

FACTORS AFFECTING SHOOT PRODUCTION IN TEA (*CAMELLIA SINENSIS*) WHEN GROWN AS A PLANTATION CROP

1. SOME EFFECTS OF THE LENGTH OF PLUCKING ROUND ON FLUSH SHOOT PRODUCTION

G. B. Portsmouth

General Introduction.—The tea of commerce is a product made from the still tender apical portions of secondary and higher order shoots. Accordingly, many of the problems arising in connection with the cultivation of *Camellia sinensis* as a plantation crop necessitate an understanding of the factors affecting shoot production.

Previous work by Tubbs (1936, 1937) and Bond (1942, 1945) dealing with shoot production in commercially cultivated tea has all been based on observations made on very heterogeneous field material of seedling origin. In more recent years the development of vegetative propagation has permitted the use of uniform clonal material for such observations, thus greatly increasing their precision and reliability. It is accordingly the aim of the present series of papers to report the results of some of the observations on shoot production in the tea bush, as affected by normal cultivation and plucking practices, which have been made using the pure line clonal material now available on St. Coombs.

At this elevation (4,500 feet) the bushes are normally pruned every 3 or 4 years by cutting across the branches at a level of from 18 to 24 inches from the ground. As soon as the primary shoots have developed sufficiently they are broken back to a level, approximately two mature leaves above the pruning level, to form a plucking table. All secondary shoots formed above this second level constitute the "crop" shoots, which are normally plucked every 9 or 10 days according to a definite system.

Tea is a plant whose shoots exhibit the phenomenon of periodic growth (Bond 1942). This means that, while the majority of crop shoots are still in their first flush of active growth at the time of plucking, there are some shoots present in which growth has already temporarily ceased. The former will be designated "flush" shoots and the latter "banji" shoots, in accordance with local usage. For cropping purposes, flush shoots are normally considered ready for plucking as soon as there are three full leaves clear of the bud. Plucking is carried out by removing the top two or more open leaves and terminal bud, but always leaving one mature leaf below the point of plucking. Banji shoots are, however, always plucked as soon as active growth has ceased, provided one mature leaf can be left below the point of plucking.

Due to the length of plucking round, the crop harvested consists of a mixture of shoots comprising bud plus 2 leaves, bud plus 3 leaves, bud plus 4 leaves etc., the relative proportions depending on the rate of growth prevailing during the plucking interval.

As a consequence of one mature leaf being left on the bush when each crop shoot is plucked, the height of the plucking table gradually rises as the pruning cycle progresses until, by the time the next prune is due, it may be as much as 3 or even 4 feet from the ground.

Crop, as harvested, consists of a mixture of both flush and banji shoots. In the case of flush shoots the effects of external factors are not complicated by the variations

in shoot size which are introduced by the changes in terminal bud activity which accompany the onset of the banji state. Accordingly, in this and the following paper, attention will be concentrated on the changes occurring in actively growing flush shoots, as being more readily susceptible to accurate analysis.

Experimental.—For the present series of observations use was made of a small area of T.R.I. Clone No. 4, planted in 1940, at a spacing of $3\frac{1}{2}' \times 3'$. This area had been last pruned at 18" from ground level on 5-2-48 so that the bushes were just over 13 months from pruning when recording was started on 14-3-49.

The experiment comprised a total of some 80 bushes, divided into 4 blocks, each containing 10 pairs of bushes. One bush of each pair was plucked at 7 day intervals throughout and the other at 14 day intervals. There was thus a total of 40 bushes plucked weekly and 40 bushes plucked fortnightly.

At each plucking the flush shoots from each treatment were collected separately by blocks and brought at once into the laboratory. Here they were sorted out into groups consisting of shoots made up of bud plus 2 leaves, bud plus 3 leaves, bud plus 4 leaves, etc., counted, weighed and recorded. Material consisting of a bud and more than two leaves was then reduced to bud plus 2 leaves and again weighed and recorded. All banji shoots were also plucked but were not recorded. Recording was concluded on 13-11-50.

The experimental area was manured in accordance with normal estate practice in July 1948, May 1949 and June 1950.

