

CONCLUDING REPORT ON A PHOSPHATE MANURIAL TRIAL, ST COOMBS

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This trial was laid down in No. 13 Field, St Coombs, in 1946 to study the effect of three levels of phosphoric acid (P_2O_5) on yield response of mature tea. A further comparison was made between Saphosphosphate and Superphosphate manures. Other nutrients were applied uniformly to all plots, except that in the years when zerophosphate was one of the treatments no attempt had been made to compensate for the absence of calcium (an inseparable component of each of the types of phosphatic manure). In 1963 it was decided that results did not warrant continuation of the trial, although the plots themselves are of such promising vigour that they are to be used in a new trial to investigate the relation between yield and the level and frequency of application of nitrogen. It is the recent improvement in bush vigour, coupled with the lack of yield response to phosphate levels, which make it worth while to report observations in some detail.

References to the somewhat chequered history of the trial will be found in the Annual Report of the Institute (Portsmouth, 1953, Tolhurst, 1961, 1962, 1963, Visser, 1956). A summary of the main features is given here.

Site

A spur from the North slope of No. 13 Field, sharply ridged in the upper half. The tea was planted in 1937 and the original vegetation was patana grassland. On such an exposed ridge it is probable that the growth of the grass was below average.

This area, in common with others in the same field, was planted for use as experimental plots. There is no doubt that the jat of tea is poorer than the average for this field. Virus-like distortions, not yet firmly identified, are frequent and at one stage, after pruning in 1960, their severity was such that we seriously considered abandoning the area.

No trees have been interplanted, except for one abortive attempt in 1960 to establish *Sesbania* as a windbreak. Most of the plots suffer the full force of the dry North-East Moonsoon winds.

Manuring

Nitrogen and Potash.

- 1946: Probably none, as this was a pruning year and also the transition period, when the area was taken over by a Scientific Division.
- 1947: 32 lb N and 16 lb K_2O per acre.
- 1948: None. Pruned again, rested for 10 months, followed by a light cut-across.
- 1949: 40 lb N and 20 lb K_2O .
- 1950: 120 lb N and 60 lb K_2O .
- 1951: 80 lb N and 40 lb K_2O .

This was continued for each year to 1958 inclusive, when the trial reverted to my Division.

In 1959 the same rate of manure was retained.

In 1960, July, the final pruning cycle was begun; manuring was as follows:—

- 1st year: 120 lb N and 60 lb K_2O .
- 2nd year: 180 lb N and 90 lb K_2O .
- 3rd year: 180 lb N and 90 lb K_2O .

Phosphate

Zero-phosphate was one of the treatments from 1947 until 1959 inclusive, the phosphate levels being:—

- 0, 12 and 24 lb P_2O_5 in 1947 (these treatments were omitted in 1948).
- 0, 15 and 30 lb P_2O_5 each year from 1949 to 1959 inclusive.

In the final cycle the three phosphate levels were, for each year from 1960 to 1963:—

- 30, 45 and 60 lb P_2O_5 per acre per annum, in place of 0, 15 and 30 lb P_2O_5 respectively.

Magnesium

Deficiency symptoms were, in 1959, severe in several parts of the area. Dolomite at 5 cwt per acre was broadcast in mid-1960, and magnesium sulphate sprayed on to the foliage at various times in 1961.

Pruning

It is not known what degree of cleaning out was practised in any of the four prunings in 1946, 1948, 1952 or 1956. By 1960 the frames were uniformly poor. Spread was often small and branches were thin. Wood rot had caused severe damage to the trunks and few healthy main limbs were present. Similar conditions were to be seen in adjacent tea which, from observation of the row pattern, may have been planted as part of the same original block but which was certainly never taken over for any experimental purpose.

In 1960 all bushes were pruned hard and clean using saws where necessary and cutting the worst rotted branches at their base. Figure 1 illustrates a representative pruned frame. For unavoidable reasons the resting period which had been decided upon had to be extended and plucking was not started until the fourteenth month. Although doubtless beneficial, this long period was certainly not necessary in order to pluck on to a reasonable foundation.

