106.2
10. Tumkur .	..	..	..	..	100.0	100.0	100.0	100.0
11. Mathura .	..	..	112.5	125.0	..	..	..	..
12. Mirzapur .	..	..	95.0	90.0	..	..	..	..
13. Bilaspur .	..	..	103.6	108.5	..	..	..	..

6.47. Comparing the spatial (Table 6.16) and the temporal (Table 6.17) change in the yield of the crops in the treated and untreated areas, we find interestingly enough that in the districts where the yields on treated area had been higher than on the untreated area and in control village, had been also the districts where the increase in the yield rate in 1960-61 over the pre-treatment year had been greater viz., Hyderabad, Rajkot, Coimbatore, Ahmednagar for Jowar crop, Gwalior and Mathura for wheat, Coimbatore for horsegram and Rajkot for groundnut. These comparisons indicate that land treated with soil conservation measures gives a higher yield than the area not-treated and higher than the yield prevailing in the pre-treatment period.

6.48. An attempt has also been made to analyse the sequential aspect of the impact of soil conservation treatments on crop yields. The data on crop yields reported for different years by the respondents have been tabulated in Table 6.18 to show the percentage change in yield per acre of important crops in 1960-61 over the yield in the pre-conservation period. Data for only three districts, Ahmednagar, Baroda and Coimbatore, where the soil conservation works have been carried out for a larger number of years have been analysed for this purpose. The figures for Ahmednagar are presented in Table 6.18, while those for Baroda and Coimbatore are given in the Appendix B-10.

TABLE 6.18

Percentage change in yield per acre of important crops over the pre-conservation period

District Ahmednagar

After completion of soil conservation work by	Percent of respondents relevant	Percentage change over pre-conservation period in yield per hectare of				
		Jowar	Bajra	Safflower	Tur	Horsegram
(1)	(2)	(3)	(4)	(5)	(6)	(7)
One year . . .	92.5	—2.4	—5.5	+3.8	0.0	—11.3
Two years . .	65.0	0.0	—10.0	0.0	0.0	0.0
Seven years . .	20.0	+18.7	..	..	..	..
Eight years . .	20.0	+14.5	0.0	..	..	..

Note.—Respondents relevant for seven & eight years do not report the yield of Safflower, Tur & Horsegram.

Data in these tables reveal that in Coimbatore and Ahmednagar, the yield of jowar, bajra and horse-gram recorded a decrease of varying magnitude in the first year after the completion of soil conservation works. After this year, however, the yields of these crops started increasing and by the second or third year, went up above the pre-conservation level. In the case of safflower in Ahmednagar, groundnut in Coimbatore, and paddy, cotton and tur in Baroda, however, the yield levels recorded a rise even from the first year after the soil conservation treatment. A closer scrutiny of the data in these tables reveals that the figures for Ahmednagar and, to some extent, Coimbatore, show a consistent pattern. It is also the one suggested on technical grounds, namely that the yield level of crops, particularly on dry land, is likely to go down in the first or second year after conservation and then rise gradually and eventually reach a level much higher than that in the pre-conservation period. The extent of rise and the ability to sustain it are determined very largely, by the fertiliser programme and other improved practices followed by the cultivators. Without these, the yields may fall again. The data for Ahmednagar show that in the treated land, the yield of jowar had risen by 15 to 16 per cent. This may be taken as a broad indication of the impact of soil conservation treatment on the yield of crops.

Impact on the Value of Land

6.49. The effect of conservation treatments on the fertility, productivity and net returns from land is reflected in the value which it fetches in purchase and sale. An attempt has been made to assess this impact in a number of ways. First, the views of the respondent-cultivators about the change in the value of land after soil conservation treatment had been carried out were ascertained. The replies received are summarised in Table 6.19 for all districts.

TABLE 6.19

Respondents reporting change in the value of land according to year of completion of soil conservation work on their land (all districts)

Soil conservation work completed in	% of relevant respondents	Percentage of respondents reporting change in land value		
		Increase	Decrease	Constant
1. 1959-60	38.7	64.7	0.6	27.5
2. 1958-59	22.4	62.6	..	28.2
3. 1957-58	19.4	75.0	..	25.0
4. 1956-57	16.2	92.5	..	7.5

It appears from Table 6.19 that between 62 and 92 per cent of the respondents reported an increase in the value of land. As the number of years (since the treatments were completed) increases, the proportion of respondents reporting rise in land values also increased. This is to be expected.

6.50. The reasons for increase in the value of land as given by the respondents are analysed in Table 6.20.

TABLE 6.20

Respondent's views on the reasons for increase in the value of land

Sl. No.	Reasons	Percent of respondents giving reasons for increase according to year of completion of soil conservation work			
		1959-60	1958-59	1957-58	1956-57
(1)	(2)	(3)	(4)	(5)	(6)
1.	Increase in general price level	38.4	40.6	56.9	9.5
2.	Due to soil conservation measures	61.5	47.8	48.6	51.4
3.	Increase in demand of land	..	4.3	2.8	48.6
4.	Scarcity of land due to submersion	18.3	..	..	..
5.	Increase in price of produce	..	..	1.4	1.4
6.	Due to demand for tea cultivation	2.8	4.3	2.8	..
7.	Yield has stabilized	..	2.9	13.8	1.4
8.	Growth of township nearby	18.3	..	..	..
9.	Irrigation available	5.5	..	1.4	..
10.	Others	..	4.3	..	..
11.	Cannot say	8.3	..	6.9	14.9

More than one reason has been adduced by the respondents for the increase in the value of land. In all, 324 respondents have given 419 reasons. One of the important reasons for the increase in the value of land is, according to the respondents, the general rise in the price level. Other factors such as the scarcity of land in Bilaspur because of submersion of cultivated land in the Govindsagar reservoir, the growth of a township, and demand for land for tea cultivation in the Nilgiris have been considered important by a relatively small section of the respondents. By far, the largest proportion of the respondents, however, have also stated that the increase in the value of land has been on account of the soil conservation treatments. Two or three respondents who reported a decrease in the value of land stated that water-logging due to bunding and the removal of the fertile upper layer of soil for bund construction were the reasons. On the whole, therefore, it may be said that more than 50 per cent of the respondent-cultivators reporting a rise in land values ascribed it also to bunding, terracing and other treatments.

6.51. *Value of land in* 1960-61 vis-a-vis *that before soil conservation treatment.*—In addition to the views of the respondents about the change in the value of land, an attempt has been made to collect data from the selected villages on the actual value of unirrigated land before soil conservation treatment and after it. The extent of the change indicated by these data is given in Table 6.21.

TABLE 6.21

Change in the value of soil conservation land (unirrigated) in the villages treated by soil conservation measures

Soil conservation work completed in	Percent change in value in 1960-61 over that before soil conservation of land of		
	Class A	Class B	Class C
(1)	(2)	(3)	(4)
1959-60	+68.0	+80.2	+94.7
1958-59	— 8.6	+ 3.0	+ 0.8
1957-58	+53.8	+ 9.2	+ 3.7
1956-57	+23.2	+26.6	+19.0
1953-54	+17.6	+12.5	+28.6
1952-53	+80.0	+134.4	+108.7
1951-52	+50.0	+50.0	+100.0

The data in Table 6.21 reveal that fluctuations have taken place in the value of land of all classes in the villages covered as between the year before the treatment and 1960-61. By and large, however, the data consistently show that the land values in 1960-61—whether for Class A or B or C type of land—were much higher than in the year before the treatments. The average increase for all the villages, irrespective of year-groups, works out to 42 per cent.

6.52. *Change in the value of land according to reasons for change.*—The reasons given for change in the value of land have been seen in Table 6.20; we may further pursue this analysis and combine it with the extent of change in 1960-61 over the pre-treatment period. This has been attempted in table 6.22, where data on the extent of change in land values have been analysed separately for groups of respondents advancing exclusive reason or reasons for it.

TABLE 6.22

Percent change in the value of land reported by respondents in covered villages

Soil conservation work completed in	Percent change in land value in 1960-61 over pre-conservation period, on account of		
	Soil conservation treatment	General rise in price level	Soil conservation treatment & general rise in price level
(1)	(2)	(3)	(4)
1959-60	59.8	34.6	15.7
1958-59	69.7	28.5	24.8
1957-58	48.7	27.4	34.4
1956-57	78.7	46.4	117.5*
1955-56	100.0	14.3	16.7

*Soil conservation and other reasons.

It will be seen that the increase in the value of land had some what consistent trend—a progressive rise upto 100%—in the case of lands of the respondents who gave soil conservation treatment as the reason for rise in land values. The value of land in 1960-61 was 60% higher than that in the pre-treatment year for lands on which soil conservation work was completed in 1959-60, and the increase was higher still for lands on which works were completed earlier. The pattern of the increase in land values of respondents giving 'general price level' as the reason for change does not show any similar trend. Similarly, there is no particular trend in the increase in the value of land of those respondents who gave both these reasons for the change in land values.

6.53. *Change in the value of land in the villages covered by soil conservation treatment and in control villages.*—During the enquiry an attempt was made to collect data from selected villages about the value of three categories of land. In the villages covered by soil conservation treatment data on the value of land per acre of the three classes of land were separately collected for treated area and untreated area. On the basis of these data, a composite index of change has been worked out, for each of the district of Ahmednagar, Dharwar, Nilgiris and Mathura. The index shows the change in the value of land between the year before the soil conservation measures and 1960-61. The data are given in Table 6·23.

TABLE 6·23

Index of land values between the period before soil conservation treatment and in 1960-61

Districts	Index of land values in the two time periods		
	Covered villages		Area requiring soil conservation treatment in control villages
	Soil conservation treated area	Un-treated area	
(1)	(2)	(3)	(4)
Ahmednagar	109.5	101.2	..
Dharwar	121.9	126.6	..
Nilgiris	131.1	106.9	94.1
Mathura	140.5	126.5	118.1

Between the year before soil conservation treatment and 1960-61, the value of treated land has increased more than that of untreated

land in three districts and more than that in the control villages also in two districts. Appreciation of the value of treated land has been greater than that of untreated land probably because of the investment in soil conservation works and the improvement of the quality of land. It is possible that the greater increase in the value of untreated land than that in the control villages could be attributed to anticipated improvement of land by soil conservation treatment. In Nilgiris and Mathura the rise in land values has been greater than in Ahmednagar. In Nilgiris the cost of soil conservation treatment is very high and in Mathura the alluvial soil properly treated, can be put immediately to better crops. This probably explains the higher rate of increase in land values in the two districts.

6.54. *Responsibility for maintenance and repair of bunds.*—Maintenance and repair of the bunds at the appropriate time is an imperative part of the programme. No lasting results can be achieved unless this responsibility is properly accepted and discharged. In the course of the enquiry, knowledgeable persons as well as the respondents in the sample villages were asked to state whose responsibility this was.

6.55. The replies obtained from the knowledgeable persons indicate that this is the responsibility of the beneficiaries as a group. In two villages in Koraput the knowledgeable persons reported that this was the responsibility of the Government; in one village each in Anantapur and Ahmednagar the knowledgeable persons stated that the responsibility of maintenance and repair was of the Government; in all the six villages in United M. & N. C. Hills, the knowledgeable persons reported that maintenance of soil conservation treatment work was the responsibility of the individual beneficiaries.

6.56. The respondent-cultivators stated that the maintenance and repair of bunds was the responsibility of the cultivator himself. All the respondents in Hazaribagh, Nilgiris, Tumkur, Mathura, Bilaspur and United M. & N. C. Hills reported that it was the responsibility of the individual cultivator to repair the bunds and terraces. In other districts also, more than 65% of the respondents considered it their own responsibility to repair and maintain the bunds. Only in Coimbatore, 60% of the respondents and in Hyderabad 50% considered repair and maintenance as the responsibility of the Government. The proportion of those who said that repair and maintenance should be the Government's burden is also significant in Koraput (33%), Anantapur (27%), Gwalior (22%), Rajkot (16%) and Ahmednagar (13%). It may be noted that eventhough in Coimbatore, Ahmednagar, Gwalior and Rajkot, the programme had been taken up much earlier than in most other districts, a significant proportion of respondents still did not accept their own responsibility in the matter of maintenance and repair of bunds. Evidence of this nature tend to show that the soil conservation programme has not yet succeeded in fully involving the cultivators in it and making them identify with it. As long as a sizeable section of the cultivators continue to think that it is a programme sponsored by the Government, the maintenance and repair of bunds will remain neglected and unattended.

CHAPTER VII

SPECIAL PROBLEMS OF LAND IMPROVEMENT

7.1. The problems selected for study in Assam, Punjab and West Bengal are special to these States, in the sense that these are somewhat different from those studied in the other States. In Assam, the soil conservation programme has been directed to arrest shifting cultivation (Jhuming) mainly through the plantation of cash crops. In many districts of West Bengal and Punjab, drainage and reclamation of land are problems of grave magnitude; and a large provision has been made under the soil conservation programme in the Third Plan of these States on relevant schemes. It is these special problems that have been enquired into in these States. The data collected from the selected areas could not be analysed along with those for the other States, due to lack of uniformity. It is for this reason that the special problems of land improvement in Assam, Punjab and West Bengal have to be taken up separately in this chapter. A discussion of the problems and the programmes as observed in selected districts in these States are presented in the form of three notes.

Note on 'shifting cultivation' in United Mikir and North Cachar Hills, Assam

7.2. The configuration of the land in Assam is such that the major plains area is the Brahmaputra Valley, sandwitched between the main Himalayan ranges in the north and the Garo, the Khasi, Jaintia, Mikir and Naga Hills in the south. The other plains area, though much smaller than the Brahmaputra Valley is the Cachar district, which lies between the Khasi and the North Cachar Hills on the north and the Mizo Hills district in the south. The rainfall in the State is, perhaps, the heaviest in India. The average annual rainfall in the hilly areas is over 200 inches, while certain places like Cherrapunji received in certain years as much as 600 inches.

Problem of shifting cultivation

7.3. Shifting cultivation, locally known as 'Jhuming', is the traditional form of agriculture usually practised by the tribal people in the hilly areas of the State. Their practice is to grow crops for a short period on steep slopes after cutting and burning the forest vegetation. The cutting and clearing of the forest is done during the dry season from November to March. The 'Jhumed' area is cropped for two seasons and then abandoned. Because of this practice, the individuals or households or even the village do not have settled lands for agricultural purposes. And the cutting and burning of hillsides results in the destruction and wastage of the forest resources.

7.4. An area of 20,000 square miles, or about 25% of the total area of the State is reported to be under shifting cultivation. Besides, about 1,000 square miles of the foot-hill areas of the plains districts of the State are also subject to shifting cultivation by tribesmen who have migrated to these areas. Intensive grazing by professional graziers along the foothill areas and bank erosion in plains

districts are the other soil erosion problems of the State. However, 'jhuming' or 'shifting cultivation' in the hill areas of Assam is a far more serious problem than any other type of soil erosion in the State. It is for this reason that the State Government's programme of soil conservation has so far been confined to the four hill districts of Assam. In these hilly districts, all rights of ownership of the forest vest with the respective district council which is a body, autonomous in character. The local people have the right to cultivate as much as can be managed by them, by paying a lease fee to the District Council.

7.5. The practice of jhuming has been regarded as unscientific and wasteful both by the Forest and Agricultural Departments; and attempts have been made in the past, without avail, to wean the tribal people away from it. One can certainly say that the past approaches to the problem were not based on enough of understanding of the environment of the tribal people, their adjustment to it, and the way of life that has evolved in this process. Lack of such understanding resulted in a condemnatory attitude and a blindness to the realities. Similar was also the experience in certain parts of Africa. Fortunately, the recent approach to the problem can be said to be marked by more of sympathy and realism.

Soil conservation problem in Mikir and North Cachar Hills

7.6. United Mikir and North Cachar Hills is the district where data have been collected, and observations for the purpose of this study conducted in six purposively selected villages covered by the conservation programme. One of these villages is from the North Cachar Hills, three from Mikir Hills and two from the Special Multi-purpose Tribal Blocks; and in each village ten or so respondents were interviewed with a view to knowing more particularly, the impact of the soil conservation programme.

7.7. Of the total area affected by jhuming in the district, the details about which are not available, 7,409 acres were covered by soil conservation measures by the end of the Second Plan. In the selected villages, soil conservation measures have covered 384.50 acres. The different programmes have been undertaken with the help of funds made available by the Ministry of Home Affairs, Government of India, for the development of tribal and backward areas.

7.8. The objective of soil conservation in this area is mainly to stabilise the pattern of living of the Mikirs by offering them a stable and accepted economic base. The main items undertaken under the programme are plantation of economic species like cashewnut, black pepper, rubber, coffee and lac and terracing of land where some source of perennial irrigation is available. The programme taken up in the multi-purpose tribal blocks include terracing, contour bunding and plantation of recommended commercial crops such as coffee, black pepper and cashewnut. The programme has a dual purpose. The economic and social benefits accruing from the cultivation of long term cash crops will, it is expected, help the Mikirs to give up

their migratory existence, as land planted with a long-term cash crop cannot so easily be given up after the initial labour. The income from these plantations is expected to be an adequate incentive for the farmers to stick to their holdings. As an indirect benefit of immense value, much of the abandoned 'Jhum' land will have a better utilization pattern than is given to it under the traditional practices

7.9. The Soil Conservation Wing of the Forest Department is providing funds to the cultivators for starting plantations on their newly jhumed land under a loan-*cum*-subsidy scheme. Fifty per cent of the total amount advanced to a cultivator during the first four years of plantation is treated as subsidy, and the remaining 50% as loan to be recovered in six yearly instalments, the first instalment starting from the fifth year of the plantation. The pattern of financial assistance under the tribal block programme provides for a 25% subsidy for terracing and 50% subsidy for terracing and contour bunding. Funds for the latter subsidy are provided by the Agriculture Department.

Planning and preparation for soil conservation measures

7.10. The planning, annual programming and determination of the coverage are decided upon by the Divisional Soil Conservation Officer and the District Agricultural Officer for the district. The Divisional Soil Conservation Officer is reported to be responsible for the departmental programme, the schemes, programmes, budgets etc. for which are, however, approved at the State level by the Soil Conservation Wing of the Forest Department. As for the block programme, the block extension officer is responsible for drawing up and implementing the scheme subject to the approval of the District Agricultural Officer. The technical aspect of the scheme, however, requires the approval of the Divisional Soil Conservation Officer.

7.11. It may be pointed out here, that generally no village as such is selected for soil conservation work; demonstration centres only are set up in selected parts of the district for the purpose of extension-education. The cultivators of the villages close to the demonstration centres are generally informed about the programme; and those who are willing to take it up on their own are considered for subsidy. As the measures are undertaken by the individuals, their consent is implied. Since it is mainly the plantation programme that is being recommended to the cultivators, the demonstration centres opened at various places are expected to serve the purpose of educating the cultivators. But it was observed that no attempt was being made to bring the cultivators to these centres. Group meetings in the selected villages had, however, been held in order to educate the cultivators about the nature, growth, yield, and income of, and the different operations on the plantations. It has been reported that the reaction of the cultivators has been favourable.

Role played by Special Multi-purpose Tribal Blocks

7.12. There are two SMPT blocks in the district. The measures taken up under the block programme are terracing, contour bunding and cultivation of recommended cash crops as plantation. It has,

however, been observed that not enough of attention is being paid by the blocks to the soil conservation work. In one of the selected villages, only two farmers have taken up terracing on an almost negligible area. Similarly, in another selected village, the block did not pay much attention to the planning, propagation and popularisation of the programme. On the contrary, the soil conservation department has definitely done something in the village.

Execution of soil conservation programme in the District

7.13. *Administrative agency and its set up.*—A district level functionery of the Soil Conservation Department is in-charge of the soil conservation work in the district. The district is divided into two ranges under the charge of rangers. Rangers are helped by the staff of the demonstration centres; and Forest Officers in charge of soil conservation programme, the demonstration units being placed at the bottom of the administrative structure in the district.

7.14. The soil conservation programme in the blocks is expected to be technically supervised by the Soil Conservation Officer. But in actual practice this supervision is not forthcoming. The extension officers (Soil Conservation) who are posted in the blocks are looking after the soil conservation programme in all respects. The programme in the villages is being carried out by the individual cultivators concerned, who take it up on their land. The department supervises the operation-wise activity in the fields of those who have taken up departmental assistance under the loan-*cum*-subsidy scheme. In short, there is very little of coordination between the departmental and block staff.

7.15. *Impact on employment.*—Though the data available are rather inadequate, an attempt has been made to assess the impact of the programme on employment and cropping pattern. In the selected villages the programme was taken up and executed by the cultivators themselves under the technical guidance of the Department. All the labour required for the plantation programme was available in the villages. Of the total labour employed for the execution of soil conservation measures, 'self or family' labour accounts for 92% in the selected villages of the SMPT block and about 89% in the other selected villages. Employment generated in the selected villages comes to 37 man-days per acre. It has also resulted in more intensive utilization of family labour than before. Thus the villagers have reaped the benefit of the employment generated.

7.16. *Change in the value of land.*—As already pointed out, land in Mikir and North Cachar Hills districts belong to the district councils, and the cultivators pay lease money for cultivation. There is no system of purchase or sale of land.

7.17. *Change in the cropping pattern.*—The soil conservation programme has brought about a significant change in the cropping pattern of sample cultivators. The data collected from the selected respondents in the SMPT block villages and other selected villages show that plantation of cashewnut accounts for a significant portion *i.e.*

18% and 48% respectively of the holding, as compared to practically nil before the measures. Some area (about 5%) has also come under black pepper and coffee in the villages other than SMPT ones. The area under paddy has gone down from about 86% to 75% in SMPT block villages and from 94% to 45% in other villages. Similarly, the area under til and cotton has also declined. Table 7.1 shows the change in cropping pattern, on the entire holding of the respondents and on that part of their holding on which soil conservation measures have been taken up.

TABLE 7.1

Cropping pattern of the selected respondents before and after soil conservation measures

(In percent to total cropped area)

Name of the crop	On entire holding				On soil conservation holding			
	Of respondents in SMPT villages		Of respondents in other sample villages		Of respondents in SMPT villages		Of respondents in other sample villages	
	Before soil conservation measures	1960-61	Before soil conservation measures	1960-61	Before soil conservation measures	1960-61	Before soil conservation measures	1960-61
1. Paddy . .	85·5	74·8	94·1	44·8	81·7	43·8	90·0	..
2. Til . .	10·9	3·0	1·5	1·0	18·3	..	1·4	..
3. Cotton . .	..	..	3·7	1·2	..	..	7·2	..
4. Orchard . .	3·6	4·0	0·7	..	..	..	1·4	..
5. Cashewnut .	..	18·2	..	48·0	..	56·2	..	90·7
6. Black-pepper .	..	..	..	2·5	..	..	..	4·6
7. Coffee . .	..	..	..	2·5	..	..	..	4·6

NOTE : There is no irrigated area in the Villages.

The change in the cropping pattern on that part of the holdings, of the respondents in 1960-61, on which soil conservation measures have been taken up is even more significant. The plantation of cash crops was started only after the soil conservation measures were taken ; and in 1960-61, about 56% of the area in SMPT block villages were under cashewnut and about 91% in other selected villages. The area under black-pepper and coffee was about 9% in other selected villages. In the SMPT villages it is yet not grown. The

area under paddy has also been reduced from about 82% and 90% in SMPT villages, and other villages to about 44% and zero% respectively. Til and cotton which formed about 9% in other selected villages have completely been replaced.

7.18. The programme of soil conservation in Mikir and North Cachar Hills districts, which was started rather recently, has already brought about some benefits to the cultivators. More employment has been created for the cultivators. It has also resulted in more intensive use of the family labour. Another very important benefit has been that a significant change in the cropping pattern has taken place which ultimately is likely to result in an appreciable increase in net return from the holdings of the cultivators concerned. The data collected from the selected villages reveal that the cultivators are readily taking up the plantation of crops like cashewnut, black-pepper and coffee. It is expected that after 4-5 years it will bring an economic benefit and enable them to have a better living, besides providing them with greater security as a result of stabilised and settled cultivation. Reduction of the area under shifting cultivation along with the plantation programme would also mean decrease in the extent of the soil erosion problem. The programme has, however, been inadequately coordinated between the tribal blocks and the Soil Conservation Wing of the Forest Department at all the levels. Supervision has also been poor. Whatever progress has been achieved may thus be said to be largely due to the acceptance of the programme by certain sections of the people.

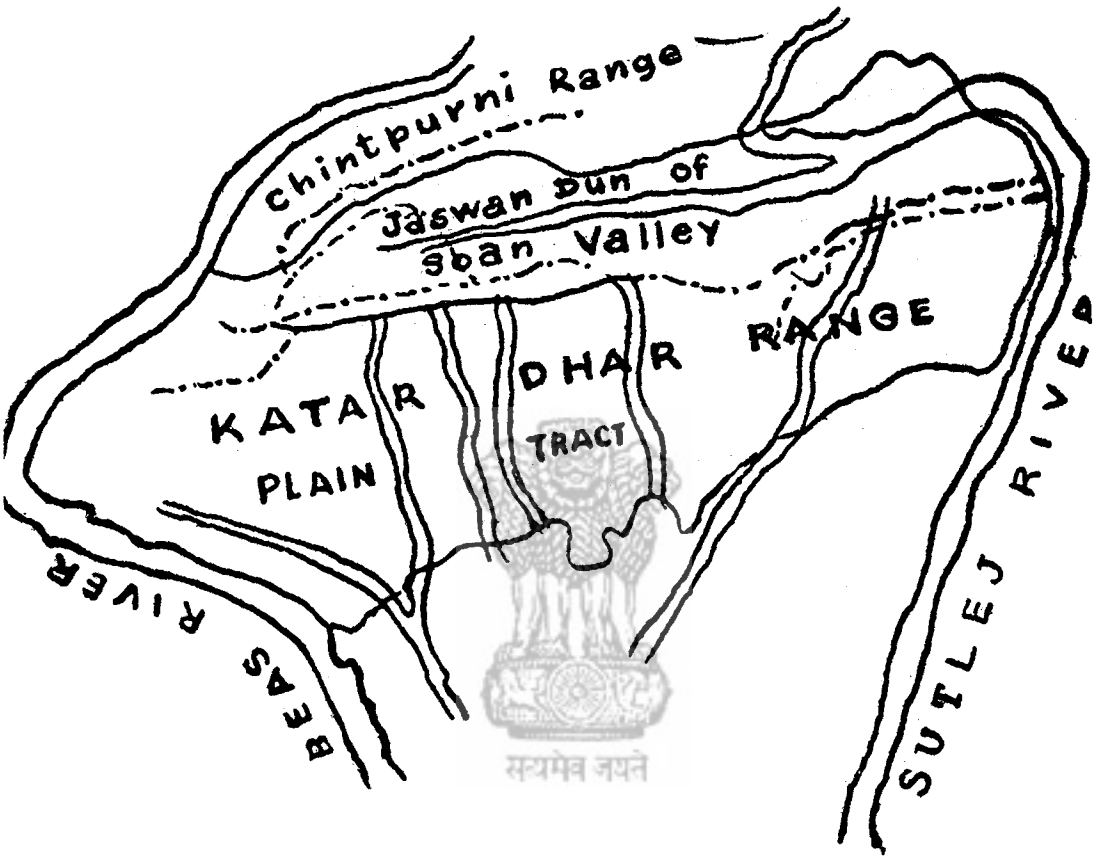
'Choe' Problem and Soil Conservation in Hoshiarpur District, Punjab

7.19. Different parts of the Punjab have different problems of erosion and conservation. The western and southern districts, like Rohtak, Hissar, Gurgaon, Ferozepur, Sangrur and Bhatinda, face the problem of moisture conservation. The western border of the State adjoining Rajasthan has areas which are affected also by wind erosion. Hilly districts, like Kangra, parts of Gurdaspur and Simla, face the menace of erosion caused by heavy rainfall on land with steep slopes. Parts of districts like Amritsar, Kapurthala, Sangrur and Karnal, suffer from excessive water-logging and salt efflorescence. In the districts of Hoshiarpur and Ambala, 'Choes' (hill torrentes) pose a grave problem. It has been estimated for the whole of Punjab that about 50 lakh acres are affected by water erosion and about 20 lakh acres by wind erosion, of which about 10 lakh acres are covered by active sand-dunes.

Features of Hoshiarpur District

7.20. Hoshiarpur district was selected for a study of the choe problem, in consultation with the State Government. Information about the soil conservation programme was collected at the district level, and from four villages—two from flood affected area and two from areas where the agriculture department had laid out demonstrations. Ten respondents were selected from each village for the purpose of this study.

7.21. Hoshiarpur district is situated in the northern part of the State. Its total area is 2,232 square miles, more or less equally divided among hills and plains. The district can be divided into four physical regions as shown in a map of the district given below:—



Map showing physical regions of Hoshiarpur District

(1) *The Plains Tract.*—An alluvial formation. Traversed by a large number of hill torrents known as choes.

(2) *Katar Dhar Range.*—It is formed of loose tertiary sand stone and conglomerates and is the main water-divide between the Plain Tract and Soan Valley.

(3) *Soan Valley or the Jaswan Dun.*—This is a formation similar to other Duns of Himalayas, as those of Dehra Dun. It is traversed by the drainage of the Soan river which carries the water of the innumerable ravines in the hills.

(4) *Chintpurni Range.*—This range forms almost the northern boundary of the district.

The average rain-fall in the district was about 37" in 1952-53 and about 47" in 1959-60 nearly 80 to 90 per cent of the annual precipitation occurs during the summer season, mostly in the months of July and August.

Cropping pattern of the District

7.22. Both Kharif and Rabi crops are important in the cropping of the district, the respective portions being about 48 and 52 per cent of the total cropped area in 1960-61. Table 7.2 gives the cropping pattern of the district for 1960-61:

TABLE 7.2

Cropping pattern in Hoshiarpur in 1960-61

Crop	Crop area in 1960-61 (hectares, acres in brackets)			
	Total	% of gross cropped area	Irrigated	% of total
(1)	(2)	(3)	(4)	(5)
Kharif				
1. Paddy	31,513 (77,870)	8·5	16,323 (40,336)	51·8
2. Maize	70,381 (1,73,915)	19·0	2,856 (7,056)	4·1
3. Sugarcane	18,407 (45,484)	5·0	2,271 (5,611)	12·3
4. Cotton	3,994 (9,870)	1·1	297 (734)	7·4
5. Fodder	28,003 (69,197)	7·6	72 (1,77)	0·3
6. Pulses	9,188 (22,705)	2·5	614 (1,516)	6·7
7. Others	17,530 (43,318)	4·7	54 (134)	0·3
TOTAL	1,79,016 (4,42,359)	48·4	22,487 (55,564)	12·6
Rabi				
1. Wheat	66,711 (1,64,847)	18·0	9,074 (22,423)	13·6
2. Wheat & Gram	91,605 (2,26,360)	24·8	12,066 (29,817)	13·2
3. Gram	7,788 (19,244)	2·1	1,245 (3,076)	16·0
4. Barley	805 (1,990)	0·2	30 (75)	3·8
5. Wheat & Barley	472 (1,167)	0·1	.. (..)	..
6. Fodder	20,743 (51,257)	5·6	8,394 (20,741)	40·5
7. Others	2,950 (7,290)	0·8	2,361 (5,835)	80·0
TOTAL	1,91,074 (4,72,155)	51·6	33,170 (81,967)	17·4
Gross cropped area	3,70,090 (9,14,514)	100·0	55,657 (1,37,531)	15·0
Net sown area	2,85,249 (7,04,864)		55,462 (1,37,049)	

7.23. Maize, paddy and sugarcane are the main kharif crops of the district, while wheat and *gochani* (*i.e.* wheat & gram mixed) are the important Rabi crops. Fodder also forms a significant portion of the cultivated area. Paddy and fodder are generally grown on irrigated lands while all other crops are grown mainly on unirrigated lands.

