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PRELIMINARY REPORT ON THE EFFECT OF CALCIUM CARBIDE AS AN YIELD STIMULANT IN COMPARISON TO ETHEPHON IN *HEVEA BRASILIENSIS*

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ABSTRACT

An yield stimulation experiment using calcium carbide and ethephon was laid out at the Central Experiment Station of Rubber Research Institute of India. A novel method of application of calcium carbide is used in the present study. The preliminary results are promising. The most important observation is a 50 per cent higher cumulative yield with calcium carbide stimulation in conventionally tapped trees when compared to stimulation with ethephon. The effect of calcium carbide is more in the first two tappings after stimulation, followed by a decline. Due to wintering yield under all treatments declined during February to April and later increased. Calcium carbide may be used as an yield stimulant after assessing its long term effect on yield and brown bast.

INTRODUCTION

The system of yield stimulation has become an established commercial practice in *Hevea*. A systematic research on stimulation was started in 1930's. Two main categories of stimulants were distinguished *i. e.*, compounds which decompose to produce ethylene and analogues of ethylene such as acetylene; and growth regulators which induce the tissue to produce ethylene. Pakinathan (1970) screened 187 compounds including calcium carbide (CaC_2) in search for new stimulants. Wu Kaihua and Wang Hongbo (1986) reported superiority of puncture tapping combined with CaC_2 stimulation over conventional excision tapping. Ethephon stimulation under conventional tapping systems are well studied (Abraham, 1970; Sivakumaran et al., 1983; Sethuraj, George and Sulochanamma, 1975; Eschbach and Tonnelier, 1984; Lee, Ismail and Ng. 1985). However, no information is available on effectiveness of soil application of CaC_2 under conventional tapping systems.

MATERIALS AND METHODS

A field experiment was laid out in a completely randomised design in the Central Experiment Station of Rubber Research Institute of India. Trees with abnormally low or high yields were excluded from the trial based on pre-experiment treewise yield data. The details of various treatments given are presented in Table I. Each treatment has ten trees as replicates. The method of application of CaC_2 is illustrated in Fig. 1. A 30cm long, hollow and perforated bamboo pipe was fixed in the soil, 15-20 cm away from the plant, adjacent to the tapping panel. Twenty gm CaC_2 granules were sprinkled around the neck of the bamboo pipe and sealed using a porcelain cup.

The method of puncture tapping adopted is as given in Fig. 2. Four vertical bands of 40 cm length were made on the tree, 20 cm above the bud union and four punctures/band were made on each tapping. Calcium carbide stimulation was repeated

Table 1. *Details of various treatments*

Treatment Number	Treatment	Type of stimulant	Method of application	Frequency
T_1	Puncture tapping (PT) + CaC_2	CaC_2	Soil application 20 g/tree	Once in 15 days
T_2	Puncture tapping + Ethephon (ET)	Ethephon 5%	On vertical bands (4 nos)	Once in 30 days
T_3	1/2 S d/2 + CaC_2	CaC_2	Soil application 20 g/tree	Once in 15 days
T_4	1/2 S d/2 + Ethephon (ET)	Ethephon 5%	Bark application (5 cm. below tapping cut)	Once in 60 days
T_5	1/2 S d/2 (control)	—	—	—

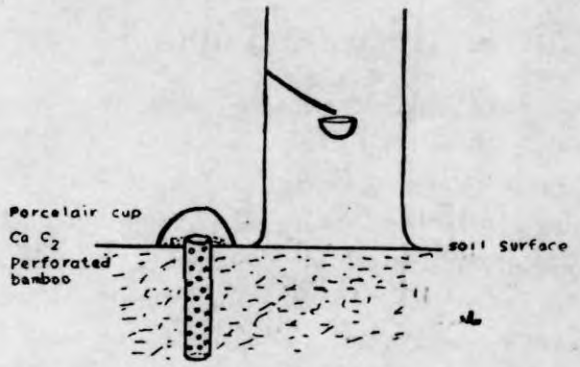

Fig. 1. Method of application of calcium carbide

at 15 days interval, whereas ethephon stimulation was carried out at band change (once in a month) for puncture tapping (PT), and at 60 days interval in case of bark application.

The first stimulation was carried out in December and tapping commenced on 2nd January 1988. Tree wise yield data was collected by cup lump method. One CaC_2 stimulation was omitted during wintering.

RESULTS

The mean yield data obtained for the initial five months of the trials are presented in Fig. 3. The yield differences were significant at 5% error. Half spiral alternate daily tapping system with CaC_2 stimulation gave the maximum dry rubber yield. The yield (g/tree/tap) in this treatment was 73 per cent higher than the 1/2S d/2 control. This was 50 per cent higher than the yield obtained with ethephon stimulation under

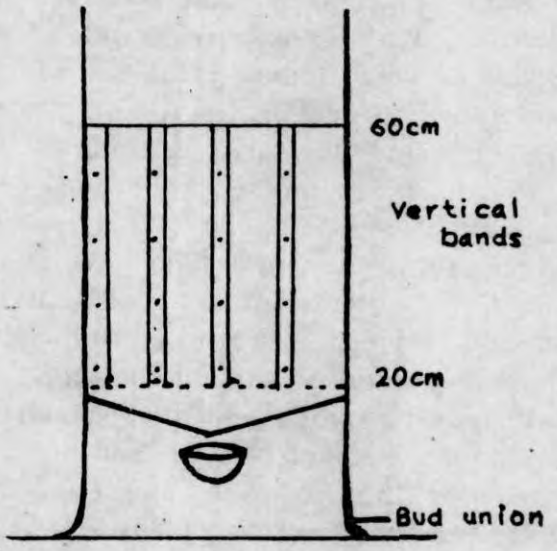

Fig. 2. Puncture tapping under ethephon and calcium carbide treatments (Four vertical bands of 40 cm length and 4 punctures/band)

