OBSERVATIONS ON BARK THICKNESS AND RENEWAL IN MALAYAN BUDDINGS.

By

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Introduction.

One of the commonest objections advanced against budding is that budded trees may not be able to provide bark adequate for tapping nor to renew bark tapped. The foundation for this fear is not easy to discover. The few references to bark character that can be found in the literature of budding are scarcely likely to prejudice the minds of readers against the practice.

Previous References.

The only contributor who has much to say on the subject is Heusser, who, in his first paper on the experimental tapping of Hevea buddings (3. p. 66), says "As far as I can judge from observations made so far, bark renewal leaves nothing to be desired. It is however not impossible that in the course of time it will turn out to be less good than in the case of strongly growing seedlings, and that budded trees will have to be allowed a longer period for bark renewal than trees grown from seed". In a second paper (4, p. 692) he says "Generally speaking this (bark renewal) seems to be a little less vigorous than that of strongly growing seedlings which are tapped for the first time. This is not so with clone AVROS 50, however; the bark renewal of this clone is as good as that of seedlings. The oldest renewed bark, now two years old, has an adequate thickness and the panels are beautifully arched and without edges or holes, as is sometimes seen when bark renewal is bad". Of the other AVROS clones under discussion, he describes clones 80, 52 and 36 as giving no cause for anxiety, and clone 33, standing on a clay soil, as giving the impression that it renews its bark more slowly. In a later paper (5) he refers to bark thickness in four clones: clone AVROS 80, referred to in the second paper as giving no cause for anxiety, is now good, having renewed about 6 mm. in 16 months. Of the other three, which are not referred to previously, clone AVROS 51 had thick bark and good renewal; in clones AVROS 71 and 152 the renewed bark when 16 months old was 6—7 mm. thick while the normal thickness of primary bark was 8 mm.

Heusser speaks only of the "possibility" of poor renewal in the future, and his later work proves that this possibility was realised in only one clone which gave the impression of renewing slowly. Further he implies that bark thickness and renewal are clone characters, not general characteristics of buddings.

Another reference to the subject comes from Java, for Gunst (1, p. 888) states that after 2½ years the renewed bark of the Bodjong Datar buddings was slightly better than that of seedlings of the same age.

Special Features of the Bark of Buddings.

Normally the bark of seedlings and buddings differs considerably in the amount of cork present. Cork consists only of dead cells and cannot therefore directly affect the productivity of a tree but its presence or absence does affect to some extent the tapping of the tree. Where there is plenty of cork, as in most seedlings, the tapper has room to rest the whole cutting edge of his knife upon the bark; whereas if but little cork is developed, as is usual with buddings, he can obtain support for only a portion of the cutting edge. Where much cork is present, a lip will be left on the outside of the cut which will tend to prevent latex spilling over the edge.

Although it is not uncommon for seedlings to have little cork, with buddings it is the rule, and it is owing to this scarcity of cork that the tapping of buddings requires a little extra skill.

Experiment on Pilmoor Estate.

With a view to obtaining information on bark thickness and the amount and rate of renewal in budded trees, measurements were made on some of those in tapping on Pilmoor Estate. These were budded in the first half of 1924 and transplanted as stumps at the end of 1924. They are mentioned on page 42 of the Annual Report 1928. Tapping was alternate daily in alternate months and the cut was spiral over half the girth. Tapping started in January 1928.