Choe menace in the district

7.24. The district is popularly known as the district of 'Choes' (fast flowing hill torrents). There are over 100 choes in the district and over 1,000 villages are affected by these choes. The choes start in the hills and make their way through the plains. They break up into a number of distributories as they come out from the foot of the hills. They continue depositing more and more detritus and debris in all directions during the rainy season. In the dry season the loose sand is weathered away by the wind and spread over adjacent cultivable lands. In this way, the area of culturable land under the grip of choe menace increases from year to year. Table 7.3 illustrates this point rather well.

TABLE 7.3

Area under choes

Year	Area (in hectares, acres in brackets)
1852	19,508 (48,206)
1884	32,298 (80,057)
1895-96	38,172 (94,326)
1914	40,043 (98,948)
1927	40,873 (1,01,000)
1936	60,703 (1,50,000)
1952	1,71,350 (4,23,415)

It is apparent from the above figures that the area under choes has increased progressively over the years. Between 1914 and 1952, it increased by 300% or by 3.24 lakh acres.

7.25. The havoc caused by these choes are collosal. They are a lurking menace to the prosperity of the region. Over 4 lakh acres or over 40% of the culturable area of the district is under choes. Reclamation of this area would result in a substantial increase in agricultural production. It would also add to the land revenue income of the State Government.

Measures adopted in the past

7.26. The control of the choes of the Sub-Shiwalik range is an age-old problem. For the last century or so, it has been discussed in various conferences and committees; but no suitable and effective remedial measures had been taken till recently. The only measure adopted earlier to control this menace was plantation of trees in the watershed. A Choe Act was passed by the Secretary of State in 1900. This Act provided for the plantation of trees, preservation of forest already existing and restriction on grazing. Even though the Act has been in force for the last sixty years or so, it has not been effective in stopping devastation from spreading to very large areas. While the measures recommended undoubtedly help for soil conservation, the erosion problem in Hoshiarpur is so vast in magnitude that these alone have not yielded the desired results.

7.27. *Remedial measures.*—Each choe is a force by itself and has to be investigated individually if effective measures for its control are to be devised. A treatment suitable for one choe may not be equally applicable to another. The first essential step is, therefore, a detailed survey of the region covered by a choe. Some of the following remedial measures, if adopted in varying combinations according to different situations, are likely to yield effective results:—

(i) Construction of dams and detention basins.

(ii) Training of the choes and khads as they emerge from the hills and start meandering in the plains before they fall into the main drain.

(iii) Grouping together at the foot of the hills, wherever possible of the different choes by effecting diversions in their course. The combined discharge will dig out a channel for itself and transport the sediments down stream where they join with the large drain.

(iv) Reclaiming systematically the lands under choes which have been lost to cultivation.

(v) Soil conservation measures like progressive plantation and afforestation.

7.28. *Training of Nasrala choe.*—Nasrala choe was causing a great damage to fertile agricultural lands along its course. The gravity of the manace was realized when the choe water also affected the railway embankment and the Adampore aerodrome. A choe training programme was then taken up by the Irrigation Department under the control of the Director, Land Reclamation, Irrigation and Power Research Institute at Amritsar.

7.29. *Survey work.*—Two types of surveys, plane-table and contour, were carried out by the research staff of the Institute in 1954-55. The position of the river etc. with respect to its surroundings and the slope of the area were mapped out with the help of these surveys; and the training programme for the Nasrala choe was planned.

7.30. *Execution of the programme.*—The programme was executed by the Executive Engineer (choe) under the guidance of the Director, Land Reclamation, Irrigation and Power Research Institute. His

engineering staff got the work executed at site. The programme was started in 1954-55 and its first phase completed in 1955-56 on an experimental basis. Under this scheme, a 23-mile long bund was constructed (on both sides of the choe). The cost of the work was shared by the Defence Department, the Railways and the Punjab Government in the ratio of 2:1:1 respectively. The entire task of construction was entrusted to the S.D.O. Nasrala choe subdivision of Hoshiarpur, who has regular staff under him.

7.31. *Impact of the programme.*—It is reported that the Nasrala choe training programme has helped in checking recurrent floods on about 27,000 acres of land, 5,000 acres in Hoshiarpur District and 22,000 acres in Jullundur district. Encouraged by this programme, the Irrigation Department has planned some other projects to be executed in the Third Plan for checking the menace of floods in the District.

7.32. *Reclamation and improvement work on agricultural land.*—With the checking of the recurrent floods, the cultivators took the initiative to reclaim and improve the land, which had been rendered unfit for cultivation. They used their local implements and other resources. In one of the two selected villages, Fatehgarh Niara, the cultivators have reclaimed or developed 55% of the affected area. In the other village, Khilwana which is severely affected by sand, the villagers have reclaimed about 12% of the affected area. All this has been achieved through the efforts of the cultivators themselves without any help from the Government. In one of the villages, it was observed that the village leaders had requested the Government authorities for the loan of a tractor or other such implement for reclamation and improvement work. No tractor could, however, be made available to the people of the village by the Government.

7.33. *Impact on yield.*—The average yield per acre has generally increased because of this reclamation and improvement work on agricultural lands. Of the 20 respondents contacted, 80% reported increase in yield, and the other 20% reported no such increase. It was, however, observed that the yield on the reclaimed land was still lower, compared to that of other cultivated land. From the data collected from the selected respondents it appeared that the average yield of wheat-gram, an important crop mixture in the area, on about 17% of the holdings was about 1,150 lbs. per acre, while none of the newly reclaimed lands had yet attained this level of yield, their yield ranging from 100 to 900 lbs. per acre. It was probably due to the fact that the individual measures were not sufficient for the huge task of reclaiming the land. It is true that with a few more years of development, the reclaimed lands will reach a higher level of productivity. Probably, the task of reclamation could have been tackled better if the individual efforts of the cultivators were supplemented by Governmental help in the matter of equipment and machinery. In any case, the newly reclaimed land has added to the overall agricultural production of the project area.

7.34. *Value of land.*—The average value of all lands has gone up as a result of this choe training programme. This view was confirmed by the selected respondents who were contacted for this purpose. Eighty-five per cent of the respondents reported an increase in the value of land per acre, while the remaining 15% replied that

it was constant. The extent of rise in the value of land has generally been reported as about 50%. This also shows in a way that the cultivators have benefited from the programme.

7.35. *Impact on cropping pattern.*—The cropping pattern has also undergone a change to some extent. The newly reclaimed land has generally been put under fodder crops like bajra/jowar. The land which had earlier been under the plough but improved after the choe training programme has either been put to superior or more value-intensive crops like sugarcane, wheat+gram etc. or double cropped. This is confirmed by the information obtained from the 20 selected respondents in the two villages. The data on the cropping pattern followed by these respondents before the choe training programme and in 1961-62 are given in Table 7.4.

TABLE 7.4

Cropping pattern of the respondents in two villages before and after the choe training programme

(Area in hectares, acres in bracket)

Village	No. of selected respondents	Area under different crops before & after choe training programme							
		Maize		Wheat+Gram		Sugarcane		Fodder (Bajra/Jowar)	
		Before the programme	1961-62	Before the programme	1961-62	Before the programme	1961-62	Before the programme	1961-62
1. Khilwana	10	11·3 (28·0)	9·2 (22·8)	18·6 (46·0)	18·8 (46·4)	4·0 (10·0)	8·3 (20·4)	14·4 (35·7)	11·5 (28·4)
2. Fatehgarh Niara	10	10·2 (25·2)	11·8 (29·2)	24·4 (60·3)	26·0 (64·3)	4·9 (12·0)	7·6 (18·9)	15·0 (37·0)	18·6 (46·0)
Total	20	21·5 (53·2)	21·0 (52·0)	43·0 (106·3)	44·8 (110·7)	8·9 (22·0)	15·9 (39·3)	29·4 (72·7)	30·1 (74·4)
Index of change		100	98	100	104	100	179	100	102

The data in Table 7.4 show that the area under superior crops, especially sugarcane, has gone up by 79% in 1961-62 as compared to the period before the choe training programme. The area under fodder crops is more or less the same; this is perhaps due to the fact that a part of the newly reclaimed land had been put under fodder whereas a part of the earlier fodder area has been sown with the superior crops after carrying out improvement on such land, which was induced by the training of the choe. This shift along with the increase in yield per acre indicates that the cultivators of the area are getting a higher net return from their holdings. To the extent this is so, the general level of income and living of the cultivators has gone up.

7.36. *Soil Conservation Demonstration projects in Hoshiarpur district.*—The Agriculture Department has started the soil conservation programme on agricultural lands only recently, in 1961-62. So far only a few demonstration projects have been set up. Hoshiarpur is one of the districts where such demonstrations have been set up. There are at present three demonstration projects in the district. All these have been started on private lands under a scheme of two years' duration. The entire cost of the demonstration work is to be borne by the Government. The cultivators are expected to maintain the soil conservation mechanical measures and treatments executed by the Department and to adopt the recommended conservation farming practices. The three demonstration projects cover an area of 2,200 acres. Upto the end of 1961, graded bunds have been constructed to cover an area of 624 acres.

7.37. Before taking up the soil conservation works the consent of the cultivators on whose lands these are to be carried out is obtained. In one of the two selected villages, Behdala, the cultivators were found to have resisted the programme in the beginning. They apprehended that the Government might ultimately acquire the land and render them homeless, as they had already witnessed the acquisition proceedings in the Nangal project area. The soil conservation staff arranged meetings and explained to them the importance and the need for soil conservation measures. The Panchayat and the service cooperative society also took some part in persuading the cultivators to accept the programme. As a result, an agreement was signed by almost all the cultivators.

Sonarpur—Arapanch Drainage Scheme No. 1 in 24-Parganas, West Bengal

7.38. *Selection of the project for study.*—The Sonarpur—Arapanch Drainage Scheme in the district of 24-Parganas was taken up for study, at the instance of the Development Commissioner West Bengal, in the early part of 1962. Background data about the working of the project etc. were collected from concerned officers at the district level. Four villages were purposively selected from the project area, in consultation with the officers of the Agriculture and the Irrigation Departments, for purposes of field investigation. These four villages were located at different levels of the slope of the drainage region. In each village 10 respondents were selected for obtaining data at the household level.

7.39. The Sonarpur—Arapanch—Malta Drainage basin covers an area of about 108 square miles. The basin is situated to the south of the river Bidyadhari. The Bidyadhari and its tributary the Peali had created a rich alluvial basin by depositing silt year after year. Attracted by the fertility of the soil, the inhabitants of the area interfered with the natural course of the river by putting bunds along the banks of the river in a concerted effort. As a result, the silt-laden tidal river was confined to a restricted course and it deposited the silt on its bed. In the process, river bed got raised above the level of the surrounding area, eventually converting the whole basin into a vast sheet of water-logged area.

7.40. As a result of water-logging of the whole area for about a decade, the economy of the entire basin was almost shattered; and many families living in these villages were dislodged. Farming was not possible over most of the area. Fishing and Bidi-making were the only means of livelihood left open; and the income from these was meagre. Most of the agricultural labour families and the petty cultivators migrated to other areas not affected or relatively less affected by water-logging. A few persons migrated to urban or industrial places like Calcutta and Canning to work as unskilled labourers or to take up petty trades. It was common practice for heads of families and other able-bodied persons to leave villages in search of employment, while their dependants stayed behind.

Planning and execution of the Drainage Scheme

7.41. The scheme was prepared and recommended for execution by the Greater Calcutta 'Master Plan' Technical Committee. In order to give impetus to the intensive food production scheme, the Drainage project was recommended on a priority basis. Financial sanction was obtained from the Government of India in May, 1951 and the work on the execution of the project began towards the end of the same year.

7.42. In order to find out the extent and dimensions of the water-logging problem, a pre-survey had been conducted a year before the commencement of the work on the project. The project was planned entirely at the initiative of the State Government as a measure of relief to the inhabitant of the area whose economic condition had been deteriorated immensely during the preceding two decades. The Sonarpur—Arapanch Drainage scheme was divided into two separate parts for the purpose of execution. They are:—

Part I.—Covering an area of 57 sq. miles to the west of the river Peali, and

Part II—Covering an area of 51 sq. miles to the east of the Peali.

The work on part I of the scheme was initiated in 1951 and completed in 1956. Our inquiry was confined to this scheme.

Salient features of the selected project

7.43. Some of the salient features of the Sonarpur—Arapanch drainage scheme (Part I) are given below :—

(i) The basin of the scheme (Part I) covers areas of Sonarpur and Baruipur Police Stations in the district of 24-Parganas.

(ii) An area of 36½ sq. miles or 23,360 acres out of the geographical area of 57 sq. miles of the basin was covered by the drainage scheme.

(iii) A drainage canal and branch channels of 9 and 18 miles length respectively were constructed.

(iv) Drainage by ordinary gravitational method having been found not feasible, the problem had been solved by pumping, the effluent being discharged into the Peali.

(v) A pumping station was erected at Utterbagh on the bank of the river Peali for the purpose of drainage operations.

(vi) The project was executed with financial assistance from the Government of India.

Financial aspects of the project

7.44. The cost of the scheme was originally estimated as Rs. 44 lakhs approximately; and this estimate had to be revised subsequently in 1953 to a little over Rs. 55 lakhs. The whole scheme was executed with financial assistance from Government of India, ¼th of which was grant and the rest loan to be repaid in 15 equated annual instalments carrying simple interest at 3⅜% per annum.

7.45. As far as engineering or mechanical drainage measures are concerned, the entire cost was met by the Government; and the people of the area did not contribute in any form. The per-acre cost of the scheme, according to the project reports, worked out to Rs. 221. However, as far as follow-up measures of reclamation, such as de-weeding of the wide-spread water weed 'Hogla' etc. are concerned, the responsibility rests with the beneficiaries. The per-acre cost of these operations varied between Rs. 20 and Rs. 30, in the four villages studied.

Executing agency and the operational details of the scheme

7.46. The Irrigation and Waterways Department of the West Bengal Government was incharge of operation of the scheme. The Department of Agriculture was, however, informally associated with the operation of the scheme, as it was eventually the job of the latter to push through the programme of reclamation which closely followed the drainage measures.

7.47. Though work on the Project commenced in December, 1951, the four giant pumps were actually commissioned to operation only in May, 1953. The entire work was completed in the year 1956 at a total cost of Rs. 55·30 lakhs. A net-work of channels drew the water from the low pockets and fed the Pumping Stations through a main canal. The whole mass of water was lifted by four giant pumps having an aggregate capacity of 3,75,000 gallons per minute, to a height of 15 feet and discharged over the silted bed of the river Peali.

Overall achievement of Drainage Scheme and its impact on the economy of the area

7.48. A total of 13,731 families in 89 villages spread over Baruipur and Sonarpur P. S. of 24-Parganas benefited from the Sonarpur-Arapanch Drainage Scheme No. 1. According to the reports of the Agriculture Department, an area of 11,000 acres was reclaimed and brought under cultivation during the first year of operation of the scheme *i.e.* in 1953-54. In all, 24,960 acres have so far been reclaimed and put under cultivation.

7.49. While village Petua and Purshottampur are medium-sized villages, South Garia is the biggest of the four selected for this study, the smallest being village Atghora. The occupational distribution of the households in the four selected villages is given in Table 7·5.

TABLE 7.5

Occupational distribution of households in selected villages in 1960-61

Occupations	No. of households in				
	South Garia	Petua	Purushot-tampur	Atghora	All Villages
All occupations	600	199	131	50	980
(*a*) Mainly owner cultivators . (%age to the total households).	150 (25)	50 (25.1)	56 (42.7)	5 (10.0)	261 (26.6)
(*b*) Mainly tenant cultivators . (%age to the total households).	100 (16.7)	70 (35.2)	22 (16.8)	9 (18.0)	201 (20.5)
(*c*) Agricultural labourers . (%age to the total households).	50 (8.3)	30 (15.1)	42 (32.1)	17 (34.0)	139 (14.2)
(*d*) Non-cultivating land owners. (%age to the total households).	20 (3.3)	Nil (..)	1 (0.8)	2 (4.0)	23 (2.3)
(*e*) Non-agricultural labourers . (%age to the total households).	280 (46.7)	49 (24.6)	10 (7.6)	17 (34.0)	356 (36.3)

It may be observed from Table 7.5 that the owner-cultivators account for the highest proportion of the households in Purushottampur where the proportion of agricultural labour households is also very high. In the other villages, labour households account for the largest proportion of the households.

7.50. *Proportion of area under cultivation and Drainage Scheme in the various villages in* 1960-61.—Of the total geographical area of 1310.71 acres in the four selected villages, 82.4% is under cultivation while the proportion of total area covered by drainage is 74%. Of the total area brought under the drainage scheme, 94.8% have been reclaimed and brought under cultivation. There are 303 owners of land in the selected villages who were affected by the water-logging problem. The area affected was 954.6 acres. The drainage scheme covers the entire area.

7.51. *Size and other particulars of the holdings of the respondents,* 1960-61.—The total area of the operational holdings of the 40 respondents is 237.1 acres, while their owned holdings add up to 212:7 acres, 85% of the total net holdings being cultivated. The major portion of the cultivation holdings or 53·9% are inside the villages. Nearly 107 acres of the holdings of the respondents were affected by water-logging. Of this, 90.8% have already been covered by the drainage measures. The proportion of area requiring drainage measures varies from 82.5% to 99.7% in the villages. Nearly 80% of respondents hold less than five acres within the village. Only 10% have holdings larger than 10 acres inside the villages. Average holding inside the villages comes to 3.6 acres only.

Impact of the Project on the people

7.52. *Change in cultivated, gross cropped area and the cropping pattern in the selected villages.*—As a result of the execution of the drainage project, most of the water-logged part of the holdings was reclaimed. This reclamation meant extension of the area under cultivation. Some of these details are given in Table 7.6.

TABLE 7.6

Cropping pattern of selected villages before drainage and in 1960-61

(Area in hectares, acres in brackets)

Village	Before drainage (i.e. 1952-53)					During 1960-61				
	Kharif	Rabi		Net sown area	Gross cropped area	Kharif	Rabi		Net sown area	Gross cropped area
	Paddy	Vegetables	Pulses			Paddy	Pulses	Vegetables		
Purushottampur	12.1 (30.0)	3.2 (8.0)*	.. ..	15.4 (38.0)	15.4 (38.0)	117.8 (291.2)	2.0 (5.0)	8.1 (20.0)*	125.9 (311.2)	128.0 (316.2)
Atghora . .	6.0 (14.9)	.. ..	.. ..	6.0 (14.9)	6.0 (14.9)	46.9 (115.8)	16.2 (40.0)	.. ..	46.9 (115.8)	63.0 (155.8)
South Garia †	24.3 (60.0)	.. ..	.. ..	24.3 (60.0)	24.3 (60.0)	149.9 (370.4)	4.0 (10.0)	.. ..	149.9 (370.4)	153.9 (380.4)
Petua . .	.. ..	.. ..	.. ..	.. ..	.. ..	96.0 (237.33)	3.2 (8.0)	.. ..	96.0 (237.3)	99.3 (245.3)
Total (4 villages)	42.4 (104.9)	3.2 (8.0)	.. ..	45.7 (112.9)	45.7 (112.9)	410.6 (1014.7)	25.4 (63.0)	8.1 (20.0)	418.7 (1034.7)	444.2 (1097.7)
Index of change .	100	100	..	100	100	967.3	..	250.0	916.5	972.3

*Vegetables are grown on irrigated area.

†1953--54 is the year before drainage for the village South Garia but the ditails of cropping pattern are provided for the year 1952—53.

Table 7.6 reveals that the gross cropped area has increased more than nine times from 112·9 acres in 1952-53 to 1097·7 acres in 1960-61. Similarly, the net sown area has increased over nine-fold from 112.9 acres in 1952-53 to 1034·7 acres in 1960-61. In other words, an additional area of 921·8 acres has been put under cultivation after reclamation.

7.53. Paddy is by far the most important crop of the area with 1014.7 acres under it in 1960-61 compared with only 104.9 acres in 1952-53. No pulses were grown before the project period while in 1960-61, 63 acres have been put under pulses. The only irrigated crop is vegetables. The area under vegetables has risen from eight acres in the earlier period to 20 acres in 1960-61.

Change in cultivated, gross cropped area and the cropping pattern on the holdings of selected cultivators

7.54. All the respondents had a net sown area of only 33·2 acres of land, within the selected villages, before drainage. The net sown area increased three-fold to 107 acres in 1960-61. Similarly, the gross cropped area are increased from 39.7 acres to 123·9 acres. Thus gross cropped area has increased by about 212%. For the part of holding of respondents, covered by drainage, the increase in the gross cropped area from the period before drainage to 1960-61 is even higher being 371·9%. Details about the cropping pattern in the two time periods are given in Table 7·7.

TABLE 7.7

Cropping pattern of part of holdings of respondents, covered under drainage, before the scheme and in 1960-61

(Area in hectares, acres in brackets)

Village	Before drainage*				During 1960-61			
	Paddy	Pulses	Net sown area	Gross cropped area	Paddy	Pulses	Net sown area	Gross cropped area
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Purushottampur	2.1 (5.25)	..	2.1 (5.25)	2.1 (5.25)	5.5 (13.72)	0.1 (0.21)	5.5 (13.72)	5.6 (13.93)
Atghora	5.5 (13.49)	..	5.5 (13.49)	5.5 (13.49)	7.5 (18.50)	2.0 (4.92)	7.5 (18.50)	9.5 (23.42)
Petua	..	..	..	..	10.1 (24.96)	0.2 (0.41)	10.1 (24.96)	10.3 (25 37)
South Garia	1.5 (3.66)	..	1.5 (3.66)	1.5 (3.66)	15.9 (39.41)	1.5 (3.58)	15.9 (39.41)	17.4 (42.99)
Total	9.1 (22.40)	..	9.1 (22.40)	9.1 (22.40)	39.0 (96.59)	3.8 (9.12)	39.0 (96.59)	42.8 (105.71)
Index of change	100	..	100	100	431.2	..	431.2	471.9

*1953-54 is the year before drainage for village South Garia and 1959-60 is the year before for the other villages.

7.55. The net sown area has increased more than four-fold from 22.4 acres to 96.6 acres between the two time periods. Paddy is the main crop and the entire net sown area was put under this crop in 1952-53 and in 1960-61, during the kharif season. There was no area under pulses before the drainage, while 9.1 acres were sown with various pulses like khesari and masur in 1960-61.

Adoption of improved Agricultural practices

7.56. Most of the cultivators in the scheme area are still adopting traditional agricultural practices. Table 7.8 gives a picture of the position regarding adoption of improved practices by the respondents in 1960-61.

TABLE 7.8

No. of respondents adopting improved agricultural practices in 1960-61

Improved agricultural practices	Total no. of respondents	No. adopting the practice	%age of respondents adopting
(1)	(2)	(3)	(4)
1. Improved seed (paddy)	40	16	40.0
2. Japanese method of paddy cultivation	40	3	7.5
3. Chemical fertilisers	40	8	20.0
4. Green manure	40	2	5.0
5. Compost manure	40	4	10.0

The most popular improved practice appears to be the use of improved seed which has been adopted by 40% of the respondents. It is followed by use of fertilizers by 20% of the respondents. The other practices have been adopted only by a few respondents, composting by 10%, Japanese method by 7.5% and green manuring by 5%.

Impact on yield of paddy

7.57. It is only the relatively high lands in the area, where a small crop of paddy could be grown when the area was lying waterlogged. The lower areas could not be cropped at all. On the former category of lands, the yield of paddy was very low. The yield per acre of paddy has gone up significantly after the execution of the drainage programme. Of the 39 respondents growing paddy in 1960-61; 14 were also growing it before the scheme. It is the yield per acre of these 14 respondents, that has been compared. Table 7.9 gives the distribution of these respondents, according to various ranges of yield per acre, for the year before the scheme, one year after completion of the scheme and in 1960-61.

TABLE 7.9

Distribution of respondents according to various yield ranges per acre—paddy, at different times

Yield range per acre (Mds.)	No. of respondents reporting various yield ranges		
	In the year before drainage	In the first year after drainage	In 1960-61
(1)	(2)	(3)	(4)
2— 5	9 (64%)	..	..
5—10	5 (36%)	1 (7%)	1 (7%)
10—15	..	..	1 (7%)
15—20	..	8 (57%)	11 (79%)
20—25	..	5 (36%)	1 (7%)
No. of respondents	14	14	14
Average yield (Mds.)	3.7	17.4	15.6
Index of change	100	470.3	421.6

7.58. Table 7.9 shows that all the 14 respondents reported an yield level below 10 mds. per acre in the year before drainage scheme; and 64% reported yields even less than five mds. One year after the drainage scheme, 93% of the respondents obtained a yield per acre of 15 mds. or more; and 36% reported that they had obtained an yield per acre between 20-25 mds. It appears that the impact of the programme was immediate and tremendous in magnitude. However, in 1960-61, only 7% of the respondents obtained yields of 20-25 mds. per acre and 14% obtained less than 15 mds. The yield per acre which increased nearly five-fold the year after the drainage scheme, gradually decreased in 1960-61. The average yield per acre for these 14 respondents was 3.7 mds. originally; it jumped upto 17.4 mds. per acre year after the scheme and then came down somewhat to 15.6 mds. per acre in 1960-61. The same trend is also noticeable in the case of all the 39 respondents. The average yield in their case for the year after works out to 16.3 mds. per acre; while it decreased to 15.3 mds. per acre in 1960-61. This decrease in yield is perhaps due mainly to the spread of the wild weed called 'Jhangi' in paddy fields. It may also be due to some extent to a gradual deterioration in the capacity of the land to produce, in the absence of intensive use of fertilizers and farm yard manure. In other words, the cultivators of the area have failed to maintain the fertility of the land which has been reclaimed. The extension staff of the Agriculture department may also not have played their part well, in educating the cultivators in improved techniques of cultivation and providing them with the necessary facilities for taking up improved practices.

Impact of drainage in land values

7.59. As a result of the drainage scheme, agriculture became more stabilised, the element of uncertainty was reduced, and the yield from land also went up considerably. As a result of these factors, the value of land in the area increased 5 to 6 times. The respondents were asked to report the value of land per acre for the period before the drainage and the land value as in 1960-61. For the period before drainage, 85% of the respondents reported the value of land per acre as Rs. 300 or less. Only one respondent reported a value per acre higher than Rs. 500. For 1960-61, a large proportion or 60% have given the price of land as between Rs. 1001 and Rs. 1400 per acre. A significant proportion, or 40% reported the land value higher than Rs. 1400 per acre. The average value per acre of land for the period before drainage works out to Rs. 266, as compared to Rs. 1393 for 1960-61, thus showing an increase of 424% over this period.

Land management and changes in the ownership of land

7.60. There has been no marked change in the management pattern of land which is generally cultivated by the owners. An attempt was made by the State Government in 1954-55 to start a cooperative farm which was to be managed by the Department of Agriculture. But due to lack of cooperation from the farmers of the area whose lands were acquired, and perhaps also due to inefficient management, the experiment in cooperative farming did not succeed and the land was eventually returned to the owners for cultivation.

7.61. There has not been any marked change in the ownership of land. Only 20 persons were involved in sale transactions involving 37.6 acres of land, after the completion of the drainage project. The area under transactions formed only about 3.9% of the area reclaimed after drainage. Of the area under sale transactions, 3.3 acres were sold by six respondents for a total value of Rs. 2,600 mainly to other cultivators. The per acre value of land sold by respondents comes to Rs. 808. Nine respondents purchased an area of 10.5 acres at a total cost of Rs. 9,932·50. The per-acre cost of land purchased by these respondents is about Rs. 949. For all transactions, of sale and purchase, the value per acre comes to Rs. 933.

Improvement of transport and communication facilities in the post-drainage period

7.62. With the execution of the Sonarpur-Arapanch Drainage Scheme, a marked improvement has taken place in transport and communication facilities. A number of approach or link roads were constructed linking villages with nearest fair-weather roads and rail heads. These improvements have almost completely replaced the use of 'Donga' or country boat which was the chief means of transport before drainage period. Consequent upon these developments, the movement of people and consumer goods inside the scheme area and the neighbouring area has greatly increased, bringing in its wake its impact on customs, habits and the way of life. Some of the important towns which have now been made easily accessible to many villages within the scheme area are Baruipur, Sonarpur, Canning and Calcutta.

7.63. The four selected villages have also had their share in the development of transport facilities. A kutcha road of one mile connecting village Petua with Subhasgram Railway Station has been constructed. This facilitates travel by inhabitants of Petua either to Calcutta or Baruipur from Subhasgram. A kutcha road which had fallen into disuse in the pre-drainage period had since been metalled. This has greatly facilitated the movement from village Atghora to Champati and Baruipur Railway Stations. The village South Garia has benefited from a new metalled road of about one mile length connecting Champati Railway station which is on the Calcutta—Canning line. The people of village Purushottampur have, through their voluntary effort, repaired the existing kutcha road of about one mile length. This road is linked to a metalled road leading to some important towns. Thus all the selected villages have been provided with a road connecting the nearest rail head or all-weather road where bus or rail transport is available. This general improvement in transport facilities has helped and is likely to help further the development of the area covered by the Sonarpur-Arapanch project.

Marketable surplus as reported by Respondents

7.64. Details of marketable surplus are not available for 1952-53, the year before the drainage project. However, from the meagre area under cultivation in that year and the reported low yields, it can be safely presumed that no marketable surplus existed for any of the crops produced. For the year 1960-61, marketable surplus has

been reported by the respondents mainly in respect of paddy, vegetables and fruits. A total of 10 respondents (or 25% of respondents), had 210 mds. of surplus paddy for disposal which was marketed during the year 1961. This works out to 13.3 per cent of the output in 1960-61. Of the total marketable surplus in the selected villages 45% are reported to come from the village South Garia alone. About 140 mds. of various kinds of vegetables were disposed of by 12 respondents from the two villages, Atghora and Purshottampur in the year 1960-61; another respondent having sold vegetables worth Rs. 1700. As far as fruit is concerned, 14000 bananas were sold by 6 respondents; one person sold bananas worth Rs. 500. Of these seven respondents, two also marketed Guava worth Rs. 800.

Impact of drainage on employment

7.65. After the execution of scheme, as we have seen earlier, almost the whole of the area affected previously by water-logging was reclaimed and put under cultivation. This has resulted in the creation of increased employment opportunities in agriculture in the area. Most of the persons who had migrated earlier returned to the area. Fishing and Bidi making which had become a full time job, during the period when the area was badly affected by water-logging, became a subsidiary occupation for a significant number of labourers in the post-drainage period. It appears that almost all the classes of people in the area have benefited in terms of increased employment after the execution of the drainage project. However, the actual extent of the benfit is not known.

