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THE ROLE OF SNAG ON THE GROWTH OF SCION IN BUD GRAFTED PLANTS OF *HEVEA* WITH SPECIAL REFERENCE TO YOUNG BUDDINGS

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SUMMARY

The effect of the snag on the time of sprouting was higher than that on the growth of the scion. The longer snags delayed sprouting, specially when they contained leaves attached to them. The difference between the long snags with leaves attached and short snags was higher when the growth condition of the plants was poor. Comparable growth can be obtained with shorter snags by improving the agromanagement practices during the first three to four months of the seedling plant.

Key words: rubber, snag, scion growth

INTRODUCTION

The method of propagation of *Hevea* is grafting buds from selected clones on to unselected seedling rootstocks raised in ground nurseries or in polybags. Once the graft is successful, the aerial part of the stock plant is cut above the bud patch and the grafted bud is allowed to grow. Basically, two grafting techniques are used i.e. brown budding technique and the green budding technique. The age and the size of the stock plant as well as the budwood are different in two techniques and accordingly the length of the stock stem retained above the bud graft is also different. The size of the snag is important for the initial growth of the grafted bud because, once the stock plant is cut, the plant has no foliage on it and therefore the grafted bud totally depends on the food reserves of the stock until it develops its own leaves.

In brown budding, the stock plant is more than one year old and about 2-3 cm in diameter. Accordingly, when the stock plant is cut about 10 cm above the bud patch, it contains enough food reserves to support the growth of the grafted bud. In

case of green budding, the stock plant is about 6 months old and about 1 cm diameter. The height of the snag here is a little longer than that of brown buddings, about 15 cm. When it comes to young budding, the technique of bud grafting is similar to that of green budding but, the stock plants are very small, approximately 6 mm diameter and 2–3 months old, and therefore the size of the snag is recommended to increase up to about 20 - 25 cm. The reason for this is not only the higher quantity of food reserves in longer snags but also the incidence of possible dyeback
of the snag, which eventually reaches the scion shoot also. In order to control the incidence of dyeback, it has been recommended to leave 2–3 functioning leaves from the lowest leaf whorl, attached to the snag (Yoon et al, 1989).

The uses and the effects of the snag in young buddings has been studied by Yoon et al (1989). Longer snags with leaves attached to them has given the best scion growth. This effect was similar in the trials conducted at the Rubber Research Institute of Sri Lanka for the clones grown in Sri Lanka. When the stock was left with three leaves attached to it, the scion growth was better as measured by the diameter and the length (Seneviratne et al, 1994). Even with or without leaves, the problem with longer snags was the presence of a large number of dormant buds which need removing for the growth of the grafted bud. The normal practice is to remove or nick off all these buds on the stock by using a rod file. At least two rounds, one at the time of cut back and another after about two weeks, should be done to complete the nicking process. This is rather laborious and also, if not carried out properly and in time, the effects are adverse. As long as stock buds grow out, the grafted bud remains dormant. This not only delays sprouting of the scion bud, but also makes it weak as the food reserves has been utilized for the growth of the stock buds which are removed.

A different method to prevent or control the growth of stock buds were tried as nicking was difficult to be carried out properly and also expensive.

MATERIALS AND METHODS

Stock plants were raised in 6"X 15", gauge 500, black polythene bags. Plants were fertilized according to the RRISL recommendations and details are given in Seneviratne et al,(1994).

Following snag treatments were tested in one experiment conducted in 1992. Plants were budgrafted at 3 months age with clones RRIC 100 and RRIC 102.

Treatment Number	Snag treatment
1	15 cm long + nicking
2	50 cm long + nicking
3	50 cm long + 3 leaves + nicking
4	50 cm long + top covered with a piece of black polythene + lower buds covered with black polythene strips Plate 1.d)
5	15 cm long + top covered with a piece of black polythene (Plate 1.e)

In the following year,the effect of the snag was tested again to confirm the results. Clones RRIC 100 and RRIC 121 were used for this. Only three treatments were tested as follows.

