ROTHAMSTED RESEARCH

XIII. The Technique of Field Experiments

Full Table of Content

The Importance of Field Experiments

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T. H. J. Carroll (1932) *The Importance of Field Experiments ;* Xiii. The Technique Of Field Experiments, pp 60 - 63 **- DOI: https://doi.org/10.23637/ERADOC-1-214**

the necessity of cutting them out. The bulked produce of the independently located sampling units form an excellent sample for chemical analysis. Smaller plots can be dealt with by the sampling method than by ordinary farm methods, and this is of great importance, since for a given experimental area, greater replication can be obtained by reducing the size of plot, and the accuracy of the experiment so increased. Where large scale machinery suitable for dealing with small experimental plots is not available, the sampling method may be used, and the problem of harvesting complex field experiments at farms some distance from the organising centre can be solved. Finally, since sampling in some form is necessary for the study of crop growth and development, a statistically sound method of sampling is indispensable.

REFERENCES

[1] Clapham, A. R., *J. Agric. Sci.* **19,** 1929.
[2] Engledow, F. L., *J. Agric. Sci.*, **16,** 1926.
[3] Arny, A. C., and Garber, R. J., *J. Amer. Soc. Agron.*, **11,** 1919.
[4] Arny, A. C., and Steinmetz, F. H., *J. Amer. Soc. Agron.*, **11,** 1919.
[5] Wishart, J., and Clapham, A. R., *J. Agric. Sci.*, **19,** 1929.
[6] Clapham, A. R., *J. Agric. Sci.*, **21,** 1931.

THE IMPORTANCE OF FIELD EXPERIMENTS

By T. H. J. CARROLL

Imperial Chemical Industries

During the last few years the number of artificial fertilisers placed on the market has considerably increased. In particular Imperial Chemical Industries has placed before the farmer a number of concentrated fertilisers such as have not previously been available in this country.

It is of the greatest importance to the fertiliser industry that it should know as accurately as possible the value of its products.

Numerous institutions and agricultural stations in this country are engaged in establishing the general value of fertilisers. There are some, however, who do not care to include the new concentrated fertilisers in their programme of work because they were made by one commercial firm.

https://doi.org/10.23637/ERADOC-1-214

Since, however, it is essential that the manufacturers must have as accurate an estimate as possible of the value of the fertilisers they offer to the farmer it is obvious that they should encourage such institutes to experiment with fertilisers, either by providing grants of money or in other ways. But this is not sufficient. The methods by which fertiliser experiments are carried out by such bodies must be carefully examined, and the results scrutinised so as to be able to judge to what extent these official experiments supply the fertiliser makers with reliable material for judging and for proving the importance of their products.

So far as one is able to judge from the published results of experiments by many agricultural stations the fertiliser industry is not being materially helped in its search for knowledge of the effects of its products. For instance published reports seldom state the number of replications used, the method of lay-out is rarely stated, and the degree of significance of the results is not stated. Moreover, information essential to the proper understanding of the trial, such as previous manurial treatment of the ground, previous cropping, etc., is usually omitted. More important still the economic aspect of the situation receives no attention as a rule, although a profitable return on money expended on fertilisers is almost invariably the sole reason for using them, and the real value of a fertiliser lies, not in increased yields so much as in the amount of profit which its application provides to the user.

Reliable investigations into the effects of fertilisers which may be expected under normal farming conditions are only possible by means of tests with fertilisers carried out on a large scale. Such tests should be carried out on a uniform plan, all the treatments should be replicated a sufficient number of times to allow of the results being statistically examined, and the trials should be so distributed that the effects of varying weather conditions can be studied.

The cultivation treatment of all the plots should of course be identical, and at each centre each operation should cover all the plots on the same day. The seed used at all the centres should, so far as possible, be the same, and the same methods of harvesting should be followed.

The object of such a multiple scheme of experiments should be to obtain an exact knowledge of the efficiency of the various fertilisers which contain one or more of the three principal plant foods. That is to say, one should be able to ascertain for the country as a whole the effects of nitrogen, phosphoric acid and potash which the farmer can count on getting in a normal season. At the same time it should be possible to find what combination of plant foods, and what quantities of them provide, the most *profitable* result.

https://doi.org/10.23637/ERADOC-1-214

The experiments should also be designed to ascertain the most favourable time of application.

