NOTES UPON THE REJUVENATING OF OLD RUBBER PLANTATIONS

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IT is not proposed here to go into the merits or demerits of budded rubber although its potentialities cannot be overlooked.

The Dutch by scientific research have greatly increased the yields of both Cinchona and Sugar and it is more than likely they will do the same with rubber. Although at the present time there appear to be no authentic figures giving the yields of budded rubber from any appreciable acreage, we have it on the authority of Dr. Cramer, who is one of the greatest authorities on rubber in the world today, that $2\frac{1}{2}$ times the yield obtained from ordinary unbudded rubber can be reasonably expected. We also know that the Dunlop Company—whose Chairman has one of the best business brains in the world—is opening up thousands of acres in budded rubber in the Malay States.

Although it appears to be very difficult to obtain accurate figures as to the acreage and yield of *Native Rubber in Java and Sumatra* the potential production from this source is probably enormous.

During the restriction years 1922-1927 the Dutch were going full out for crop—making enormous profits and they undoubtedly thought that rubber was the finest money-making proposition in the world, and hundreds of thousands of acres must have been planted up with rubber during that fatal period.

We have it on the authority of Sir Cecil Clementi, the Governor of the Straits Settlements, who visited those countries a few years ago that the potential production from this source was 450,000 tons !

There is no doubt that with no overhead charges native rubber can be produced very cheaply, and if we are to compete with such we must try to increase our yields, and the best way of doing this appears to be to plant budded rubber.

I would hesitate to advise rejuvenating on estates giving their 600-700 lb. or more per acre, as with annual or biennial manuring increased yields could be reasonably expected—at any rate in Ceylon. However, these yields are exceptional. For estates giving their 300-400 lb. per acre—and for poor areas on good estates—and on most estates a few poor areas are to be found—it is to be commended. Unless something is done to increase the yields such estates appear to be doomed.

At the present time with labour much cheaper than it has ever been before (a few years ago Sinhalese were paid anything from -/50 to Re. 1/- per day for new clearing work, whereas now they are willing to work for -/40,) rejuvenating can be done just about half as cheaply as in normal times.

For an estate of 1,000 acres yielding 500 lb. per acre, I would suggest the following programme, by which the yields could be increased by more than half.

(1) Keep as a permanent stand 600 acres of the best rubber and manure annually or biennially.

(2) Rejuvenate 400 acres at the rate of 50 acres a year.

By this programme an eventual yield of 860,000 lb. could be reasonably expected:

600 acres at	600 lb.	per acre	= 360,000 lb.
400 ,, ,,	1,250 ,,	,, ,,	= 500,000 ,,
			860,000 lb.

I estimate an acre of rejuvenated rubber can be brought into bearing in its 7th year for Rs. 350/- an acre:

Opening	Rs.	155·00
1st year	,,	47·50
2nd ,, ...	,,	32·50
3rd ,, ...	,,	30·00
4th ,, ...	,,	30·00
5th ,, ...	,,	27·50
6th ,, ...	,,	27·50
	Rs.	350·00

Details on page 152

The programme can be regulated according to the funds available but it is essential to lay down a policy and stick to it.

Clones.—First of all it will have to be decided what clones to plant and budwood or budded stumps purchased. There are many proved clones available at cheap rates and 10 to 15 buds

per yard of budwood can be expected. Some proved Ceylon clones should shortly be available.

The following is a list of the foreign clones with the yields claimed for them, but I cannot vouch for their authenticity.

For the purpose of comparing the yields of various clones it is best to study Table A, which gives the dry lb. per tree per year at the different ages of the respective clones.

(1) *Tjirandji 1. Clones.*

The highest yield yet recorded is 35 lb. per tree per year by clone Tjirandji I in its 11th year.

The record to date is: 9th year = 20·67 lb. per tree.
10th ,, = 27·5 ,, ,, ,,
11th ,, = 35·0 ,, ,, ,,

Tjirandji 16 would appear to be the next best with a record of 9th year = 23·9 lb. per tree
10th ,, = 23·8 ,, ,, ,,
11th ,, = 20·2 ,, ,, ,,

Tjirandji 8 is poor in comparison with its sister clones, the yield only being 9th year = 14·03 lb. per tree
10th ,, = 16·3 ,, ,, ,,
11th ,, = 17·6 ,, ,, ,,

Although poor in comparison with Tjirandji 16 it should not be discarded as its yields compare most favourably with the Avros and Bodjong Datar clones.

(2) *Bodjong Datar Clones.*

The best of these is B.D. 5 which has a fine progressive record 10th year = 18·5 lb. per tree per year
11th ,, = 25·3 ,, ,, ,, ,, ,,
12th ,, = 26·0 ,, ,, ,, ,, ,,
13th ,, = 26·6 ,, ,, ,, ,, ,,

This clone, however, does not appear to be particularly suited to Ceylon owing to its susceptibility to Palmivora.

B. D. 2 and 10 both have good yields, but unfortunately both fell off in the 4th year of tapping. It will be interesting to see whether in the 1931 yields further progress is recorded.