Treatment Number	Snag treatment
6	Long snag + 3 leaves + nicking
7	Long snag + nicking
8	Short snag (15 cm) + nicking

Stock plants were cut about 4 weeks after bud grafting. Treatment 1 & 8, 2 & 7 and 3 & 6 are similar. For treatments 4 and 5, about 1" width black polythene strips were used to cover the snag buds.

RESULTS

The sprouting percentage of the treatments 1–5 and 6–8 are shown in Figs. 1 and 2 respectively. As shown in figures 1 and 2, sprouting is faster with shorter snags. More than 70% has sprouted after about 15 days of cut back in treatments 1 & 5. Though treatments 2, 3 and 4 had similar size snags of about 50 cm, snags of treatment 3 contained leaves on them and showed the slowest sprouting.

Though more than 75% of the plants with shorter snags sprouted at about one month of cut back, it was below 20% for longer snags and below 10% when long snags contained leaves. Plate 1 also shows the appearance of the plants of treatments 6–8 after about 2–3 weeks of cut back. Plants of treatment 8 (short snag) have sprouted and grown up to about 30 cm (Plate 1.c), while those of treatment 6

(long snag + 3 leaves) have not started sprouting (Plate 1.a). Some plants of treatment 7 (long snag only) have just sprouted while some others show 15–20 cm long scions (Plate 1.b). Generally, sprouting is more uniform with shorter snags (Plate 1).
Plate 2 shows the performance of snags after another 2 weeks (5 weeks after cut back). The differences between treatments, as measured by the growth of the scion, have become small with time. Scions of treatments 6 and 8 show similar growth while the of the plants of treatment 7 is still behind. However, plants of treatment 8 (short snags) contain mature leaves (Plate 2.c) indicating their faster growth. The diameter of the scion shoots of treatments 1–5 and 6–8 are shown in Figures 3 and 4 respectively.

The highest diameter of 13.8 mm was obtained in treatment 6 when the long snag contained leaves. However, in this experiment, plants with shorter snags too showed a better growth, i.e. mean diameter of 13.1 and the difference was not significant. Plant with long snags but no leaves showed the least mean diameter (12 mm). The reason for the better growth with shorter snags was the earlier sprouting and thereby they becoming self sustainable in a shortest possible time. With long snags, the sprouting get delayed and also, the sprouting of the snag buds, as a result of