Some Post-drainage problems of selected villages

7.66. Villages Petua and South Garia which are situated on the lower slopes of the basin, are adversely affected, particularly during the rainy season, by the ingress of water from higher areas. Village Petua has to cope with the danger of water pressure not only from breaches in the canal embankment near the village, but also accumulation of the rain water flowing under the railway bridges. Agravating this problem further, a by channel meant for discharging surplus water of this village usually gets silted up. This needs to be re-excavated, if the village is to be relieved of the problem of water-logging. In village South Garia, about 60 acres or 20% of the drained area still get water-logged. During the years of heavy rainfall like 1959, either the crops are not harvested at all or the yield is very low.

7.67. Absence of field bunds with adequate arrangements to retain sufficient quantity of water for the growth of crops is reported as a major problem by the majority of the respondents. While fishing is a source of income to some families, it has become a curse to a number of cultivators. Fishermen often let out water from the fields to enable them to fish easily. They also fix their nets in the canal, thereby obstructing the free flow of water which puts additional pressure on canal embankments.

7.68. On the other hand, the village Purushottampur is badly affected by the excessive draining out of water. This being a high level area, the fields go dry when the pumps are operated. The same problem is felt in village Atghora to a lessor extent.

7.69. To overcome some of the important problems of the post-drainage period, the respondents have given the following suggestions:

(1) provision of Hume-pipes at suitable places and control arrangements to let in or let out water when needed;

(2) Construction of high ring bunds with control arrangements to check the ingress of outside water;

(3) Periodic excavation of canal and by-channels, and carrying out repairs at proper time ;

(4) Arrangements to check the irresponsible and indiscriminate methods used by fishermen to catch fish.

A General Evaluation of the Drainage Scheme

7.70. The Sonarpur-Arapanch Drainage scheme has reportedly benefited 13,731 families in 89 villages where a water-logged area of 24,960 acres has been drained and reclaimed. The people of these villages, particularly the owners and cultivators of land, have benefited tremendously from the execution of this scheme. It has resulted in a net addition to the area under cultivation which has increased about ten times. The area under paddy has increased to about the same extent. The income from the area previously water-logged has increased considerably, and the increase has been higher in respect of the low-lying lands on which cropping could not be attempted before. And lands on the border-line of submergence were yielding an output of paddy of only 3·7 mds. per acre. The average yield has gone up four-and-a-half times as a result of reclamation. There is also a phenominal rise in the price of land which indicates the substantial improvement that has taken place in the net income and general living conditions of the cultivators of the scheme area.

7.71. There are, however, a few other aspects of the scheme that need some examination. The scheme was taken up as a part of the bigger project for improving drainage in the Calcutta city. It has been executed departmentally and the beneficiary cultivators contributed neither in cash nor in labour. The entire capital cost of the project has been met by the State Government out of a Central loan. Similarly, the maintenance and operation expenses are also being borne fully by the Government. No betterment levy nor any other taxes like increase in land revenue have been imposed on the beneficiaries. Execution of the drainage scheme and the resultant increase in productivity and value of land has come as a windfall to landowners. Labourers and other sections of the population have also benefited to some extent from the greater employment and occupational opportunities opened up; but they have not shared in the windfall gain through capital appreciation. Lastly, all of this gain has been passed on to individuals, as the attempt to form cooperative was given up after the initial year or two. If such schemes are to be undertaken on a large-scale, the State Government will hardly be able to finance them unless betterment levies and/or annual drainage charges are imposed on the beneficiaries.

7.72. The whole scheme has been looked after by the Irrigation and Waterways Department of the State Government. The other development departments were not connected with the scheme in any way. The Agriculture Department and the Community Development blocks did not organise any special drive to educate the cultivators to take up improved agricultural practices. The neglect of the scheme area by these development departments may have resulted in the lowering of the yield per acre in 1960-61 compared with the yield in the initial year after drainage. If these figures give any indication of a trend, it may be said that the per acre yield could have been kept up if not improved with the judicious use of fertilizers, green manure and farm yard manure. These are aspects that may be looked into by the concerned agencies of the State Government.

7.73. Since under the Third Plan, the West Bengal Government propose to take up a large-sized drainage programme, the return aspects of the programmes need to be looked into in the light of the lessons learnt from the Sonarpur-Arapanch scheme. An attempt has been made in Table 7.10 to analyse the direct cost and benefit aspects of the scheme.

TABLE 7.10

Estimates of Direct Cost—benefit ratio for Sonarpur—Arapanch Drainage Scheme No. 1

Items	Value or ratio (Rs.)
Capital cost and gain	
1. (*a*) Total capital cost (actual)	53,30,491
(*b*) Total capital cost per acre	213.6
2. (*a*) Total capital gain (direct)	2,81,29,920
(*b*) Capital gain per acre	1,127
3. Cost-gain ratio	1 : 5.3
Recurring expenditure and additional income	
4. (*a*) Annual recurring expenditure	2,75,000
(*b*) Annual recurring expenditure per acre	11
5. (*a*) Gross value of additional annual output (Paddy)	43,43,651
(*b*) Gross value of additional annual output per acre (Paddy)	174
6. Ratio of annual cost to gross additional income.	1 : 15.8

NOTE :—(1) Paddy value has been taken as Rs. 13 per maund both before and after the project period.

(2) The recurring expenditure varies between Rs. 2.50 lakhs and Rs. 3 lakhs. Rs. 2.75 lakhs have been taken for the above calculation.

(3) The estimate of gross value of additional income is on the low side, since it has been calculated by taking into account only the additional yield of paddy. Va u derived from the cultivation of vegetables has been left out. It should be noted that the net additional income would be much smaller. The ratio of annual cost to the annual net additional income may be very close to the ratio of capital cost to capital gain.

The data show that against an actual *direct* capital cost of Rs. 53,30,491 or Rs. 213:6 per acre, the *direct* appreciation in the capital value of land has been of the order of Rs. 2,81,29,920 or Rs. 1,127 per acre. The ratio of capital cost to capital gain thus works out to 1:5.3. On the recurring side, the average annual charges come to Rs. 2,75,000 or Rs. 11 per acre; while even a conservative estimate of the annual increase in gross income and output (purely in terms of paddy) amounts to Rs. 43,43,651 or Rs. 174 per acre. The ratio of recurring cost to gross output works out to 1:15.8. If the net additional income is computed, the ratio will come down probably to the level of the capital cost to capital gain ratio. The State has not so far taken any share either in this capital or in the recurring gain. The cost-benefit ratio shows that the scheme could have been self-financing.

CHAPTER VIII

SUMMARY AND SUGGESTIONS

I

Summary of Findings

Objective and method of the study

8.1. The objective of the study is to examine in the context of the Third Plan, the progress achieved in soil conservation extension on agricultural lands; to analyse at different levels from the State to the field, the hinderances and difficulties encountered in administering the programme and making legislative, promotional and organizational arrangements for it; to assess in a general way the impact of the programme and its acceptance by the cultivators, and to suggest lines of improvement and highlight areas and issues requiring further consideration. In all, 22 districts were selected for the study, the selection being purposive. Field data were collected from 123 randomly selected villages, 87 covered by the soil conservation programme and 36 not so covered from 21 districts. The study in one district, Midnapur was confined to general observations without field investigation in any specific area.

Extent of the problem and historical background

8.2. There is lack of factual data to indicate the extent of the erosion problem on agricultural lands. The Royal Commission on Agriculture (1928) recognized the importance of the soil erosion problem and recommended that the exact extent of the evil should be investigated. The Famine Enquiry Commission (1945) recognized the necessity for contour bunding on a large scale. Under the All India Soil and Land-Use Survey scheme started in March 1958, 12 million acres of land have been surveyed so far. The Third Five-Year Plan puts the area affected by erosion at about 200 million acres.

Land use in India and economic issues involved

8.3. The data on land use provide a clue to the prevalent imbalance in the utilization of land. The aim of conservation should be so to regulate the present use of land as to result in a progressive rise in its productivity and to preserve and enhance its quality for the posterity. Individual cultivators are prone to be short-sighted in exploiting land as they care more for immediate gain than for future consequences. The State can play an important role in reducing the period required for realising the future increment in income by introducing and assisting suitable conservation farming measures for early increases in net return from land.

Progress in the First two Plans and the programme for the Third

8.4. *Policy and approach in the three Plans.*—In the report on the First Plan the issues bearing on the soil conservation programme for the country were clearly set forth, the broad objectives of

the policy laid down and a national programme for soil conservation initiated. The Second Plan called for a systematic implementation of the policy laid down in the First Plan, laying special emphasis on personnel training and involvement of local institutions like the Panchayats. The Third Plan has attempted to estimate more clearly the extent of the problems and spell out in greater details, the areas of action and the contents of the programme.

8.5. The Soil conservation activities in the Plans have ranged from research and surveys to contour bunding and extension of dry farming practices. The outlays in the First, Second and Third Plans were Rs. 2 crores, Rs. 20 crores and Rs. 72 crores respectively, and the expenditure incurred during the Second Plan was about Rs. 18 crores.

8.6. *Centrally-executed and sponsored schemes.*—The Central Government has been directly executing certain schemes relating to research, demonstration and training. The All-India Soil and Land-Use Survey is also a Centrally executed scheme. Besides these, some schemes are Centrally-sponsored such as soil conservation in river valley project areas, dry farming demonstrations and survey of ravine lands. The outlay on these programmes has been increased considerably in the Third Plan. Whereas the outlay was Rs. 2·71 crores or a little above 10% of the total outlay in the Second Plan, in the Third Plan it has been increased to nearly Rs. 13 crores or 18% of the total outlay. In the Second Plan the expenditure on Centrally-executed and sponsored schemes was Rs. 1·93 crores or 71% of the outlay.

8.7. *Progress of soil conservation programme in the States.*—Soil conservation programme for agricultural land includes diverse schemes, and there is apparent lack of uniformity in the classification of what is categorized as soil conservation programme. This probably originates from the method of treatment of each individual problem. It has not been possible to draw composite scheme for a specific problem area or water shed area. The approach of drawing up individual schemes was considered practical in the Second Plan and has been continued in the Third Plan.

8.8. *First Plan.*—In the First Plan period, the soil conservation programme on agricultural land could not be taken up in many States. Some progress had been reported from Andhra, Gujarat, Kerala, Madras, Maharashtra and Mysore. But the bulk of the achievement in the First Plan was in the erstwhile Bombay State and in Madras. The total of about seven lakh acres of agricultural land was brought under soil conservation treatment in these two States.

8.9. *Second Plan.*—In the Second Plan there was considerable element of trial and error in the fixation of targets and outlays. This state of affairs was most probably due to the inadequacy of experience and of the data relating to the execution of soil conservation programme in different States. In the Second Plan about Rs. 18 crores was the total estimated expenditure on soil conservation programmes in all States and Union Territories. Of this, about 34

per cent was in Maharashtra alone. The programme of soil conservation treatment on mainly agricultural land accounted for nearly 63 per cent of the total expenditure. The remaining expenditure was on soil conservation on agricultural and forest lands in river valley project areas, in the ravine-affected areas, in hilly areas, in waste lands, desert areas and for demonstration, research and training.

8.10. About 2·3 million acres of mainly agricultural land was covered by soil conservation treatment in the Second Plan. Of this more than 50% was in Maharashtra and between 5 and 16 per cent each in Madras, Mysore and Gujarat.

8.11. The soil conservation treatment in hilly areas, in river valley projects, ravines, waste lands and deserts also covered some agricultural land. The agricultural land in these areas treated in the Second Plan has been estimated at about 1·37 lakh acres. About 12 lakh acres of forest lands in these areas were also treated by soil conservation measures in the Second Plan.

8.12. *Demonstration, research and training.*—About two per cent of the total expenditure in the Second Plan in all States and Union Territories was spent on soil conservation demonstration. The expenditure on research was very insignificant and ranged between 1 and 3 per cent in most of the States, and was about 10 per cent in U.P. Similarly, the expenditure on training of staff for soil conservation programme ranged between 1 and 2 per cent in most of the States. In the States and Union Territories together, the expenditure on demonstration, research and training formed about 5% of the total expenditure on soil conservation programme.

8.13. *Soil conservation programme in the Third Plan.*—As compared with the Second Plan, the Third Plan provision has been increased by about four times and the targets by five times. In the total provision for all States and Union Territories in the Third Plan, Gujarat and Maharashtra account for nearly 50% of the outlay. Similarly, in the total target for soil conservation on agricultural land, the target for Maharashtra is 46% and that for Gujarat, U.P. and M.P. is between 10 and 13 per cent.

8.14. As compared with the original targets drawn in the Third Plan, it has been observed that some States have scaled down the targets in their State Plans. As a result of the scaling down of the targets, the original target for soil conservation on agricultural land will be brought down from 11 million acres to nearly eight million acres. Similarly, in the State Development Plans some States have somewhat scaled down their original target for the programme of dry farming measures.

8.15. The programme for dry farming measures is to be carried out through Community Development Blocks and no separate funds have been provided for this programme. The Community Development Blocks had generally no programme of extension of dry farming measures in the Second Plan.

8.16. *Provision for demonstration, research and training in the Third Plan.*—The Plan provision of the States for demonstration, research and training schemes forms about 5% of the total provision for soil conservation programme. The outlay for research is a little less than 1% of the total provision for soil conservation programme and for training and demonstration about 2% each. It is difficult to comment on the right proportion of outlay for different soil conservation programmes in the States. The norms are yet to be fully developed and more attention needs to be given to this matter.

Planning and Execution of Soil Conservation Measures

8.17. *Survey and investigation.*—No detailed land and soil survey appears to have been carried out in any State for assessing the nature and extent of the problems of soil erosion. Reconnaissance surveys have, however, been carried out in eight States. The targets for the Third Plan in these States are based mainly on these reconnaissance surveys. In other States, the targets are based on rough estimates and/or the extent of funds available.

8.18. *Soil and land-use surveys.*—The Central Soil Conservation Board initiated an integrated all-India soil conservation and land use survey in 1958; and about 12 million acres had been surveyed under the scheme by the end of Second Plan. The Central Survey Organization is also expected to extend technical supervision and guidance to the States in carrying out such surveys. In reality, not enough of such supervision could be made available; and to that extent the objective of having a standard scientific survey has not been served. Lack of technical personnel and lack of funds are the two major obstacles reported by the States as coming in the way of conducting soil and land-use surveys.

8.19. *Soil conservation research.*—The Central Research Stations have made appreciable progress in the field of research work by the end of the Second Plan. Not much of progress could, however, be achieved by the State Governments with research work on soil conservation measures. Many States did not have any research station or centre by the end of the Second Plan. Only in Maharashtra, Mysore, Orissa, U.P., and the DVC area in Bihar, soil conservation measures were experimented in the Research Stations and afterwards demonstrated. It may be said that during the Second Plan period the research programme of the States could not be fully established.

8.20. Soil Conservation research conducted so far has been concerned largely with erosion and run-off studies, hydrological investigations and engineering measures to tackle problems of erosion. Research on problems connected with conservation farming methods, seems to have been relatively neglected. Secondly, researches conducted so far are applicable mainly to the red and laterite soils and to a lesser extent the alluvial soils in the north. One major problem that is still evading solution relates to techniques of conservation of deep black and clayey soils in Maharashtra, Mysore and Gujarat. Thirdly, research has yet to make a head-way in the methodology and approach to a complete soil and water conservation programme on a watershed basis in various agro-climatic zones.

8.21. *Methods of extension education used in States.*—The principal methods of extension education reported to be used by five State Governments are 'demonstration', 'personal contact', 'general meeting', 'sight seeing' and 'issuing of pamphlets'. 'Organisation of Farmers' Unions' in Maharashtra is still another method used for educating farmers in soil conservation measures.

8.22. *Demonstration programme.*—The Central Soil Conservation Board approved 40 dry farming demonstrations in 1959 for various States. However, due to administrative delays and organisational difficulties in the States, only 21 of these demonstrations could be put into execution by the end of the Second Plan. In most of the States, demonstrations set up under the programme of the State Governments, are not pursued to obtain data on the economics of soil conservation. Method demonstration, rather than result demonstration seems to characterize the approach. Demonstrations are likely to succeed, if the farmers are convinced about the advantages that may accrue quantitatively, like increase in crop yield, increase in net income and reduction of soil loss. Only from Andhra Pradesh, it is reported that the demonstration projects have, by and large, served their purpose. In most of the other States, no efforts are reportedly made to convince the farmers through result demonstrations.

8.23. All the State Governments have reported that after the engineering measures are adopted in the demonstration projects, the areas are left to be managed by the farmers themselves. In other words, the very important aspect of conservation farming methods or follow-up practices is neglected. As a consequence, the demonstrations set up are not usually found to be fully effective, which means that these projects are not fully serving the desired purpose.

Preparation for Soil Conservation Work on Agricultural Lands

8.24. *Legislative provisions.*—The earliest soil conservation legislation in India is the Punjab Land Preservation Act of 1900. It was enacted primarily for afforestation work in the Siwalik hills. The Bombay Land Improvement Schemes Act, 1942 has provided the broad pattern for soil conservation legislation in many States and for the Model Soil Conservation Bill framed by the Central Soil Conservation Board. The States of Assam, Bihar, Orissa, West Bengal and Rajasthan have not yet passed any Soil Conservation legislation.

8.25. *Central and State Soil Conservation Boards.*—The Central Soil Conservation Board was established in 1953. Some of the important functions of the Board are (i) to organise, coordinate and initiate research in soil conservation, (ii) to assist States and River Valley Projects in drawing up schemes and enactment of legislation, (iii) to arrange for the training of technical personnel, (iv) to provide assistance in carrying out surveys, (v) to recommend financial assistance, and (vi) to coordinate inter-State soil conservation projects.

8.26. State-level soil conservation boards have not yet been set up in Assam, Gujarat, Maharashtra, Mysore, West Bengal and Jammu and Kashmir. In the remaining States, Boards at the State level are there but with different nomenclature. There are marked variations

in the functions and scope of these Boards. In some States, the functions are of the advisory and coordinating type. But in States like Madhya Pradesh, Madars, Kerala and Uttar Pradesh, besides being advisory and coordinating bodies, these institutions are also responsible for the execution of soil conservation schemes. It is only in Himachal Pradesh and to a lesser extent in Rajasthan that the State Boards appear to have been effective in achieving coordination among the departments concerned with soil conservation.

Administrative arrangements for the planning and execution of soil conservation programme

8.27. The experience with the soil conservation programme in the Second Plan shows that the lack of an effective organisation in most States was responsible for a considerable time-lag between the assessment of the need for training facilities and the creation of such facilities, between the survey work and the execution of the soil conservation extension schemes. The magnitude of the programme in the Third Plan is such that it cannot be successfully carried out unless the administrative and executive organisation in the States is streamlined and suitably geared for this task.

8.28. The organisational pattern in the States varies considerably. Generally speaking, at the State level, there is not yet a single organisation of the type recommended by the Planning Commission, to assume responsibility for the soil conservation programme as a whole. There is no department for soil conservation. Different departments such as Agriculture, Forests and even Irrigation attend to items of work which fall within their purview and in which they specialize. Because of organizational deficiency, there is a general lack of a coordinated approach to soil conservation problems, assessment of soil conservation needs, requirements for training, research, extension and perspective planning.

8.29. In Assam and Jammu and Kashmir, the Forest Department, with its own set-up under the Chief Conservator of Forests, is running the soil conservation programme. In all other States, the Agriculture Department has been entrusted with the programmes particularly for agricultural lands. In most of these States, an officer of the rank of Joint or Deputy Director has been provided for assisting the Director of Agriculture in looking after the Soil Conservation programme. The drainage schemes are the responsibility of the Irrigation Department in some States.

8.30. The set-up below the State-level displays two broad patterns. In Kerala, Punjab, Rajasthan, U.P., Bihar and West Bengal, the revenue—administrative district has been made the unit for soil conservation works. The second pattern is to be found in States like Andhra, Gujarat, Maharashtra, Mysore, M.P., Madras, Orissa and H.P., where there are soil conservation divisions, sub-divisions and units like charge, section or range for field work. In this set-up, the Soil Conservation Sub-divisional Officer occupies a key position.

8.31. *Training of Personnel.*—The programme of personnel training has received greater attention of the State Governments in the Third Plan. Of the nine States for which data on the training programme were analysed, seven (Bihar, Gujarat, Himachal Pradesh,

Madhya Pradesh, Maharashtra, Mysore and Uttar Pradesh) have provided for the training of a larger number of officials than the trained personnel available by the end of the Second Plan. In Madras and Andhra, the number is somewhat less.

8.32. *Financial assistance.*—The soil conservation extension schemes generally provide for a subsidy of 25% of the total cost to be granted to the beneficiaries in the majority of the States. This subsidy is equally shared between the State and the Centre. In Andhra Pradesh, Madras, Gujarat, Maharashtra and Mysore, to the material & labour cost of soil conservation treatment, an amount equal to 33⅓ per cent of it is added as establishment charges in order to arrive at the total cost of the soil conservation works. Of this total cost, an amount equal to 25% is given as subsidy and the balance treated as a loan to the cultivators at a rate of interest of 4½% per annum. This means that the subsidy given covers only the cost of overhead establishment. This procedure has come in for a good deal of criticism from some sections of the farmers who feel that the aid given is in reality a book adjustment.

Coordination of Soil Conservation programme

8.33. Four State Governments have reported that as only one department is responsible for soil conservation work on agriculture lands, there is no problem of coordination. Governments of other five States have reported that there is no need of any coordination as there are no conflicts between the departments concerned with the execution of the programme. It is, however, felt that for demarcating areas, allocating funds and entrusting responsibilities for work in particular areas, there is a definite need for a coordinating agency at the State level. Besides, matters like formulation of policies and priorities, pursuit of research, demonstration and training programmes do require a good amount of coordinated thinking and action. Instances of inadequacy or lack of coordination have come to our notice, one of which may be referred to here. In Maharashtra and Mysore, surveys were conducted to determine the land capability classes of waste land. The recommendations on the basis of surveys, about appropriate soil conservation measures for different classes of land were not apparently taken into account in effecting the distribution of these lands wherever done. Evidence of inadequacy or lack of coordination has been found in a number of States, sometimes within the Agriculture Department and in some cases among the different agencies working in this field.

8.34. In the districts selected for study, some instances came to our notice where there had been an integrated approach to the soil erosion problem. One may cite the soil conservation programme in the DVC area of Hazaribagh district (Bihar) as the best example of this approach. The DVC soil conservation work is planned and carried out coordinatedly and jointly by its Forestry, Engineering and Soil Conservation Extension Sections under one Director. Up-land area is tackled by the Soil Conservation Extension Section; in the highly eroded area where cropping is not possible, afforestation work is undertaken by the Forestry Section, while gullied areas are treated by the Engineering Section which constructs check dams, small

earth dams, etc. Care is taken to ensure that the proposed measures are applied in proper combination to meet the needs of different kinds of lands in the watershed. In Ahmednagar, soil conservation work taken up before 1947 used to include a programme of treating unreserved forest lands along with the adjacent agricultural lands. Since 1947, however, the work has been confined largely to the construction of contour bunds on agricultural lands.

8.35. *Policy of linking up consolidation of holdings with soil conservation.*—Effective land consolidation in close cooperation with the soil conservation programme and consistent with soil conservation needs would improve agricultural efficiency and result in increased production from land. Only in Maharashtra and the DVC area in Bihar, some effort has been made to link up consolidation of holdings with soil conservation measures. It has been observed, however, that there is, in actual practice, a general lack of coordination between the two programmes in Maharashtra. Mostly the State Governments do not even have any future plan for linking up the two programmes.

Role of C. D. Blocks in soil conservation programme

8.36. The Community Development Blocks have an important role to play in preparing the villagers for soil conservation schemes like contour bunding, and educating and inducing the cultivators to adopt conservation farming methods and practices. In Gujarat, Madhya Pradesh, Madras, Mysore and Maharashtra, the entire soil conservation programme is operated by the Agriculture Department; and the participation of the Block agency is negligible. No information is available for Jammu and Kashmir. In West Bengal and Punjab there is no programme of soil conservation in C. D. Blocks. In the remaining eight States, the programme has been taken up in C. D. Blocks as a distinct Block programme, according to the needs of the area. However, as far as Andhra Pradesh is concerned, it is reported that the Block programmes are not very effective. Terracing of hilly areas is the programme that had been usually undertaken in Special Multipurpose Tribal Blocks in Assam. It is reported that enough of attention has not been paid by the Blocks to this type of work.

8.37. In most of the States, the Block agency does not play any part in preparing the people for taking up soil conservation measures. As far as extension and follow-up of conservation or dry farming methods are concerned, these should essentially form a part of the duties of the Agricultural Extension officers and VLWs in the Blocks. Follow-up measures are nothing else but improved cultural practices for conserving soil and moisture which, if followed, would result in higher agricultural production in the area. From almost all the States it has been reported that the Block extension agency is not looking after the follow-up programme, nor is it involved in most States in the engineering aspects of the programme. Lack of coordination and understanding, and inadequate inter-departmental cooperation are factors standing in the way. In fact, the role of blocks in this programme does not seem to have been properly thought out yet in the majority of the States.

8.38. *Method of execution.*—Conservation treatments have mostly been undertaken on a sub-catchment basis. The construction work is either executed directly by the department or given on contract or is undertaken by the individual beneficiaries under the technical guidance of the department. In Andhra Pradesh and Madras, the work is undertaken either directly by the Department on a piece rate system or through contractors. In Kerala the work is executed by the department or by individual beneficiaries under the supervision of the department. In Maharashtra, the local people are used by the department for earth-work. Farmers' Unions are reportedly helping in mobilising labour for earth-work; but such association of the Farmers' Union with soil conservation work was not noticed in our selected villages. In U. P., *ad-hoc* soil conservation village committees are formed to discuss soil conservation schemes; and the beneficiaries do the earth-work under the guidance of the department. In the DVC area of Bihar, people are associated with the programme at all stages of the work, starting from the planning stage.

8.39. *Role of People's institutions and local leadership.*—People's institutions, particularly Block Samities and Village Panchayats have a significant role to play in soil conservation programmes. They can help in developing among the farmers consciousness and know-how about the programme and thereby create favourable conditions for cooperation from the people in making the programme a success. Institutions like the panchayat and the cooperative have not been associated with the programme in a majority of the States. Panchayat is the only institution associated with the programme in a few States, and its role has mainly been to persuade the farmers to accept bunding or adopt the recommended soil conservation programme. It has not been assigned any positive role in the execution of the programme. With the new set up of 'Panchayati Raj' in different States, the role of panchayats with respect to development work, including soil conservation programme, is bound to increase. It is only in Rajasthan that the Panchayat Samities and Zila Parishad are now actively associated with the soil conservation programme from the planning stage.

8.40. *Role of Farmers' Unions in Maharashtra.*—Farmers' Unions were organised in 1957-58. They did play some role in Western Maharashtra in obtaining consent from the people and mobilizing them for bunding work. However, after the bunding work was over and wages were paid, they ceased to be effective. Their role in the bunding programme in Vidharbha and Marathawada regions has been much less than in the Ahmednagar—Sholapur region. The official sponsorship and support of these Unions appear to have created confusion in the minds of the village people, as to the relative importance of basic institutions like the panchayat and the cooperative, *vis-a-vis* and *ad-hoc* body like the Farmer's Union.

Characteristics of the districts elected for field study

8.41. *Rainfall and slope.*—The agro-climatic characteristics of the 21 districts selected for detailed field study have been discussed. The average annual rainfall in four of the selected districts is less than 65 cms; 11 of the districts fall in the medium rainfall category with an average annual precipitation between 65 cms. and 130 cms; while six

districts receive more than 130 cms. of annual rainfall. In two of the selected districts, Bilaspur (Himachal Pradesh) and Nilgiris (Madras), the slope of utilized land and treated for agricultural uses has been found to be much higher than that usually considered suitable for cultivation purposes.

8.42. *Land use.*—In a majority of the selected districts in the plains, the forest area is less than 13% of the geographical area which is below the recommended norm of 20%. In the predominently hill districts the corresponding proportion is below the norm of 60%. The cultivated area accounts for more than 45% of the geographical area in most of the districts. The proportion under 'uncultivable lands excluding fallows' is less than 14% in 16 of the 21 districts; and that under 'fallow land other than current fallow' less than 3% in about a half of these districts.

8.43. *Cropping pattern.*—Among the field crops, the area under wide-row crops, close-growing crops and legumes is less than 20 per cent in 10, 4 and 14 districts respectively, between 20 and 40 per cent in 4, 7 and 6 districts, between 40 and 60 per cent in 4, 6 and 1 districts respectively, and above 60% in 3. 4 and 0 districts, respectively. Plantation crops are important only in the Nilgiris (Madras), Trichur (Kerala) and United Mikir and North Cachar Hills (Assam). The percentage of the geographical area grown with these crops in the three districts is 57, 38 and 10, respectively.

Soil conservation problems, area affected and the progress of the schemes

8.44. Rain erosion and conservation of moisture are the two major problems in the selected districts. Among the sample villages, 83% of the villages covered by soil conservation measures and 97% of the ones not yet covered have also reported the existence of these problems. Other problems like wind erosion, salinity and alkalinity, water-logging and shifting cultivation are also reported from some of the districts.

8.45. Available estimates of the area affected by erosion and other problems are not based on scientific surveys and investigations. Roughly speaking; in three of the districts more than 60 per cent of the geographical area excluding forests is reported to be affected by soil erosion; in another six districts this proportion ranges between 34 and 56 per cent; in the remaining districts the proportion is less than 25%. In the selected villages, the corresponding proportion ranges between 13% in the Nilgiris (Madras) to 76% in Anantapur (Andhra). On the other hand, the entire holding of the sample respondents in Nilgiris required soil conservation measures; and the proportion of the area of the sample holdings requiring soil conservation measures has more than 70 per cent in another 13 districts.

8.46. The soil conservation programme was taken up in the last years of the First Plan or during the Second Plan in most of the selected districts except Baroda, Coimbatore, Nilgiris, Ahmednagar and Dharwar. All the sample households in five districts and about 75% of these in 10 other districts belonged to villages where soil conservation measures were initiated in the first three years of the Second Plan period. Respondents in the covered villages had on an average more than 20 acres of owned land in five districts, 10 to 20

acres in eight districts, 5 to 10 acres in 3 districts and less than five acres in the remaining districts. Almost the entire holding of the respondents in 11 districts was within the village itself. The proportion of the operational holding of the respondents, requiring conservation treatments was 100% in two districts, between 67 and 93 per cent in 13 districts and between 28 and 50 per cent in 4 districts.

8.47. The recommended soil conservation measures are reported to have been demonstrated in 12 of the selected districts. In three districts, Hazaribagh (Bihar Government area), Tumkur and Midnapur, the soil conservation programme has been purely on a demonstration basis. The area covered till the end of 1960-61 by soil conservation extension measures was not significant in almost all the districts except in Ahmednagar where 25% of the affected area had been treated by the end of the Second Plan. By the end of Third Plan, however, the achievement targeted is to cover 77% of the affected area in Jaipur and 49% and 22% respectively of such area in Ahmednagar and Mathura. In the Nilgiris, the achievement is likely to be 12%. For the other districts, either the target data for the Third Plan are not available or the achievement envisaged is not significant. In the selected villages, though a fairly large proportion of the area required soil conservation, a good proportion of it had been covered by suitable measures by the end of 1960-61. In all, 197 soil conservation projects with a total area of 44,102 acres had been taken up in 79 villages; and work on 39,465 acres was completed by 1960-61. On the holdings of selected respondents in 14 districts, the proportion of the area covered to that requiring treatment was more than 70 per cent.