Results.—(a) **COMPOSITION OF CROP HARVESTED.**—The main effects of the different lengths of plucking round were found in the changes produced in the proportions of the various shoots comprising the crop harvested, in their respective individual weights and in the total number of each type of shoot harvested.

Figures showing the average composition of the crop harvested for the first full year of plucking, reduced to a single bush basis, are given in Table 1.

Table 1. *Composition of crop harvested per bush from 14-3-49 to 6-3-50.*

PLUCKING PERIOD	WEEKLY				FORTNIGHTLY				
	*B+2	B+3	B+4	Total	B+2	B+3	B+4	B+5	Total
Total number of plucks ...	—	—	—	52	—	—	—	—	26
Total number of shoots ...	434.1	136.4	1.5	572.0	196.0	150.7	20.0	0.1	366.8
Percentage composition by number ...	75.9	23.8	0.3	100.0	53.4	41.1	5.5	—	100.0
Total fresh weight of shoots (gm) ...	185.0	95.2	1.9	282.1	86.0	128.1	28.9	0.2	243.2
Percentage composition by weight ...	65.6	33.8	0.6	100.0	35.4	52.7	11.9	—	100.0
Mean fresh weight of each shoot (gm) ...	0.43	0.70	1.23	0.49	0.44	0.85	1.44	2.18	0.66
Mean number per pluck ...	8.35	2.62	0.03	11.00	7.54	5.79	0.77	—	14.10
Mean number per week ...	—	—	—	11.00	—	—	—	—	7.05

* Note—In the column headings of this table B + 2 stands for a bud plus 2 leaf shoot, etc. etc.

It will be seen that the main effects of increasing the length of the plucking round from a week to a fortnight were:—

(1) A decrease in the total number of shoots harvested per bush from 572.0 to 366.8 or by 35.9 per cent. This represented a reduction in the weekly rate of new flush production from 11.00 to 7.05 shoots per bush.

(2) An increase in the proportion of shoots with more than 2 leaves. This was equivalent to a reduction in the percentage of the desired bud plus 2 leaf shoots from 75.9 per cent to 53.4 per cent.

(3) An increase in the weight of each individual shoot harvested from a mean value of 0.49 gm. to a mean value of 0.66 gm. or by 25.8 per cent. This increase was negligible in the case of the desired bud plus 2 leaf shoot, but increased markedly with each increase in the leaf number of the shoot harvested.

Contrary to expectation, the increase in individual shoot weight, resulting from the longer round, was entirely insufficient to make up for the reduction in the total number of shoots harvested. As a consequence there was a net decrease in the weight of the total crop harvested from 282.1 gm. to 243.2 gm. or some 13.8 per cent.

(b) **QUALITY OF CROP HARVESTED.**—The quality of the tea that can be made from the crop harvested at any given plucking depends to a large extent upon its composition, in terms of bud plus 2 leaves, bud plus 3 leaves, etc. In this connection it is generally accepted that the best quality tea will be made if only the tenderest shoots, consisting of bud plus 2 leaves, are accepted for manufacture. If this standard of "fine plucking" is adopted for a comparison of the effects of weekly and fortnightly plucking rounds, then it is necessary for all shoots harvested to be reduced by "breaking back" to bud plus 2 leaf shoots and the basal harder portions discarded before final yields of crop suitable for quality manufacture are recorded.

An analysis of the crop produced per bush, reduced to shoots of bud plus 2 leaves only, over the period 14-3-49 to 6-3-50 is given in Table 2.