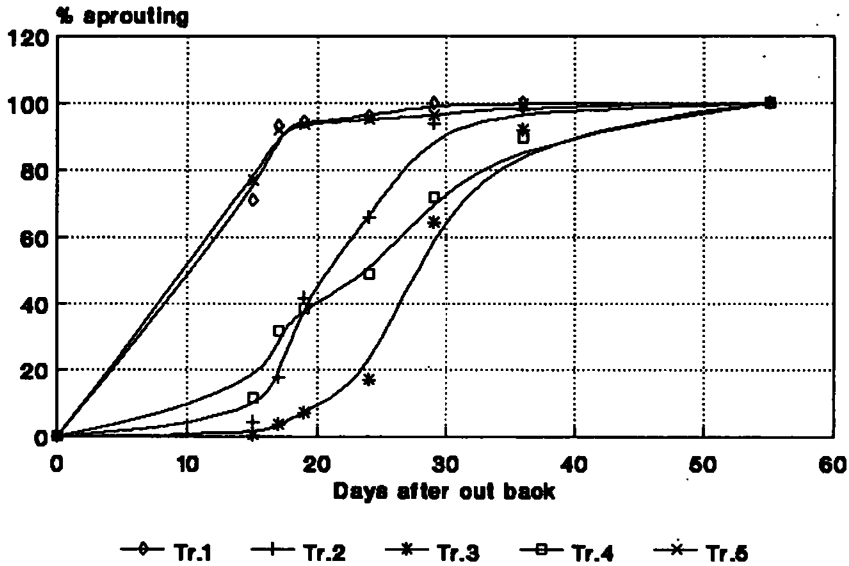


Fig. 1. The percentage sprouting of treatments 1–5, clones RRIC 100 and RRIC 121

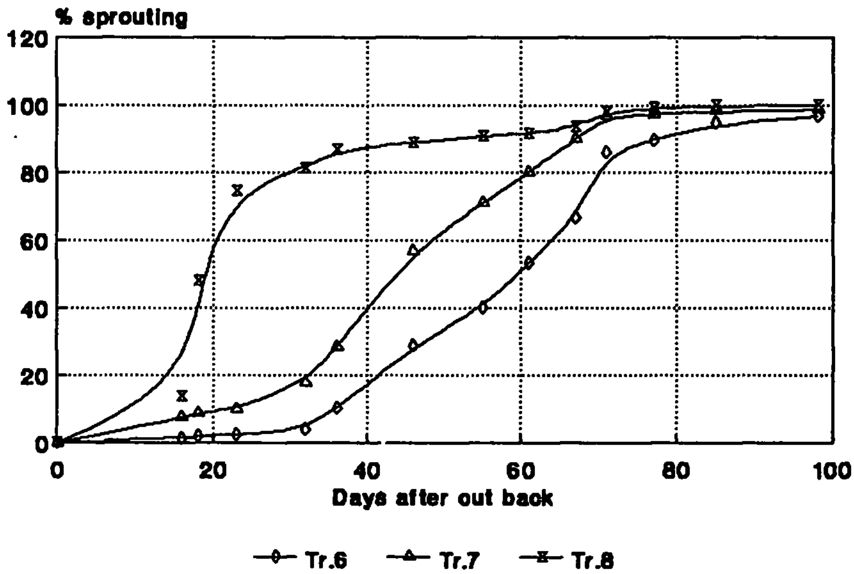


Fig. 2. The percentage sprouting of treatments 6-8. Clones RRIC 100 and RRIC 121

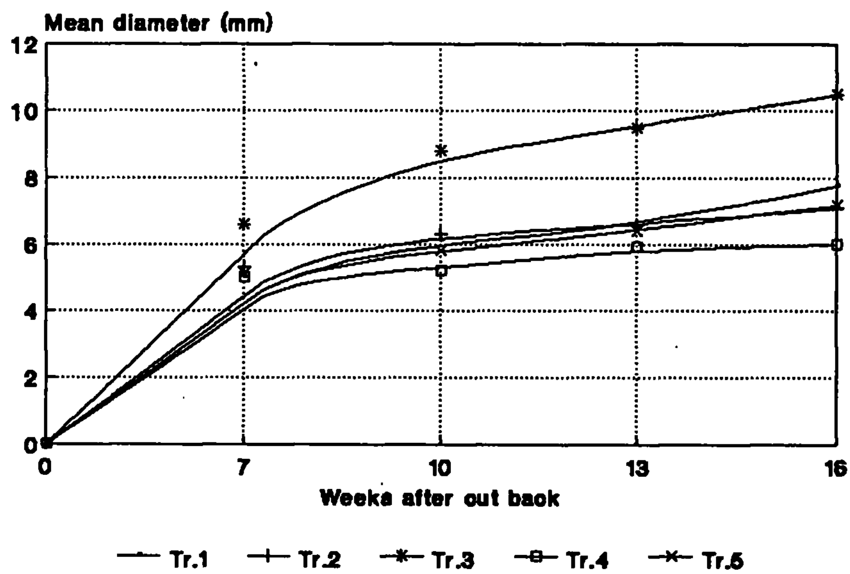


Fig. 3 The mean diameter of the scion shoots of snag treatments 1–5. For clones RRIC 100 and RRIC 102.

