A RECENT STUDY OF THE RESULTS OF SOME CEYLON TEA FERTILIZER TRIALS

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From its early days the T.R.I. has conducted experiments on the fertilization of tea. Today the importance of this subject can hardly be in doubt and I have recently visited Ceylon to sift through the accumulated evidence from several experiments, two of them over 24 years old.

In most of these trials the crops did not reach present-day levels. Plainly it would be a mistake to infer too much from these results about the fertilization of really heavy crops.

Nitrogen

One result that stands out is the paramount importance of nitrogen. When the T.R.I. started, its use was suspect, but planters today are aware of the "eight-pound ratio," and often use the "ten-pound ratio" instead, but it may be questioned whether even this is enough. Eden (1949) showed that 100 lb. of made tea takes 6.38 lb. of nitrogen from the soil. Losses must be large, so 8 lb. by way of replacement does not seem a lot. Certainly there is evidence that it could well be increased. Thus on Field 3 at St. Coombs during the third, fourth and fifth pruning cycles the crop averaged 695 lb. per acre per year. Using the "eight-pound ratio" this means that about 56 lb. of nitrogen per acre should have been applied each year. Actually the experiment tested 40, 60 and 80 lb., and this resulted in 625 lb. of tea from the lowest level, 691 lb. from the middle and 771 lb. from the highest. In fact the bushes were able to make good use of 80 lb. of nitrogen. What is more, the response is not falling off, the increase of crop from the second increment of nitrogen being quite as big as that from the first. Here then is an instance when more fertilizer could usefully have been given. Much the same thing happened in the sixth, seventh, eighth and ninth cycles. Over this period the crop each year averaged 642 lb. per acre, so the amount of nitrogen called for by the "eight-pound ratio" would have been rather less than before. Even using the "ten-pound ratio" about 65 lb. per acre would have been the recommended dressing. The crops for the low, medium and high dressings were respectively 570 lb., 636 lb. and 719 lb. per acre. Once again it was worth while to use more nitrogen than the recommendation, and once again the response showed no sign of falling off as higher levels were reached.

This does not always happen. Thus, at Endane in the low country no response at all was found from nitrogen during the first two cycles, amounting in all to three years. Nevertheless, the trial was a very sensitive one, well able to detect quite small differences, so there are circumstances in which nitrogen does no immediate good. However, in this trial the lowest of the three levels was 80 lb. per acre, and this is quite high. It is unlikely, though, that the area can continue to crop at its present level without reaching the point when further nitrogen will be needed.*

**I am told that later results are now available, and these suggest that high nitrogen (160 lb. per acre) may even be reducing crop as compared with 80 lb. per acre. This result, if confirmed, is surprising, but it serves as a warning against the uncritical use of really high dressings of nitrogen. S. C. P.*

In general, it appears that the "eight-pound ratio" is rather low, but nitrogen should not just be piled on. A "ten-pound ratio" is probably about right.

Phosphate

The story with phosphate is very different. Here we can easily give too much. For example, in the trial at Passara applications of 30 lb. per acre as superphosphate had to be given up because of the harm they were doing. Thus in the fourth and fifth pruning cycles the bushes without phosphate gave 663 lb. per acre per year, but those with it gave only 600 lb.

Something similar happened on Field 3 in the trial already mentioned. Here in the third, fourth and fifth cycles, the trial compared no phosphatic fertilizer with applications of 30 and 60 lb. per acre as superphosphate. The crops per acre were respectively 638 lb., 713 lb. and 725 lb. for these three levels of phosphate. The highest application had done no harm, but neither had it done much good. For the next four cycles the figures were 599 lb., 673 lb. and 653 lb. Here it might seem the largest dose had done harm. Possibly the decrease in crop is just chance, but the result will not encourage anyone to spend money on more phosphate than was given by the middle application.

How do these results fit in with current manurial practice? Using T.R.I. 500 at the "eight-pound ratio," 3.8 lb. of P_2O_5 is given for each 100 lb. of crop. Consequently, at Passara the recommended application would be 23 lb., or 28 lb. if expansion were attempted, and this latter figure certainly is too much. On Field 3, however, the recommended dressings of phosphate would be about right, though they should certainly not be increased. In fact, if more nitrogen is to be given, we should not increase the phosphate as well.

It appears that 100 lb. of crop removes 1.55 lb. of P_2O_5 from the soil (Eden, 1949). Using fertilizers at present rates, there may be a build-up of phosphate in the soil over the years, because unlike nitrogen it is not immobilised by bacteria. At first this may not matter, but eventually more will be supplied than the plants require. It is not known if this will do harm, but it is quite possible that it will.

The question arises here whether the form of phosphate is important. The trials at Passara and on Field 3 used superphosphate, but rock phosphate is more usual in commerce. Certainly superphosphate leads to a build-up of calcium in the leaves, a result clearly established by chemical analyses carried out in 1952 on samples from Field 3. However, this may happen with rock phosphate also, and it is not certain that a reasonable excess of calcium is harmful. Altogether this question is very open, and much more needs to be known.

It may be noted that the best level of phosphate does not appear to have anything to do with the amount of nitrogen given. That being so, there is no need to tie the application of phosphate to that of nitrogen as is done with a standard fertilizer mixture. It would certainly be wise to ensure a good supply of phosphate for a start, but as crops begin to rise there seems little point in increasing the applications in proportion. It should then be good enough to put back about 3 lb. of P_2O_5 for each 100 lb. of crop.

Potash

The evidence is that present applications are about right. For a long time potash may appear to have little effect, but if too little is given the consequences can become serious in the extreme. On no account, therefore, should it be ignored. A 100 lb. of crop takes 3.47 lb. of oxide of potash out of the soil (Eden, 1949); T.R.I. 500 at the "eight-pound ratio" puts 4.7 lb. back. This seems a sound practice.

A need for balance

The fertilization of a plant can never be considered only in terms of NPK, though these are the most important elements. The early workers at the T.R.I. rightly started with these three, but it is generally accepted that there are others that can matter. For example, Tolhurst (1956) has pointed out the need for magnesium. These minor elements need to be taken into account when deciding the form of fertilizer to be used, because most are given incidentally in substances chosen for their content of N, P, or K.

Among the major elements also a balance must be preserved. Anything taken out of the soil must be replaced or impoverishment will result, so over a period fertilization must be more or less on a replacement basis. It would therefore be a mistake to give nitrogen alone, even though for the moment phosphate and potash appeared to be sufficient.

However, this does not mean always giving the three major elements in the same proportion. For phosphate at least it appears that there is a best level, neither too low nor too high. A constant mixture can well give too much phosphate when crops are high, or else give too little when crops are low.

Finally, it should be emphasized that this paper is concerned with the results available to date from four trials. These need to be considered along with any other evidence that may be available, and the whole seen in perspective. In particular, special local conditions can call for special measures.

Acknowledgments

I have benefited greatly from conversations with Dr. T. Eden and Mr. J. A. H. Tolhurst, both of whom have had long experience of these matters.

References

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