	B. D. 2	B. D. 10	
10th year	15·4	16·7	lb. per tree
11th ,,	17·4	18·9	,, ,, ,,
12th ,,	18·0	20·0	,, ,, ,,
13th ,,	12·5	17·8	,, ,, ,,

(3) *Avros Clones.*

Although the Avros clones do not come up to the standard of the Tjirandji and Bodjong Datar Clones they are possibly more reliable as it appears that the yields of a greater number of Avros trees have been recorded in comparison with the other two.

A study of the Avros Yields in Table A. is interesting.

Avros 256 would appear to be the best yielder in the 7th and 8th year, the only 2 years recorded in respect of this clone.

Avros 80, although not exceptionally high has a fine progressive yield over 7 years.

5th	year	4·10	lb.	per	tree	per year
6th	,,	5·10	,,	,,	,,	,, ,,
7th	,,	7·45	,,	,,	,,	,, ,,
8th	,,	9·04	,,	,,	,,	,, ,,
9th	,,	9·80	,,	,,	,,	,, ,,
10th	,,	12·55	,,	,,	,,	,, ,,
11th	,,	13·40	,,	,,	,,	,, ,,

Avros 49 and 50 also show steady progress over 7 years' tapping, with the exception of a slight setback in the Avros 50 in the 8th year yields.

Avros 71 and 152, although only tapped for 4 years show steady progress and high yields.

In the following Table the yields at different ages are compared.

TABLE A

The Yields are in Dry lb. per tree per Year

YIELDS

Clone		Date Budded	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year	11th year	12th year	13th year
Avros	33	1920	—	1·94	3·95	8·40	9·74	10·05	11·20	14·04	—	—	—
	36	1921	1·47	3·53	7·10	8·15	11·72	14·60	14·35	—	—	—	—
	49	1919	—	—	1·45	3·51	7·43	11·45	12·60	12·15	15·40	—	—
	50	1920	—	2·15	5·17	10·65	11·99	10·40	10·99	14·21	—	—	—
	52	1919	—	—	3·1	4·11	6·70	8·25	6·91	10·41	11·71	—	—
	80	1919	—	—	4·10	5·10	7·45	9·04	9·80	12·55	13·40	—	—
	51	1922	—	—	·95	2·57	4·65	6·81	—	—	—	—	—
	53	1922	—	—	—	—	7·13	8·83	—	—	—	—	—
	65	1922	—	—	2·36	2·94	5·60	6·86	—	—	—	—	—
	71	1922	—	—	2·76	4·57	7·66	11·00	—	—	—	—	—
	152	1922	—	—	3·41	6·07	8·35	11·65	—	—	—	—	—
	163	1922	—	—	2·76	4·47	7·35	8·24	—	—	—	—	—
	182	1922	—	—	—	—	6·75	7·31	—	—	—	—	—
	147	1922	—	—	—	—	3·22	4·96	—	—	—	—	—
	256	1922	—	—	—	—	15·25	16·25	—	—	—	—	—
T. J.	1	1920	—	—	—	—	—	—	30·67	27·5	35·0	—	—
	8	1920	—	—	—	—	—	—	14·03	16·3	17·6	—	—
	16	1920	—	—	—	—	—	—	23·9	23·8	20·2	—	—
B. D.	2	1918	—	—	—	—	—	—	—	15 4	17·4	18·0	12·5
	5	1918	—	—	—	—	—	—	—	18·5	25·3	26·0	26·6
	10	1918	—	—	—	—	—	—	—	16·7	18·9	20·0	17·8

To prove that Budded rubber trees renew bark as well as ordinary trees the following experiment is quoted from an article by Dr. C. Heusser in *The Archief voor de Rubber cultuur.*—August, 1930.

Clone	No. Trees Tested	Thickness of Virgin Bark @ 39 inches	Renewed bark after 1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	6th yr	7th yr.
Avros 33	10	9·5 mm	4·6 mm	4·7 mm	5·8 mm	7·1 mm	7·3 mm	7·1 mm	7·6 mm
36	10	10·6 ,,	4·5 ,,	5·2 ,,	6·7 ,,	7·3 ,,	7·6 ,,	8·1 ,,	9·2 ,,
49	5	10·2 ,,	4 9 ,,	6·5 ,,	7·0 ,,	7·6 ,,	8·3 ,,	8·3 ,,	10·6 ,,
50	9	10·6 ,,	4·4 ,,	4·9 ,,	5·7 ,,	7·3 ,,	7·8 ,,	8·3 ,,	8·7 ,,
52	10	9·7 ,,	4·1 ,,	4·6 ,,	5·5 ,,	6·7 ,,	7·3 ,,	7·5 ,,	8·2 ,,
80	7	10·2 ,,	4·5 ,,	4·7 ,,	5·6 ,,	6·5 ,,	7·0 ,,	7·2 ,,	8·4 ,,

Remarks.—These bark renewals can only be regarded as extremely satisfactory, the minimum being approximately equivalent to $\frac{3}{8}$th inch and the maximum just over $\frac{1}{2}$ inch. It is doubtful if more than a very small percentage of trees *ever* renew bark as thick as $\frac{1}{2}$ inch in Ceylon.

