3 May 1932.

F. Keith Jackson, Esq.,
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Indore,
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1196.

Dear Mr. Jackson:

Dr. Fisher has handed your letter of 16 April 1932, to me and as I am exceedingly interested in the type of experiment you propose, has suggested that I get into touch with you. In explanation I should say that I was previously concerned with field experiments at Rothamsted and am now engaged in similar work at the Ceylon Tea Research Institute. Just for the present I am working under Dr. Fisher here. Dr. Fisher has of course approved the proposals which follow.

If I interpret you aright you are interested in the following main questions:-

(1) The relative merits of (a) F.Y.M. [Farm Yard Manure]
(b) Compost
(c) Cake. [Safflower]

(2) The relative merits of using these reinforced with artificial nitrogen.

(3) The question of whether to use the reinforcing N in a single dressing or on two occasions.

(4) The effect of superphosphate as a conditioning reagent on the lines of Howard's work.

So many questions do indeed involve a complex experiment. As Dr. Fisher pointed out in his previous letter the correct and adequate interpretation of such an investigation depends very largely upon the choice of treatments. The advantages of complexity in an experiment are two-fold:

(1) It enables interactions to be studied and thus surveys a wide field of response, and
(2) It can be made very economical of land and labour and highly productive of accuracy in the ensuing results.

This second point is of paramount importance. Such a goal is only attained if every plot is made to contribute to the answering of every question propounded. Your proposed scheme does not entirely meet these requirements. For instance you have 11 treatments involving super. Of these 11 only 10 are exactly paralleled by others without super, and there are other 'no super' plots with no specific parallel.

I have therefore recast your experiment as follows. I propose a nucleus of 9 treatments all of which have a standard dose of nitrogen.

1 unit Organic manure
2 units " "
3 " " "

½ unit Organic + ½ unit Artificial
1 " " + 1 " "
1½ units " + 1½ units "

½ unit Organic + ½ unit Artificial (applied in 2 doses)
1 " " + 1 " " " " " "
1½ units " + 1½ units " " " " "

To each plot there can correspond another with super added. This gives 18 plots. For 3 types of Organic 54 plots. Four-fold replication in randomised blocks 216 plots which is not much greater than your present number.

You will see that for most questions your effective replication is a multiple of 4 since each plot plays a part in answering each question. I have tabulated some of them below.

(1) General difference due to use of 3 organic manures: the differences between all quantities of one type minus all quantities of another (including reinforced treatments). 72 comparisons.

(2) Effect of differing doses of nitrogen 3 x 3 x 2 x 4 = 72

(3) Difference between straight organic and reinforced 3 x 2 x 3 x 4 = 72.

(4) Difference between divided and single reinforcements 72.

(5) For consideration of specific types of organic manure the number is in all cases $\frac{72}{3} = 24$.

(6) The same applies for specific quantities: 24

(7) The phosphate question involves 108 comparisons.

This list is not exhaustive. The more interactions considered, the smaller the effective replication built up on similar lines. For all interactions studied simultaneously the basic four-fold comparison holds.

I have suggested reinforcement to the extent of 50 per cent. N, but any other proportion will do provided the total N is the same, and I have restricted the reinforcement to one type of artificial either S/Am. or Nit/Soda at will. Since this is a survey experiment other complications might await the consideration of the results obtained from the primary experiment.

Yours faithfully,

(T. EDEN).