

STANDARD INSTRUCTIONS FOR THE PROTECTION OF PRUNED SURFACES IN BUDDING OPERATIONS.

BY

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The budding operation should be undertaken preferably on young rubber trees from 12 to 18 months old. It is desirable to carry out the budding operation at as early an age as possible, so that when budding has been successfully accomplished, and the stock finally pruned, only a comparatively small wood surface from 1 to 1½ inches in diameter is exposed by the cutting. A small surface of this size is rapidly covered by the ingrowing callus. Healing may be completed in from six to nine months and there is no special necessity to lay emphasis on the matter of a protective covering.

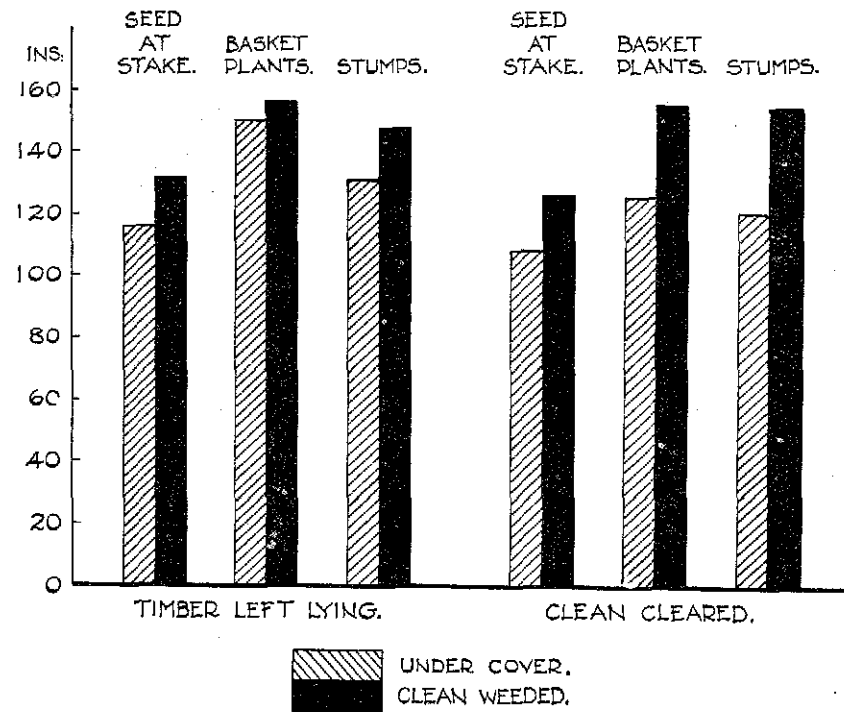
While it is generally recognised that young seedling stocks are most easily worked, there are numerous instances where obstacles have arisen to delay the budding programme and the plants to be budded have attained the age of 2½ to 3 years before the operation has been undertaken.

When budding has been done successfully on a 2½ years old stock, the cutting back of the stock after budding exposes a surface, on normally grown trees, of 4 to 5 inches diameter. An exposed wood surface of such a size may not be covered by the ingrowing callus for years, and there seems to be a definite lack of understanding of the principles which govern the reasons for protecting these large exposed wood surfaces.

It is a well-known fact, to which attention has been called since budding was initiated as a plantation practice that, when the stock is cut back, die-back fungi of various types enter through the exposed wood surface if steps are not taken to prevent their entry by means of some protective material. The materials used in this connection at the present date seem to be very variable. In this article recommendations are given which should be considered as standard from which there should be no deviation.

Again, not only are the materials used for protecting the exposed wood surface very variable, but the actual method, in practice, of cutting back the stumps varies according to the ideas of different people interested in budding. This should not be so,

GROWTH OF RUBBER 18 MONTHS FROM PLANTING.



for there are sound reasons for following the general method which is given below.

Where budding has been done successfully on 2—3 years old stocks and the latter are cut back, it is usual to find that some attempt is made to protect the large wood surface exposed. For this purpose painting with a solution of Brunolinum, white lead paint mixed with linseed oil, or even simple dressings with wood tar, have been tried. Melted grafting wax or a tacky dressing such as Cargilineum, have also been used but most estates are now using an Asphaltum-Kerosene mixture described by Sutcliffe* and recommended by the Rubber Research Institute. Considerable success has attended the use of the latter mixture but even where this has been used there may still be a considerable amount of unsuspected damage, owing to the entry of "die-back" fungi through the supposedly well protected wood-surfaces of the cut snags.

