REPORT OF THE INDIAN FAMINE COMMISSION.

APPENDIX.

VOL. III.—EVIDENCE IN REPLY TO INQUIRIES OF THE COMMISSION.

CHAPTER I.—CONDITION OF THE COUNTRY AND PEOPLE.

Presented to both Houses of Parliament by Command of Her Majesty.

LONDON:
PRINTED BY EYRE AND SPOTTISWOODE.

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[3086.—III.] *Price 6s. 4d.*

INQUIRIES ADDRESSED BY THE FAMINE COMMISSION TO THE VARIOUS LOCAL GOVERNMENTS AND ADMINISTRATIONS.

CHAPTER I.

CONDITION OF THE COUNTRY AND PEOPLE.

1. Rain-fall.

What is the normal system of rain-fall in your province? From what quarter does the rain come, and in what months does it fall? Give any returns you possess showing the average amount gauged in each month; and state whence they are obtained, and how the registers of rain-fall are kept. Within what limits can the rain-fall vary without doing serious injury? What is the amount of rain-fall for each month, and for the whole year, which, judging from past experience, you consider to be sufficient for agricultural necessities? What are the different agricultural operations depending on the due arrival of each of the expected monsoons or seasonal rains? What is the effect on the crops of the failure of any of these elements of rain-fall, and what is the combination of circumstances under which the worst results have been produced? So far as necessary differences in the several districts should be distinguished, and separate returns supplied for them

page 1.

2. Past Famines and their Effects.

What part of the country is most subject to famine and freest from it, and why? What is known as to past famines, their causes, their dates, their extent locally, and their severity as tested by prices, mortality, loss of revenue, and expenditure on relief? Give, as far as possible, precise figures. Has the province suffered from any other destructive calamity, such as floods, frost, hail, locusts, blight, &c., to such an extent as to produce distress amounting to famine, or to create any general and widespread failure of the crop? To what extent do famines in any past period appear to have affected the general condition of the country, and how long has the effect lasted? Has the condition of the country improved in spite of such calamities? What is the normal increase in the population of the country, and how far has it been affected and kept down by famine? What are the facts on which your opinion on these last points is based?

vide separate volume, "Famine Histories."

3. Agricultural Statistics.

Give any statistics you possess as to the average area in each district under cultivation yearly, distinguishing food crops from others; the average amount of the chief food grains produced per acre; the total consumption in the district of such grains; the surplus that remains for export, or the deficiency that has to be supplied by import in ordinary years. How are these statistics collected, what amount of reliance may be placed on them, and what suggestions can you make for their improvement? If you have no statistics on these subjects, give any approximation or estimate you can - - - - - page 41.

4. Protection from Drought.

What area of your province and of its several districts is protected from drought in an average year by irrigation from wells, tanks or jhils, canals, or channels from rivers? To how much of this area is the protection complete and permanent, and how much is dependent on the local rain? How much of the area so protected is devoted to food crops, and what is the total amount of produce from that area? What is the effect of irrigation of crops (other than food crops) in adding to the powers of the population to resist famine? Supposing canals, tanks, wells, and jhils to be utilized to the utmost extent and kept in the highest possible order, what extent of the country would be protected from drought in a year when there was a failure of the rain?

page 98.

5. Staple Food Grains.

What grains form the staple food of your people? When are they sown and harvested, and what are the critical times at which rain is essential to each of them, or at which a failure or an excessive fall of rain may be mischievous or ruinous? - - - - - - - - - - page 149.

6. Manure and Rotation of Crops.

What proportion of the cultivated land and what class of crops is manured yearly, and what is the average weight of manure given to the acre (1) in land constantly manured; (2) in land occasionally manured? If there is any customary rotation of crops or fallows, state it - - - page 158.

7. Agricultural Improvement.

Have any attempts been made by the Government or private persons to improve agriculture in your province, either in the way of introducing new or improved implements, or new staples, or improved seed, or better methods of cultivation, or better breeds of cattle, and so forth? and with what result? Have you any suggestion to make for such improvement? Is there any Government model farm in your province? Or have any estates under the management of Government or of the Court of Wards been used for the object of making experiments or setting examples of improved agriculture? If so, state the system of management, whom they were placed under, and what the results, financial and agricultural, have been. Have any improvements been made in the breed of cattle, in the forms of ploughs, carts, sugar mills, or any other agricultural instruments, or in the mode of drawing water from wells? Have any agricultural exhibitions been held in your province, and have you observed that any good result has been obtained from them? Was

anything exhibited the imitation or adoption of which would have been useful to, and practicable by, the ordinary cultivator? And, if so, was there any willingness to imitate or adopt such improvements? Have you observed that there has been any deterioration of the soil, or that crops are worse than they used to be within your own experience? Does any such question specially arise in case of irrigated land? State specifically on what facts you base your replies. Where there is any popular belief in such deterioration, state what facts are adduced in support of it - - - - - - - page 177.

8. Proportion of Population engaged in Agriculture.

What proportion of your population is agricultural, that is, either directly engaged in the cultivation of the soil, solely or in combination with some other occupation, or deriving their chief income from the land? And of this class what proportion live entirely by the profits of the cultivation of their own land, and what proportion support themselves wholly or in part by field labour for others? - - - page 227.

9. Daily life and Circumstances of Cultivators.

What is the ordinary economic condition of the portion of the agricultural population directly engaged in the cultivation of the land and possessing any proprietary or occupancy interest in land? Illustrate your reply by giving the actual facts as to a few typical instances of such persons taken from four or five different villages in several districts of your province. State, with regard to each, what area of land he holds for tillage or grazing, what his family consists of, what amount of food grain and what value of other produce he raises on an average off his land in a year, what rent or revenue or cesses he pays for his land, what expenses he incurs in hired labour (other than his own labour and that of his family), what amount he spends in a year in purchases of necessaries which he cannot produce on his land, what kind of house he lives in, how many rooms it possesses and how many out-houses, what quantity of cattle or other live stock he possesses, what other property, and what stock of grain. How does he dispose of any surplus income, whether by hoarding or lending his money, or investing it in ornaments, or spending it on marriage ceremonies, or otherwise? What are his debts, and to what are they commonly due? State what proportion of the agriculturists of your district you believe to be in debt, and what proportion their average indebtedness bears to their average yearly income. Endeavour to obtain the opinions on these points of well-informed and trustworthy Native residents of different districts, and in submitting such opinions explain the position of your informants, and the probable means at their command of forming correct conclusions - - page 237.

10. Systems of Land Tenure.

Describe the tenures of land (proprietary and occupancy) which are most common, and as nearly as you can the area of cultivated land held by each kind of tenure. How far does the character of the tenure appear to affect the economic condition of the person holding it? Are there any conditions of tenure (such, for instance, as unrestricted freedom of transfer) which might be changed with advantage to the holder and without injury to other parties? - - - - - - - - page 324.

11. Improvements by Land Owners.

Are the holders of the above tenures in the habit of carrying out material improvements, such as digging wells or channels necessary in order to use the water in a canal? Are their actions in this respect affected most by the security or insecurity of their tenure, or by their wealth or poverty? Or are there any other reasons which hinder such investments of their labour and capital? What have been the effects of recent Land Improvement Acts? Have they tended to enlarge or narrow the making of advances by Government? Does the condition of the country render it desirable that the operation of these Acts should be facilitated, or their scope enlarged, and are there any apparent difficulties in the way of doing this that could be removed? Is the demand for interest on Government advances obstructive or prohibitory? - page 349.

12. Effect of the Law on Improvements in Land.

How far is the landowner's or the cultivator's readiness to improve the land checked by any operation of the law? Is the digging of wells checked in any such way? How far does the expectation of having to pay increased revenue or rent in consequence of any improvement check the execution of improvements? page 362.

13. Incidence of Land Revenue.

What is the general incidence of land revenue on the cultivated area, both for the arable land as a whole and for the different classes of such land (irrigated, dry, &c.)? What proportion does such revenue bear to the value of the gross produce? Is the incidence on the various classes of land fairly distributed, or would you propose any re-adjustment of it? When was the assessment fixed? Has there been any practical difficulty in realising the land revenue as now assessed? At what dates are the instalments of revenue payable, and what relation do these bear to the ordinary periods of harvest or of realization of rents, as the case may be? Do the several instalments bear a fair proportion to the value of the several harvests from which the revenue or rent has to be made good? What rate of interest, if any, is charged on land revenue in arrear? - - - - - - - - - - - page 364.

14. Price of Land and Alienation of Estates.

What is the average price of land per acre? What amount of land on an average is sold every year for arrears of revenue and for decrees of court? What quantity of land has been transferred in your district to non-agricultural and non-resident landlords? - - - - - - page 400.

15. Wages of Labour.

What are the wages usually paid to hired field labourers? Are they paid in kind or money? Give the rates as far as you can for the chief kinds of labour in ordinary years. Is the hired labourer usually able to subsist with fair ease on the grain or other payments he receives at harvest and other periods during the intervals between such payments, or is he frequently forced to borrow and forestall future payments? page 418.

16. Price of Food Grains.

What is the normal rate of prices of each of the chief staples of food in certain typical districts? What is the usual variation between the prices at harvest time and other times of the year? What rise in price would indicate the approach of alarming scarcity? In past times of severe scarcity what effect has been produced on prices; has the rise been sudden or gradual, and has it affected one staple more than another? Or has the rise been of such a character as to tend to equalise the prices of all staples? - - page 431.

17. Trade and the Trading Classes.

What is the state of your province as to the activity of commerce? Has it an energetic and enterprising trading class? Do any of the districts subsist mainly on its own resources, and export or import little? Or is there an active and constant ebb and flow of trade? - - - - - - page 446.

18. Roads.

What are the facts in your province as regards the means of communication? Do bridged and metalled roads connect all the important centres of trade that should be thus connected? Are the roads in good working order and sufficient for the traffic on them, or not? Are they open through the year, or closed for wheeled traffic in the rains? Is the ordinary means of conveyance by wheeled carriage, or by pack bullocks; and if by wheeled carriage, is there a sufficient number of carts in the district for all its wants? What is the ordinary cost per mile of conveying one ton of merchandise either by wheeled or by pack carriage? page 464.

19. Railways.

To what extent are railways developed in your province? What districts are not traversed by them, and what distances have to be gone to reach the railways from the districts furthest from them? Are any districts so much isolated as to make it desirable to extend railways to them to facilitate the introduction of food in time of famine? Has the effect of the existing railways been to equalise prices and stimulate trade to any important extent? Give any facts that support this view - - - - page 475.

20. Water Communication.

If there is water communication in your district, give an account of it; what kinds of boats are used, what their number is, what the nature is of the traffic they convey; state whether the navigation is capable of any improvement, and whether it is conducted on natural channels, or by canals, and if by the latter, under what regulations. What is the ordinary cost per mile of boat carriage for one ton? - - page 486.

21. Need of Additional Communications.

Is there any portion of your province into which, by reason of the want or the badness of the roads or other means of access, or of local or temporary disturbing causes of weather, &c., it might be impossible or difficult for unassisted trade in time of scarcity to throw enough grain to feed (say) one quarter of the population for six months? If there is such a part, state where it is, what is its area and population, and what are the special difficulties to be overcome, and how they might best be removed - - page 497.

22. Telegraphic Communication.

To what extent has telegraphic communication been established between the chief towns of your province? Having in view the value of rapid communication in time of distress, are there any important lines which it might be desirable to construct? - - - - - - - page 502.

23. Denudation of Forest Lands.

Has there been within the historic period any sensible denudation of the forest in, or bordering on, your province? Can it be tested by statistics showing over how much area forest or scrub jungle has been cut down? Can you state any specific facts which lead you to think that such deforestation has caused injurious effects in any way, either in respect to the fall of rain, or the abundance or permanence of water in streams, or wells, or the subsoil, or the denudation of the surface soil so as to render it unfit for cultivation? And what injury has been produced, and to what extent? Can you adduce any direct evidence that such injury as you think has been caused by the clearing of forest has been remedied by its reproduction? If you think the clearing has been injurious, what steps would you propose to take towards reboisement? Should it be done by artificial planting, or by conservation of the tract, so as to keep out cattle-grazing and fires? Can such conservation be effected without interfering with any vested rights of the people, or with their consent, if interference is necessary? Which of the two methods would be easiest, cheapest, quickest of operation, and most effectual? To what extent and on how large an area could either method be followed? - page 505.

24 and 25. Famine Mortality.

Can any estimate be made of the number and proportion of deaths which are the inevitable consequence of famine, not being due directly to starvation, but to such privations as adults in health can bear with safety, but which prove fatal to children or the old and sickly; or to such diseases as follow in the train of famine from eating unwholesome food, roots, berries, leaves, &c., or arise from other and obscure causes like cholera and fever commonly concomitant on famine? What statistics exist as to past famines to show the depopulation that they have caused, and how far it is due to an increased death-rate, to emigration, or to a decreased birth-rate? If any special census was taken after the famine, state whether any trustworthy information was obtained as to the different classes of population which have suffered most; whether the early stages of a famine affect certain classes more or less severely than its later stages; whether the loss of life has been greater among males or females, among adults or children, to what extent the birth-rate has been affected; and how far local influences, peculiarities of administration, or tenure, climate, soil, water, density of population, systems of cultivation, &c., have tended to mitigate or intensify the inevitable effects of scarcity.

If no such census was taken, state what information is to be got from the mortuary returns for the period embraced by the last famine in your province, as compared with those for ordinary periods, and what conclusions may be drawn from those returns - - - - - - - page 526.

26. Local Responsibility and Famine Expenditure.

It has been laid down by the Government of India as a settled principle that local financial responsibility should be enforced in the case of a famine as far as possible. With this view, special taxation has recently been imposed on the country, the proceeds of which the Government has proposed to apply as a mutual assurance fund which will be available for the benefit of the people on whom the calamity of famine may actually fall. But it has been recognised that it would be preferable if some portion of this taxation could be made more strictly local, both in its levy and its application to relief purposes. Can you suggest any way by which it might be rendered practicable to provide that where State funds have been expended on the relief of famine, such expenditure should be recovered from the locality which has benefited by it under any system of taxation (in modification of or in substitution for that recently adopted and not in addition to it) in a manner that should bring into operation a sense of local responsibility, first, in the direction of securing the lives of the people, and second, of protecting them from unnecessary expenditure on relief? How could such a principle be applied to a smaller area than that of a province or presidency? Could the expenditure in a single district or subdivision of a district be recovered from that district or subdivision by such special taxation wholly or in part, or under any special circumstances, or in reference to any class of the community requiring relief, leaving a smaller or larger portion of the charge to be made good from the province or presidency at large, or from the resources of the Government of India? Could any plan be suggested under which, subject to similar limitations, a municipality might be required to bear the cost of feeding its own poor? What kind of special local taxation should be adopted for this purpose? What would be the probable effect (1) on the minds of the people, (2) on the temper of officials, of the knowledge that the cost of famine relief expended on their behalf or by them would have to be recouped by local taxation? Is there any reason to suppose that the sense of local responsibility, if it could be brought to bear, would not operate beneficially in the case of relief of the distressed portion of the population in India? - - - - page 534.

INDEX OF EVIDENCE IN REPLY TO INQUIRIES OF THE FAMINE COMMISSION.

PUNJAB.

Mr. Alimulla - -	Honorary Extra Assistant Commissioner, Rohtak.	Q. 9, p. 240.
Mr. B. H. Baden-Powell, C.S.	Conservator of Forests -	Q. 23, pp. 505, 509.
Mr. W. Coldstream, C.S. -	Deputy Commissioner, Hoshiarpur.	Q. 9, p. 241.
Colonel W. G. Davies, C.S.I.	Commissioner, Delhi -	Q. 11, p. 350. Q. 12, p. 362.
Mr. C. A. Elliott, C.S., C.S.I.	Secretary, Famine Commission.	Q. 13, p. 381.
Mr. C. R. Hawkins, C.S. -	Deputy Commissioner, Amritsar.	Q. 9, p. 242.
The Lieutenant-Governor -	- - - - -	Q. 26, p. 534.
Mr. Liotard - -	- - - - -	Q. 7, p. 224.
Mr. J. B. Lyall, C.S. -	Settlement Commissioner, Mooltan and Derajat.	Q. 9, p. 246. Q. 11, p. 350.
Mr. J. R. Maconochie, C.S.	Settlement Officer, Delhi -	Q. 9, p. 237.
Mr. Justice P. S. Melvill -	Late Officiating Judge, Chief Court, Punjab.	Q. 14, p. 405.
Mirza Azim Beg - -	Assistant Settlement Officer, Jhelum District.	Q. 9, p. 243.
Muhammad Hayat Khan, C.S.I.	Judicial Assistant Commissioner, Gurdaspur.	Q. 9, p. 243.
Surgeon-Major A. Neil -	Meteorological Reporter to the Punjab Government.	Q. 1, p. 2.
Mr. E. O'Brien, C.S. -	Settlement Officer, Muzaffargarh.	Q. 9, p. 244.
Mr. Gore Ouseley, C.S.	Financial Commissioner -	Q. 11, p. 349. Q. 12, p. 362.
Punjab Government	- - - - -	Q. 14, p. 402.
Mr. S. S. Thorburn, C.S. -	Settlement Officer, Bannu -	Q. 9, p. 246.
Mr. T. H. Thornton, C.S. -	Judge of the Chief Court -	Q. 13, p. 371.
Mr. T. W. H. Tolbort, C.S.	Deputy Commissioner, Gujranwalla.	Q. 9, p. 243.
Lieutenant-Colonel Tremenheere.	Bengal Engineers - -	Q. 6, p. 162.
Major E. G. Wace, B.S.C. -	Deputy Commissioner -	Q. 1, p. 1. Q. 3, p. 41. Q. 4, p. 98. Q. 5 p. 149. Q. 6, p. 158. Q. 7, p. 177. Q. p. 227. Q. 10, p. 324. Q. 13, p. 36 Q. 14, p. 400. Q. 15, p. 418. Q. 16, p. 43 Q. 17, p. 446. Q. 18, p. 464. Q. 19, p. 47 Q. 20, p. 486. Q. 21, p. 497. Q. 22, p. 50 Q. 23, pp. 505, 509.
Mr. J. Wilson, C.S. -	Assistant Settlement Officer, Gurgaon.	Q. 9, p. 238.

NORTH-WEST PROVINCES AND OUDH.

Mr. E. B. Alexander, C.S. -	Assistant Settlement Officer, Moradabad.	Q. 9, p. 256.
Mr. W. C. Benett, C.S. -	Assistant Commissioner, Lucknow.	Q. 9, p. 289.
Board of Revenue - -	- - - - -	Q. 11, p. 353.
Mr. E. C. Buck, C.S. - -	Member, Local Famine Committee.	Q. 3, p. 55. Q. 4, pp. 119, 126. Q. 5, p. 15 Q. 6, p. 163. Q. 7, p. 185. Q. 10, p. 32 Q. 14, p. 407. Q. 17, p. 447. Q. 1 p. 465. Q. 19, p. 476. Q. 20, p. 48 Q. 21, p. 497.
Captain J. E. Campbell, B.S.C.	Deputy Conservator of Forests, Kumaun.	Q. 23, p. 511.
Mr. W. Crooke, C.S. -	Assistant Magistrate, Gorakhpur.	Q. 9, p. 288.
Mr. C. A. Elliott, C.S., C.S.I.	Secretary, Famine Commission.	Q. 3, p. 58. Q. 4, p. 123. Q. 5. p. 150. Q. 6 p. 163. Q. 7. p. 185. Q. 8, p. 229. Q. 1 p. 329. Q. 13. p. 385.
Mr. S. A. Hill - -	Meteorological Reporter to Government, N.W. Provinces and Oudh.	Q. 1, p. 4.

...han Sing - -	Deputy Collector, Bulandshahr.	Q. 9, p. 253.
...Lieutenant-Governor -	- - - - -	Q. 4, p. 129.
... Liotard - -	- - - - -	Q. 7, p. 224.
...r. A. M. Markham, C.S. -	Officiating Collector, Allahabad.	Q. 9, p. 274.
Maulvi Karim Baksh -	Extra Assistant Commissioner, Jhansi.	Q. 9, p. 275.
Major C. C. S. Moncrieff, R.E., C.S.I.	Superintending Engineer -	Q. 20, p. 491.
Major R.H.de Montmorency, B.S.C.	Deputy Commissioner, Bahraich.	Q. 23, p. 511.
Babu T. N. Mukarji -	Head Superintendent, Department of Agriculture and Commerce, N.W. Provinces and Oudh.	Q. 9, p. 268.
Captain D. G. Pitcher, B.S.C.	Secretary to Local Famine Committee.	Q. 15, p. 420. Q. 16, p. 435. Q. 22, p. 503 Q. 23, p. 510. Q. 24, 25, p. 526.
Surgeon-Major C. Planck -	Sanitary Commissioner -	Q. 24, 25, p. 527.
Mr. I. W. Quinton, C.S. -	Member, Famine Committee	Q. 11, p. 351.
Pundit Radha-Kishen -	Deputy Collector, Muzaffarnagar.	Q. 9, p. 248.
...r. H. G. Ross, C.S. -	Superintendent, Dehra Dun	Q. 23, p. 512.
...r. R. D. Spedding, C.S. -	Collector, Gorakhpur -	Q. 9, p. 280.
...r. J. Smith, C.S. - -	Officiating Magistrate, Meerut.	Q. 9, p. 253.
...r. E. Stack, C.S. - -	Assistant Collector, Bareilly	Q. 9, p. 260.
...r. A. E. Staley, C.S. -	Assistant Collector, Etawah	Q. 9, p. 263.
...ptain E. S. Wood - -	Conservator of Forests, Oudh.	Q. 23, p. 511.
... F. N. Wright, C.S. -	Collector, Cawnpore - -	Q. 9, p. 264.
...nshi Zahid Hussain -	Deputy Collector, Jaunpur -	Q. 9, p. 280.

Bengal.

H. S. Beadon, C.S. -	Officiating Collector, Cuttack	Q. 26, p. 536.
E. G. Glazier, C.S. -	Collector, Dinagepore -	Q. 26, p. 537.
Liotard - -	- - - - -	Q. 7, p. 226.
A. P. MacDonnell, C.S.	Officiating Magistrate and Deputy Collector.	Q. 9, p. 291.
... Alex. Pedler - -	Officiating Meteorological Reporter.	Q. 1, p. 15.
...bu Raj Kumar Sircar -	Honorary Secretary, Rajshahye Association.	Q. 9, p. 290.
...r. F. H. B. Skrine, S.C. -	Assistant Magistrate and Collector, Nuddea.	Q. 9, p. 291.
... G. Toynbee, C.S. -	Officiating Collector of Patna. On special duty.	Q. 3, p. 74. Q. 4, p. 134. Q. 5, p. 151. Q. 6, p. 167. Q. 7, p. 189. Q. 8, p. 232. Q. 9, p. 290. Q. 10, p. 335. Q. 11, p. 354. Q. 12, p. 363. Q. 13, p. 387. Q. 14, p. 410. Q. 15, p. 422. Q. 16, p. 436. Q. 17, p. 458. Q. 18, p. 467. Q. 19, p. 478. Q. 20, p. 491. Q. 21, p. 499. Q. 22, p. 503. Q. 23, p. 513. Q. 24, 25, p. 528. Q. 26, p. 535.

Central Provinces.

...r. Bapu Rao - -	Extra Assistant Commissioner, Saugor.	Q. 9, p. 293. Q. 15, p. 423.
...rgeon-Major J. F. Barter	Officiating Sanitary Commissioner.	Q. 1, p. 23. Q. 24, 25, p. 530.
...r. Bhargao Rao - -	Extra Assistant Commissioner, Narsinghpur.	Q. 9, p. 294. Q. 15, p. 425.
...ptain J. C. Doveton, M.S.C.	Conservator of Forests -	Q. 23, p. 513.
...r. E. E. Fernandez -	Assistant Conservator of Forests.	Q. 5, p. 153.
...r. Charles Grant, C.S. -	Officiating Judicial Commissioner.	Q. 11, p. 356. Q. 26, p. 540.
...r. C. W. Imrie, C.S. -	Assistant Commissioner, Saugor.	Q. 9, p. 294. Q. 15, p. 425.
...r. L. K. Laurie, S.C. -	Assistant Commissioner, Wardha.	Q. 15, p. 424.
...r. Liotard - - -	- - - - -	Q. 7, p. 219.
...ajor J. O. Mayne, R.E. -	Officiating Chief Engineer -	Q. 18, p. 469.
...r. J. W. Neill, C.S. - -	Officiating Commissioner, Nagpur Division.	Q. 26, p. 539.

Mr. G. Jasper Nicholls, C.S.	Assistant Commissioner -	Q. 1, p. 23. Q. 3, p. 76. Q. 4, p. 134. Q. 5, p. 152. Q. 6, p. 167. Q. 7, p. 192. Q. 8, p. 233. Q. 9, p. 291. Q. 10, p. 338. Q. 11, p. 354. Q. 13, p. 390. Q. 14, p. 411. Q. 15, p. 422. Q. 16, p. 438. Q. 17, p. 458. Q. 18, p. 468. Q. 19, p. 479. Q. 20, p. 493. Q. 21, p. 500. Q. 22, p. 504. Q. 26, p. 538.
Wasadeo Ballal Kher -	Extra Assistant Commissioner, Seoni.	Q. 9, p. 295. Q. 15, p. 426.

BERAR.

General Balfour, C.B. -	- - - - -	Q. 19, p. 482.
Mr. Bahmanji Jamasji -	Assistant Commissioner -	Q. 9, p. 299.
Mr. Ballantyne - -	Assistant Conservator of Forests.	Q. 22, p. 514.
The Cotton Commissioner -	- - - - -	Q. 19, p. 481.
Mr. A. J. Dunlop - -	Assistant Commissioner -	Q. 1, p. 25. Q. 3, p. 79. Q. 4, p. 141. Q. 5, p. 154. Q. 6, p. 168. Q. 7, p. 196. Q. 10, p. 340. Q. 11, p. 357. Q. 13, p. 391. Q. 14, p. 411. Q. 15, p. 427. Q. 16, p. 440. Q. 17, p. 459. Q. 18, p. 470. Q. 19, p. 481. Q. 21, p. 501.
Colonel Elphinstone -	- - - - -	Q. 6, p. 168. Q. 7, p. 197.
Mr. W. B. Jones - -	Commissioner - -	Q. 7, p. 197. Q. 9, p. 298. Q. 10, p. 341. Q. 13, p. 392. Q. 21, p. 501.
Mr. Liotard - -	- - - - -	Q. 7, p. 219.
Mr. A. C. Lyall - -	Secretary to Government of India, Foreign Department (formerly Commissioner, West Berar).	Q. 10, p. 340.
Major K. J. L. Mackenzie -	Deputy Commissioner -	Q. 4, p. 142. Q. 6, p. 168. Q. 7, p. 197. Q. 11, pp. 357, 358. Q. 15, p. 427.
Lieutenant-Colonel H. C. Menzies.	Deputy Commissioner -	Q. 4, p. 142. Q. 6, p. 168. Q. 7, p. 197. Q. 11, p. 357. Q. 15, p. 427. Q. 15, p. 427.
Colonel W. Nembhard -	Late Commissioner, East Berar.	Q. 3, p. 79. Q. 4, p. 141.
Sri Krishna Narhar -	Extra Assistant Commissioner.	Q. 9, p. 296.
Major H. C. A. Szczepanski	Deputy Commissioner -	Q. 6, p. 168. Q. 7, p. 197. Q. 9, p. 296. Q. 11, pp. 357, 358. Q. 15, p. 427.

BOMBAY.

Colonel W. C. Anderson -	Commissioner of Survey -	Q. 6, p. 169. Q. 7, p. 199. Q. 10, p. 344. Q. 11, p. 358. Q. 13, p. 392. Q. 14, p. 412. Q. 26, p. 541.
Mr. T. Chambers - -	Meteorological Reporter -	Q. 1, p. 25.
Mr. Charles - -	Collector, Dharwar - -	Q. 26, p. 542.
Mr. Erskine - -	Commissioner, Northern Division.	Q. 7, p. 199. Q. 26, p. 542.
Colonel Haig, R.E. -	- - - - -	Q. 20, p. 495.
Surgeon-Major Hewlett, C.I.E.	Acting Sanitary Commissioner in 1876 and 1877.	Q. 24, 25, p. 532.
Colonel Jenkin Jones, R.E.	Superintending Engineer, Central Division.	Q. 18, p. 470.
Mahadeo Wasudeo Baryé -	Member of Famine Commission.	Q. 9, p. 301.
Mr. Norman - -	Collector, Poona - -	Q. 26, p. 541.
Mr. W. G. Pedder, C.S. -	Secretary, Revenue Department, India Office (formerly Settlement Officer, Guzerat, Superintendent of Revenue Survey, Khandesh, &c.).	Q. 6, p. 169. Q. 10, p. 344. Q. 11, p. 358. Q. 26, p. 542.
Mr. J. B. Peile, C.S. - -	Member of Famine Commission.	Q. 1, pp. 25, 27. Q. 3, p. 82. Q. 4, p. 142. Q. 5, p. 154. Q. 6. p. 168. Q. 7, p. 197. Q. 8, p. 233. Q. 9, p. 303. Q. 10, p. 343. Q. 11, p. 358. Q. 12, p. 363. Q. 15, p. 427. Q. 16, p. 441. Q. 17, p. 461. Q. 19, p. 482. Q. 21, p. 501. Q. 22, p. 504.
Mr. Percival - -	Sholapur - - -	Q. 10, p. 343. Q. 26, p. 542.
Lieutenant-Colonel W. Peyton.	Conservator of Forests, Southern Division.	Q. 23, p. 517.
Mr. Porteous - -	In charge, Kaira - -	Q. 18, p. 471. Q. 7, p. 197.
Mr. Propert - -	Collector, Khandesh -	Q. 10, p. 343. Q. 7, p. 198.
Mr. Ramsay - -	Collector, Kaladgi - -	Q. 26, p. 541.
Mr. E. P. Robertson -	Commissioner, Central Division.	Q. 6. p. 169. Q. 7, p. 198. Q. 10, p. 344. Q. 19, p. 483.
Mr. Shuttleworth - -	Conservator of Forests, Northern Division.	Q. 23, p. 514.

Mr. Spry	Collector, Kaladgi	Q. 26, p. 541.
Mr. Wallinger	Deputy Conservator, Poona	Q. 23, p. 517.
Major-General St. Clair Wilkins, R.E.	Superintending Engineer, Southern Division.	Q. 18, p. 471. Q. 19, p. 482.

SINDH.

Colonel M. R. Haig	Settlement Officer	Q. 1, p. 29. Q. 3, p. 84. Q. 5, p. 155. Q. 6, p. 170. Q. 9, p. 307. Q. 10, p. 345. Q. 11, p. 359. Q. 13, p. 393. Q. 18, p. 472. Q. 19, p. 483. Q. 20, p. 495.

MADRAS.

Lieutenant-Colonel Beddome	Conservator of Forests	Q. 23, p. 520.
Board of Revenue		Q. 1, p. 30. Q. 3, p. 84. Q. 4, p. 144. Q. 5, p. 155. Q. 6, p. 170. Q. 7, p. 200. Q. 8, p. 233. Q. 10, p. 346. Q. 11, p. 359. Q. 12, p. 363. Q. 13, p. 393. Q. 14, p. 413. Q. 15, p. 428. Q. 16, p. 441. Q. 17, p. 462. Q. 18, p. 472. Q. 19, p. 483. Q. 20, p. 495. Q. 21, p. 501. Q. 22, p. 504.
Surgeon-Major W. R. Cornish.	Sanitary Commissioner, Madras.	Q. 24, 25, p. 532.
Mr. W. S. Foster	Collector, Godavery	Q. 23, p. 519.
Mr. H. Goodrich	Collector	Q. 9, p. 308.
Mr. Gordon	Bellary	Q. 23, p. 518.
Mr. J. G. Horsfall	Acting Collector, Kistna	Q. 23, p. 520.
Mr. Liotard		Q. 7, p. 203.
Mr. Logan	Malabar	Q. 23, p. 519.
Mr. J. Pennington	Collector, Tinnevelly	Q. 23, p. 518.
Mr. J. F. Price	Collector, Chingleput	Q. 23, p. 518.
Mr. Price	Cuddapah	Q. 9, p. 308.
Sir W. R. Robinson, K.C.S.I.	Member of Council	Q. 23, p. 518. Q. 26, p. 543.
Mr. Webster	Coimbatore	Q. 23, p. 520.
Mr. W. Wilson	Director of Revenue Settlements.	Q. 9, p. 308.

MYSORE.

Captain C. Bowen, R.E.	Officiating Superintendent Engineer.	Q. 18, p. 473.
Mr. F. Harman	Superintendent	Q. 6, p. 174. Q. 7, p. 201.
Colonel A. Hay	Commissioner, Ashtagram Division.	Q. 1, p. 36. Q. 9, p. 310. Q. 14, p. 417.
Major W. Hill	Deputy Commissioner, Shimoga.	Q. 9, p. 310.
Mr. Krishnaiengar	Deputy Commissioner, Kolar	Q. 11, p. 361. Q. 14, p. 417. Q. 15, p. 429. Q. 19, p. 485. Q. 23, p. 522.
Mr. J. Lacey	Assistant Commissioner, Bangalore.	Q. 5, p. 156. Q. 16, p. 444.
Mr. Liotard		Q. 7, p. 217.
Mr. G. F. Meiklejohn	Assistant Superintendent, Revenue Survey.	Q. 12, p. 363. Q. 17, p. 463.
Colonel J. L. Pearse	Commissioner, Nundidrug Division.	Q. 9, p. 309. Q. 10, p. 348. Q. 14, p. 417. Q. 24, 25, p. 533.
Mr. L. Ricketts	Deputy Commissioner, Bangalore.	Q. 6, p. 174. Q. 7, p. 201. Q. 11, p. 360.
Captain G. J. Van Someren	Conservator of Forests	Q. 23, p. 523.

RAJPUTANA.

Captain D. W. K. Barr	Political Agent, Marwar and Jeysalmere.	Q. 1 p. 38. Q. 5, p. 156. Q. 7, p. 201. Q. 9, p. 311. Q. 17, p. 463. Q. 18, p. 474.
Colonel W. H. Beynon	Political Agent, Jeypore	Q. 16, p. 444. Q. 18, p. 474.
Lieutenant-Colonel T. Dennehy.	Political Agent, Dholpur	Q. 3, p. 94. Q. 4, p. 146. Q. 10, p. 348.
Captain V. E. Law	Political Agent, Alwur	Q. 3, p. 93. Q. 4, p. 146. Q. 13, p. 396.
Mahadeo Wasudeo Barvé	Member of Famine Commission.	P. 323.
Deputy Surgeon-General B. Moore.		Q. 1, p. 38. Q. 4, p. 147. Q. 18, p. 474.
Major P. W. Powlett	Political Agent, Kotah	Q. 3, p. 94. Q. 4, p. 147. Q. 7, p. 202. Q. 10, p. 348. Q. 13, p. 396. Q. 17, p. 463.
Mr. L. S. Saunders	Commissioner, Ajmere	Q. 4, p. 147. Q. 7, p. 202. Q. 12, p. 363. Q. 23, p. 525.
Mr. L. D. Spencer	Political Agent, Eastern States.	Q. 3, p. 94. Q. 4, p. 147. Q. 13, p. 396.
Mr. T. White	Assistant Commissioner, Ajmere.	Q. 7, p. 202. Q. 23, p. 525.

Central India.

Lieutenant-Colonel P. W. Bannerman.	Political Agent, Baghelkhand.	Q. 7, p. 202. Q. 9, p. 312. Q. 10, p. 349. Q. 13, p. 397. Q. 18, p. 474.
Mahadeo Wasudeo Barvé -	Member of Famine Commission.	P. 323.
Lieutenant-Colonel Martin - - - -		Q. 18, p. 474.
Mir Shahamat Ali -	Political Agent and Superintendent, Rutlam.	Q 7, p. 203. Q. 9, p. 312. Q. 10, p. 349. Q. 11, p. 362. Q. 12, p. 364. Q. 13, p. 397. Q. 18, p. 474.
Colonel W. Osborne - -	Political Agent, Bhopal -	Q. 13, p. 397.
Pundit Suroop Narain - - - - -		Q. 10, p. 349. Q. 11, p. 362. Q. 13, p. 397.
Mr. Wingate - - - - - -		Q. 1, p. 39. Q. 3, p. 94. Q. 4, p. 148. Q. 5, p. 157. Q. 6, p. 175. Q. 8, p. 236. Q. 11, p. 349. Q. 11, p. 362. Q. 12, p. 364. Q. 14, p. 417. Q. 15, p. 429. Q. 16, p. 444. Q. 17, p. 463. Q. 21, p. 502. Q. 23, p. 525.

Hyderabad.

Mahadeo Wasudeo Barvé -	Member of Famine Commission.	P. 323.
Moulvie Mahdi Ali - -	Secretary to H.H. the Nizam's Government in the Revenue Department.	Q. 1, p. 39. Q. 3, p. 95. Q. 4, p. 148. Q. 5, p. 157. Q. 6, p. 175. Q. 8, p. 236. Q. 9, p. 236. Q. 9, p. 312. Q. 11, p. 362. Q. 13, p. 398. Q. 15, p. 430. Q. 16, p. 445.

ERRATA.

P. 348.—The reply to Question 10 is by Colonel Pearse.
P. 363.—The reply to Question 12 is by Mr. G. F. Meiklejohn.
P. 483.—Mr. Dharwar should be Mr. Charles, Dharwar.

APPENDIX.

CHAPTER I.—QUESTION 1.

What is the normal system of rain-fall in your Province? From what quarter does the rain come, and in what months does it fall? Give any returns you possess showing the average amount gauged in each month; and state whence they are obtained, and how the registers of rain-fall are kept. Within what limits can the rain-fall vary without doing serious injury? What is the amount of rain-fall for each month, and for the whole year, which, judging from past experience, you consider to be sufficient for agricultural necessities? What are the different agricultural operations depending on the due arrival of each of the expected monsoons or seasonal rains? What is the effect on the crops of the failure of any of these elements of rain-fall, and what is the combination of circumstances under which the worst results have been produced? So far as necessary, differences in the several districts should be distinguished and separate returns supplied for them.

PUNJAB.

The rain-fall is registered at the head-quarters of each tahsíl and district. At the tahsíl offices the observations are made, and the registers written up by one of the native revenue clerks under the supervision of the tahsíldár. At the head-quarters of each district the observations are similarly made either at the tahsíl or sadar office.

At the great majority of these observing stations (aggregating about 150) the gauge used for registering the rain-fall is a cylindrical copper tube, into which the rain-fall is collected from a wide funnel. The depth of water in the tube is measured by a metal scale. The dimensions of the tube and the funnel are so adjusted that one inch of water in the tube represents a fall of one-tenth of an inch at the mouth of the funnel, that is to say, on the surface of the ground. At a few stations more elaborate gauges are in use.

In addition to these weekly reports by the land revenue establishments, a system of meteorological observations is carried out at the head-quarter medical dispensary of each district, and reported to a selected medical officer at Lahore, who fills the office of Meteorological Reporter to the Punjab Government. These observations are carried on with accurate instruments, and include, besides the rain-fall, humidity and temperature of the atmosphere, barometric pressures, and the wind directions; and are summarised in an annual report addressed to the Punjab Government.

It is noteworthy that the rain-fall reported by the land revenue establishments, though observed with rough instruments and by clerks on small pay, agrees well with the more detailed and scientific observations last described.

The rain-fall of the Punjab, like that of the North-West Provinces, is brought to it by wind currents from the east and south-east. A portion of the fall may be due to the south-west currents from the Indian Ocean; but so much of these as contribute to the Punjab rain-fall seem to strike the eastern currents at a point east of Delhi, and are deflected by and added to the latter.

It is a proverb all over the Punjab that the east wind brings rain. This is said both of the autumn and winter rains. I gather from Dr. Neil's report that his observations do not corroborate this fact in respect of the winter rains. But the fact is notorious, even in winter, that rain comes with the east wind; and I have no doubt that in due time meteorological observations will confirm and explain it.

The province has two well-marked rainy seasons; the autumn rains, which usually commence at the end of June and last into the middle of September; and the winter rains, which occur principally between January and March.

The average annual fall in each district, and more especially the average amount of the autumn fall, depends mainly on its distance from the base of the Himalayan tracts, which stretch from end to end of the province on its north-east side. The following table illustrates this. It shows the way the rain-fall of each doáb or delta decreases as we recede from the hills:—

From EAST — To WEST.

BETWEEN THE RIVERS JUMNA AND BEAS.			BETWEEN THE RIVERS BEAS AND RAVI.			BETWEEN THE RIVERS RAVI AND CHENAB.			BETWEEN THE RIVERS CHENAB AND JHELUM.			BETWEEN THE RIVERS JHELUM AND INDUS, AND DOWN WEST BANK OF INDUS RIVER.		
STATION.	Distance from Himalayan base.	Rain-fall.	STATION.	Distance from Himalayan base.	Rain-fall.	STATION.	Distance from Himalayan base.	Rain-fall.	STATION.	Distance from Himalayan base.	Rain-fall.	STATION.	Distance from Himalayan base.	Rain-fall.
	Miles.	Inches.		Miles.	Inches.		Miles.	Inches.		Miles.	Inches.		Miles.	Inches.
Narsingarh	10	44	Dera	0	54	Pathánkot	0	54	Siálkot	25	39	Gujrat	30	29	Abbott-abad	0	46
Umballa	26	35	Hoshiárpur	32	34	Gurdáspur	25	31	Daska	40	30	Phálian	55	26	Haripur	16	36
Pipli	56	26	Jullundur	55	30	Batála	44	27	Gujránwála	55	26	Bhera	80	16	Rawalpindi	32	32
Kaithal	70	18	Nakodar	72	26	Amritsar	65	23	Hafizabad	80	20	Shahpur	110	13	Fátahjang	50	–
Hissar	135	17	Ferozepore	112	20	Kasur	110	22	Sharakpur	100	19				Talagang	100	14
Sirsa	135	14	Muktsar	144	13	Chunián	140	22	Chiniot	130	13				Miánwáli	145	10
						Dipálpur	170	8	Jhang	170	10				Dera Ismail Khan.	200	8
						Montgomery	200	9							Leiah	260	8
						Mooltan	290	6							Muzaffargarh	310	6
															Rájanpur	400	–

CHAP. I. QN. 1.

PUNJAB.

Major Wace.

The winter rains contribute but a small portion of the total annual fall. In the Delhi and Umballa divisions they are usually 4 inches out of 30; in the submontane tracts of the Jullundur, Amritsar, and Lahore divisions they are 5 out of 30 and 35; or in the parts more distant from the hills 3 out of 20. In the northern part of the Rawalpindi division they increase to 7 out of 30. At Sirsa and Shahpur, far removed from the hills, they are 2 out of 13; and at Mooltan 1 out of 6. Yet owing to the low temperature of the winter, these small falls of rain in all but the southernmost portion of the province raise crops equal in value to those grown under the fierce sun and heavy rains of the autumn.

It is not possible to state exactly, or nearly exactly, how many inches of rain are needed in each month. On the other hand, the description of the years of scarcity which have occurred in the Punjab, and of the seasons at which rain is essential to each crop, or injurious to it, go far to supply the information required. Briefly summarised, that information is as follows:—For the autumn (kharif) crop the most favourable conditions are falls of rain commencing at the end of June and lasting, with breaks not exceeding a fortnight, into the middle of September. The total fall is not so important as the repetition of moderate falls at the intervals stated.

The most unfavourable conditions consist in the failure of the last half of the autumn rains in July and August.

The seasons in the Punjab are so adjusted that the later rains of the autumn (August to October) both ripen the autumn crops and prepare the ground for the rabi sowings. If these rains fail, two crops are lost at one blow. Both in 1860 and 1868 it was this which caused the famine. The natives say that the loss of the kharif harvest by itself does not cause famine, but that famine always comes in with the kharif, and goes out with the kharif. That is to say, the kharif may fail owing to short rains at the sowing time; but if the later rain fails absolutely, the rain which both ripens the autumn millets and on which the wheat is sown, the country loses at one blow a year's food supply. In the same way famine goes out with the kharif, because these late autumn rains bless the country with two crops at once.

Dr. Neil.

January.—This is the coldest month of the year throughout the Punjab, and usually more so than November and December. The winds usually blow from north-westerly directions, but, as in the cold season generally, vary greatly.

The rain-falls during this month, as indeed during the cold weather generally, are due to local influences, local areas of low pressure, whither wind currents of different degrees of saturation and different temperatures blow and mingle. A good instance of this was shown in January 1874, on the 21st and 22nd of the month. On the north-west frontier the wind had been blowing previously mostly from northerly and easterly directions; while on the north-eastern boundary, from below and through the district of Ludhiana, the wind came from westerly sources. These currents, impinging and uniting, deflected towards the more eastern districts, and there, the regions being colder, precipitated their moisture.

A cold wind from the hills meeting a warmer current from the plains will serve to produce a depression of temperature with consequent condensation of moisture, and a continuance of this will bring the moisture below the dew point or point of saturation, and a fall of rain will be the result. The range of rain-fall for January extends from a maximum of four inches to a few drops. The submontane districts are usually the most liberally supplied, from causes described above.

February.—This month is warmer by an average of 5° or 6° than January. The winds, though variable, blow mostly from northerly and westerly directions, and the rains are due mostly to the same causes as I have mentioned in my remarks for the previous month. The largest rain-falls occur in the submontane districts. The largest fall during this month in Lahore (4·67 inches) occurred in 1877; so also in Rawalpindi and in Siálkot in the same year. In the more eastern districts the fall does not usually reach one inch, and the same remark applies to the more southern districts.

March.—The mean temperature of this month exceeds that of February usually by about seven degrees. The temperature in the sun's rays begins to increase greatly. The winds, still variable, begin to blow more frequently from easterly sources as the heat of Northern and Western India begins to increase, but northerly and westerly currents still prevail. The average rain-fall at Lahore rarely exceeds two inches; and seldom, indeed, reaches that amount. During this month of 1868 and 1869 the rain-fall in the submontane districts and a few others was very considerable, and was due to a prevalence of wind currents blowing towards the great north-eastern boundary, and being there met by counter-currents. In March 1871, these same districts had very little rain, and I account for this by the fact that the westerly currents were so powerful that they carried their moisture far into the mountains beyond the districts noted. The average amount of rain in the more southern districts, such as Delhi, Gurgaon, Hissar, does not usually exceed an inch. In the submontane districts the fall is more plentiful, from the reasons given above, and in the western and north-western districts the fall is also usually tolerably plentiful. This will depend of course greatly upon whether the area of low pressure may shift towards them, and thus cause a rush of wind currents in that direction.

April.—The mean temperature of this month exceeds that of March by about 11°. The wind begins to assume more southerly directions, but is still variable. The rain-fall varies very much throughout the province. In the more southern districts and on the north-western frontier it seldom exceeds one inch, and in many places does not even reach that amount. The north-eastern districts usually fare better, though occasionally very badly.

May.—This month has a mean increase of about 10° over that of April. The amount of rain varies very much in different years during this month in the Punjab. In the years 1869, 1870, 1871, this month was almost rainless, and in 1874, 75, 76, 77, very little fell, at random periods. In the years 1867 and 1872, and notably in the present year, the falls for this month have been very considerable. On turning to my report for 1869, I find the following remark:—"The most remarkable difference in the amount of "rain is observable in May as compared with that of "the same month for the two previous years, during "which it so happened that a certain amount of rain "fell in almost every district in the province. The "barometer showed greater fluctuations of pressure "during the month in 1867 and 1868." It is to be observed that the month of March of 1869 was unusually rainy which, due, as the cold weather rains are, to local influences, principally accounts, partly at least, for the scanty fall in the May following.

Turning to the table of "Directions of Wind," for 1869, I find that the winds were with unusual frequency easterly, as for example at Siálkot, and this will account for the absence of rain in the submontane districts. The wind currents were blowing towards the area of low pressure. Turning to the report for 1872, I find that westerly currents were more prevalent; the area of low pressure had therefore been more eastward.

June.—This is the hottest month of the year. The amount of rain which falls during this month is subject to very great variation. In the report for June 1873, I made the following observations:—"It is

" most interesting to compare this month's (June " 1873) weather results with those of the same month " for the past four years." In my report for June 1871, I wrote as follows:—" The rain-fall during this " month was unusually large in the eastern and " south-eastern districts and in the hills. The cause " of this was the almost entire prevalence of the " south-east winds. These south-east rain-bearing " winds, blowing as they did along the great mountain " boundary of the Himalayas, had most of their " moisture precipitated to the east of 74° longitude. " The south-west winds to the west of this, on the " other hand, meeting seldom with any resistance from " counter-currents, blew onwards towards the north- " western boundary of the province, over a large " tract of arid country, and had little moisture left in " them by the time they reached the great Sulimán " range as south-eastern deflected currents. The " districts north of the 33rd parallel fell short of their " usual supply of rain, and it is most likely that, with " the same predominance of south-easterly winds, " this state of matters will always maintain, as it will " also in the case of districts lying to the west of 74° " longitude. As the Gangetic current waxes stronger " or otherwise over the south-western, the greater or " less will be the fall of rain in June."

Quoting still from the report of 1873, "The table of results shows at a glance in how far the above remarks are confirmed by subsequent observation. Take for example Ludhiána. In June 1871, when east and south-east prevailed, there was a fall of over 10 inches of rain; while in 1873 for the same month there was a fall of only a fraction of an inch. With the other years for the same month there will be found shades of difference which correspond to the prevalence of the rain-bearing currents or otherwise. The same remark applies to Siálkot, Lahore, and Rawalpindi.

July.—Owing to the rains this month is slightly cooler than June, and the daily range of temperature is less. As a general rule, the monsoon rains do not set in in the Punjab before the end of the first week of this month. At all events this is usually the case with the districts north of the 30th parallel. As regards the amount of rain which the province will receive during this month and the following, we have tolerably definite and trustworthy data at command. Depending as the rain-fall is upon monsoon influences, and recognising the fact that two rain-bearing currents, south-western and south-eastern, affect the eastern and northern parts of the Indian Peninsula, we have only to discover by observation whether the current is more or less powerful than the other. Of the two monsoon currents, the south-east or Gangetic current is the one upon which the Punjab depends most for rain. In my report for July 1873, I wrote as follows:— "A considerable amount of rain fell in most of the " eastern districts, and the obvious cause was the " prevalence of the rain-bearing currents from the " east and south-east."

The fall was observed to be most copious in the more eastern districts, in some of which the fall nearly doubled the mean of previous years for the same month. If we compare the falls of July 1869 and 1873, we notice that north of latitude 30° the fall for the *former* period far exceeded that of the latter, while in the districts *south* of that parallel, the rains were, in 1869, comparatively scanty. Thus, at Delhi the fall in July 1869 was only 6·5 inches; while that of July 1873 in the same station was nearly three times that amount. On examining the wind charts for these periods, we find that during the early part of the month of 1869 the winds blew most frequently from westerly directions; and it was not till the middle of the month that rain fairly set in with the change of wind to south-east. Again, as regards July 1874, I wrote:—" Had the south-west monsoon " been *more* powerful, less rain would probably have " fallen in the districts north of the 30th parallel and " to the east of the 73rd degree of longitude, inasmuch " as to the west of this lies a dry arid country, in " which moisture (in the south-west wind) is ab- " sorbed."

August.—The temperature of this month differs but little from that of July. The rain which falls depends of course upon monsoon influences. In this month of 1868, there was a great scarcity of rain in the more southern, and in many of the submontane districts. Take, as example, Delhi and Siálkot. In 1867 Delhi had 7·4 inches in this month, and Siálkot 26·2; whereas in 1868, for the same period, Delhi had *only* 0·3 *inches*, and Siálkot 9·7. These results were due entirely to the greater frequency and force of the easterly and south-easterly currents in the former period than in the latter.

September.—The weather phenomena for this month are also under monsoon influences. The south-easterly currents begin by this time to lose their force, and the south-west monsoon prevails. In my report for 1873 I wrote as follows:—" The south-west monsoon from " the Arabian Sea meets with little obstacle, as it " blows over the comparatively arid plains to the " east of the Indus river; and as it blows onwards " towards the great Himalayan boundary, the failing " south-east current is unable to deflect it. These " facts show why there are later rains in the north- " eastern districts than in those further to the south. " A reference to a map will show that the remaining " moisture of the combined currents gets dammed up, " as it were, against the great mountain boundaries, " and falls as rain in the valley bounded on the west " by the great Sulimán range, on the north by the " hills north of Pesháwar, and, to the east by the " continuation of the Himalayan range."

October.—During the early part of this month the monsoon breaks up, and a little rain falls throughout the province, sometimes in considerable quantity in the submontane districts. This fall sometimes does not occur till about the middle of the month. Westerly winds are most frequent. The area of lowest pressure, about this period, seems to be along the Indus valley.

November.—This is the least rainy month of the year in the Punjab. A little falls occasionally in the north-western area of low pressure. The winds are variable, but most frequently westerly.

December.—The winds are very variable during this month, but westerly currents are most frequent. A little rain usually falls about the end of the month, called the Christmas rains.

The following table is intended to show how much the mean temperature of each month differs in increase or decrease from that of its predecessor. A glance at such a summary will show that during the first six months, January to June inclusive, the greatest monthly increase of temperature occurs in April and May, and the greatest decrease during the latter half of the year, in November. January is the coldest month, and June the hottest.

STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Lahore - - -	53·96	60·35	68·74	80·96	89·14	94·39	90·31	89·68	86·41	77·93	65·21	56·25
Rawalpindi - - -	50·75	55·83	63·59	74·56	85·48	93·27	90·32	87·54	83·76	74·02	61·90	53·60
D. I. Khan - - -	52·77	58·75	67·02	78·57	88·77	95·06	93·48	90·83	87·08	75·74	63·35	54·41
Siálkot - - -	54·09	59·72	67·19	78·71	88·78	93·11	88·33	87·16	85·65	76·96	63·88	54·73
Mean of the four stations	52·89	58·66	66·63	78·20	88·04	93·96	90·61	88·80	85·73	76·16	63·59	54·75
Mean difference between each month - -	..	+ 5·77	+ 7·97	+11·57	+9·84	+5·92	−3·35	−1·81	−3·07	−9·57	−12·57	−8·84

NORTH-WEST PROVINCES AND OUDH.

RAIN-FALL OF THE N.-W. PROVINCES AND OUDH.

The first subject to be treated will be the history of rain-fall observations in the North-Western Provinces, and their general character as regards accuracy. Then will follow the two chief sections of the report, dealing with the detailed distribution of rain-fall in space and in time respectively. The tables showing the average monthly and annual rain-fall at a large number of stations will be relegated to an appendix.

History of Rain-fall Observations in the N.-W. Provinces and Oudh.—The first attempt at a systematic record of the rain-fall of the North-West Provinces was made in the year 1844. In earlier years various independent observers from time to time registered the rain-fall and other meteorological phenomena observed at the stations where they resided, but their observations were generally for such short periods, and so desultory in character, as to be of very little value in subsequent investigations. A notable exception to this general rule was the meteorological register kept for two years at Benares by Mr. James Prinsep, and published in the volume of the *Asiatic Researches* for 1823. Mr. Prinsep was able to deduce from his observations more accurate values for the temperature, pressure, and humidity of the air, and for the daily and annual ranges of the barometer and thermometer at Benares, than were given by any subsequent observations until a regular meteorological observatory was established at that station in 1867. As regards rain-fall, however, a period of two years is much too short to allow a correct average to be deduced from the observations, and therefore Mr. Prinsep's figures can furnish little or no information that would be of value in drawing up this report.

After the great famine of 1838, the attention of the Board of Revenue appears to have been directed to the desirability of obtaining numerous observations of rain-fall from every district in the province, to enable the members of the Board to estimate the probable character of the crops of each year, and the revenue-paying power of the cultivators. With this object in view, a rain-gauge was set up in the beginning of 1844 at every tahsíl or revenue subdivision of a district. A year or two later the number of gauges was increased considerably, one being placed at nearly every police station or thánn. Thus organized, the system of observation continued in operation down to the year of the mutiny. The registers were sent into the office of the Board of Revenue, and were published, either in full or as an abstract, in the Board's annual reports. An abstract of all the observations taken between May 1844 and October 1850 was also published in a separate form, but the date of publication (probably about 1853 or 1854) is not stated.

During the mutiny year, 1857, and the three following years, owing to the disturbed state of the country, no record of the rain-fall was kept at any of the revenue stations in the plains, and the records for the year preceding the mutiny, 1856, seem, as a rule, to have been lost. From the Himalayan districts of Kumaun and Dehra Dun, to which the rebellion did not extend, we have a few registers for the years 1856–60, and these help to fill up the break of four or five years which exists in the registers for all the other stations.

Rain-fall observations were re-commenced generally over the North-Western Provinces in 1860, and in Oudh a beginning was made a year or two later. At first gauges were set up at a few of the police stations as well as at the tahsíls; but experience having shown that the observations made by the police were generally of little or no value, they were very soon abandoned. Abstracts of the weekly rain-fall returns for 1860–61, and the two following years, were published by the Board of Revenue; but many of the figures for these years were obviously inaccurate, and it was only about the beginning of 1864 that fairly trustworthy observations from the outlying stations began to be received. Since then weekly returns of rain-fall have been regularly published in the *Government Gazette*. In Oudh many of the observations continued to be of a doubtful character three or four years longer, but in 1868 they began to be checked by Dr. Bo[illegible]avia, of the Oudh Department of Science, and since then they have been much more accurate.

In drawing up the tables of average rain-fall given in the appendix, the records for the North-Western Provinces have been assumed to begin with 1864, or the first year after 1864 in which the observations appeared to be fairly accurate. Similarly, in Oudh, the records are supposed to commence in 1868, those of earlier date being ignored on account of the numerous errors they contain. In the case of the sudder station of each district in the North-Western Provinces, the whole of the observations having been taken under the immediate supervision of the Collector, may be considered equally accurate, and for these stations the average rain-fall for the whole period of observation, as well as for the fifteen years (1864–78), is given in the table. It will be observed that in very few cases is there any considerable difference between the two averages.

Rain-gauges used.—Before proceeding to discuss the distribution of the annual rain-fall over the provinces, it may be well to state what is known regarding the accuracy or inaccuracy of the gauges by which the rain-fall has been measured. What form of gauge was employed before the mutiny I do not know; but since then almost all the instruments in use have been constructed on the principle known as Fleming's. A gauge of this kind consists of a wide conical funnel, ending below in a cylindrical tube of smaller diameter. In this tube moves a float carrying a graduated rod, each division of which corresponds to a tenth of an inch of rain. The instruments have been made at the Roorkee workshops, and, as a rule, they are capable of giving fairly accurate measurements if properly used. One defect they all have is that they require a certain quantity of water to raise the float and bring the zero point of the measuring rod up to the fiducial mark. This quantity varies with each instrument, and, in most cases, no allowance has been made for it. Another cause of error is the circumstance that the rod is graduated only to tenths of an inch, and the nearest division simply is recorded at each reading. Light falls of rain under ·05 of an inch are therefore neglected; and, as these are by no means rare, especially in the cold weather months, the result is that, on the average, the observed figures are always three or four per cent. below the truth.

No attempt has been made to correct this error in the observations; but the tahsílí returns, with all very improbable figures carefully weeded out, have been taken as they stood. In order to obtain more correct averages than those given, seven per cent. might be added to all the figures for the months from November to May, and three per cent. to those for the remaining months. Neglecting this small error, and assuming that the observations have been taken with a moderate degree of care, one sees that the data furnished by the 233 stations, situated on the plains within the bounds of the province, and whose rain-falls are given in the appendix, are sufficiently numerous to afford as exact a knowledge of the distribution of rain over the plains districts of these provinces as could at present be obtained for any European country of equal area.

SECTION I.—DISTRIBUTION IN SPACE.

Rain-fall Maps.—The best way to obtain a correct notion of the geographical distribution of rain-fall, temperature, or any other meteorological phenomenon, is to take a map and mark on it the figures recorded at every observing station, and then to sweep lines through all those places where the figures are nearly equal. In this way the curves on the maps accom-

panying this report have been drawn, each line passing through places whose rain-fall is represented by the figures attached to the line. In drawing the lines of equal rain-fall, two or three stations have been left out of account, because their rain-fall totals differ more than ten per cent. from the averages for the surrounding stations, while no obvious reason, such as proximity to a mountain, can be assigned for such a difference. The annual totals for these stations are marked with a note of interrogation. The figures are always considerably less than the means for the surrounding stations, and the error is probably due to the observers neglecting to record light falls of rain.

A map constructed in this way represents as accurately as possible the average distribution of the rain-fall over a plain country like the Doab, Rohilkhand, and Oudh, even when the observing stations are 20 or 30 miles apart; but in hilly countries, such as Bundelkhand, Baghelkhand, and the southern parts of the Mirzapur district, the stations would require to be very numerous, in order that the map might be anything better than a rough approximation to the truth. In a mountainous country like Kumaun and Garhwal, any attempt to draw detailed isohyetic lines would be only misleading. The lines of equal rain-fall on these maps are accordingly confined to the plains and the hill country south of the Ganges; the rain-fall figures for each of the Himalayan stations being printed separately, close by the name of the station.

The earliest rain-fall maps for the North-Western Provinces appear to have been drawn up in 1864, and were published with the report of the Board of Revenue for 1863-64. In the *Punjab Government Gazette* for the 19th December 1863, Mr. E. Prinsep, the Settlement Officer of Ambala, had published a paper in which he showed that the districts of the Punjab might be arranged in zones of nearly equal rain-fall, parallel to the Himalaya; the zone of heaviest rain lying along the foot of the mountains, and that of least rain bordering on the Bikanir desert. At the suggestion of Mr. G. Batten, then Secretary to the Board, two maps were drawn up to show whether anything like a similar distribution of the rain-fall obtained in these provinces,—one representing the rain-fall of 1863–64, and the other the average rain-fall of nine years (1844–45 to 1852–53). The Board's report says that no satisfactory conclusion could be drawn from these maps regarding Mr. Batten's suggestion, because the data were not perfectly trustworthy. Owing to the absence of observations from Oudh, which lies in the heart of the North-Western Provinces, as well as to the way in which the maps were drawn and coloured, it would have been very difficult to see whether there was any truth in Mr. Batten's surmise, however accurate the observations might have been. The mistake in colouring consisted in giving every district the same tint throughout, as if its rain-fall were everywhere the same. Thus the parallelism of the rain-fall zones with the Himalaya was completely masked, because the district boundaries seldom or never run parallel to the mountains.

Geographical Distribution of the Annual Rain-fall.—A glance at the map for the whole year will show that Mr. Prinsep's conclusion regarding the distribution of rain-fall in the Punjab may be extended (as has already been shown by General Strachey and other writers) to the North-Western Provinces and Oudh. In the western half of the area the lines of equal rain divide the Doáb and Rohilkhand into strips which would be nearly parallel to the mountain axis were it not that they generally widen out towards the east, and contract as they extend westwards. This is but another way of saying that the amount of the annual rain-fall varies, not only with distance from the Himalaya, but with distance from the warm sea from which the moist winds usually blow. To the south of the Jumna the rain-fall again increases. The cause of this increase will be discussed further on.