After a preliminary trial, complete records of bark thickness were taken on 23/28 July 1928 and again on 14/18 January 1929. On both occasions sets of 3 readings were taken from each tree, one set from each strip left after each month's tapping, one set in the virgin bark half an inch above the opening cut and a similar set half an inch below the most recent cut. As there were four monthly strips on the first occasion and six on the second, six and eight sets of readings respectively were taken from each

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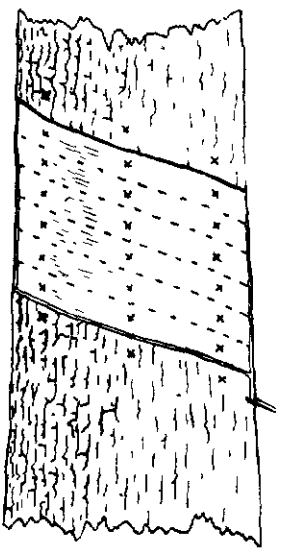
tree. The three readings of a set were taken, one at about one inch from each end of the strip and one in the middle. These readings were close to each of the three monthly tar marks. Vertically the readings were taken near the lower edges of the tar marks; as tapping started each time about the 12th day of the month and went on for one calendar month, the lower edge of a tar mark came almost at the middle of each tapping period. The crosses on the text figure below indicate the spots at which readings were taken.



The instrument used for these measurements was a Chesterman's Engineer's Depth gauge with a sharpened tongue readings to one tenth of a millimetre were easily visible. This is the most suitable instrument yet met with for bark measurements of buddings and young seedlings. All instruments of this kind must penetrate the cambium and pass right to the wood, thus including in their register tissues that should, normally, not be touched by the tapper. This particular instrument has the further advantage that it leaves only a very small wound.

Fifty eight trees from four clones were tapped regularly throughout the period and from all these trees measurements were obtained as described above. The first records were taken while the trees were actually in tapping; it was noticeable that when readings fell as low as 0·5/0·6 mm. the bark looked greenish and tender, as though tapping had been as close to the cambium as was practicable without damaging it: a tapper is therefore allowing himself a safe margin if he never goes below 0·8 mm. from the wood.

TABLE OF BARK THICKNESS IN MM.

Clone.	Date of Recording.	Above Panel.	Tapped 1. Feb.	Tapped 1. Apr.	Tapped 1. June.	Tapped 20. July. 1. Aug.	Tapped 1. Oct.	Tapped 1. Dec.	Below Panel.
A 44	July 1928	5·8	4·4	3·9	3·1	1·2			5·5
	Jan. 1929	6·9	5·5	5·2	4·7	4·3	4·1	3·5	6·5
B 50	July 1928	5·1	4·2	3·7	2·8	1·1			4·7
	Jan. 1929	5·8	5·0	4·6	4·2	4·1	3·9	3·2	5·8
B 58	July 1928	5·7	4·5	4·1	3·2	1·0			5·5
	Jan. 1929	6·1	5·0	4·7	4·6	4·4	4·2	3·2	6·2
B 84	July 1928	7·0	5·2	4·7	3·8	1·3			6·7
	Jan. 1929	7·7	6·3	5·9	5·5	5·1	5·2	4·0	7·5
Average of Above	July 1928	6·0	4·6	4·1	3·2	1·2			5·6
	Jan. 1929	6·7	5·5	5·1	4·8	4·5	4·3	3·5	6·5
	Increase.	0·7	0·9	1·0	1·6	3·3	...	...	0·9
	Percentage Renewal.	...	77 82	69 77	54 71	67	65	52	...

Results.

The table opposite shows the average thickness at the two dates of recording for each strip of each clone and also of all the trees together. It will be noticed that individual clones maintained much the same position relative to the general average of bark thickness at both dates of measurement. Clone B 84 is in each case well above the average; clone A 44 is close to it; clone B 50 is consistently the worst.

Figures 1 and 2 have been compiled from the table. They represent the position at each of the dates of recording—the first date on the left page, the second date on the right. The figures for the best clone (B 84), the average, and the worst clone (B 50) are represented graphically in the right column: the black line shows the thickness of the worst clone, the shaded line that of the average, the white line that of the best clone. In the left column is given a sketch of a radial section of a typical panel to show the renewed bark and to indicate how the figures were obtained.