The mode of entry is simply explained. After cutting back, the woody tissues of the stump begin to dry out owing to the developing scion absorbing the water supplied from the roots. As a result of the drying-out, the woody tissues of the snag contract and the cut surface shows small cracks or splits which, if not quickly attended to, allow the entry of die-back fungi. If such cracks are examined carefully it will be found that they are often filled with fine earth.

After entry through the cracks in the exposed wood surface the fungi grow rapidly downward into the tissues. If no measures are taken to check their growth, penetration into the main axis below the point of union with the scion may take place and the fungi may progress right down into the main tap-root, thus killing the plants outright. The progress of these fungi through the tissues may be accelerated in plants deficient in vigour, or on areas where plants lack condition owing to slight attacks from fungi such as *Fomes lignosus*.

Figures I, II and III show the sequence of events. The case illustrated is an example of budding done on a 2½ years old stock on which the snag had been cut back to within two inches of the height at which the bud had been inserted. The cutting back was done in August, and the cut surface was painted over with a solution of Brunolinum. This painting would prevent the entry of any die-back fungi for some time, possibly three or four months. Figure No. 1 is a longitudinal section taken in the following April, which shows that the wood-rotting fungi have penetrated to a depth of 2½ inches, i.e. to the level of the bud-patch, in a short

* H. Sutcliffe. The Use of Asphalts and Bitumens on Estates. Quarterly Journal, Rubber Research Institute of Malaya, Vol. 2, No. 3, 1930.

space of time, probably not more than 4-5 months. If the rot is allowed to extend below the level of the bud-patch there is the obvious danger of ultimate penetration into the main axis with the subsequent total loss of the plant. Even if the rot is discovered before it enters the main axis, the complete removal of the rotting tissue, which is now necessary, is extremely difficult to accomplish satisfactorily. Figure No. II shows a horizontal section of the specimen shown in Figure No. I and Figure No. IV shows a dead tree suspected to be attacked by *Fomes lignosus*, but which was actually killed as a result of the wood-rotting fungi gaining an entry through the cut-end of the snag, growing into the main axis and so into the tap-root, with the resultant complete rotting of all the tissues of the tap-root.

It is not advisable in this article to make recommendations for treatment with regard to those estates on which the snags rotting away as described may be found. It will be far more satisfactory to deal with any particular case on its merits and estate managers who have carried out budding operations and later find the rotting of the snag tissues as described above, are invited to write for advice and treatment. Such a position should not arise if the following recommendations are carefully followed.

Recommendations for the Treatment of Buddings made on Stocks not more than 18 months old.

1. It is assumed that the budding has been done successfully and pruning has now to be undertaken. The following procedure is recommended.

- (a) Ten days to a fortnight after opening the budding, the stock should be pruned back to within three to four inches above the level of the bud-patch. (Figure V).
- (b) The wood surface exposed by this pruning requires protection. On the day following pruning, the cut surface should be fully covered by a layer of a mixture made up of Asphaltum 2 parts and Kerosene 1 part. This mixture is smeared over the cut surface with the fingers.
- (c) Given normal growth, after about six months, the lower portion of the scion shoot shows the development of brown bark to a height of about 2 feet from the union. At this stage, the second and final pruning of the stock should be carried out. The level at which the second pruning should take place is usually self-evident. A distinct external ridge marks the limit of living wood, (Figures V and VI at A) and the pruning cut should be made at this limit of living tissue marked by the

external ridge, so as to remove all dead or moribund tissue above.

- (d) This newly exposed wood surface must again be protected. The procedure is slightly different from that suggested above for the first pruning. Immediately after the pruning is done, the coolie performing the operation should paint the fresh cut with either a 20 per cent. solution of Agrisol or Brunolinum Plantarium, both of which substances are water miscible. This protective painting will prevent any possibility of spores of the various die-back fungi germinating on the cut surface overnight. On the following day the cut surface is covered as before with a complete layer of the Asphaltum-Kerosene mixture.

II. *Recommendations for Treatment of Buddings on Stocks older than 18 months.*

The following procedure is recommended:—

- (a) From ten days to a fortnight after "opening" the budding, the stock should be pruned off at a height of 6 to 8 inches, or even higher, above the top of the bud-patch, with a sloping cut at an angle of about 30° (c.f. Buddings on younger trees). (Fig. VI).
- (b) The exposed wood surface requires protection. On the day after the pruning the surface should be completely covered with the Asphaltum-Kerosene mixture as explained above. However, there is a danger, some time after the bud-shoot comes away, of the Asphaltum-layer cracking owing to the drying out and splitting of the woody tissues immediately beneath the protective layer. Splitting of the Asphaltum layer should be taken as an absolute criterion that the cut ends of the snags require further treatment and all surfaces showing splitting should be re-treated immediately with a more fluid Asphaltum-Kerosene mixture containing Asphaltum 1 part, Kerosene 1 part. Such re-treatment could be easily undertaken by the labourers employed on the frequent pruning inspections which are so necessary for young buddings in the first year.
- (c) The second pruning is undertaken as soon as the oldest portions of the scions show brown bark to a height of about 2 feet. The point of the final pruning is indicated by an external ridge of tissue (Figure VI at A). It is

of importance to note that this external ridge of tissue on stumps more than 2 years old is generally higher on the side of the stock on which the bud is grafted so that a sloping cut must generally be made to remove dead tissue. (Figs. VII and VIII).

