

# ESTIMATIONS OF ORGANIC MATTER SUPPLIED BY REGULARLY PLUCKED TEA BUSHES

T. Visser

## 1. Introduction

It is common knowledge that the addition of organic material in the form of loppings, compost or manure helps to maintain and increase the fertility of the soil. However, it is not so often realised that the tea bush itself returns a considerable amount of organic matter which contributes to humus and nutrient conservation.

In the first place, pruning periodically returns sizeable amounts of material; Eden (1937), who determined the dry weight of foliage from prunings on six estates at different altitudes, found that the amount varied between 0.7 and 1.4 tons per acre.

Secondly, poor light conditions under the plucking table cause a continual and substantial leaf-fall throughout the cycle, but little information is available on this subject. It was thought useful, therefore, to estimate, from available data for different plucking methods, the contribution made by both prunings and fallen leaves towards the organic matter supply of a tea field.

## 2. Leaf abscission in relation to time after pruning

Figures obtained by Tubbs (1935) of the dry weights of flush harvested over nine successive periods of 63 days from tipping, and of the dry weights of maintenance foliage determined at the end of each period, give an indication of when leaf abscission commences. Since the flush was plucked to the single leaf, it is possible to calculate from the weight of flush (F) harvested in each period of 63 days, and from the average dry weight of a flush shoot (FW) [on the average 0.11 g. in the 1st and 0.09 g. in the 2nd year after pruning, according to Tubbs (1937)], how many single leaves would be added per period (F/FW). Likewise, from the total weight of the maintenance foliage (M) present at each time, and the average dry weight per leaf (MW) [on the average 0.175 g. according to Visser (1958)], the number of maintenance leaves actually present can be assessed (M/MW). The calculated data are given in Table 1.

TABLE 1.—*Calculated numbers of leaves present, and assessed numbers, on regularly-plucked tea bushes in relation to time after tipping (calculations from weights of flush and of foliage determined by Tubbs, 1935)*

1	2	3		4
Days after tipping	Single leaves added per period	Single leaves present		
		Calculated*	Assessed	
63	—	(500)	500	
126	220	720	940	
180	270	990	1310	
252	270	1260	1160	
315	310	1570	1490	
378	400	1970	1960	
441	410	2380	2290	
504	320	2700	2280	
567	420	3120	2540	

\*Column 3 shows the cumulative totals of Column 2, plus the initial 500 leaves.

It will be seen from Table 1, that the actual number of leaves present on the bush (Column 4) is initially greater—until after about six months from tipping—than was expected from calculation (Column 3). At this stage, probably, not all pluckable shoots were removed, as a regular plucking table had still to be formed. From between 378 and 441 days after tipping, the expected number exceeds the number of leaves actually present, indicating that leaf abscission became a substantial feature from that time, amounting to about 400 leaves in 63 days, rising to nearly 600 in the next 63 days.

If this leaf-drop had been maintained over a three-year pruning cycle (32 months plucking) each bush would have dropped 3,000 leaves which, on the basis of 3,000 bushes per acre and a leaf weight of 0.175 g. would be equivalent to 1.55 tons of dry organic matter per acre.

### 3. Organic matter supplied as foliage in a three and four-year pruning cycle up-country

The calculations below are based on the results of the 6th cycle of the old and the 1st cycle of the new fish-leaf plucking experiment carried out at St Coombs (Visser, 1960, 1960a).

#### 3.1. Single-leaf plucking, 3-year cycle

Bushes, continuously single-leaf plucked, carried at the time of clean pruning 1.21 tons of foliage which, on the basis of 3,000 bushes per acre, works out at 410 g. dry weight, or 2,340 leaves ( $410/0.175$ ) per bush.

According to figures given by Tubbs (1935) (see Table 1, Column 4), bushes that are plucked regularly carry the equivalent of 1490 leaves ten months after tipping.