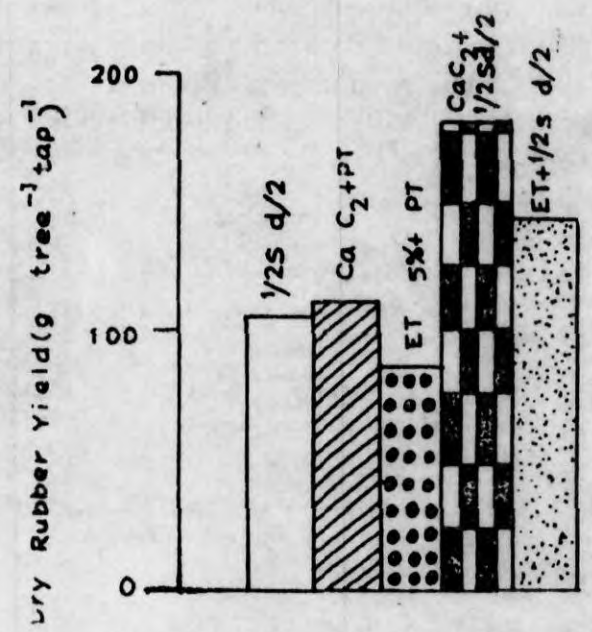

Fig. 3. Mean dry rubber yield (g tree^{-1} tap^{-1}) under different treatments

the same tapping system. Similarly with puncture tapping system also higher yield was obtained with CaC_2 stimulation when compared to ethephon stimulation. However, puncture tapping was found to be less effective than conventional tapping system, and the difference between calcium carbide and ethephon effects were non-significant.

Yield stimulation effects of CaC_2 and ethephon on individual tappings after stimulant application are presented in Table II. Maximum stimulatory effect was observed in the first and second tappings in trees stimulated with CaC_2. The response showed gradual decline afterwards. In case of ethephon, the response showed gradual increase initially and was steady afterwards.

Monthly yield data (Fig. 4) shows that increased yield obtained by the application of the two stimulants reduced drastically

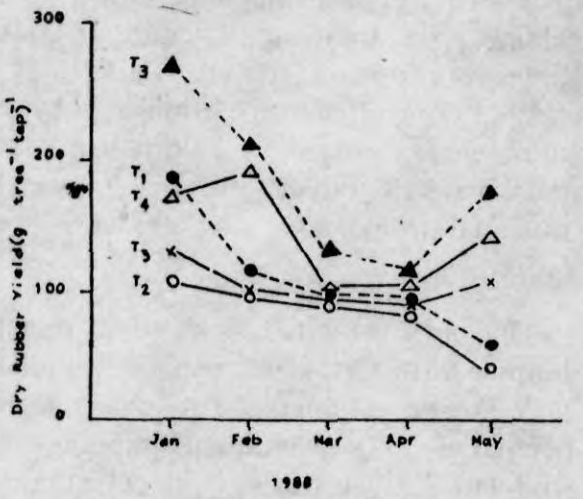

Fig. 4. Monthly dry rubber yield (g tree^{-1} tap^{-1}) under various treatments
T_1 – CaC_2 + puncture tapping
T_2 – Ethephon + puncture tapping
T_3 – CaC_2 + ½S d/2 6d/7
T_4 – Ethephon + ½S d/2 6d/7
T_5 – ½S d/2 6d/7

Table II. *Effects of calcium carbide and ethephon stimulations on dry rubber yield (g) tree^{-1} on each tapping day in January 1988 under puncture and conventional tapping systems in clone RRIM 600 (Panel B 1 – 1)**

Treatment	Tapping dates												
	2	5	7	9	12	14	16	19	21	23	26	28	30
PT + CaC_2	194	221	175	159	—	160	**	—	257	200	—	178	134
PT + ET	70	109	107	107	—	141	—	—	114	93	—	133	93
1/2 S d/2 + CaC_2	258	282	260	258	—	237	**	—	308	284	—	266	257
1/2 S d/2 + ET	133	145	151	158	—	171	—	—	194	179	—	228	191
1/2 S d/2 (Control)	120	126	127	143	—	125	—	—	118	125	—	133	144

* First stimulation was given on 31 December 1987 ** Second application of CaC_2

during the wintering period. However, the stimulatory effects were again evident in the month of May.

DISCUSSION

The results obtained so far from the study indicate that soil application of CaC_2, with the modifications described can be equally or more effective than bark application of ethephon under the conventional 1/2S d/2 tapping system. The liberated acetylene might be either directly acting as a stimulant to latex flow or a good portion of the acetylene may be getting converted to ethylene by soil nitrogenase enzyme. Pakinathan (1970) demonstrated direct effect of acetylene liberated from CaC_2 on latex flow stimulation.

The present data shows that puncture tapping with CaC_2 or ethephon stimulation may not be remunerative in older trees as compared to conventional tapping with stimulation. However, puncture tapping with CaC_2 stimulation might be comparable with conventional tapping without stimulation, as found in the present study. This is in agreement with the reports from People's Republic of China (Wu Kaihua and Wang Hongbo 1986). However, a lesser yield for puncture tapping with ethephon stimulation is observed when compared to conventional tapping. This is further supported by findings of Samarnayake (1985).

The response to CaC_2 application is for a short period and this is comparable to groove application of ethephon. In further studies CaC_2 stimulation may be compared with groove or lace application of ethephon. Decline in response to stimulation during wintering is in agreement with other reports (Sivakumaran, Pakinathan and Abraham 1981). The decline was observed for the stimulatory effect of both ethephon and CaC_2.

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