"PRANG BESAR CLONES"

TABLE B

The Yields are in Dry lb. per tree per Year

Clone	No. of trees	Date Budded	6th year	7th year	8th year	9th year	10th year
186	265	1922	—	11·5	15·25	22·5	27·5
23	44	1922	—	12·25	15·	17·5	21·25
5	153	1922	—	9·25	12·5	16·	18·30
180	211	1922	—	10·	13·15	14·5	21·5
25	128	1922	—	12·	13·6	15·	19·25
24	94	1923	10·01	15·1	18·25	18·10	—
49	73	1923	10·1	12·25	15·90	18·	—
123	173	1923	11·90	15·25	16·75	16·75	—
183	170	1923	8·75	12·75	16·25	19·75	—
155	14	1923	9·60	13·60	13·12	14·25	—
86	25	1923	—	11·85	16·	18·75	—

Records of Bark Renewal of "Prang Besar Clones"

Clone	Virgin Bark	*Renewed Bark	
P.B. 23	9·78 m.m.	6·7 m.m.	
P.B. 25	9·41 ,,	7·65 ,,	
P.B. 186	11·45 ,,	8·0 ,,	
P.B. 123	8·95 ,,	6·75 ,,	Tapped May, 1927—measured
P.B. 24	10·51 ,,	8·66 ,,	August, 1929, renewal for
P.B. 180	10·12 ,,	7·03 ,,	$2\frac{1}{4}$ years.
P.B. 155	8·44 ,,	6·68 ,,	
P.B. 49	9·95 ,,	6·93 ,,	
P.B. 5	9·4 ,,	6·94 ,,	

*These renewals are all about 30 per cent. more than those shown for the Avros Clones.

Nurseries.—It must be decided whether budding is to be done in the field or in the nursery. I have had experience of both and am rather undecided as to which is better.

If budding is done in the nursery, it will be necessary to find a suitable piece of land for laying down a nursery and on most estates there should be no difficulty about this. By laying down a nursery at least a year is gained, but the question arises whether this will not be made up ultimately by budding in the field. My budded areas are not yet old enough for me to form an opinion about this.

By budding in the nursery it will be necessary to transplant the budded stumps to the field. This does not arise when budding in the field.

When transplanting, success depends a great deal on weather conditions. In one case when conditions were favourable and rain fell for some days after planting, 10 per cent. only died. In another case, when no rain fell for some days after planting, as many as 25 per cent. died. In some instances it was a case of the stump dying and in others of the bud.

With regard to budding, I have obtained just as high a percentage of success by budding in the field as in the nursery, and under the former method once the bud has taken practically no failures have been recorded.

In any case it will be as well to lay down a small nursery for supplying any failures and the following method of planting is recommended:—

Dimensions of Beds	...	30 ft. × 15 ft.
Distance between rows	...	1½ ft. × 1½ ft.
Distance between seeds	...	6 in. × 6 in.

I have found that by planting double seeds at every 6 inches excellent results have been obtained.

Thinning out should take place every few months—all weak and sickly plants being uprooted—leaving a stand of approximately 1½ ft. × 1½ ft. By doing this a vigorous stock is assured which is essential for budding. It is more expensive than planting fewer seeds but is well worth it.

Multiplication Nursery.—If *budded stumps* are purchased these should be planted out for multiplication purposes. If *budwood* is purchased it will be essential to lay down a nursery

on the plan recommended above and this should be done about one year before the budwood is purchased. After budding has taken place the young plants will be transferred to the multiplication nursery. Distance of planting—4 ft. × 4 ft.

The young plants should be manured every few months with Nicifos or Ammophos and the nursery kept regularly weeded. About two yards of budwood can be expected one year after planting.

Budding.—I do not propose to go into details of the operation of budding as there are many books and articles written on the subject. However, I have found that:

(1) Plants about 1-1½ years old are the best for budding.

(2) Budding should not be undertaken during very wet or very dry weather, or when the trees are wintering.

I have had outstanding success with the budding tape as supplied by Mr. E. W. Whitelaw of Pantiya Estate and can highly recommend it.

I can recommend Mr. F. Summers' book "The Improvement of Yield in Hevea Brasiliensis" for those who wish to become thoroughly acquainted with the subject.

SYSTEM OF OPENING

It must be decided what system of planting is to be undertaken, Contour Platforms, Denham Till Contour Trenches, or the ordinary method of drains, silt-pits and terraces. Having had experience of all these systems I can strongly recommend the first.

As regards costs there is very little to choose between the Contour Platforms and the ordinary method of draining, terracing, silt-pitting, and the trenches are the most expensive.

Contour Platforms are recommended for the following reasons:

(1) Once they are cut there is practically nothing to be spent on future upkeep, except for occasional washaways on steep land during very heavy downpours.

(This is only likely to happen during the first year after planting as once the green manure is established there is very little fear of washaways.)

(2) They hold up all the water which is beneficial, especially in a dry district.

(3) When the trees come into tapping—it will be far easier work for the tappers and they should be able to tap more trees and in consequence the cost of tapping should be reduced.

(4) Supervision is much easier.

Under the old method of planting, expenditure on upkeep is never ending. No matter how strongly the terraces are built after a few years they always need repairing, and the drains and silt-pits should be cleaned out at least once a year.