Observations, 1960-1963

Seven months after pruning growth suddenly improved, and the nitrogen-deficiency symptoms which followed prompted an increase in the nitrogen level to 120 lb in the first year. A further increase to 180 lb N in subsequent years was made without knowing the yield potential, but on the assumption that this level of manure should allow frames to form with little risk of starvation. Nitrogen-deficiency symptoms were not seen again, even after a heavy cropping period early in 1963.

Virus-like distortions became less evident once the bushes were brought into plucking. Plucking, for the first few months, concentrated on the bush centres. As the side branches were gradually brought into plucking, so the round was shortened to a seven-day average. Plucking to the small fish-leaf, with periodic lightening to allow a new layer of foliage to form, was the practice for the second half of the cycle. The height of the plucking table at the end of three years was thirty inches, which compares favourably with much tea at this elevation of the same age.

Even after three years the cover was nowhere tight. It was noticed early in the cycle that plots at the lower, and flatter, end of the ridge were yielding more than those at the higher end. This difference had not been seen in earlier cycles, and became again less noticeable as the weaker bushes developed laterally.

Yield records showed no differences between the two types of phosphatic manure, nor between the three levels of P_2O_5 . Average yields for the whole trial converted to dry weights per acre, were:

2nd year of cycle:	1,460 lb
3rd year:	2,090 lb

Each year was a complete twelve-month period, dated from pruning.

Chemical Analysis

Samples of flush and of the upper-most mature leaves were taken in October and November 1962. The mature-leaf sampling was repeated in May 1963, during a surge in growth after an unusually dry period which lasted from mid-November 1962 to early April 1963. The 1962 samplings were made after a short period of cool, wet, weather.

Only the results of the phosphate, (P_2O_5), analyses for the mature-leaf samples need be quoted here. The results for the flush shoot showed no appreciable differences, whereas in the mature leaf there were significant differences in P_2O_5 content related to the level of phosphate applied as manure.

For the 1962 sampling the mean P_2O_5 contents were 0.25, 0.28 and 0.30% on dry matter for the manurial treatments 30,45 and 60 lb P_2O_5 per acre per annum respectively. Differences were highly significant.

For the 1963 sampling the results reached the same level of significance, the means being again 0.25, 0.28 and 0.30% P_2O_5 . No differences were shown between the two types of phosphatic manure.

Conclusions

Any field experiment is subject to the limitation that its results may only really be translated to similar plant material treated in a similar way. This counsel of perfection can rarely be followed in practice particularly when, as in this case, few experiments have been done on a given problem. It is my own opinion that the results obtained from this trial could be applied to a large acreage of tea in Ceylon. A point of view which finds favour in the low-country nowadays is that plenty of phosphate is required to support the stands of shade trees commonly grown there. There is no local evidence to support this idea which, in view of the very low carry-off of nutrients from the fields by the trees, would seem to me to be of doubtful validity. In order not to prejudice future experimentation this section will avoid reference to low-country tea.