In the eastern half of the provinces, however, the parallelism of the rain-fall zones with the Himalaya can only be traced in the districts lying to the north-east of the Ghágra river. An irregular quadrilateral, occupying the lower parts of the drainage areas of the Gumti and Sai rivers, and extending north-westwards nearly as far as Lucknow and Bara Banki, has an average rain-fall over 40 inches, while the rain-fall of the greater part of the Fyzabad district on the north-east and of the Azamgarh and Ghazipur districts to the east, as well as that of south Behar, is under 40 inches. Immediately to the west of this area, in the Rae Bareli, Unao, Fatehpur, and Cawnpore districts, the rain-fall averages only about 30 inches, while farther west, in the districts of Etawah and Mainpuri, it is over 30 inches. It thus seems as if a portion of the rain that would fall in Rae Bareli, Unao, Fatehpur, and Cawnpore, were the easterly winds constantly blowing, is compelled for some reason or other to fall 50 miles to the east of these districts.

South of the Jumna the rain-fall again increases, and in the eastern-half of the map of the lines of equal rain will be seen to run generally parallel to that river, or its continuation the Ganges. In the district of Shahabad, between the Ganges and the Son, there is a long narrow strip of country, with an annual rain-fall of over 45 inches. This is probably due to the influence of the Kaimur hills which have here to be surmounted by the south-easterly winds from the Bay of Bengal. Farther to the west, in south Mirzapur and Rewah, the prevailing winds of the rainy season are westerly, and the heaviest rain falls on the north-west side of the Kaimur range.

The decrease of rain with distance from the Himalaya up to a certain limit, and its increase beyond that limit, as well as the gradual decrease on passing from south-east to north-west, are perhaps more clearly seen when the map is divided into equal rectangular sections by lines parallel and perpendicular to the Himalaya and the average rain-fall of each section is calculated as in the following table.

MEAN ANNUAL RAIN-FALL of the NORTH-WESTERN PROVINCES and OUDH in ZONES parallel to the HIMALAYA.

Distance, in miles, from the Foot of the Hills.	On Cross Strips through										
	Saharanpur.	Bijnor.	Moradabad.	Bareilly.	Shahjahánpur.	Kheri.	Bahraich.	Fyzabad.	Basti.	Parauna.	Motihari.
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
0 to 25	40·7	46·6	49·5	57·7	?	?	?	?	?	?	?
25 „ 50	31·0	36·8	40·5	46·3	46·8	46·0	44·5	47·4	46·7	46·6	46·9
50 „ 75	28·9	28·8	36·6	42·0	38·4	36·4	40·2	40·5	41·0	41·7	44·8
75 „ 100	23·5	23·2	28·3	32·2	33·7	33·7	37·0	42·5	38·4	37·6	43·8
100 „ 125	25·5	23·5	24·6	30·9	29·5	31·3	33·9	35·0	40·0	36·4	38·6
125 „ 150	—	24·5	23·7	30·4	29·9	31·3	31·3	37·3	35·7	38·0	38·5
150 „ 175	—	—	26·0	27·6	32·4	31·2	34·0	35·2	39·5	38·2	—
175 „ 200	—	—	26·0	27·0	29·7	31·0	38·5	39·8	41·7	41·6	—
200 „ 225	—	—	—	32·8	30·1	32·9	38·8	48·5	63·6	44·6	—
225 „ 250	—	—	—	—	30·4	35·1	—	—	—	—	—
250 „ 275	—	—	—	—	33·4	?	—	—	—	—	—
275 „ 300	—	—	—	—	37·1	38·6	—	—	—	—	—
300 „ 325	—	—	—	—	37·8	41·1	—	—	—	—	—

The heavy rain in south-eastern Oudh is indicated by the figures for the strips through Basti and Fyzabad at distances of 75 and 100 miles from the hills.

Reasons of the observed Distribution.—The causes of the observed distribution of rain over the upper half of the valley of the Ganges are not far to seek or difficult to understand. In the first place, the rain-fall gradually diminishes on proceeding up the valley from south-east to north-west, because the prevalent rainy winds are south-easterly. These winds come from the Bay of Bengal branch of the south-west monsoon current, and are in fact that portion of the current which is deflected from its normal course by the mountains north of Bengal, and by the indraught towards a region of low atmospheric pressure that occupies the centre and south of the Punjab during the rainy season. Since these winds are constantly parting with their moisture during their passage inland, it follows that the farther we proceed from the sea in the direction of the wind's motion the less will the rain-fall become.

Next it must be borne in mind, that though rain is sometimes precipitated from the lowest strata of the air, it more usually falls from clouds formed at a considerable height, and that in deducing the probable character of the rain-fall of any locality from a knowledge of the prevailing winds, the upper as well as the lower currents of the atmosphere must be considered. Now although the prevailing direction of the winds at stations on the plains near the foot of the Himalaya is nearly parallel to the axis of the range during the rainy season, it is very different at considerable elevations. At stations of 6,000 or 7,000 feet elevation above sea level, the mean direction of the wind for each month varies from west to south-east; the average direction for the whole year being nearly at right angles to the general line of the mountains. At greater elevations the winds are constantly south-westerly. At Dehra, 2,250 feet above the sea, or 1,400 feet above the neighbouring plain, the winds are north-westerly during a portion of the dry season; but in the rainy months they are there also at right angles to the direction of the mountain range. The directions of the mean winds for each month at several hill stations are given in the next table.

MEAN WIND DIRECTIONS at HIMALAYAN STATIONS.

Station.	Elevation.	January.	February.	March.	April.	May.	June.
	Feet.						
Dehra - - -	2,250	S. 72° W.	S. 67° W.	S. 79° W.	S. 74° W.	S. 58° W.	S. 66° W.
Ranikhet - - -	6,080	N. 89° W.	S. 62° W.	S. 52° W.	S. 66° W.	S. 63° W.	S. 69° W.
Darjiling - - -	6,930	S. 50° W.	S. 65° W.	S. 67° W.	S. 68° W.	S. 51° W.	S. 14° W.
Chakrata - - -	7,070	S. 29° E.	S. 56° E.	S. 20° E.	S. 57° W.	S. 42° W.	S. 53° W.
Leh - - - -	11,570	S. 8° W.	S. 11° W.	S. 28° W.	S. 22° W.	S. 40° W.	S. 52° W.

Station.	July.	August.	September.	October.	November.	December.	No. of Years' Observations.
Dehra - - -	S. 67° W.	S. 56° W.	N. 61° W.	N. 64° W.	N. 78° W.	N. 89° W.	9–10
Ranikhet - - -	S. 77° W.	S. 72° W.	S. 61° W.	S. 53° W.	S. 56° W.	S. 60° W.	6–8
Darjiling - - -	S. 12° E.	S. 13° E.	S. 23° W.	S. 48° W.	S. 38° W.	S. 38° W.	10
Chakrata - - -	S. 51° W.	S. 55° W.	S. 50° W.	S. 28° W.	S. 29° W.	S. 18° W.	6–8
Leh - - -	S. 57° W.	S. 55° W.	S. 29° W.	S. 37° W.	S. 27° W.	S. 17° W.	4

A current of air cannot continue to blow against an obstacle like the Himalayan mountain wall without being forced to rise upwards, and the upward motion will not be confined to the immediate neighbourhood of the mountains, but will commence at some distance to windward. In this way all that portion of the summer monsoon current which lies more than 2,000 feet or so above the plain will generally be found flowing up a gentle incline towards the hills. Of the lower stratum, which usually moves in a direction parallel to the mountains along their base, portions are deflected upward by every projecting spur and ridge inclined more or less nearly at right angles to the main chain. And even in this region southerly and south-westerly winds are not uncommon, for it is only the *mean* wind direction which is parallel of the mountain axis. During the summer monsoon, therefore, the whole of the southern slope of the Himalaya, and a broad belt of the plain at its foot, are occupied by a system of ascending atmospheric currents. A mass of air cannot, however, ascend in the atmosphere without expanding, and it cannot expand without pushing aside other air and occupying its place. In doing this a quantity of heat equivalent of the work done disappears, and the temperature of the ascending air is lowered. By an easy deduction from the mechanical theory of heat, it may be shown that in this way the temperature of dry air would be lowered one degree Fahrenheit for every 183 or 184 feet of elevation. Moist air would be cooled rather more slowly, but still, in an ascending stream, it would very soon acquire a temperature so low that a portion of its moisture must necessarily assume the form of cloud and rain. This cooling, consequent on expansion in an ascending current, is usually the immediate cause of rain. Wherever the ascending movement is most rapid, provided the supply of vapour be constant, there the rain-fall will be heaviest. Accordingly we find the greatest amount of precipitation along the lower slopes of the Himalaya, from which region the quantity diminishes towards the south-west because the ascensional movement becomes less and less rapid with distance from the obstacle. The amount of rain also diminishes on proceeding towards the inner and higher ridges of the chain, owing to the rapid exhaustion of the vapour. What the law of this diminution is will be considered further on.

Any other circumstance that tends to make moist air or vapour ascend will act as a cause of rain. In a perfectly still atmosphere over a sheet of warm water, aqueous vapour will constantly be formed, and by spontaneous diffusion will ascend until the air becomes saturated with vapour, and cloud or rain is generated. The saturation point is always reached first at some high level, whilst the air at the surface of the ground is still capable of taking up more moisture. The reason of this is that the temperature falls too rapidly on ascending to permit the vapour to attain the condition of equilibrium that would finally be reached by diffusion; because the quantity of moisture required to satisfy the conditions of equilibrium at a high level is much greater than that which can exist as vapour at the temperature of the given elevation. Cumulus clouds formed in this way are frequently seen at the close of the rainy season, and about that time of the year a fine day often ends in a thunderstorm or other atmospheric disturbance, due to the recondensation of the water vapour raised by the action of the sun while above the horizon.

The latent heat given out during the precipitation of rain expands and diminishes the density of the air with which the vapour was mixed, and thus sets the whole mass ascending. This is followed by a further

condensation of vapour, the liberation of more latent heat, an acceleration of the ascensional movement, and a strengthening of the indraught of air at the bottom. In this way rain-fall once commenced tends to perpetuate itself, provided the supply of vapour be kept up. The summer monsoon current is thus maintained for a short time after the thermal focus of the Indian continent has travelled to the south of the region toward which the winds blow, and the force and persistency of this atmospheric current are much greater than the mere difference of temperature between sea and land observed at the surface of the earth would lead us to expect. In the same way the torrential rains and violent winds of a cyclonic storm are supposed to be produced by the rapid condensation of vapour. A fuller account of the functions performed by rain-fall in atmospheric physics will be found in Mr. John Eliot's cyclone reports, and in his report on the meteorology of India in 1877.

The increase of rain-fall to the south of the Jumna can now be explained. It is due partly to the action of the Bundelkhand hills and those of Rajputana in causing the air to ascend, but perhaps chiefly, as Mr. Eliot has suggested, to the atmospheric eddies or minor cyclones produced by the interaction of the easterly and westerly winds from the Bay of Bengal and the Arabian Sea, which meet along this line. This is shown by the unsteadiness of the winds in the neighbourhood of the Jumna during the monsoon months, south-easterly and north-westerly winds being nearly equally frequent.

Thus, at the following stations along the Ganges-Jumna, the per-centages of the winds that blow from the mean directions are very small:—

Stations.	Mean directions—June, July, August, and September.	Steadiness per cent.	Years' Observations.
Benares	S. 16° E.	5	10
Chunar	S. 27° E.	7	2
Allahabad	N. 22° W.	7	8
Agra	N. 40° W.	10	7

Contrasted with these we have, for the region of easterly winds north of the Ganges, the following figures which indicate much greater steadiness:—

Stations.	Mean directions—June, July, August, and September.	Steadiness per cent.	Years' Observations.
Gorakhpur	S. 77° E.	46	8
Fyzabad	E.	58	7
Lucknow	S. 42° E.	14	6
Bareilly	S. 74° E.	21	7
Fatehgarh	S. 18° E.	17	4
Meerut	N. 26° E.	26	5
Roorkee	S. 30° E.	19	7

To the south of the Jumna also, in the region swept by south-westerly winds from the Bombay coast, the per-centage indicating the steadiness of the wind is far greater than along the line of that river, as shown in the following table:—

Stations.	Mean directions—June to September.	Steadiness per cent.	Years' Observations.
Jhansi	N. 88° W.	21	10
Saugor	S. 71° W.	61	8
Jabalpur	S. 85° W.	47	8
Sutna	N. 64° W.	45	3

The zone in which the opposing winds meet is constantly shifting, but there can be little doubt that the principal eddy thus formed most frequently occupies the quadrilateral bounded by lines joining Allahabad, Benares, Sultanpur, and Rae Bareli, and that the excessive rain-fall over the north-eastern half of this region, as compared with the districts to the eastward at the same distance from the Himalaya, is due to the indraught and ascension of moist air in the feeble cyclonic vortex thus formed.

The cyclonic character of the winds of this region throughout the summer monsoon is clearly shown by the resultant directions E. at Fyzabad, N. N. E. at Rae Bareli, N. E. at Partabgarh, N. N. W. at Allahabad, S. by E. at Benares, and E. by S. at Gorakhpur. The relations of wind to rain-fall have only been worked out in detail for one station, Benares.

The direction from which rainy winds most frequently blow at Benares is due east. Next in order of frequency come north-east, due west, south-east, south-west, and north-west, rain least frequently accompanying winds from the north and south. Winds from these latter directions blow very seldom, whilst easterly and especially westerly winds are often felt. Consequently we find that rain accompanies a south-easterly wind one day in three, an easterly wind two days in seven, a north-east wind one day in four, a south-west wind one day in five, a south wind one day in six, a north or north-west wind one day in seven, and a westerly wind only one day in 13. The average rain-fall of the 10 years, 1867–76, was distributed under the principal wind directions as follows:—

	Inch.
North	1·21
North-east	5·99
East	9·37
South-east	4·84
South	0·46
South-west	4·57
West	8·47
North-west	4·49
Calm	2·51

From this it appears that the ratio of the rain brought by westerly winds to that which comes from the east is much greater than would be expected from the relative frequency of rainy winds from these quarters. In fact the individual falls of rain are more than half as heavy again when the wind is westerly as when it is easterly. The average daily rain-fall when the rainy wind blows from each of the eight principal points of the compass is the following:—

	Inch.
North	0·684
North-east	0·557
East	0·590
South-east	0·560
South	0·655
South-west	0·684
West	0·880
North-west	0·885

The excessive precipitation with westerly and north-westerly winds is doubtless due to the circumstance that, in the rainy season, such winds only reach Benares when there is a cyclonic circulation of the air round a region of low barometer and heavy rain-fall in the valley of the Gumti river to the north.

The relations of wind to rain-fall at Benares being thus affected by the proximity of the station to the region of heavy rain in Jaunpur and south-eastern Oudh, it would be very desirable to know what these relations are at places further to the west,—for example, at Lucknow, Agra, or Roorkee. Sufficient materials already exist for the discussion of the question as regards some of these places, but I have not yet been able to work them up.

Average Rain-fall of the Province.—People often ask what is the average rain-fall of the North-Western Provinces, or what was the rain-fall of last year. Such a question is not very easily answered offhand. Sometimes the answer given is the simple mean of the rain-fall totals for all the observing stations, sometimes the mean of the averages for the several districts, and often the mean of the divisional averages; these in turn being the averages of the averages for

all the districts in each division. Examples of all these ways of calculating the average rain-fall of the province might be quoted from official reports.

The first method will obviously give too low a result, because rain-gauge stations are numerous in the dry districts of the Meerut and Agra divisions, and few and far between in the rainy districts of the Benares division and the north of Oudh. The second might be expected to give a better result, but still there would be a large probable error owing to the very unequal areas of the districts. By the third method the doubt would be increased, because the divisions are by no means equal in area, and the number of these units is much smaller than that of the districts. In fact, to obtain a correct average for the whole province, the total area should be divided into a number of portions so small that the rain-fall of each would be the same in every part. The area of each small portion should then be multiplied by its rain-fall, and the sum of the products divided by the total area. To perform this operation would of course be practically impossible, but a close approximation to the same result may be obtained by adding together the averages for all the equal sections given in the table on page 5 (counting only such rectangular sections or portions of these as are contained within the provincial boundary), and dividing the sum by the number of sections. The average for the plains districts, including the native territory of Rampur, and such Native states in Bundelkhand as are more or less completely surrounded by British territory, thus determined, is 37·6 inches. Another accurate method, the details of which are given in the next table, consists in taking off from the map by means of a planimeter the area of so much of each strip of country bounded by lines of equal rain-fall as lies within the province, multiplying the area of each strip by the arithmetical mean of the figures attached to the two boundary lines, and dividing the sum of the products by the sum of the areas.

MEAN RAIN-FALL of the PROVINCE as measured from the RAIN-FALL MAP.

Strip.	Area—square miles.	MeanRain-fall—inches.	Product.
Under 25 inches	4,333	22·5	97,492·5
From 25 „ to 30 inches	12,113	27·5	333,107·5
„ 30 „ to 35 „	20,648	32·5	671,060·0
„ 35 „ to 40 „	21,761	37·5	816,037·5
„ 40 „ to 45 „	19,949	42·5	847,832·5
„ 45 „ to 50 „	10,379	47·5	493,002·5
Over 50 „	4,672	57·5 (?)	268,640·0
Total	93,855	37·58	3,527,172·5

The average annual rain-fall of the whole province, with the exception of the Himalayan districts, determined in this way is 37·58 inches—a result that agrees very closely with the other. For the hill districts the data are much too few to afford any legitimate ground for constructing an average. Leaving these out of account, we find that the 233 plains stations within the bounds of the province give a simple average of only 35·2 inches, and this is, as we have anticipated, a good deal less than the true average.

The district and divisional averages, calculated in the usual way, are the following :—

	Inches.		Inches.
Saharanpur	41·60		
Muzaffarnagar	29·96		
Meerut	25·61		
Bulandshahr	25·64		
Aligarh	24·68	Meerut division (excluding Dehra Dun)	29·50
Bijnor	42·11		
Moradabad	39·13		
Tarai	47·78		
Bareilly	44·75		
Budaun	31·94		
Sháhjahánpur	36·06	Rohilkhand division (with the Tarai)	40·30
Muttra	24·36		
Agra	25·42		
Mainpuri	31·55		
Etawah	32·25		
Etah	29·37		
Farukhabad	30·10	Agra division	28·84
Jalaun	30·18		
Jhansi	34·47		
Lalitpur	38·61	Jhánsi division	34·42
Cawnpore	31·17		
Fatehpur	34·02		
Hamirpur	32·89		
Banda	39·12		
Allahabad	36·47		
Jaunpur	40·37	Allahabad division	35·68
Mirzapur	41·05		
Benares	38·58		
Ghazipur	37·66		
Azamgarh	37·14		
Basti	45·83		
Gorakhpur	44·02	Benares division	40·71
Kheri	46·10		
Sitapur	35·43		

	Inches.		Inches.
Hardoi	31·64	Sitapur division	37·72
Bara Banki	37·71		
Lucknow	34·86		
Unao	31·93	Lucknow division	34·67
Bahraich	45·11		
Gonda	42·70		
Fyzabad	38·28	Fyzabad division	42·03
Rae Bareli	33·20		
Sultanpur	39·88		
Partabgarh	34·22	Rae Bareli division	35·77
Mean of districts	35·78	Mean of divisions	35·96

It happens that the divisions and districts of large and small areas are nearly equally divided between the dry and wet portions of the province. The averages calculated on the bases of the districts and the divisions respectively therefore agree very closely when many years' observations are taken into account, and either result differs from the true average by less than two inches. It does not follow, however, that the mean of the district averages for any single year will approach as closely to the truth, for it may happen that the majority of the small districts will be drier than usual, and most of the large districts wetter, or *vice versâ*.

The chief reason why the district averages give a result considerably below that obtained from the sections of equal area is the fewness or the entire absence of gauges in the rainiest parts of the Mirzapur, Gorakhpur, and Basti districts, and along the north of Oudh. The Rampur territory and portions of Chirkhari and other native states in Bundelkhand have also been included in the equal sections, but the rain-fall of these differs little from the average for the whole province.

SECTION II.—DISTRIBUTION IN TIME.

Rain-fall, like every other atmospheric phenomenon, is subject to two periodic variations, depending on the varying influence of the sun's heat, according to the different ways in which the portion of the earth's surface under consideration is presented to the sun by the diurnal rotation and the annual revolution of the earth in its orbit.

It may also be subject to a variation of long period, dependent upon a supposed inequality in the absolute

quantity of heat emitted from the sun at different times. Taking these three periods in order, the diurnal variation will be first considered.

Diurnal Variation.—The data available for the determination of the distribution of the rain-fall of the North-Western Provinces from hour to hour are too few to admit of any very accurate conclusions being drawn from them. During the three years 1876, 1877, and 1878, hourly meteorological observations were taken on the 7th, 14th, 21st, and 28th of each month at four stations—Roorkee, Agra, Lucknow, and Allahabad. The observations extended from midnight to midnight each day. During the three years there were thus 144 observations taken at each station for each hour except midnight. At this hour 288 observations were taken.

There were thus 14,400 observations altogether, and out of these rain was observed to be falling 473 times. Dividing the numbers for midnight by two, to make them comparable with the rest, we find that rain was observed 455 times out of a total of 13,824 observations, or once in thirty times nearly. The distribution of the rain-fall observations among the different hours is shown in the following table :—

HOURLY FREQUENCY of RAIN-FALL.

Stations.	Hours.											
	Mid-night.	1 A.M.	2 A.M.	3 A.M.	4 A.M.	5 A.M.	6 A.M.	7 A.M.	8 A.M.	9 A.M.	10 A.M.	11 A.M.
Roorkee -	7	12	12	12	15	11	12	11	9	9	9	7
Agra -	2	3	3	4	6	5	6	4	5	1	3	4
Lucknow -	3	5	4	4	3	2	3	6	5	4	4	3
Allahabad -	6	8	5	6	5	6	4	5	1	3	5	4
Total -	18	28	24	26	29	24	25	26	20	17	21	18

Stations.	Hours.											
	Noon.	1 P.M.	2 P.M.	3 P.M.	4 P.M.	5 P.M.	6 P.M.	7 P.M.	8 P.M.	9 P.M.	10 P.M.	11 P.M.
Roorkee -	9	5	3	4	5	6	3	5	4	2	2	5
Agra -	5	8	5	7	6	3	2	2	4	2	2	3
Lucknow -	3	3	2	4	5	4	1	1	3	4	2	1
Allahabad -	7	3	5	3	4	2	4	3	5	2	2	4
Total -	24	19	15	18	20	15	10	11	16	10	8	13

The hour at which rain is most frequent appears to be 4 a.m. This is very nearly the time of greatest humidity of the air near the ground. The hour of least frequent rain-fall, however, occurs at 10 p.m., long after the driest time of the day, the latter falling in the afternoon shortly after the time of highest temperature. The hour of least frequent rain-fall nearly coincides, however, with that of least humidity at the height of the cloud stratum. In the next table the distribution of cloud from hour to hour is given, and it will be seen that there is a general similarity between the cloud and rain-fall tables, though the rain-fall is more frequent in the early morning hours than the distribution of cloud would lead us to infer.

HOURLY DISTRIBUTION of CLOUD in TENTHS of the VISIBLE EXPANSE of SKY.

Stations.*	Hours.											
	Mid-night.	1 A.M.	2 A.M.	3 A.M.	4 A.M.	5 A.M.	6 A.M.	7 A.M.	8 A.M.	9 A.M.	10 A.M.	11 A.M.
Roorkee -	3·14	3·20	3·22	3·08	3·09	3·03	3·20	3·30	3·25	3·30	3·44	3·48
Lucknow -	2·47	2·63	2·68	2·69	2·80	3·26	3·32	3·46	3·50	3·38	3·50	3·58
Allahabad -	2·56	2·54	2·59	2·55	2·60	2·93	3·35	3·46	3·29	3·36	3·20	3·32
Mean -	2·72	2·79	2·83	2·77	2·83	3·07	3·29	3·41	3·35	3·35	3·38	3·46

Stations.	Hours.											
	Noon.	1 P.M.	2 P.M.	3 P.M.	4 P.M.	5 P.M.	6 P.M.	7 P.M.	8 P.M.	9 P.M.	10 P.M.	11 P.M.
Roorkee -	3·65	3·49	3·77	3·74	3·61	3·41	3·33	3·18	3·05	3·07	3·19	3·12
Lucknow -	3·73	4·09	4·13	3·99	3·94	3·88	3·70	2·94	2·52	2·52	2·45	2·31
Allahabad -	3·45	3·52	3·67	3·79	3·74	3·72	3·69	2·99	2·62	2·47	2·66	2·63
Mean -	3·61	3·70	3·86	3·84	3·76	3·67	3·57	3·04	2·73	2·69	2·77	2·69

* Agra is not included in this table because the observer there only estimated the amount of cloud visible in the daytime.

At only two of the stations, Agra and Lucknow, was the rain-fall measured from hour to hour. The number of observations was much too small to yield a mean for each hour free from considerable irregularities, but by lumping together the observations of several hours the results are rendered more uniform. Thus 32 per cent. of the total rain was collected between midnight and 6 a.m.; 35 per cent. between 6 a.m. and noon; 28 per cent. between noon and 6 p.m.; and only 5 per cent. between 6 p.m. and midnight.

The practical conclusion to be drawn from these results is that where a rain-gauge is read only once a day, the hour that will be most convenient to the observer, and at the same time will give the day's rain-fall with the least error, is 6 p.m. This has for some years been the hour prescribed for reading the rain-gauge at the meteorological observatories, and I believe it has been generally adopted for the district gauges since the beginning of the present year (1879). Previously there was no general rule as to the hour at which the rain was to be measured, those in use ranging from 6 a.m. to 7 p.m.

Annual Variation.—A reference to the figures for the mean rain-fall of each month will show that the month of least rain nearly everywhere is November. At the majority of the stations this month has been without rain ever since 1864 or (in Oudh) 1868. December is also a month of very scanty rain, but towards the end of the year the showers, usually known as the "Christmas rains," begin to fall. The winter rains continue to fall at intervals throughout January, February, and March, attaining their maximum in January at most of the stations in these provinces, in February at a few of the north-western stations on the plains and in Kumaun, and in March along the north-western frontier and in the Himalaya north of the Punjab. A second minimum of rain-fall is reached in April, this month being nearly as rainless as November at most places on the plains. The rain-fall of the latter half of March and the whole of April and May falls chiefly in thunderstorms, or at the end of the duststorms that are frequent in these months. In March and April the precipitation accompanying thunderstorms often takes the form of hail.

The first half of June is usually a dry period, broken only by occasional thunderstorms, but between the middle and the end of the month the heavy rains of the summer monsoon commence. These are heaviest in July, usually about the end of the month. They gradually decrease in frequency and amount during August and September, and finally cease near the end of that month, or in the first week of October.

At the time of heaviest rain in July it frequently rains more or less every day for ten days or a fortnight, but in August and September the "breaks in the rains" become more numerous and last longer until the end of the rainy season is reached.

The two minima in November and April serve to divide the rain-fall of the year into two distinct seasonal falls. The winter rains extend from November to April inclusive, and have their maximum in January or February. The summer rain falls during the remaining months and attains its maximum in July. For the purposes of agriculture, it is necessary, however, to distinguish between the winter rains proper, which fall in the four months November, December, January, and February, and the showers that fall during the thunderstorms of March and April. The former are usually beneficial to the crops, whilst the latter are injurious. In drawing the maps representing the distribution of the rain-fall of the different seasons, the "winter rain" has been taken to include only that which falls from November to February; the rain of March and April, together with that of May, has been called "hot-weather rain," and that of the five months, June to October, has been called the "monsoon rain."

The relative humidity of the air near the ground has also two maxima and two minima each year, corresponding to the maxima and minima of rain.

MEAN MONTHLY HUMIDITIES in PER-CENTAGES of SATURATION.

Stations.	Years' Observations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Chakrata	8—9	64	63	55	45	50	67	91	92	84	61	50	58
Ranikhet	7	56	54	47	38	48	61	82	83	76	55	50	51
Dehra	10	58	56	48	38	38	56	79	81	75	56	50	56
Roorkee	10	66	63	51	36	36	51	76	76	73	61	57	65
Meerut	9	56	49	44	33	39	47	70	71	66	52	48	56
Bareilly	9—10	61	55	46	36	37	53	75	75	72	58	51	58
Agra	9—10	55	47	40	28	29	47	68	72	69	48	42	52
Lucknow	10	58	49	37	30	36	54	74	76	73	56	46	54
Gorakhpur	9—10	59	52	46	41	51	67	78	81	77	61	51	59
Jhánsi	10	47	39	33	24	27	46	70	70	67	43	35	43
Allahabad	6—9	60	51	40	35	37	51	75	76	76	60	53	59
Benares	8—9	65	57	45	39	41	60	81	82	80	67	63	66

This distribution of atmospheric humidity is clearly the effect rather than the cause of the rain distribution, because it is least in April before the rainy season proper, and there is only a secondary minimum in November, whereas the rain-fall is everywhere less in November than in April. The excess of humidity in November as compared with April is doubtless caused partly by the greater evaporation from the ground in the former month, and partly by the very high temperature of April, which renders the air capable of retaining in the gaseous form a much larger proportion of moisture than it actually possesses.

The distribution of cloud observed at the meteorological stations of the North-Western Provinces accords perfectly with that of rain-fall, as might, indeed, have been expected.

MEAN MONTHLY DISTRIBUTION of CLOUD in TENTHS of the whole EXPANSE.

Stations.	Years' Observations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Chakrata	6—7	4·51	4·18	4·03	2·92	3·48	4·20	8·42	8·47	6·79	2·28	1·74	3·62
Ranikhet	6—7	3·93	4·24	3·89	3·07	3·40	5·61	8·56	8·43	5·64	1·69	1·31	2·99
Dehra	6—7	4·08	3·55	3·58	2·77	3·06	4·36	7·62	7·29	4·83	1·08	1·33	2·74
Roorkee	6—7	3·16	3·17	2·54	2·10	1·91	3·03	6·36	6·03	4·58	0·99	0·82	2·18
Meerut	5—7	2·93	2·20	2·54	1·91	2·03	3·14	7·03	6·15	4·98	0·87	0·65	1·82
Bareilly	6—7	3·17	2·62	2·54	1·48	1·76	3·78	6·88	6·93	4·50	0·73	0·72	1·85
Agra	6—7	1·73	2·05	1·54	1·19	1·09	3·32	5·68	5·68	3·86	0·62	0·55	1·23
Lucknow	6—7	3·46	3·27	3·12	2·39	2·11	4·86	7·67	7·06	5·62	1·61	0·92	2·37
Gorakhpur	5—7	2·18	1·93	1·47	1·17	1·75	4·10	5·74	5·75	4·74	1·61	0·64	1·12
Jhánsi	3—7	0·83	0·68	0·21	0·66	0·79	1·88	5·00	4·43	2·40	0·19	0·34	0·40
Allahabad	7	2·18	2·17	1·77	1·24	1·68	4·18	8·03	7·38	5·46	1·19	0·67	2·09
Benares	6—7	2·54	2·11	2·28	2·00	2·23	4·77	7·57	7·55	5·48	2·17	0·94	1·94

The figures for the different stations in this table are not fairly comparable, since in cloud estimations a good deal seems to depend on the idiosyncracy of the observer. Thus the figures for Gorakhpur are much too low in comparison with the others, and those for Allahabad perhaps a little too high.

The map showing the distribution of the winter rain over the provinces indicates the excess of rain at this season towards the north-west. Thus the lines of 4, 3, and 2 inches winter rain-fall, which cross the plains of the Punjab at a considerable distance from the hills, approach nearer and nearer to the Himalaya as they pass eastwards through the Doab, Rohilkhand, and Oudh, until in the north of Behar they all enter or touch the mountain zone. The districts with least rain in winter are Agra, Jalaun, and Jhánsi, with the adjoining portions of the Gwalior territory. In this respect the south-western part of these provinces resembles Malwa and the greater part of the Bombay Presidency.

The rain of March, April, and May is greater at all the Himalayan stations than that of the winter months November, December, January, and February, whereas on the plains it is a good deal less. On the plains the rain of these three months, which falls chiefly in May, varies from over three inches in north Behar to less than an inch in Bundelkhand. The region of least rain-fall in these months includes the whole of Bundelkhand, the Allahabad division, and two or three of the southern districts of Oudh. The May showers, which in Behar may be considered a regularly recurring periodical phenomenon, are only felt as such in the north-eastern districts of these provinces and in parts of Mirzapur. Elsewhere the rain-fall of May is confined to local showers accompanying thunderstorms.

The monsoon rains, which constitute nine-tenths of the average annual fall, are very similar in distribution to the total rain-fall of the year.

Regularity of the Seasons in India.—Nothing can better illustrate the great regularity of all the elements of meteorological observations in India than the small variability of the dates of the beginning and end of the rainy season. Thus, at Bombay, in three years out of four, the monsoon rains commence on the 4th or 5th of June, and when they are a week later than usual, as they were in 1878, all sorts of dire effects are expected to follow. The farther any place is from the coast the less likely are the moist winds to reach it every year about the same time, but even in the North-Western Provinces the uniform sequence of the seasons is very striking.

Thus the winter rains commence on the average about the 22nd of December in the north-western districts, and a day or two later in the south-eastern; hence their usual name "the Christmas rains." The greatest observed variations from this date during 16 years were 20 days before and 17 days after the mean. The odds are exactly even that in any given year these rains will commence between the 20th December and the end of the month.

The dates of the beginning and end of the summer monsoon are given in the next table. In Kumaun and Gorakhpur the rains begin earliest, and in three days they extend over the whole province. But although there is a great deal of uniformity in the average dates, nothing like a regular march of the monsoon from one end of the province to the other, can be observed in any single year. The summer rains cease first in the Punjab and the north-western districts of these provinces, and continue longest in the most easterly district, Gházipur.

DATES of the COMMENCEMENT and CLOSE of the MONSOON RAINS, from the OBSERVATIONS of 15 Years.

Districts.	Commencement.			Close.		
	Mean.	Earliest.	Latest.	Mean.	Earliest.	Latest.
Gorakhpur	14th June	30th May	1st July	1st October	20th September	19th October.
Gházipur	16th ,,	1st June	2nd ,,	3rd ,,	20th ,,	19th ,,
Benares	17th ,,	6th ,,	3rd ,,	30th September	15th ,,	18th ,,
Allahabad	16th ,,	4th ,,	1st ,,	30th ,,	15th ,,	16th ,,
Cawnpore	17th ,,	4th ,,	3rd ,,	28th ,,	17th ,,	17th ,,
Bareilly	16th ,,	1st ,,	9th ,,	29th ,,	17th ,,	18th ,,
Jhánsi	16th ,,	4th ,,	28th June	28th ,,	16th ,,	16th ,,
Agra	17th ,,	3rd ,,	10th July	26th ,,	11th ,,	17th ,,
Saháranpur	17th ,,	3rd ,,	8th ,,	27th ,,	11th ,,	18th ,,
Kumaun	14th ,,	1st ,,	29th June	1st October	18th ,,	17th ,,
Dehra Dún	16th ,,	2nd ,,	1st July	30th September	13th ,,	18th ,,

The extreme variation of the date of commencement on the average of the 11 districts given in the table is exactly a month, and the variation of the date of the cessation of the rain is just the same. The table shows that the usual rule regarding the duration of the monsoon rains, viz., that they commence in the middle of June, and last to the end of September, is very close to the truth.

Causes of the observed Distribution in Time.—At the end of October and throughout November the atmosphere over Northern India is more nearly in a state of statical equilibrium than at any other time of the year. Very light winds or calms prevail over the whole area in November. The fluctuations of pressure are confined to the daily barometric tides, and a succession of slow pulsations of very small amplitude with a period of ten days or a fortnight. Similar conditions obtain in December, but in that month the wind velocity becomes greater, and the amplitude of the barometric oscillations also increases. Towards the end of the month "the barometer falls "for several days, easterly winds set in over the "Gangetic valley, thus reversing the normal direc- "tion of the lower atmospheric current; clouds form, "and rain begins to fall, generally commencing in "the Punjab, and extending eastward over the North- "Western Provinces, and occasionally over Behar, "Bengal, and even Assam. The explanation appears "simple. It has been pointed out that the impor- "tant air movements at this time are not horizontal, "but vertical. The fall of the barometer preceding "the setting in of the easterly winds and the rain- "fall appears to indicate an ascensional movement of "the atmosphere going on over a part or the whole "of Northern India. The ascensional movement is, "in the majority of cases, the indispensable condition "for the formation of cloud and for rain precipitation. "This is followed by indraught, which takes mainly "the form of an easterly current up the Gangetic "valley. Hence, according to this view, the easterly "winds are a frequent accompaniment, and therefore "an occasional indication, but they are not the cause "of the cold weather rains, neither do they bring "them. These rains are almost entirely due to the "moisture brought up by the upper south-west cur- "rent, the reverse of the north-east trade wind, "which is the characteristic wind of the lower strata "of the cold season in Southern Asia and the adjacent "seas."*

It was formerly supposed that the winter rains were simply the effect of the low temperature of the winter months, whereby a portion of the aqueous vapour always present in the air was condensed. This view is, however, inconsistent with the fact that in the North-West Punjab, where these rains are heaviest, the month in which the precipitation is greatest is March, whereas the coldest month is January. In a year when these rains are heavy in January, as in 1877, there is also a well-marked increase in the pressure of atmospheric vapour in January as compared with the months before and after, although the low temperature of the month would by itself tend to diminish the pressure of vapour. This may be illustrated by the following table, which gives the vapour tension for three winter months of 1876–77 at 20 places in North India. The increase in January 1877 was very well seen as far down as Lower Bengal, but on the eastern side of the Bay it was not perceptible.

INCREASE of VAPOUR TENSION in NORTH INDIA in January 1877.

Stations.	VAPOUR TENSION.		
	December 1876.	January 1877.	February 1877.
	Inch.	Inch.	Inch.
Simla	·160	·173	·171
Chakráta	·154	·164	·147
Dehra	·305	·317	·301
Ranikhet	·195	·201	·182
Peshawar	·256	·260	·227
Rawal Pindi	·256	·277	·255
Sialkot	·326	·362	·330
Lahore	·258	·315	·295
Delhi	·233	·320	·277
Roorkee	·311	·339	·330
Meerut	·270	·338	·300
Bareilly	·285	·351	·334
Agra	·265	·329	·263
Lucknow	·280	·368	·295
Gorakhpur	·329	·383	·336
Jhánsi	·245	·309	·257
Allahabad	·343	·427	·349
Benares	·309	·388	·321
Hazaribagh	·256	·344	·270
Chittagong	·457	·459	·482

The excess in January 1877 was no doubt partly perhaps chiefly, an effect of the evaporation of the heavy rain of that month; but it was not altogether due to this, because the original observations, from which the means in the table have been calculated, show a distinct increase in the proportion of vapour accompanying the easterly wind which set in two days before the rain commenced in the North-Western Provinces.

Since these rains, accompanied or preceded by moist south-easterly wind, begin first in the Punjab, whilst in the eastern districts of the North-Western Provinces and in Behar dry winds from the opposite quarter are blowing, it would be difficult to account for their formation were it not known that an upper current from the south or south-west nearly always blows in opposition to the trade wind of the north hemisphere, and that in subtropical regions this descends and becomes a surface wind. As a current of air is cooled on ascending, it is heated by descending and being compressed. Consequently the moist current from the equator does not usually precipitate its vapour in the region of its descent unless there is some independent cause of cold at work. Accordingly we find that in the subtropical zones of both hemispheres, outside the region of the monsoons, as, for example, in Afghanistan, Persia, Asia Minor, the Mediterranean coast region, California, the Cape of Good Hope, and South Australia, rain is almost entirely confined to the winter months. There can be little doubt that the winter rain of North India is only a part of the same general phenomenon.

If this be the case, the easterly or south-easterly winds of the Gangetic valley, that precede or accompany the winter rains, would be explained, as, in part at least, due to the descent of a branch of the equatorial current in a region lying to the south of the Ganges; its subsequent northward movement being modified by the direction of the mountain range. The upward deflection of this current where it strikes against the mountains of the north-west Punjab would suffice to start the precipitation; and, as has been already shown, the rain-fall when once commenced will tend to perpetuate itself. The influence of the equatorial current thus continues to be felt in the extreme north-west, where the rains are heaviest down to the end of March or April. Over India proper the north-west winds of the hot season are by that time blowing in full strength; and the upper current only shows itself now and then in the form of streaks of cloud drifting from the south-west, or in

* This account of the origin of the winter rains, the most rational I have yet seen, I have taken the liberty of reproducing from Mr. Eliot's report on the meteorology of India for 1877. It seems probable, however, that the easterly winds in the valley of the Ganges which accompany these rains may not be altogether the effect of the rains, but partly also their cause, and may be connected with a considerable change in the direction of the upper current, indicated by the wind-directions at Chakráta during the winter months, viz., in November, S.W. by S.; in December, S.S.W.; in January, S.E. by S.; in February, S.E. by E.; in March, S.S.E.; and in April, S.W. by W.

the rain or hail that falls during a thunderstorm. In the hot season the region of the descent of the upper current has probably travelled far to the north or north-west of the Indian area.

As the temperature rises in March and April hot north-westerly winds blow down the valley of the Ganges with increasing velocity. These are, however, only day winds, blowing most strongly in the early hours of the afternoon and dying away about sunset. During the months characterised by these hot winds the barometer falls steadily over India, and the decrease of pressure is greatest in the Punjab and Rajputana whence the winds blow. At last the usual relation between pressure and wind direction becomes reversed, and the winds for some time blow apparently from places where the pressure is low to places where it is higher.

In the cold weather months the barometer stands highest in the Punjab, and the pressure decreases uniformly southwards to the neighbourhood of the equator. During the hot weather the pressure falls more rapidly in the interior of Northern India than over the Bay of Bengal and the Arabian Sea; thus in April there is a ridge of high pressure stretching across the Southern India and the Bay, from which the north-east monsoon continues to blow on one side, and southerly sea winds, which bring frequent showers to the coasts of Bengal and Orissa, on the other.

As the season advances these sea winds increase in strength, and the ridge of high pressure moves southward, but the winds are still confined to the lower strata of the atmosphere only. At last, about the middle of May, the high pressure of the centre of the bay retreats to the equator and disappears; there is then a nearly uniform slope of pressure or "baric gradient" extending from the tropic of Capricorn to the Himalaya. This sets in motion towards Southern Asia a broad and very deep current of the atmosphere, which, blowing over an immense area of warm sea, arrives saturated with moisture.* Along the west coast of India it appears as a westerly or south-westerly wind (owing to the deflection caused by the earth's rotation), at the head of the Bay of Bengal its direction is nearly due south, and in the valley of the Ganges it is south-easterly or easterly, while in the north of the Punjab it is often north-easterly. The movement of the wind of the summer monsoon is therefore cyclonic or rotatory round the region of greatest heat at the end of June or beginning of July; but the westerly winds which blow across Southern India, in what may be called the normal course of the monsoon, are much more powerful than those which blow up the valley of the Ganges from the east. These easterly winds, though all important to the North-Western Provinces, Behar, and the eastern half of the Punjab, are in fact only a minor eddy in the great south-westerly current that sets in towards Southern Asia in the summer months; and being only a minor feature of the general movement, they are very liable to be disturbed by small and apparently quite insignificant variations in the distribution of barometric pressure.

The monsoon rains commence in the extreme south of India, Ceylon, and Burmah in the last week of May. They advance rapidly along the coast, and reach Bombay in the first and Calcutta in the second week of June. Though the advance is pretty uniform along the coast, it is by no means so in the interior of Upper India. The temperature of this region being much higher than that of the Bay of Bengal, the sea wind advancing inland will for that very reason become drier, and may continue to blow for days or even weeks before an atmospheric disturbance sufficient to cause general rain-fall is set up. In this way the approach of the rains is heralded by a sudden and great increase of the proportion of aqueous vapour in the air, sometimes a week or more before the rain begins, and even before the direction of the wind at the surface of the ground gives any indication of its approach.

At last some cause, perhaps slight and apparently accidental, sets a portion of the air in upward motion and rain commences. It has already been shown how the fall once commenced tends to perpetuate and feed itself by setting free latent heat and expanding the air, thus producing a further upward movement and the indraught of more moist air.

In this way rain continues to fall at frequent intervals over Upper India until the time of the autumnal equinox, when the rapid retreat of the sun to the south of the equator produces a general lowering of the temperature and a weakening of the monsoon current, which gradually dies away about the end of September. By the middle of October the rains have usually ceased, and the season of clear skies, uniform pressure, and feeble north-westerly winds has come round again.

Monthly Frequency of Hailstorms.—In connexion with the monthly distribution of rain-fall it may be well to state what is known of the relative frequency of hailstorms at different seasons of the year. A knowledge of the distribution of these storms both in time and in space is of such immense importance to agriculture in this country that it might be thought the occurrence of each storm would be carefully noted in the weekly rain returns furnished by the district officers. As a matter of fact this has very seldom been done, however, the column of the rain-fall forms headed "Remarks" having been for many years usually occupied by the information that the wind during the week was "easterly and westerly" and the weather "cloudy and clear." Of late the latter remark has fallen into the disuse it merited. During the years 1873–77, Dr. Bonavia of Lucknow received information of nearly every hailstorm observed in the province of Oudh, and published the same in a tabular form in the annual reports of the Lucknow Observatory. From his tables, combined with the few notices of hailstorms in the reports of the Board of Revenue, and with occasional notices of such storms during 1878 furnished by the district officers, the following figures are taken. They give nearly all the available information on the subject:—

Month.	Number of Storms.
January	10
February	11
March	18
April	9
May	4
June	0
July	0
August	0
September	0
October	3
November	0
December	0

The month of greatest frequency is March, and the four months of the rainy season June, July, August, and September, as well as the dry months, November and December, appear to be free from hail. In May and October these storms are very unusual, the only ones recorded having occurred in October 1877, and May 1855 and 1878; these months being all characterised by very extraordinary atmospheric conditions in Northern India. The figures, so far as they go, agree fairly with a table of the relative frequency of hailstorms at different seasons, published by Dr. Buist in the British Association Report for 1855. Dr. Buist's table includes observations from all the provinces of India. It shows that hail is most frequent in February, March, and April, and very rare in the remaining months, especially during the rainy season.

The hailstones which fall in May in these provinces seem to be distinguishable by their immense size. On the 11th of May 1855 a hailstorm occurred at Naini Tál in which many stones of 6, 8, or 10 ounces in weight, and even one or two weighing more than a

* This account of the transition from the N.E. to the S.W. monsoon is substantially the same as that given in the Meteorological Report for 1877 by Mr. Eliot.

pound and a half, were observed to fall, the circumferences of these varying from 9 to 13 inches.

In May 1878, there were severe hailstorms in many districts on the 6th and 8th. On the former day hailstones weighing a pound and a half each fell at Muhammadabad and Rasra, in the Ghazipur district, and others from two to two and a half inches in diameter fell at Azamgarh. About the same time there was a storm at Naini Tál in which some of the hailstones were sufficiently heavy to punch holes through the zinc roofs on which they fell; and the quantity of hail which fell was so great that it lay in shady places nearly a month. In the cooler months of February, March, and April such large hailstones have not been observed.

All the districts of the North-Western Provinces and Oudh are subject to occasional visitations of hailstorms. Those parts of the provinces from which they are most frequently reported comprise the Himálayan districts, Rohilkhand, Oudh, the middle Doáb, Hamírpur, and Jhánsi.

Variations of long period.—Of late years the questions whether the sun's heat is variable or not, and whether any variation that may exist can be detected in remote meteorological effects, such as rain-fall, have excited a considerable degree of interest, and given rise to long discussions in *Nature* and other scientific journals. Nothing like a definite conclusion regarding these questions has yet been arrived at; many observers holding that there is a balance of evidence in favour of an excess of solar heat and terrestrial rain-fall when sun-spots are numerous, and others that the heat is greatest when the sun-spots are few. The question as regards its bearing on the rain-fall of North India has recently been discussed in a paper published in the third part of the *Indian Meteorological Memoirs*. In this I have shown that no distinct relation whatever between the sun-spots and the rain brought by the summer monsoon can be traced, but that there is some evidence in favour of an inverse relation between the area of the spots and the winter rain, the latter being generally heaviest a year or two before the spots reach their minimum. In this respect the winter rain-fall of North India and other subtropical countries resembles the temperature of stations lying between the tropics, these places being generally hottest about a year before the sun-spot minimum. The simplest explanation of this relation is that in hot years a larger proportion of vapour than usual is raised between the tropics and transported by the upper current to North India and the Himalayn, where it is precipitated during the winter months.

It is by no means true, as some people have suggested, that Indian famines always occur about the time of minimum sun-spot, and that a careful study of the surface of the sun would enable us to predict them. Taking all the famines and scarcities that have occurred in Upper India since the commencement of British rule, as given in Mr. Girdlestone's *Past Famines of the North-Western Provinces*, together with a list of those that have occurred since his report was written, we may classify the years in which they occurred according to the character of the sun-spots as follows:—

FAMINES recorded in the NORTH-WESTERN PROVINCES, classified according to SUN-SPOT CHARACTER.

Sun-spot Area.	Famines and Scarcities.	Total Number.
Maximum	1803–4, 1819, 1827–28, 1837–38, 1860–61	5
Medium	1813–14, 1825–26, 1868–69, 1873–74	4
Minimum	1783–84, 1832–34, 1867, 1877–78	4

The table shows that famines due to the failure of the summer rains are just as likely to occur at one part of the sun-spot cycle as at another, or that if famines be any more probable at one time than at another they are rather more likely to occur when sun-spots are numerous than when they are few. This conclusion is directly opposed to the usual theory on the subject. It may be objected that in this table great famines are classed together with the local scarcities like that of 1867 in Kumaun and that of 1873–74 in Gorakhpur and Behar. When our attention is restricted to the four great droughts of the period, however, we arrive at exactly the same results. Two of these, the first and the latest, occurred at minimum sun-spot epochs, and the other two, those of 1837–8 and 1860–1, at times of maximum sun-spot.

An attempt has been made to calculate the mean rain-fall of the North-Western Provinces for each of the past 35 years in terms of the average for many years. The results are here given in the variations of the winter and summer rains as well as of the annual fall being shown. The winter rain of any year means that which fell between November of the preceding year and April of the given year.

MEAN RAIN-FALL of the NORTH-WESTERN PROVINCES for each YEAR from 1844 to 1878, in PER-CENTAGES of the AVERAGE for many YEARS.

Year.	Number of Stations.	Winter.	Summer.	Whole Year.
1844	28	?	87	?
1845	29	143	91	96
1846	29	66	106	102
1847	28–29	76	105	103
1848	29–30	72	73	73
1849	30–31	92	90	90
1850	31–38	160	87	94
1851	38	183	82	91
1852	38	109	94	95
1853	38	117	91	93
1854	35–38	61	123	117
1855	34–35	172	101	107
1856	7–11	49	129	122
1857	10	86	97	96
1858	9	68	101	98
1859	9	150	89	95
1860	9–30	76	54	56
1861	26–32	23	128	118
1862	27–32	65	123	118
1863	39–40	54	115	109
1864	40	71	69	69
1865	40–41	147	95	100
1866	41	103	92	93
1867	42	91	135	131
1868	42	146	66	73
1869	42–43	109	97	98
1870	43	103	121	119
1871	43–44	61	131	125
1872	44	152	111	115
1873	44	46	101	96
1874	44	71	131	126
1875	44	70	114	110
1876	43–44	46	93	89
1877	39	174	45	57
1878	39	217	90	102

The per-centage for each year has been arrived at in the following way. Let r_1, r_2, r_3, ... r_n be the rain-falls of a number of stations for the given year,

and let the averages for the same places be R_1, R_2, R_3, ... R_n respectively. Then—

$$\text{Per-centage} = 100 \times \frac{r_1 + r_2 + r_3 \ldots + r_n}{R_1 + R_2 + R_3 \ldots + R_n}$$

For most of the years where 28 or more stations have been taken into account, the figures may be taken as fairly accurate, but for the years 1856–60 there is a large probable error. No records for any of the plains stations during those years have been discovered, and the figures in the table are founded on observations taken at a few places in Kumaun and Dehra Dun, supplemented by returns from three or four stations in the Punjab and from Jabalpur in the Central Provinces.

The first conclusion to be drawn from the table is that, so far as past experience enables us to judge, it is not likely that more than six dry years or six wet ones will ever occur in succession. The longest dry period in the table included the six years from 1848 to 1853, and the longest wet period extended from 1870 to 1875.

There is also a considerable balance of evidence in favour of a rule that when the winter rains have been unusually heavy the succeeding rains of the summer monsoon will be light, and *vice versâ*. The following 12 years had the winter rain-fall excessive, and that of summer defective, viz., 1845, 1850, 1851, 1852, 1853, 1859, 1865, 1866, 1868, 1869, 1877, 1878; and 13 years, 1846, 1847, 1854, 1856, 1858, 1861, 1862, 1863, 1867, 1871, 1873, 1874, 1875, had dry winters followed by wet summers. Against these 25 instances in favour of the rule there were only three years, 1855, 1870, and 1872, with the rain-fall excessive in both seasons; and six, 1848, 1849, 1857, 1860, 1864, and 1876, with a deficiency both in summer and winter. In his report on the meteorology of India for 1876, Mr. Blanford has suggested a reason for the inverse variation of the rain-fall of the winter and summer seasons. It is that an unusually great precipitation of snow on the north-west Himalaya, accompanying heavy winter rains, will retard the rise of temperature over Northern India in April, May, and June, and thus prevent to some extent the diminution of pressure that causes the indraught of the vapour-laden winds from the south. On the other hand, when the snow-fall has been less than the average, the temperature will rise, and the pressure decrease more than usual, and the southerly winds of the summer monsoon will be unusually strong. The explanation is, however, incomplete, for the year 1871, in which the winter rains were light and those of the summer were far heavier than usual all over North India, was characterised by a very low temperature in April, May, and June; whereas 1878, a year of heavy winter and scanty summer rains, had the hottest June ever recorded. Although this relation between the rains of the cold and hot seasons has not yet been satisfactorily explained, it may for the present be adopted as a fairly good empirical rule, the exceptions to which are not likely to be very numerous.

The winter rain-fall of the province is seen to be much more variable in amount than that of the summer season, the former ranging from 22 to 217 per cent. of the average, while the latter only ranges between 45 and 135 per cent. Owing to the inverse relation between the rain-falls of the two seasons, already pointed out, the annual totals on the average of the whole province have a still smaller range, the maximum being only 31 per cent. above the mean, and the minimum 44 per cent below it.

Nevertheless, at individual stations, the variability of the annual totals is extremely great, as the following examples will show. The highest rain-fall at Dehra, in any year for which we have complete returns, was 112·6 inches in 1853, and the lowest was 35·1 inches in 1848. At Naini Tal the rain-fall ranged between 131 inches in 1853 and 30·1 in 1860. On the plains the variability is almost as great. Thus, at Meerut the rain-fall in 1870 was 40 inches, and in 1868 only 15·6; at Bareilly 58·8 inches fell in 1878, and only 23·7 in the previous year; at Agra 46·5 inches fell in 1873, and only 9·8 inches in 1877. Farther east, we have for the maximum at Allahabad 61 inches in 1854, and for the minimum 15·7 in 1864; at Benares 64·4 inches in 1848, and only 19·5 inches in 1864; and at Jaunpur a range from 74 inches in 1871 to 7·6 in 1846.

In the Jhánsi division and in Oudh, although the observations for these are for a smaller number of years, the variability of the annual rain-fall appears to be quite as great as in the districts for which the records go back to 1844. Thus, at Jhánsi the rain-fall of 1868 was only 13·3 inches, while that of the next year amounted to 52·3 inches; at Lucknow 64·9 inches fell in 1871, and only 14·4 in 1877, and at Fyzabad the figures for the last 10 years range between 87·2 inches in 1871 and 17·4 in 1876.

In years when the average rain-fall of the whole province is below the mean, some districts are subject to unusually heavy local falls. In 1877, for example, when the average summer rain-fall for the whole province was less than half the usual amount, there was a succession of heavy downpours in Jaunpur, which brought the rain-fall of the summer months at that station nearly up to the average. In like manner, a succession of very heavy falls of rain in July and August 1878 rendered the totals for these months at Bareilly, Dehra, and Mussoorie very excessive, while the rain-fall of the same months was deficient in amount over nearly all the rest of the province.

It has been pointed out by Mr. Blandford that these irregularities of rain-fall distribution (which are also observed in rainy years, though they are then not so striking) appear to be determined by certain minute but persistent differences of atmospheric pressure which modify the directions of the prevailing winds, and thus send unusually large quantities of vapour to be precipitated over well-defined local areas. Many of these pressure differences are already established at the commencement of the rainy season, and others originate during its continuance, but once set up they usually persist for several months or even years. Thus an accurate knowledge of their amount and distribution, combined with a knowledge of the probable general character of the coming monsoon, derived from observations taken over the whole of India and the Indian seas, may one day afford a basis for foretelling the distribution of the rain-fall before the commencement of the summer monsoon.

BENGAL.

After giving an account of the normal distribution of wind and rain-fall and their causes in the Province of Bengal, a description mainly drawn from Mr. Blandford's reports, and which therefore need not be repeated here, he goes on thus:—

We must now take up each division in turn and describe the normal rain-fall and prevalent winds, and how they differ one from another. It is believed that considerable reliance may be placed upon the accuracy of the statements of rain-fall, &c. which are afterwards given; for each sadar and subdivisional station is furnished with a Symon's rain-gauge, which is of the simplest construction, and is therefore very little liable to get out of order, and which is again so simple in principle that it is difficult to imagine that any mistake can be made in its readings. The rain-fall recorded by these instruments is daily registered, and the reports are in most cases forwarded to this office through the civil officer in charge of each division. The other statistics here given, such as

CHAP. I. QN. 1. BENGAL. *Mr. Pedler.*

wind directions, &c., are obtained from the records kept by the meteorological observers at the various stations under this department, and which are also believed to be very fairly accurate. It will be convenient to commence with the divisions from the eastward, working towards the west; and it will be seen below that in this way we shall follow as nearly as possible what may be called the natural sequence, commencing with the district having the greatest rain-fall, working down to that with the smallest. Thus we have the following divisions with their rain-fall, working from east to west:—Assam,* 115 inches annual rain-fall; Chittagong, 100 inches; Dacca, 76 inches; Cooch Behar, 134 inches; Rajshahye, 72 inches; Presidency, 58 inches; Burdwan, 57 inches; Bhagulpore, 52 inches; Orissa, 60 inches; Chota Nagpore, 49 inches; and Patna, 45 inches. There are only two exceptions to this sequence, that is, Cooch Behar and Orissa, and these two are exceptional—the first, because it includes the Himalayan stations, and the second, because a large proportion is on the sea-coast.

Chittagong.—This division is, next to Assam, the most easterly, and, as before stated, it receives also a large proportion of rain-fall. This division is represented by the following rain-fall stations:—Chittagong, Cox's Bazar, Noakholly, Comillah, Brahmanberiah, Rangamatee Hill, and Hill Tipperah; and rain-fall observations have been made in these stations for periods varying from 4 to 20 years. Most of these stations are at or near the sea level, many lie almost on the sea-cost, whilst to windward of them there is a range of mountains that runs obliquely across the path of the south-west monsoon, and which materially alters its direction. Speaking generally, we may say that the northern stations of this division receive a larger share of rain-fall than the southern. The winds in the Chittagong district are strongly northerly during the months from November to February inclusive, but in March and April the southerly element predominates, and the south-west monsoon commences here in April and continues to blow steadily for seven months; owing partly perhaps to the obstacle presented by the Arracan Mountains to the progress of the south-west monsoon, or perhaps to a greater extent to the low barometric pressure in the Gangetic delta, the wind directions in this division are south-east and south-south-east during the greater part of the monsoon months, and apparently the wind is more easterly in the northern parts than in the southern. The rains begin earlier at the northern than at the more southerly stations, for at the latter little rain falls in April, and that in May is usually light.

The average monthly rain-fall for the whole of this division, together with the average rain-fall of some of the principal stations, are here given—

* The report on the rain-fall of Assam is described in a report submitted to that Government.

RAIN-FALL in the CHITTAGONG DIVISION in INCHES.

Names of Stations.	Number of Years of Records.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Averages† - -	4 to 19	0·71	0·83	2·04	4·96	10·37	22·17	21·11	18·25	11·99	6·89	0·87	0·21	100·40
Chittagong - -	17 to 19	0·59	1·31	1·31	4·71	9·17	22·53	22·17	21·46	12·94	6·31	1·71	0·39	104·60
Noakhally - -	17 to 19	0·47	0·80	2·09	3·86	9·91	22·67	20·99	20·26	15·92	8·37	1·42	0·11	106·87
Tipperah - -	14 to 16	0·79	0·83	2·49	7·05	11·42	19·06	16·76	15·28	9·77	6·14	1·35	0·08	91·02
Rangamattee Hill -	8	0·43	0·83	2·33	4·46	10·30	17·52	18·17	18·38	11·19	7·85	1·23	0·22	92·91
Hill Tipperah -	4 to 5	1·35	0·98	3·29	5·24	10·13	14·43	10·88	16·37	8·03	4·22	1·17	0·20	76·29

† Average of whole division.

The division of Chittagong is thus well supplied with rain, as, on the average, 100·40 inches are recorded; this is fairly distributed in the whole division, and is usually spread over from six and seven months, the three months June, July, and August being as a rule the wettest.

Dacca.—In this division we have chiefly low-lying lands which receive the monsoon currents direct from the Bay of Bengal, and therefore the average rain-fall is fairly high. The number of recording rain-fall stations has varied from 11 to 14, and the number of years over which observations have been taken has been in the larger stations 16, but in the subdivisional stations only four years. The principal stations may be considered to be Dacca, Furreedpore, Burrisal, and Mymensingh, and these may be accepted as typical of the whole district.

This division is one in which the rain-fall is very equally distributed, and in some respects it is like that of Chittagong. As before, the average winds work round from north-west in January through west and south to south-south-east, remaining in this direction almost throughout the rains, then passing through east almost suddenly to north at the end of October or commencement of November. In April the wind becomes on the average south, and at this time the rain-fall commences and continues until October; the largest amount falling in June and July. The rain-fall varies from about 70 to 95 inches, as is shown by the following table which gives the average monthly rain-fall of the whole division, and also the rain-fall of some of the principal stations:—

RAIN-FALL in the DACCA DIVISION in INCHES.

Names of Stations.	Number of Years of Observations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Divisional Average	4 to 16	0·71	1·12	1·79	4·23	8·58	16·48	15·27	12·74	10·57	4·86	0·20	0·13	76·60
Dacca - -	23 to 25	0·29	0·83	2·33	6·44	9·51	12·82	11·64	12·10	9·52	5·51	0·75	0·18	71·92
Furreedpore -	8	0·54	0·96	2·32	4·83	9·34	13·49	11·33	12·46	11·02	3·95	0·26	0·01	70·51
Burrisal - -	8 to 9	0·78	1·14	1·70	2·79	6·75	15·17	16·78	12·83	10·40	4·49	0·89	0·17	73·89
Mymensingh -	10 to 12	0·35	1·09	1·44	7·09	13·89	22·07	16·39	14·78	12·99	4·85	0·13	0·05	95·12

This table clearly shows that in its progress westwards the average rain-fall is steadily diminishing, although this is perhaps not quite so marked as in some cases that will be quoted from subsequent divisions.