As regards the Contour Trenches, they are more expensive to cut—in my experience the growth is not so good—and if they ever get filled up—it will be necessary to convert them into platforms—which will add a good deal to the cost.

Contour Platforms.—A good planting distance is 20 ft. x 15 ft. i.e. 20 feet between the platforms and 15 feet between trees. This gives a stand of 145 trees per acre.

Lining.—This should be done while the old rubber is still standing and the materials required are: a road tracer, which should be accurate; a lining rope with tags at every 15 feet; a tape measure with a tag at 20 feet and the necessary pegs.

A Conductor or Kanakapulle and a few intelligent coolies can easily do this work which should be checked every now and then to see that the pegs are put in level and the distances correct.

When the land is very steep the distance between platforms should be increased to 25 feet to allow the platforms to be cut wider so that silt-pits may be put at the back if necessary.

It will be found impossible to take the contour right round the hill as on steep land it will be found to diverge and on flat to converge. It is best to break the line so that the distance between platforms is always 20 feet!

This will ensure the planting being symmetrical and is a check on the acreage.

Cost per acre including pegs Rs. 1·50.

Holing.—It is preferable to cut the holes while the old rubber is still standing and I would recommend their being cut the year previous to planting. By doing this a certain amount of soil and leaves will find their way into the holes during the heavy rains.

Holes 3 ft. × 3 ft. × 3 ft. are recommended where the soil is poor—Task per cooly 3 holes a day—Cost per acre. ... ... Rs. 20·30

Holes $2\frac{1}{2}$ ft. × $2\frac{1}{2}$ ft. × 2 ft. are recommended where the soil is good—Task per cooly 6 holes a day—Cost per acre. ... ... ,, 10·15

If possible it should be given on contract at 14-15 cents a hole for the former, and 7 cents a hole for the latter.

Dynamiting.—If the land is at all rocky dynamiting should be done to ensure each hole being of the same dimensions so that every plant has an equally good chance of growing. If money is no object the dynamiting of each and every hole is recommended. Where dynamiting is not done the bottom of each hole should be stirred, and a crowbar 5 ft. × $1\frac{1}{2}$ in. is a useful tool for this work.

I have paid 7 cents a foot for drilling and blasting—cost of dynamite, fuse, detonators, etc. on estate account.

The cost per acre of this work depends upon the number of holes that have to be dynamited.

Filling Holes.—This should be done after all the uprooting and burning is finished as a certain amount of ash will then be available for putting in the holes.

Unless the soil is very washed out and exhausted there will generally be found a few inches of top soil which can be forked and utilised for filling.

It is of vital importance that the filling be done thoroughly and this work requires very careful supervision.

The following method is recommended: Sweep and collect all the leaves from the clearing and from the adjacent rubber, and also the soil from the drains and silt-pits. Fork the top soil and mix together with the leaves, and with the mixture fill the holes.

It will be found that where the rubber is badly grown—and it is these areas which will be rejuvenated first—there will be found very few leaves and top soil and it is these areas which require special treatment.

In our case, good jungle soil was transported by the estate lorry and Adco was also used when filling the holes in these poor areas. It is expensive but very well worth it.

It is very difficult to estimate the cost of filling as it all depends on the nature of the soil and how much has to be transported, and the distance of transport by lorry and to the field.

Approximate cost of filling.—It is best for coolies to work in pairs—Holes 3 ft. × 3 ft. × 3 ft.—Two coolies should fill 6 holes a day.

This works out at roughly, 14 cents a hole—Cost per acre Rs. 20·30.

Holes $2\frac{1}{2}$ ft. × $2\frac{1}{2}$ ft. × 2 ft. Two coolies should fill 15 holes a day. This works out at roughly 6 cents a hole—cost per acre Rs. 8·70.

Plus cost of Adco and transport of jungle soil.

Uprooting.—It is essential that the land be thoroughly cleared up and all the trees burnt before a start is made on cutting platforms.

Elephants should be employed for uprooting. The large lateral roots will have to be cut and a gang should be employed at this some days ahead of the elephant uprooting.

A cooly should be able to cut the roots of 20-30 trees a day and a good elephant, provided the land is not too steep, should uproot 125-150 trees a day.

The work should be given out on contract—cost of uprooting, including cutting of side roots 9 cents per tree or at 80 trees per acre—Rs. 7·20 per acre.

If there are any cases of *Fomes* in the area to be rejuvenated it is absolutely essential to remove all the roots, and this is very expensive. The big lateral roots should be uprooted by elephants by means of a hook on a strong chain, and the whole area deeply forked, great care being taken to see that all the small roots are collected and burnt.

Many planters are of the opinion that in any case all the lateral roots should be taken out, but I do not think it essential.

Most rubber in Ceylon was orginally planted 15 ft. x 15 ft. or a stand of a little over 200 trees per acre. At the present time most estates average round about 90, and well over 100 trees per acre have been cut out. In a good many cases coolies were employed for this work and it was very imperfectly done.

Generally speaking *Fomes* is not very prevalent in Ceylon and in most cases where it is so it is generally on old tea land. Personally I do not think that the cutting out of the old rubber has been the cause of much *Fomes*.

Cutting up, Heaping and Burning.—After the uprooting is finished the whole area has the appearance of felled jungle.