If Figures 1 and 2 be compared strip for strip, the amount can be found by which each strip has increased in thickness between the two dates of recording, as shown in Figure 3. The two strips tapped last (Oct. 1 and Dec. 1) had had only a portion of the full period for renewal: in both of these renewal has been reckoned as starting at 0·8 mm. from the wood, which allows the tapper his margin of cambium and a few cells outside it.

Figure 3 gives the impression that renewal was rapid immediately after tapping but slowed down considerably after the first few months. To verify this the amount of measured increase between 23/28 July 1928, or the date of tapping, if later, and 14/18 January 1929 was worked out for each strip on a time unit basis; the unit chosen was one week. Figure 4 shows graphically this average weekly increase for each strip. It demonstrates quite clearly that renewal was very rapid at first but slowed down later until, some six months after tapping, its apparent progress was very little faster than the normal progress of virgin bark. At this stage the renewed bark had become as hard to penetrate as virgin bark.

Percentage Renewal.

The figures for percentage renewal, as given in the table, appear very high. In this connection the following points should be borne in mind. Firstly, as has been pointed out above, the rate of renewal, rapid at first, slowed down as soon as the delicate cambium cells were well protected. Secondly the percen-

tage has been reckoned on the figures as they stand, although the first 10 to 15 per cent. is made up of cambium cells and "tapper's margin" which should not have been tapped. Thirdly the trees were still very young and active. Fourthly these figures represent the result of purely quantitative investigation and give no information on the quality of the bark: the newly formed tissues are as yet not necessarily fully organised and able to yield a normal quantity of latex.

Variability.

In all strips the variation of the three readings of the various sets is very striking and erratic. Readings along one strip vary from each other as a rule by between 0·4 and 0·7 mm. Differences of this order would scarcely call for comment but differences as great as 1·5 mm. and even 2·0 mm. between adjacent readings of one strip occur sufficiently often to require consideration, although they tend to become smoothed out in a table or diagram based on averages.

Differences in hardness of bark, flakes of cork, unevenness of pressure in inserting the instrument, vagaries of the tapper and so on would all cause variations, but hardly to the extent noticeable. Frequently no unevenness is apparent to the recorder. To examine these extreme figures more closely, during the second period of recording readings were taken from some trees at closer intervals along the strips, in one case as close as half an inch apart. The results found from tree 114 (clone A 44) illustrate clearly the kind of variation sometimes encountered. Seven readings were taken from each strip, the readings being about one inch apart; the results obtained have been plotted in the order in which they occurred and are given graphically in Figure 5. It will be noticed that unevenness is not confined to renewed bark but is equally striking in virgin bark.

In his microscopic examination of virgin bark, Haigh (2) took three samples from each tree, all at the same height. He found variation in all ways to be sufficiently great to eliminate almost entirely the personal error. He mentions three trees in each of which the three plugs, taken at the same height, were very variable. The tree showing the greatest divergence gave readings of 16, 15 and 6 mm., which are in the ratio of 2·7 : 2·5 : 1·0; he gives no other instance of a ratio higher than 2 : 1. In the case under review no divergence reached a ratio as high as 2 : 1. From his experience Haigh considers that the precaution of taking 3 samples per tree has been fully justified.