Table 2. *Analysis of crop produced per bush as Bud + 2 leaf shoots only.*

PLUCKING PERIOD	WEEKLY		FORTNIGHTLY	
	Weight (gm.)	Percentage	Weight (gm.)	Percentage
Bud plus 2 leaves	185.0	65.6	86.0	35.4
Bud plus 3 leaves	95.2	34.4	128.1	64.6
Bud plus 4 leaves	1.9		28.9	
Bud plus 5 leaves	—		0.2	
Total weight plucked	282.1		100.0	
Weight discarded	48.1	17.1	84.8	34.9
Total crop as Bud plus 2 leaf shoots	234.0	82.9	158.4	65.1

This analysis shows that only 35.4 per cent of the fortnightly plucked shoots consisted of bud plus 2 leaf shoots, immediately acceptable for manufacture, as compared with 65.6 per cent in the case of the weekly plucked shoots. The large increase in the proportion of older shoots in the flush plucked fortnightly meant that much more "breaking back" had to be carried out on this material. As a consequence some 34.9 per cent by weight of the material plucked fortnightly had to be discarded as compared with only 17.1 per cent of the weekly plucked material. Thus, if a "fine plucking" standard was accepted, rather more than twice the amount of material had to be discarded from the fortnightly pluckings than from the weekly pluckings.

It can, therefore, be postulated that if the whole of the crop, as plucked, was accepted for manufacture, that from fortnightly plucked bushes would produce a much poorer quality tea than that from weekly plucked bushes.

In addition to the loss of quality brought about by an increase in the length of plucking round reference may again be made to the actual loss of crop which has been recorded from this cause. When the whole of the crop, as plucked, was accepted for manufacture, this amounted to 38.9 gms. per bush, or 13.8 per cent of the total of 282.1 gms. produced by weekly plucking. If, however, a "fine plucking" standard was introduced the loss rose to 75.6 gms. per bush, which was 32.3 per cent of the 234.0 gms. of crop accepted for manufacture from the weekly plucking. This increase in the percentage loss of crop affords yet another measure of the loss of quality produced by an increase in the length of plucking round.

Discussion and Conclusions.—From the commercial standpoint it is obviously desirable for the planter to aim at producing the largest crop possible while still maintaining a high standard of quality. It is clear that above a certain optimal time interval the quality of the crop harvested must decrease with any increase in the length of the plucking round.

The experiment afforded no evidence as to the length of this optimal time interval, but from another experiment, reported later in this series (Portsmouth and Rajiah 1957), it is known that, at this elevation, the average time interval between the unfolding of each new flush shoot leaf is approximately 9 days. This time interval corresponds exactly with the 9 day plucking round which has been adopted by most planters on estates at this elevation. It would appear that this is no chance coincidence, since it seems reasonable to suppose that a plucking round based on the time interval between the unfolding of successive shoot leaves would permit of the greatest possible weight of the desired bud plus 2 leaf shoots being harvested. Plucking intervals in excess of 9 days will, as has been demonstrated, undoubtedly produce crops containing an increased proportion of the coarser shoots with more than 2 leaves and so give poorer quality teas.

Under the conditions of this experiment, *i.e.* with a rigidly controlled method of plucking, it has been shown that weekly plucking produced a considerably greater yield of crop in the form of flush shoots. However it is premature to draw any practical conclusion from this finding for the following reasons:—

(1) No information is presented regarding the changes in the proportion of banji shoots produced by changes in the length of the plucking round. In normal estate plucking banji shoots may constitute an appreciable proportion of the crop harvested.

(2) Estate plucking practice is not generally so closely controlled as was the present experiment. As a consequence psychological factors may lead to pluckers harvesting an undue proportion of the crop from those bushes displaying the largest

numbers of shoots ready for plucking, or to them avoiding entirely those bushes with a large proportion of banji shoots.

Information is, however, being collected in connection with banji shoot production and will it is hoped be presented in a later paper of this series.

Summary.—An experiment is described in which uniform bushes of T.R.I. Clone No. 4 were plucked to a predetermined standard, at weekly and fortnightly intervals, for some 21 months and the different types of flush shoots regularly harvested, recorded and weighed.

Increasing the length of the plucking interval from a week to a fortnight resulted in:—

- (1) A decrease in the total number of flush shoots harvested per bush.
- (2) An increase in the proportion of shoots with more than 2 leaves.
- (3) An increase in the mean weight of each individual shoot harvested.
- (4) A decrease in the manufacturing quality of the crop harvested.

The increase in the mean weight of the individual shoots harvested was not, however, sufficient to counter-balance the reduction in the total number of shoots harvested and there was thus a net loss of crop with the longer plucking interval.

References

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