11 December 1930.

W.H. Parker, Esq.,
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6/2/5

Dear Mr Parker,

Many thanks for your letter and enclosures.

I should be extremely interested to assist in a comparison of different arrangements for variety trials with potatoes, though some preliminary agreement would be necessary as to the exact object of the investigation.

(1) The actual precision of different arrangements may be most simply compared by the use of uniformity trials, for in these the actual "errors", i.e. deviations in yield of different areas with the same variety and treatment, are known, and the precision of different possible experimental arrangements may be compared on the same land. Results obtained in this way are comparable with actual trials provided that in the latter systematic errors due to edge effects are fully eliminated. The results of such comparisons, a large number of which have been made, are, I believe, uniformly in favour of the Latin square, for such a number
of varieties as six.

(ii) The validity of the estimate of error for any chosen method of arrangement, in conjunction with the proposed method of estimation, may also be tested out on uniformity trial data, and from these it appears that only the randomised methods of arrangement give reliable estimates of error.

A comparison could of course be made between different arrangements of the same experiment on neighbouring pieces of land, and the aggregate of a number of such comparisons would doubtless show the same effects as do the uniformity trials. Owing to different variabilities in different pieces of land, no single comparison of this sort could be convincing.

The experiment on potatoes of which you send the details is open to criticism from a number of points of view:-

(a) The use of single rows exposes the plants of any one variety to competition on both sides from other varieties, and this cannot be assumed to be equivalent to competition from rows of the same variety, such as occurs when a uniform crop is grown.

(b) The estimate of error adopted is theoretically unsatisfactory and liable to be an underestimate, for the percentage differences used refer only to rows at intervals of 1, 2 and
3 row widths, whereas with six varieties however arranged, corresponding plots of different varieties must often be further apart than this.

(c) The method of calculating the standard error is exceedingly laborious. At least three times as much work as is necessary must be involved in working out the percentages, their differences, and the squares of their differences. These differences moreover are not uncorrelated, and the sum of squares represents the sum of about 35 instead of 138 independent squares.

(d) Although the error of the experiment you send me seems to be exceedingly low, I much doubt if such a low error even if it were valid, could be taken as representative of experiments with only 40 plants per plot.

I think you would find it worth while, unless you are absolutely restricted by lack of seed tubers, to try an experiment with nearly square plots of about a fortieth of an acre, either on a 6 x 6 Latin square, or in 8 randomised blocks. The comparison between these two methods, for both of which valid estimates of error could be made, at a number of different places would be valuable in showing whether the advantage of the Latin square arrangement would outweigh the reduced replication.

Yours sincerely,