

A METHOD OF INDUCING FLORAL STIMULUS FOR EARLY FLOWERING OF HEVEA BRASILIENSIS

By

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In plant breeding work with a perennial crop such as Hevea the plant breeder may have to wait six or seven years for the progeny of successive generations of crosses to reach maturity for natural flowering.

A reliable method of inducing flowering in young rubber plants at an early stage would result in a considerable saving of time for the plant breeder to obtain by hand pollination material possessing the desired characters of vigour, yield and disease resistance.

This paper describes a method to induce early flowering in young budded plants of Hevea brasiliensis.

Hevea is monoecious, *i.e.* both male and female flowers are borne on the same tree. Depending on the genetic constitution and the environmental conditions, the male flowers of Hevea may shed pollen before the female flowers are open or the female flowers may be open before the pollen is sufficiently mature for fertilization. The periods of flowering may also vary from clone to clone during the flowering season.

These factors present difficulties in plant breeding work involving specific crosses between selected clones and must be considered when devising breeding programmes. The successful inducement of early and, in some cases, continuous flowering in young Hevea budded plants could considerably minimize these difficulties.

Horticulturists have claimed that the downward training of branches of fruit trees reduces vegetative growth and promotes flowering. Studies on "gravimorphism" in trees indicate the effects of gravity on growth, apical dominance and flowering in fruit trees.

Work carried out by Wareing and Nasr (1) at the University of Manchester has shown that two-year-old stool-bed layers of apple stocks in a normal vertical position initiate relatively few flowers but the layers grown horizontally show heavy flowering on the spurs of the shoots.

Similar experiments on methods of inducing floral stimuli in Hevea have been tried out in 1954 at the Institut des Recherches sur le Caoutchouc en Indochine (2).

The disease-resistant Hevea material recently introduced into Ceylon for breeding work could be used, as young budgrafts, for inducing early flowering with the object of accelerating breeding work.

It should also be possible to considerably reduce the period of commencement of flowering by crown-budding or branch-budding with the required material on

pollarded mature trees of Hevea. Finally, there is the possibility of using flower hormones as a spray for inducing early flowering. These methods are being tried out in the course of our breeding work with Hevea.

Photoperiodic induction methods have been tried out in our preliminary investigations but with inconclusive results. Further attempts will be made under greenhouse conditions.

The present investigation for early flowering of Hevea possibly combines the action of "gravimorphism" and of ringbarking. Sufficient controls were unfortunately not introduced to differentiate clearly between these two treatments. It is known, however, that a severe set-back to a plant caused by ringbarking or root disease does induce precocious flowering and fruiting.

Method of Planting.—Budded stumps of three clones were planted about 6 to 8 feet apart in rectangular pits in nursery beds. The stumps were inclined about 45° to the horizontal with the budpatch about 2" below ground level or just above ground level. Figs. 1 and 2 give the diagrammatic details of the position of the stumps at the time of planting, and the subsequent development of the bud shoot.

Each planting hole was initially manured with 20 lb. of cattle manure, and no further manuring was done throughout the experiment. A summary of the details of planting is given below:—

Clone	Number of budded stumps planted	Date of planting	Number surviving
FX 25	5	30.6.56	1
FX 2784	5	30.6.56	3
RRIC 52	13	6.8.56	6

Fig. 1

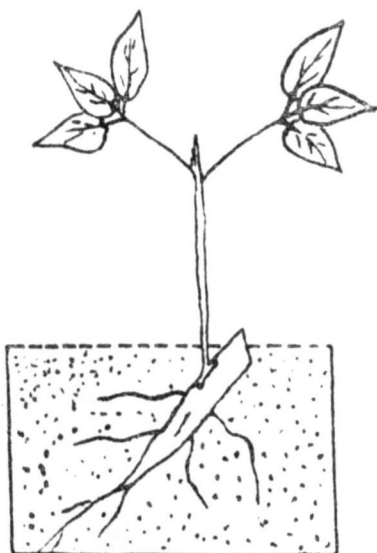
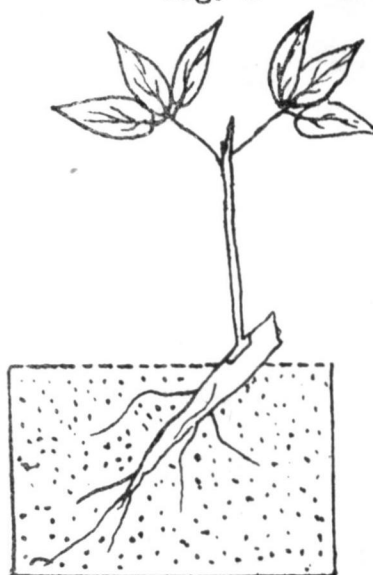


Fig. 2



Preliminary Treatments.—When the budshoots had developed to a height of 4 feet above ground level they were bent into a horizontal position. The bending was done according to the natural slant of the stem inwards towards the snag end of the stock to prevent breakage. All secondary shoots were allowed to develop and these in time were also bent to a horizontal position. The bending was done by means of coir-rope tied at a point on the stem protected with a padding of coir-fibre and fastened to a peg in the ground. This can be seen in plate 1 near the white screen in the background. One plant of clone FX 2784 was allowed to grow without bending the main stem or branches. This plant is seen in the right foreground of plate 2.