- (d) Painting with the Agrisol or Brunolinum mixture and the application of the Asphaltum-Kerosene mixture is carried out as recommended for buddings made on smaller stocks (Sec. I.d). It is essential that the protective Asphaltum-Kerosene layer should be maintained unbroken until callusing over of the exposed wood surface is completed. The more fluid Asphaltum-Kerosene mixture already mentioned is recommended for this purpose.

The details of the treatments given above should be considered as standard recommendations and should be followed rigorously. Exceptional cases are bound to occur and these should be notified to the Institute when they will be dealt with individually; also cases which have been recently budded and which now show rotting snag tissues should be notified to the Institute as these also require individual attention.

Explanation of Figures.

Figure I: Longitudinal section through a snag of a stock of 2½ years of age showing depth of penetration of "Die-back" fungi which have entered through cracks that have developed since the cut surface was treated with a disinfectant mixture. There was no surface indication of the rot beyond radiating cracks which appeared owing to drying out of the tissues.

Figure II: Transverse section of specimen shown in Figure I.

Figure III: Typical specimen of a snag on a stock grafted at 18 months old. The small amount of decayed tissue as shown in the drawing can be neglected for if the graft has developed vigorously the weakly parasitic "Die-back" fungi cannot make further progress and are ultimately cut out naturally.

Figure IV: Longitudinal section of tap-root of a 2½ year old bud-graft, showing the whole of the root tissues disintegrated by "Die-back" fungi which had entered via the snag.

Figure V: Illustrates the first cutting back of snag on 12—18 months old stock. Note external ridge of tissue at "A" indicating limits of living tissue.

Figure VI: Illustrates the first cutting back of snag on stocks $2\frac{1}{2}$ years old or over. Note difference of length of snag left after the first pruning (c.f. Fig. V).

Figures VII and VIII: Illustrates the position where the second and final pruning should be made and slope of cut, on stocks of 12—13 months of age (Fig. VII) (b) on older stocks (Fig. VIII).

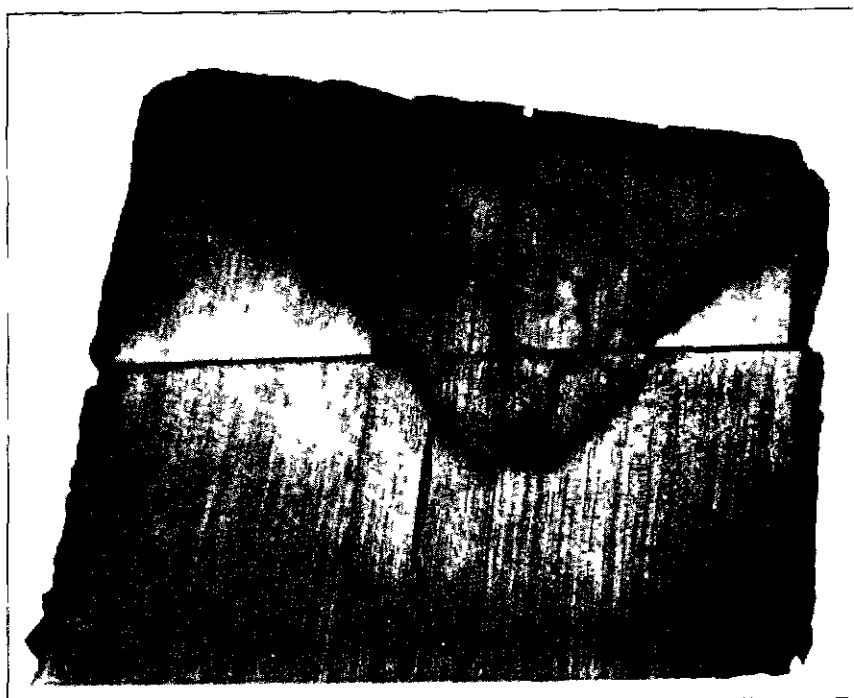


FIGURE I.



FIGURE II.