Cooch Behar.—In this division we have a marked example of the influence of hills and mountain ranges in increasing the rain-fall of a district. The average annual rain-fall of this division is 134·57 inches, the highest in fact of any division here treated of. There are here five rain-fall recording stations, namely, Darjeeling, Julpigoree, Cooch Behar, Buxa, and Boda. All these stations are situated either in the hills or at the foot of them, and it will be seen that in each case we have heavy rain-fall. The wind directions are only recorded at one station, namely, Darjeeling, and here for the first five months in the year there is a great preponderance of westerly winds, which, however, in June change round to the south and remain at or about this quarter until October, when the wind direction again turns towards the west. Slight rains commence in this division in April and May, but the monsoon months are really June, July, August, and September; comparatively small quantities falling in October. In this division the rain-fall is not uniform, nor could it be expected to be so, for some of the stations are on the plains and others in the hills. Thus at Buxa there is an annual fall of 238·90 inches, whilst at Boda only 88·07 inches fall: Buxa is on the hills, Boda is on the plains. The following table shows the average monthly rain-fall for the whole division, as also for the five stations above mentioned:—

RAIN-FALL in the COOCH BEHAR DIVISION in INCHES.

Names of Stations.	Number of Years of Observations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Divisional Average	4 to 7	0·73	0·41	1·34	5·53	10·46	30·14	29·60	26·59	22·81	6·73	0·11	0·12	134·57
Darjeeling - -	14 to 17	0·35	1·00	1·25	3·78	6·10	24·80	27·22	24·60	15·81	7·24	0·17	0·15	112·47
Julpigoree - -	7 to 8	0·47	0·28	1·75	4·45	9·12	30·46	25·42	23·67	23·76	6·23	0·02	0·03	125·66
Cooch Behar -	5 to 6	0·56	0·13	0·62	6·95	12·09	35·72	21·85	21·76	16·14	5·38	0·05	—	121·25
Buxa - -	8	0·90	0·85	1·68	9·15	18·82	46·59	54·41	43·99	33·68	11·33	0·55	0·50	222·43
Boda - -	6 to 7	0·60	0·27	0·63	2·59	7·36	21·04	14·91	17·38	16·26	6·85	—	0·08	87·97

Here we have a division far removed from the sea, yet standing at the head in the list of rain-fall. This is caused by the fact previously stated, that when air laden with moisture rises it expands and is thereby cooled, and by the fall of the temperature a large proportion of the vapour is deposited in the form of rain, and though in this instance the monsoon current has deposited part of its moisture by passing over a large portion of land surface, yet when it rises and becomes cooled, a further and generally larger quantity of rain is again produced.

Rajshahye.—This division is situated at some little distance to the south and east of the hills, and yet their influence is not altogether unfelt; for it appears that the rainfall in many of the Rajshahye stations is higher than others in the same latitude in the Gangetic delta. This is probably owing to the influence of the hills on the north and north-east which obstruct and deflect the monsoon current, and thus increase the precipitation of its vapour; consequently there is a larger fall of rain in the division than would otherwise be the case. There are here 10 rain-fall recording stations which have been established for periods varying from 5 to 20 years. There is now only one wind direction record kept in this district; but up to 1874 Berhampore was included in this division (it is now, however, in the Presidency division), and the records from this station show that from May to September south-east winds probably prevail in Rajshahye. The rains are heaviest here from June to September, but a fair quantity also falls in May and October.

The rains are here somewhat unequally distributed, as is shown by the following table, giving the average monthly rain-fall for the whole division, and the average for several of the larger stations:—

RAIN-FALL in the RAJSHAHYE DIVISION in INCHES.

Names of Stations.	Number of Years of Records.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Divisional Average	5 to 20	0·52	0·92	1·09	3·34	6·68	15·21	14·67	12·48	12·37	5·09	0·30	0·11	72·78
Dinagepore -	13 to 16	0·20	0·66	0·60	2·80	7·25	19·16	15·43	13·19	12·67	6·68	0·02	0·04	78·70
Maldah - -	18 to 20	0·46	0·85	0·86	1·86	3·21	9·85	10·16	9·56	10·71	4·50	0·18	0·40	52·60
Bauleah -	14 to 17	0·30	1·19	1·18	1·95	5·76	11·01	12·29	10·27	10·85	5·24	0·25	0·04	60·33
Rungpur - -	14 to 16	0·39	0·33	0·95	3·11	9·81	21·86	16·65	13·40	11·64	5·43	0·04	0·12	83·73
Bogra - -	12 to 15	0·58	1·03	0·75	4·63	9·09	16·58	16·55	11·21	13·58	5·46	0·29	0·10	79·85
Pubna - -	9 to 10	0·44	0·71	1·26	4·54	7·38	12·29	10·61	11·35	10·83	4·47	0·10	0·02	64·00

Speaking generally, we may say that, other things being equal, the easterly and northerly stations in this division receive more rain than the westerly and southerly ones, and also that the rains usually begin somewhat earlier in the former than in the latter stations.

Presidency Division.—We have here a division in which the average rain-fall is fairly equally distributed; there are some 26 recording stations, and in some instances records for as long as 47 years are available; but in the case of the subdivisional stations only four years' observations have been recorded. Here, as before, the wind direction passes from the north or north-west in January through west to south in April, but it is not till June that the wind becomes full south or somewhat east of south; and it is by the wind current from this latter quarter that the larger proportion of rain is brought. In October the wind veers round again to the north and the rains cease. The rain-fall usually commences in the south part of this division in the second or third week in June, and ceases about 15th October; in the northern parts of this district the rains commence somewhat later and end rather earlier. The principal rain-fall in this

district occurs in the three months June, July, and August; smaller quantities falling in September, October, and May. The diminishing quantity in the two former months is due to the slackening of the monsoon current, and the rain-fall in May is principally due to the class of storms called "north-westers." Winter rains are somewhat rare in the southern part of this division.

The table below contains the average monthly rain-fall for the whole division, and also the averages of some of the principal places :—

RAIN-FALL in the PRESIDENCY DIVISION in INCHES.

Names of Stations.	Number of Years of Observations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Divisional Average	4 to 47	0·57	1·10	1·31	2·73	5·15	11·63	10·70	10·98	8·43	4·96	0·32	0·10	57·98
Saugor Island -	9 to 10	0·18	0·76	1·07	1·59	4·62	12·72	14·63	14·26	13·07	10·94	0·66	0·05	74·55
Calcutta - -	48	0·43	0·87	1·35	2·39	5·40	12·08	12·78	13·94	10·18	5·61	0·55	0·23	65·81
Alipore - -	6 to 7	0·33	1·69	2·20	2·09	4·49	11·22	13·23	13·97	9·09	6·29	0·30	0·09	64·99
Kishnaghur -	12 to 14	0·59	0·89	1·04	4·06	7·18	11·38	10·13	10·20	6·85	4·24	0·07	0·15	56·78
Jessore - -	14 to 17	0·59	0·62	1·67	3·68	7·36	13·48	10·75	11·50	8·78	5·62	0·73	0·12	64·90
Berhampore -	19 to 21	0·42	0·90	1·09	2·32	4·22	9·91	10·02	10·21	9·41	5·64	0·16	0·08	54·38

In this division we may notice generally that, other things being equal, the southerly stations receive a larger proportion of rain than the northerly, and the easterly stations a larger proportion of rain than the westerly.

Burdwan.—This district in position and general condition is similar to the Presidency division, and like it receives a moderate rain-fall; the average for the whole of the Presidency division being 57·98 inches, whilst that of the Burdwan division is 57·11 inches. There are 15 rain-fall recording stations in this division, and the period during which registration has been effected varies from 4 to 20 years. The rain-fall in this district is tolerably uniformly distributed, and it is brought by winds from the same direction as those described for the Presidency division; if anything, the direction in the Burdwan district is rather more easterly. As before, the months in which the largest amount of rain falls are June, July, August, and September, and these are the months which are characterized by south-east and south-south-east winds; it is in fact from this quarter that the larger proportion of the monsoon rain comes. In October and May also there is a moderate rain-fall, the former being brought by the close of the monsoon, and the latter principally by the storms known as north-westers. The period of the commencement of the monsoon is about the same as that given for the Presidency district; but as before, in the southern portion of the division, the monsoon commences rather earlier than in the northern part.

In the following table we have the average monthly rain-fall for the whole division, and also the average for some of the principal stations :—

RAIN-FALL in BURDWAN DIVISION in INCHES.

Names of Stations.	Number of Years of Records.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Divisional Average	4 to 20	0·56	1·30	1·42	2·16	4·14	10·00	11·47	11·65	8·62	5·29	0·33	0·17	75·11
Burdwan - -	14 to 16	0·67	1·10	1·58	2·80	4·51	11·07	12·44	11·78	8·51	5·40	0·24	0·52	60·62
Bankoora - -	17 to 19	0·33	1·13	1·66	1·72	3·44	10·08	12·62	10·58	8·63	5·29	0·38	1·00	56·86
Sooree - -	13 to 14	0·48	0·93	0·72	0·86	2·34	9·62	12·95	12·62	9·39	4·18	0·13	0·13	54·35
Midnapore -	11 to 13	0·72	0·46	1·54	1·67	5·49	11·43	11·60	10·93	8·66	6·14	0·43	0·01	59·08
Hooghly - -	12	0·61	1·48	2·18	3·68	5·23	10·65	11·97	12·31	7·88	3·94	0·41	0·15	60·49
Howrah - -	8 to 19	0·49	1·52	2·79	2·31	3·95	12·71	12·99	13·00	10·00	5·05	0·35	0·10	65·26

Speaking generally, we may say that the rain-fall of this division varies between 50 and 70 inches, and that the stations in the south, and therefore near the sea-coast, receive a heavier rain-fall than the northern ones. There is also apparently a diminution of rain-fall from the east towards the westerly portion of this division, but this is perhaps not so marked as is the case in the other divisions.

Bhagulpore.—This is one of the Behar divisions, and is therefore situated at a considerable distance from the sea, and consequently the rain-fall is here less than in the divisions formerly discussed. The wind directions are determined at two stations, Monghyr and Purneah, and throughout the early months in the year there is a decided preponderance of westerly winds; it is not till July that the wind becomes south-east and south-south-east, when it is from this quarter that the greater part of the rain comes; the easterly element is here stronger than in the more southerly divisions. In this division there are 15 rain-fall recording stations which have sent in returns from periods varying from 4 to 20 years, and the average monthly result obtained from these, together with the average rain-fall of some of the principal stations, are herewith given in a tabular form :—

RAIN-FALL in the BHAGULPORE DIVISION in INCHES.

Names of Stations.	Number of Years of Records.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Divisional Average	4 to 20	0·51	1·26	0·51	1·06	2·96	9·09	12·72	11·24	9·90	3·26	0·03	0·04	52·58
Monghyr - -	19 to 20	0·39	0·57	0·42	0·42	1·55	6·12	11·51	10·90	8·05	3·61	0·04	0·10	43·68
Bhagulpore - -	18 to 19	0·46	0·57	0·34	1·09	2·26	8·47	11·03	10·73	7·67	5·05	0·01	0·08	47·76
Purneah - -	6 to 7	0·40	0·43	0·21	1·84	2·56	12·36	14·90	13·62	10·98	3·88	—	0·05	61·23
Mya Doomka -	6	0·44	0·72	0·71	1·19	3·39	10·72	13·51	13·78	9·49	3·08	0·01	0·03	57·07

From this table it will be seen that no heavy rain-fall takes place in this division until June, and generally towards the close of this month, whilst the rains almost cease by the beginning of October; the wettest months are July and August, and in September it is clear that there is a weakening of the monsoon current.

Speaking generally, the stations in the south and east of this division, and those lying nearest to the line of the Himalayas, receive a greater rain-fall than those in the west. This is illustrated by the fact that Purneah receives an annual rain-fall of 61·23 inches, whilst Monghyr receives only 43·68 inches. The former station is only 65 miles from the foot of the Himalayas, whilst Monghyr is, more or less, protected from the monsoon winds by the rocky and elevated country of Hazaribagh, which stretches to the south of this district. The average rain-fall of this division may be said to vary between 40 and 60 inches.

Orissa.—This division, although one of the most westerly in the provinces under the Lieutenant-Governor of Bengal, receives ordinarily a fairly large proportion of rain, larger indeed than the three divisions previously described. This is, however, accounted for by the fact that it lies on the sea-coast, and therefore receives its portion of the monsoon current in its original humid condition.

As might be expected, the wind directions are here somewhat different to those of other districts. In January the wind instead of being north-west or north is usually north-east, whilst as early as February the influence of the south winds begins to be felt; in March they blow steadily from a decidedly south-westerly direction, and continue at or almost this quarter until September; at the middle or end of October the wind goes round to the north-west, and continues northerly until the end of the year. In this division the rain is brought entirely by south-westerly winds instead of by south-easterly winds, as is the case in most of the other divisions of this province.

There are 10 rain-fall recording stations here, and the periods for which observations are available vary between 4 and 19 years. The average monthly rain-fall for the whole division and for some of the principal stations is shown in the following table:—

RAIN-FALL in the ORISSA DIVISION in INCHES.

Names of Stations.	Number of Years of Records.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Divisional Average	4 to 19	0·51	0·73	0·82	1·62	2·83	10·37	12·98	11·46	9·64	7·59	1·34	0·22	60·11
Cuttack - -	16 to 18	0·54	0·35	0·94	1·52	2·09	10·39	12·32	10·80	9·68	6·50	0·98	0·52	56·63
False Point - -	10	0·46	0·58	1·19	1·42	2·58	11·36	16·06	13·51	11·41	13·73	3·11	0·13	76·04
Pooree - -	17 to 20	0·22	1·15	0·61	1·14	2·27	7·99	9·43	11·85	9·29	8·45	1·98	0·72	55·10
Balasore - -	14 to 16	0·94	1·24	1·68	2·54	4·26	10·54	11·22	12·20	12·27	7·48	0·59	0·18	65·78

The rain-fall of this division may be said to vary between 50 and 75 inches, and other things being equal, the stations near the sea-coast will receive a heavier fall of rain than those in the interior. This is clearly shown by the pair of stations, False Point, which is on the coast, and which has an average annual rain-fall 76·04 inches, and Cuttack, which is some 50 miles inland, only receives 56·63 inches.

Chota Nagpore.—This division includes a considerable tract of elevated land, which in the case of Hazaribagh is as high as 2,010 feet. Most of the country is indeed, more or less, elevated and undulating, and also much covered with jungle. As might therefore be expected, the meteorological conditions of different parts of the division vary somewhat according to the elevation and position of the stations.

At one station only in this division is the wind direction recorded, and these observations have been made for the last 10 years. Starting in January with a well-defined north-westerly wind, it generally becomes more and more westerly until June, when it becomes south-west, and from this quarter the first considerable quantities of rain come; the wind afterwards becomes more southerly, and in September south-easterly, but in October it passes back to the north-west direction. It is during July and August that the greater part of the rain falls, when the wind is nearly south, whilst by the beginning of October the rains have almost ceased. During the cold weather months also usually small quantities of rain fall, but this is apparently due to the winter anti-monsoon current, as was explained in the general description of monsoon currents in Bengal. This division is represented by seven rain-fall recording stations from which statistics are available for periods varying from 4 to 20 years.

The average monthly rain-fall of the whole division, together with that of some of the principal stations, is here given in a tabular form:—

RAIN-FALL in the CHOTA NAGPORE DIVISION in INCHES.

Names of Stations.	Number of Years of Records.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Divisional Average	4 to 20	0·61	0·94	0·85	0·76	1·64	8·64	12·95	11·75	8·23	3·43	0·09	0·09	49·99
Hazaribagh -	15	0·48	0·69	0·62	0·35	1·00	8·62	13·05	12·33	7·26	3·60	0·24	0·09	48·33
Ranchee - -	16 to 18	0·92	1·04	1·31	0·58	1·52	7·43	12·50	10·90	7·81	3·45	0·13	0·09	47·68
Chybassa - -	7 to 8	0·69	0·83	1·24	0·95	2·90	8·62	13·61	12·03	9·47	4·17	0·14	0·12	54·77
Purulia - -	10 to 12	0·55	0·78	0·78	0·93	1·53	8·55	11·36	11·92	6·80	4·37	0·08	0·19	47·84

The rain-fall of this division may be said to vary between 45 and 55 inches, about one-half of which is usually received in the two months July and August. Generally speaking, there is a diminution in the amount of rain-fall in the stations from east to west and from north to south. Thus Hazaribagh has a mean rain-fall higher than Manbhoom, which is situated 70 miles to the eastward, and Chybassa

CHAP. I. QN. 1. BENGAL. *Mr. Pedler.*

again has an annual rain-fall 6 or 7 inches higher than Hazaribagh, which is 100 miles to the northward. As a rule, the monsoon commences rather later and closes rather sooner in the district of Chota Nagpore than it does in the more southerly and westerly districts of Bengal.

Patna.—This is the most westerly and northerly of the divisions in this province, and therefore, as before pointed out, the average rain-fall will be the smallest. In all the Behar stations the mean rain-fall is low, and in most respects their climate is similar to that of the North-Western Provinces. In this division there are two stations, Patna and Gya, at which the wind directions are recorded, and the average of 10 years observations at these places shows that, as in the case of Chota Nagpore, in the early months of the year there is a strong preponderance of westerly winds; there is, however, one very curious point about the wind directions here, that following on the westerly winds we have northerly and north-easterly ones, and finally in July the winds become almost due east. This change of direction is the reverse of what usually occurs. At the end of July the winds become south-east or east-south-east, and it is from this quarter that the vapour-bearing current reaches this division. In October the wind again goes round to the north-west and the rains cease. Before, however, the south-east and east-south-east winds can reach the division, they have to pass over a small tract of elevated ground as that in the Sonthal Pergunnah district, and consequently they have already deposited a considerable portion of their moisture before reaching this division. The rain-fall here is accordingly light, varying from nearly 40 up to 55 inches. In this district there are 22 rain-fall recording stations which have furnished returns for periods varying between 4 and 29 years. The average monthly divisional rain-fall, together with that of some of the principal stations in the division, is given in the following table:—

RAIN-FALL in the PATNA DIVISION in INCHES.

Names of Stations.	Number of Years of Records.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Divisional Average	4 to 20	0·63	0·45	0·46	0·54	1·45	7·71	12·12	10·73	8·57	2·34	0·02	0·09	45·11
Patna - -	17 to 19	0·65	0·49	0·25	0·30	1·32	6·87	9·77	8·51	7·47	2·63	0·13	0·15	38·54
Gya - - -	11 to 13	0·72	0·44	0·47	0·35	0·40	6·17	11·78	9·72	6·89	3·32	—	0·09	40·35
Arrah - -	17 to 19	0·84	0·45	0·59	0·76	1·06	7·10	12·91	10·04	9·65	2·63	0·21	0·07	46·31
Mozufferpore -	13 to 15	0·71	0·33	0·62	0·63	1·87	6·26	10·51	9·68	9·16	3·67	0·03	—	43·47
Durbhunga - -	6	0·33	0·18	0·36	0·88	1·69	7·24	12·89	9·84	10·90	1·81	—	0·07	46·19
Chupra - -	17 to 20	0·68	0·35	0·50	0·52	0·93	5·93	8·77	8·79	7·03	2·62	0·02	—	36·14
Motihari - -	11 to 12	0·37	0·18	0·83	0·67	2·38	8·81	10·34	11·31	9·27	3·87	—	0·14	48·17

In this division the rain-fall appears to be more generally distributed than is the case in the other divisions, and it is difficult to trace any general principle in the slight variations which occur; apparently however, a line through the middle of this division following nearly the course of the Ganges will represent the line of least rain-fall, whilst north and south of this there is increased precipitation of rain.

The monsoon commences in this division about a fortnight later, and ends rather earlier than in South and Eastern Bengal, and the greater portion of the rain-fall is in the months of July and August. This division also usually receives a certain portion of the winter rains brought by the winter anti-monsoon current.

In concluding our review of the rain-fall of these divisions, we may make the following general statements. It may be comprehensively said that the rains brought by the south-west monsoon commence earlier and fall in larger quantity and with greater regularity in the divisions to the east of these provinces, and that they commence later and diminish in quantity and also in regularity in passing towards the western districts; so that the eastern divisions are altogether more moist than those of the west; and that in all probability the western and north-western divisions of this province will always be more subject to drought and famine than those to the east.

The following two tables are a resumé of the results as given above; they show in the first table the average monthly wind directions of stations in each division, and in the second table the average monthly divisional rain-fall:—

AVERAGE WIND DIRECTIONS in BENGAL.

Names of Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Sibsagar -	N. 63° E.	N. 65° E.	N. 64° E.	N. 56° E.	N. 44° E.	N. 89° E.	S. 34° W.	N. 6° E.	N. 67° E.	N. 72° E.	N. 63° E.	N. 74° E.
Goalpara -	S. 89 E.	N. 86 E.	N. 80 E.	N. 87 E.	S. 86 E.	S. 76 E.	S. 55 E.	S. 15 E.	S. 67 E.	S. 85 E.	S. 87 E.	S. 87 E.
Silchar -	S. 22 E.	S. 33 E.	S. 60 E.	S. 82 E.	N. 71 E.	N. 57 E.	N. 21 E.	S. 49 W.	S. 42 W.	S. 46 E.	S. 74 E.	S. 55 E.
Chittagong -	N. 26 W.	N. 40 W.	S. 60 W.	S. 13 W.	S. 7 W.	S. 30 E.	S. 42 E.	S. 31 E.	S. 27 E.	N. 19 W.	N. 19 W.	N. 24 W.
Dacca -	N. 50 W.	S. 79 W.	S. 22 W.	S. 8 E.	S. 21 E.	S. 19 E.	S. 21 E.	S. 16 E.	S. 78 E.	N. 74 E.	N. 17 W.	N. 34 W.
Darjeeling -	S. 50 W.	S. 65 W.	S. 67 W.	S. 68 W.	S. 51 W.	S. 14 W.	S. 12 E.	S. 13 E.	S. 23 W.	S. 48 W.	S. 38 W.	S. 38 W.
Calcutta -	N. 38 W.	S. 81 W.	S. 32 W.	S. 3 W.	S. 11 E.	S. 4 E.	S. 11 E.	S. 17 E.	S. 27 E.	N. 48 W.	N. 17 W.	N. 26 W.
Saugor Island	N. 7 E.	S. 68 W.	S. 41 W.	S. 25 W.	S. 17 W.	S. 21 W.	S. 29 W.	S. 27 W.	S. 8 W.	N. 11 E.	N.	N. 12 E.
Jessore -	N. 21 W.	N. 63 W.	S. 66 W.	S. 12 W.	S. 7 E.	S. 18 E.	S. 16 E.	S. 16 E.	S. 23 E.	N. 63 E.	N. 1 E.	N. 10 W.
Berhampore	N. 35 W.	N. 65 W.	S. 79 W.	S. 8 W.	S. 35 E.	S. 37 E.	S. 44 E.	S. 45 E.	S. 45 E.	N. 3 W.	N. 26 W.	N. 26 W.
Burdwan -	N. 38 W.	N. 57 W.	S. 72 W.	S. 39 W.	S. 4 W.	S. 16 E.	S. 21 E.	S. 40 E.	S. 16 E.	N. 16 E.	N. 15 W.	N. 25 W.
Monghyr	S. 72 W.	S. 73 W.	N. 83 W.	N. 45 E.	N. 71 E.	N. 85 E.	S. 84 E.	S. 69 E.	S. 81 E.	S. 82 W.	S. 87 W.	S. 69 W.

Names of Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Purneah -	N. 77° W.	S. 80° W.	N. 81° W.	°	N. 80° E.	°	°	°	S. 77° E.	N. 49° W.	N. 73° W.	N. 79° W.
Cuttack -	N. 64 E.	S. 9 W.	S. 19 W.	S. 16 W.	S. 5 W.	S. 28 W.	S. 42 W.	S. 48 W.	S. 7 W.	N. 30 E.	N. 17 W.	N. 5 E.
False Point -	N. 45 E.	S. 27 W.	S. 46 W.	S. 44 W.	S. 36 W.	S. 49 W.	S. 63 W.	S. 63 W.	S. 32 W.	N. 40 E.	N. 20 E.	N. 30 E.
Hazaribagh -	N. 64 W.	N. 69 W.	N. 78 W.	N. 73 W.	S. 89 W.	S. 30 W.	S. 13 E.	S. 41 W.	S. 57 E.	N. 48 W.	N. 49 W.	N. 58 W.
Patna - -	N. 78 W.	N. 75 W.	N. 72 W.	N. 30 W.	N. 41 E.	N. 68 E.	N. 82 E.	S. 67 E.	S. 84 E.	N. 33 W.	N. 66 W.	N. 79 W.
Gya - -	N. 59 W.	N. 85 W.	N. 89 W.	N. 69 W.	N. 31 E.	N. 84 E.	S. 69 E.	S. 50 E.	S. 76 E.	N. 48 W.	N. 28 W.	N. 65 W.
Durbhanga -	—	—	—	—	—	—	—	—	—	—	—	—

AVERAGE RAIN-FALL in the DIVISIONS of BENGAL in INCHES.

Names of Stations.	Number of Stations in Divisions.	Number of Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Assam - -	21 to 23	4 to 20	0·86	1·83	3·90	9·67	14·53	22·86	23·13	18·05	14·11	9·34	0·68	0·29	115·15
Chittagong -	6 to 7	4 to 19	0·71	0·83	2·04	4·96	10·37	22·17	21·11	18·25	11·99	6·89	0·87	0·21	100·40
Dacca - -	11 to 14	4 to 16	0·71	1·12	1·79	4·23	8·50	16·48	15·27	12·74	10·57	4·86	0·20	0·13	76·60
Cooch Behar -	5	4 to 7	0·73	0·41	1·34	5·53	10·46	30·14	29·60	26·59	22·81	6·73	0·11	0·12	134·57
Rajshahye -	10	5 to 20	0·52	0·92	1·09	3·34	6·68	15·21	14·67	12·48	12·37	5·09	0·30	0·11	72·78
Presidency -	25 to 26	4 to 47	0·57	1·10	1·31	2·73	5·15	11·63	10·70	10·98	8·43	4·96	0·32	0·10	57·98
Burdwan -	15	4 to 20	0·56	1·30	1·42	2·16	4·14	10·00	11·47	11·65	8·62	5·29	0·33	0·17	57·11
Bhagulpore -	12 to 15	4 to 20	0·51	1·26	0·51	1·03	2·96	9·09	12·72	11·24	9·90	3·26	0·03	0·04	52·58
Orissa - -	10	4 to 19	0·51	0·73	0·82	1·62	2·83	10·37	12·98	11·46	9·64	7·59	1·34	0·22	60·11
Chota Nagpore -	7	4 to 20	0·61	0·94	0·85	0·76	1·64	8·64	12·95	11·75	8·23	3·43	0·09	0·10	49·99
Patna - -	22	4 to 20	0·63	0·45	0·46	0·54	1·45	7·71	12·12	10·73	8·57	2·34	0·02	0·09	45·11

With reference to the question "within what limits can the rain-fall vary," and also with reference to the three succeeding questions, it must be explained that the Meteorological Department receives no statistics of any kind as to the agricultural conditions of this province; consequently, it is unable to give any detailed or definite information on these subjects. Generally it may be stated that it is not so much the *absolute* amount of rain which is received by any particular district that determines whether the crops are good or bad, but rather that this depends upon the rain which comes, falling at seasonable times. Again, as the time at which rain may be acceptable will vary according to whether the land cultivated is high or low-lying, or whether backward or forward in cultivation, it would be a difficult matter to say exactly when rain is really or generally required.

Also an excessive rain-fall at many parts of the year is just as bad for the crops as a want of rain, and a flood is in all probability as disastrous as a drought.

Again, in the majority of instances, one inch of rain falling daily on four alternate days may do more good than a continued drizzle of half an inch of rain on each of eight consecutive days; and there is no doubt that either of the former would do vastly more good than a violent rain in which 4 inches fall, say, in a couple of hours. Looking at these considerations, it is not possible to do more than advance the most general of all general statements, and say that *in all probability* a variation of more than 10 or even 15 per cent., either above or below the average rain-fall in each month (provided only the fall is seasonably distributed), might not be attended with serious consequences; but that *in all probability* a variation of 25 or 30 per cent. would cause damage, whether the variation was above or below the average fall, and of the two the smaller quantity of rain would produce the greater damage.

The last and only other question which could possibly be dealt with from the records of the Meteorological Department is the second half of the last question in paragraph 1, namely, "what is "the combination of circumstances under which the "worst results have been produced."

Now undoubtedly the worst results which have been produced are those of the two famine years 1865 and 1873, and an examination of the distribution of rain-fall in these two years in comparison with the average fall will perhaps throw some light on this question.

In order to illustrate this difference of the average rain-fall and of the rain-fall of 1865, a map is attached which shows the average rain-fall of Bengal in red lines, whilst the blue figures are the rain-fall of 1865. Inspection of this will show at a glance that the general rain-fall was not very deficient except in Orissa; but Statement I. will show clearly that the rains almost entirely ceased about the middle of September.

The total quantity of rain-fall for the year was not unusually small in the larger part of Bengal, but it fell abnormally and unseasonably. Much rain fell in the early months of the year before it was of much good, for the usual sowing time had not arrived, and the rains which usually fall in the latter end of September and commencement of October, and which are so essential to the crops, entirely failed. The crops, however, in the more humid districts of Eastern Bengal (where the rain-fall commences earlier) ripened notwithstanding the early cessation of the rains; but in the drier districts of Orissa and Western Bengal the crop was prematurely cut off. In Orissa, the general fall of rain having also been very deficient, the results were much worse than in the greater part of Western Bengal.

The season 1873 was also one which was marked by famine in these provinces, and the cause of this

is clearly shown by the rain-fall statistics of that year.

A chart of the rain-fall of 1873, compared with the average rain-fall of these provinces, was prepared for the Meteorological Report for 1873, from which it appears that, generally speaking, in the year 1873 the rain-fall of Bengal was very deficient. As, however, this chart only shows us the general result of the year, Statement II. has been prepared showing the monthly divisional rain-fall of 1873 compared with the averages of many years.

From this it may be again seen that with rare local exceptions the rain-fall of 1873 was considerably below the average, and that also, as a general rule, the deficiency was not confined to any one portion of the year, but that it was fairly distributed throughout the season. As might be expected, however, the deficiency was not equally distributed throughout the province, and the variations exhibited some peculiar features which led Mr. Blanford to believe that "while the monsoon current as a whole was either "unusually weak or unusually dry, that portion "which came from the Bay of Bengal failed to a "greater extent than that which came from the "Arabian Sea." This failure of the rains was greatest in the division of Rajshahye, where the deficiency amounted to between 40 and 60 per cent. of the average, and in the Bhagulpore division generally it was almost equally great. In Northern Tirhoot the deficiency averaged from 25 to 40 per cent. of the normal fall, but in the Patna division generally, and in the Monghyr district of the Bhagulpore division, the deficiency was not so great, and on the average it was scarcely so much as 20 per cent. In the Chota Nagpore division the fall was somewhat in excess of the average, and at the two stations Hazaribagh and Ranchee the excess amounted to about 15 per cent. Even in these districts, however, the partial failure of the crops, which is said to have happened, appeared to have been produced rather by the early cessation of the rains than by any absolute deficiency in their total quantity.

In the deltaic districts of Lower Bengal the deficiency was on the average from 30 to 40 per cent.; but this amount varied, and in the western district the rain-fall was much nearer the normal amount than in the eastern. In one station on the west, at Sooree, there was indeed an actual excess above the average fall. In the eastern division of this Presidency the deficiency was about 20 per cent. of the average fall; but even this statement is liable to exceptions, for at Noakholly 17 per cent. above the average fell. The greatest local deficiency appeared to be in the Assam Hills, for in the case of Cherapoonjee the rain-fall was no less than 241 inches below the average, or about 46 per cent. of the normal amount. The rain-fall in India in this year appeared to be above the average on a line running nearly north and south through Hazaribagh, Ranchee, Jhansi, and Agra, that is, on or about the line where the monsoon current from the Bay of Bengal meets with the monsoon current coming from the Arabian Sea.

In the two last months of the rains (September and October), which perhaps may be considered almost of the greatest importance from an agricultural point of view, there was very considerable deficiency, and it may be noticed that in those divisions which suffered most from famine that the rain-fall was so considerably deficient as to almost cease in September, and in all probability this early cessation of the rains was one of the chief, if not the chief, cause of the famine which occurred.

Mr. Blanford, in his review of the Meteorology of the year 1873, says, "I think it not improbable that "the dryness of the year was in great part due to a "persistent barometric depression in the south-east "of the Bay, probably extending also both eastward; "but the irregular (barometric) depression in the "upper part of the Gangetic valley, and the high "pressure in Eastern Bengal, were certainly also "influential in the result, as has already been shown "at a previous page of the report."

So far, then, as our present experience goes, it appears that the worst results have been produced by the failure of the latter part of the rains, namely, in the months of September and October, but, as before pointed out, this affects the drier divisions of the western part of this Presidency to a greater extent than the eastern and more humid divisions.

Partial failure of the monsoon at the commencement or at the middle of the rainy season will of course be serious; but it may only be the means of throwing back the crops, and such would be the usual result; but failure of the rains at the close of the monsoon season means destruction of the principal crop of the year, upon which agriculturists in this province principally rely.

No. 1.—STATEMENT showing the RAIN-FALL of 1865 compared with the AVERAGE RAIN-FALL.

Division.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Total of 1865.	Total of Average.
	1865.	Average.	1865.	Average.	1865.	Average.	1865.	Average.	1865.	Average.	1865.	Average.	1865.	Average.	1865.	Average.	1865.	Average.	1865.	Average.	1865.	Average.	1865.	Average.		
Chittagong	0·27	0·71	1·15	0·83	0·73	2·04	5·65	4·96	14·13	10·37	23·43	22·17	30·32	21·11	10·08	18·25	7·63	11·99	2·79	6·89	—	0·87	—	0·21	96·71	109·40
Dacca	—	0·71	1·17	1·12	1·18	1·79	21·93	4·23	19·66	8·50	21·28	16·48	24·41	15·27	8·56	12·74	5·44	10·57	1·38	4·86	0·53	0·20	—	0·13	105·01	76·69
Cooch Behar	—	0·73	—	0·41	—	1·34	—	5·53	—	10·46	—	30·14	—	29·60	—	26·59	—	22·81	—	6·73	—	0·11	—	0·12	—	134·57
Rajshahye	—	0·52	2·23	0·92	1·73	1·60	6·35	3·34	9·27	6·68	14·58	15·21	20·85	14·67	8·42	12·48	6·49	12·37	0·52	5·09	—	0·30	0·87	0·11	71·31	72·78
Presidency	0·16	0·57	2·22	1·10	1·99	1·31	3·19	—	15·88	5·15	8·19	11·63	11·09	10·70	6·83	10·98	10·13	8·43	—	4·96	—	0·32	—	0·10	59·68	57·98
Burdwan	—	0·56	2·23	1·30	3·23	1·42	3·93	2·16	10·90	4·14	11·17	10·00	12·45	11·47	6·77	11·65	8·20	8·62	0·17	5·29	—	0·33	0·63	0·17	59·08	57·11
Bhagulpore	0·07	0·51	1·00	1·26	1·47	0·51	2·50	1·06	7·37	2·96	4·92	9·09	16·16	12·72	10·92	11·24	5·50	9·90	—	3·26	—	0·03	0·95	0·04	50·80	52·58
Orissa	0·12	0·51	1·57	0·73	3·27	0·82	2·85	1·62	12·27	2·83	4·92	16·37	5·10	12·98	6·92	11·46	7·25	9·64	0·15	7·59	—	1·34	—	0·22	44·42	60·11
Chota Nagpore.	0·50	0·61	2·50	0·94	1·95	0·85	0·40	0·76	4·20	1·64	5·10	8·64	11·40	12·95	8·30	11·75	4·30	8·23	—	3·43	—	0·09	—	0·10	38·65	49·99
Patna	0·08	0·63	0·63	0·45	1·78	0·46	2·14	0·54	2·75	1·45	2·12	7·71	12·06	12·12	5·98	10·73	2·82	8·57	—	2·34	0·07	0·02	0·25	0·09	30·68	45·11

No. 2.—STATEMENT showing the RAIN-FALL of 1873 compared with the AVERAGE RAIN-FALL.

Division.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Total of 1873.	Total of Average.
	1873.	Average.	1873.	Average.	1873.	Average.	1873.	Average.	1873.	Average.	1873.	Average.	1873.	Average.	1873.	Average.	1873.	Average.	1873.	Average.	1873.	Average.	1873.	Average.		
Chittagong	0·41	0·71	0·06	0·83	1·32	2·04	6·41	4·96	6·40	10·37	19·99	22·17	19·96	21·11	20·02	18·25	8·73	11·99	4·27	6·89	0·41	0·87	0·67	0·21	88·65	100·40
Dacca	0·10	0·71	0·14	1·12	0·95	1·79	4·78	4·23	5·88	8·50	9·77	16·48	15·10	15·27	15·68	12·74	6·92	10·57	1·55	4·86	0·34	0·20	0·64	0·13	61·85	76·60
Cooch Behar	0·10	0·73	0·22	0·41	1·32	1·34	7·03	5·53	3·81	10·46	35·99	30·14	21·35	29·60	20·44	26·59	14·48	22·81	0·25	6·73	—	0·11	0·18	0·12	105·17	134·57
Rajshahye	0·26	0·52	0·14	0·92	1·03	1·09	3·64	3·34	1·48	6·68	10·58	15·21	9·31	14·67	11·75	12·48	5·16	12·37	0·23	5·09	0·04	0·30	0·25	0·11	43·87	72·78
Presidency	0·12	0·57	0·10	1·10	1·09	1·31	2·12	2·73	3·31	5·15	4·59	11·63	13·81	10·70	11·87	10·98	2·32	8·43	0·22	4·96	0·29	0·32	0·24	0·19	40·68	57·98
Burdwan	0·06	0·56	0·01	1·30	1·52	1·42	2·00	2·16	3·56	4·14	4·41	10·00	16·97	11·47	11·83	11·65	5·48	8·62	0·69	5·29	0·17	0·33	0·51	0·17	47·21	57·11
Bhagulpore	0·24	0·51	—	1·26	0·84	0·51	0·97	1·06	0·74	2·96	4·78	9·09	12·21	12·72	10·61	11·24	4·94	9·90	0·03	3·26	0·01	0·03	0·16	0·04	35·53	52·58
Orissa	0·08	0·51	—	0·73	1·00	0·82	1·03	1·62	3·08	2·83	3·74	10·37	11·48	12·98	12·87	11·46	6·57	9·64	5·58	7·59	0·52	1·34	0·50	0·21	46·45	60·11
Chota Nagpore.	0·03	0·61	0·01	0·94	1·55	0·85	0·91	0·76	1·14	1·64	2·76	8·64	19·49	12·95	13·27	11·75	7·75	8·23	0·29	3·43	0·04	0·09	0·19	0·10	47·43	49·99
Patna	0·31	0·63	0·03	0·45	1·42	0·46	0·30	0·54	0·52	1·45	3·56	7·71	15·54	12·12	9·64	10·73	2·24	8·57	0·01	2·34	0·01	0·02	0·12	0·09	33·70	45·11

CENTRAL PROVINCES.

The watersheds are these,—

The Vindhyan.
The Nerbudda.
The Tapti.
The Satpura.
The Godavari.
The Mahanadi.

The "Vindhyan" comprises the north and south escarpments of the Vindhyan range; the Ganges receives the waters of the former, and the Nerbudda those of the latter; the districts of Saugor, Damoh, and the subdivision Murwara are in this area.

The "Nerbudda" embraces the valley of the Nerbudda situated between the Vindhyan and Satpura ranges; it includes the districts of Jubbulpore, Narsinghpur, Hoshangabad, and Nimar. The Nerbudda river receives the waters of this tract.

The "Tapti" lies to the west of the main spur of the Satpura range; and in the Central Provinces is confined to the subdivision of Burhanpur and a part of Betul; it is drained by the Tapti river.

The "Satpura" division comprises the high lands of the Central Provinces running from east to west; the districts are Mandla and Balaghat, Seoni, Chhindwara and Betul. The drainage of the northern slopes falls into the Nerbudda, that of the western reaches the sea by means of the Tapti, and that of the southern is carried by the Godavari into the Bay of Bengal.

The "Godavari" comprises the plain country south of the Satpuras; the districts from east to west are Bhandara and Chanda, Nagpur and Wardha; the Godavari river receives the drainage of this tract.

The "Mahanadi" division comprises the plains of Chhattisgarh and Sambalpur; this tract is drained by the Mahanadi.

These divisions indicate the rain-fall systems. Striking the most western portion of the provinces in the Tapti division, the monsoon currents are divided by the Satpura range into the northern and southern, local peculiarities of hill and forest increasing or diminishing the amount of rain-fall. The higher ranges of hills, as Pachmarhi or the Mahadeo group, and the more eastern or trap formation, as the Mohtoor range, receive the heaviest rain-falls, which reach about 80 inches; whilst Burhanpur receives the lowest, or on an average about 28. Passing eastwards the rain-fall increases: thus Khandwa receives about 35, Hoshangabad 47, Narsinghpur 55, Jubbulpore 60, and the Vindhyan districts about 55. Similarly the hill districts receive from 40 on the western border to 60 on the eastern. Passing onwards over the southern part of the provinces, the monsoon strikes the Wardha district first, where the fall is about 35 inches, Nagpur receives 40, Chanda 43, and Bhandara 50, the plains of Chhattisgarh receive between 40 and 50, and the most eastern district, Sambalpur, receives 55 inches; this district and part of Chhattisgarh receives a portion of its rain-fall from a north-easterly direction.

The south-west monsoon commences in June; occasionally within the first 10 days; at other times it is delayed until the third week; it continues until some time in September and occasionally until October.

The eastern districts receive also some rain from a north-easterly direction, but particular observation has not hitherto been directed to this question.

Rain-gauges are kept at head-quarters of districts and of tahsils; also at meteorological observatories, where the officials attached to the Courts and observatories respectively keep up the registers. The following table gives the results recorded for the past 10 years. Registers are also kept at dispensaries.

AVERAGE RAIN-FALL registered in the several DISTRICTS of the CENTRAL PROVINCES for 10 YEARS, from 1868–1877.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1868	1·62	0·28	0·50	0·07	0·46	7·25	9·61	5·76	4·80	0·09	—	0·07	30·51
1869	0·08	0·12	0·77	0·17	0·37	4·26	15·54	12·51	10·96	3·93	0·02	0·67	49·40
1870	1·22	0·12	1·02	0·52	0·02	10·76	16·94	8·30	7·41	3·27	0·59	—	50·17
1871	0·56	0·49	0·04	0·13	1·03	12·54	15·37	6·61	10·96	0·13	0·22	0·18	48·26
1872	0·03	0·06	0·85	1·00	0·05	8·43	15·80	14·32	8·53	1·88	0·04	0·67	51·26
1873	0·21	0·36	0·53	0·07	0·76	3·11	13·29	9·99	11·35	0·23	0·01	0·25	40·16
1874	0·45	0·23	0·19	0·04	0·69	12·80	16·82	15·82	6·83	0·90	0·05	0·03	54·85
1875	0·26	0·49	0·01	0·11	0·48	10·92	20·60	10·39	10·22	2·11	0·01	0·05	55·69
1876	—	—	0·17	—	0·12	3·89	17·44	13·66	8·89	0·41	—	—	44·58
1877	2·98	0·90	0·66	1·88	2·19	9·13	10·04	12·34	3·75	2·63	0·24	1·45	48·19
Mean	0·74	0·30	0·42	0·40	0·62	8·33	15·14	10·97	8·37	1·56	0·12	0·34	47·31

CHAP. I. QN. 1.

CENTRAL PROVINCES.

Dr. Barter and Mr. Nicholls.

In a report on the variation of rain-fall in tropical India, dated 18th of May 1877, by the Meteorological Reporter to the Government of India, the rain-fall for Nagpur and Jubbulpore for a series of years is given. Thus the average rain-fall for Nagpur for the years 1855–1876 inclusive was 39·85; the highest annual rain-fall was 57·75 inches in 1867, and the lowest was 25·49 in 1868. The average for Jubbulpore for the years 1845 to 1876 inclusive was 53·26; the highest being 86·93 in 1874, and the lowest 28·30 in 1868.

The Sanitary Commissioner's statistics show that the average fall for the provinces in 1868 was 30 inches; the Jubbulpore district received 28·3, Raipur 35·8, and Bilaspur 29·0, and in these districts there was a famine; but in Jubbulpore, if not in the other districts, there were predisposing causes; in other districts also, which received light falls, there was considerable distress,—thus in the Seoni district, which received 31·4, although there was not a wide-spread famine, there was widespread distress; but in this district, when times are hard, a large section of the community subsists on jungle produce, as berries, fruit, roots, &c., or eke out an existence with their aid; here then the effects of scarcity would not be so marked. The average rain-fall for the provinces during the months August, September, and October, for the 10 years ending 1867, and the fall during these months in 1868, is here given.

	Ten years.	1868.
August	9·50	4·60
September	6·40	1·70
October	1·20	0·10

But the amount of rain absolutely required depends, to no small extent, on the nature of the fall. Should this occur in plumps or heavy falls, and, as a necessary consequence, run off the ground and be followed by long breaks, a larger rain-fall will be necessary; but should light constant showers occur with occasional or a few heavy downpours at the critical periods of transplanting and earing—and sufficient to fill tanks—in rice-growing districts, then a smaller quantity in the aggregate will be sufficient.

Again, the nature of the crops raised governs the minimum required; rice-growing lands demand a larger rain-fall than the heavy black soils where wheat, joár, &c. are grown; in the former, if fairly distributed, 35 to 40 inches may be regarded as the minimum; and in the latter 27 to 35, varying in different districts.

But an excessive or an unseasonable rain-fall may also do considerable damage and cause much distress; the unseasonable and, in some places, excessive rain of the past cold season has resulted in a general rust or blight of the wheat crop, a short linseed crop, and destruction of the gram crop and masur.

We consider the minimum for rice lands to be from 35 to 40 inches, varying in different districts, provided also that the distribution be fairly opportune.

For black cotton soils we consider that from 27 to 35 would be absolutely requisite, varying in different districts. But the distribution is not of such vital importance, provided that no considerable portion of this total amount comes in torrents so as to run off and not sink into the soil, and that at least three inches fall late in September. This is of especial importance for the sake of the rabi sowings.

As for the maximum, the black cotton soil could stand 50 inches in the monsoon, provided that there are intervals of sunshine to strengthen and give health to the plants, and to allow of weeding and the banking up of the earth around the roots of the joár and cotton plants, done by a small plough four or five times in the rains.

For rice lands, provided there are intervals of sunshine, too much rain is difficult to imagine, provided that it does not fall heavily after the middle of October. Kodo and kutki are generally sown on sandy soil and on sloping ground, and so can hardly be injured by excess of rain.

The black cotton soil, after a tolerably good monsoon, has produced fair crops without the aid of winter rain.

Rain not exceeding three or four inches, from the middle of December to the middle of January for the southern districts, extending to a fortnight later for the northern districts, will be of immense advantage, but rain in excess of this amount greatly increases the risk of blight. A long continuance of cloudy weather at this time is still more dangerous.

For the rice districts and tracts rain is absolutely necessary only during the monsoon. Probably the following distribution is necessary to produce fair crops in all these tracts,—Chhattisgarh, Sambalpur, the Bhandara rice country, including Balaghat and Chanda, and the north of Betul and Chhindwara, and the sandy soils of Saugor, Damoh, and Jubbulpore.

June, 2nd half	3 inches	Sowing.
July, 1st half	4 „	
July, 2nd half	8 „	Transplanting.
August, 1st half	8 „	
August, 2nd half	4 „	Sunshine and showers.
September, 1st half	6 „	Earing period of early rice.
September, 2nd half	7 „	
October, 1st half	4 „	Earing of late rice.
	44 „	

The black* cotton soils require, to produce fair crops:—

June, 2nd half	3 inches	Sowings.
July, 1st half	4 „	
July, 2nd half	4 „	
August, 1st half	4 „	Showers and sunshine required for weeding operations.
August, 2nd half	4 „	
September, 1st half	6 „	
September, 2nd half	7 „	Blossoming of cotton and joár.
October, 1st half	2 „	Rabi sowing.
December, 2nd half	1 „	Earing of rabi crops. Southern districts.
January, 1st half	2 „	
January, 2nd half	2 „	Northern districts.
	38 „	for southern districts.
	39 „	for northern districts.

These figures are intended to cover all districts. Some localities could do fairly well with something less.

The sowings and the maintenance of the crops, including the transplanting of the rice, depend on the south-west monsoon.

It is doubtful whether we have any other than the south-western monsoon. But the October showers called the "Hathi," or elephant showers, come from the east or south-east.

These rains are partial and uncertain, but are of great importance to strengthen the late rice and joár and cotton when in blossom, and to keep the rabi lands from hardening, and to reduce the temperature of the surface of the earth to fit it for the germinating of the seed. The winter showers generally come from the north-east, and strengthen the wheat and other crops at the critical time of earing or blossoming.

* Nagpur division, except the Bhandara rice field; the west of Chhattisgarh; the Jubbulpore division, save the north of Saugor, of Damoh, and of Jubbulpore; and all the Nerbudda division, except the north of Betul and Chhindwara.

BERAR.

Mr. Dunlop.

The province of Berar, the area of which is 17,711 square miles, is geographically divided into three sections.

On the northern side is the Melghat forming a portion of the Satpura range of mountains. Its area is 1,649 square miles.

On the southern side is the Balaghat or up-land country, comprising the Ajunta ridge, and sloping down southwards from thence to the Hyderabad territory, and between these two ranges of hills lies the Pyanghat or low-land country, an extremely fertile valley running the entire length of the province from east to west, with a breadth of from 40 to 50 miles.

The Melghat is chiefly forest land; there is but little cultivation.

The Balaghat country includes the whole of the Wun and Basim districts, and the greater portion of the Buldana district.

The Pyanghat country includes the whole of the Amraoti and Akola districts, the Ellichpur district (except the Melghat), and one Taluka of the Buldana district.

Roughly speaking, the Balaghat and Pyanghat tracts are about equal in area, each comprising about 8,000 square miles.

The monsoon rains are heaviest in the Melghat, and lightest in the Pyanghat country, the average rain-fall at the head-quarter stations in these three divisions being as follows :—

		Inches.
Melghat		57·57
Balaghat	Wun	41·08
	Basim	38·66
	Buldana	29·06
	Average	36·26
Pyanghat	Amraoti	32·99
	Akola	28·98
	Ellichpur	28·06
	Average	30·03

Exclusive of the Melghat, the chief drainage of which is northwards into the Tapti river, the average annual rain-fall on the province in the past six years has been 33·88 inches.

The south-west monsoon commences about the second week in June, and continues until the end of September or beginning of October. In normal years we have showers from the east or north-east in December or January which are beneficial for the late crops, but it is on the south-west monsoon that we are really dependent for our rain-fall.

BOMBAY.

Mr. Peile.

The rain-fall of the Bombay Presidency is derived from the south-west monsoon between June and October. From certain natural causes, the quantity of rain precipitated from this current varies greatly and regularly from north to south, being smallest in Sind and greatest in Canara. Thus the average fall from north to south is—

		Inches.
Sind		8·42
Katch		14·30
Kattywar		24
Guzerat		33
North Konkan		68
Bombay		73
S. Konkan	Colaba	108
	Vingorla	112
Kanara—Honawar		152

But the line of the Ghats, running parallel to the coast throughout the south of the Presidency from 50 to 30 miles from the sea, causes another variation. On the Ghats or Sahyadri range the average fall is 215 inches. The plain above them is a high plateau sloping from 2,000 feet above the sea at the Ghats to about 1,400 feet on the east frontier. This plateau may be divided into three parallel tracts—(1.) That immediately east of the Ghats, or West Deccan. The average fall in the West Deccan is 33 inches. (2.) The East Deccan. The average fall of the East Deccan is 23 inches. (3.) The tract between the East and West Deccan, which is drier than either, the rain-fall being 20 inches in the south of Kaladgi and east of Dharwar, and at Siroor (Poona), and Niphad (Nassick.) This is the district which requires protection from failure of the rain-fall. In the extreme East Deccan the fall is larger, owing to the recurve of the monsoon. Especially in September and October the rain-fall is larger in the East Deccan, and particularly in the south part of it, than in the Konkan or Guzerat.

Mr. Chambers.

In order to obtain in tabular form a general and concise view of the rain-fall of the Presidency, I have selected the rain records of the following stations, and grouped them as shown below :—

(a.)

Sind.	Guzerat.	Konkan.	Sahyadri Range.	North Deccan.	South Deccan.	West Deccan.	East Deccan.
Kurrachee.	Surat.	Karwar.	Matheran.	Dhulia.	Satara.	Nasik.	Ahmednagar.
Sehwan.	Broach.	Honawar.	Mahableshwar.	Nasik.	Sholapur.	Malegaon.	Sholapur.
Tatta.	Kaira.	Vingorla.	Igatpuri.	Malegaon.	Kolhapur.	Poona.	Gokak.
Hyderabad.	Godhra.	Ratnagiri.		Ahmednagar.	Belgaum.	Satara.	Hubli.
Umerkot.	Ahmedabad.	Colaba Observatory.		Poona.	Gokak.	Kolhapur.	Nargund.
Nagan.	Boria.				Hubli.	Belgaum.	Kalghatgi.
Shikarpur.	Edar.	Tanna.			Nargund.		Bijapur.
Rohri.	Palanpur.				Kalghatgi.		
Jacobabad.	Rajkot.				Bijapur.		
	Deesa.						

The rain registers of the above stations are sufficient to show with tolerable accuracy the salient features of the rain-fall distribution of the Presidency. The normal monthly and annual rain-fall for each of these groups of stations is given below :—

Districts.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Sind - - -	0·37	0·23	0·27	0·10	0·14	0·60	2·78	2·82	0·72	0·12	0·12	0·15	8·42
Guzerat - - -	0·02	0·21	0·03	0·02	0·38	4·55	11·32	10·14	5·46	0·56	0· 5	0·05	32·89
Konkan - -	0·56	0·00	0·08	0·21	1·23	31·77	35·72	20·64	11·77	2·90	0·62	0·09	105·59
Sahyadri Range - -	0·28	0·01	0·23	0·46	0·78	38·23	83·09	59·83	26·75	4·59	0·50	0·13	214·88
North Deccan - -	0·42	0·05	0·10	0·34	0·76	5·18	4·72	4·29	4·38	2·92	0·66	0·24	24·06
South Deccan - -	0·15	0·02	0·26	1·00	1·71	5·52	6·68	4·88	3·35	4·24	0·59	0·75	29·15
West Deccan - -	0·25	0·03	0·15	0·91	1·36	6·94	9·43	6·15	3·86	3·74	0·84	0·30	33·96
East Deccan - -	0·20	0·03	0·28	0·75	1·56	4·27	3·39	3·57	3·71	4·11	0·44	0·86	23·17

In Guzerat, the Konkan, along the Sahyadri Range, and in the western portions of the Deccan bordering on the Sahyadri Range, the rain comes chiefly from the west and south-west, but it also falls in the monsoon months (June to September), during calms and in unsettled weather. In Sind and in the eastern portions of the Presidency rain seldom falls when the westerly monsoon wind blows with full force, but usually during the temporary cessations of the westerly wind and when the wind is from the eastward. The rain which falls on the Deccan in the month of October comes almost exclusively from the eastward.

With reference to "*the effect on the crops of the* "*failure of any of these elements of rain-fall, and* "*the combination of circumstances under which the* "*worst results have been produced*," I would point to the great per-centage deficiencies (given below in table (*e*)) of the rain-fall on the Deccan (particularly in the southern and eastern portions) in the three successive months (August, September, and October). The failure of crops on the Deccan in 1876 appears to have been chiefly due to this continued deficiency of rain.

The most important factor amongst the causes which determine a famine is probably a deficiency of the usual rain-fall. It is of this factor that I possess personal knowledge, and to which my remarks will therefore be confined.

Those portions of the country which have the smallest normal rain-fall will be most subject to famine, and those in which the normal rain-fall is heavy will be freest from it, not only because the rain-fall is usually small in amount in the former districts and large in the latter, but chiefly because the *per-centage variation* of the rain-fall in districts where the fall is normally small, is greater than in those where the fall is usually large.

Sind, the Thar, and portions of Rajputana are examples of regions in which food grains cannot be grown without irrigation, on account of the scantiness of the normal rain-fall; the Konkan and along the Sahyadri Range, of regions of normally heavy rain-fall, in which the fall of any individual year is rarely or perhaps never less than 50 per cent. of the normal quantity, and in which a total failure of the crops will very rarely or perhaps never happen. The remaining districts of the Presidency occupy positions intermediate between these two extremes, and it is in these districts mainly that a deficiency of rain is most severely felt.

The comparative greatness of the per-centage of the rain-fall in districts where the rain-fall is normally small may be illustrated by a consideration of the rain-fall distribution of the famine years 1876 and 1877.

A similar discussion of the per-centage rain-fall distribution of a large number of past years would doubtless be very informing, and would afford a broader basis on which to found any general conclusions, but this is a work requiring special provision for its accomplishment, and therefore at present impracticable.

The most convenient numerical form in which to study the rain-fall for practical purposes appears to be that of per-centages of the average fall. When put into this form the variations of the rain-fall may be taken as a comparative measure of their effects on the crops in different districts, an advantage which cannot be claimed for the numbers representing the absolute variations, for in a district where the average absolute fall is great a variation of a few inches more or less is of little consequence, whereas a variation of the same absolute amounts in districts where the fall is usually scanty might determine the success or failure of agricultural operations. The rain-fall of each district in the monsoon months (June to October), and the total for the year, is given in the per-centage form for the years 1876 and 1877, and in the two following tables:—

(*c*.) PER-CENTAGES of NORMAL RAIN-FALL in 1876.

Districts.	June.	July.	Aug.	Sept.	Oct.	Year.
Sind - -	8	173	114	57	—	112
Guzerat - -	31	107	100	117	—	92
Konkan - -	72	96	48	60	—	70
Sahyadri Range -	47	121	87	44	—	85
North Deccan -	87	102	79	25	5	59
South Deccan -	55	143	42	33	8	62
West Deccan -	63	141	64	29	11	71
East Deccan -	55	111	35	31	5	47

(*d*.) PER-CENTAGES of NORMAL RAIN-FALL in 1877.

Districts.	June.	July.	Aug.	Sept.	Oct.	Year.
Sind - -	18	8	—	290	117	54
Guzerat - -	60	30	8	99	612	53
Konkan - -	88	34	78	81	348	73
Sahyadri Range -	66	52	49	69	142	58
North Deccan -	124	39	97	85	88	88
South Deccan -	139	31	92	303	189	125
West Deccan -	128	29	74	165	137	83
East Deccan -	149	38	95	268	183	142

The figures given above show what per-centage of the normal fall of each month was received in each district; and the numbers given below show for the same years the *per-centage variation* (*i.e.*, excess or defect) from the normal quantity for each of the wet months of the year, which are June to October in the Deccan, and June to September elsewhere.

(*c.*) PER-CENTAGE VARIATION of the RAIN-FALL of each DISTRICT in the YEARS 1876 and 1877.

Months.	Sind.	Guzerat.	Konkan.	Sahyadri Range.	West Deccan.	East Deccan.	North Deccan.	South Deccan.
1876.								
June	− 92	− 69	− 28	− 53	− 37	− 45	− 13	− 45
July	+ 73	+ 7	− 4	+ 21	+ 41	+ 11	+ 2	+ 43
August	+ 14	—	− 52	− 13	− 36	− 65	− 21	− 58
September	− 43	+ 17	− 40	− 56	− 71	− 69	− 75	− 67
October	—	—	—	—	− 89	− 95	− 96	− 92
1877.								
June	− 82	− 40	− 12	− 34	+ 28	+ 49	+ 24	+ 39
July	− 92	− 70	− 66	− 48	− 71	− 62	− 61	− 69
August	− 100	− 92	− 22	− 51	− 26	− 5	− 3	− 8
September	+ 190	− 1	− 19	− 31	+ 65	− 164	− 15	+ 203
October	—	—	—	—	+ 37	+ 83	− 12	+ 89
Sums	686	296	243	307	501	648	321	713
Means	85	37	30	38	50	64	32	71

The mean monthly per-centage variation for each district in the years 1876 and 1877 is obtained by taking the sum of the per-centage variations irrespective of signs, and dividing by the number of months. Arranging below these mean results in the order of the total annual rain-fall of each district, we find that the per-centage variation of the rain-fall is much greater in Sind and in the Deccan, where the normal rain-fall is small, than in the Konkan and Guzerat, where the normal fall is more considerable.

—	Sahyadri Range.	Konkan.	Guzerat.	Deccan, mean of East and West.	Sind.
Total normal annual fall in inches.	215	106	33	29	8
Monthly per-centage variation from normal.	38	30	37	57	85

This conclusion is the same as that given in my "Brief Sketch of the Meteorology of the Bombay Presidency in 1877," from which I quote the following passage :—

"Arranging below the per-centages of this month (July 1877), in the order of the absolute normal fall of each district, we find that there is a well-marked similarity of progression in the two sets of numbers :—

—		Sahyadri Range.	Konkan.	Guzerat.	West Deccan.	Sind.
July	Normal fall	83·09	35·72	11·32	9·43	2·78
	Per-centage fall in 1877.	52	34	30	29	8

"From these numbers it appears that when the rains directly dependent on the south-west monsoon current are deficient, the failure is most serious in those districts where the normal rain-fall due to this particular current is least, and that the failure does not affect in the same proportion those regions where the rain-fall is heavy. This is what might be expected from theoretical considerations, and the conclusion has an important bearing on any protective measures against the effects of famine that may be in contemplation for the benefit of these districts, for it shows very clearly that those regions which are subject to the greatest per-centage variations of their rain-fall are identical with those in which the rain-fall is normally scanty, and that, comparatively speaking, those in which the normal rain-fall is heavy may be left to take care of themselves, since the per-centage variations of rain-fall in those districts are comparatively small."

Mr. Peile.

The following is a summary of the answers to the latter half of question 1, the districts being taken in their order from north to south.

Kutch.—(Average fall 14·30 inches.) A fall of 10 inches would suffice well distributed, thus—

July	5 inches.
August	1 „
September	4 „
June	5 inches.
July	10 „
August	7 „
September	6 „
October	2 „
Total	30 „

Kathiawar.—(Average fall 24 inches.) A fall of 20 inches is necessary for a good crop. In June 6 inches are required for sowing cotton, millet, til, and inferior grain. Sowing goes on to July 1. In July 5 inches, and in August 4 inches are wanted to develop the crops; in September 4 inches. For sowing the cold weather crops in October a fall of 5 inches is desired. These are wheat and rice. The failure of the July and August rain causes the early crops to wither. Failure of the October rains endangers the wheat and rice.

Kaira.—All depends on the way the rain-fall is distributed. The following falls would give full crops :—

Surat.—No serious damage if the rain-fall is not less than half the average (average 42 inches).

