RUBBER.

THE BUDDING OF RUBBER ON A COMMERCIAL SCALE.

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The following notes prepared by Mr. R. A. Taylor, Physiological Botanist of the Rubber Research Scheme, Ceylon, and distributed at the Budding Demonstration held at the Royal Botanic Gardens, Peradeniya, on 8th July, 1926, are reproduced in the *Tropical Agriculturist* as they are of general interest:—

The object of budding is obvious to all and requires no explanation. It is essentially a short-cut to the production of high-yielding trees, and does away with the lengthy and difficult processes of selection, crossing, and the raising of genetically pure strains.

The plants raised by this means have a root stock grown from seed, preferably from vigorously growing trees, and a superstructure which develops from a bud attached at about ground level. The trunk, that is the part which will eventually be tapped, is developed from the bud and it will be seen that an acre planted up with bud-grafts from a common Mother Tree is really an acre carrying about 100 separate parts of one tree. If the Mother Tree has been carefully selected on account of its high yielding properties, it would be expected that the acre would carry 100 trees equal in value to the parent. The value of Budding depends on the truth of this assertion.

It has now been proved that, while many Mother Trees reproduce their high-yielding properties in their budded offspring, there are some which do not; and, unless a tree has been previously tested, there is no definite assurance that the offspring so raised will come up to expectation. Unfortunately the only method, known at present, of testing this ability to hand on high-yielding properties, is actually to tap and record the yields of the progeny. This testing alone therefore requires 6 years at the very least.

There are no trees in Ceylon which have been proved in this way, but work has been begun by the Department of Agriculture and will also be carried out by the Rubber Research Scheme on its newly opened Experiment Station. In this year's programme twelve consistent high yielders are being tested. It will be possible to include a further 20 or 30 trees next year. Of these latter about a dozen have already been selected, records of yield from all of which have been kept for at least 12 months.

SCHEDULE OF OPERATIONS.

Recording of Yields of Bud Mother Trees.

It is essential that any tree used as a Mother Tree should be a consistent high yielder and for this reason yield records must be kept over a fairly long period. The longer this period of record keeping the better, as trees are

known which, while yielding heavily one year, may fall off considerably the following year, or may even yield well for a month or two and then deteriorate to medium or even poor yielders.

One year should be the minimum period employed and if possible daily records should be kept. If this latter is not practicable the yield from one tapping may be recorded every fortnight, but this of course gives no exact measures of the actual total yield obtained.

Pruning Back of the Mother Trees for the Production of Budwood.

Once the Mother Trees have been definitely selected some of the branches should be pruned back to encourage the growth of young succulent shoots, from which the bark strips readily.

It is better not to cut the branch through where it is very thick as the resulting wound will then take a long time to heal over, and it may offer lodgment for fungal spores. No branch of a greater diameter than 4 inches should be cut and not more than 3 of the adventitious shoots which appear should be allowed to grow. This will in most cases ensure a complete callusing over of the cut branch and a supply of well-grown budwood will be available. This pruning can be conveniently carried out about the time the nursery for the stocks is being laid out.

Laying out of Nursery.

It is advisable to have the stocks about one year, or at least not more than two years old, at the time of Budding, and they should be well grown. To ensure that vigorous stocks are available, the nursery should be in a high state of cultivation and the plants not too close together. It is suggested that rows be about 1 foot apart and the plants about 9 inches apart in the rows. This allows sufficient room to bud the plants in the nursery if this is desired, and prevents overcrowding. If the nursery is laid down at the same time as the Mother Trees are lopped, the stock and the branch from which the bud is to be taken will be of about the same age.

In choosing seed for stocks it is advisable to use only that produced by vigorously growing trees which show fairly good yields. The total effects of stock on scion are not yet known but it may be that future yields will be affected detrimentally by the use of stocks grown from seed from a poorly grown unproductive type of tree.

Budding in the Nursery and Budding in the Field.

The actual budding operation can be carried out either before or after the stumps have been planted out. Both methods have been employed successfully, and the choice of methods depends on the time of year at which it is desired to bud, and probably on the growth of the stocks.

Budding in the Nursery.

Points in favour.

The plants are close together and less time is required to carry out the work.

Transport of Budwood, tapes, etc., is reduced to a minimum.

Less time and labour are required in making the subsequent inspections of the plants and in rebudding any failures.

The plants afford each other a certain amount of protection.

The stocks are generally more vigorous, as it is easier to keep a nursery in a high state of cultivation, and much of the success of Budding depends on the vigour of the stocks.

A selection of stocks from the point of view of vigour is possible.

Points against.

Plants budded in the nursery are best planted out just as the buds are beginning to shoot and unless very carefully transported the buds are very liable to injury.

Unless the plants can be budded early in April it is unlikely that they will be ready to plant out during the S. W. Monsoon which is usually considered the most favourable time.

Whenever planted out there is an additional check on the growth after the bud has been fixed.

Budding in the Field.

Points in favour.

Here the stumps are planted out in their permanent situations before the bud is affixed and the unavoidable check to growth is past.

There is no shifting of the plants after budding with the attendant risks of loss through injury.

The stocks can be selected before being taken from the nursery, only the well-grown plants being used. (I do not advise budding on to stocks raised by the seed-at-stake method as no such selection is then possible.)

Points against.

The actual budding and the subsequent inspections are more difficult and laborious, and the rebudding of any failures will take a much longer time.