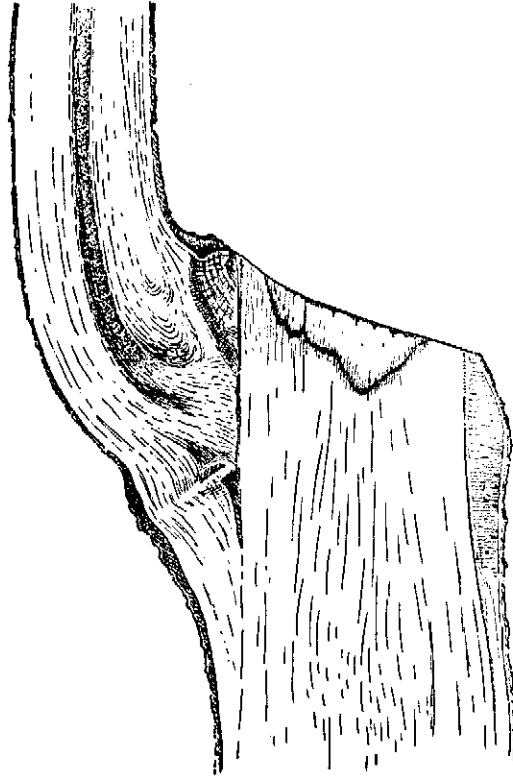


FIGURE III.

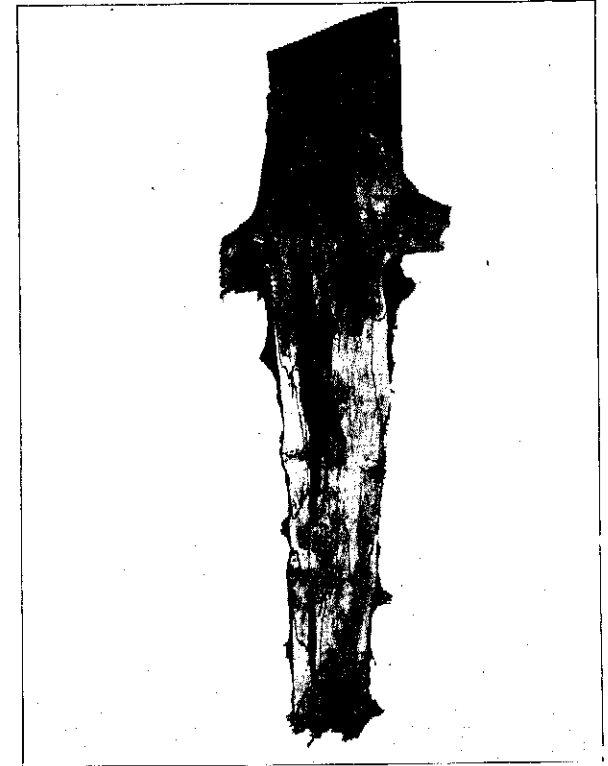


FIGURE IV.

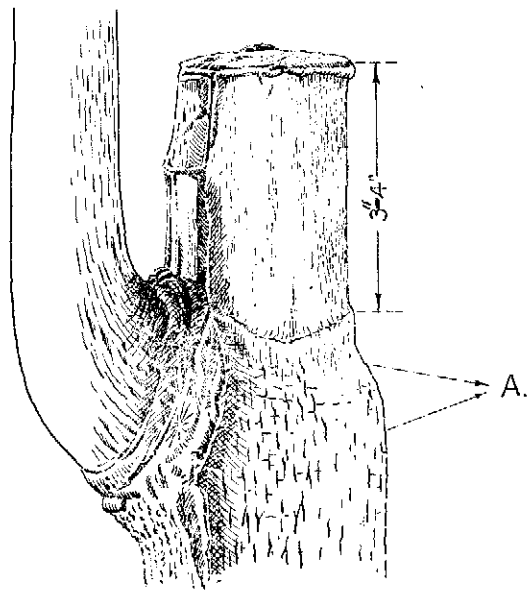


FIGURE V.