Unfortunately we are still far from this ideal state of affairs.

Although thousands of so-called fertiliser experiments have been carried out in this country we have scarcely yet begun to collect reliable information in a scientific way. The farmer is not altogether to blame for not taking the results of previous fertiliser experiments into account when planning his fertiliser programme. He realises, better than we imagine, the limitations of the *ordinary* fertiliser trial.

If we are to arrive at certain and exact results we must be able to put a value on all those factors which influence the yield, including the one which is the object of the investigation, namely the fertiliser effect. The factor which it appears impossible at present to assess is the influence of the weather. The weather sometimes favours the plant and sometimes hinders it. It is not so much the weather over the whole season as the particular climatic conditions at critical stages of the plant's life. Weather conditions, therefore, being frequently the factor with the greatest influence on the harvest also determine the efficiency of the fertiliser in an important way. For instance, the fluctuations in the efficiency of fertilisers caused directly by weather conditions may be so considerable that, on the same site, the efficiency of 1 lb. of nitrogen during three successive years may vary between 20, 12 and 28 lb. of grain. It is evident that if the farmer intended profiting from the results of such a trial for one year only, he would arrive at false conclusions regarding the *average* fertilising efficiency of the material tested. As most of the published results of trials carried out in this country are due to demonstrations of one year only, the majority of farmers are right in rejecting these results as a basis of their future fertilising plans.

How then can we make the results of our fertiliser trials more exact so as to provide the farmer with a more reliable guide for his scheme of fertilising? We must first of all ascertain the *average* effect of the weather over a more or less extended period of years. This could be done by carrying out the experiment at the same place over several years, but such period would have to be at least five years and probably ten. But for propaganda purposes the fertiliser industry requires to be rapidly informed of the value of its products, and even five years is a long time to wait.

The alternative method is to have the largest possible number of trials in regions where the soil type is fairly uniform and cultivation methods similar. Weather conditions would generally vary in different districts of such regions, and the influence of the weather

https://doi.org/10.23637/ERADOC-1-214

might be ascertained over one or two years by combining the results of such regional trials. The accuracy of such estimation will be all the greater if the number of trials is large and if the weather conditions vary to a considerable degree in the various districts of the region under consideration.

To sum up one may say that the routine methods of trials as at present largely practised do not meet our modern demands for accuracy. A search should be made for regions where the agricultural and climatic conditions are practically the same. In such regions a large number of experiments should be organised according to the same method. Only in this way can the real efficiency of fertilisers be ascertained. This is specially obvious when we are considering the effects of one particular plant food applied in different forms or at different times, where the effects may differ only to a very small degree and where the influence of the weather may be many times greater than such small differences due specifically to the fertiliser.

It is obvious that such a scheme of fertiliser experiments should be very carefully organised and carried out with meticulous care. This, however, is not impossible in practice, given a suitable staff of qualified workers. The number of agricultural institutes capable of carrying out such a scheme in this country is not sufficient to cover the whole country, and it will be necessary for fertiliser makers to engage in this work for themselves, but if such institutes as already exist could be persuaded to organise a large number of exact trials on a carefully conceived and uniform plan such work would go a long way towards providing the farmer with really reliable evidence of the practical value to him of modern chemical fertilisers.

DISCUSSION

Dr. E. S. Beaven (Warminster), whose well known half drill strip method has been used by the National Institute of Agricultural Botany in their variety trials for many years, opened the discussion. On the grounds of ease of manipulation in the field he strongly preferred a systematic arrangement to the randomised system used by the Rothamsted workers. The statistician was a good servant but a bad master. He considered that the justification for agricultural experiments lay in the degree to which they helped the farmer's pocket. Continental workers had been ahead of this country in carrying out replicated experiments with a uniform plan at numerous scattered centres. He instanced the early work done on this plan in Denmark with Barley varieties.

https://doi.org/10.23637/ERADOC-1-214