Outlay and expenditure per acre and loans issued to beneficiaries

8.48. The expenditure per acre of soil conservation works during the Second Plan has been found to be the highest in Bilaspur (Himachal Pradesh) and Nilgiris (Madras), the actual figures being Rs. 485 and Rs. 317 per acre, respectively. In other districts, it has ranged between Rs. 24 and Rs. 57 per acre, except in Trichur where the expenditure per acre has been about Rs. 80. Expenditure per acre has been lower than the outlay per acre in some of the districts and higher in others. This experience has led to a more realistic approach to the calculation of outlay in the Third Plan. The position in respect of recovery of loans advanced to the beneficiaries for carrying out soil conservation works on their lands seems to be very weak and needs to be given more attention.

Soil conservation measures

8.49. *Mechanical measures.*—The respondent-cultivators have been found to be aware of, and to some extent, adopting certain measures like field bunding, terracing etc., though these do not conform to scientific standards of modern soil conservation treatment. Contour bunding and allied measures with suitable modifications have been recommended in most of the districts in the plains, and terracing and contour trenching in the hilly areas.

8.50. *Crop rotations.*—In 20 of the 21 selected districts, in all, 38 rotations are being followed traditionally in these areas and 38 of these have been later approved or recognised as useful by the soil

conservation officers. As for new crop rotations, 12 have been recommended in seven of the selected districts. The period of transition from exploitative to conservation farming rotations is reported to be two years in Mathura, eight years in Dharwar and 10 years in Rajkot and Ahmednagar.

8.51. *Cultural practices.*—Traditional cultural practices like ploughing of land without regard to its slope, ploughing more than once without regard to depth of the soil, heavy seed rate etc. are being discouraged; and improved cultural practices are being recommended as conservation farming practices or as dry farming practices in all the districts.

Problems of extension of soil conservation and dry farming practices

8.52. *Selection of villages for conservation work.*—Soil conservation work has been taken up in the selected districts at different points of time; but in most of them the programme received importance only during the Second Plan period. In a number of these districts, only a few villages have so far been covered by soil conservation treatment. Nearly 93% of the villages where work has been taken up, were selected by Soil Conservation Officers of the Agriculture Department. Nearly two-thirds of these formed a part of the bunding scheme. Nearness to road or Block was the reason for selection of about a quarter of the villages. In a few cases the people approached the Department staff with a request to select their village.

8.53. *C.D. blocks and soil conservation.*—The C. D. blocks are not directly involved in soil conservation work, except in Uttar Pradesh, the Bihar Government schemes in Bihar, and the tribal block areas in Assam. In Jaipur and Gwalior, they are, however, associated with the selection of areas.

Association of people.—Soil conservation treatments are generally undertaken by the Department either directly or through contractors. In Districts like Mathura, Mirzapur, Bilaspur and Jaipur the work was found to be carried out by the individual cultivators under the guidance of the Departmental Officials.

8.54. *Peoples' Institutions.*—Peoples' institutions have not been associated with the work in most of the selected districts. In Uttar Pradesh, the soil conservation village committees discuss the plan and programme and the earth-work is done by the beneficiaries. In the State Government project areas in Bihar the Panchayats are expected to undertake the earth-work.

8.55. *Consent of cultivators.*—In some regions (Maharashtra, Gujarat and parts of Mysore), the consent of owners of 66% of the land area to be covered had to be obtained, whereas in other areas the consent of all the beneficiaries is to be secured before soil conservation work can be undertaken on their land. While the Acts in certain States provide for compulsory implementation on the lands of the recalcitrant minority, the practice in many areas is to leave out such lands.

8.56. There was opposition from the people to the programme in selected villages of six districts, but they were ultimately won over. The main reasons for the opposition were (a) that the measures might result in the Government acquiring their land; (b) inconvenient location of water outlets; (c) that the zig-zag nature of the bunds caused obstruction to ploughing; and (d) loss of land and top soil due to bunds. In some instances though written consent had been given, the respondents were not aware of it. In the tribal areas of Koraput (Orissa), however, consent of the people were not reportedly taken by the officials.

8.57. *Extension education.*—Individual and group contacts, mass meetings, film shows, Gram Sahayak camps and distribution of literature are the types of media reported to be used to educate the cultivators in soil conservation and dry farming measures. In many areas, these have not been very affective. There has been a general inadequacy of effort directed at extension education, particularly through demonstration.

8.58. *Knowledge of soil conservation measures.*—In the sample villages all the selected respondents and in the control villages 86% of the respondents knew of soil conservation mechanical treatments. The soil conservation staff and visits to the work site in their own or neighbouring villages were the main sources of such knowledge.

8.59. *Reaction of cultivators.*—It has been observed that in 8 of the 18 districts a good proportion of the sample respondents (more than 45%) were not convinced of the utility of the programme. Still these people did not object to the works being carried out as they thought they had no right to object, or there was pressure of the extension worker.

8.60. *Cost, efficiency and technique of bunding.*—The bulk of the respondents in nine districts thought the execution of the works quite efficient; but they were critical in another five districts. Large proportions of the respondents in seven districts thought the cost of the work to be high, while those in four other districts considered it to be reasonable. Others did not have any idea of the cost. The technique of bunding has been adjudged good or satisfactory by all or a sizeable proportion of the respondents in eight districts and unsatisfactory in six other districts. The fact that a significant proportion of the respondents in quite a number of districts is not satisfied with or is critical of the efficiency of execution of soil conservation works, their cost and the technique of bunding, suggests that the soil conservation departments should pay serious attention to these complaints and rectify the defects. The situation also calls for intensification of efforts to improve public relations and extension education.

8.61. *Difficulties of cultivators in control villages.*—The respondent cultivators in the control villages were generally aware of the soil erosion problems on their lands; and most of them had seen soil conservation works in the neighbouring villages. They mentioned certain limiting factors or difficulties like lack of finance, lack of technical know-how about contour alignments and the specification of the bunds, in the way of their undertaking soil conservation construction treatments. They also require some facilities like Government undertaking the work on their land, technical and financial

assistance. The most important condition they impose is that they should be convinced first about the increase in yield etc. and income expected from the treatment.

8.62. *Knowledge and adoption of conservation or dry farming practices.*—Improved agricultural practices are propagated in all districts; no special efforts are made to follow them up. The main dry farming practices are special crop-rotations, contour cultivation, strip cropping, use of fertilizers, low seed rate, green manuring, growing grass on bunds and cover crops. Knowledge of these was reported by varying proportions of respondents in 10 out of 18 districts. The soil conservation staff or block officers, visit to other villages and traditional knowledge were the main avenues for the spread of information about these practices. As the knowledge of the conservation or dry farming practices was poor, the extent of adoption was still poorer. For example, an important practice like contour cultivation was not adopted by a large proportion of the sample cultivators; worse is the story with regard to other important practices like strip cropping, and cultivation of cover crops.

8.63. The adoption of conservation farming practices depends on the awareness, willingness and preparedness of the cultivators. Hence the adoption of the practices other than the traditional ones depends upon the extent of extension work done or demonstrations in or near the villages. It has been observed that the adopting cultivators generally took to the measures after soil conservation treatments had been carried out on their lands; in two or three districts the adoption by the majority was earlier than or in the same year as the treatments. The practices adopted earlier are the traditional ones.

8.64. *Facilities required for adoption.*—Those who have not adopted the conservation farming practices have given one or more of reasons like that (1) they were not convinced of the effect of the measures on yield or income, (2) the measures might adversely effect the growth of plants, (3) they did not feel the need for the measures and (4) they had no knowledge. These reasons have almost a parallel reflection in the facilities required for adoption. If convinced of the favourable effect of the measures on yield and income and if they were properly educated in the usefulness of soil conservation treatment and farming practices, the bulk of non-adopters reported that they would go in for the measures.

Impact of soil conservation treatment and measures

8.65. Results of the experiments conducted in different research stations notably at Sholapur in Maharashtra, Deochanda by the Damodar Valley Corporation and Rehmankheda in Uttar Pradesh show that there is reduction of soil loss, retention of moisture in the soil and improvement in the yield of grain as well as straw as a result of soil conservation treatments on agricultural land.

8.66. Soil conservation treatment involves labour-intensive engineering and construction works of a productive type. In most of the districts, the works have been mainly executed during the slack seasons. But in some, particularly in Nilgiris and Bilaspur, the works were carried out in the peak seasons also. Labour-saving devices like

bull-dozers were utilized for constructing bunds in only a few selected districts and Keni or bund-forming implements in Ahmednagar. The wage component formed a significant proportion of the total expenditure on soil conservation work; in some districts it was as high as 66%.

8.67. *Employment on soil conservation in selected villages.*—The execution of the soil conservation programmes in the selected villages in some districts like Nilgiris, Rajkot, Coimbatore, Ahmednagar, Dharwar and Hyderabad extended over five years or more. In 10 of the 18 districts the works provided employment over a period longer than six months per year and have thus covered at least, if not more than the slack seasons. In 9 of the 18 districts, the average employment per acre of treated land varied between 17 and 35 mandays. The volume of employment generated is correlated with expenditure and intensity of work per acre.

8.68. The employment generated by soil conservation works was availed of only to the extent of 40 to 76 per cent by the residents of the respective villages; the rest going to the people of other villages and outsiders. The employment per day of work ranged between 10 and 20 mandays in 7 out of 15 districts.

8.69. The works were executed in most of the districts by the department either by employing hired labour or by contractors. Wage labour, thus, accounted for more than 50% of the total employment in most of the districts.

8.70. Major repair or maintenance work on the bunds, terraces, etc. have been reported only from seven districts and in most of these only in the first year after treatment. The employment generated in the first two years has been strictly limited and works out to less than one manday per acre of land treated except in two hilly districts. No bullock labour has been utilised for repairs.

8.71. The bulk of the respondents in all year groups (according to the year of completion of the works) expressed the view that employment for their family labour or for their bullocks have not increased but remained constant after the adoption of soil conservation treatment on their land.

8.72. *Net cultivated area after soil conservation.*—The majority of the respondents in six districts (Bilaspur, Gwalior, Nilgiris, Hazaribagh and Hyderabad) and all the respondents in the remaining districts reported that there had been no change in the net cultivated area on their holdings as a result of soil conservation treatments.

8.73. *Area lost to bunds.*—All the cultivator-respondents in seven districts (Anantapur, Hyderabad, Rajkot, Trichur, Ahmednagar, Tumkur and Mirzapur) have reported that some part of their soil conservation area had been used up in the construction of bunds. Area lost to bunds was less than 5% of the cultivated holding of the respondents in most of the selected districts.

8.74. *Fragmentation of holdings due to soil conservation.*—Though in most of the areas, strict contour bunds are adjusted as far as possible with the existing field and property boundaries, some sample respondents in quite a number of districts held the view that there had been fragmentation of their holdings.

8.75. *Impact on cropping pattern.*—The majority of the respondents in all the selected districts reported that they had not raised any new crops on their treated lands nor had they made any shifts in the area under different crops. The small proportion who reported a change either in respect of introduction of new crops or shifts in the area under different crops attributed it mainly to the improvement in soil and moisture conditions brought about by soil conservation measures; in some cases this was also due to the availability or extension of irrigation facilities. In 8 of the 21 districts, there had been no change in the average gross cropped area between the period before soil conservation measures and in 1960-61.

8.76. *Crop rotation and cultural practices.*—In 1960-61 a significant section of the respondents had changed over to different crop rotations, previously known to them. The newly adopted rotations were among those traditionally followed by the cultivators and do not figure among the rotations specifically recommended by the soil conservation department.

8.77. The respondent cultivators' reactions in respect of the effects on fertility of soil and quality of crop of soil conservation treatments show a progressive realization and admission of the benefits accruing from soil conservation treatments.

8.78. *Impact on yield of crops.*—Respondents in quite a few areas have reported a larger increase in the yield per acre on treated land than that on unconserved areas and in control villages. The districts where the yields on treated area had been higher than that on the untreated area and in control villages, were the areas where the increase in yield rate in 1960-61 over the pre-treatment year had been also greater. It has been observed that the yield level of crops, particularly on dry land, went down in the first or second year after conservation and then rose gradually to a level much higher than that in the pre-conservation period. The extent of rise and the ability to sustain it are determined very largely by the fertilizer programme and other improved practices followed by the cultivators.

8.79. *Value of land.*—Increase in the value of treated land has been reported by 62 to 92 per cent of the respondents. The main reasons advanced for this increase are: general increase in the price of land, and the favourable effect of bunding, terracing and other treatments. The data consistently indicate that the land values in 1960-61 (for all types of land) were much higher than in the year before the treatments; the average increase for all the villages, irrespective of year groups was 42%. It has been observed that the value of untreated land in the covered villages was higher than that in the control villages, probably because of the anticipated improvements through the extension of soil conservation treatments.

8.80. *Responsibility of maintenance and repairs.*—Timely repairs and maintenance form an imperative part of the programme. The knowledgeable persons in almost all districts held the view that this should be the duty of the beneficiaries as a group; while the respondent cultivators maintained that this should be the duty of the individuals. A sizeable proportion of respondents also stated that this should be the Government's duty. Such views tend to confirm the

observations made earlier that the soil conservation programme has not yet succeeded in fully involving the cultivators and making them identify with it.

Special Problems of Land Improvements

8.81. Problems selected for special study in Assam, Punjab and West Bengal are somewhat different from those studied in the other States. Those are shifting cultivation or 'Jhuming' in Assam, anti-erosion and reclamation scheme in 'choe' areas in Punjab and drainage of water-logged lands in West Bengal.

Conservation for 'Jhum' areas

8.82. About 25% of the total area of Assam is reported to be under 'Jhuming' or shifting cultivation. The State Government's programme of soil conservation has so far been confined to the four hilly districts where this practice is most common. Rights of ownership of land in those districts vest with the autonomous district councils; and cultivators can cultivate as much as can be managed by them by paying a lease fee.

Soil Conservation problem in United Mikir and North Cachar hills

8.83. By the end of the Second Plan, 7409 acres in the United Mikir and North Cachar districts and 384.50 acres in the six selected villages have reportedly been covered by the programme, the main items of which are plantation of economic species like cashew-nut, black pepper, rubber, coffee, lac and terracing of the land where some source of perennial irrigation is available. The principal objective of the programme is to stablise the pattern of living of the mikirs by offering them a stable and accepted economic base.

8.84. Since it is mainly the plantation programme that is being recommended to the cultivators, the demonstration centres are first opened at various places to serve the purpose of education of the cultivators. But it was observed that no attempt was being made to bring the cultivators to these centres. Group meetings in the selected villages had, however, been held in order to educate the cultivators in the nature, growth, yield, and income of, and the different operations on the plantations. The reaction of the cultivators to this approach has been reported to be favourable.

8.85. The two Special Multi-purpose Tribal blocks in the district take up, under the block programme, schemes for terracing, contour bunding and cultivation of recommended cash crops as plantations. It has, however, been observed that not enough of attention is being paid by the blocks to the soil conservation work.

8.86. The programme in this district is largely being carried out by the cultivators themselves, under the technical guidance of the departmental staff. It has generated a good amount of employment, which comes to 37 mandays per acre. It is expected that after 4 to 5 years, the conservation measures will result in better living, greater security and decrease in the extent of the soil erosion problem.

The programme has, however, been inadequately coordinated between the tribal blocks and the Soil Conservation Wing of the Forest Department. It can be said that whatever progress has been achieved is largely due to the acceptance of the programme by certain sections of the people.

Choe Problem and Soil Conservation in Hoshiarpur District, Punjab

8.87. *Choe menace in the district.*—Hoshiarpur is popularly known as the district of 'choes' (fast flowing hill torrents). There are over 100 choes in the district and over 1000 villages are affected by these choes. The area affected by the choes has increased progressively over the years. Between 1914 and 1952, it increased by 300% or by 3·24 lakh acres. Over 40% of the cultivable area or over four lakh acres of the district are under the choe menace.

8.88. Each choe is a force by itself and has to be investigated individually if effective measures for its control are to be devised. The first essential step is, therefore, a detailed survey of the region covered by a choe. Such remedial measures as construction of dams and detention basins, training of choes and *khads*, grouping together of the different choes at the foot of the hills, reclaiming systematically the lands under choes and progressive plantation and afforestation, are likely to yield effective results if adopted in varying combinations according to different situations.

Training of Nasrala choe and its impact

8.89. The Nasrala choe training programme was taken up by the Irrigation Department in 1954-55; and its first phase completed in 1955-56 on an experimental basis. Under this scheme, a 23-mile long bund was constructed (on both sides of the choe). The cost of the work was shared by the Defence Department; the Railways and the Punjab Government in the ratio of 2:1:1 respectively. The Nasrala choe training programme has helped in checking the recurrent floods on about 27,000 acres of land; 5,000 acres in Hoshiarpur and 22,000 acres in Jullundur District. With the checking of the recurrent floods, the cultivators in the two villages selected for study had reclaimed or developed about 55% of the affected area in the one and about 12% in the other. All this has been achieved through the efforts of the cultivators themselves without any help from the Government. The cropping pattern has also undergone a change to some extent. The newly reclaimed land has generally been put under fodder crops like bajra/jowar. The land which had earlier been under the plough but improved after the choe training programme has either been put to superior or more-intensive crops like sugarcane, wheat+gram etc., or double cropped.

8.90. Of the respondents contacted in the two villages, 80% reported an increase in yield. The yield on the reclaimed land was still lower, compared with that of other cultivated land. It was probably due to the fact that the individual measures were not sufficient for the huge task of reclaiming the land. The average value of all lands has gone up as a result of this choe training programme. Eighty-five per cent of the selected respondents reported an increase in the value of land per acre to the extent of about 50%.

Soil conservation demonstration projects in the district

8.91. The Agriculture Department started the soil conservation demonstration programme on agricultural lands only in 1961-62. The entire cost of the demonstration work is being borne by the Government. The cultivators are expected to maintain the soil conservation mechanical measures executed by the department and to adopt the recommended conservation farming practices. In one of the two selected villages, the cultivators resisted the programme in the beginning, because of the fear of acquisition of land by the Government; but they were won over through the efforts of the soil conservation staff, the Panchayat and the service cooperative society. In the end, the consent of almost all cultivators was obtained.

Sonarpur—Arapanch Drainage Scheme No. 1 in 24-Parganas, West Bengal : Evaluation of the drainage scheme

8.92. The Sonarpur-Arapanch drainage scheme has reportedly benefited 13,731 families in 89 villages where a water-logged area of 24,960 acres has been drained and reclaimed. It has resulted in a net addition to the area under cultivation which has increased about ten times. The area under paddy has increased to about the same extent. The average yield has gone up four-and-a-half times as a result of reclamation, from about 3·7 to about 15 to 17 mds. per acre. There has also been a phenominal rise in the value of land.

8.93. The scheme was taken up as a part of a bigger project for improving drainage of the city of Calcutta. It has been executed departmentally; and the beneficiary cultivators contributed neither in cash nor in labour. The entire capital cost of the project has been met by the State Government out of a Central loan. Similarly, the maintenance and operation expenses are also being borne fully by the Government. No betterment levy or any other taxes-like increase in land revenue have been imposed on the beneficiaries, who have been allowed to enjoy all the gain. An attempt to pass on the advantage to a cooperative was given up after a year or two. If such schemes are to be undertaken on a large-scale, the State Government will hardly be able to finance them unless betterment levies and/or annual drainage charges are imposed on the beneficiaries as a necessary payment for the gain they would derive.

8.94. The scheme is looked after by the Irrigation and Waterways Department of the State Government. The Agriculture Department and the Community Development blocks did not organise any special drive to educate the cultivators to take up improved agricultural practices.

8.95. Since under the Third Plan, the West Bengal Government propose to take up a large-sized drainage programme, the return aspects of the programmes need to be looked into in the light of the lessons learnt from the Sonarpur-Arapanch scheme. An attempt has been made to analyse the *direct* cost and benefit aspects of the scheme. The data show that against an actual *direct* capital cost of Rs. 213·6 per cent, the *direct* appreciation in the capital value of land has been of the order of Rs. 1,127 per acre. The ratio of capital cost to capital gain thus works out to 1:5·3. On the recurring side, the

average annual charges come to Rs. 11 per acre; while even a conservative estimate of the annual increase in gross income and output (purely in terms of paddy) amounts to Rs. 174 per acre. The ratio of recurring cost to gross output works out to 1:15·8. If the net additional income is computed, the ratio will come down probably near the level of the capital cost to capital gain ratio. The State has not so far taken any share either in this capital or in the recurring gain. The cost-benefit ratio shows that the scheme could have been self-financing.

II

Suggestions and Issues for Consideration

8.96. Soil conservation is a field of activity on which the Government have embarked comparatively recently. Even though the First Plan initiated a national programme for soil conservation, it was not until the later part of the Second Plan that the programme could be said to have got going. Whereas in a programme like irrigation we have more than half a century of knowledge and experience, in respect of soil conservation in most States, we have hardly more than five years behind us. Yet, it is the only land improvement measure applicable to the vast unirrigated areas, particularly in the drier parts of the country. It should, therefore, be placed in the same order of importance as irrigation.

8.97. The newness of the programme may be the general reason behind the inadequacy of preparation and the deficiencies in administration and organisation that have been responsible for the admittedly small progress achieved so far. We have tried in this study to point out the extent of achievement realised so far, and the problems and difficulties faced at different levels and in different fields. Our analysis does highlight some of the deficiencies and shortcomings already known and admitted. There are, however, others that are less generally known and recognised. It can hardly be over-emphasised that corrective action and improvements are urgently needed in these fields if the large order of achievement targeted in the Third Plan is to be realised. It is in this light that a few suggestions are offered here and a few issues posed for further consideration.

Soil Conservation

Objectives and Approach

8.98. Because of the vital importance of water for human use, the raising of trees, crops and livestock for power generation, navigation and sanitation and equally because of its destructive power in run-off and floods, river basin is generally considered the most logical unit for land classification, planning and development. Even when a whole river basin is not made the unit because of the vast area to be covered, smaller catchment basins are almost invariably used as the unit for planning and operational purposes. While this approach has been partially accepted for soil conservation the catchments of river valley projects, it has yet to be extended to the whole basin of all rivers.

8.99. Ideally, soil conservation implies a coordinated attempt to use each piece of land according to its capability and treat it according to its need. For this purpose, the capability and need of each piece of land has to be viewed in the total perspective of water-shed

or catchment basin of which it forms a part. The approach to soil conservation should, therefore, be based on the principle of complete water-shed management, involving engineering, agricultural forestry and other activities. Such a coordinated view of soil conservation is seldom noticed in the programmes of the States.

8.100. The technical approach to soil conservation in India seems to have been dictated so far by a concern for the prevention of gully and sheet erosion, with the result that soil conservation measures have tended to be identified with bunding and other treatments to reduce run-off and erosion. It is generally admitted, however, that the benefit of any bunding and other anti-erosion treatments cannot be fully obtained unless these are followed by conservation farming on the treated lands. The study shows that soil conservation in this comprehensive sense has seldom been the objective in the States' programmes.

Planning of the Soil Conservation Programme

8.101. Soil conservation is one of the newer programmes in the Five-Year Plans. It has been taken up on an extensive scale in most States only during the Third Five-Year Plan. Because of the inadequacy of previous experience in this line of work, the cost data and other estimates underlying the formulation of targets and outlays have shown unexpected changes and modifications in each of the Plans including the Third. The past experience serves to underline the urgent need for systematic attempts to build up data on costs of conservation treatments and measures in different areas.

8.102. The literature on the soil conservation programme gives the impression that the emphasis in its formulation as well as execution has so far been mainly on the engineering and construction side. This is probably a natural corollary of a pre-occupation with immediate anti-erosion treatments. With as large a construction (bunding, etc.) programme as has been envisaged in the Third Plan, it is necessary that the aspect of farming methods and practices on treated lands be given more attention and made an integral part of the soil conservation programme in most of the States.

8.103. The soil conservation programme for agricultural land as formulated by the State Governments includes diverse and different schemes in different States. There is an apparent lack of uniformity in the classification of what is categorised as soil conservation. This makes it difficult to scrutinise the outlays and targets on any systematic basis. It needs to be more fully integrated in respect of its different administrative components; namely, research, training, demonstration and execution. The total outlay for the whole programme should be allocated on these items in some optimum proportion. Norms for these optimum proportion have not yet been fully developed and attention needs to be given to this matter.

Survey, Research and Demonstration

8.104. No detailed land and soil survey appears to have been carried out in any State for assessing the nature and extent of the problem of soil erosion. Lack of technical personnel and lack of funds

are the two major obstacles reported by the States as coming in the way of such soil and land use surveys. There is probably a case for giving a higher priority to the schemes for such surveys.

8.105. Since soil conservation is one of the most difficult programmes to fully demonstrate, the methods and practices to be adopted for conservation purposes should be fully established and supported by research results before they are either demonstrated or extended. Soil conservation research conducted so far has been concerned largely with erosion and run-off studies, hydrological investigations and engineering measures to tackle problems of erosion. There is a great need for expanding research activities in a number of directions. Methods of conservation have yet to be evolved for heavy black soils; research on problems connected with conservation farming methods seems to have been relatively neglected. Research has yet to make a headway in the method and approach to complete soil and water conservation on water-shed basins in various agro-climatic zones. There are also differences of opinion regarding the effectiveness of field bunding or *medhbundi* for conservation purposes. Most of these problems are of a regional or local nature, and are not amenable to any all-India approach. The State Governments should, therefore, pay more attention to the soil conservation research centres, help them get properly equipped and enable them to quickly embark on the study of such urgent problems.

8.106. One of the weaknesses of the programme as it has been operated in the past, is the unsatisfactory nature of the demonstrations. The attempt so far seems to have been to conduct method demonstration rather than result demonstration. Our study, however, shows that the cultivators are more interested in the economics of soil conservation treatments and measures than in merely seeing the specifications of the bunds, etc. If extension education is to be strengthened, demonstrations have to be pursued to the results so that the cultivators can be shown the effect of the treatments on productivity and net returns.

Administration of the programme

8.107. There is a general admission in the Planning Commission and in the Ministry of Food and Agriculture that unless the policy-making and executive agencies in the States are strengthened, the achievements envisaged in the Third Plan may not be realised. For strengthening the policy-making side, the State Governments that have not yet set up any soil conservation board should take early steps to constitute such a body. Besides, in a few of the States where some State-level boards have been set up, the functions of this body do not include policy formulation and administrative coordination. These bodies need to be re-constituted so that they may be effective in, and capable of taking decisions on matters of policy and providing expert guidance and coordination. Constitution of bodies of this type necessarily requires enactment of soil conservation legislation by the States that have not yet done so and suitable modification and amendment of the laws already passed in a number of others. It may be worthwhile, in this connection, for the Central Soil Conservation Board to discuss again with some of the State Governments, the provisions of the Model Bill circulated by it in 1954.

8.108. The administrative machinery for soil conservation in the State Governments needs to be strengthened at different levels. Realising the need for it, the Planning Commission have made provision in the Third Plan for a higher rate of subsidy (50%) on schemes submitted for this purpose by State Governments. It appears, however, that no State Government except Orissa, have so far come forward with any proposal for taking advantage of this provision.

8.109. In Maharashtra and Mysore, surveys were conducted to determine the land capability classes of waste land. The recommendations on the basis of the surveys about the appropriate soil conservation measures for different classes of land were not taken into account in effecting the distribution of this land. Such instances of lack of coordination have been found in almost all States. In fact, the most urgent need is for effective coordination of the soil conservation activities of the various agencies engaged in the implementation of the programme. As far as possible, the responsibility for soil conservation should be given to one single authority, preferably the Department of Agriculture where an officer of the rank of Joint Director should be placed in overall charge of the programme in each State. It is not enough, however, to have an officer of this rank. He should also be assisted by specialists in forestry, agriculture, engineering, drainage and soil survey, and should be backed by a high power committee of the type recommended by the Planning Commission.

8.110. Unless the State Governments expand their training facilities at an early date, it may not be possible for many of them to achieve even the original targets fixed for the Third Plan. The earlier the personnel are trained, the better the prospects of achievement.

8.111. A study of the norms of achievement per unit of the staff reveals that these have been fixed at a rather low level in some States. It is true that as the programme gets more and more extended, the administrative machinery becomes smoother and the achievement per unit of staff tends to increase. This process can, however, be expedited if the State Governments make it a point to review the norms of achievement per unit of staff periodically at different levels.

8.112. It has been noticed in many areas that there is a considerable time-lag between the sanctioning of a soil conservation scheme and the completion of the contour survey. Delays of this type not only reduce the level of achievement but also add to the costs of conservation per acre by reducing the achievement per unit of staff per year. The achievement in the Third Plan can be considerably increased if suitable measures are taken at an early date to cut down the delay between different stages of the programme and to expedite the survey operations.

8.113. More attention should be given by the Revenue Department to the collection of arrears of loans. They can also extend to the soil conservation staff greater help in matters relating to land titles and records.

Role of the C.D. Block and People's Institutions

8.114. The extension agency in the community development blocks has not been assigned any role in the execution of the programme in a majority of the States. Though the block agency may not have been associated with the departmental programme of soil conservation on agricultural lands, in some of the States, blocks have been carrying out field bunding *watbundi* or *medhbundi* on farm lands. In the tribal areas, the Special Multipurpose Tribal Blocks also carry out conservation measures, sometimes under the guidance of the Forest Department. In short, there are activities designated as soil conservation work, that the block agency has been taking up in a number of States. Unfortunately, there seem to exist serious doubts in the minds of soil conservation specialists as to the technical soundness and scientific value of such works for the purpose of soil conservation. This conflict of views needs to be resolved as early as possible, so that the block agency would not have any doubts in undertaking and expanding such activities and could receive technical guidance and support from the Departmental staff.

8.115. The objective of convincing the farmers of the usefulness of conservation farming practices is not emphasized in the demonstration projects in many States. In most of the States, after the construction of bunds, the demonstrations are left to the charge of the cultivators. Attempts are not usually made to derive data on the economics of soil conservation. It is here that the block agency can play an important part in pursuing these to their logical results. In order that the demonstrations may achieve the objective of convincing the cultivators of the usefulness of the conservation treatments, conservation farming practices have to be introduced on the lands and their results demonstrated, analysed and discussed. The soil conservation staff are not at present carrying out this task; nor are the block staff involved in it. In order that the block agency may undertake such tasks, the block staff, particularly the extension officers and the VLWs, would have to be given special training in soil conservation treatments and practices.

8.116. The block agency can also play a very useful role in preparing the farmers for undertaking soil conservation treatments and in extending conservation farming practices on treated lands. The study shows that the block agency had not taken up these responsibilities in most of the districts. In fact, the soil conservation agency of the agriculture department, has no liaison with the block agency; and the latter has not taken any interest in either persuading the cultivators to keep bunds in proper state of maintenance or in extending conservation and dry farming practices. A proper coordination, if not integration of the two agencies, seems to be an urgent need, in nearly all States except U.P. While it is true that the specialist staff required for executing soil conservation measures survey, alignment, etc. are not available in the blocks, it is also true that the block staff can help in demonstration and extension. Besides, under the Panchayati Raj set-up, the soil conservation extension staff will have to be linked in some form or other with the block set-up. This question of integration of the two agencies needs to be considered by the State Governments in the light of the conditions obtaining in their area.