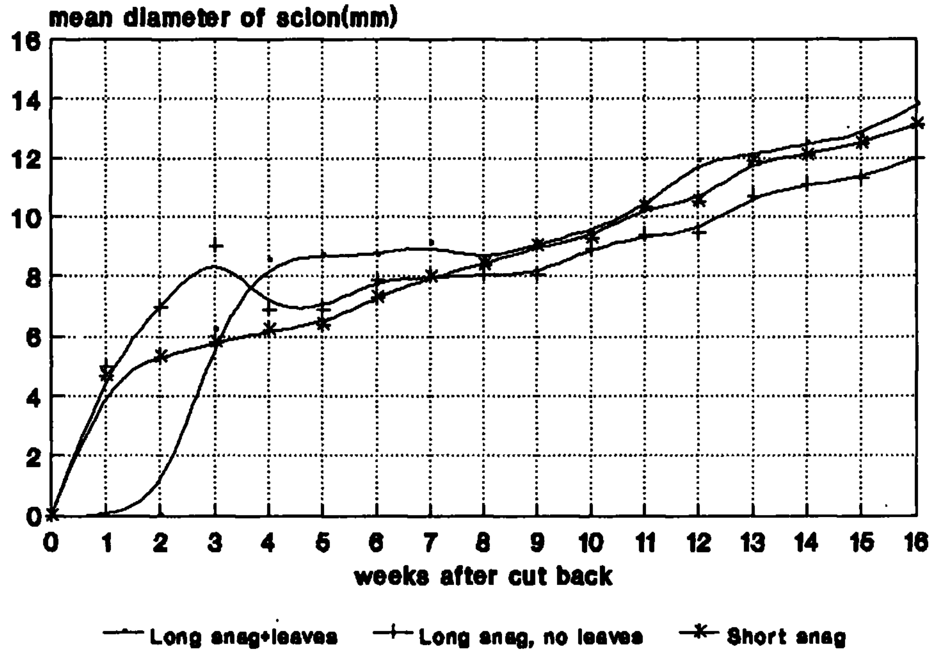


Fig. 4 The mean diameter of the scion shoots of snag treatments 6–8, for clones RRIC 100 and RRIC 121

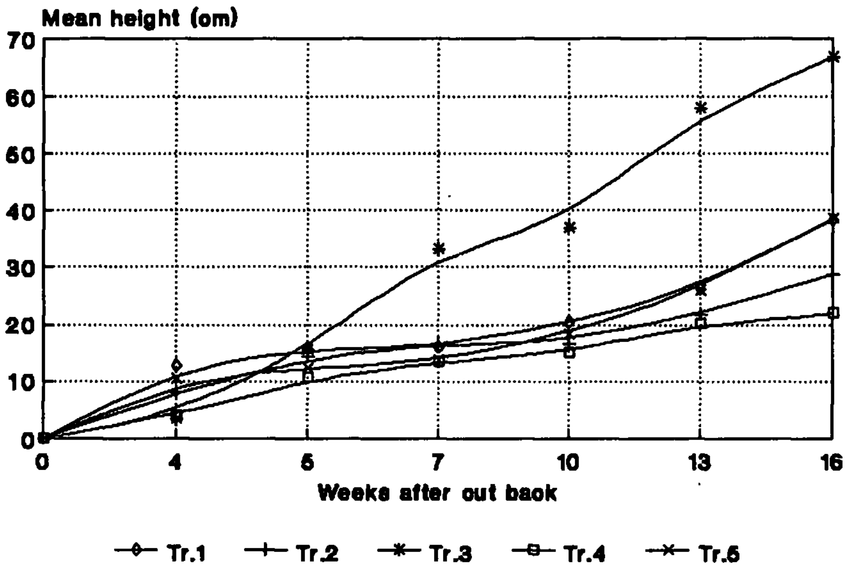


Fig. 5 The mean heights of the scions of snag treatments 1–5 for scion clones RRIC 100.