A gang should be employed at cutting up immediately behind the elephant uprooting—as the trees are far easier to cut when green. The trees should be cut into 12-15 feet lengths and then stacked into large heaps with the small branches, etc. at the bottom and the trunks on top.

Elephants were tried for heaping, but it was found that it could be done cheaper by coolies as the logs can be easily removed by levering.

The best time to do the uprooting, cutting up and heaping is in December-January, and by the time the hot weather sets in in February-March, the heaps are ready for burning.

Cost of cutting up in lengths	3 cents a tree	
Cost of heaping and burning	7 ,, ,,	
	10 ,, ,,	or at 80

trees per acre—Cost per acre, Rs. 8/-.

The uprooting, cutting up and burning can be given out on contract at say 20 cents a tree or Rs. 16/- per acre.

If the block to be rejuvenated is near a river or cart road it may be possible to get a firewood contractor to do this work for nothing.

Cutting of Platforms.—As stated previously the planting distance recommended is 20 ft. x 15 ft., i.e. 20 feet between platforms and 15 feet between trees. If the land is very steep

the distance between platforms should be increased to 25 feet to allow the platforms to be made wider so that silt-pits can be cut at the back of them if considered necessary.

On steep land the breadth of platforms should be 7 feet and on flat and undulating 6 feet.

The height of the platforms will vary according to the lie of the land—on very steep land 6 ft. to 8 ft.—on undulating 3 ft. to 6 ft. and on flat 1 ft. to 3 ft.

The photos accompanying this article will give a very good idea of the contour platform system.

It will be seen that it is a succession of small platforms in the middle of each of which the tree is planted.

The dimensions of the platforms are approximately 12 feet long by six feet broad, the height depending on the lie of the land.

It is essential to build bunds at the edge of the platforms. This increases the water-holding capacity and minimises the risk of washaways.

Any available stone can be used for building the bunds; and if stone is not available earth can be used.

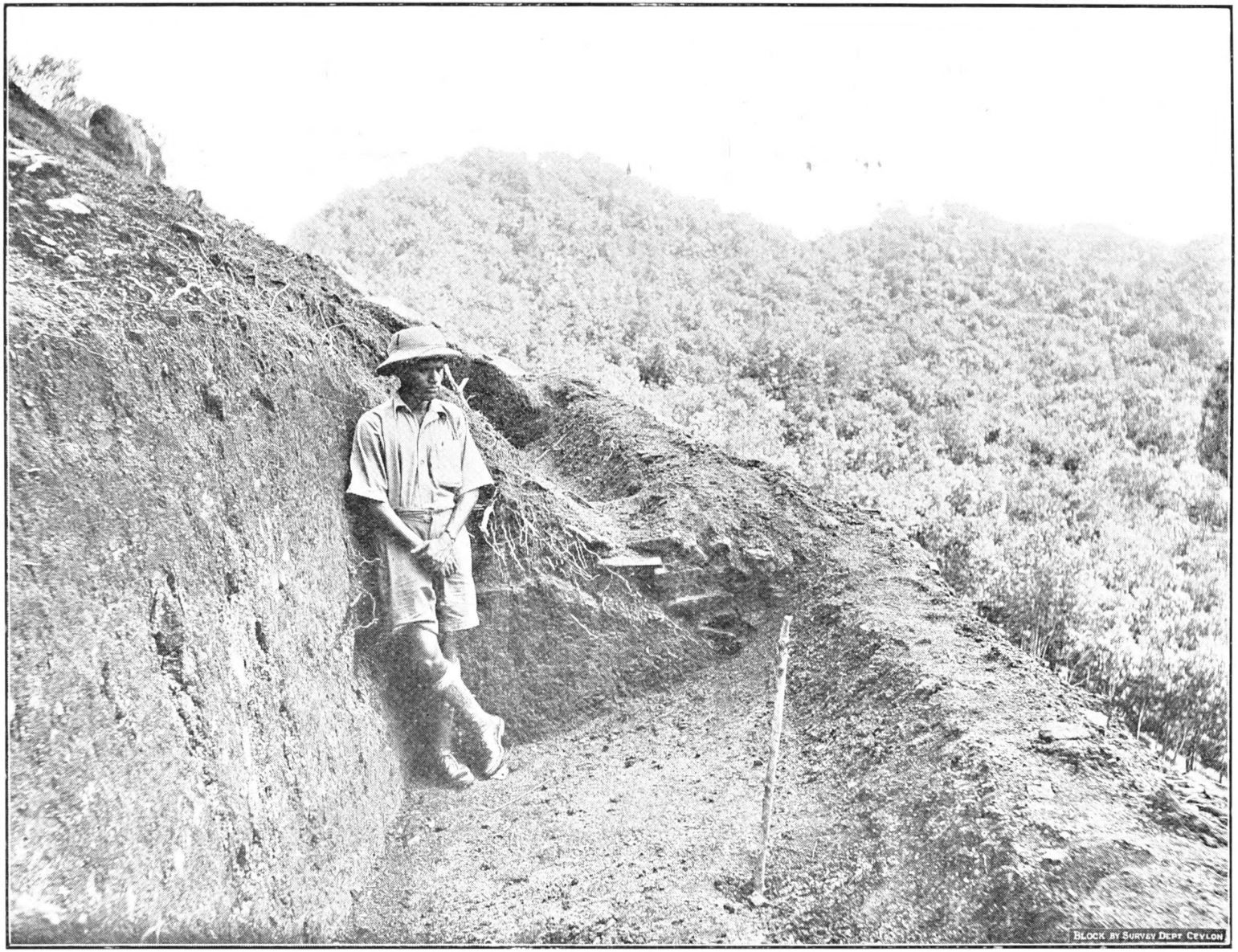
The bunds should be approximately one and a half feet high and one and a half feet broad.

