Precision Observations on Weather and Crops.

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THE earlier researches of Lawes and Gilbert,[1] Shaw,[2] Hooker[3] and others have shown that forecasts of crop acreage and yields can be made on the basis of weather factors. Where adequate data exist such forecasts may be more accurate than those arrived at by the subjective methods used in the official forecasts of most countries. Pioneer work of this nature has been done in India by Jacob[4] and Unaker.[5]

In India, while the official statistics of area sown to different crops are fairly accurate, the data of yield per acre are not so satisfactory. The information collected in the past regarding the various agricultural and meteorological factors concerned has been limited to very rough estimates of the final yield over large areas on the one hand and to certain observations on the "macro" or general climate at the few observatories of the India Meteorological Department on the other. The yield data of the Government Experimental Farms in different provinces are, with a few exceptions, available only for short periods, and systematic climatological data have rarely been maintained.

While some interesting general relationships can be established with these past data,* it is necessary to ensure the collection of more complete information in future years. This involves the recording side by side of systematic, detailed and uniform data of the climatic factors in the actual environment of a crop as well as the life-history of the crop during the growing season. Such information will enable us to study crop weather relationships in all their aspects.

The British Agricultural Meteorological Committee (*vide* Report of the Conference of Empire Meteorologists, 1929, Agricultural Section) having realised the importance of this aspect of Agricultural Meteorology, outlined a detailed scheme called the "Precision Scheme" with a view to record detailed observations on a few crops, according to a specified sampling technique. Our experience at Poona with the micro-climates of different crops [6, 7, 8, 9] suggested that such a scheme to be complete should also include detailed observations of the micro-climate.

In order to develop all the details of a combined "Weather and Crop Precision Scheme" which would be suitable for Indian conditions, the Agricultural Meteorology Branch prepared a draft scheme which was circulated in order to elicit detailed criticisms and suggestions from the various agricultural departments and crop specialists. Their suggestions and remarks have been very valuable in revising the scheme. In order to gain actual working experience of the scheme as well as to decide upon the sampling technique suitable for Indian crops, the Agricultural Meteorology Branch also started precision observations on wheat and jowar at Poona, on rice at Karjat in collaboration with the Crop Botanist, and on Bajri at Baroda in collaboration with the Superintendent of the Baroda Experimental Farm. Some very interesting results have been obtained as regards the stand, growth and yield of these crops. The results in the case of wheat alone are briefly indicated here.

In Table I is given the frequency distribution of the number of plants per quarter metre on the 26th February 1934, observed in 160 quarter metre unit lengths of drill selected according to the sampling technique for wheat.

It is interesting to observe the very wide range of fluctuation of plant density. The estimated average number of plants per

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[1] Lawes and Gilbert, *J. Roy. Agri. Soc.*, 1880.

[2] W. N. Shaw, *Proc. Roy. Soc.*, 1905, **74**, 552–3.

[3] R. H. Hooker, *J. Roy. Stat. Soc.*, 1905, **68**, 285.

[4] S. M. Jacob, *Memo. Ind. Met. Dept.*, **31**, Part XIV, 131.

[5] M. V. Unaker, *Memo. Ind. Met. Dept.*, **25**, 145–61.

* Please see a recent note entitled "*Influence of* Weather and Prices on the Cotton Crop of the Bombay Presidency," by R. J. Kalamkar in *Curr. Sci.*, 1936, **4**, 484.

[6] L. A. Ramdas, "Micro-climatology," *Curr. Sci.*, 1934, **2**, 445.

[7] R. J. Kalamkar, *Curr. Sci.*, 1934, **3**, 80.

[8] L. A. Ramdas, R. J. Kalamkar and K. M. Gadre, *Ind. J. Agri. Sci.*, 1934, **4**.

[9] L. A. Ramdas, R. J. Kalamkar and K. M. Gadre, *Ind. J. Agri. Sci.*, February 1935, **5**, 1.

TABLE I.

Frequency Distribution of Number of Plants per Quarter Metre Lengths (26th February 1934).

Number of plants per quarter metre	Frequency
0	27
1	36
2	44
3	24
4	19
5	8
6	1
7	0
8	0
9	1

metre, assuming 80% germination in the laboratory would be as high as 41 at a seed rate of 53 lbs. per acre (distance between rows being 12") while at harvest it was as low as 8, the reduction under field conditions being due to interculturing, mechanical injury to plants due to soil cracking and to other damages such as nibbling by rats, etc.

Table II shows the developmental stages of the wheat crop.

A maximum shoot-plant ratio of 5·3 was reached by the middle of December which by harvest time was reduced to 4 on account of the dying off of late formed tillers about the middle of December. More than 50% of the shoots had put forth ear-heads by the middle of January and about 90% by harvest time. The average number of ears per plant at harvest was 3·5. The yield of grain and straw per metre length as estimated by sampling was 25·5 gms. and 49·0 gms. respectively while the actual yields were 23·3 and 50·5 gms. respectively.

Such quantitative measurements of plant growth enable us to determine the principal events which mark the progress of the crop from germination to maturity and if the observations are made in a similar manner at a number of centres over a long series of years, it will be possible to study crop-weather relations in all their aspects.

In conclusion the writers wish to express their best thanks to Dr. L. A. Ramdas, Agricultural Meteorologist for his suggestions during the course of this investigation.

TABLE II.

Developmental Stages of the Wheat Crop.

Date	Plants per metre	Shoots per metre	Shoot : plant ratio	Height in cm.	Number of green leaves per plant	Number of ear heads per metre	General Remarks
5th Nov. 1933	15·7	27·5	1·75	2·51	2·94		(1) Sowing was done on 14th October. Germination was complete by 21st October 1933.
13th Nov. 1933	13·8	44·8	3·25	3·74	3·73		
18th Nov. 1933	13·9	56·9	4·10	4·68	3·55		(2) Interculture with slit-hoe on 22nd November 1933.
25th Nov. 1933	11·9	56·7	4·77	6·34	4·24		
2nd Dec. 1933	10·0	51·9	5·17	7·55	4·78		(3) Cracking of soil observed on the 9th December 1933. Lower leaves turning yellow and found drying by the end of December.
9th Dec. 1933	9·2	47·5	5·17	10·05	5·19		
16th Dec. 1933	8·9	45·8	5·30	13·88	5·56		(4) Rust noticed on the 13th January 1934.
23rd Dec. 1933	9·4	42·9	4·55	23·83	5·60		
30th Dec. 1933	10·4	47·0	4·52	31·01	5·74	1·5	(5) Crop harvested on the 26th February 1934.
6th Jan. 1934	9·8	38·8	3·98	38·82	5·28	7·7	
13th Jan. 1934	8·8	36·4	4·12	46·88	5·00	19·8	
20th Jan. 1934	9.2	36·7	4·00	..	..	25·4	
26th Feb. 1934	8·2	32·2	3·94	50·20	..	29·0	