1 (a) 1 (b) 1 (c)

Plate. 1 The scion growth of the snag treatments 6–8 ,(results after 2–3 weeks of cut back)
1 (a). Tr.6 – Long snag + 3 leaves + nicking
1 (b). Tr.7 – Long snag + nicking (no leaves)
1 (c). Tr.8 – Short snag (15 cm) + nicking

2 (a) 2 (b) 2 (c)

Plate. 2. The scion growth of the snag treatments 6–8 ,(results after 5–6 weeks of cut back)

2 (a). Tr.6 – Long snag + 3 leaves + nicking
2 (b). Tr.7 – Long snag + nicking (no leaves)
2 (c). Tr.8 – Short snag (15 cm) + nicking

improper nicking, affects the growth of the scion. When the diameter of the scion of the two clones, RRIC 100 and RRIC 121, were analyzed, they were not significantly different and therefore they were pooled together to see the differences between treatments. The similar treatments in the first experiment showed lower diameters but within the experiment, the results were similar to that of the experiment with treatments 6–8. The reason for this was the poor growth of the plants which affects the growth of the scion to a greater extent when the snag is shorter. This made the difference between the long snag with leaves and short snags large.

The height of the shoots showed a difference between the clones and for RRIC 100 and RRIC 121 it was significant (p=0.0001) from the sixth week until field planting. The mean heights of the scion shoots for treatments 1–5 for the two clones RRIC 100 and RRIC 121 separately are shown in Figs 5 and 6 respectively.

As seen in Figures 5 and 6, the heights are different in two clones but the effect of the snag is almost the same. Treatment 3 shows the highest, while the treatment 4 shows the lowest and the others lie in between. The data presented here is until the plants were transferred to field.

Though there are differences in the lengths of scion shoots of clones RRIC 100 and RRIC 102, their responses to the snag treatments are similar. Snags with three leaves show the highest mean length for both clones and are significantly different from the other treatments. However, this is shown after about 7 weeks of cut back until field planting. Initially, the mean of the treatment 3 is lower (Figs 5 & 6) due to delay in sprouting. The differences observed in the lengths of scions were measured until field planting and at that stage they contained 2–3 leaf whorls. Treatments with long snags with no leaves showed very uneven growth and this was partly due to improper nicking. Initially , the pieces of polythene were fixed with a rubber band and it was unsuccessful perhaps, they were not resistant to out door temperature, and in about 2 weeks time rubber bands were replaced with pieces of nylon thread. Plate 3 shows the results after about 13 weeks of cut back.

Though the heights were significantly different, for the two clones in the second experiment also, their responses to the treatments 6–8 were similar. Therefore, the data for RRIC 100 and RRIC 121 were pooled when treatments were compared. The results are shown in Fig.7.