A considerable saving is effected in cutting the platforms by leaving a strip—3 feet wide on steep land, and 4 feet on undulating—uncut—midway between the holes. Water which runs down the slope is guided into the platforms by the bund along the edge.

These blocks in the platforms also serve a useful purpose in preventing lateral flow of water in the event of a washaway at one portion of the platform.

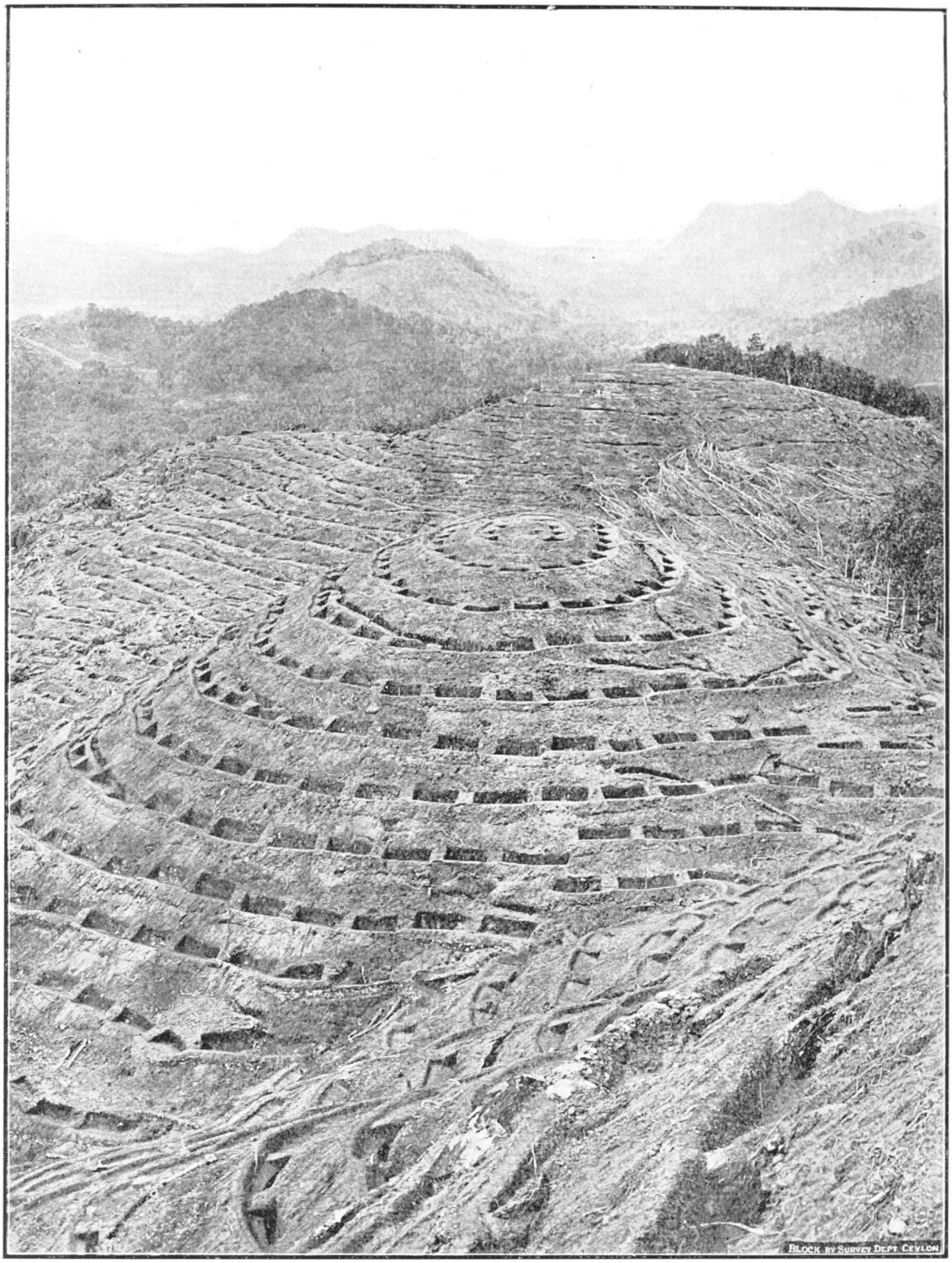
When a start is to be made on the actual cutting, pegs should be put at 4 to 6 feet above the top side of each hole and joined together by a rope. This is to give the coolies an idea where the cutting is to be done. The bank should be cut on a slope—which will vary according to the height.