It is more difficult to have the whole plantation in such a high state of cultivation that the stocks will be as vigorous as those growing in a nursery.

HOW TO BUD.

Preparation of Budding Tapes.

The tapes used to bind up the point where the bud has been fixed must be prepared beforehand. Strips of thin cloth about 1 inch wide are soaked in a mixture of 2 parts of resin, 1 part bees wax and 1 part tallow. The resin is ground up fairly finely and melted along with the other ingredients in a kerosene tin over a fire. When thoroughly mixed the strips of cloth are soaked and then rolled on to sticks for ease in handling later.

Budding Knife.

The knife should have a strong sharp blade and also be supplied with the bone spatula which can be used for levering up the bark.

Collection of Budwood.

The budwood is brought to the scene of operations as pieces of branches cut to suitable lengths. If a considerable distance has to be covered, the severed ends can be sealed with tallow, to prevent desiccation. These lengths can be packed in boxes with grass or other packing material to prevent damage.

Preparation of Stock for the Reception of the Bud.

A small rectangular piece of bark is removed from the stock at a height

of not more than 2 inches from the ground. The size of the piece removed is regulated by the use of a small metal mould round which one clean cut is made down to the wood. The bark is then levered off with the spatula end of the knife, the greatest care being taken that nothing is allowed to touch the exposed cambium on the stock.

Removing the Bud and attaching to the Stock.

The bud is removed with a piece of bark attached, of such a size as to fit exactly into the place prepared on the stock. A mould is also used here, and this mould is slightly smaller than the other, and has a hole in the centre. The mould is laid on the budwood so that the bud can be seen through the hole and a sharp cut to the wood is made round three sides. The piece of bark containing the bud is then removed from the branch by a sharp cut from above downwards. This usually removes a piece of the wood which can easily be detached. Care is also taken here that nothing is allowed to touch the cambium of the bud before it is applied to the stock. The bud with the piece of bark is then fitted into the stock, care being taken to insert it the right way up. The whole is then bound up tightly with the prepared tape, beginning from the bottom.

If desired, the piece of bark need not be completely removed from the stock; the cut need only be made round 3 sides of the mould leaving the piece unsevered at the base. The bud can be inserted behind this and the flap folded over it. A certain amount of protection against desiccation is thus afforded.

It is essential that the wrapping be airtight as any drying out will cause a failure.

Subsequent Examinations.

In 14 days' time the bandage may be removed and the first inspection made. If the attached bud is still green the operation has been successful. If still green after a month, the stock is cut off about 2 inches above the point of union and the wood tarred.

POINTS TO BE GIVEN ESPECIAL CARE.

1 Make sure that the bud does not remain attached to the wood.

2. **Avoid touching the cambium, either on the stock or on the piece of bark containing the bud.**

3. It is most important that no adventitious buds on the stock be allowed to develop. This is a fairly common occurrence where the bud has failed to " take " and, unless closely examined, the shoot produced may very easily be mistaken for the budded shoot.

RUBBER TAPPING EXPERIMENTS, HENERATGODA.

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The further results from the rubber tapping experiments at Heneratgoda to test the relative values in yield of rubber from tappings on 1/4, 1/3, and 1/2 circumferences are presented herewith. These figures are for the 15 months January 1st, 1925 to March 31st, 1926. They complete three years since the experiments were started in 1923.

The following is a summary of the results secured from the commencement of this experiment :—

	Quarters. grammes	ratio	Thirds. grammes	ratio	Halves. grammes	ratio
April 1st 1923 to March 31st, 1924	18,288	100	28,082	153·5	34,617	190
April 1st 1924 to March 31st, 1925	27,259	100	34,888	128	45,412	166·6
April 1st 1925 to March 31st, 1926	38,132	100	47,535	124·7	64,155	168·2
Total	83,679	100	110,505	132	144,184	192·4

In comparison with the above might be quoted figures from other countries.

(1) The Malayan ratios were as follows :—

1/4 : 1/3 : 1/2=100 : 121 : 143. The yields from 1/2 circumference were from V—cuts.

(2) The Sumatra ratios were :

1/4 : 1/3 : 1/2=100 : 125 : 150. Here again the yields from the half circumference were from V—cuts.

(3) The Java ratios were :

1/4 : 1/3 : 1/2=100 : 117·5 : 145.

It will be observed that the ratios in Ceylon have changed during the different years and this is clearly brought out by the following figures :—

Quarter circumference	1923—24	1924—25	1925—26
grammes	18,288	27,259	38,132
ratio	100	149	208·5
Third circumference			
grammes	28,082	34,888	47,535
ratio	100	124·2	169·2
Half circumference			
grammes	34,617	45,412	64,155
ratio	100	131	185·3

Those trees giving the lowest initial yields have improved in yields at a proportionately higher rate than those trees giving high yields. The group tapped on 1/4 circumference was the most uniform at the commencement of the experiment in regard to yields and this has shown the greatest proportionate increase.

PROPORTION OF SCRAP.

The percentage of scrap on total rubber is shown in the following table :—

	1923	1924	1925—26
Quarter circumference	10·1	11·3	13·0
Third circumference	10·0	9·5	9·2
Half circumference	14·2	14·5	14·0

The increase in the percentage of scrap for the cuts on quarter circumference has been due to the abnormal percentage of scrap given by trees numbered 61 and 81.