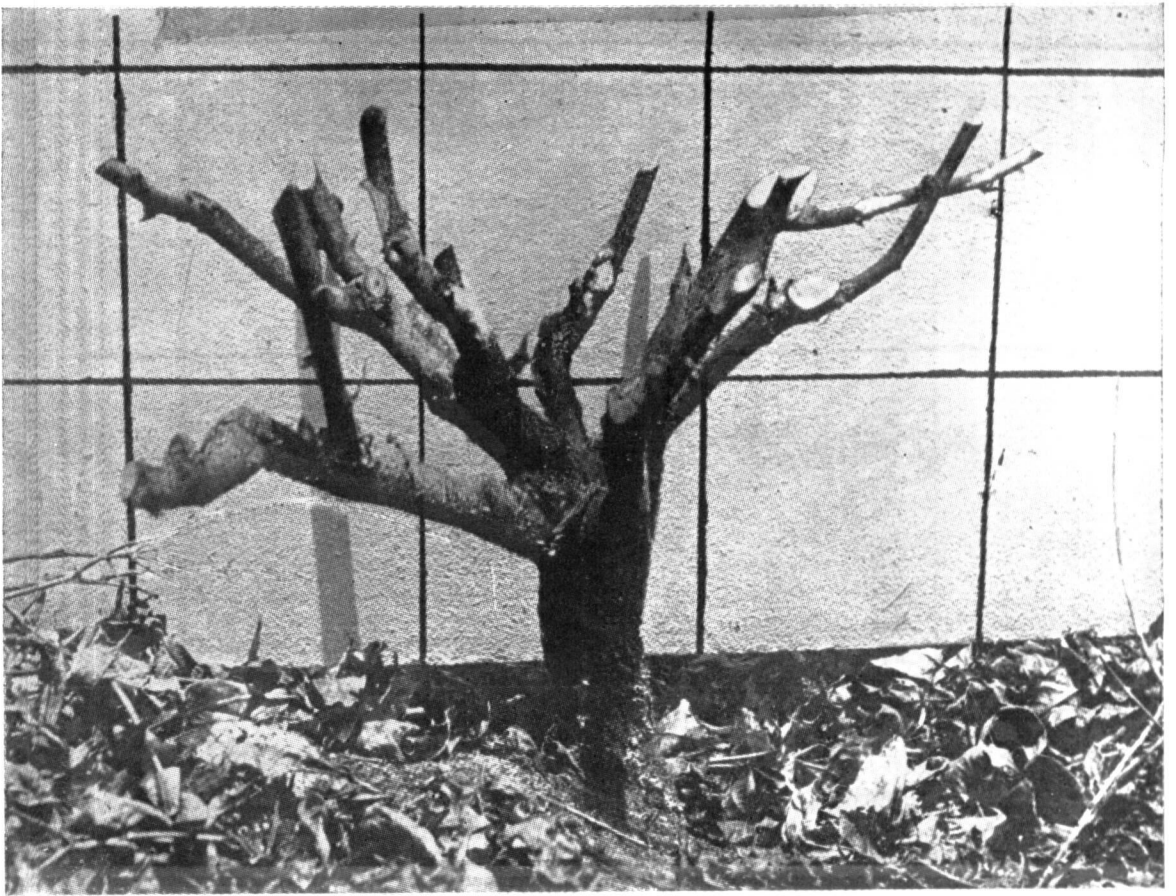


Fig. 1. A typical frame after pruning in 1960. Phosphate Manurial Trial, No. 13 Field, St Coombs.