Khandesh.—15 inches of rain falling advantageously, better than 30 inches badly distributed. After the first burst of 4 or 5 inches, a fall of 4 inches per month for four or five months sufficient. A combination of scanty rain and excessive heat produces the worst results.

Nasik.—A fall of 25 inches, if seasonable, is sufficient. Heavy rain coming when not wanted often does harm. Rain is required before sowing in June, after that a few falls at intervals, and good rain in September to enable the crops to ripen. Rabi crops are sown after the October rain, and require showers in December.

CHAP. I. QN. 1.
BOMBAY.
Mr. Peile.

Poona.—The early crops are sown after the first fall of rain from the beginning of June to the end of July. A second fall is required in August to mature the crops. Further rain is necessary in September. Showers in October, November, and December are of great benefit to the rabi crops. If the rain falls seasonably, a small quantity only is required, about 15 inches being sufficient, well distributed.

Ahmednagar.—The monsoon season may be divided into the periods (1) from June 10th to August 15th, and (2) from September 1st to October 15th. A fall of 15 inches between June and October would give good crops if the rain fell favourably. This happened in 1873–74 in the Kopergám taluka. A fall of 30 inches would not cause damage. The kharif crop is principally bajra, sown in June or July, reaped in November or December. The rabi crop is wheat, jowári, and gram, sown in September, and reaped in February or March. Near the Western Ghats (Akola taluka) rice and nagli are also grown.

Sholapur.—The crops depend more on the time at which the rain falls than on the quantity. Kharif crops (quarter of the whole) are sown in June or July, as the rain falls; rabi crops in September and October.

Kaladgi.—The Collector says the district is dependent on the monsoon for its rain-fall, and chiefly so on the south-west monsoon. The rain generally falls at intervals between May and October. A little often falls in April, but that is only useful as replenishing the water supply.

The average amount gauged in each of the months when the rain is useful for agriculture is as follows:—

	Inches.	Cents.
May	1	67
June	3	91
July	1	49
August	3	23
September	7	1
October	4	4

The average fall for the year being 22 inches 64 cents. It is difficult to give any limit within which the rain-fall may vary without doing serious injury. The actual amount gauged is scarcely a criterion, because a heavy fall of a few hours may gauge much, but be of little good if it ceases entirely, whereas a gentle but continuous rain, which does not gauge much, may be most beneficial. For instance, the rain-fall in June 1876 (6 inches 83 cents) is the highest recorded in the 10 years, but yet that was the great year of famine. The rain in September 1877 (12 inches 3 cents) did infinite damage from its heaviness, whereas I cannot learn that that of September 1874 (22 inches 6 cents) did. Again, the fall of 1876 (13 inches 40 cents) resulted in severe famine, whereas the fall of 1871 (13 inches 92 cents) did not cause any bad effects. In that latter year the rain may be said to have fallen seasonably though scantily, and I would take the aggregate and monthly fall during it as a criterion of what is sufficient.

I believe from what I hear, and judging from the present year, the rain-fall may almost entirely fail in June and to the middle of July without causing serious injury, provided the rain falls seasonably afterwards.

Up to the middle of August the sowing of the kharif crops is dependent on the rain-fall, and from that time till the end of October the sowing of the rabi crops is so dependent.

If the rain fails, the crops either cannot be sown or get withered up. During 1876 the rain so fell that it was of benefit to neither crop, so that famine resulted.

Satara.—The Collector says the regular rain-fall takes place from about the 20th June till the 30th September. This is the westerly monsoon, on which the greater part of the district depends. It does not as a rule penetrate more than 20 miles east of Satara. The eastern part of the district depends upon storms at irregular intervals, from the 15th May to the 15th June. Some easterly rain occasionally falls about Christmas and in March or April. I consider that a fall of 32 inches, if favourably distributed, is sufficient for the district, but we cannot well do with less. The variation, therefore, should be between 32 inches and 53 inches. We require rain from May 15th to January. The minimum fall, if favourably distributed, would be—

May	3 inches.
June	9 „
July	5 „
August	5 „
September	5 „
October	4 „
November	— „
December, January	1 „
Total	32 „

The May rain is required to prepare the fields and to cause the grass to begin to spring, so as to be ready to receive the westerly monsoon in June. About 5 of the 9 inches in June should fall between the 5th and the 20th of that month, so as to enable the cultivators to complete the preparation of their fields and to sow bajra in the east, early jowári and pulses in the centre, and rice and nachni in the extreme west of the district. The remaining 4 inches will cause the seed to germinate, and the crops to grow. The 5 inches in July should fall about the middle of the month, to enable bajra to be sown in the centre of the district. The rain in August and September is necessary for the proper growth of the crops, and if an inch or two falls at the end of September, with 4 inches at the beginning of October, the rabi crop can be sown, and will flourish, but it needs an inch in December or January, about Christmas or New Year's day, to help it on. If rain does not fall in May or June, the grass crop will probably fail in the centre and west of the district, and rice will probably not be sown. If rain falls early in June, and if there is a long break, the rice and nachni will wither. If rain does not fall in June or July, the kharif crop will not be sown. I give up to the 20th July for sowing kharif. If good rain falls in June and none in July or August, the kharif will be lost. If seasonable rain falls at the end of September and the beginning of October, the rabi crop will thrive. If none falls in September and October, but early in November, the rabi crop will not be so good; if no rain falls in September, October, or November, the rabi crop will fail. The worst results in this district have been produced by the failure of easterly rain, and a scanty fall from the west in June and July.

Dharwar.—Mr. Charles says the normal system of rain-fall in Dharwar may be divided into three periods. The first is from the middle of April till the end of the first week in June. During this period there should be heavy thunderstorms about every 10 or 15 days, with falls of from half to 2 inches, generally from the east. These falls are necessary for the rice fields all along the western side of the district, to enable the rice to be sown before the end of May. East of Hubli these rains are of no particular use, as in the black soil there is no rice, and no crops are sown before the end of June or beginning of July.

The next period is that of the S.W. monsoon, and lasts from the middle of June till the middle or end of September. The monsoon should begin with about a week of heavy rain, that is to say, heavy showers lasting some hours every day, to moisten thoroughly all the land intended for early jowári and nachni. After a week's rain, there should be a week of nearly fair weather, to enable fieldwork to go on, and early sowings of jowári should begin in the beginning of July.

The whole of July should be wet, with but few entirely dry days. August is generally a dry month, in average years the rain-fall being from 2 to 3 inches only. September should be moderately wet, with many fine days.

October is the month that exercises most influence on the harvest, and unfortunately it is also the month which has the most uncertain rain-fall. If there be no rain-fall at all, as was the case in 1876, the cotton, later jowári, and wheat crops are entirely lost, as happened in 1877.

If it be unprecedentedly heavy, as in 1877, the early jowari is injured and the ears sprout, as was seen in November 1877.

The October rain comes entirely from the east, and is not of the nature of steady rain, but comes in sudden and very heavy downpours, lasting an hour or two.

The total rain-fall in October should be about 6 inches, from half an inch to 2 inches falling in one heavy plump every few days. This gives all the moisture necessary for the cotton and wheat and later jowári crops, and after October the less rain that falls the better both for the harvesting of the early jowári crop and for the cotton and wheat and rabi crops generally. But few seasons pass without a few days of rain, often heavy, in December and January, and any excess causes mildew in the wheat. This refers to the east of the district only, as the rice and early jowári are cut in November and the beginning of December, and rain in January matters little in these parts.

Ratnagiri.—The Collector says we are dependent on the south-west monsoon, which comes about the 5th of June, and continues, with breaks, up to 15th October.

The rain-fall is gauged at every one of the 12 Taluka and Mahal head-quarters, and also at the civil hospitals at Ratnagiri, Vingorla, and Dapoli. The average rain-fall in the past 20 years has been as follows:—

	Inches.	Cents.
In June	29	49
„ July	32	57
„ August	18	2
„ September	12	33
„ October	2	59

The average fall in the year is 97 inches 62 cents; this would be a fair and sufficient amount. A smart fall for about 10 days is required with the burst of the monsoon, to enable the people to sow their seedling patches of rice and plough up their other lands, ready for soakage before transplantation. A break with light showers for a fortnight would then be serviceable.

In July there should be very heavy rain and storms. In fact there can then hardly be too much rain. During that month the ryot will be first soaking (by swamping) his lands, and will then be occupied in transplanting.

Heavy and steady rain with intervals of sunshine should follow throughout August, when the ryot will be weeding his fields.

Lighter rain and more sun should follow in September. At the end of September a few heavy falls will be seasonable. Early in October the "halway" or early crops on the uplands will be ready to cut.

About the middle of October heavy rain for some days will be seasonable, and conduce greatly to a good "warkas" or hill-crop season.

A late monsoon, therefore, results in a diminished area of cultivation, because the ryot has too short an interval between the first fall and the very heavy rains of July, and in a lighter crop, because the seedlings have not grown sufficiently strong for transplanting when the heavy rains come.

A drought in September and October necessarily results in the drying up and withering of the hill crops.

A combination of a late monsoon, therefore, with drought in September and October, brings ruin to the crops of the Konkan, especially to the hill crops.

Canara.—For rice crops on the coast the rain-fall should not exceed 120 inches or be less than 85 inches. In the latter case the fall should be spread through four months. Above Ghâts the fall may be as low as 30 inches. Rice land and the areca nut, cardamom, pepper, and cocoanut gardens are prepared and sown in May. The monsoon is expected by June 5th. Rice transplanting takes place in June and July. A second crop of rice is sown in December in the moistest lands. A deficiency of rain in June or July defers sowing, in August parches the crops, in September diminishes the out-turn. A total failure in June and July would produce the worst results.

Thana.—When the monsoon begins in June or July, the ground is ploughed and the rice seed sown in nurseries previously prepared with ash manure. A copious fall of rain in July is needed to prepare the fields to have the rice transplanted into them. After this sunshine and light showers for three weeks, and then a good fall is needed to fill the grain. Dry weather is required in October and November, when the crops are cut. Failure of timely rain injures the crop, but no disaster worse than a partial failure from scanty rain is recorded.

Colaba.—Rice is the staple crop. A seasonable rain-fall would be—June, 20 inches; July, 20 inches; August, 30 inches; September, 15 inches; October, 5 inches. Failure of rain when the rice is sown and transplanted is fatal to the crops.

SINDH.

Sindh lies just outside the regular track of the south-west monsoon. Its rain-fall is therefore fluctuating, and as a rule scanty. The average annual fall is about 7 inches. The minimum may be put at 2½ inches; the greatest fall recorded since 1856 has been 28·45 inches. Excluding the rare years in which the fall is excessive, the average is about 5 inches. (Sindh Gazetteer, from observations of Kurrachee Meteorological Observatory.) The following are the monthly averages as recorded at five principal stations representing northern, central, eastern, and southern Sind.

Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Shikarpur	·34	·29	·51	—	·64	·20	·95	2·49	·30	—	—	·13
Sehwan	·31	·10	·14	·3	·16	—	1·31	3·30	·87	—	—	·18
Umarkote	·7	·14	—	—	·11	·20	3·97	2·30	·2	—	—	·8
Hyderabad	·30	·29	·12	·5	·1	·57	3·13	1·69	·85	—	·8	·2
Kurrachee	·67	·3	—	—	·01	·30	4·08	·54	·34	—	—	·15
Average for province	·34	·17	·15	·16	·18	·25	2·69	2·6	·47	—	·16	·11

CHAP. I. QN. 1.

SINDH.

Colonel Haig.

2. In regard to its agriculture, Sind may be said to be almost independent of rain, and the scanty average rain-fall above shown would, if rain were more regular, ensure abundant harvests. Unfortunately the fall is very fluctuating. In many years there is hardly any; in some years there is greatly too much. August is the only month in which there is, as a rule, no failure. A perfect rain-fall would be about as follows—

		Inches.
Kharif	June	·50 (beginning about 20th).
	July	2·50
	August	3·00
	September	·50 (not after 10th).
Rabi	December	·20 (beginning about 25th).
	January	·60
	February	·40 (not after 25th).

Thus, a rainfall of 7·70 inches, if not fluctuating, is about the best quantity that can be had in aid of irrigation.

3. Failure of rain is more serious in the rabi than in the kharif season. In the latter it results in some deficiency, both in quality and quantity of the crop; but in the rabi the crops grown (especially wheat, the most valuable of all) on land flooded during the inundation are liable to nearly total failure if no rain falls during the cold season.

MADRAS.

The Board of Revenue.

MADRAS.

For the purpose of illustrating the system of rain-fall of the Presidency, the year may be conveniently divided into two equal periods, viz., from the 1st October to the 31st March, and from the 1st April to the 30th September, the bulk of the rain-fall in these periods being due to the south-west and north-east monsoon respectively.

2. The south-west monsoon commences to blow in the end of May or beginning of June, and a great portion of the vapour brought with it from the Indian ocean is intercepted and condensed by the Western Ghâts and precipitated in torrents of rain on the strip of land between these mountains and the sea, which forms the district of Malabar and Canara, and the kingdoms of Travancore and Cochin. A portion, however, passes over the range, or through the gaps which here and there occur, and finds its way in more or less abundance to every district in the Presidency. Excluding the minor showers of April, which are not due to the influence of either monsoon, the average rain-fall of the six years ending 1875–76 during the south-west monsoon for each district is noted below.* It will be observed that according to this average the rain-fall is less in Malabar than in Canara, and the returns from the Trevandrum Observatory show that the fall in that State is considerably less than in Malabar. The same phenomenon occurs with what blows over the Western Ghâts, the fall in the Northern Districts of Ganjam and Vizagapatam being almost one fourth of that in Canara, while in the district of Tinnevelly to the extreme south of the Presidency the average amount registered is no more than 4·14 inches. Subject to this same rule of a greater fall in the more northerly districts, the amount of rain precipitated to the east of the Western Ghâts seems to vary directly with the distance the vapour has to be carried overland, the fall in the more inland districts being almost invariably less than in the districts nearer the coast in the line of the wind, the only exceptions to both rules being the district of Nellore and, in a much less degree, the adjoining district of Kistna, where the fall is less than in several other districts both further south and further inland.

3. The north-east monsoon blows from the Bay of Bengal, commencing about the middle of October and ending in December. The statement below* shows the average rain-fall in each district between the 1st October and the 31st December. The amount which falls is much less than that during the south-west monsoon, and its distribution seems to be governed by more complex laws.

4. Very little rain falls in the early months of the year, but before the burst of the south-west monsoon there are occasionally a few showers popularly known as "the mango showers," the average quantity of which is as shown below:—

	Inches.
Tinnevelly	5·86
Malabar	5·44
Tanjore	4·33
Madura	4·18
Coimbatore	3·20
South Arcot	2·77
Trichinopoly	2·82
Chingleput	2·61
Salem	2·35
South Canara	2·35
Madras	2·22
North Arcot	2·13
Ganjam	1·99
Vizagapatam	1·48
Nellore	1·24
Kistna	1·07
Godavari	1·02
Bellary	0·75
Cuddapah	0·73
Kurnool	0·47

The total average rain-fall in each district ranges thus:—

	Inches.
South Canara	143·60
Malabar	114·95

	Inches.
*South Canara	130·80
Malabar	97·07
Ganjam	30·27
Vizagapatam	26·02
Godavari	25·89
Kurnool	23·22
North Arcot	23·23
Salem	21·78
South Arcot	21·08
Kistna	21·08
Chingleput	20·97
Madras	20·76
Cuddapah	19·14
Bellary	17·68
Tanjore	16·00
Trichinopoly	15·14
Nellore	14·19
Coimbatore	11·54
Madura	7·96
Tinnevelly	4·14

	Inches.
*Madras	34·98
Chingleput	24·64
Tanjore	28·16
Nellore	21·04
South Arcot	20·92
Trichinopoly	16·98
North Arcot	14·98
Vizagapatam	13·15
Malabar	12·44
Godavari	12·37
Tinnevelly	12·85
Ganjam	11·77
Madura	11·59
Salem	11·17
Cuddapah	11·10
South Canara	10·45
Kistna	10·43
Coimbatore	10·07
Bellary	7·34
Kurnool	6·32

	Inches.
Madras	57·96
Chingleput	48·22
South Arcot	44·77
Ganjam	44·03
Tanjore	43·49
Vizagapatam	40·65
North Arcot	40·34
Godavari	39·28
Nellore	36·47
Salem	35·30
Trichinopoly	34·94
Kistna	32·58
Cuddapah	30·97
Kurnool	30·01
Coimbatore	24·81
Bellary	25·77
Madura	23·73
Tinnevelly	22·85

It is to be noted that the rain-fall given above is merely the average for a district, and that it not unfrequently happens that the rain-fall in one part of a district varies as widely from that in another part of the same district as it does from that in stations in other districts, if not more so.

The following statement shows the proportion of the Ryotwar area cultivated under each of the monsoons in Fasli 1284, which was a favourable year. The figures, however, cannot be said to be absolutely correct, as the village accountants often enter the cultivation of one month in the month following; but they are sufficiently near the mark to furnish a rough idea of the extent to which the country is indebted to each of the monsoons. It must, however, be borne in mind that most of the crops, the cultivation of which is commenced under the south-west monsoon, are matured during the north-east monsoon.

Districts.	From April to September.			From October to March.		
	Dry.	Wet.	Total.	Dry.	Wet.	Total.
Ganjam	90	93	92	10	7	8
Vizagapatam	82	83	83	18	17	17
Godavari	76	96	87	24	4	13
Kistna	51	70	53	49	30	47
Nellore	32	49	36	68	51	64
Cuddapah	57	69	57	43	31	43
Bellary	68	63	67	32	37	33
Kurnool	65	80	65	35	20	35
Chingleput	37	34	35	63	66	65
North Arcot	73	69	72	27	31	28
South Arcot	71	61	68	29	39	32
Tanjore	51	61	59	49	39	41
Trichinopoly	57	62	58	43	38	42
Madura	50	38	48	50	62	52
Tinnevelly	9	35	15	91	65	85
Coimbatore	57	60	57	43	40	43
Nilgiris	65	100	65	35	—	35
Salem	81	75	80	19	25	20

N.B.—In Madras cultivation is trifling and not recorded, and for Malabar and South Canara monthly cultivation figures are not available.

A statement showing the average rain-fall of six years in each district in each month is annexed :—

STATEMENT of RAIN-FALL in each DISTRICT and for each MONTH on the AVERAGE of the SIX YEARS from 1870–71 to 1875–76 (inclusive).

Districts.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Total of the whole Period.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Ganjam	6·25	6·27	6·75	9·09	9·74	1·49	0·54	0·22	0·11	0·52	1·14	1·91	44·03
Vizagapatam	4·60	5·33	5·97	8·01	10·68	1·55	0·92	0·09	0·28	0·30	0·81	2·11	40·65
Godavari	4·08	6·24	4·98	8·58	10·48	1·51	0·38	0·11	0·18	0·34	0·39	2·01	39·28
Kistna	2·99	4·85	5·00	6·77	8·54	1·61	0·28	0·47	0·05	0·34	0·21	1·47	32·58
Nellore	1·43	3·04	3·45	4·82	11·07	7·65	2·32	0·35	0·57	0·19	0·13	1·45	36·47
Cuddapah	2·44	2·99	4·09	7·00	7·97	2·44	0·69	0·13	0·15	0·22	0·23	2·62	30·97
Bellary	2·96	2·69	3·49	5·91	6·41	0·71	0·22	0·05	0·01	0·14	0·54	2·63	25·77
Kurnool	3·29	5·32	4·19	8·37	5·24	0·74	0·34	0·04	0·00	0·14	0·29	2·05	30·01
Madras	3·17	4·58	4·84	6·08	14·34	16·27	4·37	0·10	1·10	0·39	0·63	2·09	57·96
Chingleput	2·72	3·94	5·32	6·17	9·66	12·14	2·84	0·26	1·69	0·21	0·45	2·82	48·22
North Arcot	2·53	3·46	5·26	7·51	7·83	5·81	1·34	0·28	1·03	0·50	0·32	4·47	40·34
South Arcot	1·79	3·16	6·27	6·51	8·19	9·62	3·11	0·25	1·35	0·20	0·97	3·35	44·77
Tanjore	1·88	2·43	4·60	4·34	8·28	10·21	4·67	0·71	1·50	0·25	1·87	2·75	43·49
Trichinopoly	2·01	1·88	4·49	4·32	8·34	6·50	2·14	0·35	0·95	0·10	1·42	2·44	34·94
Madura	1·30	0·86	2·36	1·83	5·12	5·03	1·44	0·56	1·03	0·60	1·99	1·61	23·73
Tinnevelly	0·78	0·34	0·71	1·05	3·56	7·42	1·87	1·59	1·53	1·08	1·66	1·31	22·85
Coimbatore	2·07	1·66	2·19	2·69	5·56	3·95	0·56	0·15	0·56	0·52	1·97	2·93	24·81
Salem	2·40	2·70	4·77	6·63	7·22	2·89	1·06	0·07	0·40	0·62	1·26	5·28	35·30
South Canara	38·09	47·57	22·08	14·56	8·55	1·63	0·27	0·82	0·18	0·26	1·09	8·50	143·60
Malabar	35·42	32·17	11·44	8·51	8·49	3·18	0·77	0·56	0·61	0·61	3·66	9·53	114·95

The average given in the statement is taken on the results of the six years ending 1875–76, and is, in the opinion of the Board, a fair approximation to the normal rain-fall so far as there can be said to be any "normal" rain-fall when the variations in the average of a district in six ordinary years are as great as are detailed below :—

District.	Maximum.	Minimum.
	In.	In.
Ganjam	60·44	30·67
Vizagapatam	54·32	26·30
Godavari	47·35	26·91
Kistna	36·63	26·37
Nellore	44·36	28·97
Cuddapah	50·89	21·77
Bellary	39·19	19·63
Chingleput	76·01	29·39
North Arcot	55·93	25·80
South Arcot	63·81	33·42
Tanjore	57·06	30·27
Trichinopoly	46·26	24·35
Madura	29·73	15·61
Tinnevelly	27·93	19·33
Coimbatore	27·78	22·77
Salem	42·98	27·71
South Canara	183·87	114·42
Malabar	138·41	97·75
Kurnool	49·74	22·97

The Board have not calculated the average on the results of a larger number of years, as correct figures are not available for years previous to 1870–71 as will be seen hereafter, and 1876–77 was altogether an exceptional year, the like of which, it is to be hoped, may not recur for a very long time.

As the quantity of rainfall required for agricultural operations depends upon various circumstances, such as the kind of crop raised, the nature of the soil and situation, and other considerations, the board requested the Collectors to consult the local experience of agriculturists, and to forward two statements showing for the principal crops in each district, (1) the maximum amount of rain they can bear each month without being injured, and (2) the minimum quantity they require to yield an average crop. The statements received have been tabulated, but it is evident that the information given is not very trustworthy. Many Collectors themselves state that the information furnished by them is not accurate, and in other cases there is abundant internal evidence to the same effect.

There can be no doubt that the experience of ages has taught the ryot to adapt his cultivation to the periods of rain-fall, by so timing his operations that his crop may arrive at particular stages of growth at periods of the year when the rain that is usually expected will benefit instead of injuring it. In those districts in which the mango showers fall with any degree of regularity, cultivation begins as early as April when the season is favourable. The light rains that fall enable the ryots to plough the ground and prepare it for receiving the seed. The seed is sown in the month of May, when moderate showers fall before the regular burst of the south-west monsoon. Where the mango showers cannot be depended upon, and even in other districts when it has been ascertained that the usual mango showers have failed, ploughing and preparing the ground is as late as the end of May or the beginning of June, and seed is sown before the end of the latter month, by which time the south-west monsoon has fairly burst in all the districts. In the tracts irrigated by the river systems fed by the rains of the south-west monsoon, such as the Godavari, the Kistna, and the Cauvery, the sowing takes place a little earlier, as the river freshes supply the required moisture before the south-west rains set in on the east coast. Paddy crop is from four to six months on the ground (one variety even less), and the dry crops generally between three and four months. The first crop of paddy (kar) and the dry crops generally take four months, and are reaped by the end of October before the north-east monsoon sets in. But the most extensively cultivated variety of paddy is samba, which is reaped in six months, and requires the rains of the north-east monsoon to bring it to maturity. After the first crop is reaped, if there is sufficient water, a second is sown and gathered about February or March. On dry lands also a second crop is sometimes raised of cholum, cumbu, ragi, or varagu, if the first harvest is over by October; if later, gram, oil seeds and pulses are sown in December and January, and matured by the moisture left by the north-east monsoon rains and the heavy dew which then falls. On the west coast the cultivation of cereals may be said to be almost confined to the growth of paddy. The first and the most important crop, called yenel in South Canara, and kanni in Malabar, is reaped by September. The second crop is put in in November and reaped in January, and depends upon rivers, channels, and springs, assisted by the north-east rains, If there is sufficient water in the rivers and private tanks, a third crop is put in the ground in February and reaped in May.

It is to be borne in mind that the above is a very general description of cultivation, and that the times of reaping and sowing differ from place to place, according to local peculiarities and the kinds of crops raised. It will be seen that rain is essential at the sowing time, viz., in June and July, for otherwise the cultivation cannot be commenced. If the rain holds off till August, the cultivation under the south-west monsoon will, perhaps, be given up. If it is undertaken, it may suffer from the heavy rain of the north-east monsoon; and on the other hand, if the north-east monsoon fails, the crop must inevitably perish. Of the wet crops, "samba" paddy begins to ear in 4½ months, and "kar" at the close of the third month. Continued drought at this period will be most injurious, and the injury cannot be repaired by any subsequent rain-fall. The following extract from the report of Mr. Price, the Collector of Chingleput, puts this matter in a clear light:—

"There are two periods which are critical in regard to crops; first, when the flower is about to appear; second, when the ears are filling. An excess of rain or the reverse for a fortnight or three weeks decides what the fate of the crop will be. Subsequent rain-fall or fine weather may mitigate matters, but will not finally remedy them. Thus, as regards the early rice crop, if there is heavy rain at the end of June and into the middle of July, it would do harm; if it went on to the end of July and well into August, it would do still more; but if the rain held off during the latter part of July and it was fine in August, the flower which ought not to have had rain on it in June and July would, to a considerable extent, recover. So if when the ears began to fill towards the middle of July there was a want of rain, which would cause a good deal of the young ears to become chaff, and copious rain came at the end of the month, a good deal of the grain would recover. Generally speaking, it may be said that where there is either heavy rain or want of it for about three weeks beyond the period at which it should usually fall, or the reverse, and then that the season rights itself, no very material damage occurs; but if this time has elapsed, marked and permanent injury is occasioned. In the case of ragi, heavy rain will damage it when coming into ear, and when ripening; fine weather within three weeks in the first instance, and within ten days or a fortnight in the second, will put matters right. In the first instance the ears do not fill; in the second the grain apparently germinates whilst on the stem.

"The cumbu crop is much more delicate than either rice or ragi. If there is heavy rain at the time of its coming into flower, nothing will save the crop. On the other hand, if there is any dry weather near to the time that the first flower shoots should appear, and copious rain comes, the cumbu recovers in a marvellous way. Heavy rain again after the grain has formed causes injury by inducing a kind of spurious germination; fine weather within a fornight or three weeks will check this, but if there is too much dry weather after the heads are formed, no subsequent falls of rain will recover the crop. It may, however, induce the throwing out of young shoots, and the production of a light crop."

The quantity of rain-fall required for growth, as already stated, depends upon a variety of circumstances, such as soil, temperature, situation of the land, state of the atmosphere, and prevalence of winds, so that any general description must necessarily be no more than a rough approximation. Some crops can stand drought better and longer than others, and the quantity of rain required for certain crops and soils is much greater than that required for others. In slopes the moisture soon drains off, and a heavier rain-fall is necessary for the growth of crops there than elsewhere. Some soils, on the other hand, such as the black cotton soils of Bellary, are very retentive of moisture, and any large amount of rain will do injury. Rice crops can stand almost any amount of rain without being seriously injured, provided the plant is not wholly submerged in water. Varagu is a most hardy crop, can withstand drought long, and revive to a great extent if rain falls before it has actually perished. Gram, gingelly, &c., are very delicate, and will be injured even by comparatively moderate rains. The following remarks of Mr. Martin, the sub-collector of Madura, in regard to the

effect of rain-fall on different crops will be found interesting:

"*Paddy.*—Excessive rain-fall will not injure this crop throughout its growth, except by breeding insects in, and knocking the grain out of, the ear. Scanty rain-fall will not repair damage under the circumstances. Deficient rain-fall will principally operate by affecting the sources of irrigation, so that field after field is deprived of its water. As it is known that paddy after being totally deprived of moisture for twenty days perishes, those fields only will be revived by copious rain-fall which have not been deprived of their supply for that length of time. The out-turn on fields so revived will vary by the length of time for which the field is dry; if for seven days it will be 40 per cent. below the average; for fourteen days 70 per cent.

"Copious rain after a failure can be remedied with paddy to a certain extent, because a variety of the plant can be sown on the withered fields the moment the tank, &c. receives a supply, and the crop may possibly only be retarded by the length of time that elapsed from the former sowing to withering, and this time may be shortened by choosing a crop that comes to harvest in a shorter time.

"*White Cholum.*—Excessive rain injures the stalk, turns it in the first month pale, and in later months red or dark brown with the final effect of disease in the ear affecting the size and consequent weight of the grain and its quality. The paleness in the first month will be quite remedied, and the crop restored by a month of scanty rain-fall. The redness in the older stage will be checked in extending, but plants already attacked will not be restored. The ear once having been formed in a deteriorated state will not be improved by scanty rain-fall. Cholum is a hardy crop, and will stand a deal of drought, springing almost as vigorously as ever from the old roots if it gets a copious rain-fall while in its first month. If it once dries up and looks scorched when the stalk is well formed it will give a bad return even though it gets copious rain.

"Varagu, ragi, and samai are very hardy plants, and will get on with very little moisture for nearly two months at first, and thrive luxuriantly afterwards under copious rain. Varagu and ragi stand a great deal of rain well, and are almost independent of a change into a light rain-fall. Samai will thrive under very heavy rain up to near harvest, when heavy rain will be fatal to it on account of the slight hold the grain has on the ear. Samai suffers from deficient rain-fall when it is well advanced.

"Cumbu follows cholum very nearly in its power to resist heavy rain or to be injured by deficiency. It is supposed to be able to do with less moisture, and at the same time to be less affected by excessive rain than cholum.

"Dhál follows very much the same seasons as cholum, but it is less likely to suffer at any part of its growth if subject to scanty rain-fall. If when young it will always retain sufficient life to be made very luxuriant by a copious fall; the effect of deficiency on the advanced plants is both in the number of pods and size of the pulse, and this will not be remedied by copious rain after they have formed. Excessive rain long continued has a tendency to produce animal life to a very destructive extent in this crop, and subsequent scanty rain-fall will not remedy it.

"Horse-gram suffering from deficient rain-fall will rally very much under a copious fall and *vice versâ*, provided the creeping tendrils are nipped off and the plants prevented running into leaf."

The following extracts from the replies of the Collectors of Vizagapatam, Kurnool, Coimbatore, Tanjore, South Canara, and Malabar, and the sub-collector of Madura, who appear to have given a good deal of attention to the subject, will be useful as showing generally what amount of rain-fall is considered necessary in the respective districts to secure a fair harvest of all the crops grown. The principle underlying these replies is the same throughout, viz., that the times for conducting particular operations have been so fixed that the expected rains may not injure but assist the growth of the crop at its several stages. The remarks of the Collectors of Vizagapatam and Kistna may be considered to be applicable to the whole of the Northern Circars, of Kurnool to the ceded districts, of Coimbatore to Salem, of Tanjore to Trichinopoly, and of South Canara to Malabar. The Collector of Vizagapatam, Mr. Goodrich, says:—

"No two falls of rain are exactly alike in the suddenness of their fall and in the strength of the wind which accompanies them.

"Periods of drought vary in their mischievous effects infinitely according to rain-fall that may have preceded them.

"Paddy requires about 3 inches in June for the seed beds and to begin ploughing. In July or in the beginning of August there is needed a fortnight's rain amounting to 6 or 8 inches if a good plant-out is to be effected. There ought not to be more than 10 dry days consecutively between the 20th June and the 1st September. September needs about 4 inches, and thrice that amount will do no harm. Four inches will not be enough unless previous rains have been copious. October needs 6 or 8 inches, and twice that amount will do no harm.

"Light rain between 15th June and 15th September will do for ragi, provided that not more than 15 days' drought occurs at any time; 20 days nearly ruins the crop, unless there have been very heavy previous rain.

"Cumbu will bear almost any amount of rain without wind. If a gale accompanies rain after the 1st July, mischief is done to all riper fields in exposed situations.

"Jonna is not grown in this district as much as it deserves to be. On black soil, retentive of moisture, it will do with very little rain, but sandy soil if red will not produce it."

Mr. Crole writes of Kurnool—

"Judging from the registered rain-fall of the last 10 years as compared with the general character of out-turn as stated in annual reports, the amount of rain-fall required for the whole year for a good crop in this district seems to be about 25 inches. If, however, the rains are regularly distributed, about 15 inches would be sufficient as shown below:—

	Inches.
May	2
June	3
July	3
August	4
September	2
October	2

"The popular saying is, and there can be no doubt of its correctness, that one good fall of rain about an inch and a half, in each fortnight after seed is sown, is sufficient for agricultural necessities. But the success of a crop does not seem to depend so much on the quantity of rain which falls as on its proper distribution over the different periods of agricultural operations and at different stages of the crop growth.

"*Ploughing.*—This operation is conducted at any time of the year, provided there is sufficient moisture in the ground. In a very large number of cases the ryots do this during their leisure hours between reaping and sowing.

"This early preparation of the ground called 'magali' (or seasoning of the earth) is considered by the ryots as peculiarly favourable to the future crop. The general practice, however, is to plough the land in the months of April and May, immediately after the burst of the first rain. Any amount of rain may fall in these months without producing any bad result, neither does the absence of the rain seriously affect, though it may greatly inconvenience, future

CHAP. I. QN. 1.
MADRAS.
The Board of Revenue.

operations. In the beginning of June, however, or about a week before the commencement of the sowing season, a good fall of rain varying from one inch in light to two in clayey soils is absolutely necessary.

"The ryots say that the quantity of rain absolutely required for sowing purposes is as much as would suffice to moisten the ground to a depth of about 6 inches from the surface (or from 1 to 2 inches).

"If the rains are late, say about a fortnight, a shorter quantity of rain moistening a less depth of ground than 6 inches will be accepted as sufficient in the belief that the advancement of the rainy season would compensate for the deficient moisture.

"If the rains fail altogether during the first fortnight of July, yellow jonna cultivation has to be given up, because the sowing of this crop later than July would subject the tender plant to excessive rain in August and September, the chief rainy months, and lessen seriously its chance of getting enough rain in the third month of its growth, when rain is essential to the development of the pótta or opened tender ear of corn, so that people never grow yellow jonna in the latter part of July.

"If, however, heavy rains fall in July and August, so as to moisten the ground to the full depth, *i.e.*, as far down as the sub-soil, they prove highly useful for sowing the later jonna in September and October. The bad effect of the early failure would be neutralized by subsequent rains.

"Again, if the rains fall earlier than June, and even if a sufficient depth of ground is moistened, jonna is, as a rule, not sown in the belief that sowing early makes the plant grow too tall and proportionately lessens the size of the ear.

"After the seed is sown cessation of rain for at least three or four days is absolutely necessary. It is more so in black than in red soil. Otherwise the clods of earth firmly stick to the seed and thereby delay and sometimes prevent germination, while all sorts of weeds begin to grow and in a measure choke the seedling.

"About 20 or 30 days after germination the weeding operation is usually performed. The quantity of rain required during the interval is in proportion to the nature of the soil and the extent to which the ground has already been moistened.

"In light soils less rain, say a *padanu* within 15 days after sowing, would be sufficient. In more clayey soils, if the ground had been moistened to the full depth when seed was sown, a slight fall to moisten the plant would be sufficient. Otherwise more rain would be necessary. After a month rain would be absolutely necessary. Any excess of rain or continued fall will conduce to the rapid growth of weeds, and by keeping the land continually muddy prevent weeding, as has been the case in very many instances during the present season, and discolour the plant. If the rains fall at proper intervals, the aggregate quantity in a month, though large, will not affect the growing crop seriously. Hence the aggregate monthly quantity does not afford a good test by which to judge of the favourable or unfavourable result. A fortnightly report will give a more correct means of ascertaining the true state of crops.

"If the rains fail for 15 days in light soils and a month in black soils after sowing, the crop, it is said, will begin to droop.

"Again, if in the second month after the crop is weeded the rains should fail within 15 days, the crops whose vitality has already been weakened by the weeding process would begin to suffer. The lateness in the fall of this rain results in a proportionate decrease in the yield of the crop.

"*Weeding operation.*—The weeding process is generally gone through twice or thrice, according to the means of the ryot, and according to the quantity of the weeds requiring to be removed, which grow more or less with reference to the nature of the soil, and the amount of rain that may have fallen. For weeding, cessation of rain indispensable."

Mr. Martin, the sub-collector of Madura, remarks—

"In April there are no dry operations and no crop to be injured by rain except by what is known as Taibhogum crop under wells in Pulney Taluk which should be nearly ripe. Any amount of rain in April will be valuable for ploughing the dry land and preparing the wet lands for what is called the Kodai crop.

"In May there are no crops of any extent that can be injured by rain, and the more falls the better, so long as the tanks do not breach, for ploughing in dry lands will continue and sowing of wet lands.

"The highest record in this part of the country was in Fasli 1277, and then there were about 7½ inches without bad results in May. In June there is no general harvest nor general sowing, and the minimum rain-fall required for ploughing is 1 inch; there is no danger from heavy rain-fall. The minimum of July may be a little less than that of June to continue the ploughing and to sow. It is taken at three-quarters of an inch, because in the good year of Fasli 1284 that was the whole amount recorded.

"The maximum for July should be about four inches. More than that will interfere with cultivation by washing away the seed and making the ground too cold. In August the minimum required varies from three-quarters of an inch to two inches, according as the crops are only to be sown or brought on. These crops will bear as much as six inches as the maximum.

"The minimum in September varies from three-quarters to three inches. The maximum recorded in September was last year, and the crops did not suffer by it because it followed great drought; there is no data to show whether they could have stood it after heavy August rain; probably five or six inches would have been as much as would have been good for them considering the absence of sun in this month. In Fasli 1282 they stood with advantage nearly seven inches.

"In October and November the growing plants are strong, and will bear more rain than in August and September. There is also more sun. Three inches is about the minimum they should have in October except certain crops which require more moisture at different periods. Eight inches is about the maximum as the plants get stronger.

"In November the minimum required is about four inches for the majority of crops with similar exceptions.

"In December the crops are ripening and should have only a light equally distributed rainfall, the minimum being one and a half inches and the maximum four inches.

"In January, February, and March no agricultural operations are commenced on dry lands. Harvesting of both dry and wet lands go on in those months, and the only operations commenced are under wells. If these have received a proper supply they can do without rain; therefore, ordinarily, rain is not required at all in January, February, and March. In these months light rain equally distributed will do no harm, but any heavy long continued shower will do so by knocking the grain out of the ear. Two inches of violent rain in either January, February, or March will harm the grain and paddy wherever it falls, but as rain usually falls in local thunder showers, it is impossible to answer this question with reference to the whole harvest of a taluk.

"The tanks, if provided with proper escapes, will stand any amount of rain; and the above remarks have no reference to maximum rainfall for wet land. The wet crops suffer from deficient water in the tanks, and the minimum rain-fall necessary to secure the area usually irrigated at the different times of years has been assumed to be what is wanted."

Mr. E. Forster Webster, the Collector of Tanjore, says:—

"The cultivation of paddy is carried on chiefly under river irrigation. In the month of September, when the rice plants are young and delicate, slight showers are required. In the month of October and November, when the plants of samba, pashanam, or later crop planted in September and reaped in February are about half grown, copious rains are required, followed by light showers in December and January. For the successful cultivation of rice crop regular and ample supply of water in the river is required during five months, viz., from July to November, a slight fresh being sufficient in the months of June and December. For dry crops rain is more or less necessary during eight months of the year, viz., from June to January, copious falls being required in the months of June and July, and also shortly before the harvest in October and November.

"In the case of paddy there should be no rain on the day next to that of planting. Excess of rain can do no harm if there is sufficient drainage for the land, otherwise the young plant will rot.

"After transplantation the plants require no rain for about a fortnight, and if light rains then fall the plants will be strong and healthy.

"Light rains do good to the plants when they are coming into ear, but very heavy rains at this time are likely to prevent the grain from forming properly, and are therefore most disastrous to the crop."

As regards Coimbatore, Mr. A. McCallum Webster remarks :—

"Cholum, ragi, and cumbu are the grains which form the staple food of the people in this district. During the ploughing season a heavy fall of rain of at least one inch is required, and for the subsequent ploughing and sowing another heavy fall necessary. Rain at intervals is most essential to them for about a month after they are sown. Failure of rain after they are sown would be mischievous or ruinous, depending upon the extent of the failure and the length of time it lasted. These crops require to be kept constantly moist for about a month or so after being sown. Failure of rain during that time for a space of 20 days would most probably be mischievous, and could not be remedied by good rain afterwards. When the plants are a little more than a month old, heavy and continuous rain would cause them to turn pale and become stunted, and thus would be mischievous. Again, when they are putting forth the ear (October and November) in ordinary seasons excessive rain would be mischievous. Crops come into ear about three months after sowing, except ragi, which ears in about two months, and to which excessive Coimbatore rain would not do any harm. Again, at harvest time (November and December) excessive rain would be mischievous. When the crops are at the middle of their growth (September and October) good rains are required. Failure then would be mischievous or ruinous, depending upon the extent of failure. It follows, therefore, that it is most important to the ryot to have his crops sown at the proper time, so that they may get good rains when they want them most and when they are most likely to get them. Failure of preliminary rains might thus do a great deal of harm eventually by preventing ploughing, &c., operations which necessarily precede, sowing being carried on at the proper time. The sowing would be late and the plants would get excessive rains when they might not be able to bear them."

Mr. Comyn, Collector of South Canara, writes :—

"The first rice crop being dependent on the falling rain, what is wanted is fairly continuous rain without long breaks. One inch a day for every day of these months would be ample ; two inches a day would do no harm ; but if 30 inches or more were to fall during any one week in the month, and there were no rain for the remaining three weeks, the crop would perish. A break of even a fortnight would do harm. In August continuous rain is not wanted except for the high-lying lands, from which water soon runs off, and even then sunshine is an advantage. In September, when the crops are approaching maturity, anything more than the maximum given would do harm ; for a fair amount of sunshine is required to ripen the crop, while heavy rain lays the crop already heavy in ear level with the ground, and rots the straw and sometimes the grain. It is impossible to state accurately the maximum amount of rain which may fall without doing injury. Low-lying lands, locally termed 'Patla,' cannot be cultivated until the water standing on them subsides to a certain extent. The cultivation of these lands is taken up later than that of the ordinary rice lands, and is more liable to be injuriously affected by continuous excessive rain than lands situated on a higher level, which have means of drainage. The character and the position of the lands in the district is so varied, that any accurate general statement showing the maximum or minimum quantity of water that may be required for the growth of the crops cannot be given. The quantity shown as the minimum is that supposed to be necessary to secure an average crop of 12 annas, but agriculturists have a very vague idea of what an inch of rain means.

"The second rice crop is partly dependent upon the rains that fall in these months, but chiefly on water from tanks and streams which are rain-fed.

"The third rice crop does not require rain, but is cultivated with the aid of water obtained from tanks or streams by natural or artificial means. Some kind or other of reservoir or nullai constructed in every land cultivated with the second and third crops. The water supply of course depends on the character of the monsoon. The minimum rain-fall given at the head of this statement, though probably sufficient to bring the first rice crop to maturity, would not suffice to keep in full flow the rivers and channels on which the second and third rice crops depend. A much greater fall would be required for this. The maximum rain-fall in any one of the last 10 years was 181 inches (1874–75), and the minimum 116 (in 1873–74 and 1875–76), when the supply was not sufficient for the second and third rice crops. The average rain-fall of the last 10 years was 137 inches, which is ample for all purposes. The rain-fall should be evenly distributed. Injury by deficient rain-fall in May or June may be remedied by rain in July and August, but should the July rains also be scanty, no subsequent rain will be of any use for this crop. Excessive rain is not likely to prove so injurious as deficient rain. Excessive rain is only to be feared in September or the beginning of October when the first rice crop is ripening and is harvested. Such rain, however, is not without its use ; for a prolonged and heavy monsoon is beneficial to the second and third rice crops, not because these crops depend on the falling rain, the case being the reverse, but on account of the plentiful supply of water which such a monsoon secures for the irrigation of the lands on which these crops are raised."

As will have been seen from the preceding remarks, seasonable distribution is of prime importance, and this is further illustrated by the fact that paddy is extensively grown in districts the average rain-fall of which varies from 143·60 to 22·85 inches. Dry crops are also cultivated within the same limits of variation, though not to any great extent ; but even where these crops are grown as staples the average rain-fall varies from 48·22 to 22·85. For wet cultivation, however, in all but the West Coast Districts the question is really whether the rain-fall is sufficient to ensure a sufficient supply to the tanks and channels, and provided this is secured the distribution of the rain-fall is not of so much consequence as for dry cultivation, although it is generally considered that the total absence of falling rains or an excess of clear sky during the cultivation season affects the out-turn of crops even where there is sufficient water for irrigation. Garden cultivation may be said to be almost independent of rain-fall unless the drought is so great

CHAP. I. QN. 1.
MADRAS.
The Board of Revenue.

as to dry up the subsoil supply. In Malabar and South Canara, where the rains never entirely fail, crops are not so much injured by drought as by excess of rain; the soil is improved by being exposed to the action of the sun in March and April, and rain in these months is injurious.

The combination of circumstances under which the worst results are likely to be produced may be said to be unseasonable distribution, combined with deficient rain-fall. It may perhaps be safely said that where the actual rain-fall of any particular year falls below the average by a quantity exceeding 40 per cent. the result must be failure of crop.

MYSORE.
Colonel Hay.

MYSORE.

For agricultural purposes the divisions of the rains are considered to consist of three well-defined periods.

First. Those which fall between the beginning of the Hindu year, and the commencement of the south-west monsoon; *i. e.* from about the end of March to the end of the first week in June.

Second. The south-west monsoon from June to August.

Third. The later rains of September, October, and November.

The first or "Múngar" rains are known also as "Dodda" or "Addamale," that is heavy downpours, resulting from the crossing of currents of air, attended with thunder and lightning, and ordinarily coming from north or north-east.

The south-west monsoon rains are styled "Maddhya" or middle rains, and described as "Sône," that is continuous mild showers or drizzle, with steady south-west wind, unattended with storms, and the last are the "Hingar," or latest rains of the other monsoon. Showers and even heavy falls occur during the winter months, but this is not reckoned as a rainy season.

From this system of rain-fall is derived the principle on which the year is divided into seasons, comprising three periods:—

1. The "Múngar" or early season, including the two first periods of rain.
2. The "Hingar" or late season, including the second or "Hingar" period of rain.
3. The dry season. From the close of the Hingar to the beginning of the Múngar rains.

Each of these seasons has its own distinct crops requiring varied operations, and the crops sown in the "Múngar" or "Hingar" season take their names from the season in which they are sown. In their progress towards maturity, however, they extend into the next period, so that the "Múngar" crop, known also as "Kár," ripens and is cut in the Hingar season, while the "Hingar," styled "Hyne," or principal crop, is harvested in the cold weather.

This last period has also its own cultivation, consisting chiefly of a rice crop, sown in the cold weather, under tanks which have received a supply either from the thunder plumps in the early months of the year, or the later falls of the north-east monsoon in October and November. This may be shown as follows:—

Rains.	Period.	Seasons.	Crop.
Múngar, early "Dodda" or "Adda," "Male" or irregular rains.	From about end of March to end of 1st week in June.	Múngar.	Múngar.
"Sone" or S.W. monsoon, "Maddhya" or middle rains.	From June to August or September.	Hingar.	Hingar.
Hingar late rains, N.E. monsoon.	September to November or part of December.	Do.	Do.
Dry season.	December to March.	Dry season called "Garbha" or pregnant, from the idea that the clouds are gradually forming rain to descend at a future period.	Harvest in following year.

The terms "Múngar" and "Hingar" are, however, usually confined to crops on unirrigated lands, and which are dependent entirely on the monsoon or other rains. The river-fed channel crops, including rice, sugar-cane, and some pulses, are described simply as "Vyshak" and "Kártik," from the months in which they are ripe; and these terms are also applied to the rice crops under tanks which are dependent for their water supply upon the monsoons.

The early rains are the period for sowing Cholum, and the Gid or shot Ragi, as well as oil seeds, and various pulses with good deal of Paddy, and all operations, including sowing, must be got through before the actual arrival of the south-west monsoon; for if the seed is not well above the ground by that time, the season may be said to be lost.

In addition to these cereals, a variety of other products are also sown during the first rains, to be cut during the Hingar period, and these are reckoned to be the following:—

Múngar or early dry crops.

A. Cereals.
   1. Cholum, great millet—Holcus sorghum.
   2. Gid ragi—Khar ragi—Cynosorus Corocanus.
   3. Sujje—Spiked millet—Holcus spicatus.
   4. Navane or Italian millet—Panicum Italicum.
   5. Sámé or Sáve—Little millet—Panicum frumentaceum.
   6. Baragoo—Little millet—Panicum Miliaceum.

B. Pulses.
   1. Ooddoo—Black gram—Phaseolus minimus.
   2. Hessaru—Green gram—Phaseolus mungo.
   3. Alasandi or Tadagani—Dolichos catiang.

C. Oil seeds.
   1. Wollellu or Achellu—Gingelly—Sessamum orientale.

The Hingar or Hyne dry crops.

A. Cereals.
   1. Ragi—Ragi—Cynosurus Corocanus.
   2. Cholum—Great millet—Holcus sorghum.
   3. Harka—Great millet—Panicum semiverticillatum.
   4. Sujje—Spiked millet—Holcus spicatus.
   5. Same or Save—Little millet—Panicum frumentaceum.
   6. Navane—Italian millet—Panicum Italicum.
   7. Baragoo—Italian millet—Panicum Miliaceum.

B. Pulses.
1. Ooddoo—Black gram—Phaseolus minimus.
2. Hessaru—Green gram—Phaseolus mungo.
3. Togari or Tovari—Pigeon pead hall—Cajanus Indicus.
4. Alasandi or Tadagani—Delichos catiang.
5. Avare—Cow gram—Dolichos labal.
6. Hurali—Horse gram—Dolichos uniflorus.

C. Oil seeds.
1. Hoochellu or Prantil—Foolish oil plant—Guizoteas oleifera.
2. Wollellu or Achellu, Gingelly—Sessamum orientale.
3. Haraloo—Castor oil—Recinus communis.

The dry crops given in the cold weather are.

I. Cereals,—nil.

II. Pulses.
1. Kadale—Bengal gram—Cicer arietinum.

III. Oil seeds,—nil.

Special produce.
1. Sugar-cane.
2. Tobacco.
3. Cotton.

Miscellaneous produce.
1. Chillies.
2. Coriander seed.

The Hindoo agricultural year is reckoned from March to March, or from the date on which the sun enters Pisces to that on which he leaves Aquarius. The three main periods, namely, two rainy seasons of Múngar (early) and Hingar (late) and one Garbha (dry weather) are divided into 27 parts of 13½ days each, distinguished by the names of the principal stars of the asterisms in which the moon is set down in the calendar as entering and remaining, and in accordance with this division the rains are supposed to be distributed in corresponding periods, the division being continued throughout the dry season, though rain may not fall at that time.

The dates and duration of these for 1877 are given below, as well as the agricultural operations usually carried on at this time.

The three main periods or seasons.	No.	Names of the Stars from which the rains receive their names.	Principal Star of Asterism.	No. of days or duration of each Star.	English Months and Dates.	The Twelve Signs of the Zodiac.
	1	Oottrabhadrapati	A Andromedæ	13⅓	15th to 28th March	Pisces.
	2	Revati	S Piscium	13⅓	29th March to 10th April	
	3	Aswini	B Arietis	13⅓	11th to 24th April	Aries.
	4	Bharani	35 Arietis	13⅓	25th April to 7th May	
	5	Krittika	21 Tauri alcyonis	13⅓	8th May to 21st May	
	6	Rohini	A Tauri aldebaran	13⅓	22nd May to 4th June	Taurus.
	7	Mrugasira	Orionis	13⅓	5th to 18th June	
	8	Aridra	A Orionis	13⅓	19th June to 2nd July	Gemini.
	9	Punarvasu	B Geminorum pollux	13⅓	3rd to 16th July	
	10	Pooshya	Cancri	13⅓	17th to 30th July	Cancer.
	11	Aslesha	E Hydræ	13⅓	31st July to 13th August	
	12	Makha	A Leonis Regulus	13⅓	14th to 27th August	Leo.
	13	Poobba	Leonis	13⅓	28th August to 10th September.	
	14	Oottra	B Leonis	13⅓	11th to 24th September	
	15	Husta	Corvi	13⅓	25th September to 7th October.	Virgo.
	16	Chittah	A Virginis spica	13⅓	8th to 21st October	
	17	Swati	A Bootis Arctur	13⅓	22nd October to 3rd November.	Libra.
	18	Vishakha	V Libra	13⅓	4th to 16th November	
	19	Anoradha	Scorpionis	13⅓	17th to 29th November	Scorpio.
	20	Jeshta	A Scorpionis autares	13⅓	30th to 13th December	
	21	Mula	Scorpionis	13⅓	14th to 26th December	Sagittarius.
	22	Purvashada	Sagittarii	13⅓	27th December to 9th January.	
	23	Oottrashada	6 Sagittarii	13⅓	10th to 23rd January	Capricornus.
	24	Shravana	A Aquinla attair	13⅓	24th January to 6th February.	
	25	Dhanishta	B Delphini	13⅓	7th to 19th February	Aquarius.
	26	Shatebhisha	Aquarii	13⅓	20th February to 2nd March.	
	27	Purvabhdrapati	A Pegasi	13⅓	3rd to 14th March	

The time occupied by the preliminary operations connected with the Múngar crop,* its sowing, maturing, and harvesting, may be taken as extending from the latter end of March till near the close of August or middle of September, and the heavy falls required to ensure a good crop are known as "Hadas," or saturations of the soil to the depth of about a span, which is estimated by those who have compared it with the rain-gauge as equal approximately to one inch of rain.

It is very difficult to obtain information which can be relied on regarding the precise amount of rain required to ensure a good crop, and still more to determine how the fall can best be distributed or the extent to which either the quantity or the times can be varied without serious injury to the crop.

The total quantity shown as having fallen in any month is no certain test, as a small quantity falling in timely showers is often better than heavy downpours with long intervals between them.

The rain required varies with soil and locality. Different crops also prosper with greater or less quantities of rain; but a rough estimate of a favourable season gives for the Múngar or early dry crops about 20 inches for cereals, 17 or 18 for pulses and oil seeds between March and August.

* Rain Múngar Crop.

CHAP. I. QN. 1.

MYSORE.

Colonel Hay.

The average for these months of the seven years 1872–78 is :—

	Inches.	Cents.
Mysore - - -	13	88
Hassan - - -	16	80

The average of the same months for 12 years 1865 to 1876 is :—

	Inches.	Cents.	
Mysore -	16	26	according to the Register at Mysore Jail.
Hassan -	18	89	According to the Register at the Civil Hospital at Hassan.

The same rough estimate gives 30 inches as needed for the "Hingar" or late dry crops between April and November, while the average of 12 years for the period is :—

Inches.	Cents.	
26	30	at Mysore.
30	32	at Hassan.

RAJPUTANA.

RAJPUTANA.

Dr. Moore.

The rain-fall is principally from the south-west monsoon, which, however, passing over the sands of Guzerat, loses much of its force before arriving over Rajputána, until, in the semi-desert district of Marwar, Jeysulmeer, and Bickaneer, the fall does not exceed 5 or 6 inches per annum. The more easterly districts to the east of the Aravelli mountains obtain also, during the earlier part of the monsoon, rain from the north-east, being the last gift of the clouds from the Bay of Bengal and the valley of the Ganges, which, instead of passing to the east, are deflected by the Himalaya mountains in a westerly direction, curving towards Central India, and even reaching the western districts of Rajputana. Roughly speaking, it may be stated that the rain-fall of Rajputána is determined by the Aravelli range of mountains, which, culminating to their highest altitude in the extreme south at Mount Aboo, run in a north-easterly direction almost through the centre of the province, being distinct as a wall for some 150 miles to Ajmere, and then continuing in a more broken manner as far as Delhi. To the west of the range the country is sandy, and the fall averages from 20 to 30 inches at the base of the hills; but, decreasing until in the far west at Jeysulmeer and Bickaneer, the fall does not exceed 5 or 6 inches, becoming almost *nil* in the extreme west, which may be regarded as the southern verge of the rainless tract stretching through from Central Asia to Northern Africa. To the east of the Aravelli range the rain-fall averages 30 inches, increasing as easterly progress is made, until the more copious rain-fall of the Central Provinces and of Central India is realised.

The rainy season commences about the beginning of July, accompanied on the east side of the Aravelli range by thunder-storms from the east, if the eastern monsoon (from the Bay of Bengal) is in force. August is the wettest month everywhere, September being often dry, but sometimes showery. There are also showers about Christmas from the north.

The rain-fall in Rajputana cannot vary much as regards diminution, without grave injury to the cultivation, and without causing a scarcity in the supply of grass, necessary for the enormous herds of cattle and flocks of sheep, forming the principal wealth of the province. It is scarcely possible for it to increase more than is acceptable, provided it does not fall at unseasonable periods. Too much rain, excepting perhaps in the extreme eastern districts, has scarcely fallen within the memory of man. Local storms may have sometimes flooded towns, or caused the downfall of some wretchedly constructed houses. But such falls have been emphatically local, the whole country never being deluged to the extent occurring in other provinces, where crops have been destroyed from such causes.

The amount of rain-fall for the whole year, which may be considered sufficient for agricultural purposes, is not less to the east of the Aravelli range than 30 inches. Here the soil is comparatively heavy, in some localities quite black, the country hilly, and much of the water is drained off by the Bunnass, the Chumbul, the Nej, and other smaller rivers piercing the country. To the west of the Aravelli range the country is sandy, the rain falling is absorbed and remains in the soil, and there are no draining rivers, the solitary exception being the Loonee, which, however, only passes through a small part of the country, the south of Marwar. Here, then, the smaller rain-fall of 12 inches suffices for the wants of the cultivators.

To furnish the best results, the rain-fall should be distributed throughout the wet months to the west of the Aravelli—3 inches in July, 8 inches in August, 2 in September, and 1 at Christmas. To the east of the Aravelli—6 inches in July, 18 in August, 4 in September, and 2 at Christmas. This is of course approximate.

Captain Barr.

Marwar and Jeysulmere.—The rain comes from the south-west and north-east, but the force of both monsoons appears to be exhausted before it reaches the semi-desert tracts of Marwar and Jeysulmere, for the average rain-fall is very small, and decreases from the south and south-west portions of the district to a minimum of 3 or 4 inches only in the north, north-west, and north-east.

The chief supply of rain comes from the south-west, and July, August, and the beginning of September is the period during which rain is expected. At Jodhpore, which may be taken as the centre of Marwar, the rain-fall gauged during the last seven years is as follows :—

	Inches.
1872 - - -	22·45
1873 - - -	11·00
1874 - - -	6·38
1875 - - -	13·92
1876 - - -	25·9
1877 - - -	4·5
1878 - - -	19·5

Giving an average rain-fall of 14·78 inches. No register is kept of monthly falls, and, with the exception of that at Jodhpore, no rain gauge is maintained in any portion of the district. Generally speaking, a fall of 6 inches is sufficient, when well distributed, to produce an average out-turn of crops; anything less than this produces a failure both of food grains and of grass, upon which the wealth of the district mainly depends. To secure favourable harvests the rain-fall should be about 15 inches, and should be distributed as follows :—July 4 inches, August 5 inches, September 4 inches, December 2 inches.

The kharif crops of bajra, jowar, moth, moong, and maize are sown after the first fall of rain, the land being broken up after the early showers, which usually herald the approach of the south-west monsoon.

The sowings are generally completed early in July; rain is required during the month for the first spring of the crop, and later to promote its growth; the fall in August and September should be sufficient to keep the crops to their full strength during the process of growth and ripening.

The latter rains, *i.e.* the last falls of either the north-east or south-west monsoon, have a double use in completing the success of the rain crops, and in moistening the soil preparatory to the rabi sowings, which generally commence in October, and are completed by the end of November. A fall of 2 inches in the end of December or the beginning of January is most beneficial to the rabi crops, which are then in the blade. An element which is worthy of notice, though frequently overlooked in the examination of registers of rain-fall, is the general condition of the weather during the months in which rain is expected. In some seasons the return of rain-fall is swelled by some unusually heavy falls at intervals during the monsoon months, the weather between these falls being marked by excessive heat, the sun being but little obscured, and the air dry. In other seasons, though the registered rain-fall was small, it has been well distributed, and the period between the falls has been marked by cool weather, a cloudy sky, and an air laden with moisture.

A failure of early fall in July is not disastrous in this district. Sowings are deferred, but with a good harvest the year before, the accumulations of food grains and grass are sufficient for present wants. It is only when the months of July and August pass without rain that hopes of the kharif fade. Should the drought continue throughout September, or the rain-fall be insufficient for the growth even of grass, the worst combination of circumstances may be said to have arrived, and a "tirkal" or a famine of water, grass, and grain falls upon the country.

CENTRAL INDIA.

Agency.	Station.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	Average.
		In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Bhopal - -	Agency Hospital -	27·6	41·0	61·6	84·9	36·4	45·8	65·7	55·9	60·3	32·5	51·1
Baghelkhand - -	Rewah ,, -	—	—	—	—	56·4	53·5	66·7	83·5	84·2	36·4	63·4
	Sutna ,, -	—	—	—	—	43·3	45·1	41·6	60·5	41·5	31·3	44·0
	Nagode ,, -	—	—	—	—	47·0	55·2	52·2	85·4	58·6	40·4	56·4
Western Malwa -	Agar ,, -	30·1	28·5	30·5	—	41·1	38·6	45·7	51·1	42·7	16·8	36·1
Deputy Bheel Agency	Manpur Dispensary	26·5	36·5	37·7	47·7	37·9	40·4	35·3	42·5	33·7	28·9	36·7

In the Bhopal and W. Malwa Agencies the rains are described as generally setting in from the east and north-east, though occasionally from the south-west.

The Baghelkhand and Deputy Bheel Agencies (Mánpur), on the other hand, state the monsoon is mainly from the south-west, though supplemented from the north-east. As the meeting of the north-east and south-west currents is believed to occur hereabouts, the Baghelkhand Agency have taken some pains to record the wind direction with the rain-fall, with the following result :—

	From East.	From West.	Per-centage from East.
At Rewah -	19·29	41·09	31·9
At Sutna -	6·19	35·84	14·7
At Nagode -	10·33	43·70	18·0

The rains begin in the middle of June and cease about the end of September or beginning of October. July is usually the wettest month. Lieutenant-Colonel Bannerman (Baghelkhand) says one-third of the annual fall occurs in July.