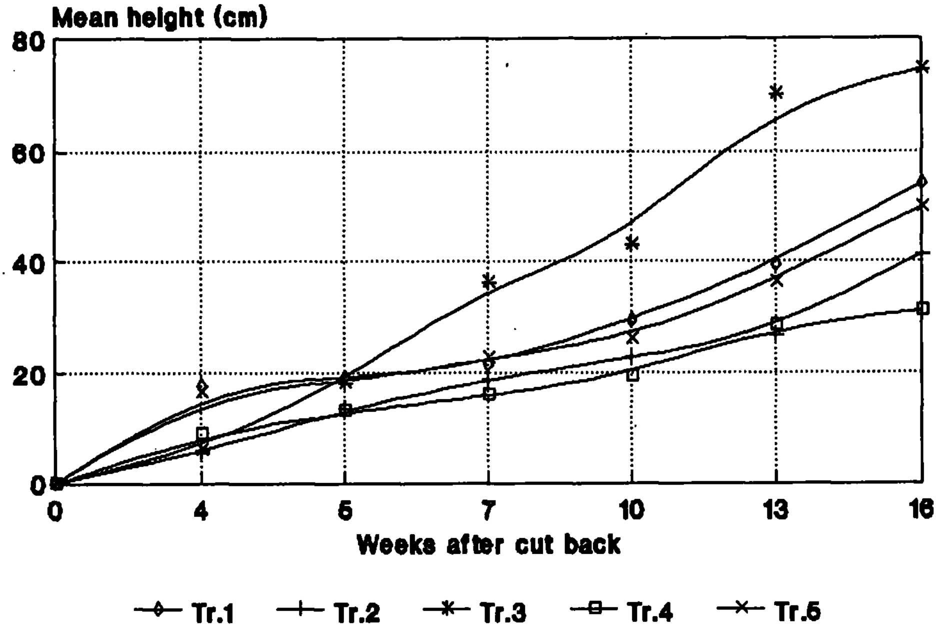


Fig. 6 The mean heights of the scions of snag treatments 1–5 for the scion clone RRIC 102.

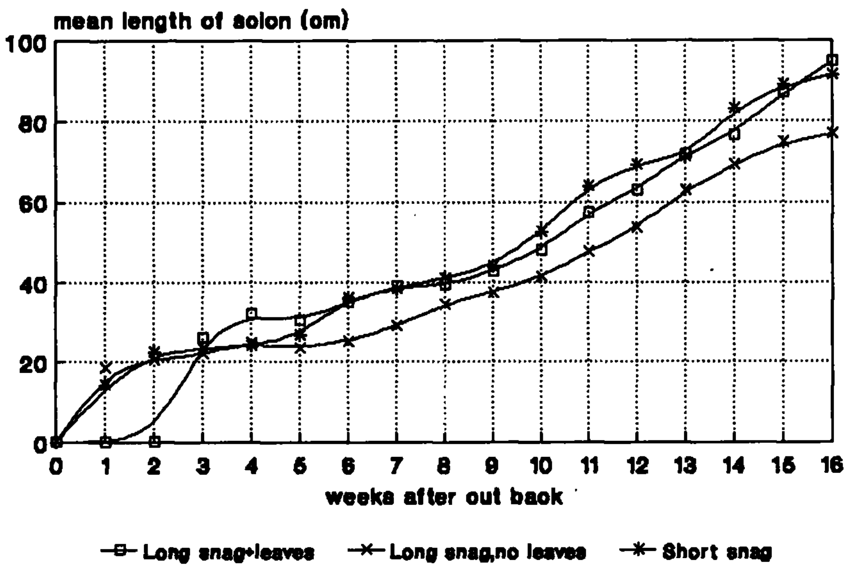
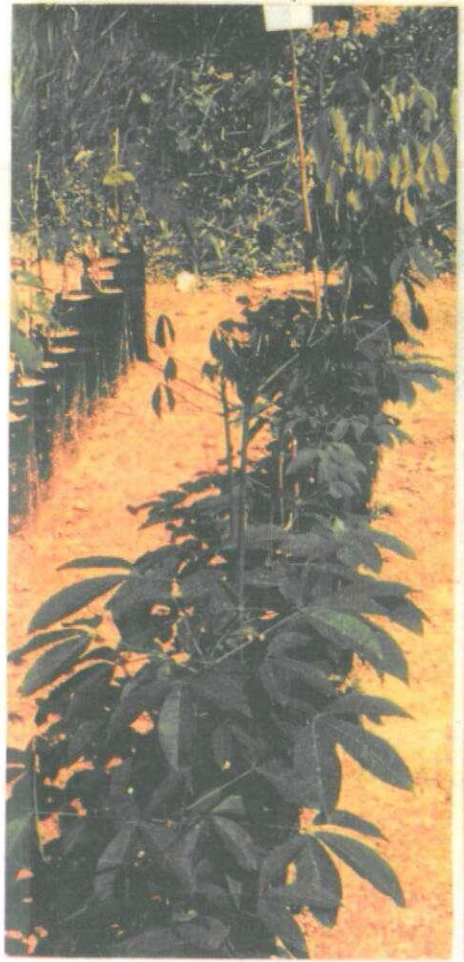
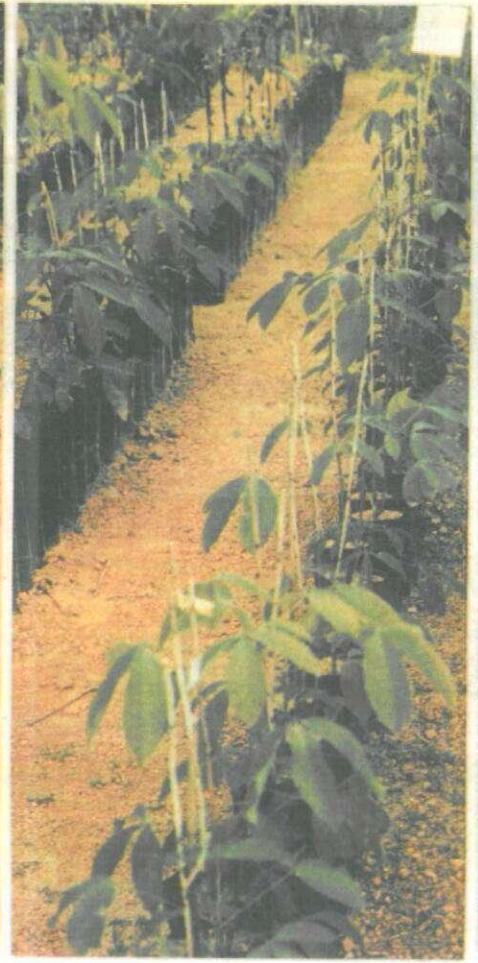