In 110 rounds, the bushes produced 3,495 lb. made tea per acre which amounts to 19.2 g. fresh weight per bush per pluck. The average fresh weight per pluckable shoot was found to be 0.52 g. (Visser, 1960); thus, on the average 37 shoots were removed per round. Since each shoot was plucked to the single leaf, it means that, in the 80 rounds of the last two years,  $80 \times 37 = 2,960$  leaves were added per bush.

As the number of maintenance leaves present ten months from tipping was assumed to be 1,490, the calculated total number of leaves formed by the time of pruning would have amounted to  $2,960 + 1,490 = 4,450$  leaves. However, in fact, only 2,340 leaves were present, so that  $4,450 - 2,340 = 2,110$  leaves per bush must have dropped. This amounts to 1.09 tons dry organic matter per acre, to which must be added 0.35 tons from tippings and 1.21 tons foliage from prunings; hence the bushes yielded in total 2.65 tons dry organic matter per acre as foliage in a 3-year cycle.

#### 3.2. Perennial fish-leaf plucking, 3-year cycle

The foliage from continuously fish-leaf-plucked bushes remains, on account of the plucking system and the low abscission rate, more or less static (Eden, 1947; Visser, 1960). However, a certain number of leaves are likely to be added as, now and then, leaves form in or under the plucking table, whilst shoots are sometimes passed over in plucking. Some of the foliage drops in the course of the cycle, which might perhaps be of the order of one-fifth of that of single-leaf-plucked bushes, or 0.22 tons per acre. Also, 0.14 tons were returned in the form of tippings and 0.44 tons as foliage from prunings, and thus bushes plucked to the fish leaf provided 0.80 tons of dry organic matter per acre as foliage in three years, which is 70% less than was produced by single-leaf-plucked bushes.

### 3.3. Single-leaf plucking, 4-year cycle

The calculations in this instance were basically the same as those in paragraph 3.1, with respect to single-leaf plucking over a 3-year cycle, so that the result only is given here.

Leaves dropped were calculated to amount to 1.23 tons per acre, to which must be added 0.26 tons of tippings and 1.80 tons of foliage from prunings. Accordingly, single-leaf-plucked bushes are estimated to have supplied 3.29 tons of dry organic matter per acre as foliage in a 4-year cycle.

### 3.4. Limited fish-leaf plucking, 4-year cycle

In the field trial where fish-leaf plucking was preceded by ten months of normal plucking and succeeded by ten months of resting before pruning, it was found that the bushes carried at the end of the cycle 2.25 tons of foliage (25% more than single-leaf-plucked bushes, due to resting). During both the first period of normal plucking and also the succeeding period of fish-leaf plucking, the number of leaves dropped is likely to have been small. During the resting period, relatively more leaves may have dropped.

The total amount is estimated to have been one-fifth of that of single-leaf plucked bushes, or 0.25 tons. Inclusive of 0.25 tons of tippings, bushes plucked to the fish-leaf for part of a 4-year cycle produced 2.75 tons dry organic matter as foliage, which is 13% less than supplied by single-leaf-plucked bushes.

## 4. Organic matter supplied as foliage in a one-and-a-half year pruning cycle in the low-country

The data of a trial on Endane Estate near Ratnapura (Visser, 1960, 1960a) were taken as a basis for calculation.

### 4.1. Single-leaf plucking

At the time of pruning 0.61 tons of foliage per acre were supplied from prunings, which, assuming that a maintenance leaf weighs 0.2 g., is equivalent to 1,035 leaves per bush. As the yield over 67 rounds was 2,265 lb. of made tea, it can be calculated—on the assumption that the fresh weight of a pluckable shoot is 0.55 g.—that 2,280 new leaves were added per bush during the plucking stage, whilst it is estimated that 200 leaves were added before tipping. Accordingly,  $2,280 + 200 = 2,480$  leaves per bush dropped, which is equivalent to 0.85 tons organic matter per acre. In reality, at the end of the cycle the bushes carried more foliage than is shown by the figure determined from prunings, because they were rim-lung pruned at a height of 22"–24". This amount is estimated to have been one-third of that removed; it can be assumed, however, that this old foliage (0.20 tons) drops in the course of the cycle.