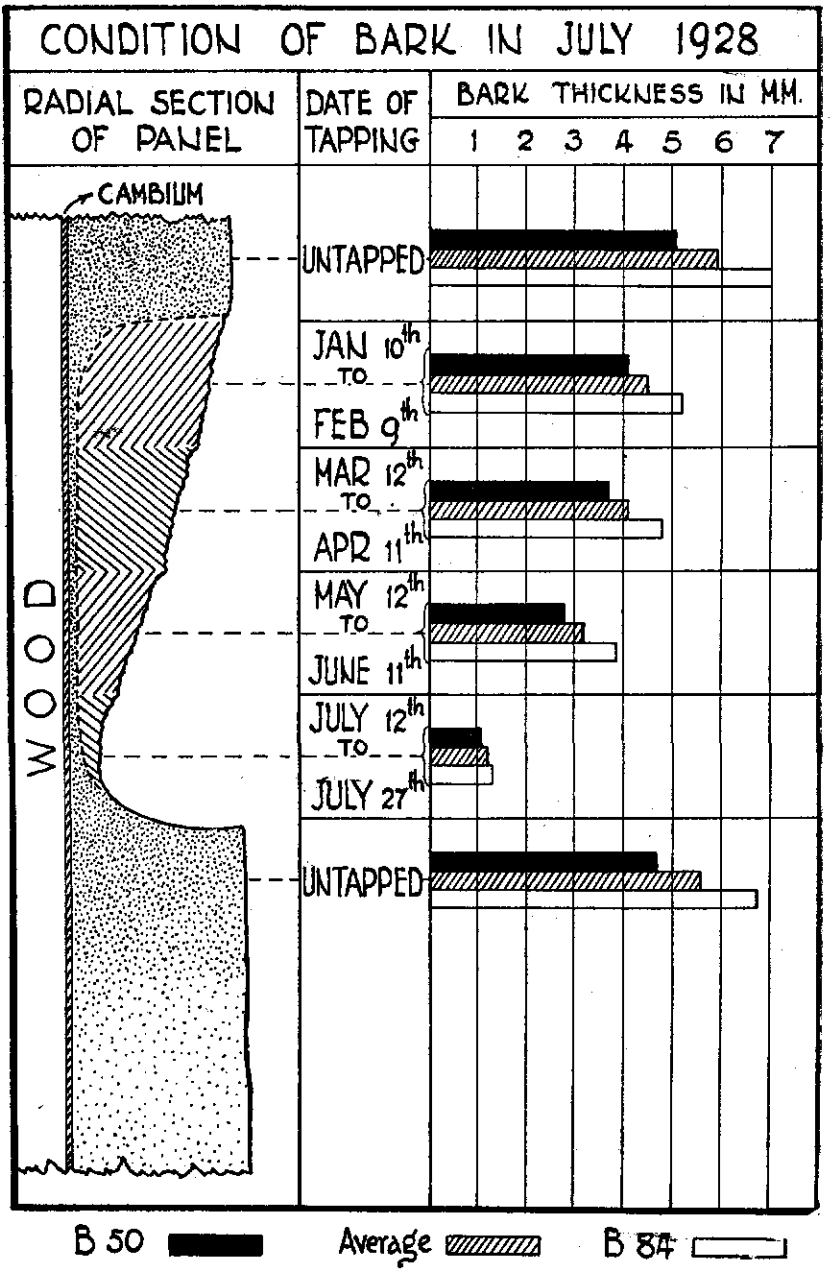

CONDITION OF BARK IN JULY 1928
RADIAL SECTION OF PANEL
DATE OF TAPPING
BARK THICKNESS IN MM.
1 2 3 4 5 6 7
CAMBIUM
WOOD
UNTAPPED
JAN 10th TO FEB 9th
MAR 12th TO APR 11th
MAY 12th TO JUNE 11th
JULY 12th TO JULY 27th
UNTAPPED
B 50
Average
B 84

FIGURE I.