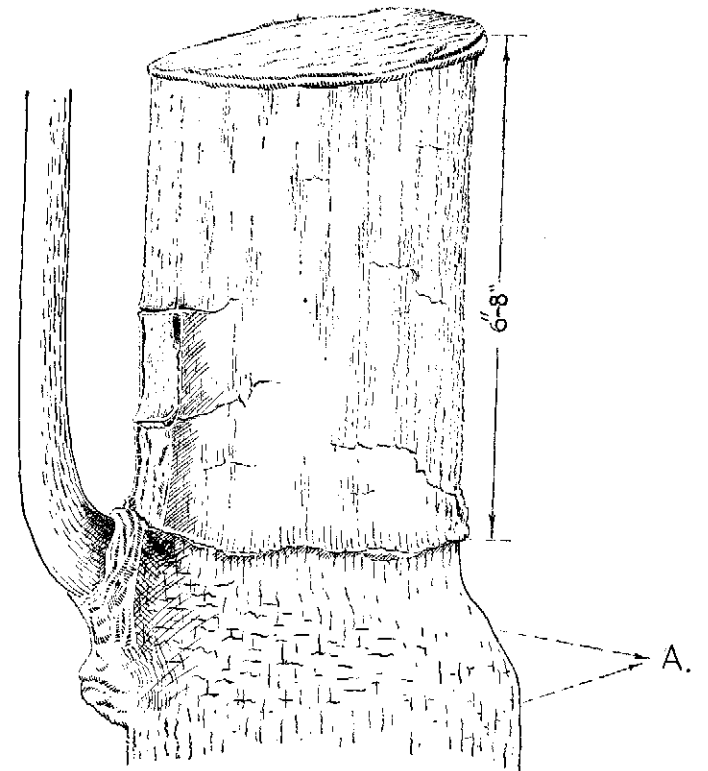


FIGURE VI.

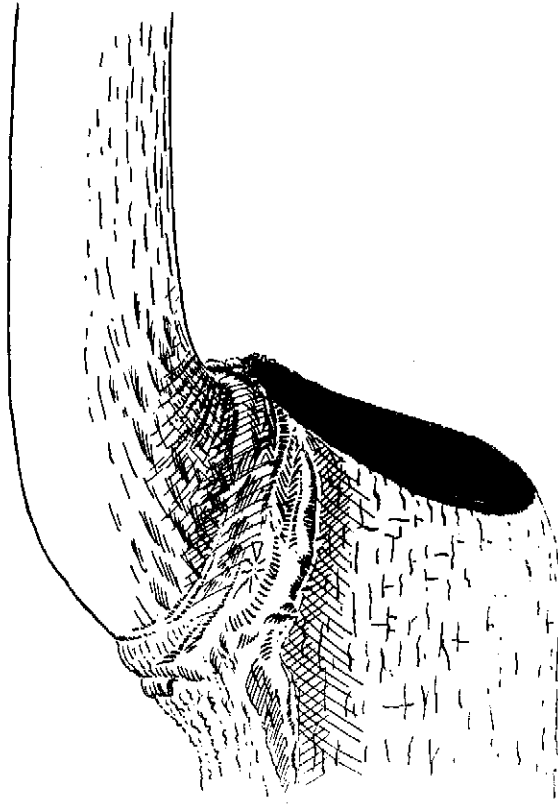


FIGURE VII.

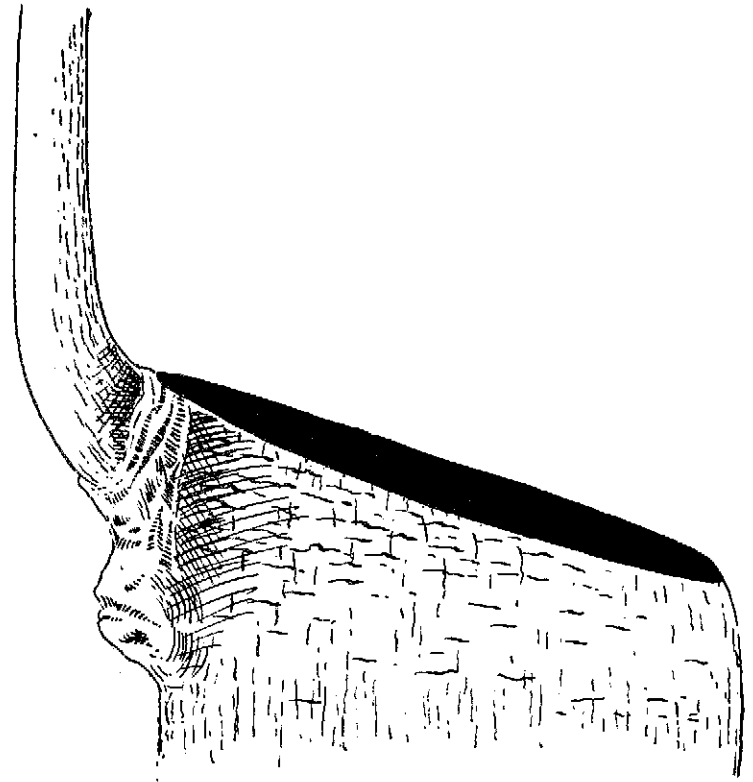


FIGURE VIII.