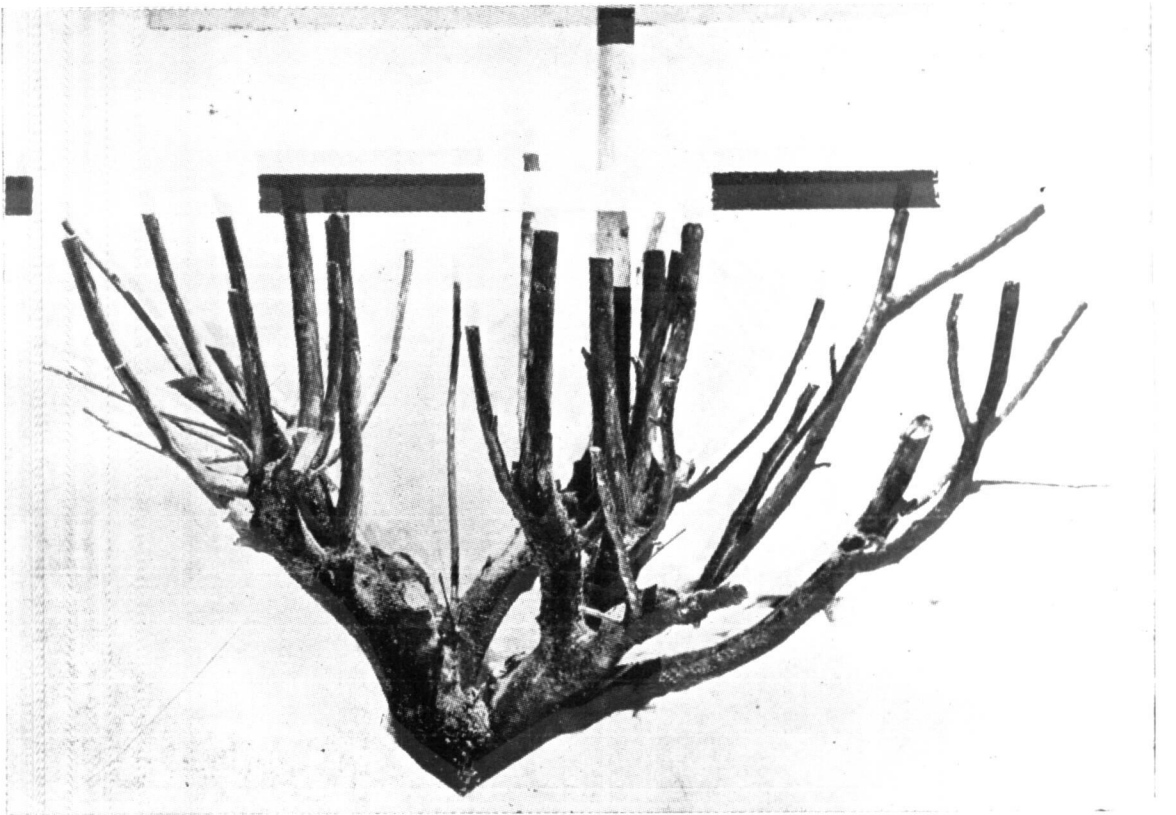


Fig. 2. A similar frame after pruning in 1963. Dead spurs, unproductive old wood, and some young branches were removed after photographing. The scales in each Figure are marked in 6-inch divisions.

This trial has shown that 30 lb P_2O_5 per acre per annum, over three years, applied to plots which had received *no phosphate at all* for at least thirteen years previously was more than enough to allow mature, poor-jat tea to recover from a hard prune and to give yields which must be described as very good.

Chemical analysis showed that the leaf composition had been influenced by the phosphatic manurial levels. Thus the lack of yield response to these treatments could not be explained by lack of availability of phosphate from either of the manures.

In addition, the growth of new wood over this period was also good. Figure 2 illustrates a representative frame, unthinned, in July 1963.

At the time of pruning there was no indication at all of a decline in the cropping rate. There was every indication that the bushes were expanding laterally at an increasing rate.

The relative efficiency of the two types of manure cannot be estimated since both appeared to have been used in excess of requirements.

We do not at the moment contemplate altering the T.700 formulae with respect to phosphate. If used at 180 lb N one of the T.700 mixtures would supply approximately 50 lb P_2O_5 . 30 lb P_2O_5 would be supplied at a nitrogen level of nearly 110 lb.

We have no evidence to enable us to comment on phosphate requirements of young plants or of individual clones and these conclusions *must not* be taken to apply to such tea. It is suggested that by recommending a mixture such as T.200 we are being more than generous with phosphate. Experiments are in progress on this point.

The NPK Manurial Trial in No. 3 Field, St Coombs, should be capable, following a similar rehabilitation (Tolhurst, 1962, 1963) of carrying on where the No. 13 Field Trial was stopped. It has an advantage in that interactions between three levels of each nutrient (NPK) can be evaluated.

References

- PORTSMOUTH, G. B. (1953). Report of the Plant Physiologist for 1952. *Rep. Tea Res. Inst. Ceylon*: 31-39.
- TOLHURST, J. A. H. (1961). Report of the Agricultural Chemist for 1960. *Rep. Tea Res. Inst. Ceylon*: 45-51.
- TOLHURST, J. A. H. (1962). Report of the Agricultural Chemist for 1961. *Rep. Tea Res. Inst. Ceylon*: 50-58.
- TOLHURST, J. A. H. (1963). Report of the Agricultural Chemist for 1962. *In Press*.
- VISSER, T. (1957). Report of the Plant Physiologist for 1956. *Rep. Tea Res. Inst. Ceylon*: 39-45.