Agency.	Limits within which rain-fall may safely vary.	Distribution.				Remarks.
		June.	July.	August.	Sept.	
Bhopal - - -	45 to 70	2	22	13	5	Actual fall of 1878; this may be taken as typical.
Baghelkhand - - -	23 to 60	1½	5½	10	7	A *minimum* fall of 26 inches, and includes 1 to 2 in., December–January.
W. Malwa - - -	32 to 40	8	6	12	6	A sufficient fall.
Rutlam - - -	——	5·5	12·5	12·0	8·2	Average monthly fall registered since 1868.
Manpur - - -	——	6	11½	8¾	8½	Monthly average for six years.

In W. Malwa in 1877 the fall only amounted to 12·21 inches from June to October, and yet the Indian corn was good and the joár unusually abundant, but the rabi suffered much.

In Central India the kharif is sown about June, and the rabi in October—November. Generally a heavier rain-fall injures the kharif and benefits the rabi. The winter rain appears to be very irregular, but benefits the wheat, grám, and opium, and is indispensable after an insufficient or scanty monsoon. In Baghelkhand, from 1½ to 2½ inches fall in December—January. In Rutlam, Mir Shahamat Ali, C.S.I., says the rain between 15th July and 15th August produces insects in the crops if not washed away by continued showers in the latter fortnight of August.

HYDERABAD.

What are the different agricultural operations depending on the due arrival of each of the expected monsoons, or seasonal rains? In answering this question we shall deal with Telingana and Marahatwari separately. The account given for the Telingana province is the result of inquiries conducted by the talukdars, while that for Marahatwari is taken from a book entitled "Notes on the Agriculturists of the Aurangabad District," by Mr. Fardunji Jamshedji.

Telingana.

Rohini (May 23rd to June 5th).—Rain sometimes falls during this naxtra,* which is not included in the category of the monsoon naxtras. The lands are first cleared of stones and scrub, and then ploughed for the kharif sowings. Sheep are folded on lands prepared for the abi rice crop. Thorns, &c. are collected for forming the field hedges. Agricultural implements, such as ploughs, harrows, &c., are mended, and the Bhagelas (a tribe) engaged as servants and labourers. The last harvesting of the tabi† rice takes place during this season.

Mirg (June 6th to 19th).—Ploughing mostly takes place on kharif lands, which are afterwards sown. Sawan, barag, kudru, kangni, maize, gingelly, urd, mung, lobha, and so forth, are sown during this month.

Ardra (June 20th to July 3rd).—Ploughing operations are still continued. Yellow jowar, hemp, cotton, and bajra are sown during this month. In garden lands vegetables are sown. Lands sown in *Mirg* are now worked with a bullock hoe. Irrigation beds are formed in lands prepared for the abi paddy crops. These are filled with water, and then the ground is ploughed thrice. It is subsequently worked with a harrow. Frequently vegetable matter is mixed with the slush formed on the surface of the fields, and allowed to rot there. The land is now re-ploughed, and is prepared to receive the seed. The seed, after being previously soaked in water for about three days, is sown broadcast. Fields are hedged in.

Punarwasu (July 4th to 17th).—Ploughing and sowing operations are carried on in the same way as that described above. Sowings of the abi paddy are general. Fields under kharif crops are weeded.

Pushya and Ashlesha (July 18th to August 14th).—Operations similar to those described above are conducted, excepting that not much ploughing is done during this naxtra. Transplantation of the paddy plants takes place in most of the fields; in others the crops are thinned, and weeded by hand. Fields under cotton are also weeded. Lands for the rabi are levelled with the bakhar.

Magha (August 15th to 28th).—This is the latest season for abi rice sowings. Tobacco is sown in nursery beds. The abi paddy crops are weeded, and transplantation takes place. Frequently the top shoots of the paddy plants are nipped off.

Purvá (August 29th to September 10th).—Of the kharif crops, mung is ready for harvest. The other operations are similar to those mentioned in the last two naxtras.

Uttra (September 11th to 24th).—The last weeding of the abi rice crops takes place. The tops of the plants are nipped off. Mung, urd, yellow joár, kangni, kudrú, and such crops are cut.

Hast (September 25th to October 8th).—Rabi crops, such as white joár, gram, linseed, barley, lakh, peas, safflower seed, &c., are sown; garden crops are also sown about this season, and the lands are manured. Bajra and yellow joár and the remaining kharif crops are now cut. The first cotton pickings take place. Tobacco seedlings are transplanted. Land for *tabi* crops is prepared, irrigation beds are formed, and the ground is watered.

Chitrá (October 9th to 21st).—The cultivators begin to cut and harvest the kharif crops. The gingelly crop is cut, bound up in bundles, three or four of them being placed in an upright position, resting one against the other, to prevent the seed dropping out. White joár, gram, safflower seed, linseed, and other rabi crops are sown. Besides the kharif and rabi crops, there is a third seasonal crop grown, which is termed *maghi*.

The maghi crops are grown about two or three weeks after the rabi sowings are finished, and these crops are raised on poor soils. Hollow ground is generally selected for this purpose, as it retains rain water. Lands for the mung crops are ploughed about this season.

Barley is sown in garden lands. The abi paddy is watered, and the crops watched. In some places this crop is harvested.

Swati (October 22nd to November 3rd).—The kharif crops, such as bajra, yellow joár, &c., are threshed and winnowed. The abi rice is harvested. Land is prepared for sugar-cane; manure, &c. being applied. The last rabi sowings take place during this season. Land for the *maghi* crop is reploughed, and karela, kulthi, &c. are sown.

Vishakha (November 4th to 17th).—The rabi crops are weeded by means of a bullock hoe. The *maghi* crop sowings are finished during this season. The abi rice is harvested, and the straw is stacked. Sugar-cane is planted. Kolus (sugar-cane mills) are fixed and the juice expressed and prepared for *gur*. Land for the rabi rice crop is prepared with manure, and irrigation beds formed.

Marahatwari.

Jeshth (June).*—The cultivator is diligently employed in levelling his lands with the bakhar or hoe-plough. If the rains have been favourable and the ground well saturated, kharif sowings take place. Cotton, hemp, til, mung, and tûr are sown through a bamboo seed-drill. Garden lands are prepared and manured for the sowings of ground-nut. Seedlings of red pepper, which have been raised previously in nursery beds, are now transplanted to garden land. Tobacco seed is also sown in nursery beds during this month. Sugar-cane fields are weeded by women, and other lands manured and prepared for planting the cane. The cane is watered about six times during this month. Guwari (dolichos fabœformis), bhendi (hibiscus esculentus), chaoli, and other vegetable seeds are sown. Varieties of gourd are also sown. The women assist the cultivator in collecting the scrub, weeds, &c., that are uprooted by the bakhar, and this they sometimes use as fuel.

Ashad (July).†—This is one of the few exceedingly busy months for the kunbi. Such lands as have not been sown during the preceding months are now worked again with the bakhar. All the cultivators are busy with this uncouth-looking, but very effective implement, wherewith both kharif and rabi lands are now levelled. The rest of the kharif sowings take place now, and are completed during the month. Bajri, maize, túr, urd, kulthi, hemp, rálá, &c. are sown. In garden lands ground-nut is sown, and seedlings of egg-plant and red pepper are transplanted. Khonde joár (a coarse grain) is in this month ready for the sickle: this species of joár is only raised in garden lands, and is chiefly used for home consumption. Kaddol, which is raised for fodder, is also cut during this month, and the working bullocks fed on it: it is a rich fodder for cattle. About four waterings are given in this month to the sugar-cane.

Shravan (August).‡—Such lands for rabi as have not been ploughed for some years are now harrowed, and then levelled with the bakhar. Fields under cotton, bajra, mung, &c. are hoed, and afterwards weeded by hand. Tobacco seedlings are transplanted from the nursery bed to the dry-crop field. Karela, a species of oil seed, is sown. Garden lands, in which ground-nut has been sown, are now weeded. The earth round the sugar-cane plant is dug, and heaped up over the roots, to strengthen the cane. Red pepper (mirch) is now ready and plucked from the plants.

Bhadrapud (September).§—Lands prepared for the rabi are levelled with the bakhar; joár, linseed, and kulthi are sown. The mung crop is harvested now

* A naxtra or nakshatr is a division of time equal to 13⅓ days. There are 27 such in the year.

† Tabi rice is sown in December or January, and cut in May or June. Abi rice is sown in June or July, and cut in November.

* Rohini and Mirg.

† Ardra and Punarwasu.

‡ Pushya and Ashlesha.

§ Magha and Purva.

(the pods being plucked from the plants), and by the end of the month some part of it is ready for the market. The ears of the bajra crop are just forming and have to be protected from birds, &c. In garden lands joár is now sown. Vegetables and edible herbs are ready for the market. The earth round the sugar-cane is again dug out, and heaped up over the roots. Fields under tobacco and cotton are weeded, and also some of the garden lands. The hemp crop is ready now; the plants are uprooted and tied in bundles, to be placed in water, for the non-fibrous part to be rotted away. Fields under cotton are weeded, and in this work women are employed.

Ashvin (October).*—If the rains have not been very heavy, the rabi sowings are completed; otherwise they generally take place during the following month. Wheat and gram are now sown; the joár sowings are finished. In garden lands wheat and joár are beginning to be sown. Urd and mung are threshed, and the women are employed on this work. Grain is forming in the bajra ears, and the crop has to be watched; very often the cultivator has to sleep in his field. Where joár and vegetables have been raised in garden lands they are weeded now, and so are the fields under cotton. In garden lands wheat, gram, &c. are sown, and more of the mirch (red pepper) plucked from the plants. Vegetables are cut and sold in large quantities during this month.

Kartick (November).*—The bajra crop is now ready for the sickle, and both men and women are busily employed in gathering the harvest. At night the cultivators remain in the fields to watch the kharif crops. The first cotton is now picked, and here again women are employed. In garden lands buckwheat, gram, opium, rajura, mustard, &c. are sown.

* Uttara and Hasta.

* Chitra, Swanti, and Vishakha.

CHAPTER I.—QUESTION 3.

Give any statistics you possess as to the average area in each district under cultivation yearly, distinguishing food crops from others; the average amount of the chief food grains produced per acre; the total consumption in the district of such grains; the surplus that remains for export, or the deficiency that has to be supplied by import in ordinary years. How are these statistics collected, what amount of reliance may be placed on them, and what suggestions can you make for their improvement? If you have no statistics on these subjects, give any approximation or estimate you can.

PUNJAB.

Statistics and their accuracy.—The statistics of cultivated areas published in the reports of each year are based on a very complete system of survey and registration. All the districts of the Punjab (a portion of the Kohat District alone excepted) have come under regular settlement, and the great majority of them have also been surveyed by the Revenue Survey. In the latter case the total area of the district is ascertained by scientific surveyors working with the most accurate methods known to science; and the cultivated area, as it exists at the time of survey, is also ascertained by the same agency, though by less exact methods. At the regular settlement of a district a less expensive method of survey is employed, with results which experience has shown to be, under proper supervision, scarcely less accurate (indeed as regards the exact area of cultivation, for reasons which I need not here explain, they are usually more accurate) than the returns of the scientific survey.

The object of a regular settlement is first to assess the land revenue, and secondly to provide a correct record of the land of which it is assessed and of the persons who have rights of ownership or occupancy therein. Many ends of the first importance are served by such a record; but the primary reason for its formation was the great difficulty of assessing and collecting the revenue without it.

The record is made up by villages, or rather by mauzas, of which perhaps the best translation is the word township. Each mauza, or (if they are small) each cluster of mauzas has an accountant, locally known as the Patwári, whose office is kept as far as possible hereditary, and whose business it is to report as they occur all successions and mutations which take place among the owners and tenants of his charge with a view to the record of holdings being kept up to date, and annually in October to inspect every field, noting the crops grown on it, and such mutations of ownership and occupancy as he may not already have reported. Immediately after this inspection he furnishes a statement showing the total cultivation of his charge for the kharif just reaped and the rabi just sown.

It will be seen that this system is built up upon a reliable foundation. The total cultivated area of each mauza is ascertained at or before settlement, both by the Revenue Survey and by the settlement officers. The record of rights prepared for each village shows also the area of each field, cultivated or waste. Thus far we may be sure that errors are eliminated. The Patwári's reports each year cannot of course be so closely checked. But there is no reason to suppose that in the majority of instances they contain any very gross errors of area and classifications.

During the past 15 years great improvement has taken place in the returns of the 21 districts that have been under settlement. It is acknowledged that there is still room for improvement. But these remarks are written in order to show that there are good grounds for accepting as fairly accurate the crop areas published in the annual reports. They are not guesses. They are originally based on surveys admittedly accurate, and differ from those surveys only to the extent of the annual expansion or contraction of cultivation and variation of crops; the facts of which are ascertained annually in October by the village accountants.

Thus far as regards statistics of area and of crops cultivated. In regard to statistics of yield our position is much weaker. It may be said with truth that the very great majority of our statistics of yield are guesses. The difficulties surrounding this question even in an advanced European country are very great, and in India they are exaggerated many fold. The agriculturists keep no record of what their crops produce, and the replies of even the most intelligent and straightforward among them need to be very carefully weighed. The Financial Commissioner has found that the returns of yield of each crop reported from year to year by each district officer are not usually, in strict language, estimates of the yield for the year under report; they are approximations arrived at by the reporting officer by the use of the data of old experiments. These experiments are either those made when the district was under settlement, or others made independently by orders of the Financial Commissioner during the years 1872–75. As regards the settlement experiments Mr. Ouseley observes that their value for the purpose to which they are applied is open to question. The officers who

made them commonly mistrust the results; in practice they never assess up to the standard indicated by their produce estimates, and not uncommonly arbitrarily modify or frankly reject them. Also the small areas, usually small fractions of an acre, subjected to actual experiment, together with the limited periods over which the observations extend, greatly reduce their value as bases for generalisation. Concerning the value of the other set of experiments, those made by the order of the Financial Commissioner during the years 1872–75, Mr. Ouseley directs me to quote the remarks on the subject made by his predecessor, in forwarding them to Government for submission to the International Statistical Congress.

"As the experiments, the results of which have now been embodied, extend over a considerable period and number several thousands, the results may be considered to be fairly general in their nature. With regard to their accuracy it is necessary to remark that the facilities for supervision of such returns are limited, and that only of late have attempts been made to procure such statistics upon an extensive scale, and the subject is one which requires considerable experience on the part of those who make the observations, and a careful exclusion of all unreliable data, to an extent which the returns now furnished can hardly claim."

The last sentence expresses one of the greatest difficulties involved in the subject. And Mr. Ouseley considers that the improvement of our annual estimates of yield depends largely on our recognising this, and on the patient training of those on whom we depend for our observations.

At the same time, taking such estimates of yield as we possess for what they are worth, a table is appended showing the average produce of the principal staples of agriculture per acre, as reported by district officers for the five years ending 1876–77; and as ascertained by the Financial Commissioner's experiments during the years 1872 to 1875.

Suggestions for the improvement of existing statistics.—The Financial Commissioner considers that improvements of two kinds are possible. First, in observing actual out-turn; secondly, in the form and system of the general statistics. On the first point he considers that district officers should be urged to make independent and systematic observations. If we could succeed in observing in each district for 10 or 15 successive years the average out-turn of say 500 acres of land, selected as representing fairly the average fertility of the district; noting at the same time all the contingencies connected with its cultivation, such as expenses, losses, &c., a basis of much value would be obtained, from which to calculate the average rate of production, and the limits within which it varies. With the large revenue establishments at the disposal of Government such observations would be practicable; secondly, as to the form and system of the general statistics now annually reported, the Financial Commissioner considers them capable of material improvement in the following ways. At present the crop area of each year is ascertained by an inspection which takes place just after the kharíf has been harvested, and while the rabi is being sown; and the rabi yield is assumed as if all the field sown with the rabi came to maturity. This is a fertile source of error; many fields of wheat and barley are cut for fodder, or the seed fails to germinate; the gram crop constantly fails to a material extent; and for these and other reasons the area harvested never agrees with the area sown. Mr. Ouseley would oblige the Patwáris to inspect and record the area of each harvest at the reaping season, *i.e.*, in October for the kharíf and in April for the rabi. In the next place, the returns required from each district should be more carefully adapted to the circumstances of its agriculture. At present one uniform set of statements is required from each district, which give: 1st, a bare statement of the total acreage of each crop; 2ndly, a statement of the average yield of each crop per acre, and 3rdly, the maximum and minimum rate of rent paid by each crop. It is only in respect of the third subject that any distinction is drawn between irrigated and unirrigated land. The returns do not provide for the separate exhibition of the irrigated and unirrigated areas, and of their respective rates of yield. Only the main crops are shown, and the agriculture is very imperfectly classified. The extent to which manure is used, and its effect on the yield, is also entirely omitted.

The omission of these details from the returns gives them an appearance of simplicity which is fallacious. The simplicity has been obtained by the excision of the most important details;—details without which they can neither be accurately compiled nor command the confidence of those who use them. It is of little use to state that wheat yields 800 lbs. per acre in one district and 600 lbs. in another, unless the proportion of crop which is irrigated in each can be stated. Situated as we are, the most important point of all is to know for each year how much of each food crop is irrigated, and how much is dependent on rain only. It is with no little difficulty and incompleteness, that an answer on this subject (see reply to question 4) could be framed, even after calling for special returns from district officers.

The Financial Commissioner does not think that the demanding of such details from district officers would necessitate the employment of more costly agency than we already possess in the village accountants and revenue establishments of the province; though it would involve an increase in special agency and the cost of supervision. Elaborate statistics are neither desirable, nor practicable; but if the returns required from each district are properly adjusted to the main features of its agriculture, it will be as easy, perhaps easier, to furnish them than the cruder returns now submitted. In brief, the annual returns required from district officers should be revised, so as to show:—

(1.) The total areas under each crop more correctly than is now done.

(2.) The area of each crop which is irrigated, aided by river floods, or solely dependent on rain; and, so far as practicable, the area manured.

(3.) The average yield of each crop under these several circumstances.

And a reasonable amount of variation should be allowed in the returns of each district; so that no one should be required to fill up tables unsuited to the agriculture which they are intended to describe, or which neglect important local specialities.

In conclusion, Mr. Ouseley would urge on the Government the creation of an appointment in the Punjab similar to that held by Mr. Buck as director of agriculture in the North-West Provinces. If the attention which Government desires its district officers to give to agriculture and its statistics is to be intelligently directed, and to achieve any results, this can only be by providing at least one officer in each province, who can give his sole attention to the supervision of the subject.

Having thus explained the nature of the statistics available, their shortcomings and the direction in which they are capable of improvement, I proceed to give the results of such statistics as have been collected in past years.

Average area in each district under cultivation.—A statement appended shows this with details of the area under each crop. The annual crop returns above described being available in the annual revenue reports; the only difficulties were to ascertain a fair average for each district, and to eliminate and correct any cases in which the returns were admittedly unreliable. To this end each district officer has been asked to state the general character of each harvest for the five years ending 1876–77; and the replies received show that the average of those five years is probably on the whole a fair one. These officers have also been asked to state whether the crop returns submitted during these five years are approximately true; the answers except in seven cases being that they are. The

seven excepted cases* are those of districts under settlement; in which either the returns submitted have been estimates necessitated by the employment of the Patwáris in settlement work, or the settlement measurements have supplied more accurate data than those before available. In all seven instances the crop returns of the recent settlement measurements have been given instead of the average of the annual crop statements.

The following is a summary of the average thus obtained for the whole province; reduced to round numbers for perspicuity's sake :—

Description of Crop.	†Lakhs of Acres.			Per-centage of Total Cultivation.		
	Rabi.	Kharif.	Total.	Rabi.	Kharif.	Total.
A.—Food Grains.						
Cereals.—Wheat	64	—	—	30	—	—
Barley	17	—	—	8	—	—
Rice	—	7	—	—	3	—
Joár	—	22	—	—	10	—
Bájra	—	29	—	—	14	—
Maize	—	9	—	—	4¼	—
China and Kangni-	—	2	—	—	1	—
Total	81	69	150	38	32¼	71
Pulses.—Gram	16½	—	—	8	—	—
Peas	1	—	—	½	—	—
Masur	1½	—	—	¾	—	—
Moth	—	11	—	—	5½	—
Másh and Mung	—	5	—	—	2½	—
Total	19	16	35	9¼	8	17¼
B.—Other Products.						
Drugs and spices	½	1½	—	¼	¾	—
Oil seeds (Mustard	4	—	—	2	—	—
Oil seeds (Til	—	2	—	—	1	—
Oil seeds (Tárámirá	2	—	—	1	—	—
Cotton and hemp	—	8	—	—	4	—
Indigo	—	1	—	—	½	—
Sugar-cane	—	3½	—	—	1¾	—
Vegetables	1½	1	—	¾	½	—
&c.	1	—	—	½	—	—
Total (B.) other products	9	17	26	4½	8	12
Total (A.) food grains	100	85	185	47½	40	88
Grand Total	109	102	211	52	48	100

Production, consumption, and surplus or deficiency of grain.—District officers have not been asked to state the average amount of the chief food grains produced per acre, as it was considered that their annual reports for five years past supplied answers on the subject, which however defective would be less so than any hurried answers that could now be given. They have been asked to state the surplus of food grains exported from or deficiency exported into their districts. They have not been asked to furnish a complete estimate of gross production and consumption; it was considered that such estimates, if furnished, would have been unreliable; they would have been contributed by officers of varying degrees of experience, acting on conflicting rules and conclusions. But as an approximation to such an estimate, district officers were asked in replying to question 5, to state not only the staple food of the people, but also the average consumption per family. (Their answers in full on this subject will be found in the replies to that question).

Accordingly in the papers appended will be found the following returns, on which my reply to this question will be framed :—

(*a.*) A statement of average produce of principal staples of agriculture in each district, (1) as reported by district officers for the five years ending 1876–77; and (2) as ascertained by experiments conducted under the orders of the Financial Commissioner during the years 1872–75.

(*b.*) A tabular abstract of district officers replies to question 5, showing the staple food of the people, and the rate of consumption per head.

(*c.*) A statement of imports and exports of agricultural produce (external trade only) compiled from the Punjab Trade Returns of the five years, 1873-74 to 1877–78.

Some remarks are called for in connection with the two latter returns.

(*a.*) *Tabular Abstract of District Officers Replies, showing Staple Food and Rate of Consumption.*—District officers were asked to give the consumption of a family of five persons, viz.. one old person, a man and his wife, and two children. In not a few instances the replies (summarised below) largely over-estimate this consumption. The most obvious cases of such over-estimating are Sirsa, a dry district, where the crops are precarious, and the poorer members of the population are often insufficiently fed; Dera Gházi Khan, where the rate given is an impossible one, and Hazára, to which the same remark applies, and where the poorer classes among the hill people certainly eat less grain than those of the plains, supplementing their meals with milk and herbs. The races of the Punjab are no doubt of larger stature than those of Southern and Eastern India; and the colder climate of this province would also cause a larger consumption of food than occurs in the rest of India. But any estimate based on an average consumption of food grains, amounting to 1 *ser* (2 lbs.) per head per diem is certainly excessive. It would be a large estimate to assume that a man and his wife in the prime of life together eat 2 *sers* per diem, and the two children with the old person will certainly on the average not eat 2 *sers*, thus giving less than 4 *sers* for five persons. The estimates submitted from each district multiplied by the population give an average for the whole province of 11½ *chitacks*, or 0·71 of a *ser* per head per diem. Allowing for the instances of over-estimate, the correct estimate is probably a consumption of 10 *chitacks* or 0·625 of a *ser* per head of population per diem.

TABLE showing AVERAGE DAILY CONSUMPTION per head of POPULATION per diem, in Sers and Decimals thereof; abstracted from District Officers' Reports.

Division.	District.	Average Daily Consumption per Head of Population.	
		By Agriculturists.	By Non-Agriculturists.
Delhi	Delhi	0·80	0·59
	Gurgaon	0·88	0·66
	Karnál	0·79	0·59
Hissar	Hissar	0·84	0·52
	Rohtak	0·85	0·61
	Sirsa	1·00	0·80
Umballa	Umballa	1·00	0·80
	Ludhiána	1·00	0·74
	Simla	0·79	0·59
Jullundur	Jullundur	1·05	0·80
	Hoshiárpur	0·88	0·77
	Kángra	0·78	0·66
Amritsar	Amritsar	0·71	0·57
	Siálkot	0·73	0·50
	Gurdáspur	0·82	0·66
Lahore	Lahore	0·79	0·57
	Ferozepore	1·00	0·80
	Gujránwála	0·88	0·79
Rawalpindi	Rawalpindi	1·06	0·91
	Jhelum	0·58	0·58
	Gujrát	1·04	0·67
	Shahpur	0·75	0·63
Mooltan	Mooltan	0·75	0·70
	Jhang	0·66	0·72
	Montgomery	0·77	0·62
	Muzaffargarh	0·82	0·80
Derajat	Dera Ismail Khan	1·00	0·70
	Dera Gházi Khan	1·60	1·40
	Bannu	0·75	0·64
Peshawar	Pesháwar	1·00	0·90
	Kohát	0·60	0·60
	Hazára	1·31	1·03

* Delhi, Gurgaon, Mooltan, Jhang, Muzaffargarh, Dera Ismáil Khan, Kohát.

† Lakh = 100,000.

(*b.*) *Table of Imports and Exports for five years ending* 1877–78.—The figures are taken from the Punjab Trade Returns. They relate solely to the trade which crosses the frontiers of the province, and the results are to be relied on.

These, with the return of average areas under each crop before described, are the materials from which the estimate of production, consumption, and surplus of food grains desired by the Famine Commission must be formed. In the existing state of our statistics of average yield it is not practicable to submit with this report any such estimate for each district, or for each division; it is necessary to confine the attempt to an estimate for the whole province; an unavoidable simplification which is perhaps the less to be regretted in the case of the Punjab; as the replies to questions 2 and 16 to 21 show, that trade in past years has succeeded and will certainly in future years increasingly succeed in distributing the produce of the province according to the demand in each part of it. There is no real isolation of the several parts of the province. The estimate framed accordingly is as follows :—

ESTIMATE of FOOD GRAINS and PULSES produced, consumed, and remaining over for Storage and Export in an average Year in the PUNJAB.

		PRODUCTION.		CONSUMPTION.								
			Estimated Produce.			Add required for Seed Grains.					Difference between columns 10 and 11; *i.e.*, amount by which surplus thus estimated exceeds average actual exports from the province.	
	Food Grains.	Average Area Cultivated in Acres.	Rate per Acre, Sers.	Total Produce, Mds.	Population, Souls.	Consumption at 14 lb. or 10 Chitaks per Head of Population per Diem.	Rate per Acre in Sers.	Amount required in Maunds.	Total Consumption in Maunds.	Surplus remaining for Storage or Export in Maunds.	Actual Exports for the 5 years ending 1877-78 in Maunds.	Amount in Maunds. / Per cent. of Total Estimated Produce.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12. / 13.
	Wheat	6,354,266	400	63,542,660	17,004,505 souls.	47,188,326	42	6,671,979	53,860,305	9,682,355	1,017,306	8,665,049 / 14
Inferior grains.	Barley	1,685,025	400	16,850,250		—	35	1,474,397				
	Rice	728,259	400	7,282,590		—	32	582,607				
	Jowár and bájra	5,129,248	250	32,057,800		—	5	641,156				
	Maize	921,968	300	6,914,760		—	14	322,683				
	Chiná and kangni	163,280	200	816,400		—	10	40,820				
	Total	8,627,780	296	63,921,800		37,148,256	—	3,061,669	40,209,925	23,711,875		
Pulses	Gram	1,650,727	300	12,380,452			20	825,363			3,499,184	24,761,619 / 20
	Others	1,887,073	200	9,435,365			8	377,415				
	Total	3,537,800	247	21,815,817		16,964,111	—	1,202,778	17,266,889	4,548,928		
	Grand Total	18,519,846	322	149,280,277		100,40 0,693	—	10,936,426	111,337,119	37,943,158	4,516,490*	33,426,668 / 22

* It is worth while noting, that the nett exports of these grains, down the Indus between the years 1861–62 and 1867–68, as registered at Mithankot, just below the junction of the Indus and Chenab, averaged only 480,242 maunds. Compare the later entries in the statement of exports appended. Exports by railway were impossible 10 years ago.

The rates of yield assumed in this estimate are the average of the rates reported by district officers for five years past; and whereas in the case of the inferior grains this could not be stated from those reports separately for each kind of grain, the average of the Financial Commissioner's experiments has been adopted. This was the only course open, as no other estimates are of a sufficiently general character. The rate of seed per acre is for the same reason taken from the Financial Commissioner's experiments. The rate of consumption assumed is 10 chitacks per head per diem, and the consumption is divided between wheat, inferior grains and pulses in the same proportion as is given in the appended tabulated statement of district officers replies, viz., wheat 47 per cent., inferior grains 37, and pulses 16. Given the produce and consumption at these rates (columns 1–9), the surplus remaining is compared in columns 10 and 11 with the nett average on rural exports. Columns 12 and 13 show the difference between this surplus and the average exports. The value of the estimate may consequently be held with fairness to depend on the possibility of giving a reasonable explanation of the discrepancy exhibited in columns 12 and 13. The details at our command limit the argument at the outside to the two heads of (1) wheat and (2) other food grains. If district officers have over-estimated the consumption of wheat relatively with other grains by even so small a proportion as 8 per cent., of the total food, the excess of wheat shown in column 12 of the estimate would disappear, and be transferred to the head of other grains. Therefore it is necessary to avoid details of kind, and to limit the argument to the total discrepancy, which is 33,426,668 maunds.

Now the estimate includes no allowance for the grain consumed by sheep, kine, camels, and horses. From data obtained from the Commissariat Departments I have ascertained that the military establishments in the Punjab (elephants, horses, mules, ponies, and bullocks) consume about 700,000 maunds of grain per annum; if we add to this the consumption of the horsed dák lines Government bullock trains, and the private establishments of our civil and military cantonments, we may take the total consumption on this head at 1,000,000 maunds per annum; though Mr. Ouseley thinks 900,000 maunds a safer conclusion.

There remains the grain consumed by cattle owned by the people of the country. The agriculturists do not usually feed their cattle with grain; but the townspeople do to a certain extent, especially their cows. The drivers of bullock carts always feed their cattle with two or three sers of grain when working. Bullocks, ponies, and mules are similarly fed when carrying pack loads. And there is a certain very limited consumption in feeding up cattle and sheep for slaughter. It is difficult to put the consumption under these various heads at less than 6,000,000

maunds per annum ; of which two-thirds is consumed by draught and pack cattle.*

And lastly, a certain reasonable amount should be allowed for dryage and loss in storage ; say 5 per cent. of the total produce :—

	Maunds.
The surplus shown in the estimate was - -	33,426,668
Deduct on the grounds above stated,—	
(1.) Consumption of the military establishments, dák lines, and cantonments - -	1,000,000
(2.) Consumed by cattle, &c. -	6,000,000
(5.) 5 per cent. of total production for dryage and loss in storing - - -	7,464,014
Total deducted -	14,464,014

* The total stock in the Punjab is,—

cows, bullocks and buffaloes - -	6,570,212
horses - - - -	84,634
ponies and mules - - -	51,395
donkeys - -	288,118
sheep and goats - -	3,849,842
camels - - - -	165,567
carts - - - - -	97,909

	Maunds.
So there remains over and above the estimated expenditure a balance of the estimated production amounting to maunds - - - -	18,962,654

This balance is 13 per cent., of the total estimated production : and the average estimated produce per acre of all food grains being 322 sers, or 644 lbs., this result indicates an excess estimate on the rate of production of 46 sers or 92 lbs. per acre. The estimate therefore indicates that on the whole province the average rate of production of food grains (pulses included) per acre is not more than 322 sers, and not less than 276 sers. The rate of consumption on which the lower estimate is based is certainly a moderate one. The consumption of grain by the cattle of the country is probably under-estimated ; but as it is a point on which we have little information, a low estimate of it has been taken.

STATEMENT in ACRES showing the average Area cultivated with each crop during the Five Years 1872–73 to 1876–77, compiled from Statements No. XXIX. appended to the Annual Revenue Reports for those Years.

NOTE.—The Districts marked * reported that these Returns were not reliable; and in such Districts Returns supplied from recent Settlement measurements have been substituted.

CEREALS AND PULSES USED AS FOOD.

Division.	District.	Harvest.	CEREALS.								PULSES.							TOTAL.		
			Wheat.	Jau (barley).	Rice.	Jowár (Great Millet).	Bájra (Spiked Millet).	Kangni (Italian Millet).	Makkai (Indian Corn).	China.	Gram.	Matar (Peas).	Masúr.	Arhar.	Moth.	Másh.	Múng.	Cereals.	Pulses.	Total Food Grains.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.
Delhi	Delhi*	Rabi	1,26,899	66,292	—	—	—	—	—	—	72,266	1,429	100	—	—	—	—	1,93,191	73,795	2,66,986
		Kharif	—	—	11,819	1,03,115	90,320	76	8,040	266	—	—	—	290	7,215	1,213	16,063	2,13,636	24,781	2,38,417
	Gurgaon*	Rabi	75,827	1,43,837	—	—	—	—	—	—	1,14,798	280	100	—	—	—	—	2,19,664	1,15,178	3,34,842
		Kharif	—	—	809	1,58,723	2,89,962	166	627	—	—	—	—	191	1,28,253	218	19,542	4,50,287	1,48,204	5,98,491
	Karnál	Rabi	1,13,222	33,255	—	—	—	—	—	315	78,376	2	2,667	—	—	—	—	1,46,792	81,045	2,27,837
		Kharif	—	—	53,386	1,03,549	31,325	185	9,891	—	—	—	—	—	9,494	10,438	11,155	1,98,336	31,087	2,29,423
Hissar	Hissar	Rabi	41,514	36,921	—	—	—	—	—	—	61,275	—	—	—	—	—	—	78,435	61,275	1,39,710
		Kharif	—	—	16,756	2,18,853	6,92,571	—	1,325	—	—	—	—	13,300	1,95,388	19,356	76,295	9,23,505	3,04,339	12,27,844
	Rohtak	Rabi	1,16,437	70,436	—	—	—	—	—	45	1,25,256	—	400	—	—	—	—	1,86,948	1,25,656	3,12,604
		Kharif	—	—	4,080	1,88,324	1,65,491	141	559	—	—	—	—	—	23,768	10,412	19,824	3,58,595	54,004	4,12,599
	Sirsa	Rabi	43,768	81,676	—	—	—	—	—	36	31,277	279	790	—	—	—	—	1,25,480	32,346	1,57,826
		Kharif	—	—	6,982	97,732	4,56,720	11	268	20	—	46	—	—	1,59,505	629	4,596	5,55,733	1,64,776	7,20,509
Umballa	Umballa	Rabi	2,79,150	44,777	—	—	—	—	—	—	1,51,753	1,471	13,303	—	—	—	—	3,23,927	1,66,527	4,90,454
		Kharif	—	—	1,25,071	1,13,886	20,512	1,049	1,10,463	13,872	—	—	—	—	17,136	19,000	1,114	3,84,853	37,250	4,22,103
	Ludhiána	Rabi	1,88,123	65,240	—	—	—	10	—	—	1,47,728	—	3,065	—	—	—	—	2,53,373	1,50,793	4,04,166
		Kharif	—	—	3,316	1,10,756	6,308	32	56,238	159	—	—	—	—	56,493	9,130	11,641	1,76,809	77,264	2,54,073
	Simla	Rabi	3,066	1,260	—	—	—	—	—	—	8	2	21	—	—	—	—	4,326	31	4,357
		Kharif	—	—	1,109	174	149	40	1,287	923	—	8	—	—	—	165	—	3,682	173	3,855
Jullundur	Jullundur	Rabi	2,98,170	21,050	—	—	—	—	—	—	55,611	—	9,637	—	—	—	—	3,14,220	65,248	3,79,468
		Kharif	—	—	11,117	1,00,838	428	3,191	1,08,499	13,124	—	—	—	—	36,542	20,905	1,909	2,37,197	59,356	2,96,553
	Hoshiárpur	Rabi	3,30,709	37,475	—	—	—	—	—	—	53,086	1,358	21,863	—	—	—	—	3,68,184	76,307	4,44,491
		Kharif	—	—	55,996	45,797	11,909	3,186	1,01,949	7,593	—	—	—	738	28,667	23,683	5,281	2,26,490	58,369	2,84,859
	Kangra	Rabi	1,24,745	42,595	—	—	—	—	—	—	94,753	2,859	4,448	—	—	—	—	1,67,340	1,02,060	2,69,400
		Kharif	—	—	1,26,792	300	304	3,092	62,142	1,948	—	—	—	404	1,234	14,197	306	1,94,578	16,141	2,10,719
Amritsar	Amritsar	Rabi	2,60,688	37,313	—	—	—	—	—	—	89,967	—	4,296	—	—	—	—	2,98,001	94,263	3,92,264
		Kharif	—	—	23,515	70,389	12	4,045	46,876	8,312	—	—	—	—	18,491	12,418	889	1,53,149	31,798	1,84,947
	Sialkot	Rabi	3,43,718	82,412	—	—	—	—	—	—	13,356	1,711	20,139	—	—	—	—	4,26,130	35,206	4,61,336
		Kharif	—	—	81,049	55,497	4,043	8,664	42,271	1,050	—	—	—	10	12,269	10,550	1,524	1,92,574	24,353	2,16,927
	Gurdáspur	Rabi	2,05,847	1,29,682	—	—	—	—	—	—	22,533	2,806	12,671	—	—	—	—	3,35,522	38,010	3,73,539
		Kharif	—	—	79,214	38,821	10,574	6,577	38,067	1,485	—	—	—	—	17,990	16,620	1,302	1,74,738	35,912	2,10,650
Lahore	Lahore	Rabi	2,54,070	39,997	—	—	—	16	—	21	1,15,085	6	7,376	—	—	—	—	2,94,104	1,22,467	4,16,571
		Kharif	—	—	19,175	70,231	1,806	4,348	29,737	3,550	—	2	—	—	50,103	11,350	9,996	1,28,847	71,451	2,00,298
	Ferozepore	Rabi	2,07,192	1,45,050	—	—	—	—	—	45	1,48,630	371	15,400	—	—	—	—	3,52,287	1,64,001	5,16,888
		Kharif	—	—	3,947	1,95,092	65,973	1,913	34,237	4,601	—	300	—	—	86,279	24,680	26,524	3,05,763	1,37,783	4,43,546
	Gujánwála	Rabi	1,80,443	61,349	—	—	—	—	—	—	24,338	566	1,272	—	—	—	—	2,41,792	26,376	2,68,168
		Kharif	—	—	13,327	43,430	5,656	1,301	13,766	5,884	—	45	—	46	46,360	1,636	19,076	83,364	66,563	1,49,927
Rawalpindi	Rawalpindi	Rabi	3,65,797	50,321	—	—	—	—	—	—	37,729	201	2,023	—	—	—	—	4,16,118	39,953	4,56,071
		Kharif	—	—	1,129	44,569	1,68,202	2,733	44,061	—	—	—	—	—	48,787	4,538	20,036	2,60,754	72,781	3,33,535
	Jhelum	Rabi	4,13,619	36,492	—	—	—	—	—	33	27,695	114	992	—	—	—	—	4,50,144	28,799	4,78,943
		Kharif	—	—	1,760	39,987	2,01,202	192	2,920	2,342	—	5	—	—	36,056	1,763	12,208	2,48,403	50,032	2,98,435
	Gujrat	Rabi	2,40,813	67,876	—	—	—	—	—	9	28,874	311	7,873	—	—	—	—	3,09,328	37,058	3,46,386
		Kharif	—	—	28,482	55,172	1,20,802	1,130	16,476	2,127	—	—	—	—	29,292	3,512	2,150	2,24,189	34,954	2,59,143
	Shahpur	Rabi	1,57,985	11,124	—	—	—	—	—	2,308	11,884	158	613	—	—	—	—	1,70,517	12,655	1,83,172
		Kharif	—	—	890	18,785	74,060	426	911	1,595	—	3	—	—	7,614	244	1,532	97,267	9,393	1,06,660
Mooltan	Mooltan*	Rabi	2,47,917	4,578	—	—	—	—	—	115	14,883	27,010	1,145	—	—	—	—	2,52,610	43,038	2,95,648
		Kharif	—	—	8,827	64,058	11,469	994	163	2,958	—	—	—	—	271	1,557	216	89,069	2,044	91,113
	Jhang*	Rabi	1,75,493	6,188	—	—	—	—	—	—	13,969	8,487	2,435	—	—	—	—	1,81,681	24,891	2,06,572
		Kharif	—	—	150	38,004	1,829	852	2,259	4,374	—	—	—	—	493	9,173	551	47,468	19,127	57,595
	Montgomery*	Rabi	2,00,048	31,158	—	—	—	3	—	285	30,080	9,358	5,370	331	92	—	—	2,31,489	45,231	2,76,720
		Kharif	—	—	10,611	29,222	246	7,994	1,889	2,967	—	—	—	274	2,457	4,849	2,572	52,929	10,152	63,081
	Muzaffargarh*	Rabi	2,03,215	10,099	—	—	—	—	—	—	12,786	24,926	4,477	—	—	—	—	2,13,314	42,189	2,55,503
		Kharif	—	—	10,353	21,545	18,241	285	—	1,266	—	—	—	—	3,959	345	208	51,690	4,512	56,202

STATEMENT in ACRES showing the Average Area cultivated with each Crop—*continued.*

NOTE.—The Districts marked * reported that these Returns were not reliable; and in such Districts Returns supplied from recent Settlement measurements have been substituted.

OTHER PRODUCTS.

Division.	District.	Harvest.	DRUGS AND SPICES.							OIL SEEDS.				FIBRES.		DYES.						
			Poppy.	Tobacco.	Turmeric.	Coriander Seed.	Ginger.	Chillies.	Other kinds.	Linseed.	Sarso (Mustard).	Til (Seasamum).	Táramira (Spinapis cricea).	Cotton.	Hemp.	Kasumbha (Safflower).	Indigo.	Vegetables.	Tea.	Sugar-cane.	Total other Products.	Grand Total Products.
0.	0.	0.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.	41.
Delhi	Delhi*	Rabi	—	1,286	—	492	—	—	—	—	419	—	2,756	—	—	—	—	2,155	—	—	7,108	2,74,094
		Kharif	—	—	—	—	—	1,578	—	—	—	20	—	28,835	155	—	288	655	—	30,782	62,313	3,00,730
	Gurgaon*	Rabi	—	1,210	—	11	—	—	1,289	—	3,733	—	1,551	—	—	—	—	3,688	—	—	11,482	3,46,324
		Kharif	—	—	—	—	—	89	—	—	—	51	—	76,341	81	—	81	915	—	414	77,972	6,76,463
	Karnál	Rabi	63	1,584	—	24	—	19	2,686	103	8,410	—	37	—	—	400	—	982	—	—	14,308	2,42,145
		Kharif	135	—	—	—	—	465	1,954	—	—	2,093	220	24,188	1,152	—	410	800	—	13,730	45,147	2,74,570
Hissar	Hissar	Rabi	—	3,062	17	3,127	—	—	1,237	—	11,227	—	—	—	—	947	—	1,120	—	—	20,737	1,60,447
		Kharif	—	—	—	—	—	2,305	14	—	—	13,798	—	22,879	2,963	—	604	2,060	—	56	44,679	12,72,523
	Rohtak	Rabi	—	3,453	—	54	—	70	952	—	10,954	—	654	—	—	241	—	1,413	—	—	17,791	3,30,395
		Kharif	—	—	—	—	—	8	3,387	—	—	12,782	—	45,652	5,259	—	2,259	1,169	—	27,491	98,007	5,10,606
	Sirsa	Rabi	7	385	—	—	—	13	554	—	14,807	—	766	—	—	3	—	745	—	4	17,284	1,75,119
		Kharif	—	—	—	—	—	33	27	—	—	47,181	—	159	12	—	—	266	—	4	47,682	7,68,191
Umballa	Umballa	Rabi	2,306	3,480	—	91	—	2	834	2,190	19,369	—	4,647	—	—	7,648	58	2,311	—	—	43,436	5,33,890
		Kharif	—	—	—	—	86	917	1,662	—	—	2,716	—	35,987	2,123	—	1,287	1,798	—	25,036	71,414	4,93,517
	Ludhiána	Rabi	304	1,921	—	84	—	17	167	270	13,539	—	869	—	355	7	1	5,720	—	—	24,254	4,28,420
		Kharif	—	—	—	—	—	52	303	—	—	642	—	13,138	1,457	—	2,587	13,446	—	11,016	42,641	2,96,714
	Simla	Rabi	299	19	—	1	—	—	—	—	11	—	—	—	—	4	—	6	29	—	369	4,726
		Kharif	—	1	43	4	374	—	160	—	—	4	—	18	—	—	—	5	—	—	609	4,464
Jullundur	Jullundur	Rabi	641	3,423	—	46	—	—	1,275	217	7,320	—	859	—	—	195	—	5,231	—	—	19,207	3,98,675
		Kharif	—	—	15	—	—	739	8,329	—	—	2,147	—	26,294	4,090	—	1,939	2,233	—	36,378	82,164	3,78,717
	Hoshárpur	Rabi	233	4,888	4	216	17	—	42	2,116	15,531	1,800	5,063	—	341	11,017	127	1,419	—	—	42,916	4,87,407
		Kharif	—	—	12	—	—	189	61	—	—	2,478	1,241	25,455	5,788	—	845	1,937	—	40,598	78,604	3,63,463
	Kángra	Rabi	944	1,015	—	114	—	64	393	3,715	5,222	—	183	—	—	817	—	848	7,235	—	20,550	2,89,950
		Kharif	—	—	1,585	—	110	120	488	—	—	5,073	—	6,284	4,200	—	—	3,216	—	7,446	28,522	2,39,241
Amritsar	Amritsar	Rabi	1,116	2,982	—	6	—	—	4,489	539	23,951	—	633	—	—	383	—	7,512	—	—	41,611	4,33,875
		Kharif	—	—	—	45	2	666	372	—	—	1,425	22	26,052	1,176	—	—	3,912	—	30,247	63,919	2,48,866
	Siálkot	Rabi	465	4,898	—	139	—	—	3,143	4,263	7,475	—	1,600	—	—	197	—	5,654	—	—	27,834	4,89,170
		Kharif	—	117	222	—	—	1,545	2,861	—	1,993	7,013	—	34,137	2,071	—	—	5,923	—	41,648	97,530	3,14,457
	Gurdáspur	Rabi	248	5,000	27	561	—	—	3,352	5,738	6,521	—	2,248	—	—	385	—	2,189	—	—	26,269	3,99,898
		Kharif	—	542	684	—	—	3,076	89	—	987	8,590	—	18,197	3,104	—	—	2,998	—	31,313	69,580	2,89,230
Lahore	Lahore	Rabi	935	2,745	—	166	—	—	10,601	4	32,722	—	3,782	—	—	—	—	3,796	—	—	54,751	4,71,322
		Kharif	—	—	—	8	—	1,178	2,190	—	—	5,594	333	30,596	493	—	—	1,922	—	2,432	43,756	2,44,054
	Ferozepore	Rabi	305	4,639	—	729	—	—	7,161	4	38,668	—	6,984	—	—	—	—	1,852	—	—	59,445	5,76,333
		Kharif	—	—	—	—	—	1,949	5,827	—	—	8,786	—	7,392	2,010	—	6	1,444	—	616	28,030	4,71,576
	Gujránwála	Rabi	184	4,552	—	75	—	51	2,166	273	3,271	—	1,969	—	—	20	—	15,024	—	—	26,879	2,95,047
		Kharif	—	—	—	—	—	172	346	—	10,871	2,759	—	36,740	714	—	—	27,214	—	26,096	1,04,912	2,54,839
Rawalpindi	Rawalpindi	Rabi	33	705	1	29	—	—	48	14	29,420	—	40,454	—	—	228	—	3,335	—	—	74,267	5,30,338
		Kharif	—	833	1	—	—	111	27	1	—	1,621	—	32,421	730	—	16	2,177	241	1,403	39,582	3,73,117
	Jhelum	Rabi	62	826	—	19	—	1	1,433	355	11,461	—	40,198	—	—	98	—	2,096	—	—	56,549	5,35,492
		Kharif	—	—	—	—	—	259	1,781	—	—	1,035	—	24,359	725	—	—	965	—	376	29,400	3,27,835
	Gujrat	Rabi	260	2,862	—	429	—	—	6,378	2,081	14,532	—	25,418	—	6	2,313	—	13,616	—	—	67,895	4,14,251
		Kharif	—	—	—	—	—	284	2,033	—	6,226	9,245	—	23,732	3,972	—	94	7,848	—	6,827	60,261	3,19,404
	Shahpur	Rabi	1,659	911	—	12	—	—	24	28	164	—	1,732	—	—	—	—	13,992	—	—	18,522	2,01,694
		Kharif	—	—	—	—	—	—	—	—	—	2,158	—	24,491	10	—	—	1,745	—	878	29,282	1,35,942
Mooltan	Mooltan*	Rabi	—	1,302	—	—	—	—	—	—	—	—	6,151	—	—	—	—	40,517	—	—	47,970	3,43,618
		Kharif	—	—	—	—	—	—	—	—	—	9,775	—	36,095	10	83	50,746	272	—	3,072	1,00,653	1,91,766
	Jhang*	Rabi	13	987	—	—	—	—	—	—	204	—	390	—	—	1	—	18,256	—	—	19,852	2,26,424
		Kharif	—	—	—	—	—	—	1	—	—	3,191	—	28,443	—	—	11	10,956	—	209	41,910	99,595
	Montgomery*	Rabi	111	1,343	—	238	—	—	—	—	10,929	—	9	—	1	2	—	1,398	—	—	16,352	2,92,072
		Kharif	—	—	—	—	—	111	2,331	—	2	9,654	133	18,243	140	—	7	1,904	—	242	29,705	92,876
	Muzaffargarh*	Rabi	61	1,122	—	12	—	—	209	1	13,417	—	8,244	—	—	88	—	1,031	—	—	25,849	2,81,352
		Kharif	—	—	—	—	—	149	1,873	—	—	4,220	—	29,582	1	—	29,638	160	—	4,280	59,050	1,15,252

STATEMENT in ACRES showing the Average Area cultivated with each Crop—*continued.*

NOTE.—The Districts marked * reported that these Returns were not reliable, and in such Districts Returns supplied from recent Settlement measurements have been substituted.

CEREALS AND PULSES USED AS FOOD.

Division.	District.	Harvest.	CEREALS.								PULSES.							TOTAL.		
			Wheat.	Jau (Barley).	Rice.	Jowar (Great Millet).	Bájra (Spiked Millet).	Kangni (Italian Millet).	Makkai (Indian Corn).	China.	Gram.	Mattar (Peas).	Masur.	Arhar.	Moth.	Másh.	Múng.	Cereals.	Pulses.	Total Food Grains.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.
Derajat	Dera Ismail Khan*	Rabi	3,19,502	14,907	—	—	—	—	—	—	18,084	17,162	1,620	—	—	—	—	3,34,409	36,866	3,71,275
		Kharif	—	—	1,970	25,917	2,62,903	1,816	139	92	—	—	—	—	724	50	2,576	2,92,837	3,350	2,96,187
	Dera Gházi Khan	Rabi	1,26,340	11,228	—	—	—	16	—	11	2,452	6,256	5,231	1	—	155	—	1,37,595	14,095	1,51,690
		Kharif	—	—	11,073	93,616	31,767	99	61	60	—	—	—	—	230	372	144	1,36,676	746	1,37,422
	Bannu	Rabi	2,34,572	28,599	—	—	—	—	—	—	48,895	6,918	5,172	—	—	—	—	2,63,171	60,985	3,24,156
		Kharif	—	—	334	11,641	89,228	—	24,045	—	—	—	—	—	4,764	3,063	3,742	1,25,248	11,569	1,36,817
Peshawar	Pesháwar	Rabi	2,90,552	2,12,280	—	—	—	8	—	—	189	138	1,648	88	—	—	—	5,02,840	2,063	5,04,903
		Kharif	—	—	10,329	62,853	2,327	1,611	59,827	34	—	—	—	433	16,555	3,257	3,429	1,36,981	23,674	1,60,655
	Kohát*	Rabi	97,533	10,014	—	—	—	—	—	—	1,984	—	—	—	—	—	—	1,07,547	1,984	1,09,531
		Kharif	—	—	2,361	2,213	47,342	2,106	12,920	—	—	—	—	—	6,327	4	11,473	66,942	17,804	84,746
	Hazara	Rabi	53,167	49,544	—	—	—	—	—	—	929	234	1,078	—	—	—	—	1,42,711	2,241	1,44,952
		Kharif	—	—	8,530	1,148	26,010	20,515	90,055	2	—	1,434	—	—	16,812	2,436	5,144	1,46,260	19,826	1,66,086
	Grand Total	Rabi	63,54,266	16,85,025	—	—	—	53	—	5,853	16,50,727	1,14,613	1,57,225	420	92	155	—	80,43,197	19,23,232	99,66,429
		Kharif	—	—	7,28,259	22,24,837	29,04,411	78,770	9,21,968	80,604	—	1,843	—	15,686	10,62,838	2,41,183	2,93,018	69,38,849	16,14,568	85,53,417

TOTAL OF EACH DIVISION.

Delhi		Rabi	3,15,948	2,43,384	—	—	—	—	—	315	2,65,440	1,711	2,867	—	—	—	—	5,59,647	2,70,018	8,29,665
		Kharif	—	—	66,014	3,65,387	4,11,667	427	18,558	266	—	—	—	481	1,44,962	11,869	46,760	8,62,259	2,04,072	10,66,331
Hissar		Rabi	2,91,749	1,89,033	—	—	—	—	—	81	2,17,808	279	1,190	—	—	—	—	3,90,863	2,19,277	6,10,140
		Kharif	—	—	21,818	5,04,909	13,08,782	152	2,152	20	—	46	—	13,300	3,78,661	30,397	1,00,715	18,37,833	5,23,119	23,60,952
Umballa		Rabi	4,70,339	1,11,277	—	—	—	10	—	—	2,99,489	1,473	16,389	—	—	—	—	5,81,626	3,17,351	8,98,977
		Kharif	—	—	1,29,496	2,24,816	26,969	1,124	1,67,988	14,954	—	8	—	—	73,629	28,295	12,755	5,65,344	1,14,687	6,80,031
Jullundur		Rabi	7,48,624	1,01,120	—	—	—	—	—	—	2,03,450	4,217	35,948	—	—	—	—	8,49,744	2,43,615	10,93,359
		Kharif	—	—	1,93,905	1,46,935	12,701	9,469	2,72,590	22,665	—	—	—	1,142	66,443	38,785	7,496	6,58,265	1,33,866	7,92,131
Amritsar		Rabi	8,10,253	2,49,407	—	—	—	—	—	—	1,25,856	4,517	37,106	—	—	—	—	10,59,660	1,67,479	12,27,139
		Kharif	—	—	1,83,778	1,64,707	14,629	19,286	1,27,214	10,847	—	—	—	10	48,750	39,588	3,715	5,20,461	92,063	6,12,524
Lahore		Rabi	6,41,705	2,46,396	—	—	—	16	—	66	2,88,253	1,143	24,048	—	—	—	—	8,88,183	3,13,444	12,01,627
		Kharif	—	—	36,449	3,08,753	73,435	7,562	77,740	14,035	—	347	—	46	1,82,742	37,066	55,596	5,17,974	2,75,797	7,93,771
Rawalpindi		Rabi	11,77,314	1,65,813	—	—	—	—	—	2,980	1,06,180	784	11,501	—	—	—	—	13,46,107	1,18,463	14,64,572
		Kharif	—	—	32,261	1,58,513	5,64,926	4,481	64,368	6,064	—	8	—	—	1,21,149	10,077	35,926	8,30,613	1,67,160	9,97,773
Mooltan		Rabi	82,668	52,023	—	—	—	3	—	400	71,718	69,781	13,427	331	92	—	—	8,79,094	1,55,349	10,34,443
		Kharif	—	—	29,941	1,53,429	31,785	10,125	4,311	11,565	—	—	—	274	7,090	15,924	3,547	2,41,156	26,835	2,67,991
Derajat		Rabi	6,80,414	54,734	—	—	—	16	—	11	69,431	30,336	12,023	1	—	155	—	7,35,175	1,11,946	8,47,121
		Kharif	—	—	13,377	1,31,174	3,83,898	1,915	24,245	152	—	—	—	—	5,718	3,845	6,462	5,54,761	15,665	5,70,426
Peshawar		Rabi	4,81,252	2,71,838	—	—	—	8	—	—	3,102	372	2,726	88	—	—	—	7,53,098	6,288	7,59,386
		Kharif	—	—	21,220	66,214	75,679	24,232	1,62,892	36	—	1,454	—	433	33,694	5,697	20,046	3,50,183	61,304	4,11,487
Total		Rabi	63,54,266	16,85,025	—	—	—	53	—	5,853	16,50,727	1,14,613	1,57,225	420	92	155	—	80,43,197	19,23,232	99,66,429
		Kharif	—	—	7,28,259	22,24,837	29,04,411	78,770	9,21,968	80,604	—	1,843	—	15,686	10,62,838	2,41,183	2,93,018	69,38,849	16,14,568	85,53,417

STATEMENT in ACRES showing the Average Area cultivated with each Crop—*continued.*

NOTE.—The Districts marked * reported that these Returns were not reliable; and in such Districts Returns supplied from recent Settlement measurements have been substituted.

OTHER PRODUCTS.

Division.	District.	Harvest.	DRUGS AND SPICES.							OIL SEEDS.				FIBRES.		DYES.						
			Poppy.	Tobacco.	Turmeric.	Coriander Seed.	Ginger.	Chillies.	Other kinds.	Linseed.	Sarso (Mustard).	Til (Sesamum).	Taramira (Spinapis eriea).	Cotton.	Hemp.	Kasumbha (Safflower).	Indigo.	Vegetables.	Tea.	Sugar-cane.	Total of the Products.	Grand Total Products.
0.	0.	0.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.	41.
Derajat	Dera Ismail Khan*	Rabi	—	666	—	5	—	—	—	19	57,459	—	24,286	—	—	65	—	1,218	—	—	83,718	4,54,193
		Kharif	—	—	—	—	—	—	50	—	—	2,037	—	33,392	—	—	—	2,045	—	76	37,598	3,33,785
	Dera Ghazi Khan	Rabi	531	1,843	—	14	—	—	140	3	8,240	—	10,656	—	—	32	—	576	—	—	22,035	1,73,725
		Kharif	—	—	—	—	—	74	32	—	—	494	—	23,005	—	—	19,605	563	—	23	43,884	1,81,306
	Bannu	Rabi	14	694	86	9	—	—	223	1	177	—	3,498	—	—	—	—	1,233	—	—	5,935	3,50,091
		Kharif	—	—	85	—	—	192	479	—	—	621	—	9,354	—	—	—	1,255	—	4,224	16,190	1,53,607
Peshawar	Peshawar	Rabi	46	1,281	23	21	—	19	5	—	22,551	—	757	—	—	—	—	2,338	—	—	27,041	5,31,944
		Kharif	—	244	—	—	—	9	690	—	—	5,189	—	17,456	22	7	23	2,109	360	8,301	34,410	1,95,065
	Kohat*	Rabi	—	3,307	—	—	—	—	—	—	62	—	494	—	—	—	—	519	—	—	4,382	1,13,913
		Kharif	—	—	—	—	—	—	—	—	—	4,792	—	6,596	—	—	—	80	—	20	11,288	96,034
	Hazara	Rabi	67	1,570	—	—	—	—	469	—	8,062	—	214	—	—	—	—	197	—	—	10,584	1,55,536
		Kharif	—	—	703	5	—	10	5	—	21	2,436	—	10,912	3	—	—	150	—	404	14,644	1,80,730
	Grand Total	Rabi	10,907	69,961	158	6,759	17	256	53,250	21,934	3,99,828	1,800	1,95,502	—	703	25,094	186	1,63,559	7,264	4	9,57,182	1,09,23,611
		Kharif	135	1,737	3,350	57	572	16,082	33,376	1	20,100	1,79,620	1,999	7,76,205	42,461	90	1,01,464	1,01,440	601	3,56,138	16,35,428	1,01,88,845

TOTAL OF EACH DIVISION.

Delhi		Rabi	63	4,080	—	527	—	19	3,975	103	12,562	—	4,344	—	—	400	—	6,825	—	—	32,898	8,62,563
		Kharif	135	—	—	—	—	2,132	1,954	—	—	2,164	220	1,29,364	1,388	—	779	2,370	—	44,926	1,85,432	12,51,763
Hissar		Rabi	7	6,900	17	3,181	—	83	2,743	—	36,988	—	1,420	—	—	1,191	—	3,278	—	4	55,812	6,65,962
		Kharif	—	—	—	—	—	2,346	3,428	—	—	73,761	—	68,390	8,234	—	2,863	3,495	—	27,551	1,90,368	25,51,320
Umballa		Rabi	2,909	5,420	—	176	—	19	1,001	2,460	32,919	—	5,516	—	355	7,650	59	9,537	29	—	68,099	9,67,636
		Kharif	—	1	43	4	460	771	2,125	—	—	3,362	—	49,143	3,580	—	3,874	15,249	—	36,052	1,14,664	7,94,098
Jullundur		Rabi	1,818	9,326	4	406	17	64	1,710	6,048	28,073	1,800	6,105	—	241	12,029	127	7,570	7,235	—	82,673	11,76,032
		Kharif	—	—	1,612	—	110	1,048	8,878	—	—	9,698	1,241	58,033	14,078	—	2,784	7,386	—	84,422	1,89,290	9,81,421
Amritsar		Rabi	1,829	12,886	27	703	—	—	10,984	10,540	37,947	—	4,481	—	—	965	—	15,355	—	—	95,714	13,22,853
		Kharif	—	659	906	43	2	5,287	3,322	—	2,980	17,928	22	78,386	6,351	—	—	12,833	—	1,03,208	2,31,029	8,43,553
Lahore		Rabi	1,424	11,936	—	970	—	51	19,922	281	74,061	—	11,135	—	—	23	—	20,672	—	—	1,41,075	13,42,702
		Kharif	—	—	—	8	—	3,209	8,363	—	10,871	17,139	333	74,638	3,217	—	6	29,680	—	29,144	1,76,698	9,70,469
Rawalpindi		Rabi	2,014	5,304	1	489	—	1	7,883	2,478	55,577	—	1,07,802	—	6	2,639	—	33,039	—	—	2,17,233	16,81,805
		Kharif	—	833	1	—	—	634	3,841	1	6,226	14,059	—	1,05,603	5,437	—	110	12,735	241	9,384	1,58,525	11,56,298
Mooltan		Rabi	185	4,754	—	250	—	—	4,195	1	24,550	—	14,794	—	1	91	—	61,202	—	—	1,10,023	11,44,466
		Kharif	—	—	—	—	—	260	209	—	2	26,849	183	1,12,363	151	83	71,422	11,492	—	8,403	2,31,408	4,99,399
Dera Jat		Rabi	545	3,203	86	28	—	—	363	23	65,876	—	38,449	—	—	97	—	3,027	—	—	1,11,688	9,58,809
		Kharif	—	—	85	—	—	266	561	—	—	3,152	—	65,821	—	—	19,603	3,861	—	4,323	97,672	6,68,098
Peshawar		Rabi	113	6,158	23	23	—	19	474	—	30,675	—	1,465	—	—	—	—	3,054	—	—	42,007	8,01,393
		Kharif	—	244	703	—	—	19	695	—	21	12,417	—	34,764	25	7	23	2,339	360	8,725	60,342	4,71,829
Total		Rabi	10,907	69,961	158	6,759	17	256	53,250	21,934	3,99,828	1,800	1,95,502	—	703	25,094	186	1,63,559	7,264	—	9,57,182	1,09,23,611
		Kharif	135	1,737	3,350	57	572	16,082	33,376	1	20,100	1,79,620	1,999	7,76,205	42,461	90	1,01,464	1,01,440	601	3,56,138	16,35,428	1,01,88,845

ABSTRACT IN ACRES.

