

28 April 1933.

Mr. F.W. Handley,
Agricultural Institute,
Kirton,
Nr. Boston, Lincs.

Dear Mr. Handley:

I have your letter of 26 April 1933 on the manurial experiments with tulip bulbs together with the data for the years 1931-32.

The differences in yield observed, in the several cases to which you direct attention, between the plots in which phosphates or potash were omitted, and the complete manure plot 9, chosen for comparison with them, certainly provide a prima facie case for saying that the omission of these ingredients from the complete manure, makes a perceptible difference to the growth of the bulbs.

These differences do not seem to be very small absolutely, about 7 per cent. in the case of phosphate, and 10 per cent. in the case of potash, and, though they are not perhaps very large compared to their standard errors, I have no doubt that they should be judged statistically significant. I imagine the

right basis to apply to the absolute difference in growth rate, would be to consider whether the omission of the phosphates diminished the commercial cost of growing the bulbs for the former year, by as much as 7 per cent. I say the commercial cost, because doubtless, in carrying out the experiment greater expenditure has been incurred than would have been for commercial purposes.

I notice you point out that the unmanured control plot 5 gives increases not much lower than that of the incomplete manure plot 4. The difference in fact is only just over 11 per cent. and it may really be true that the complete manure less potash, is, in fact, worth less for increasing the growth rate of the bulbs. There is, however, a difficulty in interpreting the results if all the 30 treatments have not been arranged at random, or at least randomised with known restrictions in the series in which they are grown. In the absence of this precaution it is, unfortunately, certain that inconsistencies between the different comparisons possible, may arise simply through uncontrollable factors affecting the fertility of the different plots.

Without a deliberate randomisation it is impossible to obtain a strictly valid estimate of sampling error and so to apply a strict test of significance to the differences observed.

When this precaution is taken, however, it is our experience that such inconsistencies vanish and that interpretations indicated by some comparisons will not be found to be contradicted by other comparisons in the same experiment.

If you would care to discuss the matter further with me, I should be very happy to see you here, for example, on May 4th. or 5th. A card in advance giving your probable time of arrival would be a convenience. I am holding your data here meanwhile.

Yours sincerely,