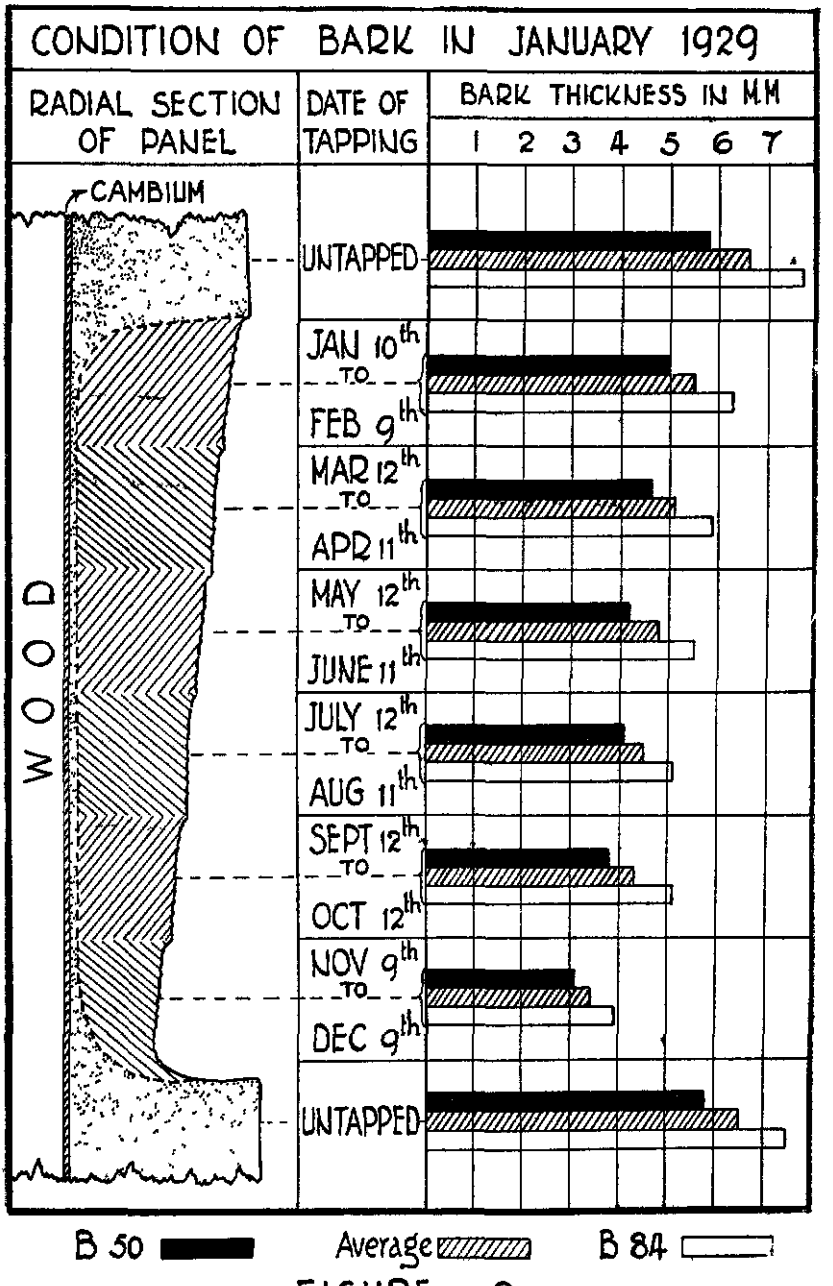

CONDITION OF BARK IN JANUARY 1929
RADIAL SECTION OF PANEL
DATE OF TAPPING
BARK THICKNESS IN MM
1 2 3 4 5 6 7
CAMBIUM
WOOD
UNTAPPED
JAN 10th TO FEB 9th
MAR 12th TO APR 11th
MAY 12th TO JUNE 11th
JULY 12th TO AUG 11th
SEPT 12th TO OCT 12th
NOV 9th TO DEC 9th
UNTAPPED
B 50
Average
B 84

FIGURE 2.