Fig. 7 The mean height of the snag treatments 6–8 for clones RRIC 100 and RRIC 121.



3 (a)



3 (b)

3 (c)

3 (d)

3 (e)

Plate 3. The scion growth of the snag treatments 1–5 (results after about 3 months of cut back).

3 (a). Tr.1 – 15 cm + nicking
3 (b). Tr.2 – 50 cm + nicking
3 (c). Tr.3 – 50 cm + 3 leaves + nicking
3 (d). Tr.4 – 50 cm + buds covered with polythene
3 (e). Tr.5 – 15 cm + buds covered with polythene

DISCUSSION

The effect of the snag on the scion growth is very clear in young buddings though the differences among the similar treatments in different years showed some variation. However, the message was the same, and similar for all clone tested RRIC 100, RRIC 102 and RRIC 121 suggesting that longer snags were beneficiary for the growth of the scion when they contained a few leaves attached to them.

The main reason for the differences of the results from year to year was the other factors such as differences in the growth condition, bud grafting success, nicking, weather conditions, diseases, poor quality seeds etc.

When the plants were poor in growth or weak, the differences were large between long and short snags, as shorter snags produced very poor scions. Though the longer snags with leaves contributed more to the growth of the scion, they always delayed sprouting. If the buds in the long snag were not removed properly and timely, then the effect of the long snag on the scion was adverse as the food reserves in the stock is used by the stock shoots for their growth while the grafted bud remains dormant. Then the growth of the scion may be similar or some times poorer than that of short snags.

The aim of the treatment 4 was to find an easier method than manual nicking to suppress the growth of stock buds present in longer snags until the grafted bud emerge out. But the growth of those buds could not be stopped by covering them with black polythene strips as some buds emerged through the small spaces in between the polythene strips and accordingly the growth of the shoot was affected.

Even in shorter snags of 15 cm, 1–2 dormant buds are found occasionally. They are normally nicked off or cut and removed once they emerged out. In treatment 5, the top of the shorter snags were covered in the similar way. However, this showed no advantage over nicking as some buds emerged through the polythene and also there were buds present further below.

