A REAPPRAISAL OF PRACTICES IN THE CULTIVATION OF LOW-COUNTRY TEA

L. H. Fernando

A century of tea growing in Ceylon has lead to the adoption of successful agricultural methods on estates. These are nevertheless subject to change with time. The impact of recent research on current estate practice is accordingly examined, by reference to five important aspects, *viz* fertilizer application, replanting, weeding, pruning and shade trees in low-country tea.

The fertilizer experiments at Endane (LA1*) and Palmgarden (LA2*), described by Joachim (1964) have been continued in collaboration with Tolhurst. In the discussion that follows, fertilizers and yields of tea are expressed in pounds per acre per year, except where otherwise stated (see Table 1). The Endane experiment on seedling tea has now run for eleven years and there is still no evidence of a response to phosphorus, potassium and magnesium. The response to nitrogen was also surprisingly small. A mean yield of 1351 lb was obtained without application of nitrogen. This was raised by 5% when nitrogen was increased to 40 lb and by a further 3% when nitrogen was increased from 40 to 80 lb. This represents increases in yield of 1.6 and 1.2 lb tea per pound of nitrogen. Further analyses of the results reveal no significant responses to nitrogen in the first year of the cycle, but in the second year the responses from 0 to 40 and from 40 to 80 lb nitrogen are 7 and 6% respectively, representing increases in yield of 2.9 and 2.5 lb tea per lb nitrogen.

The Palmgarden experiment was started in 1961 on five-year old clonal tea. Here again there has been no response to the levels of phosphorus, potassium and magnesium tested. Over the period 1961 — 1967, 75 lb nitrogen sustained a mean yield of 3195 lb. This yield was increased by 7% when nitrogen was increased to 150 lb and by a further 3% when nitrogen was increased from 150 to 225 lb. The response to nitrogen was greater in the second year of the cycle than in the first. The highest yield was obtained with 150 lb nitrogen in the first year, and 225 lb nitrogen in the second year. Increasing nitrogen from 75 to 150 lb gave a return of 2.2. lb tea per lb of nitrogen in the first year of the cycle and 3.4 lb in the second year. Similarly from 150 to 225 lb nitrogen the return was -0.2 in the first year and 2.6 in the second. The highest yields were around 2500 and 4500 lb in the first and second years of the cycle. At the end of the second year, yields were rising and it does appear profitable to extend the cycle beyond two years ; this may also enhance the response to nitrogen.

The results from Endane and Palmgarden may now be examined in relation to estate practice. Consider a ten lb ratio replacement basis which many estates still adopt, despite TRI recommendations to the contrary. On a yield of 1400 lb, comparable with that of the Endane experiment, 140 lb N, 39 lb P_2O_5, 126 lb K_2O and 15 MgO will be applied if T 795 fertilizer mixture is used. Similarly on a yield of 3500 lb, comparable with that of the Palmgarden Experiment, the tea would receive 350 lb N, 98 lb P_2O_5, 315 lb K_2O and 39 lb MgO. Both experiments show no benefit from phosphorus, potassium and magnesium and the expenditure involved in applying large quantities of these nutrients is prohibitive ; for this reason reduction or omission of phosphorus, potassium and magnesium in fertilizer mixtures has been recommended by the TRI at least as a temporary measure of economy. The nitrogen response is found to diminish at the 80 lb N level in the Endane experiment, and at 225 lb N in the Palmgarden experiment. But estates securing yields around

* See experiment numbers in TRI Annual Report, Part 2, 1965.

TABLE 1 — Response to nitrogen at Endane and Palmgarden — means of three cycles, 1961-67 Endane (seedling tea)

Nitrogen (*lb per acre per year*)	*First year of cycle* Yield (*lb per acre per year*)	% increase in yield	*Second year of cycle* Yield (*lb per acre per year*)	% increase in yield	*Mean of 1st and 2nd years* Yield (*lb per acre per year*)	% increase in yield
0	1102	0	1599	0	1351	0
40	1116	1	1713	7	1415	5
80	1113	1	1812	13	1463	8
Significant difference (P = 0.05)	34	3	64	4	90	6
			Palmgarden (VP tea)			
75	2337	0	4053	0	3195	0
150	2502	7	4306	6	3404	7
225	2488	6	4497	11	3503	10
Significant difference (P = 0.05)	63	3	128	3	167	4

6000 lb tea are applying 400 to 500 lb nitrogen in fertilizer mixtures. Although estates obtaining very high yields are using very high levels of nitrogen, this does not necessarily establish a direct relationship between fertilizer and yield. It is only by experiment that this can be determined and experiments have already been set down on estates and TRI stations comparing levels of nitrogen, ranging from 0 to 480 lb.

Estates increase nitrogen with yield, and simultaneously increase the number of applications per year. For instance, an estate applying 480 lb N may decide to split this into 12 applications per year of 40 lb N each. The results of the Palmgarden experiment support frequent applications of nitrogen ; the highest yield was obtained with the highest level of nitrogen and the highest frequency of application, which was 450 lb N in 11 applications per cycle of two years, and this yielded 9% more than seven applications per cycle. In experiments more recently initiated in the low country all combinations of six, eight and twelve applications per year with 240, 360 and 480 lb N are being compared on VP tea. Until the results of these experiments are available, it would be unwise to presume that increasing the levels of nitrogen and its frequency of application, without limit, will continue to increase yields.