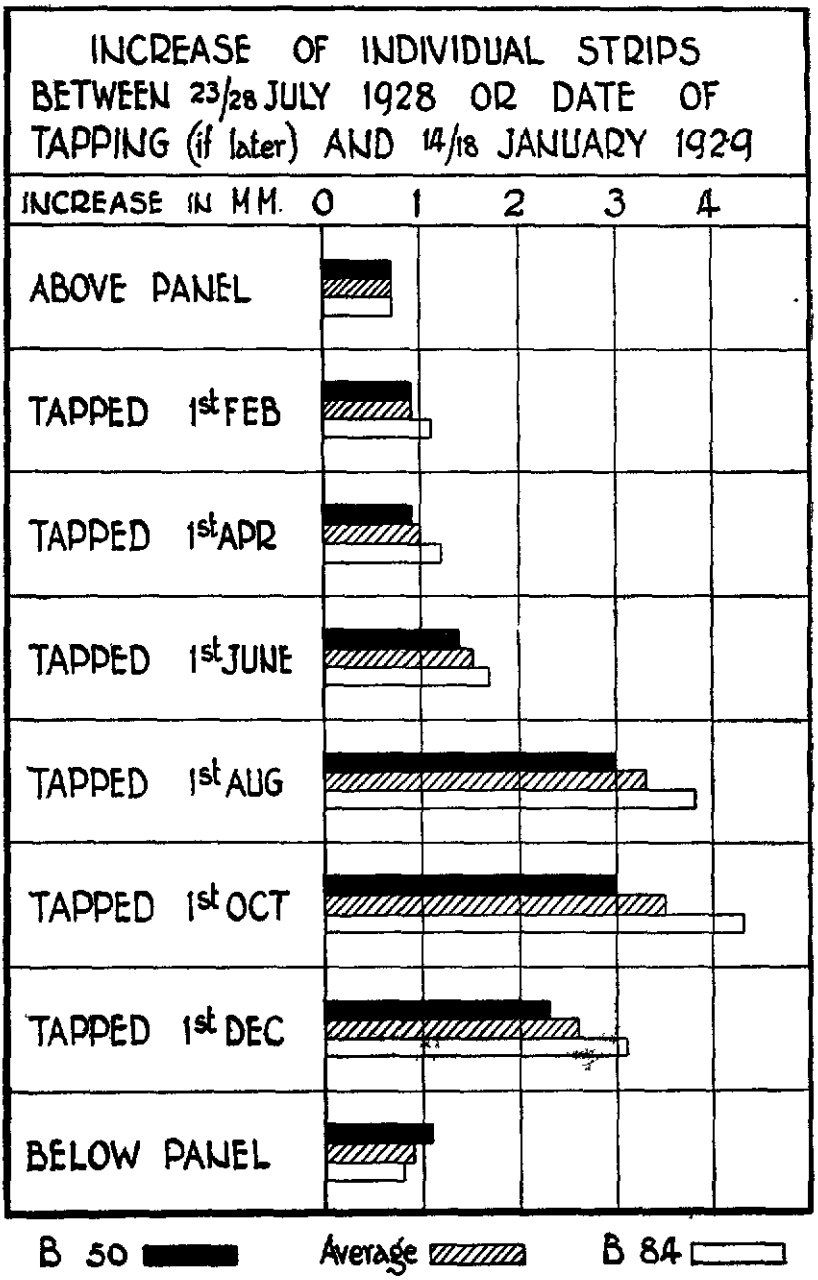

INCREASE OF INDIVIDUAL STRIPS
BETWEEN 23/28 JULY 1928 OR DATE OF
TAPPING (if later) AND 14/18 JANUARY 1929
INCREASE IN MM.
0
1
2
3
4
ABOVE PANEL
TAPPED 1st FEB
TAPPED 1st APR
TAPPED 1st JUNE
TAPPED 1st AUG
TAPPED 1st OCT
TAPPED 1st DEC
BELOW PANEL
B 50
Average
B 84

FIGURE 3.