DIVISION.	Harvest.	Cereals.	Pulses.	Total.	Other Products.	GRAND TOTAL. Harvests.	GRAND TOTAL. Total.
Delhi	Rabi	5,59,647	2,70,018	8,29,665	32,898	8,62,563	21,14,326
	Kharíf	8,62,259	2,04,072	10,66,331	1,85,432	12,51,763	
Hissar	Rabi	3,90,863	2,19,277	6,10,140	55,812	6,65,952	32,17,272
	Kharíf	18,37,833	5,23,119	23,60,952	1,90,368	25,51,320	
Umballa	Rabi	5,81,626	3,17,351	8,98,977	68,059	9,67,036	17,61,731
	Kharíf	5,65,344	1,14,687	6,80,031	1,14,664	7,94,695	
Jullundur	Rabi	8,49,744	2,43,615	10,93,359	82,673	11,76,032	21,57,453
	Kharíf	6,58,256	1,33,866	7,92,131	1,89,290	9,81,421	
Amritsar	Rabi	10,59,660	1,67,479	12,27,139	95,714	13,22,853	21,66,406
	Kharíf	5,20,461	92,063	6,12,524	2,31,029	8,43,553	
Lahore	Rabi	8,88,183	3,13,444	12,01,627	1,41,075	13,42,702	23,13,171
	Kharíf	5,17,974	2,75,797	7,93,771	1,76,698	9,70,469	
Rawalpindi	Rabi	13,46,107	1,18,465	14,64,572	2,17,233	16,81,805	28,38,103
	Kharíf	8,30,613	1,67,160	9,97,773	1,58,525	11,56,298	
Mooltan	Rabi	8,79,094	1,55,349	10,34,443	1,10,023	11,44,466	16,43,865
	Kharíf	2,41,156	26,835	2,67,991	2,31,408	4,99,399	
Derajat	Rabi	7,35,175	1,11,946	8,47,121	1,11,688	9,58,809	16,26,907
	Kharíf	5,54,761	15,665	5,70,426	97,672	6,68,098	
Peshawar	Rabi	7,53,098	6,288	7,59,386	42,007	8,01,393	12,73,222
	Kharíf	3,50,183	61,304	4,11,487	60,342	4,71,829	
Grand Total	Rabi	80,43,197	19,23,232	99,66,429	9,57,182	1,09,23,611	2,11,12,456
	Kharíf	69,38,849	16,14,568	85,53,417	16,35,428	1,01,88,845	

ABSTRACT IN PER-CENTAGE.

DIVISION.	Harvest.	Cereals.	Pulses.	Total.	Other Products.	Total.	REMARKS.
Delhi	Rabi	26	13	39	1	40 } 100	
	Kharíf	41	10	51	9	60 }	
Hissar	Rabi	12	7	19	2	21 } 100	
	Kharíf	57	16	73	6	79 }	
Umballa	Rabi	33	18	51	4	55 } 100	
	Kharíf	32	7	39	6	45 }	
Jullundur	Rabi	40	11	51	4	55 } 100	
	Kharíf	30	6	36	9	45 }	
Amritsar	Rabi	49	8	57	4	61 } 100	
	Kharíf	24	4	28	11	39 }	
Lahore	Rabi	39	13	52	6	58 } 100	
	Kharíf	22	12	34	8	42 }	
Rawalpindi	Rabi	47	4	51	8	59 } 100	
	Kharíf	29	5	34	7	41 }	
Mooltan	Rabi	53	9	62	7	69 } 100	
	Kharíf	15	2	17	14	31 }	
Derajat	Rabi	45	7	52	7	59 } 100	
	Kharíf	34	1	35	6	41 }	
Peshawar	Rabi	59	1	60	3	63 } 100	
	Kharíf	27	5	32	5	37 }	
Total	Rabi	38	9	47	4	51 } 100	
	Kharíf	33	8	41	8	49 }	

AVERAGE PRODUCE of PRINCIPAL STAPLES of AGRICULTURE in the PUNJAB.

Crop.	Period.	Produce per Acre in Lbs.	Authority.
Wheat	1872–77	826	District reports.
"	1872–75	884	Financial Commissioner's experiments.
Rice	1872–77	869	District reports.
"	1872–75	854	Financial Commissioner's experiments.
Inferior Grains :	1872–77	665	District reports.
Barley	1872–75	1,015	Financial Commissioner's experiments.
Joár	"	610	" " "
Bajra	"	477	" " "
Maize	"	598	" " "
Kangni	"	447	" " "
China	"	458	" " "
Peas	"	493	" " "
Masur	"	224	" " "
Moth	"	393	" " "
Mash	"	418	" " "
Mung	"	412	" " "
Gram	1872–77	756	District reports.
"	1872–75	253	Financial Commissioner's experiments.
Oil Seeds :	1872–77	421	District reports.
Rape or Mustard	1872–75	458	Financial Commissioner's experiments.
Linseed	"	372	" " "
Til	"	274	" " "
Taramira	"	313	" " "
Cotton	1872–77	107	District reports.
"	1872–75	363	Financial Commissioner's experiments.

STATEMENT of IMPORTS and EXPORTS of FOOD GRAINS, OIL SEEDS, and BUTTER (GHI), compiled from the PUNJAB TRADE RETURNS commencing 1869–70 and ending 1877–78.

Explanation.—The North Frontier trade is with Bajaur (North of Peshâwar) and with Kashmir and Central Asia North thereof.
The West Frontier trade is with Afghanistan.
The South Frontier trade is with Sindh, Bahâwalpur, Bikâner, and Jaipûr. Nearly all the river trade is with Sindh.
The East Frontier trade is with the North-Western Provinces and other British Provinces supplied through them. The Railway exports to Calcutta and Bombay for Europe are consequently included under this head

Across what Frontier.	Wheat.		Other Food Grains.		Ghi.		Oil Seeds.		Oil.		Total.	
	Imports.	Exports.	Imports.	Exports.	Imports.	Exports.	Imports.	Exports.	Imports.	Exports.	Imports.	Exports.
					1873–74							
North Frontier—By native carriage	—	—	26,803	10,653	20,963	21	5,074	69	25	—	52,865	10,743
West Frontier—By native carriage	—	—	901	126	2,670	—	—	—	—	—	3,571	126
South Frontier—By native land carriage	—	—	36,095	4,05,142	3,621	1,419	4,606	13,038	—	4,045	44,322	4,23,644
South Frontier—By native boats on the Indus	—	—	49,269	6,51,678	42	7,147	15	1,80,747	2,510	209	51,836	8,39,781
South Frontier—By Steam Flotilla on the Chenab and Indus.	—	—	Not shown		Not shown		Not shown		Not shown		Not shown	
Total	—	—	85,364	10,56,820	3,663	8,566	4,621	1,93,785	2,510	4,254	96,158	12,63,425
East Frontier—By native land carriage	—	—	2,04,500	14,38,359	770	365	13,471	85,776	310	1,565	2,19,051	15,26,065
East Frontier—By Sind, Punjab, and Delhi Railway.	Page 10 of Report.	5,94,788	Page 10 of Report.	27,01,990	Not shown		Not shown		Not shown		—	32,96,778
East Frontier—By East Indian State Railway	—	—	29,483	11,67,512	21,019	746	25,316	1,01,660	—	—	75,818	12,69,918
Total	—	5,94,788	2,33,983	53,07,861	21,789	1,111	38,787	1,87,436	310	1,565	2,94,869	60,92,761
Grand Total	—	5,94,788	3,47,051	63,75,460	49,085	9,698	48,482	3,81,290	2,845	5,819	4,47,463	73,67,055
					1874–75							
North Frontier—By native carriage	20,900	98,059	46,016	55,548	36,093	3,400	7,882	962	1,468	725	1,12,359	1,58,694
West Frontier—By native carriage	73,438	39,079	15,521	19,387	3,952	13	149	—	1,031	860	94,091	59,339
South Frontier—By native land carriage	78,121	1,69,854	1,93,702	6,15,590	6,445	4,821	39,515	38,563	2,034	10,053	3,19,817	8,38,881
South Frontier—By native boats on the Indus	140	2,86,993	13,770	2,18,196	—	2,896	—	2,06,792	4,012	11,732	17,922	7,26,609
South Frontier—By Steam Flotilla on the Chenab and Indus.	Not shown		Not shown		Not shown		Not shown		Not shown		Not shown	
Total	78,261	4,56,847	2,07,472	8,33,786	6,445	7,717	39,515	2,45,355	6,046	21,785	3,37,739	15,65,490
East Frontier—By native land carriage	4,03,468	10,73,869	1,73,672	3,79,350	2,325	8,302	10,692	34,296	2,284	4,796	5,92,441	15,00,613
East Frontier—By Sind, Punjab, and Delhi Railway.	6,109	7,28,512	68,153	20,10,449	571	72	2,929	47,007	4,245	19,774	82,007	28,05,814
East Frontier—By East Indian State Railway	73,674	2,49,523	—	—	30,352	508	—	—	—	—	1,04,026	2,50,031
Total	4,83,251	20,51,904	2,41,825	23,89,799	33,248	8,882	13,621	81,303	6,529	24,570	7,78,474	45,56,458
Grand Total	6,55,850	26,45,889	5,10,834	32,98,520	79,738	20,012	61,167	3,27,620	15,074	47,940	13,22,663	63,39,981

1875-76												
North Frontier—By native carriage	37,303	90,579	64,723	83,402	42,616	3	11,153	1,622	3,618	2,079	1,59,413	1,77,685
West Frontier—By native carriage	19,643	37,084	7,002	38,970	5,390	2	286	125	53	762	32,374	76,943
South Frontier—By native land carriage	30,036	1,53,801	2,46,889	3,46,190	3,987	3,382	79,016	48,680	36,549	4,853	3,96,477	5,56,906
South Frontier—By native boats on the Indus	—	4,22,267	3,683	1,82,879	5	2,920	—	2,99,628	509	739	4,197	9,08,433
South Frontier—By Steam Flotilla on the Chenab and Indus.	—	2	1,041	3,517	2	114	—	3,25,537	3,171	24	4,214	3,29,194
Total	30,036	5,76,070	2,51,613	5,32,586	3 994	6,416	79,016	6,73,845	40,229	5,616	4,04,888	17,94,533
East Frontier—By native land carriage	3,67,593	12,130	1,10,390	1,55,219	906	6,194	4,584	67,801	726	3,310	4,84,199	2,44,654
East Frontier—By Sind, Punjab, and Delhi Railway.	37,740	4,175	2,06,686	2,10,150	495	77	1,147	60,592	5,833	44,763	2,51,901	3,19,757
East Frontier—By East India State Railway	3,38,339	20,539	—	—	15,581	258	25,906	16,882	1,144	1,360	3,80,970	39,039
Total	7,43,672	36,844	3,17,076	3,65,369	16,982	6,529	31,637	1,45,275	7,703	49,433	11,17,070	6,03,450
Grand Total	8,30,654	7,40,577	6,40,414	10,20,327	68,982	12,950	1,22,092	8,20,867	51,603	57,890	17,13,745	26,52,611
1876-77												
North Frontier—By native carriage	16,758	88,820	33,127	55,752	43,462	11	22,438	539	2,143	1,460	1,17,928	1,46,582
West Frontier—By native carriage	24,618	49,320	14,964	34,879	8,841	32	459	160	97	898	48,979	85,289
South Frontier—By native land carriage	41,358	1,48,431	2,79,811	3,29,378	10,969	2,040	1,44,813	43,279	8,222	3,623	4,85,173	5,26,751
South Frontier—By native boats on the Indus	—	5,77,756	4,710	1,80,556	—	7,063	33	6,40,782	1,171	2,316	5,914	14,08,473
South Frontier—By Steam Flotilla on the Chenab and Indus.	—	17,397	309	15,742	—	224	—	4,17,929	2,337	4	2,646	4,51,296
Total	41,358	7,43,584	2,84,830	5,25,676	10,969	9,327	1,44,846	11,01,990	11,730	5,943	4,93,733	23,86,520
East Frontier—By native land carriage	5,07,681	26,404	1,17,999	3,05,665	3,389	9,527	4,671	57,412	4,134	1,524	6,37,874	4,00,532
East Frontier—By Sind, Punjab, and Delhi Railway.	28,736	16,782	2,75,194	5,14,394	79	79	6,766	39,600	8,399	15,577	3,19,174	5,86,432
East Frontier—By East Indian State Railway	68,231	2,15,101	1,09,324	1,55,229	1,875	2,089	37,884	2,81,870	6,994	956	2,24,308	6,55,245
Total	6,04,648	2,58,287	5,02,517	9,75,288	5,343	11,695	49,321	3,78,882	19,527	18,057	11,81,356	16,42,209
Grand Total	6,87,382	11,40,011	8,35,488	15,91,595	68,615	21,065	2,17,064	14,81,571	33,497	26,358	18,41,996	42,60,600
1877-78												
North Frontier—By native carriage	33,175	2,14,315	35,437	1,27,463	45,427	2	23,169	288	5,406	1,026	1,42,614	3,43,094
West Frontier—By native carriage	12,684	31,620	7,703	20,246	11,290	7	171	25	186	25	32,084	51,923
South Frontier—By native land carriage	60,568	98,291	1,69,342	2,91,935	3,975	2,973	29,955	7,499	2,151	2,433	2,65,991	4,03,131
South Frontier—By native boats on the Indus	1,855	12,14,584	11,758	3,38,330	60	23,820	831	2,87,108	3,255	—	17,759	18,63,842
South Frontier—By Steam Flotilla on the Chenab and Indus.	—	86,176	224	48,570	—	6,124	200	1,26,393	4,556	662	4,980	2,67,925
Total	62,423	13,99,051	1,81,324	6,78,835	4,035	32,917	30,986	4,21,000	9,962	3,095	2,88,730	25,34,898
East Frontier—By native land carriage	7,38,807	1,47,307	78 251	13,58,159	9,633	6,709	21,049	72,887	5,437	748	8,53,177	15,85,760
East Frontier—By Sind, Punjab, and Delhi Railway.	48,772	9,01,833	1,30,206	58,33,217	1,366	2,022	23,978	12,511	21,987	1,477	2,26,309	67,51,060
East Frontier—By East Indian State Railway	6,788	3,47,672	1,21,368	60,121	5,466	2,073	82,322	32,646	11,572	327	2,27,516	4,42,839
Total	7,94,367	13,96,812	3,29,825	72,51,497	16,465	10,804	1,27,349	1,17,994	38,996	2,552	13,07,002	87,79,659
Grand Total	9,02,649	30,41,798	5,54,289	80,78,041	77,217	43,730	1,81,675	5,39,307	54,550	6,698	17,70,380	11,799,574

ABSTRACT of the foregoing.

—	1873–74.			1874–75.			1875–76.			1876–77.			1877–78.			Average of the Five Years ending 1877–78.		
	Imports.	Exports.	Excess of Exports.	Imports.	Exports.	Excess of Exports.	Imports.	Exports.	Excess of Exports.	Imports.	Exports.	Excess of Exports.	Imports.	Exports.	Excess of Exports.	Imports.	Exports.	Excess of Exports.
Wheat - - -	—	5,94,788	5,94,788	6,55,850	26,45,889	19,90,039	8,30,654	7,40,577	—90,077	6,87,382	11,40,011	4,52,629	9,02,649	30,41,798	21,39,149	6,15,307	16,32,613	10,17,306
Other food grains - -	3,47,051	63,75,460	60,28,409	5,10,834	32,98,529	27,87,686	6,40,414	10,20,327	3,79,913	8,35,438	15,91,595	7,56,157	5,54,289	80,78,041	75,23,752	5,73,605	40,72,789	34,99,184
Total - -	3,47,051	69,70,248	66,23,197	11,66,684	59,44,409	47,77,725	14,71,068	17,60,904	2,89,836	15,22,820	27,31,606	12,08,786	14,56,938	1,11,19,839	96,62,901	11,88,912	57,05,402	45,16,490
Oil seeds - - -	48,482	3,81,290	3,32,808	61,167	3,27,620	2,66,453	1,22,092	8,20,867	6,98,775	2,17,064	14,81,571	12,64,507	1,81,675	5,39,307	3,57,632	1,30,096	7,10,131	5,80,035
Oil - - -	2,845	5,819	2,974	15,074	47,940	32,866	51,603	57,890	6,287	33,497	26,358	—7,139	54,550	6,698	—47,852	31,514	28,541	—2,973
Ghi - - -	49,085	9,698	39,387	79,738	20,012	—59,726	68,982	12,950	—56,032	68,615	21,065	—47,550	77,217	43,730	—33,487	68,727	21,491	—47,236
Grand total -	4,47,463	73,67,055	69,19,592	13,22,663	63,39,981	50,17,318	17,13,745	26,52,611	9,38,866	18,41,996	42,60,600	24,18,604	17,70,380	1,17,09,574	99,39,194	14,19,249	64,65,565	50,46,316

NORTH-WESTERN PROVINCES AND OUDH.

The statistics now submitted of the average cultivation, produce, and consumption in the districts of the North-Western Provinces are derived from four sources :—

(i.) The administration reports of the Board of Revenue for 10 years from 1867.
(ii.) The latest settlement reports available.
(iii.) The village field records compiled under the new system for 1876–77 (those for 1877–78 are not used, being of an abnormal character on account of the drought).
(iv.) The replies of district authorities to the famine queries.

In the returns, figures, except for total area, are given in even thousands.

Sources (ii.) and (iii.) are not available for the permanently settled districts.

The statistics of administration reports are very unsatisfactory and unreliable since the same figures have been repeated without alteration for a long series of years, and are evidently not the result of fresh inquiry each year.

The settlement statistics are of varied value—those of earlier years being very much more imperfect than those of later date, but both are equally subject to defect on the following grounds :—

(i.) That landholders purposely throw land out of cultivation in the years of measurement in order to deceive assessing officers.
(ii.) That settlement surveyors often omit to record crops not standing at the time of survey, so that estimates of produce deduced from their returns must often be below the mark.

The village returns under the new system of field records ought to provide the best statistics, but the year for which they are reported was the first year in which the system was introduced, and a great deal of inaccuracy resulted from inexperience and delay in commencing work.

The district officers replies are probably based on one or other of the above data, but so little explanation was afforded concerning the figures originally submitted that it was found necessary to make further inquiries, which have not been as yet completely answered.

Mode of Collecting Agricultural Statistics.—It is necessary to notice here the machinery by which agricultural statistics are now collected in the North-Western Provinces.

To every cultivated area of 1,500 to 2,000 acres there is a native official called the village accountant (or *patwari*), whose duty it has now been made to note each year in a field-book the agricultural circumstances of each field in his circle—*e.g.*, crop or crops, rent, tenancy, &c. Abstracts are compiled from the field-book, which show in tabular forms the complete agricultural circumstances of every village. To superintend every 30 or 40 *patwaris* is an overseer, called a *kanungo*, whose duty it is to instruct and supervise them in their work, and also to compile similar abstracts for each portion of the district under his supervision.

The question is asked whether any suggestions can be offered for the improvement of agricultural statistics. It is sufficient to reply that, as far as these provinces are concerned, the system which has been described forms the most complete basis which it is possible to establish for the collection of agricultural statistics, and only requires thorough supervision by district officers to ensure accurate results. The Government of these provinces and the Board of Revenue have taken measures through the Agricultural Department to maintain sufficiently strict inspection for the purpose. The outcome of the system will be a series of statistical volumes, which, containing annual entries excerpted by *kanungos* from the *patwaris'* records of the year, will exhibit under appropriate heads the fiscal and agricultural history of each mahal, village, and district for the period over which they extend, and thus provide a sound basis for future revenue and settlement operations.

The "further inquiries," to which reference has been made, have been instituted through this agency, and the replies received must be accepted as the best obtainable, as there is no time for further revision. A great deal of the information required would previously have been forthcoming had it not been for the occurrence of the late drought, which compelled district officers to utilise the establishment for more urgent work (connected with the exigencies of the season) almost immediately after the introduction of the new system.

DIVISION OF PROVINCE INTO BELTS.

In dealing with the statistics of the province some acquaintance with the changes which occur in its physical characteristics from north-west to south-east is necessary. Tracts differing in climate, temperature, soil, and moisture are followed by different agricultural conditions, are differently affected by a failure of rain, and require different treatment as regards irrigation. Changes, such as those to which reference is made, are not conterminous with district boundaries, a fact which makes it difficult to accept the district as the unit with which we should deal.*

The province is divided into four belts approximately parallel to the Himalayas, of which the characteristics are more or less different ; but it must be borne in mind that the change from one belt to another is not abrupt but gradual, and it must also be remembered that a simultaneous and gradual change in physical conditions also occurs from north-west to south-east at right angles to the line of the belts.

I.—SUB-HIMALAYAN BELT.

The first or Sub-Himalayan belt has water near the surface, and the soil is usually so moist that artificial irrigation is not needed. The main crops are sugar-cane, rice, and cereals, of which even sugar-cane is not artificially irrigated, a fact which has surprised many accustomed to the necessity of plentiful watering for cane in other parts of the province. To give instances at either extremity of the belt :—Of the cultivated area in the district of Bijnor only 5·8 per cent. was irrigated at the time of settlement, whereas sugar occupied 14 per cent. of the area ; and of Tilpur, a typical pargana in the north of Gorakhpur District, the settlement officer writes : "Irrigation is not cared for. The soil is lusty and moist, producing all the ordinary crops in abundance without any artificial watering. There are 390 wells used, generally not for irrigation, but for the other purposes of life. The average depth of water is 8 feet, and of the water itself 6 feet."

The settlement officer of Bijnor writes : "Masonry wells are hardly ever constructed, but earthen wells (mere excavation of a shaft) can be made almost everywhere." Of Bareilly : "Owing to the abundant rainfall and nearness of water to the surface, irrigation is not nearly so necessary with us as in the Doab. In the northern parganas (*i.e.*, the nearest to the hill range), fine wheat and even sugar-cane are grown without any irrigation at all," and even where wells are used "only one watering for spring cereals is necessary." So also the settlement officer of Shábjahánpur

* Another reason is that information from some districts is not only deficient but misleading.

writes: "One watering is sufficient, and that often a sprinkling rather than a slushing, so that it is impossible to give any average area of irrigation per well.

Some use has, however, been made of rivers in utilising the fall of streams issuing from the hills both in small canals and in damming up channels, but in considering this source of irrigation it must be distinctly remembered that districts in Rohilkhand run closer to the foot of the range than districts in Oudh and east of Oudh, where they are separated from the hills by a strip of level plain belonging to Nepal. The utilisation of stream fall is therefore easier towards the west than towards the east of our Sub-Himalayan belt. Small canals have been made in Bijnor, the most westerly district, but the settlement officer still remarks that "the irrigating power of the Bijnor river, is by no means worked up to its potential limit," and while General Ramsay has shown what can be done at the very foot of the mountain slope in his Bhábar canals, but little scientific work has been effected in any other portion of the belt, the most notable exception being the almost thorough protection of a Government grant estate by its owner in the north of the Gorakhpur District.

The above is a general indication of existing circumstances in the north or Sub-Himalayan belt.

II.—Rohilkhand and Ganges-Gogra Belt.

The second belt, roughly termed the Rohilkhand and Ganges-Gogra belt, approaches in the northern direction the Sub-Himalayan character,* and the Doáb character towards the south. One of the leading characteristics of the belt is its intersection by broad river valleys themselves serrated by the constantly changing courses, old and new, of shifting streams, which are at intervals fed from smaller river courses falling into them from either side. The main difference between the river system here and in the Sub-Himalayan tract is that water runs through broader and less contracted beds in the former than in the latter. The shallowness of the river channels and the wide extent of arable land on either side of them leads to an extensive use of dams and to various arrangements between zamindars and cultivators for distributing the cost of utilising river water.

Subsoil water has now become further from the surface, and is generally not found at a less distance than 10 to 15 feet, but on account of the decreasing humidity of soil and atmosphere wells are far more abundantly used than in the sub-Himalayan tracts. It is necessary, however, to divide the Rohilkhand and Ganges-Gogra belt into two sections for the following reasons:—The soil is sandier and less consistent in the west than in the east, and tanks and wells are, therefore, more easily maintained in the latter than in the former. Partly owing to this cause, partly to the greater value of the stiffer soil (which makes irrigation pay better), partly to the more forward condition (owing to historical causes) of the eastern districts, means of irrigation exist to a much higher extent in the east than in the west, notwithstanding that climatic conditions and produce are similar. Rice, sugar, and spring cereals are predominating crops in both. The difference in irrigation (gauged by a reference to the figures for the lower tracts of Budaun, Sháhjahánpur, and Bareilly, and to those for Jaunpur and Azamgarh) is that in the former about one-half, and in the latter very nearly three-fourths is irrigated; and while in the former hardly a masonry well exists, in the latter they are very numerous. It is also the case that earthen wells are often more stable in the east than in the west, where they seldom last more than one year.

III.—Doáb Belt.

The two portions of the Doáb belt differ (as elsewhere explained) in the large proportion of sand in the west (IIIA.) and in the prevalence of saline efflorescence in the east (IIIB.) Both are traversed by canals as far as Cawnpore, irrigation from which covers nearly one-eighth of the cultivated area of the districts from Saháranpur to Cawnpore. Wells are more easily maintained in the east than the west (for the same reason that reh is more easily collected and retained), namely, because soils are on the whole firmer and less permeable.

The following brief description is given of a central tract (North Cawnpore) in the lower Doáb country in Mr. Buck's note on reh*:—

"The main stratum of the country is a light soil containing a good deal of silica. It is intersected by a succession of small rivers, more or less parallel, which flow in a slanting direction into the great rivers, the Ganges and the Jumna. They are usually flanked on each side by an undulating strip of varying width which the drainage has cut up and rendered sandy. But between each pair of rivers, and *skirted by the sandy strips*, is a depressed table-land of some few miles in width in which the soil is *principally loam*, and which is full of lakes or jhíls and reh-infected tracts, which lakes themselves form the source of a new or intermediate stream. Sometimes, as I proved by the persistent examination of earthen wells over a tract 400 or 500 square miles in extent, the loam stratum is very shallow, a mere veneer as it were above the more sandy stratum, and sometimes it disappears entirely or alternates with patches of sand, but on the whole loam, becoming clayey in depressions, is the prevalent soil."

Towards the north-west, *i.e.*, as we approach belt IIIA., loam becomes less and less prevalent, and extensive tracts of light brown sand begin to appear more and more frequently in which irrigation of any kind is both difficult and unremunerative. Such is the class of land which (as explained elsewhere) chiefly gives rise to the large per-centage of the cultivable margin (not cultivated) in the districts of belt IIIA. Wells, although more easily maintained in the east, are, however, practicable in most parts of the Doáb, whether in IIIA. or in IIIB.; but wherever the Ganges or Jumna is approached the water level sinks until it often occurs that water cannot be found

* The climate is much like that of most parts of Oudh and Rohilkhand, drier than that of lower Bengal, but moister than that of the Doáb; and the country throughout the year, except in the months of May and June (till the rains come on), has some pretensions to looking green and fresh, and is not brown and parched like the Doáb. It is quite an exception for two full months to pass at any time of the year without some rain, and usually the winter rains are pretty regular and copious about Christmas time, or during the first fortnight in January.

The Settlement Officer of Azamgarh writes:—

"There are numerous swamps which are dry, or nearly so, during the hot season, but in the rainy season they spread over considerable areas. Much of the land along their edges and within reach of them is then under rice cultivation, and beyond the depth at which cultivated rice can grow there is generally a broader or narrower fringe of rushes (*narai*) and wild rice (*tinni*)."

* Compare Mr. Evans' report of Farukhabad:—

Description of the Minor Doábs.—"The general physical features of these tracts between pairs of rivers are described by Mr. Elliott. First we have at each limit north and south the alluvial beds, *i.e.*, the strip of land lying between the sandy slopes leading down to the river beds and the rivers themselves, and year by year more or less flooded by the rivers in the rains. Passing inwards are two sandy tracts rising from the basins of the rivers, the outer edge cut up by ravines which carry off the drainage of the country. These gradually become more level as one passes onwards. At the same time the soil also gradually changes, becoming firmer and less sandy by degrees, until after a while a loamy soil called dumat appears; no distinct boundary line between the two being generally perceptible. This dumat tract forms the central watershed of the Doab, and along the central line of it lie reh plains and the lakes that accompany them, when the cultivation, instead of being continuous, lies in patches of various sizes like islands in the usar. These central dumat strips may be said, roughly speaking, to be the irrigated portion of the district. In them wells are made with little difficulty and expense; they require little or no artificial assistance, such as is afforded by wattle coils or wooden or masonry frames, and last for a considerable time. In the sandy tracts wells either cannot be sunk at all, or last but a year or two, unless built up with masonry from the spring level."

nearer than 60 or 70 feet, and well irrigation becomes too expensive to use except on the very best land. The same circumstance happens to a smaller degree in the marginal land of the streams feeding the two large rivers, where not only is water further from the surface than in the central tracts, but substrata are more sandy and shifting, making the maintenance of wells more difficult than in the middle strips, where water is nearer. It is also the case that, owing to the greater depth at which water is found throughout the Doáb as compared with the north Ganges country, a greater variety of strata have to be pierced before water is reached in the former than in the latter, and it may therefore be easily understood that localities frequently occur where the substrata are so loose that earthen excavations will not stand. The consequence is that tracts fully protected and tracts not protected at all are dovetailed together somewhat promiscuously.

It is unfortunate, however, that canals and canal branches, led as they must be along water-sheds, follow the very lines which in the Central Doáb at least are best suited for wells, a circumstance proved by the small gain in revenue "due to canal" in the Central Doáb districts (land formerly "well" irrigated being classed as giving no revenue to canal).

"Other sources," *i.e.*, tanks, jhíls, and rivers, form a very small portion of the irrigation in the Doáb. The dryness and greater permeability of the soil, which, even when loam or clay above, is usually sandy under the surface, will not allow of the retention of water to any very serviceable extent, and what irrigation is derived from collected rainfall is confined chiefly to the series of shallow lakes or ponds in the central depressions (described in the note above quoted), from which water is lifted for rice or for the irrigation of young cereal crops in the first month or two after the rains; artificial tanks are so unusual that their existence as an irrigating factor may be ignored, while river water is very little used on account of the depth of water below the cliffs and the small width of the alluvial beds which are within irrigating reach.

Crops in IIIA. differ from those in IIIB. in that the former grows more sugar and wheat and less cotton and indigo. Cotton and indigo are, however, grown in the lower part of IIIA., and the upper part of IIIB. to a greater extent than in the extreme north-west, or than in the extreme south-east of the belt. In the latter indigo is stopped by the absence of canal irrigation, for it must be noted that indigo cannot, as in Bengal, be grown without water in the North-Western Provinces, and in the former cotton is subject to too heavy rainfall.

IV.—SOUTH JUMNA BELT.

The south belt is marked by decreasing rainfall and increasing depth to water. Soils are poor, and produce on account of the dryness of the atmosphere as well as of the want of humidity in the ground, is subject to great oscillations. The only exception is the black soil formation which runs through Bundelkhand, and which is tenacious of moisture, but at the same time almost impracticable under irrigation. The crops grown are in the autumn chiefly cotton with the millets and pulses, and in the winter gram and oil seeds are more common than in most districts north of the Jumna. Water lies at great depths, very often below 50 feet. In the tracts of Muttra and Agra, cultivated as they are to a great extent by the industrious Jat community, masonry wells are numerous, and large areas fully watered, but in the similar tracts of Jalaun, Hamírpur, and Bánda wells for irrigation are almost unknown.

Physical Changes from West to East.

The synopsis which has been sketched in the preceding paragraphs, indicates in the roughest way the broad outlines of variation with respect to existing physical conditions which are met with in receding from the Himalayas towards Central India. To sum up the facts in a still briefer abstract it may be said that rainfall and atmospheric moisture decrease, and that subsidence of water below the soil and difficulty of irrigation increase in proportion to distance from the Himalayan Range. It may also be noticed that this decrease in moisture (above and below the soil) is crossed at right angles by steady changes of another kind both in atmosphere and soil, the first of which may be described as the transition from the west to the east wind region, and the second as the transition from sand to loam.

The north-westerly districts, except those close to the Himalayas, have far greater aridity in the dry weather, a fiercer heat in the summer months before the rainfall, and more prolonged cold with a lower temperature in the winter, which circumstances are chiefly due to the prevalence of the dry west wind which blows over them, and which hardly reaches the south-easterly districts. The change is marked by no well-defined limit, but varies in intensity and in position from year to year, and always assumes a more or less gradual character.

The transition from sand to loam is equally difficult te define, for sand and loam tracts are intermixed in a confusing way throughout the central districts of the Doáb; but it may be noticed that large stretches of sand dunes occur in the districts in the neighbourhood of Meerut, which indicate an extensive prevalence of sandy soil, while below Cawnpore the class of "light blown sand," so common in the west, disappears almost completely from the settlement officer's record.

Physical Changes accompanied by Changes in Produce.—The gradual changes of atmosphere and soil in both directions are roughly marked by changes in the character of production. While, for instance, there is no cotton in the belt adjacent to the Himalayas, and little in the penultimate belt, it increases in the Doáb, and rises to a maximum south of the Jumna. Sugar, on the other hand, recedes in the same direction that cotton progresses. So, too, wheat, which likes winter cold and dryness of atmosphere, declines from west to east, while rice inceases in importance in the direction in which the stiffer soil and damper winds of the east tend to preserve the moisture which it requires. There are a variety of other cross lights which could (with closer statistics of detail), be clearly mapped and traced to their physical causes, but the above broad shades will sufficiently delineate the leading characteristics which belong to the different quarters of the province, and which bear a very intimate relation to its requirements for irrigation.

Statistical Statements.

(1.) *Character of Uncultivable Land.*—Noticing first the per-centage of cultivable area in each district, it will be found that the per-centage of cultivable area (not cultivated) is as a rule largest in those districts in which sand predominates. Light sand can hardly ever be called absolutely uncultivable, whereas almost all rocky stony soil, and very much of the land impregnated with saline admixtures, are absolutely uncultivable. It has also to be remembered that there is much saline land of which it is impossible to state whether or not it is cultivable, and that in consequence the per-centage of cultivable land allotted by one settlement officer to one district has not the same meaning as the per-centage allotted by another settlement officer in another district.

The uncultivable area in the northern belt consists chiefly (1) of stony undulations or slopes at the foot of the Siwaliks or Himalayas, which occur most prominently in the districts of Saháranpur, Bijnor, and Tarái, in which it will be noticed that the per-centage of uncultivable land is very large, (2) of swamps, and (3) very light sand on the edge of river beds.

The Rohilkhand and Ganges-Gogra belt has on the

CHAP. I. QN. 3. NORTH-WESTERN PROVINCES AND OUDH. *Mr. Buck.*

whole a very small area of uncultivable land (especially on the side nearest the Himalayan Range), as will be seen by observing the figures for districts which lie either completely or almost completely within it, namely, Bareilly, Budaun, Sháhjahánpur, Hardoi, Sitapur, Kheri, Bahraich, Gonda, Basti. The north-west portion of the belt is characterised by broad sandy ridges, lying above and along the wide valleys of the rivers of which some portion is uncultivable; but as the Settlement Officer of Bijnor remarks, "the places are very rare where sand so entirely predominates as to produce this result." There is also a large area of land which is rendered uncultivable by swamps and water lying on the land after the rains. In the south-east portion of the belt now under remark reh appears and renders uncultivable large areas, but not so extensive as those which are made sterile by the same cause in the Doab. The districts affected by reh are those which lie nearest the Ganges from Lucknow to Azamgarh, and to this cause may be attributed the rise in per-centage which occurs in the uncultivable area of those districts, although there is a suspicion that in some of them (and notably in Lucknow, Sultanpur, and Partabgarh) the area of uncultivated land may have been over-estimated.*

In the third or Doáb belt reh is the main cause of sterility. Reh appears to cross the Jumna from the districts north of Delhi on the Punjab side to the districts south of Delhi on the North-Western Provinces side, and, running through the centre of the Doáb as far as Allahabad, seems to find its way across the Ganges into Oudh, somewhere to the west of Lucknow, on the east of which district most of the country between the Ganges and the Gogra is affected by it, but, as observed, not so seriously as the Doáb. Reh is described by the Settlement Officer of Etáwah as appearing on "level plains from which water cannot escape." This is true, and it occurs more especially in the drainage basins (often several square miles in extent), from which the small river feeders of the Jumna and the Ganges take their rise. It is a noteworthy fact that in this region, *i.e.*, the Doáb belt, the water level, except near the Ganges, is from 20 to 30 feet below the surface, and it is probable therefore that there may be some connection between the conditions of humidity in the air and the soil and the appearance of reh at the surface of the district which lie in it. In the report on reh lately submitted to the Government of the North-Western Provinces and Oudh it was generally agreed that desiccation of atmosphere combined with a certain amount of moisture in the soil are necessary to produce that amount of evaporation which is sufficient to bring reh above ground. It is certain that in the Sub-Himalayan belt, where water is near the surface, and the atmosphere damp, and in the south belt, where water is distant and the air extremely dry, reh is practically absent. Whatever may be the case, however, the per-centage of uncultivable area in reh-infected districts is very large, rising in the Central Doáb to more than 30 per cent.

Passing now to the south-west belt, uncultivable area is due mainly to the extensive ravines which skirt the Jumna and some of its feeders, and to the stony undulating ground on the spurs from the Vindhya Range which penetrate the North-Western Provinces on its southernmost frontier from Gwalior to Rewah. Mr. Crosthwaite, the settlement officer of Etáwah, describes some tracts of that district which lie along the Jumna as "wild and inhospitable regions of ravines," terms which may be applied to much of the country on both sides of this river from Agra to Allahabad on the south boundary. The conformation of the hilly tracts in the districts of Jhánsi, Lalitpur, Hamírpur, Pánda, and Mirzapur, assimilates to that of the similar well-known country in Central India, and hardly needs further description.

(2.) *Cultivable Margin.*—The character of the cultivable margin follows very closely that of the uncultivated area: but, as noticed above, the per-centage of the former is as a rule smallest when that of the latter is greatest. The total figures show that about two-fifths of the province are uncultivated, of which, roughly speaking, more than one-half is cultivable.

Much of the cultivable margin, as well as of the uncultivable area, is reh-infected land, which would undoubtedly be brought under cultivation if reh could be eradicated, for it is a well-known fact that some of the best land of the province is that with which reh patches are intermixed. Mainpuri is a typical district, comprising as it does instances of three of the classes of land which have been described. In the north are the sandy tracts which characterise the upper part of the Doáb belt; in the centre the loam reh-infected tracts, which belong to the Central Doáb; in the south the poorer country terminating in ravines, which are included in the South Jumna belt. The following is the description given in a review by Mr. Crosthwaite, when secretary to the Board of Revenue, of the central portion: "This region," he writes, "of which the distinguishing features are *the prevalence of reh plains*, jhíls and marshes, and the wonderful fertility of the land under cultivation, is the *garden of the district*. From east to west it stretches in one uniform plain of high cultivation, luxuriant crops, and copious irrigation (the Arind runs down its centre, with the Cawnpore and Etáwah branches of the Eastern Ganges Canal on either side), culminating in the Mustafabad pargana, in which every advantage, natural and artificial, are found combined in a remarkable manner. The soil of this tract is *principally loam*."

A great deal of the cultivable area of the Sub-Himalayan belt, and of the north portion of the penultimate belt, and some portion of that in other belts, is now occupied by forest or grass and is good land, but it is doubtful whether the province would not suffer by the diminution of pasturage which would occur if any material portion of this area were brought under the plough. As it is, the protection of forests has obliged the exclusion of cattle from much of the area in which they were accustomed to graze, and any further curtailment of grazing land is to be deprecated. Another useful service which the cultivable margin performs, especially in the moister belts of the country, is the supply of thatching and fodder grasses which grow abundantly in jhíls and marshes prevalent throughout the country between the Jumna and the Himalayan Range, which are more numerous still as the Himalayas are approached.

* There is no reason to believe that Rae Bareli, which has over 17 per cent., and Jaunpur, which has only 10 per cent. of uncultivable land, are essentially different in character from the districts which lie between them, in which the per-centage is recorded as 24 and 30 per cent.

Mr. Elliott.

[*Supplementary note in continuation of Mr. Buck's Reply.*]

1. We come next to the question of the manner in which the cultivated area is sub-divided, *i.e.*, the crop acreage. And here we are met by the serious imperfection of the record, which makes it impossible as yet to deal with this subject as exhaustively as it deserves. The annual statements which every village accountant is bound to file contain an almost complete account of the agricultural condition of each village. They show the total area, the cultivated area, and the culturable waste. Against each field is recorded the name of the occupant, the area and the crop sown, whether the field is irrigated or not, and if irrigated, from what source it gets its water, the rent due and the rent paid for it—and these figures are totalled up for the entire village. If the village totals were similarly gathered together it would be easy to present to the eye a complete synopsis of the agricultural position of each district and each sub-

division of a district; and if the village returns were scrutinized by a body of competent officers, and a sufficient per-centage of them tested from time to time on the spot, and the entries compared with the actual facts, a high degree of accuracy would be obtained, and the general results would be worthy of entire confidence. Unfortunately several circumstances have combined to mar the seeming completeness of this scheme. In the first place, part of the North-Western Provinces (known as the Benares Province) is permanently settled; and in these districts there has been of late years no such careful field survey as is essential to provide the first data for agricultural statistics. Fields have altered in shape and size, and new land has been brought under cultivation, to such an extent that the old records are no longer trustworthy. In the second place, no sustained and combined effort was made to utilize the village records by totalling the figures up for districts until the new Agricultural Department was created for the North-Western Provinces in 1874; and though great progress has been made under that department, it has not yet succeeded in carrying out its main object in all districts of the North-Western Provinces, whilst its operations have not yet extended to Oudh. Mr. Buck has also already explained how the drought of 1877 disorganised his department, necessitating the diversion of the attention of officers to more immediately pressing subjects. There are, therefore, four classes of districts in the province: (1), the permanently-settled districts, as to which the total cultivated areas are very doubtful, and the detailed crop areas altogether unknown; (2), the Oudh districts which have been recently surveyed and settled, and regarding which the areas are therefore pretty accurately known, but the areas under each crop are less correctly recorded, because there has been no definite system of supervising the returns of the village accountants, and abstracting their general results; (3), six districts of the North-Western Provinces in which the Agricultural Department has not yet effected its desired reforms, so that the crop figures cannot be relied on; four of these are Himalayan or sub-montane districts, in which the areas are very large and the staff required for recording the crops is either inadequate or altogether non-existent; (4), twenty-four districts of the North-Western Provinces, into which the new system of the Agricultural Department has been definitely introduced, and the figures abstracted from the village returns are fairly trustworthy, though even here, as experience is gained and as supervision is more active, improvement is to be expected. It is proposed, therefore, in this reply, firstly, to give in full detail the crop areas for the 24 districts, so as to show what conclusions may be drawn from them, and then to apply the same ratios to the cultivated area of the entire province.

2. Before proceeding further, it may be as well to mention here the two great difficulties in the way of securing accurate crop statistics in Upper India. One of these is the habit of double-cropping. If all the land bore only one crop a year it would be sufficient to go over it once and to record the crop on it or just taken off it, and the total area under crops would agree with the total cultivated area. But where land is rich and highly manured, two and sometimes three crops are taken off it in the year; and to record these requires frequent visits and greater care, and it is necessary to bear in mind, what is often forgotten, that the cropped area should always be larger than the cultivated area. The second source of difficulty is the extraordinary extent to which mixed crops are grown. This habit makes the record confused and lengthy to a degree which can hardly be conceived. To give an example, a statement of the crops grown in the Moradabad District has been examined, with the result that, though the main kinds of articles are but 23, the combinations in which they can be grown with non-food grains and with each other amount to as many as 243. This enormously increases the difficulty of classifying the crops; and it is impossible to do it with perfect accuracy, since the proportion borne to the whole by each item in the mixed crop cannot be known, though a fairly approximate estimate may be formed.

3. The rate of produce per acre assumed as the average of each of the 24 districts will be found in the appendix.* The data on which these assumptions are made are as yet somewhat tentative, and no great degree of accuracy can at present be claimed for them. The main basis for the figures assumed has been obtained (1) by taking the estimates made by the different settlement officers while engaged in assessing the districts, during which time it has been very common to make experiments by cutting and weighing the produce of selected fields; (2) by comparing these figures with each other, and using them to modify each other, wherever, for example, there was much difference in the estimates for two adjacent districts with similar soils and system of cultivation; (3) by testing the general result by means of the requirements of the district. It may be taken as an axiom that the whole province produces on an average a little more food than its population ordinarily consumes. There is always more export than import of food. And the same rule applies, with very few exceptions, to each component part of the province—that is to each district. Large towns cause an exception to the rule, especially when the district in which they stand is small, as is the case with Benares. Another exception might be found in the case of a district largely given up to growing non-food crops which purchases part of its food from elsewhere. But this is not believed to be the case in any part of the North-Western Provinces, though the Rohilkhand districts come nearest to it. Growing an unusual quantity of sugar-cane, their out-turn of food grain comes closer to the actual need of the population than elsewhere; and Rohilkhand does frequently import food grains whenever it suffers from a short crop, paying for them by the price of its sugar. On the whole, however, this rule holds good, and it affords a sound general test of the accuracy of any calculation of average out-turn, since none can be correct which does not result in a figure slightly exceeding consumption.

4. *External Trade of the Province.*—An assertion such as this might probably be made in safety, in reliance on the known facts of the province and the general experience and consent of the officers engaged in the administration. It should, however, be capable of further demonstration by provincial trade statistics, if these had been kept up as long and supervised as carefully as has been the case in the Punjab and the Central Provinces. This, however, has not been done in the North-Western Provinces. Indeed, no statistics at all had been collected till it was decided in 1875 to establish a system corresponding to that of the adjoining province, by keeping up registering posts on the chief lines of communication. The year 1877–78 was the first year during which this system was fully at work; and it has now been decided by the orders of the Secretary of State that the system should be abolished. Short, however, as the period has been, the statistics collected have furnished some useful information. It will not be overlooked that 1877–78 was an altogether abnormal year. The kharif crop failed almost totally, and hence there was a net import of grain instead of a net export to supply the deficiency. Cotton also, and sugar, which are the products of that crop, were produced in much smaller quantities than usual; and trade was slack throughout the year, as the purchasing power of the people was much reduced. The following statement shows in abstract form what is furnished in greater detail in Mr. Buck's two annual reports, the net exports or imports of the main articles of commerce:—

* Statement No. 2.

Articles.	1877-78.		1878-79.	
	Net Imports.	Net Exports.	Net Imports.	Net Exports.
Cotton	84	—	—	153
Piece goods	102	—	519	—
Drugs	13	—	15	—
Dyes	—	11	—	25
Wheat	—	359	—	2,238
Other grains	8,183	—	—	2,271
Lac	11	—	—	—
Metals	417	—	775	—
Oil seed	—	3,450	—	6,221
Opium	—	129	—	91
Ghi	—	77	—	141
Salt	1,561	—	2,384	—
Saltpetre	—	7	—	—
Spices	21	—	46	—
Stone	145	—	—	—
Sugar, refined	—	722	—	476
„ unrefined	—	873	—	1,654
Tea	—	1	—	—
Tobacco	—	49	9	—

Note.—The figures are in maunds, 000's omitted.

As far as it is possible to draw any conclusions from the figures of only two years, one of them an exceptionally bad one, they should apparently be these. The normal imports of the country are piece goods, drugs, metals, salt, spices, and stone. Cotton was imported in 1877–78, because of the failure of the crop that year; but in 1878–79 the crop was an ordinary one, and it resumed its place among the exports.

The chief normal exports are wheat and other food grains, ghi, oil seeds, sugar, opium, and indigo. With regard to tobacco it is difficult to say what the facts are; but the general impression seems to be that the province, as a rule, consumes a little more tobacco than it grows, and does not ordinarily export, though it did so in 1877–78. How much the ordinary course and balance of trade were affected by the drought of 1877 is seen from the fact that in 1876–77 the North-Western Provinces exported by rail alone net 210,000 tons of wheat or 5,880,000 maunds, while in 1877–78 the net export was only a sixteenth of this, and was counterpoised by a very large import of inferior grains.

The trade of the province during 1878–79 with its neighbours was valued at—

	Rs.
Imports	7,05,63,000
Exports	8,80,75,000

leaving a slight balance in favour of exports, while the trade with foreign countries through the ports of Bombay and Calcutta was valued at—

	Rs.
Imports	5,64,29,000
Exports	11,13,96,000

leaving a balance of Rs. 5,49,67,000 in favour of the exports.

5. Having then obtained this general view as to the extent to which the producing powers of the province fall short of or exceed the requirements of its inhabitants, the next step is to consider what those requirements are.

As to the amount required for human food, the data for the calculation are as follows. The North-Western Provinces jail ration for adult prisoners confined for periods not exceeding three months, and doing light labour, is 1½ lbs. of the flour of the coarser millets or 1¼ lbs. of the flour of cereals. Making allowance for children who require half this ration, and for the loss in grinding, this may be taken as equivalent to 1¼ lbs. of grain per head per diem, or 5¾ maunds per annum. This precisely agrees with the quantity assumed as necessary in the Punjab, Bombay, and Madras; and is a little in excess of the estimate made in the Central Provinces and Berar, where 5 maunds is believed to be sufficient. It seems, therefore, advisable to estimate the food consumption at 5¾ maunds per head per annum, which is a little more than a ton of food to every five persons. The municipal estimate of consumption in towns is 7 maunds per head, but this would be too high for an estimate of the food of the rural population.

For seed grain the following estimate has been made, on the basis of the reports of several settlement officers and of the experience gained by the agricultural department:—

Wheat	80 lbs. per acre.	
Barley	70 „ „	
Gram	40 „ „	
Joár and bajra	10 „ „	
Rice	60 „ „	(*i.e.*, 90 lbs of paddy.)
Maize	30 „ „	
Smaller millets and pulses	20 „ „	

For the loss by dryage after the grain is harvested, and by waste during the time it is stored, it is probably safe to estimate 5 per cent. of the gross produce.

The food consumed by cattle is the item regarding which least information exists. There is no regular return made of the number of cattle, as in the Punjab; and though many settlement officers took a census of them at the time of the survey the result was not very trustworthy. The plough bullocks alone, reckoning 8 acres to a yoke, must be 6 million in the North-Western Provinces with its 25 million cultivated acres; and this implies probably a total number of 12 to 15 million cattle, including cart bullocks, cows, calves, and heifers and buffaloes. Mr. Buck, arguing from a special census taken by himself in a small area, reckons the number of cattle as high as 20 millions, and estimates their food at 7½ million maunds. In the Punjab the total number of cattle is calculated as 6 millions (which is probably too low); and their food at 6 millions of maunds. In answer to a special inquiry made from district officers, a set of replies have been received according to which every plough bullock gets a seer of grain a day while ploughing (say four months) and the same while working at the well (say four months), or 6 maunds a year, which is more than the human population consumes. Such an estimate cannot be correct; but there is little doubt that the people seldom give their bullocks as much grain as they would like to give if they could afford it. Much food is given in the form of green fodder, besides the dry fodder and cotton seed which they habitually get. Probably 2 maunds a year of food grain would be a full calculation of what they receive on an average from rich and poor owners taken together. This would amount to 12 million maunds for the North-Western Provinces. Adding in something for cart bullocks (who always get grain while they are worked) and for milch cattle, I propose to calculate the consumption of food grain at 18 millions of maunds, or ¾ of a maund to each acre.

6. It is possible now after clearing the way by these preliminary remarks to estimate what the requirements of these 24 districts are, and what the amount of food grain is which on the hypothesis already stated must be produced by the food-growing area in these districts, so that any estimate of out-turn which should fall below this would be *ipso facto* condemned as incredible:—

	Mds.	Tons.
Population 20,530,000 at 5¾ maunds	1,18,047,000	4,216,000
Cattle food at ¾ maund per acre on 19,208,000 acres	14,406,000	514,500
Seed grain at rates above stated	9,401,000	336,000
Wastage at 5 per cent. (say)	7,500,000	268,000
	1,49,354,000	5,334,500

The average out-turn of food grains in these districts must necessarily be a little larger than this, in order to allow for the small amount of export that goes on,

and for years that fall below the average. But it should not be much larger than this quantity; or else there would either be a rapidly accumulating store of grain in the country, or a larger export than is believed to exist would be required to carry it off.

7. The following table shows the abstract of the calculation made, the details of which for each district are entered in the appendix.* The district rates have been worked out, as already explained, by combining three different sets of considerations,—the estimates and conclusions arrived at by settlement and district officers; the principal that the assumed rates of adjacent districts ought to correspond to the known relative fertility of those districts; and the principle that such a result must be worked out as to show that every district is quite or nearly self-supporting.

STATISTICS of 24 DISTRICTS in the NORTH-WESTERN PROVINCES.

Food Crops.	Area, in Acres.	Produce in Maunds per Acre.	Total Out-turn, in Maunds.	Non-Food Crops.	Area, in Acres.	Value per Acre.	Total Value.
	*		*		*	Rs.	Rs.
Wheat	3,145	11·01	34,645				
Barley	940	10·18	9,576·5	Sugar-cane	477·6	80	38,108
Gram	1,281	8·37	10,718·5	Cotton	456	20	9,120
Peas	103·6	5·97	615·6	Cotton with arhar	807·6	10	8,076
Wheat, mixed	1,917	9·35	17,930	Fibres	64	20	1,280
Barley, „	1,525	9·57	14,596	Indigo	192·6	20	3,852
Jowar	2,600	7·29	18,964	Fodder	390·2	20	7,804
Bajra	1,758	6·35	11,163	Potatoes	15·5	100	1,550
Rice	1,309	11·19	14,654	Garden crops	179	30	5,370
Maize	442	11·33	5,009	Tobacco	32·1	50	1,605
Pulses	656			Opium	67	50	3,350
Small millets	428·5	7·00	7,987	Oil seeds	311·3	20	6,226
Miscellaneous	56·5			Miscellaneous	53·5	20	1,070
Arhar mixed with cotton	—	5·00	4,038				
Total	16,161·6	9·20	149,896·6	Total	3,046·4	28·7	87,411

* Three 0's omitted.

These figures lead to the conclusion that in these 24 districts the average out-turn of food grain is 9 maunds 9½ seers or 739 lbs., or about 6½ cwts. per acre; that there is one person to every ·787 acres growing food grains and to every ·935 acres bearing crops; that about 78·8 per cent. of the average food out-turn is required for the consumption of the people; about 21 is required for seed and food of cattle or lost by wastage and dryage, and about 1·3 per cent. remains over for export. So far the figures seem to be tolerably consistent with the facts, though the margin is probably smaller that the truth; and this may be accounted for by supposing either that the produce per acre is underrated, or else the double-cropped area is less than it should be.

8. With regard to the non-food crops, however, the result is not so satisfactory; and it appears impossible at present to make the estimate of consumption agree with the estimate of requirements. It has been seen from the trade statistics, imperfect as they are, that there is reason to believe that the province usually imports spices and tobacco but not cotton, though it did so in 1877–78; and that it certainly exports dyes, oil seeds, ghi, opium, and sugar. The agricultural statistics ought therefore, if they are to support the trade statistics, to show a deficit in the production of the one class of articles and a surplus in the production of the other. It does not, however, necessarily follow that the same result should take place in each district, or even in the entire area of the 24 districts. It is more customary to interchange articles of luxury than of necessity; and it has already been pointed out to what extent certain products, such as sugar-cane and cotton, are abundant in certain parts of the province and deficient in others. But, after making due allowance for this, there ought in so large a tract as this to be a tolerable approximation between production and consumption in the case of most articles, subject to the general conclusions drawn from the trade statistics.

It is necessary, therefore, to take each article in succession, and to frame an estimate of the requirements of the people and of the out-turn from the recorded area. In framing the former part of the calculation, the best guide is the estimate made by the North-Western Provinces Government of consumption in municipal towns. This was originally based on the octroi returns, and has been revised and checked during many years, so that it may now be accepted as tolerably correct; subject only to the proviso that in applying it to the wants of the rural population it is sure to be too high, since they do not consume luxuries to the same extent as townspeople.

I. Sugar.—The urban consumption is 30 lbs. of coarse and 10 to 12 lbs. of fine sugar a year, which is equivalent to about three times its weight in coarse sugar. Villagers do not buy much fine sugar, but in the cane districts (especially Rohilkhand) they consume a great deal in the course of manufacture. Taking 30 lbs. a head for the rural and 60 lbs. for the urban population (one-tenth of the whole), the requirements are—

Rural	18½ millions at 30 lbs.		555 million lbs.	
Urban	2 „	„ 60 „	120	„ „
Total			675	„ „

The produce of the best sugar-cane land in Shahjahanpur was estimated by Mr. Butt at 55 maunds per acre, but this is much above the average. Taking it at 30 maunds all round,* or 2,400 lbs. per acre, the out-turn of 477,600 acres is 1,146 million lbs., leaving a surplus of 371 million lbs., or over 4½ million maunds, which is probably too high. The export of both 1875–78 and 1878–79 was, as has been seen before, about 3 million maunds from the whole province; but the period was one of unusually low production.

II. Cotton.—The best estimate made of cotton consumption is that by Raja Lachman Singh, of Bulandshahr, who puts it at 3 lbs. 10 ozs. per head of the rural population. Raising this slightly to allow for waste and for the urban population, we may reckon it at 4 lbs., or 82 million lbs. for the whole population of the 24 districts. The cotton-growing land is divided into two classes—that which grows cotton only, and that which grows cotton mixed with other crops, especially arhar. The first class produces on the best lands about 2 maunds an acre, say about 1½ as an average. Where it is mixed with other crops, the

* Statement No. III.

* The average wholesale price is about Rs. 3 a maund, or a little less: hence the value per acre has been calculated at Rs. 80.

amount of mixture varies extremely, and only a rough estimate can be formed by which it may be put at ¾ of a maund. The out-turn will then be 1,286,000 maunds or 103 million lbs. This provides a surplus of 21 million lbs., and it has been seen that the province as a whole exported 12¼ million lbs. or 153,000 maunds in 1878–79. If this amount of export is normal the production must be larger than my estimate, since these 24 districts contain almost all the chief cotton-producing area, while Oudh and the remaining part of the North-Western Provinces grow very little of this staple.

III. Tobacco.—The municipal estimate of consumption is 8 lbs. a head; but this is probably much too high for the villages and agriculturists. The Punjab estimate is 4 lbs., which is perhaps as low as we can reasonably go; and at this rate the consumption would be 82 million lbs. In order to produce this the 32,100 acres recorded as being under tobacco must turn out 2,700 lbs. per acre, which is certainly more than is the case. And yet the province as a whole exported in 1877–78 over 4 million lbs. The only two conclusions possible are—either that the rest of the North-Western Provinces and Oudh produce much more tobacco than the 24 districts of which we have statistics; or else that the area under tobacco is much underrated.

V. Garden crops.—The same difficulty exists in the case of vegetables. The jail ration is 6 ozs. of vegetables daily for an adult, or, say 4 ozs. a head for all classes, or 90 lbs. a year. At this rate the 20½ millions require 1,845 million lbs., or 23 million maunds, to provide which the 194,500 acres under garden crops and potatoes must produce about 130 maunds per acre. But the estimate of production made by Mr. Buck is only 100 maunds for potatoes and 50 maunds for other crops, which gives an out-turn of only 10½ million maunds. There is probably a combination of errors here. The area may be understated, and the estimate of produce per acre may be too low. On the other hand, it is probable that the poorer classes eat very much less of garden vegetables, and supply the deficiency in their diet by picking leaves of wild herbs and by undergrowths which are not included in the statistics of crop acreage.

VI. Spices.—The estimate of municipal consumption is 12 lbs. a head. Mr. Thornton's figure for Punjab agriculturists is 4¼ lbs. Taking the lowest estimate, the 20½ millions require 1,089,000 maunds, and there is no area specially recorded as being under these crops. Many of these are grown in "garden land," the area of which has been shown to be insufficient to account for the requisite weight of vegetables, supposing no part to be devoted to spices. A portion of the spices are probably grown in the "miscellaneous" area; but the statistics are clearly defective under this head.

VII. Oil Seeds.—The consumption of oil in municipalities is 9 lbs. per head; in villages it is probably less, say, 8 lbs.; and 8 lbs. of oil represents, roughly, 32 lbs. of oil seeds. For 20½ millions we require then 656 million lbs., or 8,200,000 maunds of oil seeds. The province, as a whole, exported in 1877–78 3½ million maunds and in 1878–79 6¼ millions. To produce the former figure alone on 311,300 acres the average out-turn per acre must be 26 maunds, which is far too large. There is little doubt that the true explanation of this discrepancy is that oil seeds are grown to a great extent as a mixed subordinate crop with wheat and barley as well as with cotton and joár; and Mr. Buck has reckoned that in a good year the rent of an acre of wheat, say Rs. 6, is paid by the mustard thrown in with the wheat, which must therefore produce about 2½ maunds of oil seeds.

10. The result of these considerations is to show that a great deal remains to be done by the Agricultural Department of the North-Western Provinces and Oudh before we can claim to have reduced our knowledge on these subjects to anything like exactitude. The points that especially require attention are (1) the amount of grain given to cattle; (2) the extent to which double cropping goes on; (3) the extent to which the admixture of subordinate grains and undergrowths increases the food supply of the people; (4) the consumption by the people of supplementary articles of diet, such as sugar, tobacco, vegetables, and spices; (5) the more correct classification of the highly cultivated garden crops.

11. After making all these admissions, it will be readily understood that we do not profess to be able to present any very accurate synopsis of the results of the whole agricultural industry of the province. All that can be done at present in this direction is to prepare what may be called a rough working hypothesis, which may serve to direct attention to the problems that have to be solved and to invite assistance in procuring the necessary data. With this explanation, however, it may be useful to draw up an abstract sketch of this description, by assuming that we can apply to the whole province the data and ratios which have been used with regard to the 24 districts alone.