Further investigation is necessary into the fertilizer response at Endane and Palmgarden. Other experiments are necessary to determine whether adequate and regular applications of fertilizer in the early years after planting are more effective in the growth and development of tea than fertilizer applied in the later years. In this connection, the results obtained in a fertilizer experiment on young tea at the TRI substation, Kottawa, Galle, in collaboration with Tolhurst, are of considerable interest. In clonal tea fertilized at three levels each of nitrogen, phosphorus, potassium and magnesium from the time of planting, the yields in the first year of plucking were increased by 48% when nitrogen was increased from 75 to 150 and by a further 48% from 150 to 225 lb N. Similarly, 30 and 60 lb P_2O_5 increased yields by 25 and 42% respectively. But 50 and 100 lb K_2O increased yields by 3 and 7% only. Magnesium at 30 lb MgO gave no increase in yield, but 60 lb MgO raised yields by 11%.

Before I leave the subject of fertilizer, I must acknowledge the whole-hearted co-operation of Endane and Palmgarden Estates in the conduct of these experiments, and also make mention of our TRI staff, Messrs J. I. H. Bandaranayake, H. D. Jayasinghe, N. Yogaratnam, A. A. C. Karunaratne and K. H. G. Gunapala for their untiring efforts.

In old seedling tea, yields are often limited by the number of plants per acre. In the past, attempts to fill vacancies with seedlings have not proved successful and clonal plants are now used instead. Yields have been raised in this way, but differences between seedling and clonal plants in respect of fertilizer requirements and frequency of plucking have introduced new problems. Yields obtained from mixed populations of seedling and clonal tea are not as high as those obtained from pure stands of clonal tea. It is more profitable to plant clonal tea rather than supply clonal plants in seedling tea. Apart from the subsidy for replanting with clonal tea, there is the recurrent benefit of a higher yield per acre and a lower cost of production. Clonal tea in the low country is known to yield two or three times as much as old seedling tea. Replanting with clonal tea is undoubtedly the most effective way of reducing costs of production.

In replanting programmes, low-yielding fields are usually uprooted first. While this is rational, it should be stressed that poor land is best excluded. The reconditioning of tea land before replanting, referred to as rehabilitation, needs re-examination. Tea land which has been eroded may not be suitable for replanting, unless it is reconditioned, but much of our tea land may not need rehabilitation. The first experimental plots of tea grown without rehabilitation on a low yielding field at the TRI Low-Country Station, Ratnapura, have given promising results.

It does appear possible to replant tea without rehabilitation, thereby saving time and money. Instead, a quick sequence of operations is envisaged from uprooting to replanting of tea.

A vigorous leguminous cover should be seeded as soon as possible after uprooting of tea. Expenditure on deeper holes is warranted ; root systems of young clonal tea have been found confined to the hole or trench in which planting was done. After planting, the methods used to develop a proper frame and to bring the plant into plucking vary : diverse views are held on this, and experiments have accordingly been undertaken. Our observations favour the methods that are least drastic as for instance — bending to promote branching, followed by cutting across 15 to 18 inches above the ground before the plants are tipped and brought into plucking. The removal of considerable shoot growth by low and frequent cuts is better avoided, at least until we have more information on this procedure.

In Ceylon, the traditional practice is to clean weed tea. Labour has been used for this purpose and scraping of the soil diligently done. Recent experiments undertaken by Waidyanatha (1966) at the TRI Low-Country Station, Ratnapura, have shown neither an increase in yield by weeding nor a depression in yield by allowing weeds to remain longer than usual. In a mixed population of seedling and clonal tea, receiving 100 lb nitrogen per acre per year in a fertilizer mixture, weeds left as long as six months did not affect yields, but with 200 lb nitrogen there was a decline in yield when weeds were left longer than four months. In these experiments, spraying Gramoxone at half pint per acre every two months was the most effective and cheapest way of controlling weeds, and estates have been quick to adopt this, thereby saving nearly half the cost of weeding by labour.

The emphasis placed by Tubbs (1933) on lung pruning in the low country has stood the test of time. Casualties still occur when pruning is done without leaving sufficient foliage on the bush. Our recent results favour lungs left at the periphery rather than at the centre of the bush. Tubbs' recommendation of rim-lung pruning in the low country, with adequate cleaning of dead wood, still remains, qualified only by his recent advice that it would be worthwhile to spend more money on pruning. The importance of pruning in wet weather, though obvious, needs emphasis. Recent investigations by Pethiyagoda & Nagarajah (1965) would no doubt throw more light on the problems of pruning.

Shade is still a controversial subject. The first results from recent low-country experiments are in favour of no shade, and this has already been put into practice at the TRI Low Country Station by removing shade over both seedling and clonal tea. The cost of shade and its maintenance has thereby been saved, and in addition we hope there would be an increase in yield.

I have drawn attention to economy in production, which is only one aspect in the theme of this conference, but I have said nothing on quality, which Wickremasinghe and Kirtisinghe are out to achieve. Towards this end, we are examining the increased costs of plucking five-day rounds in seedling tea to obtain a high standard of leaf. If this leads to better prices for our tea, it would be yet another step towards greater economy and quality even in low-country tea.

References

JOACHIM, A. W. R. (1961). Manurial trials in the low country. *Tea Q.* **35** : 61-69.

PETHIYAGODA, U. & NAGARAJAH, S. (1965). The influence of ' lungs ' on carbohydrate reserves and growth of shoots. *Tea Q.* **36** : 88-102.

TUBBS, F. R. (1933). Recovery from pruning. *Tea Q.* **6** : 11-24.

WAIDYANATHA, U. P. DE S. (1966). The chemical control of weeds in tea in the low country of Ceylon. M. Sc. Thesis, University of Ceylon.