8.117. The construction of bunds and other works is in most areas executed by the soil conservation agency either directly or on contract. It is only in a few areas that the work is undertaken by the individual beneficiaries under the guidance of the department or agency. In a number of areas, contractors are also employed. The study shows that people's institutions like panchayats have not yet been associated with the execution of the conservation treatments in most of the States, nor does it appear that the role that the panchayats can play in getting such works executed has not been fully explored. It is only when Panchayats come into the picture more fully that the job of convincing the people, securing their consent and inducing them to undertake the work themselves on their land and speedily recovering the loans from them will become easier. In fact, panchayats can hardly be by-passed in view of their recognized role in enforcing obligations on beneficiaries and in carrying out local works. While legislation to this effect has not yet been pointed enough in many States, it does not mean that the panchayats should not be brought into the programme at this stage.

8.118. The role of voluntary organisations in the soil conservation extension programme raises a number of issues that need to be considered further. Except in Maharashtra and to some extent in U.P., no attempt seems to have been made in other States to have voluntary organisations associated with soil conservation work. Though the farmers' union in Maharashtra stands in a class by itself and has raised a number of problems and difficulties, it is undeniable that genuine voluntary organisations can, more than any other agency, create a favourable public opinion and make the cultivators realise that conservation treatments and practices are for their own good and not just a Government-sponsored programme. It is only with the cooperation and active support of voluntary organisations that the repair and maintenance of bunds and the adoption of follow-up practices can be ensured in the conservation-treated areas.

Subsidy for the programme and other economic issues

8.119. The subsidy of 25 per cent of the total cost usually given in most States appears to be meant to cover the cost of work-charged staff even though it is not usually placed before the cultivators in this light. Besides, the actual staff expenses in many areas are probably less than 25 per cent of the total cost of work in the soil conservation operational unit. This is likely to be more so as the rate of achievement per unit of staff goes on increasing. The calculation of the subsidy is done according to the general rule of thumb; it is not based on any consideration of the cultivators' discounting of future income and uncertainties. A detailed study of cost per unit, is called for so that necessary data may be available for further consideration of this issue.

8.120. Conservation treatments on cropped lands tend to result in a lowering of the yield of crops in many areas during the first one or two years because of disturbance of the top soil. In future years also, in the absence of a suitable programme of application of fertiliser, manure, and improved farming practices, the rise in the level of yields may not be sustained. Under such circumstances, the cultivator needs some positive inducement if he is to follow conservation treatments and methods, particularly when such treatments

lead, as in many cases they do, to loss of some land at least in bunds. Such inducement may be given in the shape of subsidised supply of fertilisers, improved seeds, etc. This is a matter which needs to be considered further by the Government.

8.121. Soil Conservation programme provides employment opportunities of a productive type. This is a matter which has to be fully taken account of in view of the reportedly extensive unemployment and under-employment in rural areas. The employment potential of soil conservation work and continuing productive employment that the programme would provide need a detailed study and investigation. The analysis of the data collected during this study shows that wage component in the total expenditure on soil conservation ranges between 50 and 65%; the actual employment content varying from area to area according to the intensity of soil conservation treatment. As regards continuing productive employment after initial soil conservation treatments, the bulk of the sample respondents thought that there had not been any change in it.

Self-financing Drainage schemes

8.122. Drainage schemes like the Sonarpur-Arapanch scheme in West Bengal, are essentially sound and can easily be self-financed. The State Government may consider the imposition of betterment levies and drainage charges in the benefited areas so that both the capital and recurring expenditure in such schemes need not be met from the general revenues of the State.

Dry Farming

8.123. The technical contents of the dry farming programme are still not very clear. Some improved agricultural practices like line sowing, low seed rate, field bunding, contour cultivation, strip cropping, ploughing of land once in two or three years in the case of light shallow and medium soils, etc. are generally recommended as dry farming practices for areas which get meagre and uncertain rainfall. Except in Maharashtra, the so-called dry farming practices are not backed by enough of experimental data. Under such circumstances, extension of these so-called dry farming practices to all areas where crops are grown under dry conditions carries with it uncertainties about their efficacy. There is need for more trials and experiments.

8.124. Except in one or two States, the block has had no role to play in propagating dry farming or conservation farming practices. The soil conservation staff usually prepared the people for construction measures. And for follow-up measures *i.e.*, the repair of the bunds and adoption of conservation or dry farming practices, there was virtually no agency to work with the cultivators. It was only in Maharashtra that some arrangements and provision were found to exist for dry farming demonstration and extension within the district soil conservation set-up. But even there, the dry-Farming Assistants were far too pre-occupied with the bunding programme; and of course, the block agency was not at all in the picture.

8.125. (a) The State Governments should specify the districts and blocks where the dry farming programme would be taken up in the Third Plan. A phased three-year programme for these areas may be drawn up.

(b) For each of these districts/blocks there should be available a list of dry farming practices including *Medhbundi* and field bunding which are to be recommended to the cultivators for adoption in general and/or on specific crops. As far as possible, the recommended practices should be based on experiment and trial in the research stations of the Central and State Governments and on the cultivators' farms. With the help of such data, dry farming practices should be so evolved as to be more specific with reference to the rainfall, soil and crops grown in each area.

(c) The responsibilities of the block agency, the Panchayati Raj and voluntary organizations need to be clearly defined with regard to the following items of work relating to dry farming programme:

(i) Follow-up of the soil conservation and dry farming demonstration projects;

(ii) Follow-up of the soil conservation measures on cultivators' lands in respect of repairs and maintenance of the bunds and extension of conservation farming and dry farming measures ; and

(iii) Extension of dry farming practices on all dry land in the areas not covered by soil conservation treatments.

(d) This additional programme which is being taken up by the blocks in the Third Plan should find a place in the block and village agricultural plans. There is an urgent need to work out the details of the arrangements to be made for the extension of the programme. For example, guidance will have to be given to the cultivators, dry farming demonstrations will have to be arranged, and tools and implements, seeds and fertilisers, etc. will have to be supplied to the cultivators who are willing to adopt the programme. It will help implementation if a working programme is drawn up by each block.

(e) Achievement figures for the dry farming programme need to be reported with care and accuracy so that the area shown as under dry farming includes only those areas where all the recommended dry farming measures have been actually adopted. Since quite a few improved practices are already being followed by the cultivators, the progress reports should separately indicate the new dry farming practices propagated among cultivators and adopted by them.

APPENDIX A

*Soil Conservation and Farm Planning and Management**

Dr. J. P. Bhattacharjee

1. *Introduction*

Deterioration and depletion of natural resources are world-wide phenomena. No country, advanced or under-developed, has so far been able to escape or avoid this wastage. Resource conservation has, therefore, come to be recognised as a world need. And since soil is one of the most valuable of the natural resources, soil conservation has come to acquire tremendous importance in the modern world. Much more is, however, heard and done about it in the advanced Western countries than in the under-developed countries of the East, even though the problem is no less acute and grave in the latter. It is, therefore, imperative that the problems underlying soil conservation be discussed and studied in the context of the countries in Asia and the Far East. The purpose of this paper is to discuss some of the important aspects of the economics of conservation farming and the nature of planning and management that successful soil conservation requires at the farm level. The basic fact that needs to be remembered is that successful conservation farming requires technological as well as institutional changes that raise management problems somewhat different from those under the usual methods of farming.

2. *Some General Facts about Soil Conservation*

So much has been written about the evils of soil erosion that there is hardly anything left to add, particularly for one who is not a soil scientist. Even then it is well to start out with some of the basic facts about soil erosion. Wind and water are the most important vehicles of soil loss. Among the factors that aid and accentuate soil erosion are deforestation, exploitative cropping systems, over-grazing, tracts left by wheels, animals, etc. and climatic factors like drought and heat. Soil erosion usually starts as a slow process, but eventually attains a gallopping rate. It will be seen that most of these factors are the result of man's actions and are, therefore, preventable. And because of the nature of the process of erosion the sooner they are prevented the better.

Prevention of erosion means the stopping of the soil loss that otherwise would occur. Loss of soil by itself is not an evil or danger. It becomes, so, however, whenever it leads, as it nearly always does, either to *depletion of the fertility* of land through the loss of fertile soil in the upper layer or to *deterioration in the quality* of land because of total loss of the top soil. The first loss is replenishable with a few years' efforts and capital investment. But the other loss is irreplaceable. In general, depletion of soil fertility leads eventually to deterioration in the quality of land and can thus be said to be only an earlier stage of a continuous process. The problem of soil conservation is thus one of adopting measures so as to prevent the ultimate deterioration of land and providing for its utilization in a manner designed to reduce the loss of soil to the most economical point.

An illustration of the problems mentioned above can be given here on the basis of a few simple facts collected from an area subject to erosion in the State of Bihar in East India. The average rainfall in the area is around 50 inches about 80 per cent of which falls between mid-June and mid-October. The average slope of the land varies from 1 to 2 per cent. Erosion has been going on unchecked in this area until last year when conservation measures were adopted. A survey shows that during the last 45 years approximately 17 per cent of the total area have been lost to cultivation through gully erosion. This represents the area where there has been complete deterioration of quality so much so that the land use pattern has completely changed. At present the area has fallen into the ctegory of uncultivable waste land full of gullies and some occasional shrub here and there. The remaining 83 per cent of the land has suffered depletion of fertility through sheet erosion all through these years. The exact amount of loss of fertility cannot be measured. But an idea can be obtained from the fact that at present this land yields only one very poor crop of small millets every two years. It can be presumed that the land use capacity of the area would have been much higher in the absence of sheet erosion. Among the other evil effects of this unchecked erosion, mention may be made of the silting up of the river

*'Published in farm planning and Management'
(Ministry of Food and Agriculture, Government of India, 1958) pp 168-173.

beds, and consequent tendency of the river waters to spil out in floods. Soil conservation work on this area started with a land-use survey designed for the purpose of classification of the area into crop-lands, grass-lands, grassed waterways and gullies. The specific measures adopted were consolidation of land of different owners, contour terracing of the crop land area, grassing of waterways, construction of small check dams and spill ways in the gullies, and contour cropping in a rotation allowing for erosion resisting crops.

In short, soil conservation measures include some engineering and masonry work, cooperative efforts by the cultivators, and extension workers and adoption of a changed farming system by individual cultivators. These three aspects of soil conservation are inextricably mixed together in every country and in every region. Among these three the first and the third aspects, namely, engineering work and changed farming system, imply technological change of some magnitude; while the second aspect, relating as it does to a cooperative approach to the problem by the farmers and the government presupposes a change in the institution of private control and operation of land.

3. *Economics involved in Soil Conservation*

The problem of soil conservation is not only economic but also social in its broader aspects. It is a social problem for the simple reason that land and soil are social assets, and that wastage of these poses a threat to the future output of the society. It would not, however, have been a social problem if individuals had been as much concerned about future income and output as the society is. Short-sightedness of individuals in respect of their immediate income creates a wide divergence between the present and the future needs of the people. The conflict arises basically out of the rights that go with the institution of private property in land. Exploitation of land for immediate gain, irrespective of future consequence is a practice which a society cannot afford as much as individuals. Consequently, deterioration of land and depletion of fertility are matters of concern to the society much more than to the individual. Individual farmers can, however, be concerned about these provided the society makes them sufficiently conscious of the dangers and offers alternative plans to assure them higher incomes from land use in future. It appears, therefore, that soil conservation is a field in which the society and the individual farmers have to cooperate and work together. Since both have benefits to share, the cost of soil conservation has also to be shared between the two in some proportion. The proportion would naturally vary with the nature of conservation measures. Prevention of deterioration is much more costly than saving of fertility and usually takes a longer time before returns start flowing in. The State will, therefore, have to bear a higher proportion of the costs of the former than of the latter.

The first group of economic problems in soil conservation relates, therefore, to the scale of conservation work to be undertaken and to fixing a basis for the allocation of costs and benefits of conservation work and practices between the indiviual farmers and the society as organised in the government. In determining the scale of conservation work that will be adopted by a society or its government reliance will usually be placed on a study of the comparative costs and benefits of conservation and other projects. Resources will be allocated according to the principle of opportunity costs to the society. Once the level of investment on conservation measures has thus been arrived at, the society would try to allocate a part of it to the individual farmers. The basic principle for this allocation is "ability to pay" on the part of the individuals.

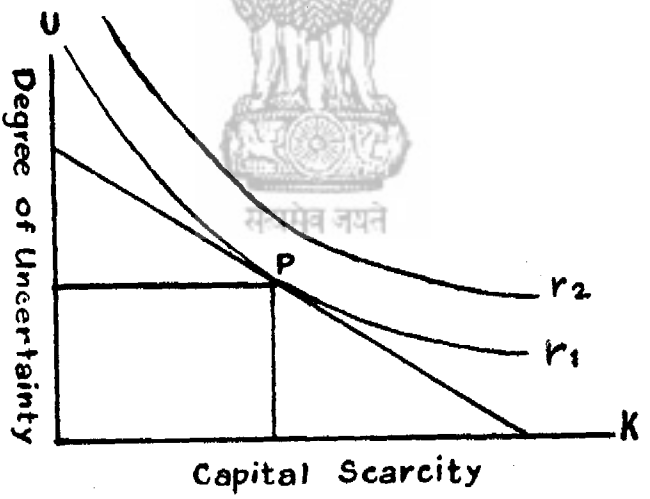
The principle of "ability to pay" is not a new one in economics and has been widely adopted in the taxation systems of different countries. In its application to levies for land development through soil conservation, ability has to be judged on the basis of financial and economic gain and resource ownership of the individual cultivators consequent on the adoption of conservation practices. This means that information has to be obtained regarding the concrete benefits that soil conservation gives rise to, the costs of such programmes and the monetary measures of the *net* benefits derived by the different individuals.

The second group of economic problems associated with soil conservation concerns the allocation of resources by the individual farmer over time. These problems are associated very largely with what is called conservation farming or farming that seeks to either prevent fertility loss or build up fertility. It has already been seen that successful conservation requires a change in the farming system and land use pattern in addition to considerable investment on works of capital nature. Even if the society bears all the costs of such capital works, it does not mean that the farmer would not have to incur any other cost on his own. In fact, conservation farming necessarily means switching over from a highly exploitative use of land to a less exploitative, and consequently an *immediately* less profitable use. It does not mean, however, that the loss of net returns or profits would continue indefinitely in the future. If that had been

the case, conservation farming would have been uneconomic by any standard to the individual. In fact, it would have been uneconomic also to most of the under-developed countries, if not to the prosperous ones. The main reason, therefore, why conservation farming is an economic proposition is that it increases *net returns after a certain period*. It is to be noted that total output may or may not fall immediately after adoption of conservation measures. What usually decreases during the transition period is net returns or profits.

It will appear from above that the fundamental economic problems involved in conservation farming so far as the individual is concerned relate to the choice between the present allocation of resources and the optimum allocation under the conservation plans. This problem can be broken down into a number of sub-problems. First there is the problem of the immediate needs of the farmer *vis-a-vis* the initial fall in net returns as a result of the adoption of the new system. The second problem is one of obtaining additional resources and /or changing the pattern of utilisation of the existing resources so as to make conservation farming possible. Thirdly, there is the problem of time preference between the present and the future, in other words, the problem presented by the discounting of the future. Fourthly, there arises the problem of uncertainty attaching to the future because of the natural risks and because of uncertainty regarding prices in future. It will be seen that most of these problems relate to the period of transition from the existing to the new system prescribed by conservation farming. The first two problems are purely budgetary and well-known to students of farm management. The last two, however, are different and need some discussion at this stage.

The problem of discounting of the future and of uncertainties can be covered under the same type of theoretical analysis, even though the two are treated separately by most production economists. In both cases the present is looked at with a premium and the future or the un-expected is discounted at rates varying with the background and the attitude of different individuals. The problem can be presented graphically if we assume that the rate of discount is a function of the capital resources of the individual on the one hand and his uncertainty preference (or aversion) on the other. The accompanying figure explains how the discount rate is usually fixed for any individual with different capital positions as reflected by degrees of capital scarcity in relation to different investment possibilities and with different degrees of uncertainty evaluated by him.



Uncertainty U and capital scarcity K are measured on the two axes and the convex curves show different combinations of the two for a given level of discount rate, r. The straight line shows the actual position of the individual in respect of availability of capital an uncertainty preference. The tangent point, p, determines his rate of discount, r, the uncertainty he would assume and the investment possibility he would go in for. Once this discount rate is obtained we can calculate how an individual feels regarding his future incomes. The simple mathematical formula that gives the discounted value or present value to an individual of future incomes in a given uncertainty situation is

$$E = \sum_{i=1}^{n} \frac{Yi}{(1+r)^i},$$

where E stands for the present value of an income stream, $Y_1, Y_2, \ldots\ldots\ldots\ldots$, Yn in years 1, 2, ..., n from now, the incomes being discounted at a rate,

r which is the resultant of the individual's capital position in relation to investment possibilities on the one hand and uncertainty preference on the other. It will be seen from this formula that the higher the discount rate of the individual the lower the present value of a future income. In general, a person with plenty of income would discount the future at a very low rate, probably at the rate of interest prevailing in the market, whereas one with inadequate capital resources would adopt a very high rate of discount. Similarly, a person with a high aversion to facing uncertainties would adopt a rate of discount much higher than one who has a small aversion.

For any individual, however, a certain discount rate can be assumed on the basis of his capital position and uncertainty preference. Given this rate of discount the present value of a future income will be smaller the larger the number of years over which the income is discounted, in other words, the more distant is the income. Similarly, as between different individuals with different discount rates the same flow of income will yield lower present values to those preferring higher discount rates than to those with lower rates. It follows, therefore, that even if net returns remain the same after switching over to conservation farming, the fact of discounting will make their present values lower than the actual net returns currently obtained.

4. *Need for Farm Planning and Management in Conservation Farming*

It has already been mentioned that conservation farming leads to an *immediate* decrease in *net* returns to the farmers. This decrease takes place through changes in land use and in cropping system and rotation with the result that the proportion of different crops to the total output changes simultaneously in *some cases* (not all cases) with a decrease even in total output. A whole host of farm management problems arise in this context. The specific problems that arise relate on the one hand to a re-allocation of the existing resources so as to conform to the needs of conservation farming and on the other to supplementing the existing with additional resources so as to maximize net returns from conservation plans. Some illustrations of the problems can be given here. A change in the land use and cropping system and in the method of farming will inevitably lead to a change in the requirements of labour over the different seasons. This will perhaps mean a change in the rhythm of life of the farm family. Such a major change can only be brought about through a replanning and rephasing of labour distribution on the basis of the bedgeting technique. It will also lead to a change in the method of utilisation and nature of distribution of animal labour. Further it will lead to a technological change of some importance to which the farmer has got to adjust himself. The technological change may range all the way from a change merely in the cultural practices to a complete change in the biological aspects of farming. Thus conservation farming may require on the one hand use of new tools and implements, new ways of cultivation like contour cropping, and new or increased dosage of fertilizers, and, on the other, may necessitate cultivation of new crops or of different varieties of the existing crops. The cultivator can accept and adjust himself to these changes only after satisfying himself about their profitability. The last but not the least, are problems presented by changes in price relationships among different crops and between agricultural and non-agricultural commodities. The degree of profitability or otherwise of any scheme of conservation farming will depend very largely on the course of prices, their level and structure. Thus it is easier to undertake conservation farming in a period of rising prices and low interest rates than in that of falling prices and high rates of interest, because future incomes will have larger present value under these conditions. Again, the farmers can be induced to adopt consevation methods more easily if agricultural prices are above parity with non-agricultural prices.

The discussion so far shows that there are two sets of problems associated with the adoption of conservation farming by the farmers, one set relating to the problems of planning of conservation farming and the other relating to the problems of easing out the transition from the present to the future. Any farm management specialist will recognise that these two are the basic problems of planning and re-organisation of farming in any situation. The special problems that arise in the case of conservation relate first to the technological change that the new system implies and, secondly, to the time factor that has to be allowed in the transition stage. The institution of land onwnership is connected largely with the second factor. So far as the first problem is concerned there is need for technical know-how on the one side and farm management education and extension on the other. When we come to the second problem we realise again the need for farm management education and extension simultaneously with extension of new facilities for capital, credit and State-aid.

Adoption of conservation farming by the farmers on a large scale therefore pre-supposes the existence of farm management studies, extension service, facilities for extending short, medium and long term credit to the farmers at reasonble rates of interest. State-aid in the field of technical know-how as well as in the carrying out of engineering works, and a spirit of cooperation among the farmers.

5. *Some of the Special Problems of Conservation Farming in Countries of Asia and the Far East*

The general problems discussed above need now to be looked at in the perspective of the under-developed countries in Asia and the Far East. In countries like the U. S. A. the emphasis in soil conservation programme has been largely on modification of the farming system by the cultivators themselves. Consequently, studies and discussions of this problem have tended more and more to emphasize problems like changes in the cropping system, role of fertilizers in smoothing out the transition and the role of livestock in increasing future income. While many of these approaches are undoubtedly suitable for adoption in the countries in this Region, we should not blind ourselves to the fact that the basic approach will have to be some what different in these countries. The most important point that needs to be remembered is that the role of the State will have to be much greater. Conservation farming, if it is to be adopted on a large scale in Asia will require participation by the State to a much larger extent than has been the case for example in the U. S. A.

Some of the special problems of these regions that give rise to this need are mentioned here. (a) The resources of the individual cultivators are extremely limited in the Asian countries with the result that even if capital and credit facilities are extended to the cultivators they would not be able to undertake soil conservation activities mainly because the returns that they can obtain from his capital will be much higher in alternative uses. (b) The nature of land ownership and fragmentation makes it almost impossible for an individual farmer to adopt conservation solely by himself. Conservation farming in these countries will have to be preceded by a thorough-going consolidation of holdings. This again requires a more effective participation by the State in conservation extension. (c) The rate of interest and the rate of discount of the future are much higher in the Asian countries than in the Western countries. Even in a country like United States it is assumed that the average rate of discount of the future by the farmers should not be taken at a level lower than 10%. In countries of Asia, however, this rate is likely to be more than twice this figure. The implication is that conservation farming is very likely to prove uneconomical to the farmers in Asian countries over a much longer period-the period of transition-- than in countries like the United State. In other words, the reduction in net returns will continue for a longer period in these cuntries because of higher rates of discounting of the uncertain future. Besides, there is no effective way to reduce this discount rate in the near future. (d) The situation is further worsoned by the poverty of these countries. The overall resources of the countries in this Region are extremely limited. There is tremendous competition for these resources from other lines or schemes of development. Consequently it is difficult even for the State in this Region to devote as much resources to conservation as it is possible for countries in the Western world.

In conclusion, it may be pointed out that conservation farming can proceed rather slowly in countries of this Region. This is the logic of events and there is no simple escape from it. But that does not mean that there is no scope for any progress in this direction. The immediate lines of progress can be more in the direction of education of the farmers in the needs of soil conservation, creation of facilities for farm planning and budgeting at the extension level, and whatever progress by the State in the direction of consevation can be undertaken without a heavy outlay. Another point that emerges is that these countries will and can afford to be more concerned about deterioration of land than about depletion of fertility. Conservation projects designed to prevent deterioration will thus receive a higher priority than projects designed for fertility preservation. Poorer countries like poorer farmers cannot afford to invest as much in the future as their richer counterparts can. The only redeeming feature in these countries is the existence of a reservoir of unutilized human capacity. To the extent the unutilized human labour of these areas can be directly applied to soil conservation work without much of external costs the prospects of conservation farming by the farmers themselves will look brighter. Undoubtedly the scope and need for studies both technical as well as farm management are very great in the field of conservation farming in the context of countries in Asia and the Far East.

APPENDIX B

List of Tables

APPENDIX-B

TABLE B-1

Outlay and Expenditure on Soil Conservation

(Rs. in lakhs)

Sl. No.	States	First Plan			Second Plan			States	Third Plan	
		Forest and Soil Conservation†			Soil Conservation				Soil Conservation	
		Outlay	Expenditure	Exp. as % of outlay	Outlay	Expenditure **	Exp. as % of outlay		Outlay	IIIrd Plan outlay as % of IInd Plan outlay
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	Andhra Pradesh	14·50	19·60	135·2	72·96	77·00	105·5	Andhra	163·00	223·4
2.	Assam	47·40	51·70	109·1	8·07	10·00	123·9	Assam	50·00	619·6
3.	Bihar	125·00	124·20	99·4	57·00	161·00	282·5	Bihar	250·00	438·9
4.	Bombay, Kutch and Saurashtra	104·70	103·40	98·8	461·26	149·00 604·00	32·3 130·9	Gujarat Maharashtra	827·00 2084·00	179·3 451·8
5.	Kerala (T+C)	..	4·60	..	30·88	22·00	71·2	Kerala	120·00	388·6
6.	M.P., V.P., Bhopal & M.B.	130·20	121·40	93·2	163·42	95·00	58·1	M.P.	300·00	183·6
7.	Madras	74·30	29·10	39·2	118·70	134·00	112·9	Madras	250·00	210·6
8.	Mysore & Coorg	9·40	10·60	112·8	85·50	152·00	177·8	Mysore	300·00	350·9
9.	Orissa	17·20	17·40	101·2	48·76	50·00	102·5	Orissa	84·00	172·3
10.	Punjab and Pepsu	103·80	98·50	94·9	35·80*	53·00	148·0	Punjab	189·00	527·9

TABLE B-1—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
11.	Rajasthan and Ajmer . .	31·60	25·00	79·1	57·00	40·00	70·2	Rajasthan	140·00	245·6
12.	U. P.	141·80	138·80	97·9	183·49	127·00	69·2	U. P.	409·00	222·9
13.	West Bengal . . .	63·70	80·10	125·7	73·62	53·00	72·0	West Bengal	466·00	633·00
14.	J. & K.	16·80	13·60	81·0	36·10	38·00	105·3	J. & K.	100·00	277·00
15.	Himachal Pradesh . .	17·80	11·80	66·3	19·95	..	..	Himachal Pradesh ..	198·00	992·5
16.	Hyderabad	21·40	14·20	66·4	103·55	..	..			
	TOTAL . . .	919·60	864·00		1556·06	1765·00			5930·00	

NOTE.—(*i*) The data for the First Plan have been taken from 'Review of the First Five Year Plan', May 1957, pp. 352 onwards. The outlay figures are 'including adjustments'.

(*ii*) Data for the Second Plan have been taken from (a) Second Five Year Plan p. 620 for the figures of outlay (b) and from Third Five Year Plan pp. 740-748 for the figures of expenditure (estimated expenditure).

(*iii*) Outlay figures for the Third Plan have been taken from Third Five Year Plan pp. 740-748.

† Data separately for soil conservation is not available.

* Outlay figures for Punjab have not been given.

** Data for expenditure relate to reorganised States (as given in Col. 9.).

TABLE B-2

Achievements under Soil Conservation measures in different areas in the Second Plan

(Figures in hectares, acres in brackets)

Sl. No.	Name of State	Achievements in different areas													
		Agricultural land	River Valley Project		Hilly areas		Ravines		Waste land		Desert			Demonstration	
			Agrl. land	Forest	Agrl. land	Forest	Agrl. land	Forest	Agrl. land	Forest	Agrl. land	Forest	Denuded forests	Agrl. land	Forest
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1.	Andhra Pradesh	14767·0 (36490)	24159·7 (59700)	..	..	..	..	..	..	..	..	..	6353·6 (15700)	1335·5 (3300)	..
2.	Assam . .	..	..	..	..	1776·6 (4390)	..	..	..	..	..	..	..	..	..
3.	Bihar . .	29258·8 (72300)	..	12140·6 (30000)	..	10117·2 (25000)	..	..	2590·0 (6400)	..	..	..	2428·1 (6000)	..	2428·1 (6000)
4.	Gujarat .	149329·1 (369000)	..	1059·1 (2617)	..	..	..	..	..	..	..	206·4 (510)	..	144·1 (356)	151·8 (375)
5.	Himachal Pradesh	244·4 (604)	..	..	..	..	..	..	..	..	..	..	..	..	4350·4 (10750)
6.	Kerala .	4642·6 (11472)	..	..	..	..	..	..	..	..	..	..	..	..	..
7.	Madhya Pradesh	19141·6 (47300)	..	1711·8 (4230)	..	..	607·0* (1500)	5098·2 (12598)	..	1715·9 (4240)	..	..	..	1031·9 (2550)	..

TABLE B-2—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
8.	Madras	49371·7 (122000)	..	..	..	3358·9 (8300)	..	..	..	..	..	1335·5** (3300)	24604·9 (60800)	404·7 (1000)	..
9.	Maharashtra	526901·2 (1302000)	..	..	1663·2 (411.0)	1740·1 (4300)	..	..	..	327350·5 (808900)	..	..	2646·6 (6540)	866·0 (2140) (15 centres)	..
10.	Mysore	109265·2 (270000)	..	..	..	..	..	..	..	..	..	..	18615·6 (46000)	1618·7 (4000)	323·7 (800) (10 centres)
11.	Orissa	..	12950·0 (32000)	6272·6 (15500)	9307·8 (23000)	1214·1 (3000)	40·5 (100)	161·9 (400)	..	..	..	..	..	1780·6 (4400)	404·7 (1000)
12.	Punjab	2590·0 (6400)	44·5 (110)	10805·1 (26700)	688·0 (1700)	3237·5 (8000)	..	..	..	..	..	4573·0 (11300)	—	121·4 (300)	202·3 (500)
13.	Rajasthan	6475·0 (16000)	..	..	..	3126·6 (7726)	..	1072·4 (2650)	..	..	..	202·3 (500)	—	809·4 (2000)	—
14.	Uttar Pradesh	28732·7 (71000)	—	..	..	574·6 (1420)	2590·0*** (6400)	..	..	1618·7 (4000)	..	..	1985·4 (4906)	2185·3 (5400)	—
15.	West Bengal	..	..	..	..	..	..	..	2541·4 (6280)	182·1 (450)	..	..	..	—	..
16.	Jammu & Kashmir.	..	..	..	..	22217·2 (54900)	..	..	..	..	..	..	—	—	—
17.	Delhi	..	..	..	..	739·4 (1827)	..	..	..	..	..	..	981·0 (2424)	6·1 (15)	—

TABLE B-2-*concld.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
18.	Tripura	..	..	..	16·2 (40)	..	..	..	..	..	..	..	165·9 (410)	..	..
19.	Manipur	..	..	..	963·1 (2380) (4 farms)	..	..	..	..	..	..	..	..	..	..
20.	Andaman & Nicobar.	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	TOTAL	940719·3 (2324566)	37154·2 (91810)	31989·2 (79047)	12638·3 (31230)	48102·2 (118863)	647·5 (1600)	6332·5 (15648)	5131·4 (12680)	330867·2 (817590)	..	6317·2 (15610)	57781·1 (142780)	10303·7 (25461) (15 centres)	7861·0 (19425) (10 centres)

* This includes area covered by C. T. O. also.

** The area reported pertains to the scheme of stablization of shifting sands in the sea-shores and in the river Paudugais from being blown over to the adjacent agricultural lands.