The bed of the platform should also be cut sloping back to the cutting face, the difference being approximately $1\frac{1}{2}$ feet. This ensures the water being collected at the back of the platform.



Platform showing Height of Cuttings

The stump will be seen to be more to the outside than the inside. The platform slopes back to the bank. Note the bund on the outside edge of the bed.



Contour Platform on average lie of land

It is essential to have the holes more on the outside than on the inside of the bed so that the young plant will not be water-logged during heavy rains.

Cutting Platforms.—I have found that the simplest method of paying for this work is by the *linear* foot.

I have paid 2, 2½ and 3 cents per foot according to the steepness of the land and the amount of cutting to be done.

There are 43,560 square feet in an acre and platforms are 20 feet apart.

At every 15 feet blocks of 3-4 feet are left *uncut* or approximately 25 per cent. of the area; so the number of linear feet to be cut is 1634, (e.g.).

$$\frac{43560}{20} - \left\{ \frac{43560}{20} \div \frac{1}{4} \right\} = 2178 - 544 = 1634 \text{ linear feet.}$$

At an average—say of 2½ cents per ft. = Approximately Rs. 40/- per acre.

Terracing and Silt-pits.—It will be found that on very steep land it will be essential to build terraces.

(1) For strengthening the bunds.

(2) For holding up the soil above the platform.

On such places silt-pits should also be cut at the back of the platform.

Approximate cost per acre Rs. 5/-.

Forking.—As soon as a few acres of platforms are cut I would strongly recommend deep forking them.

If this is done, even during very heavy downpours, there will be very little water standing in the platforms and the fear of washaways is greatly diminished.

Roughly, the cubic capacity of the platforms is increased by the depth of the forking.

A cooly can fork approximately 25 platforms a day and I have paid at the rate of 1½ cents per platform or at 145 platforms per acre Rs. 2·18—say Rs. 2·50 per acre including Head Money, etc.

Green Manure.—As soon as a few acres of platforms are cut, green manure should be planted and I recommend the following mixture:

Centrosema plumieri	...	...	40 oz.
Centrosema pubescens	...	...	16 ,,
Calopogonium	...	...	16 ,,
Pueraria javanica	...	...	8 ,,
			80 oz.

at the rate of 5 lb. per acre.

On flat and undulating land good results have been obtained by broadcasting.

On steep land small beds should be made with a rough terrace at the back, midway between platforms at every 6 feet.

Besides the cover crop the following are recommended:

Crotalaria—3 varieties.
Tephrosia candida.
Tephrosia vogelii.
Leucaena glauca.
Clitoria.

at the rate of one pound of each kind per acre. When they are grown up they should be lopped and the loppings forked in for creating humus.

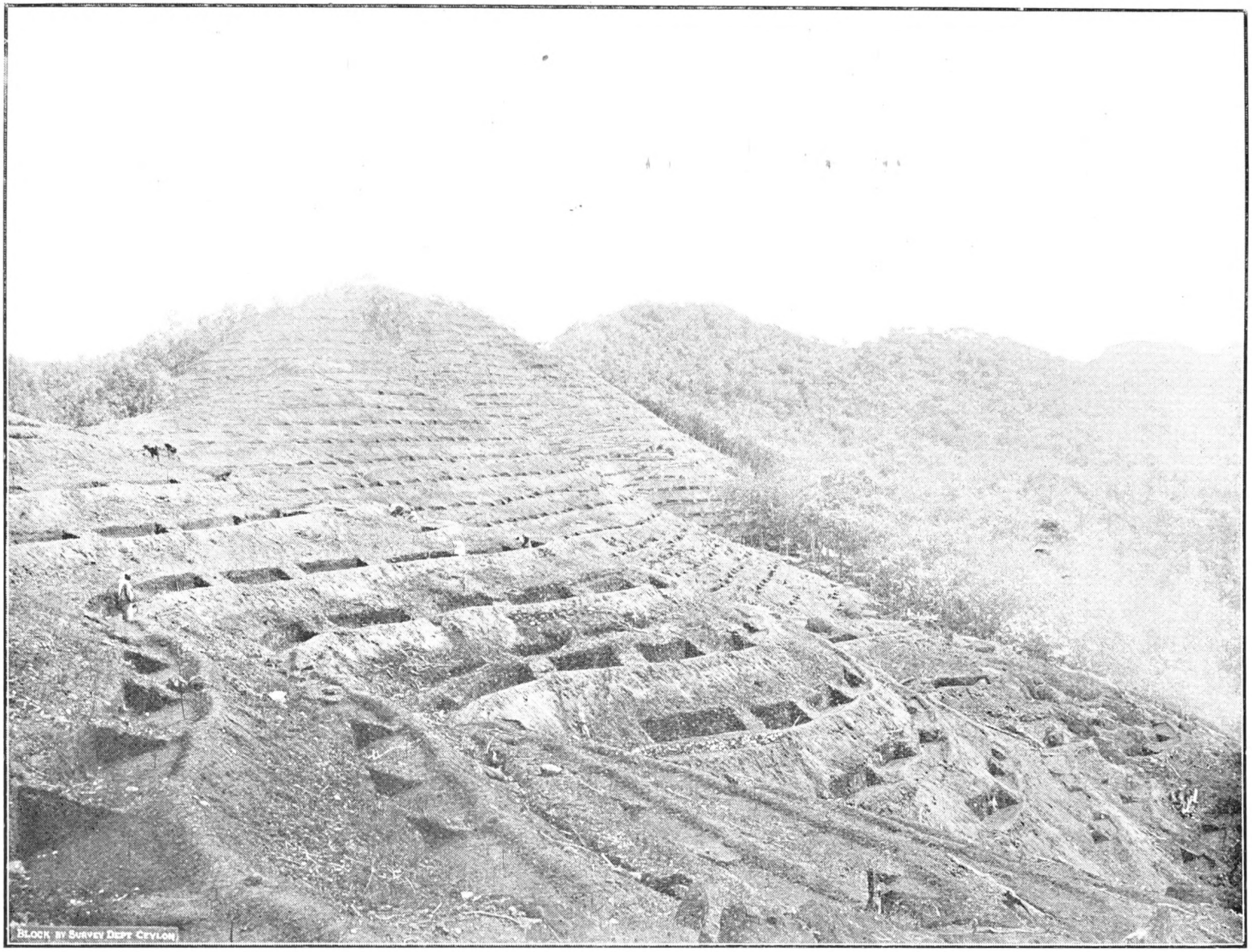
Contrary to expectation the green manure has grown well in the earth cut out from the platforms but to ensure complete success about 2 cwt. per acre of Ammophos should be applied at the time of planting.