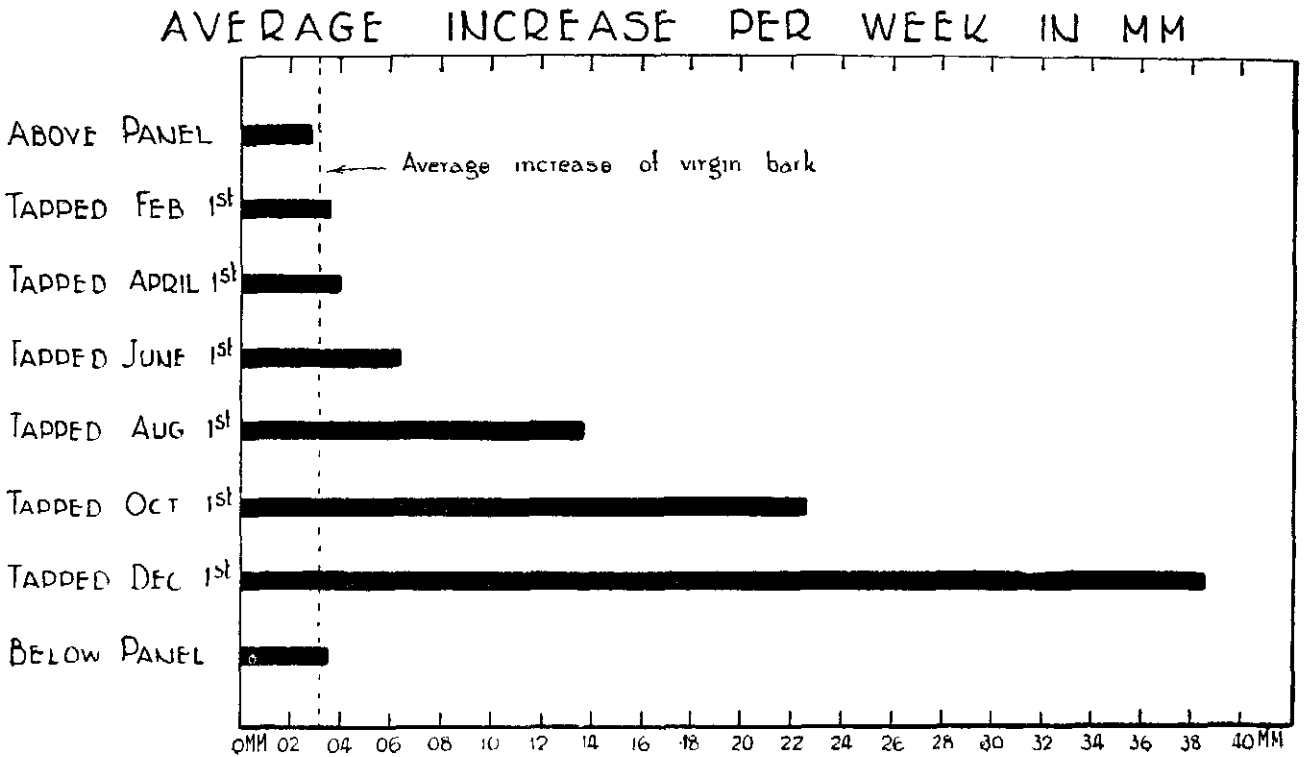

AVERAGE INCREASE PER WEEK IN MM
ABOVE PANEL
TAPPED FEB 1st
TAPPED APRIL 1st
TAPPED JUNE 1st
TAPPED AUG 1st
TAPPED OCT 1st
TAPPED DEC 1st
BELOW PANEL
Average increase of virgin bark
0MM 02 04 06 08 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40MM

FIGURE 4.

VARIATIONS IN BARK THICKNESS IN A SINGLE TREE: A 44/114.