*** The figure represents the area of ravine land surveyed.

TABLE B-3

Experiments conducted and results achieved at the Regional Soil Conservation Reesarch Centres

Soil Conservation Research Centre	Main problems of the region	Experiments conducted	Important results achieved
(1)	(2)	(3)	(4)
1. S. C. Research Centre, Dehra Dun.	(i) Soil & water conservation on cultivated lands in the plains and hills. (ii) Control of land-slides and slips. (iii) Torrent training and stream-bank protection.	1. Experiments on cropping systems, *e.g.* crop rotations, mixed cropping and strip cropping, tillage practices, soil fertility, etc. 2. Erosion and run-off studies in order to determine the type and specifications of broad-based terraces, and to find out the effectiveness of various grasses. 3. Hydrological investigations for torrent training and watershed management. 4. Studies on the ecological succession of grasses, and forest influences in watershed behaviour.	1. Cropping systems : Of the various legumes' soyabean gave the highest canopy development of 100 percent after 45 days of sowing. 2. Hydrological Studies : (i) Among the vegetation found useful for stream-bank protection was Ipomoea carnea, vitex negundo, Jatropha curcas, Arundo donax and Lannea grandis; (ii) Permeable structures, like the brushwood and single vegetative spurs, functioned better than impermeable boulder spurs.
2. S. C. Research Centre, Ootacamund.	Serious sheet and gully erosion on steep slopes.	1. Erosion and run-off studies to develope specifications, *e.g.*, length, grade and vertical interval for soil and water conservation structures, such as bench terraces and contour trenches. 2. Suitable cropping practices, *e.g.*, cropping systems, crop rotations and soil fertility. 3. Suitable afforestation techniques for eroded lands.	1. Erosion & run-off : (i) A limiting length of 400 ft. of bench terrace with an inward gradient of 1 in 40 and longitudinal gradient of 0·5 per cent has been found to function satisfactorily. (ii) Graded trenches at a vertical interval of 8 ft. (56 ft. horizontal distance) were found satisfactory on slopes of 1 in 7 (14·5 per cent approximately). (iii) Bench terracing appeared superior to graded trenches on steep slopes (between 16 per cent and 33 per cent).

TABLE B-3—*contd.*

(1)	(2)	(3)	(4)
			2. Cropping practices : One-year crop rotation of potato on contour followed by lupin helped increase the yield of potato very appreciably over the local practice of growing potato after potato. 3. Forest influences : The loss of soil and water was practically negligible under natural forest (shola). Between Acacia mollissima and blue gum, the former provided better protection.
3. S. C. Research Centres, Bellary.	Soil & water conservation problems of the deep black cotton soils that cover a large part of peninsular India.	1. Determining the efficiency of various cropping practices, such as tillage methods, crop rotations, strip cropping, crop mixtures and contour cultivation. 2. Determining the specifications, such as vertical interval, cross section and channel grade for contour, and graded bunds and broad based terraces for deep black soils. 3. Developing suitable techniques of afforestation and grass land development.	1. Cropping practices : Contour cultivation alone gave about 15% more yield than the up and down cultivation. 2. Contour bunding : For deep black soils, broad based terraces (bunds) have been found more suitable than contour bunds provided they are laid out on contour with accepted deviations, and are supported by agronomic practices.
4-6. S. C. Research Centres, at Vasad, Kotah and Agra.	The problems of ravine formation in Gujarat (Vasad) along the Mahi and Sabarmati, in Rajasthan (Kotah) along the Chambal river, and in U.P. (Agra) along the river Jamuna. The main problems for investigation are :— (i) Soil & water conservation in table land.	*For table lands* Studies on cultural practices, such as tillage practices, crop rotations, cover cropping, strip cropping, mixed cropping and fertility investigations.	*For table lands* 1. Tillage (Vasad) : Lister furrows at 0·5 and 1·0 metre intervals helped reduce the run-off and soil losses appreciably as compared to harrowing. 2. Cover cropping (Vasad) : Sannhemp as a cover-*cum*-green manure crop in bidi-tobacco and cotton was useful in promoting soil and water conservation and increasing the yield.

TABLE B-3—*contd.*

(1)	(2)	(3)	(4)
	(ii) Soil & water conservation in marginal lands and ravines. (iii) Reclamation & utilisation of ravines.		(Kotah) : The use of phosphated sannhemp as a *cover-cum*-green manure crop increased the yield of wheat over the use of non-phosphated sannhemp. 3. Crop rotations (Vasad) : The yield of bajra was significantly more when it followed the green-manured bidi tobacco. 4. Seed rates & spacing (Kotah) : For efficient and economical utilization of soil moisture, the optimum seed rate and spacing were 9 lbs./ acre and 18 inches between rows for Jowar, and 60 lbs./acre and 12 inches between rows for wheat.
		For marginal lands & ravines Studies on suitable vegetation	*For marginal lands & ravines* 1. Vegetation (Vasad) : The most promising species among the trees are acacia arabica, Albizzia lebbek, Ailanthus excelsa, Dalbergia sissoo, Dendrocalamus strictus, Eucalyptus hybrid, Pongamia glabra, Salmalia malabarica, Phyllathus emblica and Tectona grandis. Among the grasses cenchurs ciliaris and Dicanthium annulatum are most suitable. 2. Horticultural plantation (Vasad) : Among the various horticultural crops, lemon, guava, pomegranate, phalsa and mango were successfully raised. (Agra) : Of orange, lemon, guava, grape fruit which were tried, the last showed good promise.

TABLE B-3—*contd.*

(1)	(2)	(3)	(4)
		For reclamation and utilization of ravines	*For reclamation and utilization of ravines*
		Experiments for a suitable method or methods for the reclamation and utilization of ravines.	1. Reclamation of ravines for Agricultural purposes (Vasad) : The method for reclaiming the shallow and wide ravines consists in clearing and smoothening the gully beds and sides, putting up diversion-*cum*-check bunds at 100-150 ft. spacing or composite check dams, and terracing the gully sides at a 3-4 feet vertical interval. (Agra) : Gullies are reclaimed for agricultural purposes by tractor and also by bullock power. Of these two, the former is more economical. Studies on the introduction of remunerative crops indicated that castor and arhar held out good promises. Reclamation of ravines as fuel & fodder reserves (Vasad) : For the development of deep and narrow ravines as fuel and fodder reserves Acacia arabica was found to be the best fuel tree, and cenchrus oiliaries and Dicanthium annulatum as the best fodder grasses for the locality. (Kotah) : Among the economic species tried in the ravines, bamboo had established well. Among grasses, dicanthium annulatum was introduced successfully on degraded lands. (Agra) : Among the tree species tried for afforestation, Acacia arabica, Albizzia lebbek, Dalbergia Sissco, Ailanthus excelsa, Pongamia pinnata, phyllathus emblica, delonix regia, Salmalia malabarioum and purtranjiva roxburghii were doing well.

TABLE B-3—*concld.*

(1)	(2)	(3)	(4)
7. S. C. Research Centre, Chandigarh.	Erosion on the agricultural land, the devasting choes (torrents) & land slides are the main problems in the Sivalik region.	1. Determination of specifications for contour bunds and broad based terraces for effective prevention of soil erosion and run-off on agricultural land, and crop management practices for sustained productivity. 2. Watershed management studies for stabilization of the Sivaliks. 3. Studies on choes (Torrents) training and correction.	1. Soil erosion & run-off : Of the three specifications for vertical interval (V. I.) compared, *i.e.*, S+3, S+2 and $\frac{S+2}{2}$ the minimum soil loss occurred at a V.I. of S+3. 2. Soil fertility : Application of nitrogen and phosphoric acid gave a positive increase in yield.
8. S. C. Research Centre, Chatra.	The main erosion problems are landslides and slips and bank cutting by river Kosi.	1. Watershed management experiments. So far, about six catchments have been delineated. In a few catchments, series of different types of check dams have been constructed to find out the best suited and most economic ones for control of torrent cutting. 2. Experiments for the prevention of bank erosion. Different types of revetments have been constructed for this purpose. 3. Studies on grass species : Studies are underway to find out the root characteristic and binding capacity of various economic grass species.	No important result has yet been established as the research centre was established only recently and the watershed management experiments, which are the chief research programmes of the centre, are normally of a long duration.

TABLE B-4

Administrative arrangements for soil conservation programme on agricultural lands

Adm. set-up at various levels	Kerala	Punjab	Rajasthan
1. State level . . .	Joint Director of Agriculture (Soil Conservation) is in Adm. control at State-level.	*Agri. Deptt.* : Soil conservation Adviser of the status of Joint Director of Agriculture is incharge of the programme at the State-level. Divisional Soil Conservation Officer at the Hqrs., is to assist him. *Irrigation Deptt.* : Director, Irrigation Research Institute, Amritsar.	Director of Agriculture is overall incharge but Soil Conservation Officer of the rank of Deputy Director is the person charged with the execution of soil conservation programme.
2. Divisional and/or District level.	District Agriculture Officer, with requisite staff.	*Agri. Deptt.* : Assistant Soil Conservation Officer at the district level. He is assisted by Agri. Inspectors and Sub-Inspectors, at the tehsil or the lower level depending upon the type of work. *Irrigation Deptt.*: Divisional and District level officers in such areas where construction or/and research is being undertaken.	At the Divisional level, Assistant Soil Conservation Officer works under the Dy. Director of Agriculture. He coordinates the work in the Districts. At the District level, soil conservation assistants posted in selected areas work under the guidance and control of District Agriculture Officer. Other supporting staff at the district level are overseer and soil conservation fieldmen.

TABLE B-4—*contd.*

Adm. set-up at various levels	Uttar Pradesh	West Bengal	Bihar
1. State level . . .	Joint Director of Agri. (Soil Conservation) is responsible for soil conservation programme. He is assisted by one Dy. Director (Research), Dy. Director (Extension) and Executive Engineer (Soil Conservation).	Joint Director of Agriculture (Research and Education) is looking after the S. C. programme in the State. No technical officer to assist him except one assistant to deal with his files.	*Agri. Deptt.:* Soil Conservation wing of the Agriculture Department is under the adm. control of Director of Soil Conservation. He is also Conservator of Forests and is assisted by a technical officer. *D. V. C.:* Soil Conservation Department of the D.V.C. is under the charge of Director of Soil Conservation. It has six sections, each headed by a Class I Officer. Sections are (i) Research and Investigation, (ii) Extension, (iii) Engineering, (iv) Forestry, (v) Irrigation, Farming and (vi) Foreshore Farming.
2. District level and below .	District Soil Conservation Officer assisted by Engineering Assistant, if he is an agronomist. And if he is an engineer, he will be provided a senior Agronomical Assistant. In the selected blocks in the district, the soil conservation work is executed through the Block agency. Additional staff of one A.D.O, soil conservation, and 10 Assistant soil conservation Inspectors are provided in these blocks.	District Agriculture Officers. They have received training in soil conservation work.	*Agri. Deptt :* Assistant Director of soil conservation is at the District level, assisted by a Survey Officer (provided since March, 61). Block Development Officer, with the help of Soil Conservation Supervisor, is planning, preparing and executing the works, after getting approval from the Assistant Director of Soil Conservation at the District. *D. V. C.:* The area allotted to D.V.C. has been divided in 3 zones, each under a class II officer. Each zone is divided into 10 units. Each unit has 1 Soil Conservation Assistant, 2 Field Assistants, 2 'Amins' and 2 Chainmen. Since 1959-60, they are working independently.

TABLE B-4—*contd.*

Adm. set-up at various levels (1)	Andhra Pradesh (2)	Assam (3)	Gujarat (4)	Maharashtra (5)	Mysore (6)
1. State level.	Director of Agriculture assisted by one Superintending Engineer.	Chief Conservator of Forests is also Director of Soil Conservation.	Director of Agriculture; Dy. Director of Agriculture (Eng.) actually runs the show, assisted by a technical officer (Eng.).	Director of Agriculture, Joint Director of Agriculture (Soil Conservation and Engineering) handles the work assisted by one Soil Specialist, one Deputy Director of Agriculture and Research Engineer.	Director of Agriculture assisted by one Assistant Soil Conservation Officer.
2. Divisional level.	Divisional Engineer (Soil Conservation) for the entire Division which may comprise of few districts or only one district depending on the work.	5 Divisions, each headed by a *Divisional Officer, Soil Conservation.*	2 Divisions, each under the charge of Superintending Agriculture Officer, who is assisted by two officers exclusively in charge of Soil Conservation, *viz.*, a Deputy Director (Eng.) and a Divisional Soil Conservation Officer.	7 Divisions, under the charge of Deputy Director of Agri. (Eng.) and Divisional Soil Conservation Officers. The former is to assist the Superintending Agricultural Officer incharge of a Division.	2 Divisions, under the charge of Divisional Soil Conservation Officer.
3. Sub-Divisional level.	3 Sub-divisions in a Division carry out the work.	Each Division is divided usually, in two Ranges, under Range Officer.	Each Division is divided in to number of Sub-Divisions, depending on in tensity of programme and the staff available. It is under Sub-divisional Soil Conservation Officer.	Generally 5 Sub-divisions are under a Divisional Soil Conservation Officer and 3 Sub-divisions under Dy. Director of Agriculture (Eng.) attached to the Supd. Agri. Officer.	Each Division is divided into Sub-divisions which may comprise of a Revenue District or more than that, depending on the intensity of the programme. It is under the control of Sub-divisional Soil Conservation Officer.

TABLE B-4—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)
4. Field level	5 Assistants and with each 3 Sub-Assistants are in each Sub-division.	Foresters, Forest Guards and Plantation 'Malies' help the Rangers in the field.	Each Sub-division has 5 charges, each being looked after by Agricultural Supervisor. Each charge usually consist of a few villages and there are 5 Agricultural Assistants to carry out the work.	Each Sub-division is provided with 25 Agricultural Assistants (village level functionaries). Their work is supervised by five Agricultural Supervisors.	A certain number of Agri. Demonstrators and Agri. Assistants are provided. Agri. Demonstrator is incharge of 3-4 taluks and is assisted by 5-6 Agri. Assistants with their Hqrs. at taluk and suitable village centres respectively.

TABLE B-4—*concld.*

Adm. set-up at various levels	Himachal Pradesh	Madhya Pradesh	Madras	Orissa
1. State level	Development Commissioner is the Land Development Commissioner & Chairman of the Soil Conservation Board. One Soil Conservation Officer of one Division is the Secretary of the Board.	Joint Director of Agri. (Soil Conservation) working under Director of Agri. is responsible for s.c. work in the State. (Till the end of the Second Plan, there was one Soil Conservation Officer for the entire State).	Director of Agriculture is overall incharge. Agricultural Engineer and Joint Director of Agriculture are below him for periodic supervision.	Director of Agriculture is in overall charge, though Joint Director of Agriculture is solely responsible for Soil Conservation programmes. He is assisted by an Assistant Soil Conservation Officer at the Headquarters.
2. Divisional level . . .	*Agri.Deptt.*—Two Soil Conservation divisions, headed by Soil Conservation Officer. Each comprises of two districts.	At present two Divisions each headed by Divisional Soil Conservation Officer.	..	3 Divisions, each headed by a class I Soil Conservation Officer.
	Forest Deptt.—Conservator of Forests and Divisional Forest Officers.	..	..	..
3. Sub-divisional level . .	*Agri.*—There are 4 Sub-divisions of these two Divisions, each headed by Assistant Soil Conservation Officer (Survey).	Each Division is sub-divided into sub-divisions headed by an Assistant Soil Conservation Officer.	Assistant Agricultural Engineers are incharge of Sub-divisions or districts.	Divisions are divided into Sub-divisions, headed by class II Assistant Soil Conservation Officer.
	Forest.—In each Division, there are 4-5 Range Officers.	..	..	..
4. Field level	*Agri.*—There are Sections in each Sub-division, under the charge of Inspector of Soil Conservation.	Assistant Soil Conservation Officers are assisted by Agricultural Assistants and Sub-Assistants.	Agri. Engineering Supervisor and Soil Conservation Assistants execute the Soil Conservation programme.	Each Sub-division is further divided into Ranges. Under Range Officer are Sections under Surveyors or Soil Conservation Sub-Assistants.
	Forest.—Below Range Officers, there are Block Officers.	..	..	..

TABLE B-5

The area covered by soil conservation programme in 1960-61 and 1961-62, and the trained and untrained staff available for work in 1960-61

Sl. No.	State	Area covered (in hectares, acres in brackets)		Trained staff available for work in 1960-61			Untrained staff available for work in 1960-61		
		1960-61	1961-62	Officer	Assistant	Sub-Assistant	Officer	Assistant	Sub-Assistant
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1.	A. P.	10,124 (25,016)	11,082 (27,385)	6	32	16	5	20	19
2.	Bihar	14,933 (36,900)	19,789 (48,900)	2	36	..	..	..	..
3.	Gujarat	69,793 (1,72,462)	56,248 (1,38,993)	12	60	312	..	..	..
4.	H. P.	176 (436)	283 (700)	2	6	1	1	2	12
5.	Madras	22,003 (54,370)	29,704 (73,400)	9	38	23	..	..	12
6.	M. P.	2,749 (6,793)	15,225 (37,622)	11	31	147	2	--	..
7.	Maharashtra	1,95,868 (4,84,000)	2,50,096 (6,18,000)	49	210	1,055	--	--	..
8.	Mysore	16,985 (41,971)	14,933 (36,900)	10	50	190	--	--	..
9.	Orissa	9,288 (22,952)	9,679 (23,917)	9	30	44	6	6	..
10.	Rajasthan	9,111 (22,514)	7,661 (18,931)	1	5	24	3	5	..
11.	U. P.	8,891 (21,971)	8,129 (20,088)	9	46	175	4	..	..
12.	W. Bengal	405 (1,000)	345 (853)	2	--	..	1	2	..

TABLE B-6

Land Utilization Pattern in the Selected Districts

(a) *Proportion of the geographical area under forests in the selected districts.*

Proportion of the geographical area	No. of districts	Names of the districts (% area in brackets)
(i) Less than 20% . .	14	Rajkot (0·05), Maidnapur (0·65), Mathura (1·75), Jaipur (2·03), Hoshiarpur (2·55), Tumkur (4·12), Baroda (5·71), Mirzapur (7·44), Dharwar (8·09), Anantapur (10·09), Bilaspur (10·27), Ahmednagar (11·51), Hyderabad (12·94), United Mikir & N. C. Hills (18·30).
(ii) 20%—30% . . .	4	Gwalior (21·08), Coimbatore (25·20), Koraput (26·40), Amraoti (28·67).
(iii) 45%—55% . . .	3	Trichur (45·37), Hazaribagh (49·67), Nilgiris (54·37).

(b) *Proportion of the geographical area under cultivation (Net sown area + current fallow).*

Proportion of the geographical area	No. of districts	Names of the districts (% area in brackets)
(i) Less than 30% . .	4	United Mikir and N. C. Hills (6·70), Nilgiris (21·30), Bilaspur (26·97), Hazaribagh (27·27).
(ii) 30%—45% . . .	4	Mirzapur (34·25), Gwalior (41·26), Koraput (41·90), Trichur (44·41).
(iii) 45%—60% . .	8	Hyderabad (52·49), Hoshiarpur (53·82), Tumkur (53·86), Jaipur (54·00), Midnapur (56·14), Amraoti (56·58), Anantapur (58·74), Coimbatore (58·97).
(iv) 60% and above . .	5	Rajkot (70·16), Baroda (70·44), Ahmednagar (74·95), Dharwar (81·40), Mathura (86·96).

(c) *Proportion of the geographical area under 'uncultivated land excluding fallows'.*

Proportion of the geographical area	No. of districts	Names of the districts (% area in brackets)
(i) Less than 14% . . .	16	Hoshiarpur (0·13), Trichur (2·27), Ahmednagar (2·46), Mathura (3·75), Dharwar (4·27), Tumkur (4·55), Coimbatore (5·00), Amraoti (5·79), Gwalior (6.03), Anantapur (7·53), Mirzapur (7·71), Midnapur (7·93), Hazaribagh (8·23), Jaipur (8·41), Baroda (11·03), Rajkot (11·11).
(ii) 14%—25% . . .	3	Hyderabad (14·08), Nilgiris (15·71), Koraput (23·52).
(iii) 25% and above . .	2	United Mikir & N. C. Hills (48·78), and Bilaspur (49·44).

(d) *Proportion of the geographical area under fallow lands other than current fallows.*

Proportion of the geographical area	No. of districts	Names of the districts (% area in brackets)
(i) Less than 3% . .	10	Mathura (0·35), Baroda (0·49), Bilaspur (0·50), Rajkot (1·27), Dharwar (1·83), Mirzapur (1·96), Nilgiris (2·07), Ahmednagar (2·15), Gwalior (2·15), United Mikir and N. C. Hills (2·41).
(ii) 3%—15% . . .	8	Coimbatore (4·06), Trichur (4·09), Hyderabad (5·40), Amraoti (5·73), Hazaribagh (5·98), Jaipur (12·34), Anantapur (14·03), Hoshiarpur (14·70).
(iii) 15% and above . .	2	Midnapur (19·73), Tumkur (24·34).

NOTE.—In case of Koraput the Land Utilisation details refer to village areas (excluding reserve forests) surveyed in a total area of 7164·65 sq. miles out of 9446·65 sq. miles of 13 blocks into which the district has been demarcated for survey and settlement (1959-60). Under (c) the proportion 23·52 for this district includes also the area under fallow lands other than current fallow.

TABLE B-7

Distribution of the selected districts according to the proportion of gross cropped area under different categories of crops

(The figures under the line indicate the proportion of the gross cropped area irrigated (3% and above) under each category.)

(a) *Per cent Area under wide row crops.*

% to gross cropped area	No. of districts	Names of the districts (Proportion of the area in brackets)
1. Below 20 . . .	10	Hazaribagh (0·00), Koraput (0·01), Midnapur, (0·22), Mirzapur (0·40), Nilgiris (0·55), Trichur (7·14), Tumkur (10·55), United Mikir and N. C. Hills (14·67), Mathura (16·05/3·00), Gwalior (17·32).
2. 20—40 . . .	4	Hoshiarpur (21·27), Anantapur (31·87), Jaipur (36·74), Bilaspur (38·61).
3. 40—60 . . .	4	Rajkot (40·52), Hyderabad (41·97), Coimbatore (45·14/15·18), Dharwar (52·85).
4. Above 60 . . .	3	Baroda (62·14), Ahmednagar (70·90/5·95).

NOTE.—The crops included under the above category are : Jowar, Bajra, Maize, Castor seeds, Non-edible Oilseeds, Cotton, Tapioca, Chillies, Tobacco.

(b) *Per cent area under class-grazing crops.*

% to gross cropped area	No. of districts	Names of the districts (Proportion of the area in brackets)
1. Below 20 . . .	4	Rajkot (7·22/4·09), Amraoti (14·27), Ahmednagar (14·38/4·08), Nilgiris (14·49).
2. 20—40	7	Dharwar (20·79/4·98), Jaipur (21·66/17·54), Coimbatore (25·14/18·17), Baroda (26·06), Hyderabad (27·56), Anantapur (32·04/8·91), Mathura (37·79/27·44).
3. 40—60 . . .	6	Mirzapur (46·52/15·59), Tumkur (47·46/11·20), Hoshiarpur (47·52/10·34), Bilaspur (48·91/5·80), Trichur (49·49/29·93), Gwalior (53·04/20·68).
4. Above 60 . . .	4	United Mikir & N. C. Hills (64·89/5.30), Hazaribagh (74·95), Koraput (91·43), Midnapur (94·37/3·80).

NOTE.—The crops included in the above category are : Paddy, Ragi, Wheat, Barley, Minor millets, Korra, Marua, Kodra, Kodo, Kurthi, Sama, Samai, Sawan, Kakum, Kutki, Tur, Sesamum, Safflower, Rape & mustard, Linseed, Niger, Rye & Sarso, Rabi oil seeds, Edible oilseeds, Jute, Mosta, Ambadi, other fibre crops, Sugarcane, Corriander, Sweet Potato, Fodder crops, Fodder grasses.

(c) *Per cent area under legumes.*

% to gross cropped area	No. of districts	Names of the districts (Proportion of the area in brackets)
1. Below 20 . . .	14	Nilgiris (0·19), Midnapur (0·20), Koraput (0·85), Hazaribagh (2·30), United Mikir & N. C. Hills (2·82), Bilaspur (3·71), Trichur (4·06), Hoshiarpur (5·01), Amraoti (6·79), Baroda (7·94), Ahmednagar (9·35), Mirzapur (11·22), Mathura (14·54), Hyderabad (14·55).
2. 20—40	6	Dharwar (20·68), Tumkur (21·53), Coimbatore (26·01), Gwalior (29·64), Anantapur (30·27), Jaipur (31·59).
3. 40—60	1	Rajkot (49·63).
4. Above 60 . . .	..	Nil.

NOTE.—The crops included in the above category are : Bengal Gram, Red Gram, Green Gram, Black Gram, Horse Gram, Khesari, Mag, Moth, Peas & Beans, Field beans, Masur, Chaula, Other pulses, Groundnut, Soyabean, Sunnhemp, Green manuring crop, Lucerne, Sanai and Dhaincha.

(d) *Per cent area under mixed crops.*

% to gross cropped area	No. of districts	Names of the districts (Proportion of the area in brackets)
(1)	(2)	(3)
1. Below 20 . . .	18	Anantapur (0·00), Hyderabad (0·00), United Mikir & N.C. Hills (0·00), Hazaribagh (0·00), Baroda (0·00), Bilaspur (0·00), Trichur (0·00), Rajkot (0·00), Gwalior (0·00), Coimbatore (0·00), Nilgiris (0·00), Ahmednagar (0·00), Amraoti (0·00), Dharwar (0·00), Tumkur (0·00), Koraput (0·00), Jaipur (0·00), Midnapur (0·00).

(1)	(2)	(3)
2. 20—40 . . .	3	Mirzapur (25·91), Hoshiarpur (26·20/3·45) Mathura (30·98/3·74).
3. 40—60	..	Nil.
4. Above 60 . . .	..	Nil.

NOTE.—The crops included under the above category are : Cotton+ Arhar, Bajra+ Arhar, Wheat+Gram, Jowar+Arhar, Wheat+Barley, Barley+Gram, Jowar+Bajra+Arhar, Kodo+Arhar.

(e) *Per cent area under plantation crops.*

% to gross cropped area	No. of districts	Names of the districts (Proportion of the area in brackets)
1. Below 20 . . .	19	Anantapur (0·00), Hyderabad(0·00), Hazaribagh (0·00), Rajkot (0·00), Bilaspur (0·00), Gwalior (0·00), Ahmednagar (0·00), Amraoti (0·00), Dharwar (0·00), Koraput (0·00), Hoshiarpur, (0·00), Jaipur (0·00), Mathura (0·00), Mirzapur (0·00), Midnapur (0·00), Baroda (0·24), Coimbatore (1·01), Tumkur (6·36), United Mikir and N.C. Hills (10·22).
2. 20—40	1	Trichur (37·90).
3. 40—60	1	Nilgiris (56·97).
4. Above 60 . . .	..	Nil.

NOTE.—The crops included under the above category are : Tea, Coffee, Rubber, Coconut, Arecanut, Cinchona, Cardamom, Black pepper, Betelvine, Banana, Orange Citrus, Cashew nut, Dry fruits, Palmyrah, Katchu, Lac.

(f) *Per cent area under miscellaneous crops.*

% to gross cropped area	No. of districts	Names of the districts (Proportion of the area in brackets)
1. Below 20 . . .	19	Gwalior (0·00), Hoshiarpur (0·00), Mathura (0·64), Amraoti (0·99), Trichur (1·41), Rajkot (2·63), Coimbatore (2·70), Baroda (3·62), Ahmednagar (5·37), Midnapur (5·41/3·36), Dharwar (5·68), Anatapur (5·82), United Mikir & N. C. Hills (7·40), Koraput (7·71), Bilaspur (8·77), Jaipur (10·01/3·30), Tumkur (14·10), Hyderabad (15·92), Mirzapur (15·95).
2. 20—40	2	Hazaribagh (22·75), Nilgiris (27·80).
3. 40—60	Nil.	
4. Above 60 . . .	Nil.	

NOTE.—The crops included under the above category are : Arika, Spices and condiments, fruits and vegetables, misc. cereals and millets, misc. food and non-food crops, Varagu, Tamarind, Indian hemp, Other drugs & narcotics, Dyes, Pepper, Lemon grass, Vari, Italian millets, Grass and babuls, Ginger, Turmeric, Garlic, Potato etc. etc.

(g) *Intensity of cropping.*

Extent of the intensity	No. of districts	Names of the districts (% in brackets)
1. 100—105% . .	9	Amraoti (100·66), Hyderabad (101·35), Tumkur (101·99), Rajkot (102·13), Koraput (102·22), Baroda (102·24), Anantapur (102·65), Nilgiris (103·29), Dharwar (104·29).
2. 105—110% . . .	3	Gwalior (105·09), Ahmednagar (105·12), Midnapur (108·74).
3. 110—150% . . .	7	Jaipur (111·57), Mathura (120·21), United Mikir & N. C. Hills (123·46), Coimbatore (126·07), Hoshiarpur (129·74), Mirzapur (132·23), Hazaribagh (134·64).
4. Above 150% . .	2	Trichur (150·39), Bilaspur (172·54).

NOTE.—The irrigated area under the different categories of crops in Hyderabad and Hazaribagh is not available.

TABLE B-8

Crop Rotations for soil Conservation areas in the selected Districts

Sl. No	State	District	Crop rotations followed Traditionally			Recommended crop rotations (excluding those Traditionally followed)			Recommended/approved crop rotations as well as traditionally followed		
			Sl. No.	Period of rotation (years)	Sequence of rotation	Sl. No.	Period of rotation (years)	Sequence of rotation	Sl. No.	Period of rotation (years)	Sequence of rotation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1.	Andhra Pradesh.	Anantapur	..	..	..	..	..	..	1	1	Groundnut-fallow.
									2	1	Samu-fallow.
									3	1	Bajra-fallow.
									4	2	Jowar-fallow-Groundnut-fallow.
									5	2	Korra-fallow-Groundnut-fallow.
									6	2	Jowar-fallow-fallow-Horse-gram.
									7	2	Korra-fallow-Jowar-fallow.
									8	2	Samu-fallow-fallow-Horsegram.
									9	2	Jowar or Korra-fallow-fallow-Coriander.
									10	3	Jowar-fallow-Groundnut-fallow-Korra or Samu-fallow.
									11	3	Groundnut-fallow-Jowar or Korra-fallow-Cotton-fallow.
		Hyderabad							1	2	*1 Castor-Jowar-fallow.
									2	2	*1 Castor-Maize-fallow.