Therefore, inclusive of tippings (0.08 tons), the organic matter which became available as foliage amounted in total to  $0.61 + 0.85 + 0.20 + 0.08 = 1.74$  tons per acre in a 1½-year cycle.

### 4.2. Limited fish-leaf plucking

Bushes fish-leaf-plucked for the later half of the cycle carried 10% less foliage than normally plucked bushes at the time of pruning; the foliage amounted to 0.55 tons per acre or 930 leaves per bush. During the period of 28 plucks that the bushes were plucked to the single leaf, they yielded 950 lb. made tea, which equals 21.2 g. fresh weight, or 35 pluckable shoots, per bush per round. Accordingly, in addition to the estimated number of 200 leaves formed before tipping, another  $28 \times 35 = 980$  leaves were formed during the first half of the cycle. Again, on the assumption that the number of leaves left amounted to one-third of the number

removed at pruning, and that these (310) subsequently drop, the total number of leaves dropped would amount to  $980 + 200 + 310 = 1490$  leaves per bush or 0.34 tons per acre.

Including tippings (0.09 tons), bushes fish-leaf-plucked for half of a 1½-year cycle yielded  $0.55 + 0.34 + 0.09 = 0.98$  tons dry organic matter, which is 44% less than supplied by normally plucked bushes.

## 5. Summary and conclusions

The amount of dry organic matter in foliage returned to the soil from tea bushes varies with different plucking methods and with pruning cycles of different lengths. Data on natural leaf-fall were obtained by calculation and estimation; the other data on the foliage returned from tippings and prunings were obtained by direct weighing.

The results are summarised in Table 2, which also gives the amounts of made tea and of wood from prunings, determined as averages per year for the pruning cycles of different lengths.

TABLE 2.—*Estimated dry organic matter in terms of foliage and wood supplied by single-leaf and fish-leaf-plucked bushes expressed in tons per acre per year*

Treatment	Foliage	Made tea	Wood	Total
<i>Low-country, 1½-year cycle</i>				
Continuous single-leaf ...	1.16	0.67	0.81	2.64
Single-leaf/fish-leaf ...	0.65	0.77	0.74	2.16
<i>Up-country, 3-year cycle</i>				
Continuous single-leaf ...	0.88	0.52	1.05	2.45
Continuous fish-leaf ...	0.27	0.56	0.25	1.08
<i>Up-country, 4-year cycle</i>				
Continuous single-leaf ...	0.82	0.49	1.31	2.62
Single-leaf/fish-leaf ...	0.69	0.64	0.91	2.24

It will be seen from Table 2 that the top part of normally plucked bushes can supply approximately 2.5 tons of dry organic matter per acre per annum in total, of which about 2 tons are returned to the soil both in the low-country and in the up-country. The table also shows that about one-third of the organic matter of the foliage, and about one-quarter to one-fifth of the total organic matter (including wood) produced by single-leaf-plucked bushes is removed to produce made tea.

It appears further from Table 2 that limited fish-leaf plucking causes a loss of less than 20% of the total amount of organic matter produced by single-leaf-plucked bushes, which can be considered tolerable. Continuous fish-leaf plucking leads in the long run to a marked, and no doubt harmful, reduction in the supply of organic matter, amounting after the 6th cycle of fish-leaf plucking to 56% in comparison with the control.

The weight of foliage removed at the time of pruning was 50% higher in our case (in 1958) than was found by Eden (in 1936), i.e. 1.2 tons as against 0.8 tons. Probably, improved management and manuring over the past 20 years were responsible for this increase, as is indicated by the fact that the yield of the field sampled by us was about 40% higher than that of the field at St Coombs assessed by Eden.

On an estate near Ratnapura, we determined that the bushes carried 0.9 tons of foliage at the time of pruning; Eden found 1.4 tons of foliage on an estate in the same district, but in his case the bushes were rested prior to pruning which could account for the difference.

On average, it appears that the amount of organic matter removed for producing made tea is about one-quarter of the total produced by the foliage and wood of the tea bush.

### References

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