

April 1st.

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Dear Sir Thomas Middleton,

I feel I ought to write to you in view of the opinion which appears to prevail at the Meteorological Office that nothing further need be or can be done for Agricultural Research, than is already done in the existing publications.

I had no idea when I was called to sit on the Committee that it would be largely connected with the question upon which I am working, but since that is the case, I must record the opinion that the existing publications are not designed to be of use to anyone employing modern statistical methods. Modern statistics might be defined as the study of variations; yet in the Book of Normals, only means are given, and no measures of variation, neither standard deviations nor correlation coefficients. This alone shows how far the Meteorological Office is at present from keeping up with the developments of the last 30 years in statistics.

If I was, as is suggested, to use the County averages of crop yield in conjunction with the Meteorological data of the district in which the county is situated, I should be relying upon the opinion expressed, that the weather within each such district is very highly correlated. Though I am willing to grant that in the case of temperature at best this opinion is probably sound, you will

understand that as a scientific worker, I could not base conclusions upon it without instituting an actual comparison of the meteorological data, for the different stations in the district. In fact I should have to undertake a piece of fundamental meteorological research before making use of the data supplied by the Meteorological Office.

I am employed under the Ministry of Agriculture, and though I enjoy Meteorological Statistics and am much interested in them, I doubt if I can freely give all my time to purely meteorological research. That, however, is for you to consider. What I wish to point out is that the necessity for such an anomalous state of affairs, lies in the fact that the Meteorological Office do not supply purely Meteorological information, which is needed in Agricultural Research.

I remain,

Your^s faithfully,

The statistical work at Rothamsted has been designed to deduce definite scientific knowledge as to the effects of weather on crops. It is anticipated that such knowledge will be of use

- (i) In conjunction with detailed investigations of plant physiology.
- (ii) To afford an empirical basis for the adaptation of farm practise to climate and season.
- (iii) To mitigate the uncertainty of farm profits by utilising the conflicting effects of deviations from the average season upon different crops.

The data of Rothamsted include rainfall and crop records for a number of farm crops under uniform treatment on the same land at Rothamsted. The period covered is nearly 70 years; these data should therefore afford a sound basis for investigating the response of certain farm crops to normal deviations of the weather, on this land, and the relation of this response to the manurial condition of the soil.

By a very laborious analysis of the daily rainfall figures, it is believed that the effects of precipitation on these crops may be adequately formulated, and placed on a numerical basis.

The value of the Rothamsted material would be immensely enhanced if comparable data had been collected elsewhere. The kind of data which might fill these gaps are:-

- (i) Last records.

Since 1885 official returns have been made to the Ministry of Agriculture of crop production, based on estimates for parishes and published as county averages. Over the same area there have been scattered a number of meteorological stations, and at a large number of points rainfall has been ^{measured} ~~marked~~.

To bring them into relation (i) the Meteorological Office might publish weather data on a county basis designed to be comparable with the agricultural data; ~~and~~ such estimates would probably attain sufficient accuracy at least for rainfall by fitting a

smooth surface to the existing stations or (b) the Ministry of Agriculture might publish separately their crop returns for the neighbourhoods of existing meteorological stations; either as actually returned, or if the parish estimates are not sufficiently accurate, by an interpolated value based on a number of stations, allowing for position and ^{altitude} ~~altitude~~.

Both these suggestions are exposed to the criticism that the agricultural returns may be systematically erroneous in underestimating the yield in good seasons, and overestimating it in bad seasons. If this is the case, all the regression coefficients will be reduced, ^{but the natural} ~~by the natural~~ may be none the less reliable for qualitative results.

(ii) For the future it should be possible to organise correlation data with accuracy, by method (a) above using either counties, or possibly more convenient areas, and ^{concurrently} ~~consequently~~ improving the agricultural data, or by the Ministry of Agriculture providing for the accurate yearly measurements of the crops in the neighbourhood of Meteorological Stations. This would seem to be within the scope of the County Agricultural Stations.