TABLE B-8—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
2.	Assam	United Mikir & N.C. Hills.	..	..	Jhuming—cultivating the same plot after a period of 4 to 5 years.	..	..	Cultivation of cash crops like cashew-nut, black pepper and Coffee etc. is recommended.	..	..	..
3.	Bihar	Hazaribagh	1	1	Maize-fallow	1	1	Cereals-Legumes	1	1	*2 Gorra paddy mixed with Arhar (every year).
			2	1	Kulthi or Gundli-Sargoja.						
4.	Gujarat	Baroda	1	1	Paddy-Gram or wheat	..	..	..	..	..	..
			2	2	Cotton-Maize-fallow.						
			3	3	Cotton-Groundnut-fallow-fallow-Jowar.						
		Rajkot	..	..	..	1	2	Cotton+Jowar+pul-ses-groundnut-fallow.	1	1	Groundnut or Cotton or Bajra or Jowar-fallow.
						2	2	Bajra-pulses-groundnut-fallow.	2	1	Groundnut or Bajra or Jowar-wheat.
						3	1	Fallow-wheat and/or gram.	3	1	Bajra or cotton with groundnut (as a strip crop)-Wheat.
5.	Himachal Pradesh	Bilaspur	1	1	Maize-fallow (Unirrigated areas)	..	..	..	1	1	Paddy-wheat (Irrigated areas).
			2	1	Paddy-wheat+gram (Irrigated areas).				2	1	Maize-wheat (Unirrigated areas).
									3	1	Maize-wheat-gram (Unirrigated areas).
6.	Kerala	Trichur	1	1	Tapioca	..	..	..	..	..	..
			2	1	Paddy-fallow.						
			3	1	Paddy-paddy.						
7.	Madhya Pradesh.	Gwalior	1	2	Jowar and/or Til-fallow-fallow-wheat or Gram or wheat + Gram.	..	*3	..	..	..	..
			2	2	Jowar+Mung-fallow-fallow-wheat and/or Gram.						
			3	2	Jowar-fallow-fallow-Alsi.						

TABLE B-8—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
8.	Madras	Coimbatore	1	1	Groundnut-fallow.	..	..	..	1	1	Cholum mixed with pulses-fallow.
			2	1	Cotton-fallow.				2	1	Cumbu mixed with pulses-fallow.
			3	1	Groundnut-Horse gram.				3	1	Cholum-Horse gram.
								Terraced area			
		Nilgiris	1	1	Potato-Cereals	1	2	Potato-Green manure crop-fallow-Cereals-Green manure crop-fallow.	..	..	..
								Non-Terraced area			
			2	1	Potato-potato-fallow	1	1	Potato-cover crops such as cow-peas or horse gram etc. (For slopes less than 2%). For slopes steeper than 33%, tree plantation and other plantation crops after contour trenching are recommended.			
			3	1	Potato-fallow						
			4	1	Potato-vegetables-fallow.						
9.	Maharashtra	Ahmednagar	1	1	Fallow-Jowar+Safflower	1	2	Fallow-Jowar+Safflower-fallow-Gram.	1	1	Mung-Jowar.
			2	1	Bajri+Tur-fallow						
			3	2	Fallow-Jowar+Safflower-Groundnut-Fallow.	2	2	Bajri+Tur-fallow-Groundnut-fallow.			
			4	2	Bajri+Tur-Fallow-Mung or Bajri-fallow.						

TABLE B-8—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
		Amraoti	..	..	..	..	..	..	..	1	2	Cotton+Tur-Fallow-Jowar+Mung-Fallow.
										2	3	Cotton+Tur - Fallow - Jowar+Mung - Fallow - Groundnut - Fallow.
10.	Mysore	Dharwar	..	..	..	..	..	..	..	1	1	Paddy-Fallow.
										2	1	Paddy-Gram or Pulse.
										3	1	Groundnut-Fallow.
										4	2	Jowar-Fallow - Cotton-Fallow.
										5	2	Paddy-Fallow - Sugarcane-Fallow.
										6	3	Potato-Gram - Jowar-Fallow-Cotton-Fallow.
										7	3	Chillies - Fallow -Jowar-Fallow - Groundnut - Fallow.
		Tumkur	1	1	Ragi or Ragi+Pulses (mixed crop)-Fallow.	..	..	..	..	..	..
			2	1	Paddy or Paddy+Sunhemp or Green manure crop (mixed crop)-Fallow or Gram.						
			3	2	Groundnut - Fallow - Millets or Jowar-Fallow.						
			4	2	Paddy-Fallow - Sugarcane-Fallow.						
			5	3	Paddy - Fallow or Gram - Paddy-Fallow or Gram-Sugarcane.						

TABLE B-8—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
11.	Orissa	Koraput	1	1	Sweet Potato-Fallow	..	..	Planting of Cashew-nut, Agave etc. in contours and coffee, cocoa, fruit trees etc. on terraces.			
			2	1	Fallow-Horsegram.						
			3	1	Fallow-Niger.						
			4	1	Arhar+Minor millets-Fallow.						
			5	1	Arhar+Ragi-Fallow.						
			6	1	Millets+Jowar-Fallow.						
			7	2	Minor millets-Fallow-Fallow-Niger.						
			8	2	Sweet Potato - Fallow-Fallow-Niger.						
			9	2	Ragi - Fallow-minor millets-Fallow.						
			10	2	Paddy-Fallow - Ragi-Fallow.						
			11	2	Paddy+Arhar - Fallow-minor millet-Fallow.						
			12	3	Ragi - Fallow - minor millet - Fallow -Fallow-Niger.						
			13	3	Minor millets-Fallow-Fallow-Niger - Fallow-Fallow.						
			14	4	Ragi - Fallow - minor millet - Fallow - Fallow-Niger - Fallow-Fallow						
12.	Punjab	Hoshiarpur	1	1	Maize-wheat	1	1	*4 Green manuring-maize-wheat.			
			2	1	Fallow - wheat or Gram or wheat+Gram.	2	3	*4 Green manuring-wheat - Fodder - Fallow-maize-wheat.			
			3	1	Maize-Fodder.						

TABLE B-8—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
			4	2	Fallow - wheat or Gram or wheat + Gram-Fodder-wheat or Gram or wheat+ Gram.						
			5	2	Fodder - Fallow - Fallow - wheat or Gram or wheat+ Gram.						
13.	Rajasthan .	Jaipur	1	1	Bajra-Fallow.	1	2	Castor-fallow- Bajra + Moth + Moong (Mixture)-fallow.	1	2	Bajra-fallow-fallow-gram.
			2	1	Jowar-fallow.				2	2	Jowar-fallow-fallow-gram
									3	2	Groundnut- fallow-Jowar-fallow.
									4	2	Bajra-fallow-Groundnut fallow.
									5	2	Bajra - fallow - Pulses-fallow.
									6	2	Til - fallow - Bajra-fallow.
									7	2	Til - fallow - Jowar-fallow.
14.	Uttar Pradesh	Mathura :	1	1	Fallow-wheat or barley or Gram or Mustard or mixtures.	1	2	Groundnut + Arhar + Gram — Fallow-Barley + Gram.	1	2	Bajra or Jowar + Arhar-Fallow or green manuring (if irrigated) —wheat or barley or gram or mixed.
			3	4	Sugarcane - Sugarcane-Sugarcane (contd.) (Contd.) - Fallow-Gram or Peas.	..	..	(Gram is sown when the Arhar crop is standing already in the field and Groundnut crop has been harvested.)			
		Mirzapur. .	1	1	Early paddy or Sawan peas or Gram.	..	..	No crop rotation is recommended but great emphasis is	..	..	..
			2	1	Late paddy-Fallow.						

TABLE B-8—*concld.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
			3	2	Jowar or Bajra+Arhar-Fallow-wheat or Barley.			laid on use of green manuring and cover crops such as sanai, Dhaincha, Urd, Mung etc. and also on sowing of leguminous crops.			
			4	3	Sugarcane-Fallow-wheat-paddy-peas or gram.						
15.	West Bengal	Midnapur	1	1	Aman paddy-Fallow	..	..	A leguminous crop should be included at least once in three years and on unbunded areas wide-spaced crops should be avoided.			
			2	1	Aus paddy or Jute-Potato or wheat or Pulses.						
			3	1	Jute-Aman paddy-Fallow.						

*1. *Hyderabad Cols.* 10,11,12:
Castor remains in the field for eight months from July to March, thus covering part of Rabi season also. Only one crop is grown in a year.

*2. *Hoshangabad Cols.* 10, 11, 12:
Gora paddy and Arhar are sown at the same time in kharif season. After paddy is harvested, Arhar continues in the field and is harvested in the Rabi season.

3. *Gwalior Cols.* 7, 8, 9 :
Inclusion of green manure crop in the crop rotations already followed in the district is being propagated in some of the block areas by the block functionaries.

*4. *Hoshiarpur Cols.* 7, 8, 9 :
These crop rotations are for the present being adopted as an experimental measure in the demonstration projects which have been started in 61-62 and where the seed for green manuring is given to the cultivators free of cost. The crop rotations have not been so far propagated in the district as a whole.

TABLE B-9

Dry farming and Cultural practices in the selected districts on Soil Conservation area

Sl. No.	State	District	Traditionally followed and not recommended by the department	Recommended cultural practices excluding those traditionally followed	Recommended/ approved as well as traditionally followed
(1)	(2)	(3)	(4)	(5)	(6)
1.	Andhra Pradesh	Anantapur . .	..	1. Use of improved seed. 2. Ploughing burrow pits. 3. Cultivation of castor, red gram etc., on contour bunds.	1. Contour ploughing and sowing across the slope. 2. Application of farm yard manure. 3. Strip cropping.
		Hyderabad	..	1. Contour cultivtion. 2. Use of goards and perennial varieties of grasses.	1. Use of improved seed. 2. Use of farm yard manure.
2.	Assam . . .	United Mikir & N.C. Hills	..	Plantation of cash crops like cashewnut and black pepper and coffee.	
3.	Bihar . . .	Hazaribagh . .	Ploughing the land along the slope.	1. Contour cultivation. 2. Green manuring. 3. Strip cropping. 4. Use of fertilisers.	Use of improved seed.
4.	Gujarat . .	Baroda	..	..	1. Contour sowing. 2. Inter-culturing. 3. Harrowing. 4. Line and wide sowing. 5. Use of farm yard manure.

TABLE B-9—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)
		Rajkot . . .	1. 2 ploughings in case of groundnut, bajra, jowar and cotton; 3 to 4 ploughings in case of wheat. 2. 2 harrowings in case of jowar and bajra; 2 to 3 in case of wheat; 3 to 4 in case of groundnut and 4 in case of cotton. 3. Farm yard manure 5 to 7 cart loads in furrows before sowing.	1. Light, shallow and medium soils with depth should be deep ploughed every year; those without depth should be lightly ploughed. 2. Contour cultivation. 3. Strip cropping. 4. Line sowing and wider spacing. 5. Four inter-culturings for deep soils and two for shallow soils.	1. Use of improved seed and low seed rate. 2. Use of manures.
5.	Himachal Pradesh.	Bilaspur	*Maize* : Application of farm yard manure. *Wheat* : Broadcasting method of sowing.	1. *Maize*: (i) Application of fertilizers. (ii) Line sowing. 2. *Wheat*: Green manuring. 3. Growing of grasses on bunds. 4. Contour sowing. 5. Grassed land to be maintained.	*Maize*: (1) 2 to 3 ploughings (2) Weedings. *Wheat*: 2 to 3 ploughings.
6.	Kerala . . .	Trichur			Planting of tapioca cuttings on specially prepared ridges.
7.	Madhya Pradesh .	Gwalior . .	1. Higher seed rate . . 2. Sowing by broadcasting method of *Kharif* crops. 3. Line sowing in wheat or gram. 4. Ploughing without regard to the slope of the field.	1. Contour cultivation . 2. Inter-cultural operations. 3. Summer ploughing. 4. Deep ploughing. 5. Line sowing in jowar. 6. Low seed rate (thinner sowing.	Use of farm yard manure.

TABLE B-9—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)
			5. 1-2 ploughings after the rainy season. 6. Use of local seed drill in case of wheat. 7. Bakering once or twice during summer.	7. Use of compost manure. 8. Use of improved seed. 9. Use of fertilizers. 10. Green manuring. 11. Proper spacing and clean cultivation. 12. Growing of grasses on bunds.	
8.	Madras	Coimbatore	1. Ploughing and sowing up and down the slope. 2. Grassed status of land is maintained. 3. Specific seed rate.	1. Planting of wind belts and shelter belts-sand dunes fixation. 2. Use of improved seed. 3. Strip cropping and mixed cropping. 4. Use of pesticides. 5. Basin listing across the slopes. 6. Line sowing. 7. Cover cropping. 8. Mulching. 9. Use of fertilizers. 10. Use of soil bunding grasses. 11. Planting of Cynodan spies and TM V2 castor on bunds and Toes respectively. 12. Furrowing across the slopes. 13. Contour fencing.	1. Use of manures. 2. Contour cultivation. } For unbunded lands having slope less than 1½%.
		Nilgiris	1. Ploughing and sowing up and down the slope. 2. Use of cattle manure.	1. Cover cropping. 2. Green manuring and use of chemical fertilizers. 3. Application of slaked lime before preparatory cultivation to remove acidity. 4. Contour cultivation.	

TABLE B-9—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)
				5. Mulching. 6. Strip cropping. 7. Planting of grasses on bench terraces in beds and banks of diversion drains and other waterways. 8. Furrowing across the slope in case of non-terraced areas with slope less than 2%.	
9. Maharashtra.	Ahmednagar	1. Higher seed rate. 2. Ploughing once in 2 or 3 years. 3. Harrowings-2. 4. Close sowing. 5. Inter-culturing-1. 6. Cultivation with no regard to slope of the field.	1. Ploughing once in three years. 2. Harrowings-3. 3. Wide sowing. 4. Reduced seed rate. 5. Inter-culturings-3. 6. Contour cultivation. 7. Strip cropping.	Use of farm yard manure.
	Amraoti	"	Dibbling method of sowing	1. Ploughing once in 3 years. 2. Wide sowing. 3. Harrowing. 3-4. 4. Weeding. 2-3. 5. Hoeing. 4-6. 6. Use of farm yard manure.
10. Mysore	Dharwar	Cultivation along the slopes.	1. Contour cultivation. 2. Ploughing every year in light soils and once in three years in medium soils. 3. Strip cropping. 4. Manuring @5 cart loads per acre to the ploughed land.	

TABLE B-9—*contd.*

(1)	(2)	(3)	(4)	(5)	(6)
				5. Wider sowing using 18" seed drill. 6. Reduced seed rate. 7. Planting of caster on bunds. 8. Repeated interculturing (3 to 4 times).	
		Tumkur . .	1. Ploughing with wooden plough. 2. Inter culturing by hand implements. 3. Moderate seed rate.	1. Sowing of sunnhemp and sesbania crops and akkadi crops in Ragi and Groundnut. 2. Use of fertilizers. 3. Copious use of organic manure. 4. Growing of sesbania along the borders of paddy field. 5. Use of less seed rate (wider spacing). 6. Raising of seedlings on raised bed. 7. Deep ploughing once in 4 or 5 years and ploughing the land every alternate year. 8. Line sowing. 9. Drill sowing. 10. Harrowing. 11. Inter-culturing operations.	
11.	Orissa . . .	Koraput . .	..	1. Use of better seeds and manures. 2. Green manuring. 3. Contour cropping in strips. 4. Planting of grasses on hilly slopes. 5. Cashew-nut plantations.	Contour ploughing.
12.	Punjab . .	Hoshiarpur . .	1. Use of farm yard manure. 2. Use of Khurpa for hoeing of crops. 3. Use of ordinary plough for tillage.	1. Green manuring. 2. Contour Cultivation. (contour ploughing and sowing) 3. Use of fertilizer. 4. Cover cropping.	1. Use of furrow turning plough. 2. Use of wooden planks for levelling of land.

TABLE B-9—*concld.*

(1)	(2)	(3)	(4)	(5)	(6)
13	Rajasthan . .	Jaipur . . .	..	1. Line sowing. 2. Contour tillage. 3. Contour strip cropping. 4. Use of improved implements. 5. Use of manure & fertilizers.	1. Weeding, Thinning, Hoeing. 2. Line sowing. 3. Furrowing. 4. Mixed cropping.
14.	Uttar Pradesh .	Mathura . .	1. High seed rate . . . 2. Ploughing regardless of slope. 3. Use of Desi plough. (These practices are for bunded areas. In unbunded areas *Medhbundi* is practised).	1. Green manure and cover crops. 2. Reduced seed rate. 3. Contour sowing. 4. Eradication of weeds. 5. Planting of grasses on bunds. 6. Use of improved implements. 7. Strip cropping.	1. Use of fertilizers and manures. 2. Line sowing.
		Mirzapur . .	1. High seed rate . . . 2. Tillage 1-2 generally and more in case of wheat and sugar-cane. 3. Use of Desi plough. 4. *Medhbundi* (in unbunded areas only).	1. Contour sowing. 2. Growing of cover and leguminous crops. 3. Sowing of green manure crops such as Sanai, Dhaincha, Mung etc. 4. Planting of grasses on bunds. 5. Strip cropping. 6. Sowing against the slope.	Use of manures and chemical fertilizers.
15.	West Bengal . .	Midnapur . .	1. Specific seed rate. 2. Use of country plough and Bida. 3. Use of farm yard manure and fertilizers.	1. Contour ploughing. 2. Application of organic manures. 3. Green manuring. 4. Strip cropping. 5. Cultivation of close growing crops.	

TABLE B-10

Percentage change in yield per hectare of important crops in 1960-61 *over the pre-conservation period*

District Baroda

After completion of soil conservation work by	Per cent of respondents relevant	Per cent change in yield per hectare in 1960-61 over the pre-conservation period		
		Paddy	Cotton	Tur
(1)	(2)	(3)	(4)	(5)
One year	100·0	+33·1	+28·6	+16·0
Two years	97·5	+ 9·1	+11·9	Not grown
Three year	50·0	+34·5	+15·3	+13·5

District Coimbatore

After completion of soil conservation by	Per cent of respondents relevant	Per cent change in yield per hectare in 1960-61 over that pre-conservation period	
		Jowar	Groundnut
(1)	(2)	(3)	(4)
One year	100·0	—10·5	+ 5·1
Two years	50·0	+13·9	+ 5·1
Three years	50·0	+ 4·3	+15·6

APPENDIX C

Methodology of the Study

1. In a few States like Maharashtra, Madras and Gujarat, soil conservation is a fairly old programme, and has achieved a significant coverage of agricultural lands. Andhra Pradesh, U. P. and Mysore may also be placed in this category. In each of these States two districts—one being 'good' and the other 'not so good' in respect of the programme were selected for investigation, in consultation with the State Government. The principle of representativeness of the district in respect to the implementation of the soil conservation programme was also kept in view. In other States, except West Bengal, only one district, the best in coverage, was selected for study as the programme of soil conservation on agricultural lands in these States had started on a systematic basis very recently. In West Bengal, one additional district was selected to study the problem of drainage. In Jammu and Kashmir the study was confined to general observations without field study in any specific area. Districts with mainly black cotton soil have not been considered as their problems are somewhat different from the usual run of soil conservation work on agricultural land. In Madras, Coimbatore was selected from the point of good coverage of area in plains whereas in Nilgiris the type of soil conservation programme undertaken in the hill district was the basis of selection. Thus a total of 22 districts in 15 States were selected. These may be said to be a purposive sample from the restricted universe of districts where some soil conservation work had been taken in hand till the end of 1960-61.

2. Out of 22 districts selected in 15 states for the study of soil conservation on agricultural lands, the problems in Hoshiarpur in Punjab, in 24 Parganas in West Bengal and United Mikkir and North Cachar Hills in Assam were found to be both local and special in character. In Hoshiarpur district soil conservation problems fall under two broad categories, the first being water erosion developing into gullies on the slopes and the second of recurring floods causing sand deposits and water logging. The Agricultural department had undertaken demonstration projects in 1961 for the treatment of water erosion. In Midnapur (West Bengal) soil conservation work had been taken up mainly on Govt. waste lands and the private beneficiaries are few. The study in this district was confined to general observations without any specific selection of villages or households. In United Mikkir and North Cachar Hills in Assam, the objective of soil conservation is to discourage shifting cultivation and stabilise the pattern of living of the Mikirs by offering them a stable and accepted economic base.

3. From each district six villages—four where soil conservation measures had been undertaken and two (control) where the problem exists but no measures had been taken—were selected for canvassing village and household schedules. Departure from this pattern of selection had to be made in a few districts, mainly United M & NC Hills (Assam), Amraoti (Maharashtra), Hoshiarpur (Punjab) and 24-Parganas (West Bengal). In Assam, all the six villages selected are covered by soil conservation measures. In Amraoti, one additional village had to be selected as none of the selected village in section III had the requisite number of households. In Hoshiarpur and 24-Parganas only 4 villages each have been selected for the survey. In Hazaribagh (Bihar), two of the selected villages are from those covered by the DVC programme and two from those of the State Government S. C. programme, with one control village from each. In Trichur (Kerala), due to inordinately large size of the villages, wards had to be selected.

4. Another classification used in the selection of villages was the period in which work was initiated. This was done to ensure a reasonable representativeness of villages taken up in different periods. The villages covered by soil conservation measures were arranged year-wise and grouped for the purpose of selection into the following strata :

Section—I : those taken up during the First Plan period;

Section—II : those taken up during the three early years of the Second Plan (1956-59);

Section—III : those taken up during 1959-60 ; and

Section—IV : those taken up in 1960-61 or so.

Of those in the First Plan period, one was selected purposively in consultation with the district level officer incharge of soil conservation programme. If, however, there were no villages in this section all four were selected from the subsequent section or sections. For this purpose all villages were to be arranged in the desending order of the area covered by S. C. measures and divided into as many groups as the number of villages to be selected. As far as possible only those villages which had the requisite number of households (at least 10 households on whose lands S. C. work had been done) were retained in each group. From each of such groups one

village was to be selected at random. As far as possible, in the selected district or the selected sub-division we would like to have all the four villages which had started work before 1959-60. But if the number of villages which had started work before 1959-60 is less than 4, then we may have to take a village or more villages which had started work in 1959-60. If only one village is to be selected from any period group, it will always be a purposive selection in consultation with the district officer concerned.

5. Besides these four villages, two more villages would be selected purposively where scope for soil conservation exists, but the work is not taken up so far. These villages should have problems of soil erosion like those in one or more of the selected four villages. The cultivators in these villages should have had also reasonable chance of seeing soil conservation work in any village in the selected district or sub-division.

6. In this way, 87 villages coverd by soil conservation and land improvement programme in 21 districts and 36 control villages in 18 districts were selected for this study. The names of the districts and the number of villages selected in each are given below.

Districts and villages selected for study by State

Sl. No.	State	Names of selected district	No. of selected villages covered by soil conservation programme				Total	No. of control villages
			First Plan	1956-59	1959-60	1960-61		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1.	Andhra Pradesh	1. Anantapur 2. Hyderabad.	..	4	4	..	8	4
2.	Assam	1. United M & NC Hills.	..	6	..	..	6*	..
3.	Bihar	1. Hazaribagh.	1	3	..	..	4**	2**
4.	Gujarat	1. Rajkot 2. Baroda	2	6	..	..	8	4
5.	Kerala	1. Trichur	..	3	1	..	4†	2
6.	M. P.	1. Gwalior	1	3	..	..	4	2
7.	Madras	1. Coimbatore. 2. Nilgiris	2	6	..	..	8	4
8.	Maharashtra	1. Ahmednagar 2. Amraoti	1	8	..	..	9††	4
9.	Mysore	1. Dharwar 2. Tumkur	1	7	..	..	8	4
10.	Orissa	1. Koraput	..	4	..	..	4	2
11.	Rajasthan	1. Jaipur.	..	..	1	3	4	2
12.	U. P.	1. Mirzapur 2. Mathura	..	4	4	..	8	4
13.	H. P.	1. Bilaspur	..	..	4	..	4	2
14.	Punjab	1. Hoshiarpur	..	..	..	4	4	..
15.	W. Bengal	1. Midnapur‡ 2. 24-Parganas.	4	..	..	..	4	..
	TOTAL	22	12	54	14	7	87	36

*3 from Mikir hills, 1 from N. C. hills & 2 from M. P. C. D. blocks.

** 2 villages covered by DVC and one control.
2 villages covered by State Govt. scheme and one control.

†These are wards.

††As the selected villages did not have the required number of respondents, one additional village had to be selected.

‡Villages were not selected for study as the programme covered Govt. waste land.

Of the 87 selected villages, soil conservation work had been undertaken in 12 during the First Plan period, in 54 during 1956-59, in 14 during 1959-60 and 7 during 1960-61.

7. *Selection of Households* : In the selected villages all the owners of land covered by soil conservation proramme were listed in the descending order of their total holding. The owners of land thus arranged were divided into five strata and from each stratum two households were randomly selected as respondents for the household schedule. In the case of control villages, the owner-households whose lands had soil conservation problems were listed out and a sample drawn in the same way. Thus in each village ten owner-households were selected for the study. In a few sample villages where the owners of land covered by the soil conservation programme numbered less than ten, all the beneficiaries of the programme had to be selected as respondents. In all 1,203 households were thus selected and canvassed in 123 villages.

APPENDIX D

Guide Points, Schedules and Questionnaires for the Study

The data for the enquiry was collected at different levels—from the State level down wards to respondent households. Purely statistical or quantitative data was collected on the basis of schedules and the information relating to the approach to the problem, administrative arrangements, difficulties in execution etc. was collected on the basis of guide points or through the questionnaire. The following were the forms used for collecting both types of data:

(1) Guide points for collecting information at the State level.
(2) Guide points for collecting information at the district level.
(3) State schedule (SC I)
(4) District schedule (SC II)
(5) Village schedule and questionnaire (SC III)
(6) Household schedule and questionnaire (SC IV)

Guide points for collecting information at the State level

Surveys and investigations and problems of soil erosion :

1. What are the different types of surveys and investigations carried out in the State for assessing the nature and extent of problems of soil erosion and deterioration on agricultural land ?

2. What is the extent of the area in different regions covered by such surveys and investigations ?

3. Have the programmes included in the Third Five Year Plan been based on such surveys and investigations or not ?

4. Have any detailed soil and land use surveys been done in any region or district in the State taking into account land-use capability classes ?

5. What are the difficulties or bottlenecks in the way of carrying out such detailed land surveys in the whole of the State ?

6. A brief outline may be given about the nature and extent of the problems of soil erosion and deterioration known on the basis of surveys and investigations. (Please attach a map, if available).

Preparations for soil conservation measures on agricultural land :

7. What are the legislative provisions for soil conservation measures? (copies of the Acts and Bills may be attached).

8. What are the administrative arrangements for soil conservation measures at the State level ? Has the Soil Conservation Board been set up in the state?

9. What are the administrative arrangements for planning soil conservation measures at different levels below the State ? (This may be given separately for each level, soil conservation division or district, soil conservation sub-division or taluka or a block, etc.).

10. What are the procedures for obtaining the consent and co-operation of the farmers:—

(*a*) legislative and administrative provisions,

(*b*) are there any departures from these provisions in the actual enforcement of soil conservation measures ?

Execution of soil conservation measures :

11. Which departments are charged with the responsibility for carrying out soil conservation programmes in the State ? What are their special spheres of work? (This may be given separately for each department concerned).

12. Describe briefly the administrative arrangements for soil conservation work in different departments at the State level.

13. How are the soil conservation programmes of different departments coordinated?

14. If the soil conservation programmes of different departments are not coordinated, what is the scope for bringing about such coordination? What are the problems faced because of the lack of this coordination ?

15. If different departments are carrying out soil conservation work in their special areas, how are the soil conservation measures taken up coordinated and executed on agricultural lands falling within the jursidiction of different departments? What is the extent of this problem?

16. Indicate facilities/concessions, financial assistance, tools, implements etc. offered by the State Government for soil conservation work. Specify how the cost is shared by the Government and the beneficiaries; How is the loan given to the beneficiaries realised from them?

17. What are the people's institutions—statutory (Panchayat etc.), registerd (cooperative etc.), and associate voluntary bodies, (farmers' clubs, farmers' union, etc.) etc., associated with the execution of soil conservation programmes? At what stages in the planning of the programme and execution of soil conservation are these institutions associated? Describe separately their roles and functions.

Research and education :

18. Have the measures needed for control of erosion and other problems been fully experimented with and established? What are the types of problems, solutions to which are yet to be found or established?

19. What are the measures experimented with in the research stations? Indicate briefly these measures for broad types of soils and climatic regions.

20. Which of the above measures have been successfully demonstrated and fully established for extension ?

21. Describe the existing programme for educating the farmers in soil conservation and dry farming methods.

Dry farming methods in low rain-fall and scarcity areas :

22. Since when has dry farming been taken up as an agricultural extension measure?

23. Is it recommended only on lands treated with soil conservation measures, or is it also extended on other lands independently of soil conservation measures like contour bunding?

24. Which are the more important dry farming measures and practices, and indicate areas for which they are recommended.

Soil conservation in C.D. blocks :

25. What are the programmes of soil conservation taken up in C. D. blocks?

26. Is this programme taken into account in reporting the area covered by soil conservation measures in the State : If not, why not?

27. Is the soil conservation programme in the C. D. blocks technically supervised by the Agricultural Department?

Consolidation of holdings and reclaimation of land :

28. Is consolidation of holdings made a necessary part of the soil conservation measures in the State ?

29. If yes, how is this done? Is there any legislative provision for this? Is coercion in some form exercised? Are the cultivators persuaded to consolidate their holdings? Give some details to explain the actual working of consolidation of holdings and soil conservation measures in the State.

30. If consolidation of holdings is not made a necessary part of the soil conservation measures, what are the plans for linking consolidation with soil conservation ?

31. Has the State Government reclaimed any land for agricultural purposes in the Second Plan ?

32. Has the State Government any programme of reclaiming land in the Third Plan? Are the requirements of soil conservation or moisture conservation in the region concerned taken into consideration in reclaiming land for agricultural uses? Explain briefly what was done in the Second Plan period and what is intended to be done in the Third Plan period.

Yardsticks of additional production :

33. Are there any yardsticks of additional production per acre which can be attributed to various soil conservation measures ? What are these yardsticks ?

34. How are these yardsticks determined?

Guide points for collecting information at the District level

Surveys and investigations :

1. What are the different types of surveys and investigations carried out in the district for assessing the nature and extent of problems of soil erosion and deterioration of agricultural land ? When were they taken up ?

Preparation for soil conservation measures :

2. What are the arrangements in the district and at lower levels (soil conseravtion subdivision, conservation block, taluka, village and on the land of the individual cultivator) in respect of :

(*a*) planning and survey,

(*b*) annual programming and determination of coverage.

3. What are the administrative arrangements for planning soil conservation work?

4. What are the procedures for obtaining the consent and cooperation of the farmers?

5. Describe in brief how the consent of the farmers was obtained in any one project area.

Execution of soil conservation measures :

6. Which departments carry out soil conservation programmes in the district?

7. Is there a district soil conservation committee? If yes, what is it expected to do?

8. If different departments are carrying out soil conservation programmes, how are they coordinated ?

9. Are the steps recommended by the research stations under the Central Soil Conservation Board adopted by the State for extension work in the district?

10. Mention facilities/concessions, financial assistance etc. offered for soil conservation work. (specify how the cost is shared between the Government and beneficieries and the method of repayment of loan by the latter. If loans are overdue, comment on their amount and number.)

11. What are the people's institutions—statutory (Panchayat, etc.), registered (cooperatives, etc.) and associated voluntary bodies (farmers' club, unions etc.) associated with the execution of soil conservation programme. Describe separately their roles and functions.

12. Describe the programme for educating the cultivators in soil conservation measures in the district.

13. What are the steps taken to induce cultivators to switch over to new cropping pattern required for conservation farming ?

14. Is consolidation of holdings made necessary part of the soil conservation measures?

15. Do the cultivators agree to voluntary consolidation of holdings for bringing the holdings in one contour alignment ?

16. Has any land been reclaimed in the district during the Second Plan period? Are the requirements of soil conservation measures taken into consideration in reclaiming the land for agricultural uses ?

