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HAILSTORM DAMAGE TO *HEVEA* TREES IN TRIPURA AND THE PERFORMANCE OF THE RECOVERED TREES

The agroclimatic suitability of north eastern (NE) region of India for cultivation of rubber (*Hevea brasiliensis*) has been well established and studies conducted have pointed out that the growth of *Hevea* tree in this region is comparable to that in traditional regions (Sethuraj *et al.*, 1989). Nevertheless, there are some climatic constraints for growth and yield. Of the constraints, low temperature during winter followed by a period of water stress is the major limiting factor. Isolated stress factors such as hailstorm, cyclone etc. also pose problems in the establishment of rubber plantations in the region.

Occurrence of hailstorm is a common feature in the NE region. However, hailstorms with normal wind velocity and hail size generally do not pose serious problems to the growth of rubber. There are reports of severe damages caused by hailstorms to plantation crops elsewhere (Sansom, 1966). Hailstorms usually occur along with premonsoon showers. The average frequency of hailstorm in North Bengal has been estimated as 1 . 5 days per year based on the data recorded over a period of 80 years (communication from Agromet Department, Govt. of West Bengal). Though no such study has been made for Tripura, it is a fact that this region experiences hailshowers almost every year. The hailshowers generally do not adversely affect the rubber trees. However, thunderstorms accompanied with high wind velocity and large sized hails can cause serious damages. In 1986 a severe hailstorm (reported to be the worst in 30 years) hit the research farm of the Rubber Research Institute of India (RRII) at Taranagar and inflicted serious injury to the bark of mature rubber trees, besides severely damaging the nursery and immature plantations (RRII, 1987). The present study is aimed at an evaluation of the recovery from the damages inflicted on the bark by hailstorms.

The data for this investigation was recorded from a clone evaluation trial planted in randomised block design at the RRII research farm at Taranagar during 1980 with eight clones and three replications. On 3rd April, 1986 a severe thunderstorm carrying large sized hails measuring upto 7.5 - 12.5 cm in diameter, with a wind velocity more than 100 kmph hit the farm from North - North West direction. The high velocity hail chiselled the bark of the trees almost entirely on one side inflicting various degrees of damage from superficial to deep. In addition, common wind damages like branch and trunk snaps and splitting of trunk also occurred. It took almost two years for the affected trees to heal the wounds, by putting callus growth, though all the damaged trees were treated with wound dressing compounds immediately. The regenerated bark was having many protruberances and small cavities interspersed with islands of virgin bark which escaped the hail impact. The opposite side of the trunk had normal virgin bark (Figures 1 & 2) .

Fig. 1. Hailstorm hit side of a tree showing protruberances and islands of virgin, bark after recovery

Fig. 2. Damaged side opened for tapping

Four years after, the trees with an average girth of 50 cm were opened both on normal and damaged sides alternatively and yield was monitored separately. The affected side showed considerable depression in yield compared to that from the virgin bark. For refining the experimental procedure, four trees were selected per replication and given quarter spiral cuts both on affected and unaffected sides and a tapping system of $2^{1}/_{4}S\ d/_{2}\ 6d/_{7}$ 100 per cent was maintained throughout the study.

Samples were collected from various regions of regenerated bark and normal bark of the same tree for comparison of anatomical features, following routine procedures (Johanson, 1940).

The data on latex yield (Table 1)

Table 1. **Latex yield from hail damaged and normal sides during 1991-92**

Clone	Mean yield (ml/tree/tap)	
	Normal side	Damaged side
RRII 105	35.21	23.07
RRII 203	30.11	22.28
RRIM 605	29.46	20.94
RRII 118	25.13	20.84
Gl 1	24.10	19.83
GT 1	23.43	20.51
PB 5/51	22.94	15.03
RRIM 600	17.19	16.23
SE (d)	4.645	3.270

F Clones: 7.88**; Side tapped : 36.72**
Clone x Side tapped : 1.62 NS

** Significant at 1 % level, NS : Not significant

show significant variation between the normal and the damaged sides, the extent of depression of yield in the damaged side being 35.92 per cent. Analysis of variance revealed nonsignificant variation of clones x damage interaction, indicating that all the clones suffered almost uniformly from the damage and none was better than the other with regard to the extent of recovery. Anatomical studies revealed that the average density of latex vessels for the normal side was 17.07 per mm whereas it was 15.19 per mm for the damaged side, towards the cambial region (Table 2). It was

Table 2. **Counts of latex vessel rows and density of vessels in normal and damaged sides**

Clone	No. of latex vessel			
	per row		per mm	
	Normal	Damaged	Normal	Damaged
RRII 105	7.0	5.4	20.11	16.44
RRII 118	7.0	6.5	19.36	18.43
RRII 203	7.75	6.0	16.28	14.13
RRIM 600	5.0	3.5	17.14	15.46
RRIM 605	8.5	6.0	15.58	14.29
PB 5/51	6.67	6.0	15.46	14.65
GT 1	7.0	4.3	15.56	13.86
Gl 1	4.5	3.6	15.60	14.66
Weighted mean	6.62	5.06	17.07	15.19

also observed that while the bark regenerated wherever the injury was deep upto cambium, the development of latex vessels was not complete. This resulted in lower latex vessel counts and irregular and incomplete rows especially towards the hard bast region. The average number of latex vessel rows on the soft bast region of the normal side was 6.62, whereas it was 5.06 for the damaged portion. These irregular latex vessel pattern and related physiological reaction might have resulted in the yield depression on the damaged side.

The study was conducted after a period of 4-5 years of hailstorm damage and it was observed that even after four years the affected side has not regenerated to its original features. The study is of preliminary nature and detailed studies on flow characteristics have not been attempted.

As the opening was done on the unaffected side more than five years were available for the affected side to recover. Further studies on bark regeneration and flow characters are required to formulate strategies for management of hailstorm damaged trees.

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