12. The total cultivated area of the 33 districts of the North-Western Provinces (excluding the Kumaun and Garhwál districts in the Himalayas and the part of Dehra Dun which also lies in the Himalayas) is 25,344,000 acres; and taking the same ratio for double-cropped land as was found to exist in the 24 districts, or 7 per cent., the total cropped area is 27,109,000 acres. Of this (still using the ratios of the 24 districts, or 85 and 15 per cent. respectively), the area under food crops is 23,052,000 acres and under non-food crops 4,057 acres. The Oudh figures, though they do not give crop areas, are more accurate than those of the permanently settled districts of the North-Western Provinces, and they exhibit variations such as might be expected from the fact that the population is somewhat denser, the total cultivated area being 8,299,000 acres to a population of 12 millions, or nearly 1½ persons to each acre. The "dofasli" or double-cropped area is 9·1 per cent. instead of 7, and the area under food crops is larger, 87 instead of 85 per cent.—a proof that the population presses more closely on the soil for its food supply. The total area of the whole province is then as follows:—

	Acres.
Cultivated area - -	33,643,000
Double-cropped area -	2,523,000
Total cropped area - -	36,166,000
Food crops - - -	30,933,000
Non-food crops - -	5,233,000

Assuming then that on the area sown with food and non-food crops the different kinds of crops are grown in the same ratio to each other and cover the same proportionate area as in the 24 districts, of which we have more accurate statistics, we work out the following table:—

STATISTICS of NORTH-WESTERN PROVINCES and OUDH.

Food Crops.	Area in Acres.	Produce in Maunds per Acre.	Total Out-turn in Maunds.	Non-food Crops.	Area in Acres.	Value per Acre.	Total Value.
						Rs.	Rs.
Wheat	6,019·7	11·01	66,276·9				
Barley	1,799·2	10·18	18,315·8	Sugar-cane	820·5	80	65,640
Gram	2,451·9	8·37	20,522·4	Cotton	783·9	20	15,678
Peas	198·3	5·97	1,183·8	Cotton with arhar	1387·6	10	13,876
Wheat, mixed	3,669·2	9·35	34,307	Fibres	109·9	20	2,198
Barley, ,,	2,918·9	9·57	27,933·8	Indigo	331·2	20	6,624
Jowar	4,976·5	7·29	36,278·6	Fodder	670	20	13,400
Bajra	3,364	6·35	21,361·4	Potatoes	25·7	100	2,570
Rice	2,505·4	11·19	28,035·4	Garden crops	307	30	9,210
Maize	846	11·33	9,585·2	Tobacco	55·9	50	2,795
Pulses	1,251	7·00	8,757	Opium	115·6	50	5,780
Small millets	819	7·00	5,733	Oil seeds	534·7	20	10,694
Others	113·9	7·00	797·3	Miscellaneous	91	20	1,820
Arhar mixed	—	5·00	6,938				
Total	30,933·	9·22	286,302·6	Total	5,223	28·7	150,285

(000's omitted).

Requirements.	Mds.
Food of 41,000,000 at 5¾ maunds	235,750
Seed grain	22,994
Wastage at 5 per cent. of produce	14,220
Cattle food at ¾ maund per acre	25,232
Total requirements	296,196

According to this calculation the province does not provide enough food to meet the requirements of its inhabitants. This we know not to be the case; and therefore it follows that there is an error either in the calculation of consumption or of production. It is possible that the amount consumed has been over-rated, but this is hardly likely, considering the basis on which the calculation is made, and the fact that the average quantity of food grains consumed per head in towns is found to be 7 maunds. The error is more likely to be in the figures on the other side of the account; and it may be either in the area or in the rate of production per acre. I believe it lies in both of these figures. It has already been suggested that the double-cropped area was under estimated in the 24 districts; and probably it is still more under-rated in the more thickly populated tracts of Southern Oudh and the Benares Division. The rate of produce per acre is undoubtedly larger there than in the western districts, which included the poor soil of Bundelkhand, and it is not unreasonable to assume that if the general average for those districts is 9⅕ maunds, it should be 10 maunds for the whole province. This would give an out-turn of 309,330,000 maunds, or very slightly in excess of the requirements of the country. A further margin is required to provide for export, and for the fact that even in an average year the season is unfavourable to some crops; and this margin is obtained by assuming that the area cropped twice a year is larger by some 3 or 4 per cent. than has hitherto been supposed. If it is raised from 7 to 10 per cent. the area under food crops would be 31,450,000 acres and the out-turn 314,000,000 maunds, which gives a margin of 18,000,000 maunds, or 650,000 tons.

13. *Average Price of Food Grains.*—In order to define the average price of food grains the table below* has been compiled: 10 principal markets have been selected (Meerut, Agra, Cawnpore, Bareilly, Lucknow, Fyzabad, Allahabad, Gorakhpur, Benares, Jhansi), and the average monthly price at each of these places has been extracted from the official price currents, and the average of the 12 months has been taken as the yearly average of that place; the average of the yearly figures for the 10 markets has been taken as the average of the province. The price of small millets is not returned in the official price currents, but we shall be safe in taking them as a little cheaper than joár, say Rs. 40 per ton. With these data the money value of the crop can be calculated thus:—

Article.	Out-turn in Tons.	Rate per Ton.	Value.
	*	Rs.	Rs.
Wheat	2,368	63·6	150,672
Barley	654	45·5	29,634
Wheat and barley mixed	2,225	54·5	120,742
Gram and peas	775	52·3	40,445
Jowar and Indian-corn	1,638	48	78,624
Bajra	763	54·5	41,440
Common rice	1,001	80	80,080
Small millets and miscellaneous	233	40	9,320
Pulses	560	63·6	3,549
Total	10,215	54·3	553,906

* 000's omitted.

Taking off 10 per cent. for the difference between market prices and village prices, it may be fairly reckoned that the average price of food grains in the North-Western Provinces and Oudh during the last 10 years has been Rs. 50 per ton.

14. Turning to the non-food crops, the estimates and assumptions made as to the production and consumption of these in paragraph 9 in the case of the 24 districts may be applied to the whole area and population, and thrown into the form of a table, thus:—

*Article.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Average of 10 years.	Average Rate per Ton.
												Rs.
Wheat	11·7	15·9	21·9	16·5	15·5	16·9	22·5	24·9	16·8	13·4	17·6	63·6
Barley	15·2	24·1	30·9	23·3	20·8	22·1	31·4	35·8	24·2	18·1	24·6	45·5
Gram	12·8	15·8	24·8	22·6	20·7	20·2	27·5	33·5	22·7	13·8	21·4	52·3
Jowar	16·3	24·3	27·5	21·2	20·8	20·6	28·9	34·9	22·6	16·3	23·3	48·
Bajra	13·5	20·9	24·8	19·	18·6	18·4	24·5	32·	20·3	13·7	20·5	54·5
Common rice	10·5	13·7	15·8	13·8	13·8	13·2	17·4	19·3	13·3	9·4	14·	80·
Arhar	11·5	16·	23·3	19·1	17·7	13·12	18·4	26·	18·14	9·	17·6	63·6

ESTIMATE of PRODUCTION and CONSUMPTION of Articles other than FOOD GRAINS for 41,000,000 of People in the NORTH-WESTERN PROVINCES and OUDH.

Articles.	Area sown.	Rate of Production per Acre.	Out-turn.	Rate of Consumption per Head per Acre.	Total Quantity required for Consumption.	Surplus for Export.	Deficit.
	Acres.	Mds.	Mds.	Lbs. Lbs.	Mds.	Mds.	Mds.
Sugar-cane	820,000	30	24,600,000	30 & 60	16,875,000	7,725,000	—
Cotton { unmixed	783,000	1½	} 2,215,000	4	2,050,000	165,000	—
Cotton { mixed	1,387,600	¾	}				
Tobacco	55,900	20	1,118,000	4	2,050,000	—	932,000
Garden vegetables	332,700	60	19,962,000	90	46,125,000	—	25,163,000
Spices	—	—	—	4¼	2,177,000	—	2,177,000
Oil seeds	534,700	10	5,347,003	32	16,400,000	—	11,053,000
Ghi	—	—	—	4¼	2,177,000	—	—
Milk	—	—	—	15	7,687,000	—	—

With regard to sugar-cane and cotton there is nothing unlikely in the results thus presented. We know that there is a very large export of sugar, though it can hardly amount to 7,725,000 maunds or 280,000 tons; and there is probably a slight export of cotton. But the figures which show a large deficit in tobacco, vegetables, spices, and oil seeds cannot be believed. There may be a small import of tobacco from Behar, but that is not certain. In the case of vegetables it is probable that the average amount consumed is overrated and should be cut down to two-thirds, or 60 lbs., while the production must be raised to 30¾ million maunds to balance even this reduced quantity. Of spices we have no figures, but probably they are for the most part grown at home. Oil seeds we know to be exported to the extent of 5 to 6 million maunds, so the actual production must be over 20 million maunds, or 700,000 tons. Ghi we export to some small extent, so the production must be about 2,250,000 maunds; and milk must be locally produced to the extent of popular need. These two items were not referred to before. The assumed rates are adopted from Mr. Thornton's Punjab estimate, and are probably not above the truth. In the case of ghi the consumption in municipal towns is found to be over 8 lbs. per head, so that the present estimate of 4 lbs. cannot be considered excessive.

15. It is possible now to frame from the data arrived at a hypothetical statement of the agricultural produce of the country, and of its value.

Produce.	Maunds.	Tons.	Rate.	Value.
	*	*	Rs.	Rs.*
Food grains	3,14,500	11,232	50 per ton	5,61,600
Sugar	24,600	880	3 per md.	22,150
Cotton	2,215	80	10 ,,	73,800
Tobacco	2,050	73	2·8 ,,	5,125
Vegetables	30,750	1,700	1 ,,	30,750
Spices	2,177	77	6 ,,	13,062
Oil seeds	19,800	700	2·8 ,,	49,500
Ghi	2,250	80	20 ,,	45,000
Milk	7,687	275	2 ,,	15,374
Fibres	220	8	8 ,,	1,760
Opium	—	—	50 per acre	5,780
Indigo	—	—	20 ,,	6,624
Total	—	—	—	8,30,525

* 000's omitted.

The land revenue payable by the entire province is Rs. 56,675,000, or 6·8 per cent. of the value of the agricultural produce, as estimated above.

16. Although there are so many elements of doubt in this calculation that any conclusion drawn from it can only be suggested as hypothetical and tentative, it still seems worth while to pursue the inquiry one step further, and to complete this branch of the subject by an attempt to show what the condition of the agricultural population is; what portion of the produce they raise from the land is necessary to their support; what the surplus is, and what share of this is demanded by the tax gatherer or remains to the people, to be hoarded up against an evil day or to be expended in luxuries and pleasures.

17. It is a disputed question what is the number of the agricultural population as opposed to the non-agricultural; for there is no sharp division of classes in this respect. Traders and artizans constantly hold a little land, and labourers are employed in field work and other kinds of work as occasion may offer. The question has been discussed in a separate note drawn up in reply to question 8 of chapter I., and the conclusion there arrived at was that the population of the country should be classified as follows:—

Urban and non-agricultural	3,800,000
Rural, but following trades and professions alone	4,200,000
Rural and following trades or professions conjointly with agriculture	4,200,000
Rural and following agriculture only	29,750,000
Total	41,950,000

The persons then who raise the agricultural products are the two last classes of the population. Agriculture is their main employment and the chief, but not the sole, source of their livelihood, as some of them also add to their means of support from other sources, such as smith's work, weaving, and labouring for hire. For the present, as we are not dealing with the hill districts of Kumaun, Garhwál, or Dehra Dun, we must exclude their population also and deal only with 41 millions of people, of whom the rural and agricultural classes number 33 millions.

18. The production will be the same as in the preceding paragraph, and the consumption of 33 millions will be reckoned at the same rates as were employed before.

Articles.	Total Amount Produced.	Rate of Consumption per Head per Annum.	Total Consumption of 33 millions.	Surplus.	Value of Surplus.
	*		*	*	*
	Mds.		Mds.	Mds.	Rs.
Food grains	314,500	5¾ maunds, plus seed grain, cattle food, and wastage.	245,463	69,073	123,269
		Lbs.			
Sugar-cane	24,600	30	12,375	12,225	36,675
Cotton	2,215	4	1,650	565	5,650
Tobacco	2,050	4	1,650	400	1,000
Vegetables	30,750	60	24,750	6,000	6,000
Spices	2,177	4¼	1,753	424	2,544
Oil seeds	19,800	32	13,200	6,600	15,500
Ghi	2,250	4¼	1,753	497	9,940
Milk	7,687	15	6,187	1,500	3,000
Fibres	220	—	—	220	1,760
Opium	—	—	—	—	[5,780
Indigo	—	—	—	—	6,624
Total	—	—	—	—	217,723

* 000's omitted.

The surplus produce which remains over after the requirements of the agricultural population have been fully supplied, as far as necessaries are concerned, is sold by them to rich traders dwelling in the country,

and to the urban population for their consumption and for export; and the value of it is Rs. 217,723,000. Deducting 10 per cent. from the value assigned to non-food grains (the deduction having already been made from food grains) for the difference between village and town prices, the surplus will be Rs. 208,276,000.

The land revenue paid by the agricultural classes is Rs. 56,675,000, and the local and patwari cesses reckoned at 15 per cent. amount to Rs. 8,501,250, total Rs. 65,176,000. The surplus remaining therefore to the agriculturists to be spent on luxuries and on pleasures is the sum of Rs. 143,100,000, or Rs. 4 a head, or Rs. 20 per agricultural family. Looking at the province broadly, it seems that we may say that the 6½ millions of agricultural families, after providing for their own necessary requirements, such as common food and coarse clothing, and after paying land tax and cesses at the rate of Rs. 10 a piece, have a surplus to fall back on in ordinary years, amounting to Rs. 20 a piece. There are of course great differences among the different sub-divisions of this class. The tenants who pay rent instead of land revenue (rent being about double the land revenue) pay on an average Rs. 20 per family; the agricultural labourers again receive only a wage which hardly exceeds subsistence, and they pay no taxes whatever. Excluding this latter class, the landed population, who may be reckoned at 5 million families, enjoy a surplus of Rs. 26 a piece. It will be a necessary development of the supervision now exercised over agricultural statistics that in a year or two the department should be able to give the approximate number of landowners who do or do not cultivate land themselves, and of tenants who cultivate without owning land; and when this is known it will be possible to define more strictly the distribution among them of agricultural profits. Some of those who do not own or till land, as well as some of the tenants and even landowners, add to their agricultural surplus some earnings from other quarters by following trades or professions, and there are some minor sources of agricultural profit, such as meat supplied to the towns, leather, timber, and fuel, which have not been included in this account, but which, when added together, form a not immaterial increment to the income of the agricultural population.

19. These calculations represent a very reasonable amount of domestic comfort. A peasantry cannot be said to be ill off which can provide for its own necessities, and after doing this has only to pay 33 per cent. of the surplus in taxes, and is able to reserve the balance, or 66 per cent. to be hoarded or expended in luxuries. At the same time it must again be repeated that I offer these conclusions simply as the best calculations that I can frame from the imperfect data already existing; and that they will be open to revision as soon as the Agricultural Department has brought its statistics into a state of greater coherence and accuracy, a consummation which there is no doubt will, under the present director's guidance, soon be attained.

STATEMENT I.—DETAILS and PER-CENTAGES of TOTAL AREA, in ACRES.

Number.	Districts.	Total Area.	Total Cultivated Area.	Per-centage of Cultivated Area to Total Area.	Total Cultivable Area not Cultivated.	Per-centage of Cultivable Area to Total Area.	Total Uncultivable Area.	Per-centage of Uncultivable Area to Total Area.	General Character of Cultivable and Uncultivable Area.
	1.	2.	3.	4.	5.	6.	7.	8.	9.
		*	*		*		*		
	NORTH-WESTERN PROVINCES.								
	Meerut Division.								
	(Dehra Dun—See Hill Tracts).								
1	Saharanpur	1,422	825	58	177	13	420	29	St. O. S.
2	Muzaffarnagar	1,059	700	66	208	20	151	14	S. R.
3	Meerut	1,507	1,059	69	251	17	206	14	S. R.
4	Bulandshahr	1,222	850	70	246	20	126	10	S. O.
5	Aligarh	1,251	950	76	79	6	222	18	S. O.
	Total Meerut Division	6,461	4,375	67	961	15	1,125	18	
	Rohilkhand Division.								
6	Bijnor	1,196	650	54	290	24	256	22	J. S.
7	Moradabad	1,472	900	61	242	17	330	22	J. S.
8	Bareilly	1,916	1,160	60	427	23	329	17	S. R.
9	Budaun	1,275	840	66	286	22	149	12	S. R.
10	Shahjahanpur	1,116	740	66	197	18	179	16	S. R.
11	Tarai	589	130	22	169	29	290	49	J. S.
	Total Rohilkhand Division	7,564	4,420	58	1,611	22	1,533	20	
	Agra Division.								
12	Muttra	862	660	76	90	11	112	13	O. St.
13	Agra	1,394	1,050	76	140	10	204	14	O. St.
14	Mainpuri	1,086	608	56	121	11	357	33	S. O.
15	Farukhabad	1,100	670	61	194	18	236	21	S. O.
16	Etawah	1,087	550	51	176	16	361	33	O. St.
17	Etah	968	620	64	157	16	191	20	S. O.
	Total Agra Division	6,497	4,158	64	878	13	1,461	23	

* N.B.—The figures in columns 2, 3, 5, and 7 represent thousands.

STATEMENT I.—DETAILS and PER-CENTAGES of TOTAL AREA in ACRES.—*cont.*

Number.	Districts.	Total Area.	Total Cultivated Area.	Per-centage of Cultivated Area to Total Area.	Total Cultivable Area not Cultivated.	Per-centage of Cultivable Area to Total Area.	Total Uncultivable Area.	Per-centage of Uncultivable Area to Total Area.	General Character of Cultivable and Uncultivable Area.
	1.	2.	3.	4.	5.	6.	7.	8.	9.
	NORTH-WESTERN PROVINCES.—*cont.*	*	*		*		*		
	(Dehra Dun—See Hill Tracts.)								
	Allahabad Division.								
18	Cawnpore	1,496	850	57	166	11	480	32	O. St.
19	Fatehpur	1,044	545	52	127	12	372	36	O. St.
20	Banda	1,895	780	41	702	37	413	22	O. St.
21	Allahabad	1,818	1,030	57	200	11	588	32	O. St.
22	Hamirpur	1,470	750	51	412	28	308	21	J. St.
23	Jaunpur (P. S.)	995	580	58	320	32	95	10	O. R.
	Total Allahabad Division	8,718	4,535	52	1,927	22	2,256	26	
	Benares Division.								
24	Azamgarh (partly P. S.)	1,567	936	59	201	13	430	28	O. R.
25	Mirzapur (P. S.)	3,345	950	28	1,364	41	1,031	31	St. J.
26	Benares (P. S.)	639	485	76	8	1	146	23	St. J.
27	Gorakhpur	2,934	2,000	68	311	10	623	22	J. R.
28	Basti	1,784	1,250	70	291	16	243	14	J. R.
29	Ghazipur (P. S.)	1,391	990	71	160	11	241	18	O. R.
	Total Benares Division	11,660	6,611	57	2,335	20	2,714	23	
	Jhansi Division.								
30	Jalaun	995	580	58	195	20	220	22	St. R.
31	Jhansi	1,003	350	35	368	37	285	28	St. R. J.
32	Lalitpur	1,246	242	19	679	54	325	27	St. R. J.
	Total Jhansi Division	3,244	1,172	36	1,242	38	830	26	
	Hill Division.								
33	Dehra Dun	763	73	9	83	11	607	80	J. St.
34	Kumaun	3,840	327	8	500	13	3,017	78	J. St.
35	Garhwal	3,520	120	3	500	14	2,900	82	J. St.
	Total Hill Division	8,123	520	6	1,083	13	6,524	80	
	Grand Total North-Western Provinces.	52,267	25,791	49	10,037	19	16,443	32	
	OUDH.								
	Lucknow Division.								
36	Lucknow	627	332	52	140	23	155	25	O. R.
37	Bara Banki	1,132	718	63	221	20	193	17	O. R.
38	Unao	1,132	596	53	303	27	233	20	O. R.
	Total Lucknow Division	2,891	1,646	57	664	23	581	20	
	Fyzabad Division.								
39	Fyzabad	1,081	607	56	230	21	244	23	O. R.
40	Bahraich	1,487	810	54	551	37	135	9	J. R.
41	Gonda	1,754	1,070	61	504	29	180	10	J. R.
	Total Fyzabad Division	4,322	2,478	57	1,285	30	559	13	
	Sitapur Division.								
42	Sitapur	1,417	917	64	321	23	179	13	R. S.
43	Hardoi	1,472	863	59	404	27	205	14	R. S.
44	Kheri	1,511	805	54	558	37	148	9	J. R. S.
	Total Sitapur Division	4,400	2,585	59	1,283	29	532	12	
	Rae Bareli Division.								
45	Rae Bareli	1,112	570	52	344	31	198	17	O. R.
46	Sultanpur	1,041	572	55	218	21	251	24	O. R.
47	Partabgarh	918	448	49	192	21	278	30	O. R.
	Total Rae Bareli Division	3,071	1,590	52	754	24	727	24	
	Grand Total Oudh	14,684	8,299	57	3,986	27	2,399	16	
	Provincial Grand Total North-Western Provinces and Oudh	66,951	34,000	51	14,023	21	18,842	28	

* *N.B.*—The figures in columns 2, 3, 5, and 7 represent thousands.

NOTE.—In remarks column St. denotes stony; S. sandy; O. usar or reh infected land; J. jungle and forest; R. river bed, or bank, or rocky ravine. *P.S.* signifies permanently settled.

STATEMENT II.—DETAILS of CULTIVATED AREA in ACRES.

District.	Total Cultivated Area.	Portion of Cultivated Area bearing more than one Crop in the Year.	Total Acreage under Crops in the year, *i.e.*, Total of Columns 2 and 3.	Portion of Total Cropped under Food Crops.	Portion of Total Cropped Area of Column 4 under other Crops.	Per-centage of Food Crops to Total Cropped of Column 4.	Per-centage of other Crops to Total Cropped of Column 4.	Per-centage of Dofasli to Total Cultivated Area.
1.	2.	3.	4.	5.	6.	7.	8.	9.
	*	*	*	*	*			
NORTH-WESTERN PROVINCES.								
Meerut Division.								
Saharanpur	825	70	895	726	169	81·1	18·9	8·5
Muzaffarnagar	700	37	737	580	157	78·7	21·3	5·3
Meerut	1,050	100	1,150	938	212	81·5	18·5	9·5
Bulandshahr	850	68	918	772	146	84·1	15·9	8.
Aligarh	950	100	1,050	880	170	83·9	16·1	10·5
Total Meerut Division	4,375	375	4,750	3,896	854	82·1	17·9	8·5
Rohilkhand Division.								
Bijnor	650	50	700	587	113	83·9	16·1	7·7
Moradabad	900	54	954	839	115	87·9	12·1	6·
Bareilly	1,160	110	1,270	1,099	171	86·5	13·5	9·4
Budaun	840	50	890	788	102	88·5	11·5	6·
Shahjahanpur	740	40	780	659	121	84·5	15·5	5·4
Tarai	130	30	160	142	18	88·7	11·3	23·
Total Rohilkhand Division	4,420	334	4,754	4,114	640	86·5	13·5	7·5
Agra Division.								
Muttra	660	70	730	599	131	82·1	17·9	10·6
Agra	1,050	60	1,110	921	189	82·9	17·1	5·7
Mainpuri	608	40	648	560	88	86·5	13·5	6·5
Farakhabad	670	37	707	607	100	85·8	14·2	5·5
Etawah	550	65	615	501	114	81·5	18·5	11·8
Etah	620	40	660	565	95	85·6	14·4	6·4
Total Agra Division	4,158	312	4,470	3,753	717	83·9	16·1	7·5
Allahabad Division.								
Cawnpore	850	60	910	721	189	79·3	20·7	7·
Fatehpur	545	40	585	505	80	86·3	13·7	7·3
Banda	780	25	805	666	139	82·7	17·3	3·2
Allahabad	1,030	75	1,105	1,008	97	91·3	8·7	7·2
Hamirpur	750	29	779	618	161	79·3	20·7	3·8
Jaunpur	580	20	600	522	78	87·	13·	3·4
Total Allahabad Division	4,535	249	4,784	4,040	744	84·5	15·5	5·2
Benares Division.								
Azamgarh	936	68	1,004	862	142	86	14	7·2
Mirzapur	950	40	990	866	124	88	12	4·2
Benares	485	25	510	438	72	86	14	5·1
Gorakhpur	2,000	150	2,150	1,899	251	88	12	7·5
Basti	1,250	100	1,350	1,195	155	89	11	8·
Ghazipur	990	70	1,060	912	148	86	14	7·
Total Benares Division	6,611	453	7,064	6,172	892	87	13	6·8
Jhansi Division.								
Jalaun	580	20	600	518	82	86	14	3·4
Jhansi	350	10	360	300	60	83·3	16·7	2·9
Lalitpur	242	8	250	205	45	82	18	3·3
Total Jhansi Division	1,172	38	1,210	1,023	187	84·6	15·4	3·2

* The figures from columns 2 to 6 represent thousands.

STATEMENT II.—DETAILS OF CULTIVATED AREA.—*cont.*

District.	Total Cultivated Area.	Portion of Cultivated Area bearing more than one Crop in the Year.	Total Acreage under Crops in the year, *i.e.*, Total of Columns 2 and 3.	Portion of Total Acreage Cropped under Food Crops.	Portion of Total Cropped Area of Column 4 under other Crops.	Per-centage of Food Crops to Total Cropped Acreage of Column 4.	Per-centage of other Crops to Total Cropped Acreage of Column 4.	Per-centage of Dofasli to Total Cultivated Area.
1.	2.	3.	4.	5.	6.	7.	8.	9.
NORTH-WESTERN PROVINCES —*cont.*								
Hill Tracts.								
Dehra Dun	73	4	77	54	23	70	29·8	5·4
Kumaun				Unknown.				
Garhwál				Unknown.				
Total Hill Tracts	73	4	77	54	23	—	—	—
Provincial Total North-Western Provinces.	25,344	1,765	27,109	23,052	4,057	85	15	7
OUDH.								
Lucknow Division.								
Lucknow	332	50	382	333	49			
Bara Banki	718	70	788	688	100			
Unao	596	52	648	570	78			
Total Lucknow Division	1,646	172	1,818	1,591	227			
Fyzabad Division.								
Fyzabad	607	48	655	574	81			
Bahraich	801	82	883	768	115			
Gonda	1,070	100	1,170	1,015	155			
Total Fyzabad Division	2,478	230	2,708	2,357	351			
Sitapur Division.						87	13	9·1
Sitapur	917	94	1,011	874	137			
Hardoi	863	57	920	797	123			
Kheri	805	60	865	748	117			
Total Sitapur Division	2,585	211	2,796	2,419	377			
Rae Bareli Division.								
Rae Bareli	570	50	620	547	73			
Sultanpur	572	50	622	541	81			
Partabgarh	448	45	493	426	67			
Total Rae Bareli Division	1,590	145	1,735	1,514	221	—	—	—
Provincial Total Oudh	8,299	758	9,057	7,881	1,176	87	13	9·1
Grand Total North-Western Provinces and Oudh.	33,643	2,523	36,166	30,933	5,233	85·5	14·5	7·5

The figures from columns 2 to 6 represent thousands.

STATEMENT No. III.—FOR TWENTY-FOUR DISTRICTS:—DETAILS OF CROP AREAS, OUT-TURN, AND REQUIREMENTS.

[N.B.—Three 0's are omitted throughout, except in the column of rate.]

MEERUT DIVISION.

	SAHARANPUR.			MUZAFFARNAGAR.			MEERUT			BULANDSHAHR.			ALIGARH.			TOTAL OF MEERUT DIVISION, EXCLUDING DEHRA.		
	Area in Acres.	Rate per Acre (in Maunds).	Out-turn in Maunds.	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Average Rate of Produce.	Out-turn.
FOOD CROPS.																		
Wheat	270	10	2,700	220	10	2,200	300	11	3,300	140	11	1,540	182	11	2,002	1,112	10·56	11,742
Barley	30	9	270	15	11	165	14	11	154	20	11	220	94	11	1,034	173	10·65	1,843
Gram	100	9	900	46	9	414	110	9	990	44	9	396	47	9	423	347	9	3,123
Peas	·6	6	3·6	—	6	—	25	6	150	8	6	48	1	6	6	34·6	6	207·6
Wheat, mixed	34	9	306	26	9	234	120	10	1,200	86	10	860	58	10	580	324	9·81	3,180
Barley, „	5	9	45	—	9	—	30	10	300	170	10	1,700	121	10	1,210	326	9·98	3,255
Jowar	25	7	175	89	7	623	140	8	1,120	162	8	1,296	192	8	1,536	608	7·81	4,750
Bajra	40	6	240	20	6	120	42	7	294	70	7	490	83	7	581	255	6·76	1,725
Rice	134	10	1,340	44	10	440	24	10	240	3	10	30	7	10	70	212	10	2,120
Maize	27	9	243	26	9	234	80	12	960	50	12	600	47	12	564	230	11·31	2,601
Pulses	50	7	350	92·5	7	647·5	52	7	364	15	7	105	30	7	210	239·5	7	1,676·5
Small millets	—		—	1·5		10·5	—		—	4		28	18		126	23·5		164·5
Miscellaneous	10		70	—		—	1		7	—		—	—		—	11		77
Arhar (with cotton)	—	5	·5	—	5	2	—	5	7·5	—	5	45	—	5	350	—	5	405
Total Food Out-turn	725·6	—	6,643·1	580	—	5,090	938	—	9,086·5	772	—	7,358	880	—	8,692	3,895·6	—	36,869·6
Consumption as food at 5¾ maunds per head.	—	—	5,083	—	—	3,967·5	—	—	6,997·75	—	—	5,382	—	—	6,175·5	—	—	27,605·7
Seed grain	—	—	513·8	—	—	358·75	—	—	591·25	—	—	441	—	—	499	—	—	2,403·8
Wastage at 5 per cent. on out-turn	—	—	329·1	—	—	249·8	—	—	451·675	—	—	367	—	—	432·2	—	—	1,829·7
Food for cattle	—	—	619·	—	—	525	—	—	788	—	—	638	—	—	713	—	—	3,283·
Total	—	—	6,544·9	—	—	5,101·	—	—	8,828·7	—	—	6,828	—	—	7,819·7	—	—	35,122·2
Surplus or Deficit	—	—	+98·2	—	—	—11	—	—	+257·8	—	—	+530	—	—	+872·3	—	—	+1,747·4
NON-FOOD CROPS.																		
Sugar-cane	30	80	2,400	44	Same as preceding.	3,520	67	Same as preceding.	5,360	9	Same as preceding.	720	2·6	Same as preceding.	208	152·6	Same as preceding.	12,208
Cotton	25	20	500	24		480	44·5		890	33		660	21·5		430	148		2,960
Cotton and arhar	·1	10	1	—		—	1·5		15	9		90	70		700	80·6		806
Fibres	20	20	400	—		—	4		80	5		100	2		40	31		620
Indigo	·9	20	18	3		60	6		120	26		520	45·7		914	81·6		1,632
Fodder	52	20	1,040	80·5		161	60·7		1,214	30		600	12		240	235·2		4,704
Potatoes	·2	100	20	—		—	·3		30	—		—	—		—	·5		50
Garden crops	1	30	30	2		60	5		150	7		210	7		210	22		660
Tobacco	·1	50	5	1		50	2		100	4		200	5		250	12·1		605
Opium	—	—	—	—		—	—		—	—		—	—		—	—		—
Oil seeds	25	20	500	1		20	19		380	19·1		382	4·2		84	68·3		1,366
Miscellaneous	15	20	300	1·5		30	2		40	4		80	—		—	22·5		450
Total Non-food Crops	169·3	—	5,214	157	—	5,381	212	—	8,379	146·1	—	3,562	170	—	3,076	854·4	—	26,061

ROHILKHAND DIVISION.

—	Bijnor.			Budaun.			Moradabad.			Bareilly.			Shajahanpur.			Total of Division.		
	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Average Rate per Acre.	Out-turn.
Food Crops.																		
Wheat	92	10	920	240	10	2,400	174	11	1,914	214	12	2,568	212	12	2,544	932	11·1	10,346
Barley	49	9½	465·5	77	10	770	53	10	530	16	10	160	25	10	250	220	9·88	2,175·5
Gram	44	7	3·8	27	9	243	40	9	360	32	9	288	41	9	369	184	8·52	1,568
Peas	1	5	5	2	6	12	2	6	12	1	6	6	1	6	6	7	5·86	41
Wheat, mixed	44	8	352	49	10	490	111	10	1,110	58	10	580	33	11	363	295	9·81	2,895
Barley, ,,	3	8	24	21	9	189	20	9	180	12	9	108	4	9	36	60	8·95	537
Jowar	13	7	91	102	7	714	60	7	420	56	8	448	90	8	720	321	7·45	2,393
Bajra	47	5	235	218	6	1,308	139	6	834	170	7	1,190	80	7	560	654	6·31	4,127
Rice	198	12	2,376	24	10	240	144	10	1,440	325	12	3,900	93	12	1,116	784	11·57	9,072
Maize	5	10	50	10	10	100	12	12	144	47	10	470	1	10	10	75	10·32	774
Pulses	76	7	532	15·5	7	108·5	75	7	525	50	7	350	45	7	315	261·5	7	1,830·5
Small millets	10		70	1		7	9		63	104		728	30		210	154		1,078
Miscellaneous	5		35	1·5		10·5	—		—	14		98	4		28	24·5		171·5
Arhar (under cotton)	—	5	45	—	5	260	—	5	155	—	5	115	—	5	80	—	5	655
Total Food Out-turn	587	—	5,510·5	788	—	6,852	839	—	7,687	1,099	—	11,009	659	—	6,607	3,972	—	37,665·5
Consumption as food at 5¾ maunds per head.	—	—	4,237·7	—	—	5,376·2	—	—	6,454	—	—	8,665·2	—	—	5,459·6	—	—	30,192·7
Seed grain	—	—	378	—	—	446·7	—	—	455	—	—	635·8	—	—	397·8	—	—	2,313·3
Wastage at 5 per cent. on out-turn	—	—	270·8	—	—	342·6	—	—	363	—	—	550·4	—	—	330·3	—	—	1,857·1
Food for cattle	—	—	487	—	—	630	—	—	685	—	—	870	—	—	565	—	—	3,237
Total	—	—	5,373·5	—	—	6,795·5	—	—	7,957	—	—	10,721·4	—	—	6,752·7	—	—	37,600·1
Surplus or deficit	—	—	+137	—	—	+56·5	—	—	−270	—	—	+287·6	—	—	−145·7	—	—	+65·4
Non-food Crops.																		
Sugar-cane	52	80	4,160	28	Same as preceding.	2,240	44	Same as preceding.	3,520	54	Same as preceding.	4,320	45	Same as preceding.	3,600	223	Same as preceding.	17,840
Cotton	31	20	620	5		100	10		200	14		280	—		—	60		1,200
,, and arhar	9	10	90	52		520	31		310	23		230	16		160	131		1,310
Fibres	4	20	80	—		—	1		20	7		140	3		60	15		300
Indigo	—	20	—	2		40	—		—	1		20	1		20	4		80
Fodder	3	20	60	1		20	1		20	10		200	15		300	30		600
Potatoes	—	100	—	—		—	1		100	11		1,100	—		—	12		1,200
Garden crops	2	30	60	3		90	7		210	35		1,050	18		540	65		1,950
Tobacco	1	50	50	1		50	1		50	1		50	—		—	4		200
Opium	—	—	—	7		350	—		—	1		50	9		450	17		850
Oil seeds	9	20	180	1		20	7		140	8		160	13		260	38		760
Miscellaneous	2	20	40	2		40	12		240	6		120	1		20	23		460
Total Non-food Crops	113	—	5,340	102	—	3,470	115	—	4,810	171	—	7,720	121	—	5,410	622	—	26,750

AGRA DIVISION.

	Muttra.			Agra.			Etah.			Faruckabad.			Mainpuri.			Etawah.			Total of Division.		
	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Average Rate of Produce.	Out-turn.
Food Crops.																					
Wheat	80	12	960	154	12	1,848	106	12	1,272	183	12	2,196	152	12	1,824	35	12	420	710	12	8,520
Barley	40	9	360	69	9	621	30	10	300	116	10	1,160	6	10	60	25	10	250	286	9·62	2,751
Gram	55	9	495	74	9	666	21	9	189	22	9	198	11	9	99	27	9	243	210	9	1,890
Peas	1	6	6	1	6	6	1	6	6	2	6	12	2	6	12	2	6	12	9	6	54
Wheat, mixed	13	12	156	38	12	456	89	11	979	15	11	165	60	11	660	66	11	726	281	11·18	3,142
Barley, „	120	9	1,080	146	9	1,314	58	9	522	11	10	110	113	10	1,130	115	10	1,150	563	9·42	5,306
Jowar	220	7	1,540	236	7	1,652	83	7	581	95	8	760	100	7	700	110	8	880	844	7·24	6,113
Bajra	32	6	192	156	6	936	126	6	756	79	7	553	51	7	357	79	7	553	523	6·39	3,347
Rice	—	—	—	3	10	30	15	10	150	28	10	280	28	10	280	24	10	240	98	10	980
Maize	6	12	72	6	12	72	25	12	300	29	12	348	24	12	288	14	12	168	104	12	1,248
Pulses	26	7	182	32	7	224	8	7	56	15	7	105	7	7	49	2	7	14	90	7	630
Small millets	—		—	1		7	2		14	10		70	4		28	2		14	19		133
Miscellaneous	6		42	5		35	1		7	2		14	2		14	—		—	16		112
Arhar (under cotton)	—	5	350	—	5	585	—	5	95	—	5	100	—	5	120	—	5	130	—	5	1,380
Total Food Out-turn	599	—	5,435	921	—	8,452	565	—	5,227	607	—	6,071	560	—	5,621	501	—	4,800	3,753	—	35,606
Consumption as food	—	—	4,197·5	—	—	7,199	—	—	4,042·2	—	—	5,284·2	—	—	4,404·5	—	—	3,846·7	—	—	28,974·1
Seed grain	—	—	286·1	—	—	457·6	—	—	314·1	—	—	378·2	—	—	553·1	—	—	263·2	—	—	2,052·3
Wastage	—	—	273·3	—	—	430·1	—	—	267·6	—	—	298·8	—	—	281	—	—	246·7	—	—	1,797·5
Food for cattle	—	—	495·	—	—	797	—	—	465	—	—	402	—	—	496	—	—	412	—	—	3,067
Total	—	—	5,251·9	—	—	8,883·7	—	—	5,088·9	—	—	6,363·2	—	—	5,534·6	—	—	4,768·6	—	—	35,890·9
Surplus or Deficit	—	—	+183·1	—	—	−431·7	—	—	+138·1	—	—	−292·2	—	—	+86·4	—	—	+31·4	—	—	−284·9
Non-food Crops.																					
Sugar-cane	1	80	80	6	Same as preceding.	480	12	Same as preceding.	960	23	Same as preceding.	1,840	9	Same as preceding.	720	11	Same as preceding.	880	62	Same as preceding.	4,960
Cotton	43	20	860	14		280	19		380	12		240	18		360	27		540	133		2,660
Ditto and arhar	70	10	700	117		1,170	19		190	20		200	24		240	26		260	276		2,760
Fibres	1	20	20	4		80	2		40	—		—	1		20	—		—	8		160
Indigo	2	20	40	7		140	10		200	18		360	12		240	20		400	69		1,380
Fodder	5	20	100	27		540	16		320	—		—	7		140	14		280	69		1,380
Potatoes	—	—	—	—		—	—		—	2		200	—		—	—		—	2		200
Garden crops	3	30	90	5		150	11		330	8		240	4		120	5		150	36		1,080
Tobacco	1	50	50	2		100	1		50	3		150	1		50	1		50	9		450
Opium	—	—	—	—		—	2		100	12		600	8		400	10		500	32		1,600
Oil seeds	5	20	100	6		120	2		40	1		20	4		80	—		—	18		360
Miscellaneous	—	20	—	1		20	1		20	1		20	—		—	—		—	3		60
Total Non-food Crops	131	—	2,040	189	—	3,080	95	—	2,630	100		3,870	88	—	2,370	114		3,060	717	—	17,050

ALLAHABAD DIVISION.

	Cawnpore.			Fatehpur.			Allahabad.			Banda.			Hamirpur.			Total of Division excluding Jaunpur.		
	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Average Rate of Produce.	Out-turn.
Food Crops.																		
Wheat	77	12	924	49	12	588	86	12	1,032	10	9	90	51	9	459	273	11·69	3,093
Barley	80	11	880	19	11	209	130	11	1,430	21	9	189	2	9	18	252	10·81	2,726
Gram	14	9	126	39	9	351	87	9	783	136	7	952	109	7	763	385	7·72	2,975
Peas	3	6	18	3	6	18	40	6	240	—	—	—	1	6	6	47	6	282
Wheat, mixed	86	12	1,032	31	11	341	150	11	1,650	161	8	1,288	262	8	2,096	690	9·28	6,407
Barley, „	186	10	1,860	132	10	1,320	140	10	1,400	48	8	384	40	8	320	546	9·67	5,284
Jowar	180	8	1,440	110	7	770	128	7	896	148	7	1,036	86	6	516	652	7·14	4,658
Bajra	35	7	245	27	7	189	109	7	763	40	5	200	49	5	245	260	6·31	1,642
Rice	23	12	276	76	12	912	71	12	852	29	10	290	1	8	8	200	11·69	2,338
Maize	26	12	312	1	12	12	1	12	12	—	—	—	—	8	—	28	12	336
Pulses	3	7	21	3	7	21	21	7	147	20	7	140	8	7	56	55	7	385
Small millets	3		21	15		105	45		315	53		371	9		63	125		875
Miscellaneous	5		35	—		—	—		—	—		—	—		—	5		35
Arhar (under cotton)	—	5	255	—	5	205	—	5	75	—	5	575	—	5	185	—	5	1,295
Total Food Out-turn	721	—	7,445	505	—	5,041	1,008	—	3,595	666	—	5,515	618	—	4,735	3,518	—	32,331
Consumption as food	—	—	6,647	—	—	3,817·4	—	—	8,028·1	—	—	4,011·2	—	—	3,042·3	—	—	25,546
Seed grain	—	—	426·8	—	—	291·7	—	—	599·2	—	—	336·7	—	—	383·8	—	—	2,043·2
Wastage	—	—	376·1	—	—	252	—	—	479·7	—	—	272·1	—	—	235·9	—	—	1,615·8
Food for cattle	—	—	637	—	—	409	—	—	772	—	—	585	—	—	562	—	—	2,965
Total	—	—	8,086·9	—	—	4,770·1	—	—	9,879	—	—	5,205	—	—	4,229	—	—	32,170
Surplus or Deficit	—	—	−644·9	—	—	+270·9	—	—	−284	—	—	+310	—	—	+506	—	—	+161
Non-food Crops.																		
Sugar-cane	9	80	720	6	Same as preceding.	480	12	Same as preceding.	960	—	Same as preceding.	—	5	Same as preceding.	400	32	Same as preceding.	2,560
Cotton	25	20	500	4		80	10		200	12		240	27		540	78		1,560
„ and arhar	51	10	510	41		410	25		250	115		1,150	37		370	269		2,690
Fibres	2	20	40	2		40	1		20	1		20	2		40	8		160
Indigo	33	20	660	2		40	2		40	—		—	1		20	38		760
Fodder	44	20	880	—		—	3		60	1		20	—		—	48		960
Potatoes	—	—	—	—		—	1		100	—		—	—		—	1		100
Garden crops	14	30	420	19		570	10		300	2		60	3		90	48		1,440
Tobacco	1	50	50	1		50	2		100	1		50	1		50	6		300
Opium	7	50	350	4		200	6		300	1		50	—		—	18		900
Oil seeds	3	20	60	1		20	25		500	6		120	80		1,600	115		2,300
Miscellaneous	—	20	—	—			—		—	—		—	5		100	5		100
Total Non-food Crops	189	—	4,190	80	—	1,890	97	—	2,830	139	—	1,710	161	—	3,210	666	—	13,830

	Jhansi.			Jalaun.			Lalitpur.			Total of Division.			Grand Total of the 24 Districts.		
	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Rate per Acre.	Out-turn.	Area.	Average Rate of Produce.	Out-turn.	Area.	Average Rate of Produce.	Out-turn.
Food Crops.															
Wheat	81	8	648	3	8	24	34	8	272	118	8	944	3,145	11·01	34,645
Barley,	1	9	9	4	9	36	4	9	36	9	9	81	940	10·18	9,576·5
Gram	48	7½	360	83	7½	622·5	24	7½	180	155	7½	1,162·5	1,281	8·37	10,718·5
Peas	1	6	6	5	5	25	—	6	—	6	5·17	31	103·6	5·97	615·6
Wheat, mixed	48	7	336	262	7	1,834	17	8	136	327	7·05	2,306	1,917	9·35	17,930
Barley, „	2	9	18	28	7	196	—	9	—	30	7·13	214	1,525	9·57	14,596
Jowar	77	6	462	75	6	450	23	6	138	175	6	1,050	2,600	7·29	18,964
Bajra	13	5	65	53	5	265	—	9	—	66	5	330	1,758	6·35	11,171
Rice	2	8	16	1	8	8	12	10	120	15	9·6	144	1,309	11·19	14,654
Maize	—	8	—	—	8	—	5	10	50	5	10	50	442	11·33	5,009
Pulses	—		—	—		—	10		70	10		70	656		
Small millets	27	7	189	4	7	28	76	7	532	107	7	749	428·5	7	7,987
Miscellaneous	—		—	—		—	—		—	—		—	56·5		
Arhar (under cotton)	—	5	65	—	5	190	—	5	6	—	5	255	—	5	4,038
Total Food Out-turn	300	—	2,174	518	—	3,678·5	205	—	1,534	1,023	—	7,386·5	16,161·6	9·20	149,896·6
Consumption as food	—	—	1,827·3	—	—	2,325·8	—	—	1,222·4	—	—	5,375·5	—	—	117,694·0
Seed grain	—	—	169·3	—	—	318·5	—	—	99·6	—	—	587·4	—	—	9,400·0
Wastage	—	—	106·0	—	—	177·8	—	—	72·7	—	—	356·5	—	—	7,456·6
Food for cattle	—	—	262	—	—	435	—	—	182	—	—	879	—	—	13,431
Total	—	—	2,364·6	—	—	3,257·1	—	—	1,576·7	—	—	7,198·4	—	—	147,981·6
Surplus or Deficit	—	—	—	—	—	—	—	—	—	—	—	188·1	—	—	1,915
Non-food Crops.															
Sugar-cane	—	80	—	2		160	6		480	8		640	477·6		38,108
Cotton	15	20	300	20		400	2		40	37		740	456·0		9,120
„ and arhar	13	10	130	38		380	—		—	51		510	807·6		8,076
Fibres	1	20	20	1		20	—		—	2		40	64·0		1,280
Indigo	—	20	—	—		—	—		—	—		—	192·6		3,852
Fodder	1	20	20	7		140	—		—	8		160	390·2		7,804
Potatoes	—	100	—	—		—	—		—	—		—	15·5		1,550
Garden crops	2	30	60	6		180	—		—	8		240	179·0		5,370
Tobacco	—	50	—	1		50	—		—	1		50	32·1		1,605
Opium	—	50	—	—		—	—		—	—		—	67·0		3,350
Oil seeds	28	20	560	7		140	37		740	72		1,440	311·3		6,226
Miscellaneous	—	20	—	—		—	—		—	—		—	53·5		1,070
Total Non-food Crops	60	—	1,090	82	—	1,470	45	—	1,260	187	—	3,820	3,046·4	—	87,411

Same as preceding.

BENGAL.

Such figures as are available by way of reply to the first part of the Commission's third question are given in tabular form in the accompanying statement. They are taken chiefly from returns which are prepared by district officers (in Form XLI. B.), and submitted annually to Government through the Board of Revenue. They cannot be regarded as being more than the best approximation to the truth which collectors are able to make. The preparation of accurate general agricultural statistics, such as those indicated in this question, is at present impossible in these provinces.

Really accurate agricultural statistics could only be collected in these permanently settled provinces by detailed inquiries of great extent, following a cadastral survey, and involving much delay and enormous expense to Government. In the absence of any village organization, such as that which exists in the North-Western Provinces, it would be necessary to entertain a special and costly establishment to record the information required.

As regards produce per acre, so various are the soils, so different is the rainfall, so numerous are the modes of cultivation, the crops and their out-turn in the various districts of Bengal, that it is quite impossible to fix any absolute standard figure representing the average out-turn of an acre of land under any given food crop. As a rule the cultivators themselves do not know it with any tolerable degree of accuracy. From such experiments and inquiries as have been made in Bengal from time to time, and after analysing all the statistics available on the subject, Captain Ottley, R.E., came to the conclusion that as regards rice—the great staple crop of Bengal—"the average out-turn for a number of years of all classes of land will be about 15 maunds per acre." This may be accepted as the nearest possible approximation to the truth, but not as a safe basis for calculation. As regards export from, and import into, his district, a collector can only say generally whether grain is going out of or coming into it, or both. If there is a railway or a navigable river running through it he can roughly gauge the imports and exports at certain fixed points and obtain figures which may be of use to him in forming a general view of the state of his district: beyond this he cannot go. Even if funds were available, trustworthy agency would be wanting. A system of inter-district traffic registration, by which the exports from and imports into each district could be ascertained with any degree of accuracy, has never been attempted and would be quite impossible in Bengal.

An attempt has already been made to work out statistics such as those indicated by the Committee in their third question. The result is given in a work of over 300 pages by Mr. A. P. MacDonnell, C.S., entitled "Report on the food grain supply and statistical review of the relief operations in the distressed districts of Behar and Bengal during the famine of 1873–74." Such figures as Mr. MacDonnell worked out for production, consumption and export have been reproduced in the statement on the following page, but as, after a careful and laborious examination of all the sources of information available, he rejected all the others as worthless and liable to mislead, they have not been here worked out for the Commission. Mr. MacDonnell has, in the introduction to his work, fully explained in detail the process by which he has arrived at his figures, and it is not necessary to recapitulate them. He says, "No other character, however, than approximations to the truth is claimed for these estimates . . . . . This question of average rates of produce has been one of the most perplexing with which I have had to deal. *One maund, more or less, per acre may alter the complexion of a conclusion.*" A glance at Appendix No. III. to Mr. MacDonnell's work will show how hopeless is the task of arriving at a safe figure of produce per acre amid so wide a range of estimates; and when it is considered that the figures for the consumption per head of the population are merely approximations, it will be seen how impossible is the task of attempting to give accurate and reliable agricultural statistics without a cadastral survey and detailed field to field inquiries. As the settlement of these provinces is permanent, the cost of such a procedure, which is the only one by which really reliable figures could be obtained, would perhaps be out of all proportion to the value of its results. It would give no increase of revenue; it would alarm the people, and the landholders would throw every obstacle in the way of our obtaining the information sought for.

In 1872–73 special inquiries were made by Native deputy collectors with a view of collecting agricultural statistics for the selected districts of Jessore and Rungpore. The results of these inquiries are embodied in two volumes full of interesting and useful information, but as it was not based on a cadastral survey it possesses *per se* little or no real statistical value. This method of collecting agricultural statistics has not therefore been extended to other districts. The mode of procedure adopted—whereby deductions are made for the whole district from the results of inquiries made in portions of it—is not adapted to a province like Bengal, where not only each district but also each pergunnah of every district, may present features differing essentially from those of neighbouring and adjoining districts and pergunnahs.

STATEMENT showing details of Cultivation, &c.

Division.	District.	Total Area of District in Acres.	Estimated Cultivated Area in Acres.			Estimated Average Out-turn per Acre in Maunds of			Total estimated quantity of Food Grain produced in the District.	Total estimated amount required for Food and Seed in the District.	Balance available for Export.
			Food Crops.	Other Crops.	Total.	Rice.	Bhadoi.	Rubbee.			
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
									Tons.	Tons.	Tons.
Burdwan -	Burdwan - -	2,211,200	1,894,680	115,000	2,009,680	—	—	—	—	—	—
	Bankoora - -	910,080	406,000	17,000	423,000	13	4	4	195,000	131,000	64,000
	Beerbhoom - -	866,160	556,400	10,000	566,400	—	—	—	—	—	—
	Midnapore - -	3,252,480	1,927,000	382,000	2,309,000	—	—	—	—	—	—
	Hooghly with Howrah	938,880	709,050	109,700	818,750	—	—	—	—	—	—
Presidency -	24 Pergunnahs -	1,784,320	973,387	63,098	1,036,485	—	—	—	—	—	—
	Nuddea - -	2,189,440	914,538	149,182	1,063,720	—	—	—	—	—	—
	Jessore - -	2,341,120	1,704,900	79,400	1,784,300	—	—	—	—	—	—
	Moorshedabad -	1,575,680	881,000	108,000	989,000	15	12	12	457,000	327,000	130,000
Rajshahye -	Dinagepore - -	2,640,640	1,353,000	336,000	1,689,000	12	—	—	574,000	383,000	191,000
	Rajshahye - -	1,429,760	696,064	190,802	886,866	—	—	—	—	—	—
	Rungpore - -	2,224,640	1,644,000	290,000	1,934,000	15	7	10	801,000	501,000	300,000
	Bogra -	960,640	848,423	115,617	964,040	—	—	—	—	—	—
	Pubna - - -	1,265,920	409,525	30,317	439,842	—	—	—	—	—	—
	Darjeeling - -	—	—	—	—	—	—	—	—	—	—
	Julpigoree - -	1,859,840	300,940	49,779	350,719	—	—	—	—	—	—
Dacca - -	Dacca - -	1,789,440	1,171,248	125,265	1,296,513	—	—	—	—	—	—
	Furreedpore - -	1,439,360	650,440	54,200	704,640	—	—	—	—	—	—
	Backergunge - -	2,334,720	2,174,213	232,421	2,406,634	—	—	—	—	—	—
	Mymensingh - -	4,031,360	1,278,476	151,988	1,430,464	—	—	—	—	—	—
	Tipperah - -	1,574,400	1,148,364	122,285	1,270,649	—	—	—	—	—	—
Chittagong -	Chittagong - -	1,486,080	536,802	7,838	544,640	—	—	—	—	—	—
	Noakholly - -	1,185,280	660,186	42,954	703,140	—	—	—	—	—	—
	Chittagong Hill Tracts	—	—	—	—	—	—	—	—	—	—
Patna - -	Patna - - -	1,344,640	1,116,257	46,896	1,163,153	—	—	—	—	—	—
	Gya - - -	3,018,240	1,640,000	88,000	1,728,000	12	8	10	640,000	520,000	120,000
	Shahabad - -	2,806,400	1,610,000	80,000	1,690,000	12	8	12	670,000	462,000	208,000
	Durbhunga - -	1,922,560	1,964,000	85,000	2,049,000	13	12	8	861,000	620,000	241,000
	Mozufferpore -	2,134,400	1,712,000	104,000	1,816,000	12	12	10	751,000	578,000	173,000
	Sarun - - -	1,698,560	2,042,000	278,000	2,320,000	10	9	9	671,000	547,000	124,000
	Chumparun -	2,259,840	1,308,000	129,000	1,437,000	12	7	7	517,000	352,000	165,000
Bhagulpore -	Monghyr - -	2,510,080	1,802,000	150,000	1,952,000	12	11	11	658,000	484,000	174,000
	Bhagulpore - -	2,731,520	2,326,890	509,071	2,835,961	—	—	—	—	—	—
	Purneah - -	3,172,480	1,300,823	285,534	1,586,357	—	—	—	—	—	—
	Maldah - -	1,160,320	353,390	89,232	442,622	—	—	—	—	—	—
	Sonthal Pergunnahs -	3,512,320	682,619	132,588	815,207	—	—	—	—	—	—
Orissa -	Cuttack - -	2,888,320	1,237,900	112,100	1,350,000						
	Pooree - - -	1,582,080	640,185	24,135	664,320	15	—	—	—	—	—
	Balasore - -	1,323,520	545,859	37,400	583,259						
Chota Nagpore	Hazareebagh - -	4,493,440	1,196,624	122,288	1,318,912	—	—	—	—	—	—
	Lohardugga - -	7,708,160	2,552,350	271,379	2,823,738	—	—	—	—	—	—
	Singbhoom - -	2,494,080	571,346	64,302	635,648	—	—	—	—	—	—
	Manbhoom - -	3,149,440	1,193,600	619,200	1,812,800	—	—	—	—	—	—
	Total - -	92,196,240	48,634,497	6,010,971	54,645,468	—	—	—	6,795,000	4,905,000	1,890,000

(1) *Note.*—Each acre double cropped is counted as two acres.
(2) Column 11 is calculated by Mr. MacDonnell on the supposition that, in Behar, every head of the population consumes three-fourths of a seer and in Bengal two-thirds of a seer daily, and that for seed 10 seers for *bhadoi* and 30 seers for rice and *rabi* per acre are required in Behar, and one maund for rice and 10 seers for other crops in Bengal. See pp. 8, 217, 218

CHAP. I. QN. 3.

CENTRAL PROVINCES.

Mr. Nicholls.

CENTRAL PROVINCES.

The required statistics are given in the following tables :—

CROPS CULTIVATED IN ACRES.

Districts.	Rice.	Wheat.	Other Food Grains.	Oil Seeds.	Sugar-cane.	Cotton.	Opium.	Indigo.	Fibres.	Tobacco.	Vege-tables.	Others.
Nagpur - -	32,887	269,473	551,493	191,483	1,656	120,449	37	—	1,200	958	12,103	7,640
Bhandara - -	426,605	69,368	249,346	49,018	8,599	24	—	—	468	144	4,365	640
Chanda - -	227,276	53,799	271,609	85,931	5,996	36,330	—	—	1,642	1,486	9,777	—
Wardha - -	2,035	170,173	345,577	154,228	689	222,421	29	—	1,932	1,403	1,206	3,497
Balaghat - -	308,302	16,659	111,604	24,577	2,363	—	—	—	28	883	923	161
Upper Godavari -	4,227	236	16,302	1,713	6	635	—	—	—	252	—	—
Jubbulpore - -	155,894	370,421	389,069	91,362	2,057	22,565	449	—	1,755	348	1,742	891
Saugor - -	15,772	455,375	209,171	64,265	4,052	28,384	91	3	1,269	819	2,452	4,085
Damoh - - -	55,501	196,047	180,006	35,714	877	12,788	5	256	676	661	1,132	2,354
Seoni - - -	100,589	274,005	190,925	39,211	1,058	9,336	139	—	2,888	74	554	—
Mandla - - -	75,283	80,035	228,823	20,630	830	657	—	—	3,174	604	332	37
Chhindwara - -	3,974	144,323	311,651	66,443	9,543	40,928	517	—	718	—	1,515	—
Hoshangabad -	18,021	566,988	195,460	66,600	10,375	23,639	182	—	518	951	1,108	38,143
Narsinghpur - -	27,413	261,776	257,515	8,888	2,384	54,926	24	30	1,266	614	1,517	1,077
Betul - - -	17,318	189,246	382,758	59,047	8,577	2,269	1,871	—	3,601	110	2,425	6
Nimar - - -	13,128	12,455	270,508	32,331	289	38,272	173	—	2,329	134	889	1,335
Raipur - -	1,175,870	266,837	555,273	185,162	33,059	82,547	—	—	1,118	36,919	4,819	10,612
Sambalpur - -	990,590	—	212,250	106,666	4,875	49,827	—	—	1,500	2,681	5,110	2,228
Bilaspur - -	872,985	73,906	179,420	67,100	10,520	56,560	—	—	—	—	—	—
Total - -	4,523,670	3,471,122	5,088,760	1,350,397	107,805	802,437	3,517	289	26,082	49,041	51,970	72,706

GENERAL STATEMENT showing the AVERAGE PRODUCE and LOCAL CONSUMPTION with Amount available for EXPORT of EDIBLE GRAINS in the CENTRAL PROVINCES, compiled from the Statements received from District Officers.

Districts.	Area Cultivated with Edible Grain in Acres.			Total Acreage Edible Grains.	Average Produce per Acre in Lbs.			Produce of each Grain in Lbs.			Total Produce.		Population.	Local Consumption in Maunds.				Available for Export.	
	Rice.	Wheat.	Others.		Rice.	Wheat.	Others.	Rice.	Wheat.	Others.	Lbs.	Maunds.		Food at 5 Maunds per Head per Annum.	Seed at 1¼ Maunds per Acre for Rice, 1 for Wheat, and ¾ for Others.	Sundries, Cattle Wastage, &c., ¼ Maund per Person.	Total.	Maunds.	Tons.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Nagpur	32,887	269,473	551,493	853,853	609	450	364	19,732,200	121,262,850	200,849,850	341,844,900	4,273,061	631,109	3,155,545	724,202	315,555	4,195,302	77,759	2,777
Bhandara	426,605	69,368	249,343	745,349	600	300	300	255,963,000	20,810,400	74,803,800	351,577,200	4,394,715	564,813	2,824,065	789,634	282,407	3,896,106	498,609	17,807
Chanda	227,276	53,799	271,609	552,684	750	480	400	170,457,000	25,823,520	108,643,600	304,924,120	5,811,551	534,431	2,672,155	541,600	267,216	3,480,971	330,580	12,244
Wardha	2,635	170,173	345,577	517,785	400	450	435	814,000	76,577,850	150,325,560	227,717,410	2,846,467	354,720	1,773,600	431,897	177,360	2,382,857	463,610	16,557
Balaghat	308,302	16,659	111,094	436,565	520	400	300	160,317,040	6,663,600	33,481,200	200,461,840	2,505,773	302,482	1,512,460	485,740	151,241	2,149,391	356,382	12,728
Upper Godavari	4,227	256	16,302	20,765	600	450	400	2,536,200	106,200	6,520,800	9,163,200	114,540	52,120	260,600	17,616	26,060	304,270	—189,730	—6,776
Jubbulpore	155,894	370,421	389,069	915,384	373	633	406	54,209,428	234,484,179	158,048,475	446,733,082	5,584,163	528,859	2,644,295	857,090	264,429	3,765,814	1,818,349	64,941
Saugor	15,772	455,375	209,171	680,318	560	480	582	8,832,320	218,580,000	121,353,780	348,766,100	4,359,576	527,725	2,638,625	631,968	263,863	3,534,456	825,120	29,468
Damoh	55,561	196,047	130,006	381,584	720	460	322	39,960,720	90,181,620	41,861,932	172,004,272	2,150,053	269,642	1,348,210	362,928	134,821	1,845,959	304,094	10,860
Seoni	100,589	274,005	190,925	565,519	625	500	400	65,052,000	137,002,500	76,370,000	278,425,100	3,480,313	299,856	1,499,280	542,934	149,928	2,192,142	1,288,171	46,006
Mandla	75,283	80,035	228,823	384,141	500	450	500	37,641,500	36,015,750	114,411,500	188,068,750	2,350,859	213,018	1,065,090	345,756	106,509	1,517,355	833,504	30,770
Chhindwara	3,974	144,323	311,651	459,948	600	500	500	2,384,400	72,161,500	155,825,500	230,371,400	2,879,642	316,695	1,580,475	383,028	158,048	2,121,551	758,091	28,077
Hoshangabad	18,021	566,988	196,460	780,469	528	440	302	9,083,904	255,757,440	61,392 953	326,234,297	4,077,928	449,977	2,249,885	736,109	224,989	3,210,983	866,945	30,962
Narsinghpur	27,413	261,776	257,515	546,704	400	480	467	10,965,200	125,652,480	120,341,440	256,959,120	3,211,989	339,595	1,696,975	489,178	169,698	2,355,851	856,138	30,576
Betul	17,318	189,346	382,758	589,322	509	480	400	8,659,000	90,838,080	153,103,200	252,900,280	3,157,503	274,264	1,371,320	526,979	137,132	2,035,431	1,122,072	41,558
Nimar	13,128	12,455	270,598	296,181	700	640	400	9,189,600	7,971,200	108,203,200	125,364,000	1,567,050	211,176	1,055,880	231,814	105,588	1,393,282	173,768	6,436
Raipur	1,175,870	266,837	555,273	1,997,980	(·)	500	716	940,793,600	149,428,720	397,575,468	1,487,700,188	18,596,252	1,093,405	5,467,025	2,153,129	546,703	8,166,857	10,429,395	372,478
Sambalpur	900,590	—	212,250	1,202,840	480	—	480	475,483,200	—	101,880,000	577,363,200	7,217,040	523,034	2,615,170	1,397,427	261,517	4,274,114	2,942,926	105,104
Bilaspur	872,985	73,906	179,420	1,126,311	480	560	480	419,032,800	41,387,360	86,121,600	546,541,760	6,831,772	715,338	3,576,900	1,299,702	357,690	5,234,291	1,597,481	57,049
Total	4,523,670	3,471,122	5,058,769	13,053,672	459	484	431	2,091,061,000	1,710,705,099	2,271,113,838	6,072,820,219	83,410,247	8,201,519	41,007,595	12,948,725	4,100,763	58,057,083	25,353,164	939,006

The tables are founded on the annual village papers prepared by the patwaris showing the area and crop cultivated in each field. Great trouble is taken to get patwaris to give correct returns, or in those districts where there are no patwaris, to obtain them from the malguzars. Probably the total areas under each kind for fields long under cultivation are pretty correctly given. Where two or more crops are grown in the same field the difficulty is greatly increased; and probably in districts where the area of cultivation is rapidly extending; the newly broken lands are sometimes omitted for a year or so. Accordingly I am inclined to think that our area is under stated.