Yoon et al (1989) have shown a clear pattern between the growth vigour of the scion and the number of leaves retained on the snag. Increasing the number of leaves from one to four has progressively increased the leaf area and dry matter content irrespective to the height of the snag. This also shows that the presence of leaves is more important than the length of the snag. The results of the present study confirms the observations of Yoon et al (1989).The effect of different snag treatments on the growth of the scion has been reported earlier also (Seneviratne et al, 1994). In this report, the effect of the snagonly one of several other factors such as bag size, bud type, growth stage ofthe plants etc. tested on the bud grafting success and the scion growth of young buddings.

differences among the snag treatments are not very clear and there was an association also between snag treatments and different bag sizes used for raising plants. Also, the growth as measured by the diameter and the height is poor compared to the growth of the plants of the present study and this may have masked the differences between treatments.

The main reason for the poorest performance of the plants with long snags with no leaves was contributed by incomplete nicking and thereby wasting the food reserves on the growth of stock shoots. Even if nicking was done properly, there was a delay in sprouting due to the length of the snag, perhaps due to the endogenous content of plant growth regulators.

Besides the higher amount of food reserves in long snags, long snags were useful in reducing the number of dyeback incidence associated with shorter snags. This happens only in young buddings but not in either brown or green buddings. The possible reason for this is the age of the plants, i.e. young budded plants are about 4 months old at the time of cut back and there is a possibility that the cut back position is still green and tender. Accordingly, once the apical part is removed, the tender stem starts to dry and this continuous down along the shoot. However, this could be kept to a minimum by improving the agromanagement practices and also by delaying the bud grafting until the plants are about 3-3½ months old. Diameter of 8–10 mm can easily be obtained if the plants were maintained according to the recommendations. If the plants are well grown, at 4–4½ months age, i.e. the time of cut back, they have brown bark developed well above the cut back point, i.e. 15 cm, and dyeback incidence will be nil. Therefore, it is for the nurserymen to decide whether to have long snags which demands nicking or shorter snags which requires proper agromanagement practices. Certainly, both factors together will result in high quality plants. Further, when the growth condition of the stock plants is optimum, sprouting of the grafted bud is very prompt with short snags (Figs 1 & 2) and they will become self sustainable in a very short time, some times even before the plants with long snags start sprouting. As a result, the difference between the two treatments became very small though they are significant at 0.01% level for both diameter and length. Yoon et al (1988) have used the chemical Atrinal (sodium dikegulac) at 1000–2500 ppm and observed early and uniform sprouting of the grafted bud on long snags. When nicking was done, the effect has been little and similar to that applied on snags of 20 cm, as nicking has also improved sprouting. There were differences between clones, for height of the scion shoot but not for the diameter. Clone RRIC 121 always showed a higher growth rate and it was significantly different from that of RRIC 100 ($p=0.01$). The difference between the heights was significant at 0.001%.

REFERENCES

Seneviratne P, Nugawela A and Samarakoon S M A 91994). Factors affecting the bud grafting success and the scion growth of young buddings of *Hevea*. *Jl. Rubb. Res. Inst. Sri Lanka* **74**, 38–54.

Yoon, P K, Leong, S K, Ja'afar, H, Leong, H T, Iee, Y C, Phun, Y H, Leong, H C, San, K, Maria, G S, Kumarasamy, A, Subramanium, S, Sharib, J and Aziz M R A (1988). Improvement to young budding technique II. Enhancing earlier, better and more uniform sprouting. *RRIM Planters' bulletin* No.**195**, 27–36.

Yoon, P K , Leong, S K , Heh, W Y and Sim, B S (1989). Retention of snag–leaves in young buddings. In, *Proceedings of the Rubber Growers Conference*, RRIM, Malaysia. pp. 77–98.

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