Plate 1



Plate 2

In June, 1957, all plants, except one from clone RRIC 52, were ringbarked at a height of 6" above the graft union, as shown in Plate 3. In December, 1958, two plants of clone RRIC 52 sent out new shoots below the ringbarked area (Plate 3) and these shoots were allowed to grow out without interference. The growth of these shoots did not affect the rate or time of flowering of the plants, but there were indications of a healthier condition in the plants with the side shoots. No flowers were observed on these new shoots at any period during the investigations.

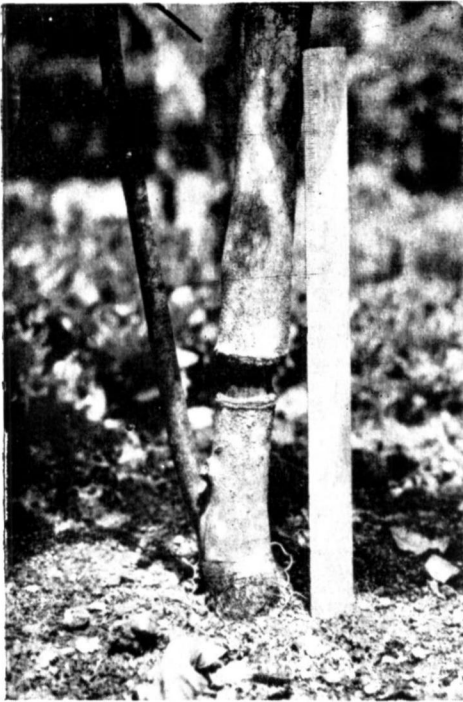


Plate 3



Plate 4

Results.—Flowering was first observed in a plant of clone FX 2784 in September, 1958, sixteen months after ringbarking and at 2 $\frac{1}{4}$ years of age. In September-October of the same year all the clones started to flower, except two plants one of which was not ringbarked (Plate 4), and the other in which the branches were not bent but the main stem was ringbarked (Plate 2).

The flowers were mainly concentrated on the small lateral shoots that arose from the bent branches, as seen in Plate 5.

Placing the budpatch above or below the ground had no effect on flowering. The flowers were more profuse on clone RRIC 52.

The duration of flowering in the two FX clones was relatively short compared with that in clone RRIC 52. The FX clones ceased to flower in June, 1959. Flowering in the plants of clone RRIC 52 has been continuous for eleven months and the clone was still flowering in October, 1959. The profuse flowering in clone RRIC 52 is seen in Plate 5.

The fruit set was extremely poor in the FX clones. It is possible that this may be due to the unfavourable weather conditions for fruit set that prevailed during 1959. Only four fruits were observed in 4 plants of the FX series.

In clone RRIC 52 the fruit set was prolific (Plates 1 and 6). In one inflorescence there were 32 sets but only 12 fruits reached maturity due mainly to heavy *Phytophthora* infection caused by continuous wet weather in the S.W. monsoon period of 1959. These conditions may partially account for the poor results obtained in the FX clones.

During the 1959 pollination season 60 test crosses were made on these plants of clone RRIC 52 using clone FX 2784 as the male parent and 7 sets were obtained. Four fruits were destroyed by Phytophthora and 3 fruits reached maturity. Nine seeds were obtained of which 4 have germinated and are now growing as young seedlings.

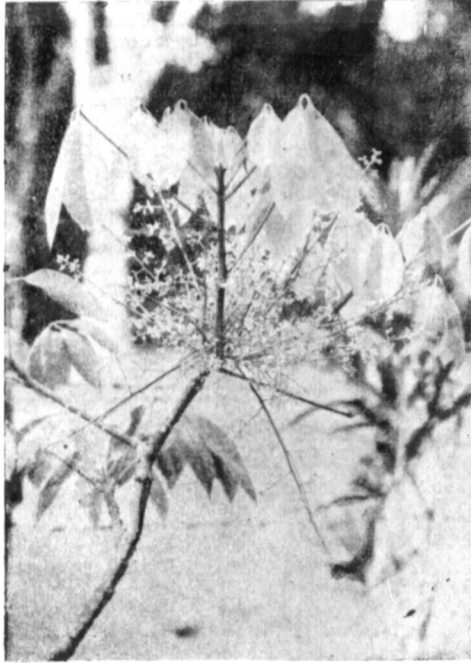


Plate 5



Plate 6

Scan

The results are shown in tabular form below:

Clone	No. of plants	Date of planting	Method of planting	Treatment	Flowering	Fruit set
FX 25	1	30.6.56	Inclined with bud patch 2" below soil level	Ring-barked and branches bent down	From Sept., 1958 to June, 1959	very poor
FX 2784	2	30.6.56	"	"	"	"
FX 2784	1	"	"	Ring-barked only	No flowering	—
RRIC 52	1	6.8.56	Inclined with bud patch 2" above soil	Not ring-barked but the branches were bent down	No flowering	—
RRIC 52	2	"	"	Ring-barked and branches bent down	Continuous from Nov., 1958	Very heavy
RRIC 52	3	"	Inclined with bud patch 2" below soil level	"	"	"

Summary.—Preliminary investigations have been carried out with ring-barking, "gravimorphic," and photoperiodic methods for inducing floral stimuli for the early flowering of *Hevea brasiliensis*.

The more successful methods resulting in early flowering of approximately 2-year-old *Hevea* budded plants, with fruit set and final germination of seed, are described.

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