The averages of produce are taken from the settlement reports, and represent the produce of average good years. In a few cases experience has led us to reduce the out-turn factor. I think our figures are within the mark as to average produce.

The local consumption has been calculated thus:—for each head of population, men, women, and children, 5 maunds each per annum, or daily for a man 1½ lb., for a woman 1 lb., for a child ¾ lb. This on our population gives close on 5 maunds. To this is added for seed, rice 1¼ maund, wheat 1 maund, and others ¾ maund, for each area cultivated. Provision has also been made for wastage, food for cattle, &c., at ½ a maund per head of population. The vegetables generally consumed, with the condiments, with fish, and animal food now and then obtained, give a fair addition to the grain supposed to represent the average consumption.

No deduction has been made on account of the jungle fruits and gums, and roots, always available for a part of the year to the forest tribes. Again, as a source of food supply, mhowa is of very great importance. I have done my best to form an estimate of the quantity which, as a mimimum might be consumed in ordinary years; but I cannot venture on figures. In Betul it is consumed for some three or four months of the year by those who eat it, probably every other day.*

The following extract of a letter just now received by me (7th August 1878) shows how mhowa is now regarded in the Seoni District:—

"I now beg to submit for your perusal two petitions submitted by Kallars of Lakhnadon, praying that the rate of duty on *mhowa* may be reduced.

"They urge the high price at which mhowa is selling, owing partly to export and partly to the fact that it is largely used for food; also that the price of 20 seers of mhowa is Rs. 1–4, or 4 annas per 'kuru.'

"They also beg that Government will supply them with mhowa.

"Inquiry made here shows that the following mahajans have exported mhowa to Nagpur and Kamptee as follows:—

	Exported. Khandies.	In stock. Khandies.
Madhopershad -	1,000	100
Murlidhar - -	500	20
Ramji, Marwari -	1,500	100
Sewaji - - -	200	—
Sookh Lal - -	1,000	100
Moona Lal - -	200	—
Kirparam - -	500	—
	4,900	320

"It is also undoubted that zamindars have made large purchases to feed their tenants, for instance Goolab Singh of Darasi purchased 1,000 khandies, and others have done the same.

"The consequence is that the price of mhowa has enormously risen, being in many places 5 or 6 rupees a khandi, and the Kallars who have been accustomed to buy at 1 rupee to 2 rupees a khandi feel the rise severely, especially as they are unable to raise the price of liquor, owing to the generally impoverished condition of the drinking classes."

From inquiries at Nagpur, it appears that much mhowa intended for the Bombay Presidency, but countermanded, has accumulated in the city. Only a small portion was despatched by railway. Such purchases in the Satpura districts would be likely to create alarm, if not panic.

I have made no deduction for this large substitution of mhowa in place of cereals, and this will, I think, compensate for an unknown or rather uncertain increment to the population since the date of the census of January 1872.

There is also some amount of cultivation in the unsettled Government waste lands, which now produces grain and other crops; of this I have no statistics, and its produce has been excluded from the statement.

The Settlement Officer of Nimar in 1870 wrote that the district imported a considerable part of its food. I, therefore, am doubtful of my figures for Nimar. For the rest, I consider that we have fairly reliable statistics, and I cannot see any way of improving them till the Central Provinces Revenue Bill, now before the Government of India, shall have been passed.

Since writing the above I have received the following account, based on the experience of the Native Assistant Commissioner for the the Balaghat District. Out of a total population of 325,000 people about 100,000 people use mhowa as food from June to April, and between 70,000 and 80,000 maunds of mhowa are thus consumed, the daily allowance may be stated at about 4 chittacks.

Of the minor forest produce about 5,000 maunds of semat* and kanhikund† are used for food.

About 80,000 maunds of cereals may be deducted. That is, it is estimated that the saving of cereals through the consumption of the crops of mhowa and forest produce amounts to 2,962 tons annually. My own impression is that it is very generally consumed in ordinary years from the middle of May to the end of September, and then forms about a third part of the food consumed by those who at all use it as food.

In Saugor the cost of mhowa is now two and a half times as high as is usual, and in Hoshangabad the Kallars are in difficulties owing to the enhanced cost, although it is believed that the crop was far from scanty.

The Deputy Commissioner of Sambalpur writes:—

"There is at present not sufficient information to enable me to submit an estimate of how many people make use of mhowa as food. Mr. Russell (late settlement officer), while out marching, evidently made some inquiries, for in his diary of the 10th February he writes: 'Here the staple rice is supplemented by mhowa, which in the jungly parts constitutes the only food for about two months, sub-jungly for one month; other grains, beans, &c. for another month; and in the very wild parts, roots and tubers resembling in appearance sweet potatoes.'

"The Raja of Rehrakol told me that in his state no one ever died of hunger, because the jungles furnished ample supplies of fruit, roots, leaves, &c., on which they subsist when grain is scarce and not within their reach."

* Total population - - 8,201,519
Forest tribes - - - 1,494,087
Bhil, Bhilal, Kol, Kurku, Gond, Meria, Khond, Byga, Barras, Sond, and others.

* Bombax malabaricum. † Tacca pinnatifida. (?)

BERAR.

In the following tables I give: 1st the average area under cultivation during the past four years; and 2nd the estimated out-turn and consumption of grain, and the surplus that remains for export.

A.

AVERAGE CULTIVATION in each DISTRICT.

Districts.	Edible Grains.								Other Crops.								Grand Total.
	Jowari.	Wheat.	Bajri.	Gram.	Rice.	Tur.	Urid.	Total.	Cotton.	Linseed.	Til.	Lac.	Kurdi.	Tobacco.	Other Products.	Total.	
Amraoti -	490,276	115,811	654	21,777	1,249	10,714	1,070	641,650	492,305	61,793	36,706	16,983	2,093	11,455	67,449	688,784	1,330,434
Akola - -	471,359	65,850	19,576	26,537	407	22,055	5,894	611,678	534,690	40,725	24,970	15,246	850	3,138	78,066	697,685	1,309,363
Ellichpur -	199,370	43,649	685	15,354	7,769	20,622	3,024	290,473	222,822	16,727	10,279	6,826	1,233	6,139	36,152	300,178	590,651
Buldana -	348,384	137,221	84,130	41,748	6,328	9,165	2,369	629,345	280,821	13,030	24,144	4,269	25,663	2,518	86,143	436,588	1,065,933
Wun - -	439,886	32,708	339	12,663	2,373	18,118	3,393	509,480	244,534	15,557	22,631	2,905	32	1,949	80,041	367,649	877,129
Basim -	296,182	103,099	6,207	67,645	14,238	16,038	20,180	523,589	184,219	2,966	26,149	24,595	24,456	2,515	146,518	411,418	935,007
Total in province.	2,245,556	498,338	111,593	185,722	32,364	96,712	35,930	3,206,215	1,959,391	150,798	144,879	70,824	53,327	27,714	494,369	2,902,302	6,108,517

B.

GENERAL STATEMENT showing the AVERAGE PRODUCE and estimated LOCAL CONSUMPTION with amount available for EXPORT.

	Average cultivated with Edible Grains in Acres.			Total Average cultivated with Edible Grains.	Average Produce per Acre in Lbs.			Produce of each Grain in Maunds.				Local Consumption in Maunds.			Available for Export.	
	Jowari.	Wheat.	Other Grains.		Jowari.	Wheat.	Other Grains.	Jowari.	Wheat.	Other Grains.	Total.	Food at 5 Maunds per Head per Annum.	Seed at 12 lbs. per Acre.	Total.	Maunds.	Tons.
Total in province	2,245,556	498,338	462,321	3,206,215	420	250	250	11,789,169	1,557,306	1,444,753	14,791,228	11,138,270	962,034	12,100,304	2,690,926	94,676

The area returns are compiled from returns rendered by the village patwaris, and may be accepted as correct.

The other figures are merely approximate estimates.

The district estimates of the out-turn of produce vary very greatly.

In 1866–67 the estimate for the chief crops was as follows :—

		Wheat.	Rice.
Amraoti - - -	356	227	156
Akola - - -	188	134	63
Ellichpur - - -	356	296	90
Buldana - - -	283	166	128
Wun - - -	299	234	275
Basim - - -	350	260	200
Total - -	305½	204½	152

A series of experiments carried out some years ago by the survey officers to ascertain the out-turn of jowari gave the following results :—

Officer who experimented.	Highest yield.	Lowest yield.	Average yield.
	Lbs.	Lbs.	Lbs.
Colonel Elphinstone -	1,842	488	1,165
Major Mackenzie - -	1,484	415	949
Captain Pemberton -	1,980	840	1,410
Mr. Jambull -	945	580	762
Mr. Morans -	1,120	880	1,000
Average - -	1,474	41	57

Colonel Nembhard, in referring to these experiments wrote as follows :—

"The land which yielded 1,842 lbs. is stated by Colonel Elphinstone to have been very superior, and it had been manured. The lowest yield met with by any of these officers was 415 lbs. Mr. Pemberton's experiments were carried out in the Morsi Taluka, where the soil is good and retentive of moisture, and it will be observed that his averages are higher than those of any other officer.

"As a rule, I think we get as good information from respectable landowners, who are civilized enough to know that our inquiry proceeds from no motive inimical to their interests, as from any tests which we ourselves have the leisure to apply, and from them I learn that an acre of millet (jowari) grown on fairly good land, and in an ordinary good season, yields from 9 to 10 maunds of grain, say 800*l*. This would be in the better sorts of the valley. Of course in the thinner and poorer soils of districts above the Ghats the average yield would be much smaller, probably not more than about 500*l*."

The actual results obtained on the Government farms, which were under the supervision of professional European gardeners, are shown below :—

Years.	Farm.	Rainfall.	Out-turn.		
			Jowari.	Wheat.	Gram.
		Inches.	Lbs.	Lbs.	Lbs.
1870-71	Akola - -	29·07	660	—	—
„	Do. - -	—	538	—	—
„	Amraoti -	40·30	—	315	241
				240	181
				200	—
				187	—
1871-72	Akola - -	12·07	Crops failed.		
„	Amraoti -	19·22	525	—	—
			230	—	—
			300	—	—
			202	—	111
1872-73	Akola - -	45·80	151	166	—
			120	—	—
			507	—	—
			1,317	—	—
			136	—	—
			564	—	—
„	Amraoti -	37·61	404	280	161
			253	—	80
			536	—	96
1873-74	Akola - -	31·01	341	300	—
			412	287	219
			—	243	313
		Average -	423	246	175

The soil of the farms was not very well suited for either wheat or gram crops, and the out-turn of these was probably smaller than is generally obtained from fields in the valley of Berar. My estimate of the average out-turn of grain crops based on the above figures is—

	Lbs.
Jowári - - -	420
Wheat - - -	250
Other grains - -	250

A table (Statement I.) showing for each district the population, revenue, total area unculturable and culturable, is appended. It has not been possible to show separately in this the particulars of land which, although held on a cultivating lease, is kept for grazing purposes by the holders.

Statement II. gives the particulars per district which Statement B. in my first report gave for the whole province. I have, however, still adhered to my own estimate of the average out-turn per acre of each crop. The district figures on this head vary* so much that it is impossible to accept them.

My estimate of an average consumption of 5 maunds of grain per head per annum was based on local inquiries which seemed to show that adults eat about 20 ounces of grain per day.

According to the Census figures of 1867 there are in Berar:—

—	Male.	Female.	Total.
Adults - -	731,142	704,232	1,435,374
†Infants - -	422,055	374,136	796,191

† Under 13 years of age.

The proportion of total infants to total adults is 55·4, or, roughly, there are two adults to one infant. Calculating then that a man eats 20 ounces of grain per day, a woman about the same, and an infant say half* that quantity, my estimate is,—

For one man per annum - -	6 maunds.
For one woman per annum -	6 „
For one child per annum - -	3 „
Total - - -	15 „

Average per head for three persons 5 maunds.

The crop statistics given at paragraph 3 of my report do not profess to include the areas of jagir and inam lands; but there is some reason to suppose that the practice in recording these statistics has varied in different districts. No specific information in regard to crop statistics of jagir and inam lands is, however, available.

I now append copies of† Statements III. and IV. of the Commissioner's Revenue Report for 1877–78, which contain later and fuller information than I was previously able to give:—

Statement III., showing the progress of cultivation during the year 1877–78, gives the total cultivated area of the province at 6,911,589, which is classified as follows:—

In reserved forests - -	10,259
In izara, or leased villages -	325,725
In jagir villages - -	228,306
In palamput villages - -	5,264
In other villages - - -	6,342,035
Total - -	6,911,589

Statement IV., showing the area under each kind of crop in 1877–78, gives the total area under cultivation at 6,470,037 acres, and the difference between the two returns is thus accounted for by the Commissioner:—

"Between column 7 of Statement III. and the total cultivation shown by Statement IV. the following differences appear:—

—	Amraoti.	Akola.	Ellichpur.	Buldana.	Wun.	Basim.
Column 6, Statement A.	1,403,685	1,421,739	612,029	1,308,807	1,065,195	1,100,141
Statement IV. -	1,368,330	1,281,240	607,996	1,122,724	1,048,976	1,041,039
Differences -	35,355	140,499	4,033	186,083	16,220	59,102

"As the heading 'Cultivated' in Statement III. means 'occupied for cultivation' these differences should indicate the amount of land retained by occupiers for pasturage.

"The Deputy Commissioner, Akola, explains that of the difference in his district, 91,899 acres only represent occupied land under grass, the rest being due to the omission of jagir and inam lands in Statement B.

"The small amount of land retained for grass in Ellichpur is said to be attributable to the proximity of the Melghat jungles, to which cattle go for grazing.

"The Deputy Commissioner, Buldana, after stating that of the difference, 186,083 acres in his district, 121,957 acres consist of indifferent and grass land in the khalsa occupied area, goes on to explain that while Statement A. includes jagir and inam cultivation, Statement B. includes nothing but the area actually under the plough in khalsa land, and that the remaining 64,126 acres of difference may be put down to the cause.

"The largeness of the figures 121,957 which, after this explanation, represent land reserved for grass, suggests a doubt as to its accuracy, but it is impossible, without delaying this report, to inquire further now.

* As an example of this I here give the district estimates of jowári out-turn in 1877–78:

Estimated Out-turn per Acre.

	Lbs.
Amraoti - - -	442
Akola - - - -	92
Ellichpur - - - -	574
Buldana - - - -	362
Wun - - - -	350
Basim - - - -	370

* A boy of 12 years will eat more than 3 maunds, but this is made up for by very young infants eating no grain.

† p. 82; but of Statement III. the total only has been given, and Statement IV. has been re-arranged and compressed.

"And the omission of jagir lands in Statement B. in Akola and Buldana raises the doubt whether they can have been included in this statement in other districts. If they have, the statistical returns of jagir villages are much more full than, judging from the facts stated in paragraph 5 of this chapter, I should have supposed them to be.

"I will not dwell further on figures, the accuracy of which might be in some districts doubtful, but will merely invite the attention of deputy commissioners to the doubt expressed above, and ask them next year to present figures which shall be thoroughly reliable regarding the occupied area left under grass. Information on this point is, I need scarcely say, of very great importance."

According the Commissioner's Revenue Report for 1876–77, the following was the extent of land under irrigation, and these are the figures which I adopted, viz.—

—	Rice Land Acres.	Irrigated Land Acres.	Total Acres.
Amraoti - - -	1,930	13,756	15,686
Akola - - -	508	20,226	20,734
Ellichpur - -	7,810	8,633	16,445
Buldana - -	2,470	25,164	27,634
Wun - - -	1,471	3,908	5,379
Basim - - -	7,256	8,554	15,810
	21,445	80,241	101,686

Irrigation fell off in 1877–78, and it is possible that Colonel Alexander referred to the returns for that year; but even if so his figures do not tally with the Commissioner's, which are as follows:—

AREA under IRRIGATION in 1877–78.

—	Rice Land Acres.	Irrigated Land.	Total.
Amraoti - - -	1,051	13,431	14,482
Akola - - -	890	11,250	12,140
Ellichpur - -	9,030	4,128	13,158
Buldana - - -	6,655	9,507	16,162
Wun - - -	2,973	2,796	5,769
Basim - - - -	10,152	8,387	18,539
	30,751	49,499	80,250

Deputy commissioners have been asked to furnish information regarding the number of wells in their districts and I hope shortly to receive their reports on this point.

STATEMENT I.

TABLE showing the POPULATION, AREA, LAND REVENUE, &c., of each DISTRICT in the HYDERABAD ASSIGNED DISTRICTS.

Districts.	Population.	* AREA OF LAND IN ACRES.				LAND REVENUE.				Remarks.
		Cultivated.	Arable Uncultivated.	Uncultivable, including Land taken up by Rivers, &c.	Total.	‡ Gross Amount Assessed.	Gross Demand of 1876-77.	Deduction on Account of Jaghirs, Village Expenses, &c.	Net Demand in 1876-77.	
						Rs.	Rs.	Rs.	Rs.	
Amraoti - - -	501,331	1,390,223	261,376	119,565	1,771,164	16,81,557	15,62,149	2,47,541	13,14,608	
Akola - - -	480,657	1,414,784	79,578	204,148	1,698,510	17,58,647	18,10,433	2,70,249	15,40,184	
Ellichpur - -	279,022	619,091	318,632	660,712	1,598,491	9,40,545	9,48,199	1,67,885	7,80,314	
Buldana - -	366,369	1,331,871	211,819	253,075	1,796,765	10,01,642	9,55,046	1,78,026	7,77,020	
Wun - - -	323,762	1,161,212	348,680	980,869	2,490,761	5,99,030	4,65,849	76,802	3,89,047	
Basim - - -	276,573	1,192,810	227,153	473,021	1,892,984	6,86,569	5,77,859	1,24,089	4,53,170	
Total - -	2,227,654*	7,109,991†	1,447,294	2,691,390	11,248,675	66,67,990	63,28,535	10,74,192	52,54,343	

* These are the Census figures of 1867, as modified by subsequent territorial changes.
† Including jaghirs.
‡ Jaghirs have not been assessed.

STATEMENT II.

GENERAL STATEMENT showing the AVERAGE PRODUCE and estimated LOCAL CONSUMPTION, with amount available for EXPORT.

District.	Average Cultivated with Edible Grains in Acres.			Total Average Cultivated with Edible Grains.	Average Produce per Acre in Lbs.			Produce of each Grain in Maunds.			Local Consumption in Maunds.			Available for Export.		Remarks.
	Jowari.	Wheat.	Other Grains.		Jowari.	Wheat.	Other Grains.	Jowari.	Wheat.	Other Grains.	Food at 5 Maunds per Head per Annum.	Seed at 12 Maunds per Acre.	Total.	Maunds.	Tons.	
Amraoti - -	490,375	115,811	35,464	641,650	420	250	250	2,674,467	362,199	110,824	2,506,655	96,247	2,602,902	544,498	19,446	
Akola - -	471,359	65,859	74,469	611,678	420	250	250	2,454,633	207,087	232,715	2,403,285	91,752	2,495,037	399,998	14,286	
Ellichpur -	199,370	45,649	47,454	290,473	420	250	250	1,016,691	136,403	142,294	1,395,110	43,571	1,438,681	—	—	
Buldana -	348,384	137,221	143,740	629,345	420	250	250	1,804,561	426,712	449,168	1,851,545	94,402	1,925,947	754,494	26,946	
Wun - -	439,886	62,708	36,886	509,480	420	250	250	2,308,410	192,211	115,185	1,618,810	76,422	1,695,232	830,574	29,663	
Basim - -	296,182	165,059	124,308	523,589	420	250	250	1,550,401	322,184	388,567	1,382,865	78,538	1,461,403	779,749	27,848	
Total in province	2,245,556	498,338	462,321	3,206,215	420	250	250	11,789,163	1,557,396	1,444,753	11,138,270	480,932	11,619,202	3,173,020	113,286	

CHAP. I. QN. 3.

BERAR.

Mr. Dunlop.

STATEMENT III.

STATEMENT showing the PROGRESS of CULTIVATION during the year 1877–78.

Classification of Area.	Area.	Un-culturable Area.	Balance or Culturable Area.	Details of Column 5.				Per-centage of column 6 to column 4.	
				Uncultivated.		Cultivated.			
				1876–77.	1877–78.	1876–77.	1877–78.	1876–77.	1877–78.
1.	2.	3.	4.	5.		6.		7.	
Reserved Forests -	730,101	541,453	188,644	177,366	178,383	11,438	10,259	6·0	5·4
Integral waste villages	399,698	255,774	143,920	144,528	143,920	95	...	...	...
Izara villages - -	887,721	400,077	487,649	3,788	161,922	467,168	325,725	95·8	66·8
Jagir do. -	380,546	115,255	265,288	36,322	36,977	236,976	228,306	89·3	86·6
Other do. -	8,852,596	1,482,194	7,370,397	1,090,471	1,028,361	6,180,911	6,342,035	83·8	86·0
Palamput do. -	7,444	2,180	5,264	...	...	5,264	5,264	100·0	100·0
Grand Total -	11,258,126	2,796,933	8,461,164	1,452,475	1,549,563	6,901,702	6,911,589	81·5	81·7

STATEMENT IV.

Showing the ACREAGE under each kind of Crop in 1877–78.

Grain.	Acreage.	Per-centage.	Grain.	Acreage.	Per-centage.
KHARIF CROP.			RABI CROP—*cont.*		
Rice - - -	30,751	0·48	Lac - - -	65,155	1·01
Joár - - - -	2,598,041	40·15	Linseed - - - -	216,891	3·35
Bajra - -	157,571	2·44	Kwide - - -	58,192	0·90
Tur - - -	90,269	1·40	Wattana - - -	21,192	0·33
Urd - - -	18,099	0·28	Masur - - -	28,941	0·45
Moong - - -	4,781	0·07	Gudmul - - -	51	—
Cotton - - -	2,078,269	32·12	Til - - -	825	0·01
Til - - -	154,553	2·39	Coriander - - -	1,506	0·02
Tobacco - - - -	17,060	0·26	Opium - - -	1,887	0·03
Kurhal - - -	37,416	0·58	Joár - - - -	6,768	0·10
Indigo - - - -	188	—			
Bhadli - - -	21,970	0·34			
Mudle - - -	6,339	0·09	GARDEN PRODUCE.		
Ralla - - -	357	0·01			
Kulthi - - -	108	—	Lemons - - -	103	—
Hulgay - - -	1,025	0·02	Guavas - - -	724	0·01
Rajgeera - - -	34	—	Plantains - - -	1,990	0·03
Kutki - - - -	61,742	0·95	Yams - - - -	211	—
Chillies - - -	19,483	0·30	Flowers - - -	23	—
Savree - - -	2,208	0·03	Vegetables - - -	9,314	0·14
Ajwan - - -	40	—	Grapes - - -	1	—
Castor Seed - - -	10,490	0·16	Garden produce - -	11,576	0·18
Kodo - - -	1,029	0·02			
Ganja - - -	74	—	MISCELLANEOUS.		
Walkat - - - -	49	—			
Ground Nut - -	2,146	0·03	Beetel leaves - -	1,622	0·03
Maize - - - -	1,639	0·03	Sweet potatoes - -	392	0·01
Turmeric - - -	2,389	0·04	Ginger - - - -	9	—
Brinjals - - - -	3,401	0·05	Cummin - - -	10	—
Hemp - -	13,940	0·22	Sugar-cane - - -	4,772	0·07
			Jira - - -	47	—
RABI CROP.			Alli - - - -	15,942	0·25
Wheat - - -	524,454	8·11			
Gram - - - -	162,184	2·51	Total cultivation -	6,470,186	100

BOMBAY.

Mr. Peile.

BOMBAY.

The following statistics will be found in a tabulated form in the Appendix of the Bombay Administration Reports. They are compiled from the returns kept in the villages and talukas. The return of culturable land is accurate and the others approximate.

1. The extent of each description, *i.e.*, irrigated dry crop, &c. of assessed culturable land in the Government villages of each district, with the cultivated area of the year, and that of the previous year for comparison.

2. The area on which each of the products of each district was cultivated in the year of report.

3. Extent of land under cotton, and quantity of clean cotton realised.

4. Prices of the products at each place.

The following statement, compiled from the Administration and Jumabandy Reports, shows the culturable area of Government land (figures are not available for alienated land), the area in occupation, and the area cropped in a good average year, 1873–74 :

GOVERNMENT LAND CULTIVATION STATEMENT, 1873–74.

No.	District.	Culturable Government Acres.	Occupied Acres.	Deduct Fallow Acres and Grass Land.	Leaves Cropped Acres.	Add twice Cropped Acres.	Total Cultivation.
1.	2.	3.	4.	5.	6.	7.	8.
1	Ahmedabad	13,24,083	9,51,738	34,260	9,17,478	9,929	9,27,407
2	Kaira	7,60,200	5,56,737	55,042	5,01,695	18,735	5,20,430
3	Panch Máháls*						
4	Broach	4,77,238	4,54,045	63,202	3,90,843	271	3,91,114
5	Surat	7,51,899	6,37,929	2,12,518	4,25,411	37,723	4,63,134
6	Thána	10,35,021	9,77,227	4,52,291	5,24,936	5,312	5,30,248
7	Kolába	4,74,495	4,72,674	2,03,176	2,69,498	7,274	2,76,772
8	Násik	20,23,744	15,97,752	2,07,770	13,89,982	6,635	13,96,617
9	Khándesh	34,40,815	23,63,093	2,28,838	21,34,255	1,258	21,35,513
10	Ahmednagar	25,56,826	24,48,750	2,74,656	21,74,094	—	21,74,094
11	Poona	19,40,165	19,01,205	1,88,721	17,12,484	14,342	17,26,826
12	Sholápur	19,52,916	19,41,633	1,69,370	17,72,263	—	17,72,263
13	Sátára	16,79,826	16,58,080	2,45,772	14,12,308	41,939	14,54,247
14	Kaládgi	20,74,227	20,12,036	51,151	19,60,885	752	19,61,637
15	Belgaum	11,90,123	11,13,083	1,30,810	9,82,273	3,602	9,85,875
16	Dhárwár	16,14,766	15,23,430	1,46,486	13,76,944	1,262	13,78,206
17	Ratnágiri	9,23,678	9,90,185	3,361	9,86,824	14,175	10,00,999
18	Kanara	—	—	—	—	—	—
	Total	2,42,20,022	2,15,99,597	26,67,424	1,89,32,173	1,63,209	1,90,95,382

* Separate figures for the Panch Máháls are not available.
Returns for Kanara are not prepared. As the survey has only been partially introduced, information for the whole district is not available.

Of the 1,90,95,382 acres shown as cropped, the principal food grains occupied the following areas :—

	Acres.
Jowári	63,37,549
Bajra	38,66,916
Wheat	12,23,736
Rice	11,32,816
	1,25,61,017

Cotton occupied 17,37,529 acres.

The following statement, compiled from the Revenue Commissioner's Returns, shows the comparative areas under the principal food grains as compared with cotton, from 1860 to 1874 :—

Year.	Jowári.	Bájri.	Wheat.	Rice.	Principal Food Grains.	Cotton.	
						Cotton Department's Figures, including Cultivation in Native States and Alienated Lands.	Revenue Commissioner's Figures, showing Cultivation in Government Lands only.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
1860–61	49,96,062	32,44,825	10,67,216	6,20,804	99,28,907	10,22,244	10,02,496
1861–62	50,33,113	33,87,121	10,60,968	6,52,573	1,00,33,775	11,43,096	11,40,434
1862–63	55,45,852	25,11,295	14,26,566	7,05,611	1,01,89,324	12,96,773	13,09,484
1863–64	52,39,527	32,08,427	13,38,934	7,28,587	1,05,15,475	17,82,174	15,17,321
1864–65	54,71,488	33,80,708	11,71,260	7,38,753	1,07,62,209	22,34,300	15,73,447
1865–66	59,70,598	34,58,587	12,07,382	7,58,859	1,13,95,426	16,48,717	11,86,097
1866–67	56,55,887	35,58,036	12,93,385	12,28,518	1,17,35,826	19,56,568	14,35,183
1867–68	57,31,923	37,39,650	13,30,896	11,83,687	1,19,85,556	19,61,078	14,36,735
1868–69	59,19,565	39,61,581	11,36,319	10,78,647	1,20,96,112	19,47,511	14,36,613
1869–70	51,38,693	46,93,079	9,66,236	11,04,490	1,19,02,498	27,80,744	19,78,711
1870–71	58,56,389	38,29,953	11,91,474	11,95,477	1,20,67,293	25,21,357	18,42,731
1871–72	71,66,951	29,06,493	10,24,969	10,95,510	1,21,93,923	19,82,493	14,46,959
1872–73	59,44,992	44,65,253	10,47,266	11,48,138	1,26,05,649	21,18,403	15,87,731
1873–74	63,37,549	38,66,916	12,23,736	11,32,816	1,25,61,017	22,66,382	17,37,529
Total	8,00,02,589	5,01,11,324	1,64,86,607	1,33,72,470	15,99,72,990	2,66,61,840	2,06,31,171
Average	57,14,476	35,79,380	11,77,615	9,55,176	1,14,26,642	19,04,417	14,73,655

CHAP. I. QN. 3.

BOMBAY.

Mr. Peile.

The following facts are furnished by the collectors as to the production per acre and the consumption and export of grain:—

District.	Average Amount of Food Grains produced per Acre.	Disposal of Crop, Amount of Local Consumption, Surplus Exported, or Deficiency Imported.
	Bengal maunds. Seers.	
Kaira	Wheat 4 24 Rice 8 58 Bajri 5 6 Grain 3 72	Bajra is largely produced. Kaira exports grain and tobacco. The people eat bajra, rice, and the coarser millets. The export of grain by railway in 1876 was 21,344 tons.
Surat	-	Rice and jowári are the principal products, covering about 21 and 18 per cent. respectively of the cultivated area. Cotton covers about 15 per cent. Surat exports surplus grain.
Broach	-	The principal food products are jowári, wheat, bajra, and pulses. Cotton occupies 44·71 per cent. of the area. Both cotton and grain are exported.
	Bengal maunds. Seers.	
Thana	Rice 12 0	Rice is the staple product. It is stated that about 48 lakhs of maunds are consumed and 12 lakhs exported.
Khandesh	Wheat 2 79 Rice 2 36 Jowári 2 28 Bajri 2 16	The principal food products are bajra, jowári, and wheat. Khandesh exports a surplus.
Nassick	-	Bajra and wheat are the principal products. After all the wants of the people have been supplied, a considerable quantity of wheat and bajra is available for export in a good season.
	Bengal maunds. Seers.	
Poona	Wheat 4 0 Bajra 4 0 Jowári 4 0 Rice 10 0	Bajra and jowári are the principal products. Surplus grain is exported from Poona.
Sholapur	-	Sholapur exports grain in average years.
Kaladgi	Jowári 232½ lbs. Bajra 218½ „ Wheat 286½ „	The production is much greater than the consumption, and a large residue remains for export or storage. In ordinary years none of the staple grains (jowári, bajra, wheat) is ever imported, though rice is for the higher classes.
Satara	Jowári 2 maunds Bajra 1 m. 16 lbs.	The whole food grain produced is consumed in Satara, and rice is imported from the Concan.
Dharwar	-	—
Colaba	Rice 20 maunds Nagli 8 „	There is a yearly surplus of produce after supplying the consumption of the people.
Ratnagiri	-	The hill crops (warkas) are nagli, wari, and harik, which the people eat. Ratnagiri does not grow enough food for its population, but depends on imports from Bombay by sea and from the Deccan by land. In 1862, a year of scarcity in the Deccan, the people of Ratnagiri were reduced to straits by the exportation of their stocks to the Deccan before the monsoon.
Canara	-	The chief product is rice, the surplus of which is exported.

SINDH.

SINDH.

Col. Haig.

5. The average area under cultivation yearly in each district is as under:—

—	Food Crops.	Other Products.	Total Acres.
	Acres.	Acres.	
Frontier Districts	134,199	49,387	183,586
Shikarpur	644,072	119,181	763,255
Hyderabad	408,936	125,594	534,530
Kurrachee	276,293	79,824	356,117
Thar and Parkar	240,854	62,587	303,441
Total	1,704,355	436,574	2,140,928

6. The various food crops are grown in the province to the following extent, and with the following average yield:—

—	Acres.	Average Yield per Acre.	Total Produce.
		Maunds.	Maunds.
1. Joár	450,829	9	40,57,461
2. Bajra	405,626	8	32,45,008
3. Wheat	313,977	10	31,39,770
4. Gram	20,698	6	1,24,188
5. Rice (dressed)	486,275	8	38,90,200
6. Barley	17,678	9	1,59,102
7. Mung and Urad	9,272	6	55,632
Total	1,704,355	—	1,46,71,361

7. The areas given in the two preceding paragraphs are the average of seven years ending 1876–77, and are taken from the annual Revenue Reports of the Commissioner in Sind. I am inclined to think, however, that they overstate actual cultivation. The yield per acre is what is generally allowed to be a fair average for Sind. If we take the annual consumption of food grains at 6 maunds per head, the requirements of the population (2,192,435) are 1,31,54,610 maunds, which would leave, supposing the estimate of produce under paragraph 6 to be near the truth, 15,16,751 maunds available for export. As a fact every taluka in the province exports produce, and the average annual export from the province of grain and pulse, considered to be the produce of Sind, has for the last five years been 11,57,807 maunds, which leaves 3,58,944 maunds as a reserve.

MADRAS.

MADRAS.

The Board of Revenue.

Statistics of acreage under the several kinds of crops are available only for lands held under ryotwari and inam tenures in this presidency. No attempt has been made to collect statistics as regards the acreage of crops in zemindari lands, as it is impossible to procure reliable statistical information in such tracts in the absence of any well constituted and trustworthy agency suited to the purpose.

The following statement shows the average acreage under the principal kinds of crops in ryotwari and inam lands in each district:—

STATEMENT showing the AVERAGE ACREAGE under Crops during the four Years ending Fasli 1285 (1875–76) in the Madras Presidency (Inam and Ryotwari Lands).

Districts.	Food Grains or Corn Crops.												Green and Garden Crops.	Seeds.	Topes and Orchards.	Special Crops.				Total Area under all Crops.
	Rice.			Cholum.	Ragi.	Varagu or Aricalu.	Cumbu.	Koralu or Tenay.	Millet or Samai.	Pulses.	Miscellaneous Crops.	Total.				Cotton.	Indigo.	Other Crops.	Total.	
	One Crop Irrigated.	Second Crop Irrigated.	Unirrigated.																	
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Ganjam	199,000	16,000	44,000	1,000	73,000	—	6,000	—	1,000	32,000	3,000	375,000	10,000	24,000	10,000	5,000	—	—	5,000	424,000
Vizagapatam	37,000	—	2,000	2,000	10,000	2,000	25,000	1,000	3,000	5,000	2,000	89,000	3,000	19,000	—	4,000	—	—	4,000	115,000
Godavari	425,000	2,000	99,000	75,000	18,000	3,000	9,000	9,000	9,000	92,000	22,000	763,000	27,000	114,000	21,000	21,000	3,000	20,000	44,000	969,000
Kistna	213,000	1,000	125,000	518,000	20,000	133,000	149,000	50,000	—	281,000	169,000	1,659,000	48,000	122,000	10,000	240,000	38,000	2,000	280,000	2,119,000
Nellore	214,000	6,000	8,000	357,000	37,000	80,000	62,000	10,000	—	63,000	104,000	941,000	20,000	47,000	—	16,000	51,000	—	67,000	1,075,000
Cuddapah	127,000	27,000	4,000	467,000	130,000	38,000	370,000	107,000	31,000	185,000	20,000	1,506,000	17,000	44,000	21,000	90,000	56,000	—	146,000	1,734,000
Bellary	107,000	36,000	5,000	1,157,000	110,000	13,000	223,000	—	680,000	498,000	59,000	2,888,000	34,000	176,000	47,000	380,000	6,000	1,000	387,000	3,532,000
Kurnool	48,000	9,000	9,000	862,000	21,000	139,000	94,000	330,000	—	151,000	51,000	1,714,000	30,000	79,000	—	230,000	42,000	—	272,000	2,095,000
Madras	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chingleput	320,000	40,000	45,000	8,000	39,000	40,000	15,000	—	—	4,000	2,000	531,000	9,000	16,000	28,000	—	12,000	—	12,000	596,000
North Arcot	197,000	80,000	6,000	23,000	96,000	65,000	97,000	1,000	7,000	45,000	3,000	620,000	19,000	67,000	15,000	—	18,000	—	18,000	739,000
South Arcot	319,000	51,000	46,000	23,000	155,000	195,000	222,000	—	6,000	24,000	3,000	1,044,000	20,000	85,000	26,000	26,000	81,000	—	107,000	1,282,000
Tanjore	577,000	45,000	59,000	14,000	36,000	121,000	47,000	—	—	28,000	10,000	1,237,000	48,000	16,000	—	4,000	1,000	—	5,000	1,306,000
Trichinopoly	128,000	54,000	16,000	156,000	109,000	160,000	164,000	1,000	31,000	74,000	—	893,000	23,000	41,000	8,000	37,000	1,000	—	38,000	1,003,000
Madura	134,000	30,000	3,000	196,000	108,000	89,000	115,000	9,000	104,000	66,000	17,000	871,000	17,000	38,000	5,000	50,000	—	1,000	51,000	982,000
Tinnevelly	192,000	28,000	—	81,000	56,000	62,000	232,000	1,000	159,000	95,000	6,000	912,000	35,000	55,000	19,000	178,000	—	3,000	181,000	1,202,000
Coimbatore	71,000	19,000	1,000	653,000	229,000	8,000	774,000	40,000	99,000	232,000	9,000	2,135,000	57,000	83,000	5,000	215,000	—	2,000	217,000	2,497,000
Nilgiris	—	—	—	—	4,000	—	—	13,000	6,000	—	12,000	35,000	2,000	1,000	—	—	—	13,000	13,000	51,000
Salem	87,000	19,000	15,000	75,000	373,000	92,000	346,000	15,000	67,000	242,000	12,000	1,343,000	30,000	111,000	7,000	11,000	2,000	1,000	14,000	1,505,000
South Canara	200,000	176,000	110,000	—	4,000	—	—	—	—	43,000	1,000	534,000	8,000	5,000	33,000	—	—	1,000	1,000	581,000
Malabar	392,000	110,000	81,000	—	3,000	—	—	—	—	—	5,000	591,000	—	26,000	255,000	—	—	32,000	32,000	904,000
Total	4,287,000	758,000	678,000	4,668,000	1,651,000	1,249,000	2,930,000	587,000	1,203,000	2,160,000	516,000	20,681,000	457,000	1,163,000	510,000	1,507,000	311,000	76,000	1,894,000	24,711,000

CHAP. I. QN. 3. MADRAS. *The Board of Revenue.*

The average has been taken on the area under crop during the four years ending 1875–76, which embraces two good and two indifferent agricultural seasons.

The area under crop in ryotwari and inam lands for the whole presidency amounts to nearly 24¾ million acres, inclusive of second crop cultivation to the extent of a little over 2¼ million acres. Of this area food grains occupy upwards of 20½ million acres, green and garden crops nearly half a million, oil seeds, &c. upwards of a million, topes and orchards half a million, cotton a million and a half, and indigo and other special crops a little less than half a million.

For zamindari lands, as already observed, no cultivation accounts are received excepting from a few districts in which zamindari cultivation is comparatively unimportant, and recourse must therefore be had to a rough estimate.

In Statement No. IV., prepared in connection with the Census of 1871, and printed in the Board's Proceedings, forming an annexure to the reply to question 10, the zamindari cultivated acreage is shown as given by the returns furnished by the zamindars, but the statement is not complete, as the necessary particulars for the large zamindaris of Shivaganga and Ramnad in the Madura District, Venkatagiri Zemindari and Pamur taluk of Kalahasti Zemindari in Nellore, and the Jeypore zemindari in Vizagapatam are omitted. The entries in the statement are not perfectly trustworthy, but the Board believe they are sufficiently correct to form the basis of a rough calculation, and no better data are available.

The following statement of zamindari cultivation has been framed on the basis of the above statement. For districts in which the zamindari cultivation has been reported by collectors, their figures have been adopted, and for the others it has been considered that for the purpose of a rough calculation the proportion of cultivated to total area may be assumed to be the same as the corresponding proportion for the remainder of the district in which they are situated :—

Cultivation in Zamindari Tracts.

	Acres.
Ganjam, exclusive of the Maliahs	733,000
Vizagapatam, exclusive of Jeypore Zemindari	1,181,000
Godavari	541,000
Kistna	534,000
Nellore	852,000
Cuddapah	—
Bellary (Sundoor)	44,000
Kurnool (Banganapally)	58,000
Madras	—
Chingleput	77,000
North Arcot	393,000
South Arcot	9,000
Tanjore	72,000
Trichinopoly	159,000
Madura	964,000
Tinnevelly	625,000
Coimbatore	61,000
Nilgiris	—
Salem	511,000
South Canara	—
Malabar	3,000
Total	6,817,000

The total cultivated area of the presidency under crops of all kinds may thus be taken at 31½ million acres.

With regard to the distribution of the different crops in the zamindari cultivated area there is as a rule absolutely no information, but there is no reason to suppose that it is very different from that found to exist as regards Government and inam lands, distribution of crops being affected more by the climate and rainfall than by the conditions of tenure under which lands are held. The following table of the distribution of food crops in zamindari lands in each district has been prepared on the supposition that the proportion of the acreage of each kind of crop is the same for zamindari as for ryotwari and inam lands which, being situated in the same district, are influenced by the same climate and rainfall and as a consequence by the same methods of cultivation :—

Districts.	Food Grains or Corn Crops (Zemindari Lands).											
	Rice.			Cholum.	Ragi.	Varagu or Aricalu.	Cumboo.	Koralu or Tenay.	Samai.	Pulses.	Miscellaneous.	Total.
	One Crop Irrigated.	Second Crop Irrigated.	Unirrigated.									
Ganjam	344,000	28,000	76,000	2,000	126,000	—	10,000	—	2,000	55,000	5,000	648,000
Vizagapatam	343,000	—	18,000	19,000	93,000	19,000	232,000	9,000	28,000	46,000	18,000	825,000
Godavari	237,000	1,000	55,000	42,000	10,000	2,000	5,000	5,000	5,000	51,000	13,000	426,000
Kistna	54,000	—	31,000	131,000	5,000	33,000	38,000	13,000	—	71,000	42,000	418,000
Nellore	170,000	5,000	6,000	283,000	29,000	63,000	49,000	8,000	—	50,000	82,000	745,000
Cuddapah	—	—	—	—	—	—	—	—	—	—	—	—
Bellary	1,000	—	—	15,000	1,000	—	3,000	—	9,000	6,000	1,000	36,000
Kurnool	1,000	—	—	24,000	1,000	4,000	3,000	2,000	—	4,000	1,000	47,000
Madras	—	—	—	—	—	—	—	—	—	—	—	—
Chingleput	42,000	6,000	6,000	1,500	5,000	6,000	2,000	—	—	1,000	—	69,000
North Arcot	105,000	42,000	3,000	12,000	51,000	35,000	52,000	—	4,000	24,000	2,000	330,000
South Arcot	2,000	—	—	—	1,000	2,000	2,000	—	—	—	—	7,000
Tanjore	18,000	—	7,000	1,000	2,000	24,000	10,000	—	—	3,000	1,000	66,000
Trichinopoly	11,000	4,000	2,000	20,000	14,000	21,000	21,500	—	4,000	10,000	—	108,000
Madura	131,000	29,000	3,000	192,000	106,000	87,000	113,000	9,000	102,000	65,000	17,000	854,000
Tinnevelly	24,000	2,000	—	68,000	27,000	12,000	233,000	1,000	65,000	24,000	11,000	467,000
Coimbatore	—	—	—	27,000	3,000	—	18,000	1,000	5,000	4,000	—	58,000
Nilgiris	—	—	—	—	—	—	—	—	—	—	—	—
Salem	30,000	7,000	5,000	25,000	127,000	31,000	118,000	5,000	23,000	82,000	4,000	457,000
South Canara	—	—	—	—	—	—	—	—	—	—	—	—
Malabar	2,000	—	—	—	—	—	—	—	—	—	—	2,000
Total	1,515,000	125,000	212,000	862,000	601,000	339,000	909,000	63,000	247,000	496,000	197,000	5,563,000

It is almost needless to remark that no very great accuracy is claimed for the above estimates.

The total area under food grains in the presidency in all kinds of lands may then be estimated as follows :—

Districts.	Food or Grain Crops, Ryotwari, Inam, and Zemindari Lands.											
	Rice.			Cholum.	Ragi.	Varagu or Aricalu.	Cumboo.	Koralu or Tenay.	Samai.	Pulses.	Miscellaneous.	Total.
	First Crop Irrigated.	Second Crop Irrigated.	Unirrigated.									
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Ganjam	543,000	44,000	120,000	3,000	199,000	—	16,000	—	3,000	87,000	8,000	1,023,000
Vizagapatam	380,000	—	20,000	21,000	103,000	21,000	257,000	10,000	31,000	51,000	20,000	914,000
Godavari	662,000	3,000	154,000	117,000	28,000	5,000	14,000	14,000	14,000	143,000	35,000	1,189,000
Kistna	267,000	1,000	156,000	649,000	25,000	166,000	187,000	63,000	—	352,000	211,000	2,077,000
Nellore	384,000	11,000	14,000	640,000	66,000	143,000	111,000	18,000	—	113,000	186,000	1,686,000
Cuddapah	127,000	27,000	4,000	407,000	130,000	38,000	370,000	107,000	31,000	185,000	20,000	1,506,000
Bellary	108,000	36,000	5,000	1,172,000	111,000	13,000	226,000	—	389,000	504,000	60,000	2,924,000
Kurnool	49,000	9,000	9,000	886,000	22,000	143,000	97,000	339,000	—	155,000	52,000	1,761,000
Madras	—	—	—	—	—	—	—	—	—	—	—	—
Chingleput	362,000	55,000	51,000	9,000	44,000	55,000	17,000	—	—	5,000	2,000	600,000
North Arcot	302,000	122,000	9,000	35,000	147,000	100,000	149,000	1,000	11,000	69,000	5,000	950,000
South Arcot	321,000	51,000	46,000	23,000	156,000	197,000	224,000	—	6,000	24,000	3,000	1,051,000
Tanjore	895,000	45,000	66,000	15,000	38,000	145,000	57,000	—	—	31,000	11,000	1,303,000
Trichinopoly	139,000	59,000	18,000	176,000	125,000	181,000	185,000	1,000	35,000	84,000	—	1,001,000
Madura	265,000	59,000	6,000	388,000	214,000	176,000	228,000	18,000	206,000	131,000	34,000	1,725,000
Tinnevelly	216,000	30,000	—	149,000	83,000	74,000	465,000	2,000	224,000	119,000	17,000	1,379,000
Coimbatore	71,000	19,000	1,000	680,000	232,000	8,000	792,000	41,000	104,000	236,000	9,000	2,193,000
Nilgiris	—	—	—	—	4,000	—	—	13,000	6,000	—	12,000	35,000
Salem	117,000	26,000	20,000	100,000	500,000	123,000	464,000	20,000	90,000	324,000	16,000	1,800,000
South Canara	200,000	176,000	110,000	—	4,000	—	—	—	—	43,000	1,000	534,000
Malabar	394,000	110,000	81,000	—	3,000	—	—	—	—	—	5,000	593,000
Total	5,802,000	883,000	890,000	5,530,000	2,232,000	1,588,000	3,859,000	647,000	1,450,000	2,656,000	707,000	26,244,000

The Board have experienced very great difficulty in endeavouring to arrive at an estimate of the ordinary average yield per acre of the different kinds of crops. With such an almost infinite variety of soils distributed in different proportions throughout the different districts, the assumption of any general average for the whole presidency may lead to very fallacious results unless the rate assumed is based on an extensive series of observations of each class of land in each district for a large number of seasons. For the districts recently settled by the Revenue Settlement Department, however, an attempt was made to ascertain the yield of different classes of land by actual experiments. In some cases the experiments extended over a large number of years, and the results were accepted in making the settlement as affording a sufficiently true index to the average yield. In other cases where the experiments had not been spread over a sufficiently long period for the elimination of variations arising from ordinary fluctuations of season, a rate was assumed by the settling officers on a joint consideration of the experimental results and the known circumstances of the tract dealt with. For districts not settled there is no information, and the only guide is the estimates furnished by the local officers on general local inquiry. The following statement shows the average yield as estimated by the Settlement Department for the settled districts, and by the collectors for the others :—

Districts.	Food Grains.										Remarks.
	Paddy.		Cholum.	Ragi.	Varagu or Aricalu.	Cumboo.	Koralu or Tenay.	Samai.	Pulses.	Miscellaneous.	
	One Crop Irrigated.	Unirrigated.									
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
Ganjam	1,344	—	—	798	—	—	—	—	—	—	
Godavari	1,938	1,525	1,421	1,743	—	1,104	—	—	—	453*	* Horse gram.
Kistna	2,015	959	992	—	960	562	—	—	—	—	
Nellore	1,615	—	459	—	736	429	—	—	—	—	
Kurnool	2,100	—	551	—	—	—	381	—	—	—	
Cuddapah (seven taluks).	2,197	—	551	657	—	341	423	300	—	300†	† Ariga.
Chingleput	1,219	—	—	474	819	—	—	—	—	—	
South Arcot (Chilambaram).	1,809	—	1,013	922	1,485	921	—	—	—	—	
Salem	1,852	—	939	945	—	802	—	—	—	—	
Coimbatore (five taluks).	1,750	—	521	496	—	479	—	—	—	—	
Trichinopoly	1,678	—	690	834	1,208	638	—	—	—	—	
Tinnevelly	1,784	—	—	—	—	—	—	—	—	—	
Vizagapatam	2,400	—	—	900	—	900	—	—	—	600‡	‡ Horse gram.
Bellary	(rice) 900	—	320	500	—	230	—	—	—	165	
North Arcot	2,500	—	600	800	—	700	—	—	—	650	
Tanjore	1,440	667	630	504	672	504	—	—	—	—	
Madura—											
Collector	(rice) 1,930	—	1,170	1,170	—	1,170	—	—	—	—	
Sub-Collector	826	—	574	763	486	328	389	358	500	—	
Nilgiris	—	—	357	—	—	—	604	650	—	1,100§	§ Gangee and wheat.
South Canara	(rice) 1,008	(rice) 472	—	—	—	—	—	—	—	—	
Malabar	1,069	—	—	—	—	—	—	—	—	—	

The rates given as averages by the Settlement Department have been arrived at on a careful calculation of the proportions of the land of different classes of soils under cultivation in each district. Taking all the tracts settled by the Revenue Settlement Department as a whole, and taking into account also the acreage of each kind of crop, the average yield per acre comes out as follows :—

	Lbs.
Paddy	1,621
Cholum	666
Ragi	770
Korra	400
Cumbu	630
Varagu	950
Ariga	500
Unirrigated paddy	1,330
Horse gram	600

The portion of the presidency in which settlement operations have been completed or are in progress comprise a sufficiently large extent of country to represent fairly the varying conditions of the different parts of the presidency with the exception of the two West Coast Districts.

Mr. Benson, the acting superintendent of Government Farms, in a memorandum on this question submitted to Mr. Ballard, estimates the average out-turn at—

	Per acre.
	Lbs.
Paddy - - - -	1,008
Unirrigated—	
Cereals - - -	616
Pulses - - - -	448

Although this estimate is based on a consideration of Settlement Reports and other observations in connection with the district of Chingleput, in which agricultural conditions are in many ways singularly unfavourable, Mr. Robertson, the superintendent of the Government Farms, considers even Mr. Benson's estimates to be too high. He bases this opinion on a statement of produce furnished by the Collector of Coimbatore for Fasli 1284, in which the rates of out-turn are all lower than those given by Mr. Benson, except as regards paddy, and he is of opinion that the Coimbatore District may be taken as fairly representing the average agricultural conditions of the entire presidency. In support of this statement he gives the following table :—

—	Coimbatore.	Whole Presidency.
Population per square mile - -	237·3	226·2
Houses - - - - -	48·6	45·0
Persons per house - - - -	4·88	5·02
Incidence of land revenue per head of the population.	Rs. 1 6 8	Rs. 1 6 8
Assessment per acre—		
Wet - - - - -	„ 7 5 0	„ 4 9 0
Dry - - - - -	„ 0 14 3	„ 1 1 0
Per-centage to total cultivation of area under—		
Cereals - - - -	77·89	76·28
Pulses - - - -	8·90	9·05
Oil seeds - - - -	5·44	5·54
Indigo - - - - -	—	1·10
Cotton, other special crops - -	8·81	6·14
Garden crops - - - -	1·96	1·89

The statement of the out-turn of produce furnished by the Collector of Coimbatore is evidently based on the rough estimates of tahsildars, and in itself is not entitled to any special weight. Independently of this, the Board doubt whether Coimbatore can be regarded as fairly representing, for the purpose in question, the average agricultural condition of the presidency. The two most important considerations which affect the out-turn of produce are the rainfall and the nature of the soil, and in both these respects Coimbatore is below the average of the presidency. Mr. Wedderburn, the late collector of Coimbatore, who was intimately acquainted with the district, writes: "I have not seen any exceptional soils in this district, though I have been over every taluk of it, and my impression of it after seven years, is that it is singularly unfavoured; rainfall scanty and ill-distributed; raging winds blow for half the year; a full crop dependent on rainfall is, I am convinced, the exception, and half or quarter the average."

Referring to Mr. Robertson's table, it seems to the Board that the proportions of area under cereals, &c. do not prove anything with respect to the out-turn, and the density of population is influenced by a variety of causes. The old assessments were not fixed throughout the presidency on a uniform principle, but even supposing them to be a tolerably good guide to the comparative yield of lands in different districts, the fact that nearly the whole of the cultivation (96 per cent.) is unirrigated in the Coimbatore District, and that the average unirrigated rate for Coimbatore is less than the average rate for the whole presidency by nearly 18 per cent. would seem to point to a conclusion somewhat different from that drawn by Mr. Robertson, who, however, has not failed to point to the fact of the irrigated assessment being above the average as a reason for considering the yield of paddy to be exceptionally high. It is also noteworthy that the proportion of poor ryots in the Coimbatore District is considerably above the average of the presidency, the number of registered puttadars paying less than 10 rupees assessment being 71 per cent. in that district against 64 per cent. for the presidency generally. The average assessment of a holding in Coimbatore District is also low, being rupees 11–9–10 against rupees 15–10–11 for the presidency, notwithstanding the fact that nearly half the puttas in Coimbatore are joint puttas.

As already remarked, the Board are sensible that, unless extensive observations are conducted for a long series of years all over the presidency, there must be more or less of uncertainty in all calculations of out-turn of produce; but they consider that the out-turn on which the assessment imposed by the Revenue Settlement are based must, in the present state of knowledge, be accepted for the districts concerned as the nearest approximation to the truth.

Turning to the estimates furnished by collectors for districts not settled, the Board consider that, though they are entitled to much less weight than the settlement out-turn, they may generally be accepted for present purposes. The fact that they differ widely is no argument for their rejection, as the settlement averages show that the out-turns of different districts vary within wide limits as specified below :—

Highest.		Lowest.		
2,197	Chingleput	1,219	Paddy	Cuddapah
1,421	Nellore	459	Cholum	Godavari
1,743	Chingleput	474	Ragi	Do.
1,104	Nellore	429	Cumbu	Do.

In a few instances, however, the collectors estimates seem obviously to require correction.

The out-turn estimated by the Collector of Vizagapatam (2,400 lbs. for paddy) has reference to a "good" crop; but as it is an average out-turn that is required, the Board consider that it will be better to adopt the general settlement average.

In the case of Tanjore, on the other hand, the collector's estimate of the out-turn of paddy, viz., 1,440 lbs. an acre, is evidently too low, as it is less than the general average obtained from the settlement returns. The selling price of land in this district is high; the harvests are generally plentiful owing to the almost never-failing irrigation that is obtained, and to the fertilising alluvial matter brought down by the rivers. There is thus every reason to believe that the out-turn cannot be less than in Godavari, viz., 1,938 lbs., and this rate will therefore be taken as applicable to Tanjore.

The average out-turn of paddy given by the Collector of North Arcot, viz., 2,500 lbs., appears high; but the experiments made by Mr. Rundall, the deputy director of Revenue Settlement, in three taluks of this district gave still higher results, viz., 2,693 lbs., and the collector's estimate may therefore be taken to represent the average for the district. Mr. Rundall attributes the comparatively large yield to the superior mode of cultivation pursued in North Arcot, the land being there invariably manured. For Madura the rate of yield—1,930 lbs. of rice or 2,900 lbs. of paddy, 1,170 lbs. of cholum, ragi, and cumbu—are very high and differ very materially from the sub-collector's estimates, which are given as 820 lbs. for paddy, 574 lbs. for cholum, 763 lbs. for ragi, and 328 lbs. for cumbu. The Board would adopt the general settlement average out-turn in the case of this district. For Malabar the rate of yield is the lowest reported, but the district is a hilly one, and the annual rainfall is sufficiently heavy to permit of rice crops being grown on much poorer land than that usually alloted to rice cultivation elsewhere. As will be seen hereafter, the estimate based on the out-turn reported from Canara goes to show that the district does not support its own population—a result for which the Board was not prepared. The collector's figures, however, are not low, and the error is probably in the statement of the area under crop, the district never having been surveyed.

The gross out-turn of food grain in each district is shown in the following statement, the calculation of the out-turn being based on the rates given by the Settlement Department and by collectors, with the modifications above noted. When for a particular grain the out-turn was not given by collectors, the general settlement average for that grain has been

taken. The yield of the second crop is assumed to be one half that of the first. For paddy the equivalent in rice has been taken at two-thirds :—

	Tons.
Ganjam	369,000
Vizagapatam	338,000
Godavari	601,000
Kistna	756,000
Nellore	489,000
Cuddapah	377,000
Bellary	796,000
Kurnool	452,000
Chingleput	199,000
North Arcot	440,000
South Arcot	508,000
Tanjore	696,000
Trichinopoly	368,000
Madura	564,000
Tinnevelly	444,000
Coimbatore	508,000
Nilgiris	7,000
Salem	647,000
South Canara	163,000
Malabar	175,000
Total	8,897,000

The next point to be considered is the quantity of grain consumed in each district. Grain generally is consumed (1) for seed and (2) for food. The estimates of collectors and of the Director of Revenue Settlement Department of the quantity of seed required for sowing an acre of land with paddy is as follows :—

Districts.	Quantity of Paddy Seeds required for an acre of Land. Lb.
Ganjam	92
Vizagapatam	71
Godavari	41
Kistna	108
Nellore	62
Cuddapah	58
Bellary	150
Kurnool	47
Chingleput	55
North Arcot	130
South Arcot	65
Tanjore	126
Trichinopoly	65
Madura	75
Tinnevelly	138
Coimbatore	55
Nilgiris	—
Salem	67
South Canara	81
Malabar	145
Total	1,631
Average	86

STATEMENT showing the quantity required for SEED in each DISTRICT of the MADRAS PRESIDENCY.

Districts.	Total Acreage under Paddy.	Seed required for an Acre in Paddy.	Quantity of Rice or Cleaned Grain for the whole Acreage, weight in Rice taken equal to ⅔rds of the weight in Paddy.	Area under Dry Grains.	Quantity of Seed required for Dry Cultivation at 20 lbs. for an Acre.	Total of Cols. 4 and 6.	Remarks.
1.	2.	3.	4.	5.	6.	7.	8.
	Acres.	Lbs.	Tons.	Acres.	Tons.	Tons.	
Ganjam	7,07,000	92	20,000	3,16,000	3,000	23,000	The figures in col. 4 are ⅔rds of col. 2 multiplied by col. 3 reduced to tons.
Vizagapatam	4,00,000	71	9,000	5,14,000	4,000	13,000	
Godavery	8,19,000	41	10,000	3,70,000	3,000	13,000	
Kistna	4,24,000	108	14,000	16,53,000	14,000	28,000	
Nellore	4,09,000	62	7,000	12,77,000	11,000	18,000	
Cuddapah	1,58,000	58	3,000	13,48,000	12,000	15,000	
Bellary	1,49,000	150	6,000	27,75,000	25,000	31,000	
Kurnool	67,000	47	1,000	16,94,000	15,000	16,000	
Chingleput	4,68,000	55	8,000	1,32,000	1,000	9,000	
N. Arcot	4,33,000	130	17,000	5,17,000	5,000	22,000	
S. Arcot	4,18,000	65	9,000	6,33,000	5,000	14,000	
Tanjore	10,06,000	126	38,000	2,97,000	3,000	41,000	
Trichinopoly	2,16,000	65	4,000	7,85,000	7,000	11,000	
Madura	3,30,000	75	7,000	13,95,000	12,000	19,000	
Tinnevelly	2,46,000	138	10,000	11,33,000	10,000	20,000	
Coimbatore	91,000	55	2,000	21,02,000	19,000	21,000	
Nilgiris	—	—	—	35,000	—	—	
Salem	1,63,000	67	4,000	16,37,000	14,000	18,000	
S. Canara	4,86,000	81	12,000	48,000	—	12,000	
Malabar	5,85,000	145	25,000	8,000	—	25,000	
Total	75,75,000	1,631	2,06,000	186,69,000	1,63,000	3,69,000	
		Average 86					