Research :

17. Have the measures for control of erosion and the recommended conservation farming methods been fully experimented with and established? What are the measures which have been experimented with and demonstrated to the cultivators in the district?

Dry Farming methods :

18. Since when have dry farming methods been taken up as agricultural extension measures ?

19. Are the dry farming methods recommended only on lands treated with soil conservation measures or are they also extended on other unbunded lands ?

20. What is the approximate unbunded area under dry farming methods in the district? What proportion of the unbunded land is under dry farming methods?

Soil Conservation in CD Blocks :

21. What are the programmes of soil conservation taken up in C.D. Blocks ?

22. Is the soil conservation programme in the C.D. blocks technically supervised by the agricultural department? Is there any soil conservation officer at the block level?

23. Is this programme taken into account in reporting the area covered by soil conservation measures in the district?

Maintenance and repairs of bunds & follow-up programme :

24. Is there a regular follow-up programme of soil conservation measures in respect of repairs and maintenance of bunds and cultural practices? Give full details.

25. How is it ensured that the cultivators repair the contour bunds and keep them in proper shape and form?

26. What is the minimum period required for complete switch over to new cultural practices and cropping pattern ? What are the practical difficulties of implementing these changes?

STATE SCHEDULE (S.C. I)

1. *Problems of soil conservation in the State* :

State :

Sl. No.	Problems of soil conservation on agricultural land*	Districts where the problem is relevant	Total estimated problem area (in acres)	Whether area estimates are based on soil and land-use surveys
(1)	(2)	(3)	(4)	(5)

*Illustrative problems of soil conservation.

1. Rain water erosion : (a) slight ; (b) moderate; (c) severe.
2. Wind erosion : (a) mild; (b) severe.
3. Salinity/alkalinity : (a) due to high water table; (This may be defined in terms of the depth of water table in feet);
   (b) Others (specify).
4. Waterlogging requiring drainage.
5. Other problems (specify).

(As far as possible information may be given separately for each of the problems illustrated above).

2. *Progress in the two Plans:*

2.1 Research, Demonstration and Training

First Plan/Second Plan period

Soil conservation programmes	Physical		Outlay (Rs.)				Expenditure (Rs.)					
				Central share			Total			Central share		
	Targets (No.)	Achievements (No.)	Total*	Total	Loans	Grants	Total	Loans	Grants	Total	Loans	Grants
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Research												
(a) No. of centres												
2. Demonstration												
(a) No. of centres												
3. Training												
(a) No. of institutions												
(b) Officers trained												
(c) Assistants trained												
(d) Sub-assistants trained.												
(e) Other categories trained.												

*Total outlay in column 4 will include Central assistance, details of which will be given separately in cols. 5 to 7.
Entries in the expenditure cols. 8 to 10 will be on the same lines.

2.2 Research Centres/Demonstration Centres set up during the First Plan/Second Plan period

Research Centre/Demonstration	Sl. No.	Name	Regions covered	Problems or measures taken up
Research Centre	1.			
	2.			
	3.			
	4.			
Demonstration centre	1.			
	2.			
	3.			
	4.			

2.3 Research, Demonstration & Training—*contd.*

Third Plan Period Targets

Soil conservation programmes	Physical targets (No.)	Outlay (Rs.)					
		Total*			Central Share		
		Total	Loans	Grants	Total	Loans	Grants
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. Research							
(a) No. of Centres							
2. Demonstration							
(a) No. of Centres							
3. Training							
(a) No. of institutions							
(b) Officers trained							
(c) Assistants trained							
(d) Sub-assistants trained							
(e) Other categories trained.							

*Total outlay in columns 3 to 5 will include Central assistance, details of which will be given separately in columns 6 to 8. Loans and grants in cols. 7 and 8 will be from the Centre to the State.

2.4 Research Centres/Demonstration Targets During the Third Plan Period

Research/Demonstration Centre	Sl. No.	Name	Regions to be covered	Problems or measures proposed to be taken up
Research Centre . .	1.			
	2.			
	3.			
	4.			
Demonstration Centre .	1.			
	2.			
	3.			
	4.			

2.5 Soil Conservation/Dry Farming Extension

First/Second Plan Period

Soil conservation programmes*	Problem districts for which applicable	Area requiring the measure (acres)	Targets (acres)	Achievements (acres)	Outlay (Rs.)			
					Total@	Central Share		
						Total	Loans	Grants
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

Expenditure (Rs.)										
G. M. F. and Agr. Programme						C.D.			People's participation		Total expenditure (cols. 10+16+19+20)
Total			Central Share			Total	Loans	Grants	In departmental programmes	In C. D. programmes	
Total	Loans	Grants	Total	Loans	Grants						
(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
All problem areas											

*Contour bunding, terracing, reclaimation of saline/alkaline land, drainage, others (specify).

@The total outlay in col. 6 will include Central share also details of which will be given separately in columns 7 to 9. Entries in the expenditure columns 10 to 12 will be on the same lines. It will also be noted that the expenditure figures in column 10 *do not include* C. D. funds and would be exclusive of people's participation. Loans and grants in columns 11, 12, 17 and 18 are those given to the beneficiaries while those in columns 14 and 15 under Central share are given to the State Governments.

2.6 Soil Conservation Extension

Third Plan Period Targets

Soil conservation programme*	Problem districts for which applicable	Area requiring the measure (acres)	Target (acres)	Outlay (Rs.)					
				Total**			Central share		
				Total	Loans	Grants	Total	Loans	Grants
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
All problem areas									

*Contour bunding, terracing, reclaimation of saline/alkaline land, drainage, others (specify).
**Total outlay in column 5 will include Central share also details of which will be given in columns 8 to 10.

3. *Additional Production From Soil Conservation Measures*

Plan periods	Targets of additional production due to soil conservation measures	Achievement of additional production
First Plan		
Second Plan		
Third Plan		

DISTRICT SCHEDULE (S.C. II)

1. *General*

1·1 State
1·2 District
1·3 Rainfall of the district (for the last ten years).
1·4 P.E.O.
1·5 Date

2. *Land utilisation and cropping pattern*

2. 1. LAND UTILIZATION (TOTAL AREA AND CLASSIFICATION OF AREA) YEVR 1960-61

Sl. No.	District/sub-division, S.C. area	Total geographical area in acres (Village papers)	Classification of area							
			Forest	Area not available for cultivation	Other uncultivated land excluding fallow land	Fallow Land		Net area sown	Total cropped area	Area sown more than once
						Fallow lands other than current fallows	Current fallows			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

1. District.
2. Selected sub-division.
3. Soil conservation area in the district.

2. 2. CROPPING PATTERN OF THE AREA/SELECTED SUB-DIVISION

Crop by season	Area under crops in 1960-61			Area under crops on the land on which Soil Conservation measures were taken in					
	Total	Irrigated	Unirrigated	Year ( ) before the soil conservation measures were taken			1960-61		
				Total	Irrigated	Unirrigated	Total	Irrigated	Unirrigated
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Kharif									
Total									
Rabi									
Total									

3. *Problems of Soil Conservation in the district*

Sl. No.	Problems of soil conservation on agricultural land	Names of Sub-divisions, Catchment areas, conservation blocks or taluks		Features of the area, like average rainfall, slopes, soil characteristics etc.		Total estimated area (acres) requiring soil conservation		Area estimates based on soil and land surveys		Year when the soil conservationwork was started
		affected	on which conservation work done	of the area affected	on which conservation work done	of the area affected	on which conservation work done	of the area affected	on which conservation work done	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	All problems									

4. Progress in the two Plans

4·1. SOIL CONSERVATION EXTENSION IN THE FIRST PLAN/SECOND PLAN PERIOD

Name of the Units of soil conservation work, if any	Area requiring soil conservation work	Soil conservation programmes	Targets (acres)	Achievements (Acres)	Estimated additional production	Outlay*			Expenditure*								
						Total	Loan	Grant	G.M.F. and Agricultural programmes			C.D.			People's participation if any		Grand total (cols. 10+13+16+17)
									Total	Loan	Grant	Total	Loan	Grant	Departmental programmes	C.D. programmes	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
All Units																	

*The outlay figures in cols. 7 to 9 are exclusive of any provision, if any, made in the C.D. funds.

The figures of expenditure under cols. 10 to 12 are exclusive of any expenditure incurred from C.D. funds.

The Grand total of the expenditure (col. 18) should be the total of cols. 10, 13, 16 and 17.

4·2. Outlay for Soil Conservation Extension in the Third Plan (for the district)

Names of units of soil conservation, if any	Area requiring Soil conservation work	Soil conservation programmes of the Plan	Targets (Acres)	Financial Outlay		
				Total	Loans	Grants
(1)	(2)	(3)	(4)	(5)	(6)	(7)

4·3. Repayment of loans given for soil conservation measures in the district/sub-division

First Plan Period						Second Plan Period					
Total loan amount (Rs.)						Total loan amount (Rs.)					
Sanctioned to the whole district	Issued to beneficiaries		Unspent amount	Amount repaid by beneficiaries	Outstanding amount	Sanctioned to the whole district	Issued to beneficiaries		Unspent amount	Amount repaid by beneficiaries	Outstanding amount
	No.	Amount					No.	Amount			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
To the selected sub-division.											

4·4. Soil Conservation Demonstration in the district (First and Second Plans)

Sl. No.	Location/places where demonstrations given	The type of demonstration	Agency responsible for the demonstration	Year when started	Duration of the demonstration	Area under demonstration (Acres)	Is it on Govt. land/Private land	If on Private land, No. of owners of land involved
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

4·5. If the demonstrations are on cultivators lands on what terms and conditions of agreement etc. are the demonstrations held on their lands ?

4·6. Are the results of the demonstration analysed in respect of cost and benefit of Soil Conservation measures ?
If yes, supply some particulars (if notes or reports on the demonstration are available a copy of the same be attached).

5. *The agricultural practices (traditional) of the cultivators in the district and the selected (sub-division) if any*

5·1. Nature of field bunding and maintenance precautions.

5·2. Rotation of crops and cultural practices :

Rotation of Crops			Cultural Practices	
Sl. No. of rotation	period of rotation	Sequence of rotation	Sl. No.	Seed rate, use of manure, tillage, use of implements etc.
(1)	(2)	(3)	(4)	(5)

6. *Recommended Soil Conservation practices in the district/sub-division*

Sl. No.	Engineering and mechanical practices	Cultural practices			Crop rotation				
					On bunded area			On unbunded area	
		On bunded area	On unbunded area	Serial No. of crop rotation	Serial number of crop rotation	Period of rotation	Sequence of rotation	Period of rotation	Sequence of rotation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

VILLAGE SCHEDULE AND QUESTIONNAIRE (S.C. III.)

1. *Indentificati n*

1.1 State———— 1.2 District/Sub-Division———— 1.3 Block/Taluk———— 1.4 Village————

1.5 Classification of village by selection criteria

Covered by Conservation	Control	If yes, distance between control village & the four villages covered by Conservation programme.
Yes/No	Yes/No.	Miles/Kilometers
V.1.		
V.2.		
V.3.		
V.4.		

1.6 No. of households (Specify year)
(a) mainly owner cultivators ————
(b) mainly tenant cultivators ————
(c) agricultural labourers ————
(d) non-cultivating land owners ————
(e) non-agricultural households————

1.7 Population————
(Specify year)
Total ————
Males ————
Females ————

1.8 Investigator ———— 1.9 P.E. O. ————

2. *Land use, cropping pattern, etc.*

2.1 LAND USE STATISTICS (1960-61)

Coverage	Geographical area	Forest area	Pastures	Uncultivated area		Fallow land		Net Sown area	Total cropped area	Area sown more than once
				Not available for cultivation	Other uncultivated land excluding fallow lands	Current fallows	Other fallows			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Whole village (Revenue) .										
Soil conservation project area, if suitably demarcated.										
Area covered by soil conservation measures.										

2.2. CROPPING PATTERN (ON THE EVE OF THE PROGRAMME AND IN 1960-61)

Crops by season	Year ( ) before the programme started*		1960-61	
	Area (acres)		Area (acres)	
	Irrigated	Unirrigated	Irrigated	Unirrigated
(1)	(2)	(3)	(4)	(5)
Kharif :				
Total				
Rabi :				
Total				

*Year immediately prior to the year when actual soil conservation construction measures were first carried out in the village. In case the year is before 1951-52, figures for 1950-51 will be given.

2.3(a) Describe the factors responsible for change in net irrigated area.

(b) What are the factors responsible for the change in the cropping pattern, if any.

2·4. YIELD IN LBS. PER ACRE OF IMPORTANT CROPS BEFORE SOIL CONSERVATION MEASURES WERE TAKEN AND IN 1960-61

Crops by season	Year ( ) before soil conservation measures were taken		1960-61			
			Land covered by soil conservation measures		Land not covered by soil conservation measures	
	Irrigated	Unirrigated	Irrigated	Unirrigated	Irrigated	Unirrigated
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Kharif :						
Rabi :						

2·5 VALUE OF LAND (ACCORDING TO CLASS) PER ACRE (IN RUPEES) BEFORE THE PROGRAMME STARTED AND IN 1960-61

	Year ( ) before the programme started		1960-61			
			Irrigated		Unirrigated	
	Irrigated	Unirrigated	Covered by soil conservation measures	Not so covered	Covered by soil conservation measures	Not so covered
(1)	(2)	(3)	(4)	(5)	(6)	(7)
I						
II						
III						

3. *Problem of soil erosion, etc.*

3.1. Describe the main problems of soil conservation in the village.

3.2. Owners of land affected by erosion, area affected by erosion and area covered uptodate.

Affected by erosion			Covered by soil conservation measures		
No. of families owning land	Area(acres)	Proportion(%) area cultivated by tenants	No. of families owning land	Area (acres)	Proportion (%) area cultivated by tenants
(1)	(2)	(3)	(4)	(5)	(6)

4. *Preparation for the programme*

4.1. Indicate the year when:

(a) The village (catchment area) was selected for soil conservation. How was it selected ?

(b) Pre-survey was carried out in agricultural lands.

(c) Alignment of blocks and sub-blocks for undertaking soil conservation measure was made.

(d) Soil conservation programme was taken up as demonstration programme.

(e) Soil conservation programme was taken up as extension programme.

(f) Consolidation of holdings programme :

(i) taken up in the village.

(ii) completed in the village.

4.2. Have any meetings been organized in the village for creating mass consciousness among the cultivators about the soil conservation programmes and to obtain their consent to implement the programme in the village ? Give a brief account of the meetings and people's reactions.

4.3. Was any demonstration of soil conservation works/practices given? Yes/No.

4.4. If yes, supply the following details :

Year	Type of demonstration (measures demonstrated)	Government land		Private land			Remarks
		No. arranged during the year	Area covered (acres)	No. arranged during the year	No. of families owning land involved	Area covered (acres)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

4.5 Were the cost, return and yield data collected in the course of demonstration? Were these analysed and explained to cultivators? If yes, please supply a set of these data.

5. *Planning the programme*

5.1. How was the programme initially planned in the village ?

5.2. How were the people informed, educated and prepared for the programme ?

5.3. What was the role of statutory (Panchayat), registered (co-operative society) institutions and voluntary organization (farmers' club, etc.) ?

5.4. What is the role of

(*i*) beneficiaries of the programme in the village,

(*ii*) other cultivators and villagers ?

5.5. (*i*) Was there any opposition to participation? Yes/No.

(*ii*) If yes, why was the programme opposed?

(*iii*) Proportion of cultivators opposing the programme.

(*iv*) Were the dissidents (in the beginning) won over ultimately ?

(*v*) If yes, how ?

6. *Execution of the programme*

6.1. What is the agency responsible for execution of the programme?

6.2. Whether the programme was carried out (*a*) departmentally, (*b*) given on contract, (*c*) carried out by the culitvators themselves through associated voluntary organization, and (*d*) carried out individually. Describe the method or methods adopted.

6.3. What were the seasons when the soil conservation work was carried out?

6.4. Indicate the types of people that cooperated in the programme.

6.5. What is/was the extent to which the labour is/was available within the village?

6.6. What tools and implements were used for carrying out the programme?

6.7. Were these provided free to the cultivators or were hired by them or owned by themselves?

7. *Progress of soil conservation work*

7.1. YEAR-WISE AREA COVERED, EMPLOYMENT GENERATED, ETC.

Sl. No. of the project	Area of the project (acres)	Month/Year when the work was		Year-wise area covered		Months when work done	Whether peak or slack months	Employment in man-days			Did the work involve any loss of crops? Yes/No
		Started	Completed	Year (Begin with the 1st year or 1950-51)	Area (Acres)			Total	To the villagers	Outsiders	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

7.2. EXPENDITURE ON SOIL CONSERVATION WORKS AND PEOPLE'S PARTICIPATION

Area (in acres) under soil conservation (upto 1960-61)	Total Govt. expenditure			People's participation through institutional agencies/community action : Yes/No	Extent of contribution (Rupees)			
	Loan	Subsidy	Total		Total Value	Cash	Kind (converted in cash)	
							Labour	Material
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

7.3. Enumerate the traditional measures of soil and moisture conservation practised in the village even before the soil conservation measures were taken.

8. *Maintenance of soil conservation work and recommended follow-up agronomic practices*

8.1. (a) Describe the arrangements for the maintenance and repair of soil conservation work.

(b) Is it the responsibility of :

(*i*) Any Government agency (mention the agency) ?

(*ii*) The beneficiaries as a group ?

(*iii*) The beneficiaries as individual cultivators ?

(c) Indicate the month and year when large scale repairs had to be carried out.

Soil conservation work completed		Major repairs undertaken		Reasons for repairs
Month/ year	Area	Month/ year	Area	

8.2. CONSERVATION FARMING METHODS (CROP ROTATION, METHODS OF TILLAGE AND CULTURAL PRACTICES)

Crop rotations				Methods of tillage				Cultural practices				Others			
Recommended rotations	S.C. or D.F. method	Followed usually* by owner cultivators, tenants or both in		Recommended practices	S.C. or D.F. method	Followed usually* by owner cultivators, tenants or both in		Recommended practices	S.C. or D.F. method	Followed usually* by owner cultivators, tenants or both in		Recommended practices measures	S.C. or D.F. method	Followed usually* by owner cultivators, tenants or both in	
		S.C. area	Other area requiring S.C. measures			S.C. area	Other area requiring S.C. measures			S.C. area	Other area requiring S.C. measures			S.C. area	Other area requiring S.C. measures
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)

*Followed by 50% or more : S. C.=Soil Conservation; D. F.=Dry Farming.

9. *Extension and education programme*

9.1 Measures taken (Film shows, mass contact, demonstrations, group meetings, individual contacts, etc.) to educate the villagers for taking of soil conservation programmes and their maintenance and cultivator's response.

S.No.	Type of measure	Reasons and reactions of the participants

9.2 Describe any special efforts made to propagate dry farming measures in un-bunded areas (area requiring soil conservation measures).

10. *Give details regarding special problems faced by the villagers when the programme was executed with reference to*

(a) legal implications (b) contour alignments (c) land property alignments for field bunds (d) village factions (e) cultivator's cooperation (f) financial implications (g) adequacy or otherwise of technical guidance (h) Others (such as uncontrolled grazing by cattle, etc. specify)

11. *If tools and implements were distributed for helping the cultivators to take up to soil conservation programme/dry farming measures, give the following details*

Name of the tool/implement	Purpose for which used	No. of tools or implements distributed	Number			No. of cultivators to whom given
			Given free	Given on hire	Sold	
(1)	(2)	(3)	(4)	(5)	(6)	(7)

12. *Additional data for control villages only.*

12.1 Are the problems of soil erosion of the village similar as any of the selected village? How ?

12.2 Is the soil conservation programme likely to be taken up in this village? Mention the approximate year when the programme would be taken up.

12.3 Why was the programme not taken up so far ? (Was there lack of mutual accord, was there lack of credit, guidance, lack of faith etc.) Describe the reasons in details.

12.4 Has any survey or investigation been taken up in the village for soil conservation work ?

12.5 Has any demonstration been given in the village ?

12.6 Are the villagers conscious of soil erosion problem? Was the matter ever considered by the village panchayat or gram-sabha ?

12.7 What were the works for community benefit involving voluntary effort taken up by the village? Mention against each work the type of people who cooperated (owners of land, cultivators of unowned land, agricultural labourers, etc.) and the number of man-days spent on each work.

12.8 Who are the owners of the land affected by soil erosion problems? (Are they owners of small holdings ?)

12.9 Have they seen the soil conservation work done in other villages? What are their views about the work in respect of productivity of land, value of land, practical difficulties of the work, etc? (Please refer to item 10 of the schedule. Views of the cultivators may be given separately for sub-item (*a*) to (*h*) listed there).

HOUSEHOLD SCHEDULE/QUESTIONNAIRE (S.C. IV)

Section Code.....

1. *Identifica ion*

1·1 State.

1·2 District

1·3 Village.

1·4 Head of the household.

1·5 Principal occupation of the head of household.

1·6 (a) Owned holding.
(b) Holding leased in.
(c) Holding leased out.
(d) (i) Net holding (a+b—c).
(ii) Of which cultivated.

(Area in acres)

Total	Inside the Village		Outside the village
	Inside S. C. block/unit	Outside S.C. block/unit	

1·7 Classification of the household

Owning the land under conservation? (Yes/No)	Cultivating the land under conservation as a tenant? (Yes/No)	If yes under col. 2	
		Name of the owner	Land area (acres) leased in from the owner
(1)	(2)	(3)	(4)

1·8 Member of
(a) Cooperative
(b) Other community/voluntary organisation.

1·9 Investigator Date.....

1·10 P.E.O. Date.....

2. *and uti isation, cropping pattern etc. (of the holding within the village)*

2·1 Land utilisation (1960-61) of the holding by fragments

(Area in acres)

Sl. No. of fragment	Area of the fragment	Cultivated area			Fallow lands other than current fallow	Other uncultivated land excluding fallow land	Gross cropped area	Area requiring soil conservation measures	Land on which soil conservation done	
		Net sown area		Current fallow					Area	Nature of S.C. treatment
		Total	Irrigated							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
TOTAL										

2·2 Cropping pattern of the entire holding within the village in the year before soil conservation measures were taken or 1950-51 and in 1960-61.

Crops by season	Year ( ) before the soil conservation measures were taken or in 1950-51		In 1960-61	
	Irrigated	Unirrigated	Irrigated	Unirrigated
(1)	(2)	(3)	(4)	(5)
Kharif				
Total				
Rabi				
Total				
Net sown area . . .				
Gross cropped area . .				

2·3 Cropping pattern of the area by fragments on which soil conservation measures taken* [for year before ( ) adopting soil conservation measures and for each year from 1956-57 to 1960-61.]

(Area in acres)

Crops by season	Year————							
	Fragment serial number							
	Sl. No.		Sl. No.		Sl. No.		Sl. No.	
	Total	Irrigated	Total	Irrigated	Total	Irrigated	Total	Irrigated
Kharif								
Total								
Rabi								
Total								
Net sown area								
Gross cropped area								

*For control villages data will be for fragments on which soil conservation measures are required.

2·4 What are the factors responsible for the change in net irrigated area on
(a) bunded land (or land covered by soil conservation measures) ?
(b) other land ?

2·5 What are the factors responsible for the change in the cropping pattern, if any on
(a) bunded land (or land covered by soil conservation measures) ?
(b) other land ?

2·6 What is the experience about the change in the cropping pattern ? How many years after the soil conservation measures could you bring about the change in the cropping pattern ?

2·7 If the fragments in the holding on which soil conservation measures have been taken are fewer now than those before the measures, what are the reasons for the reduction in the number of fragments ?

2·8 If the number of fragments has increased, give reasons.

2·9 Has your holding been consolidated ? When was the consolidation begun and completed ?

2·10 When the soil conservation measures were taken, did you voluntarily exchange any of your fragment with that of your neighbour cultivator in order to get the whole area of the holding in one contour alignment ?

2·11 The year ( ) before the soil conservation measures were taken, what had been average value of land per acre of that holding ?

2·12 What is the average value of land per acre of that holding now ?

2·13 Explain the reasons for the change in the value of land per acre.

2·14 Normal average yield per acre of important crops before and after adoption of soil conservation meaures.

Yield in lbs. per acre

Crops by season	Before ( ) adoption of soil conservation measures		After the adoption of soil conservation measures			
			1960-61		Year ( )	
	Total crop area	Crop area on which soil conservation measures taken	Total crop area	Crop area on which soil conservation measures taken*	Total crop area	Crop area on which soil conservation measures taken*
Kharif . . .						
Rabi . . .						

*For control villages, read "on which soil conservation measures are required".

3. *Soil conservation needs and measures*

3·1 What are the different soil erosion/problems* of your village and holding ?

Village Problems — Problems of his holding

3·2 Do you know that some soil conservation measures, agronomic practices and dry farming methods are recommended for over-coming the above problems ?

*Including problems of water-logging, salinity, alkalinity, shifting cultivation etc.

3.3 Knowledge and adoption of recommended soil conservation and follow-up practices.

(a) Engineering, mechanical measures and their maintenance and repairs.

Measures recommended	When did he first know about the measure (year)	How did he come to know it ?	Soil conservation measures taken up ? (Yes/No)	Year of first adoption	Reasons for non-adoption	Conditions/facilities necessary for adoption
(1)	(2)	(3)	(4)	(5)	(6)	(7)

(b) Follow-up crop rotation (specify all rotations fully and separately) and cultural practices *i.e.*, seed rate, method of tillage, use of implements, use of manures and fertilisers etc.

(1)	(2)	(3)	(4)	(5)	(6)	(7)

(c) Other measures.....

3.4 After how many years would you be able to switch over to the new cropping pattern ?

3.5 Crop rotation/rotations on the area on which soil conservation measures adopted.

Year ( ) before soil conservation measures were taken or 1950-51				1960-61 (*i.e.* presently followed)			
Fragment No.	Sl. No. of rotation	Period of rotation	Sequence of rotation	Fragment No.	Sl. No. of rotation	Period of rotation	Sequence of rotation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

3.6 On the other part of the holding on which soil conservation measures have not been taken, have you brought about any changes in the crop rotations since the adoption of soil conservation measures ? Mention the broad changes.

3.7 What are the reasons for the changes ?

3.8 Cultural practices, fertiliser application and irrigation on the area on which soil conservation measures were adopted. [For year ( ) before soil conservation measures were taken and for each year after these measures or from 1956-57 to 1960-61.]

Year————			
Fragment Sl. No.	Fragment Sl. No.	Fragment Sl. No.	Fragment Sl. No.
(1)	(2)	(3)	(4)

3.9 Are you adopting dry farming practices in the unbunded areas ? If yes, give following details :

Dry farming/Soil conservation practices followed on the present unbunded area in the	
Year ( ) before soil conservation measures taken on other land	1960-61

4. *Soil conservation measures taken up and assistance received upto* 1960-61

Soil conservation measures taken up on the holding	Total area under the measure/ repair	Year when work completed/ done	Nature of technical help/ guidance received	Expenditure			Employment			
				Total	Loans	Subsidy	Total man-days	Total bullock-days	Self/family labour (man-days)	Wage labour (man-days)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Engineering & Mechanical										
Major repairs/maintenance										

5. *Tools and implements*

5.1 Assistance or facilities received in respect of tools and implements.

Name of the tool/implement	Item of work for which used	How does it enhance the efficient execution of work ?	Is it received for soil conservation? (Yes/No)	Whether using? (Yes/No)	Supplied to him			Or whether owned by him previously
					Free for use	On hire	Sold	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

6. *Impact of soil conservation/dry farming measures*

6.1 The impact of soil conservation measures (including engineering and cultural practices) on

(a) the yield per acre (b) quality of crop (c) fertility of the soil (d) utilisation of family labour (e) utilisation of bullock labour (f) net income from land (g) source and area under irrigation (h) increase in cultivated area (in acres) (i) cultivated area (in acres or %) lost to the bunds.

7. *General*

7.1 Who carried out the soil conservation work (construction of contour bunds, levelling land, masonry escapes, grass waterways, etc.) on your holdings; whether this was done :

(a) by the soil conservation department ? . . . . . .
(b) yourself at the instance of and under the guidance of the department ? . .
(c) by any other agency (specify) ? . . . . . .
(d) yourself at your own initiative ? . . . . . .

7.2 Was your consent obtained for carrying out programme on your land ? . .

7.3 What are your views about the departmental execution of the programme with regard to its : (a) efficiency (b) cost (c) technique

7.4 Are you fully convinced of the utility of the soil conservation measures you are adopting?

7.5 If not convinced, what are the reasons for the adoption of the soil conservation measures ? . . . . . .

7.6 Have you faced or are you facing any special difficulties with regard to :

(i) contour alignment . . . . . .
(ii) land property alignments . . . . . .
(iii) uncontrolled grazing by the village cattle . . . . . .
(iv) legal implications . . . . . .
(v) other cultivators' cooperation or non-cooperation . . . . . .
(vi) technical guidance . . . . . .
(vii) village factions . . . . . .
(viii) switching over to the new cropping pattern (*e.g.* lack of credit difficulties about marketing the crop, etc.) . . . . . .
(ix) others (specify) . . . . . .

7.7 Do you consider that the responsibility of maintenance and repairs of the bunds is of the government or your own ? . . . . . .

8. *Additional questions for cultivators in the control villages*

8.1 What are the erosion problems of your land ? . . . . . .

8.2 What have been the limiting factors so far for not taking up the soil conservation programme ? . . . . . .

(i) lack of finance . . . . . .

(ii) lack of technical know-how . . . . . .

(iii) others not adopting, etc. . . . . .

(iv) others (specify) . . . . . .

8.3 Have you seen any demonstrations of the programme in a nearby village ? . .

8.4 Have you worked as labourer in an adjoining village where soil conservation measures have been taken ? . . . . . .

8.5 Has there been an increase in per acre yield in that village ? . . . . . .

8.6 Has the value per acre of land in that village gone up ? . . . . . .

8.7 When are you likely to take up the programme ? Indicate the approximate year .

8.8 What minimum facilities/conditions do you require for starting the programme ? .

8.9 How many years would you require to switch over to the new cropping pattern recommended for soil conservation or dry farming ? . . . . . .

8.10 Are any facilities required (loans, supplies etc.) or difficulties apprehended (regarding marketing of the crops etc.) in switching over to the new cropping pattern ? .

GLOSSARY

A.D.O.	Agriculture Development Officer—designation given to Agri. Extension Officer in some States.
Amin	Surveyor.
B.D.O.	Block Development Officer.
Block/Panchayat Samiti	A statutory representative local body at the block level.
C.D. Blocks	Community Development blocks.
Choe	Hill Torrents in the Punjab.
Donga	Country boat.
D.V.C.	Damodar Valley Corporation.
E.P.C.	Erosion permitting crops.
E.R.C.	Erosion resisting crops.
Gram Sahayak	A village leader trained in agricultural extension and the Community development work.
Hogla	Water weed.
Jhangi	Wild weed.
Jhuming	Shifting cultivation.
Kenis	Bund farming implements in Maharashtra.
Medhbundi	A type of field bunding.
M. & N.C. Hills	Mikir and North Cachar Hills.
Prantiya Raksha Dal	A voluntary organisation.
S.M.P.T. Block	Special Multipurpose Tribal Block.
V.L.W.	Village level worker.
Watt Bandi	A type of field bunding.
Zila Parishad	A statutory representative local body at the district level.

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