Planting.—If it is decided to do the budding in the field it will be necessary to collect seeds and lay down germinating beds. A few platforms near a spring or stream can be used for these.

When transplanting from the beds to the field care must be taken to see that none of the shoots are broken.

I strongly advocate planting 4 seeds in each hole, and gradually thinning out the weak ones.

I have found that by manuring the young seedlings every few months with a mixture of 400 lb. of Sulphate of Ammonia and 100 lb. of concentrated Superphosphate at the rate of 2 to 4 oz.



Contour Platform on steep land

a plant, excellent results have been obtained, and two to three vigorous plants remain for budding. This ensures the operation of budding being highly successful and the spare plants can be utilised for the following year's clearings. The young plants should be ready for budding about 1-1½ years after planting.

By this method a supply nursery can be done away with.

Slaughter Tapping.—As far as I know no satisfactory system has yet been discovered. It is claimed by some that 2½ times the normal yield can be obtained by slaughter tapping but this has not been my experience. I agree that a considerable increase in yield can be obtained for a few months, but not for a longer period.

I have tried several systems:

(1) Two cuts half-spiral—superimposed—tapped daily.

(2) Two cuts half-spiral—superimposed—tapped alternate daily.

(3) Tapping both sides of tree daily.

(4) Tapping both sides of tree alternate daily.

(5) Tapping both sides of tree every third day.

In all these systems—except No. 5—I have found that after a few months' tapping—the rubber content falls to such an extent that over any considerable period more rubber is obtained by the ordinary one cut half-spiral alternate day system.

In most cases the rubber content of the latex has fallen from 3 lb. 6 oz. per gallon to under 2 lb.

Under system 5 the rubber content has remained more or less constant at about 3 lb. 6 oz. per gallon for over a year. I consider this system is the best for tapping to death, and for two months before uprooting tap both sides of the tree on *alternate* days.

Assuming that the lie of land is partially steep and partially flat and undulating and that there is some poor soil, I estimate an acre can be brought into bearing in its seventh year for the following:

DETAILS OF ESTIMATE FOR OPENING

Supervision including opening fees ...	Rs.	20·00
Nurseries	,,	2·50
Lining	,,	1·50
Holing	,,	12·50
Dynamiting (including cost of dynamite, drilling and blasting)	,,	7·50
Filling holes	,,	12·50
,, ,, extra for Adco and Jungle Soil	,,	5·00
Uprooting, Cutting and Burning ...	,,	16·00
Cutting of platforms	,,	40·00
Terracing and Silt-pits	,,	5·00
Green Manure	,,	5·00
Collecting Seeds and Planting 4 seeds to a hole	,,	2·00
Fencing	,,	12·00
Tools	,,	3·00
Surveying	,,	2·00
Weeding for six months	,,	6·00
Forking Platforms	,,	2·50
	Rs.	155·00

DETAILS OF ESTIMATE FOR UPKEEP FOR 1ST YEAR

Weeding	Rs.	12·00
Budding	,,	12·50
Manuring	,,	10·00
Forking in Green Manure ...	,,	5·00
Repairing Washaways, etc.	,,	5·00
Supplying	,,	3·00
	Rs.	47·50

If budding is done in the nursery the cost of budding Rs. 12·50 should be included in the opening expenditure and deleted from 1st year's upkeep.

1st year upkeep	Rs.	47·50
2nd ,, ,,	,,	32·50
3rd ,, ,,	,,	30·00
4th ,, ,,	,,	30·00
5th ,, ,,	,,	27·50
6th ,, ,,	,,	27·50
	Rs.	350·00

As regards the subsequent year's upkeep, the weeding, supplying and repairing washaways will gradually decrease and the saving effected under these headings can be spent on extra manure and cultivation.