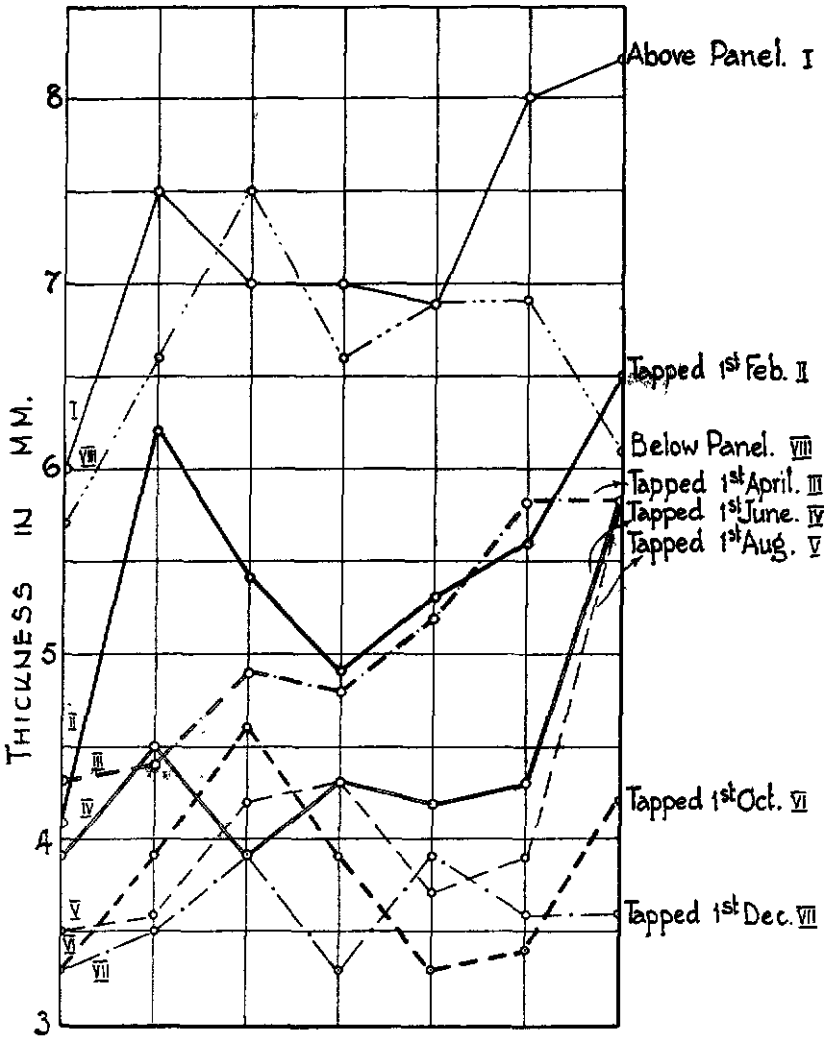


FIGURE 5.

Although in subsequent measurements in another area the present writer found much less divergence, yet he also considers that three readings are necessary to get a fair average.

Another point of interest appeared in one clone only, clone B 58. In eleven sets of readings the average of the set was no greater in January 1929 than it had been from much the same spots in July 1928; one such set appeared in the strip tapped March/April, three sets in the strip first tapped (January/February) and seven in virgin bark: no case occurred in the more recently tapped strips where renewal was still rapid. Seven of the eleven sets referred to appeared in two trees. In spite of this the average thickness for this clone, of which 13 trees were measured, still remains at least as high as the averages of clone B 50.

Conclusions.

Measurements carried out on the virgin and renewed bark of young budded trees of four clones have demonstrated that the bark *is adequate for tapping and that renewal is satisfactory so far.*

REFERENCES

(1) Gunst, H.J.V. (1928). Oculaties in de Praktijk. De Bergcultures, **2**, No. 30, 886-897.

(2) Haigh, J.C. (1928). Report on a bark examination of Peradeniya and Henerategoda Rubber Trees. Annals of Royal Botanic Gardens, Peradeniya, **11**, Pt. 1, 63-99.

(3) Heusser, C. (1924). Proeftappingen bij Hevea-oculaties I. Archief voor de Rubbercultuur, **8**, 25-70.

(4) Heusser, C. (1925). Proeftappingen bij Hevea-oculaties II. Ibid **9**, 679-693.

(5) Holder, H.J.V.S. and Heusser, C. (1928). Proeftappingen bij Hevea oculaties en Zaailingen op de Onderneming Boekit Maradja. Ibid, **12**, 25-49.