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USE OF RUBBER FACTORY EFFLUENT AS A FERTILIZER FOR YOUNG *HEVEA* PLANTS

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ABSTRACT

The effect of application of crepe factory effluents on the growth of young *Hevea* plants was investigated. Five treatments namely normal fertilizer, half normal fertilizer and diluted serum 1:1, diluted serum 1:1, diluted serum 1:2 and undiluted serum were tried out. Significant growth improvement in both height and girth were observed with all 4 serum treatments, after the 20th week.

INTRODUCTION

Effluent from natural rubber (NR) processing factories is known to cause environmental pollution in rubber growing areas in Sri Lanka, where approximately 100,000 metric tonnes of effluents are discharged annually. Pollution action of rubber effluents is due to the presence of large amounts of dissolved organic and inorganic solids and a large number of viable indicative which create a high oxygen demand.

Environmental regulations in many countries require treatment of effluent by a suitable method prior to discharge. Attempts are being made to improve the efficiency of these treatment methods such as anaerobic – facultative ponding system, oxidation ditch and Rotating bio-disc. Meanwhile attempts have also been made to explore the possible ways of utilization of effluents for various purposes. Alphen (1957) attempted to extract quebtachitol, a carbohydrate which is reported to have a growing demand in pharmaceutical industry. Attempts have also been made to use rubber serum as a medium for mushroom cultivation (Taysam 1956), for the growth chlorella (Kulkarni *et al* 1968 and 1973), and for the production of single cell protein (Annon, 1977).

Several workers have attempted to explore the potential value of rubber factory effluents as a fertilizer because of its high moisture and nutrient contents. (Dolmat *et al* 1979), Yapa 1984 Tan *et al* 1975; Kanapathy, 1968). Rubber factory effluents have been tried out on rubber itself as a fertilizer (Dolmat *et al* 1979, Yapa 1987). In rubber at 3.81 cm r.e.m. and on a normal single cut system, a 18% more yield than the control has been reported (Dolmat *et al* 1979).

Significant increases in girth and height of young rubber plants have been reported as a result of the treatment with crepe rubber serum (Yapa, 1987). Highly significant increases in the soil nutrient soils (N,P,K and Mg) have also been reported in the same study. However, only one level of serum treatment has been investigated in his green–house trial. It is therefore necessary to make a more detailed study with more different treatments and also to see how it compares with normal fertilizer applications, particularly in view of the promising results obtained so far. The present investigation is an attempt in this direction.

EXPERIMENTAL

This study was carried out in the Green–house at Dartonfield Estate of the Rubber Research Institute. Medium size seedlings with the first two leaves of clone PB 86 were used. Sixty pots with one plant each were arranged in a fully randomized design. *Boralu* series soils was used in this study. The details of the six treatments with 10 replicates are as follows:

T1 – Normal fertilizer dose (30g/tree/three months + 10g kieserite)
T2 – Half of normal fertilizer dose (15g/tree/3 months + 5g kieserite)+ 1:1 diluted serum
T3 – 1:1 diluted serum
T4 – 1:2 diluted serum
T5 – undiluted serum
T6 – Tap water (control)

Rubber factory effluents (crepe rubber serum) collected from the tank were applied once a week at the rate of 400 ml per plant with another 800 ml tap water per plant to supplement the water demand of plants. Recommended level (30g per plant) of 12:14:14 nursery rubber mixture was used as the normal fertilizer application. The trial was conducted for one year and plant diameter (plant girth) and plant height were measured at fortnightly intervals. Initial soil nutrient status (N,P,K, Mg and Ca) and levels of same nutrients at the end of the experiment were determined. Leaf sampling was also done from each pot for determination of leaf nutrient contents. Only the plant height and plant diameter data have been analyzed statistically (DMRT) and will be discussed in this paper.

RESULTS

1. Plant height

During the first 6 weeks after replanting, no response was observed to any of the treatments (Table 1). From the 8th week onwards, 1:1 diluted serum (T3) was significantly better than the control (T6), and from the 14th week onwards treatment T4 also showed significant response when compared with the control (T6).

All four serum treatments were significantly better than the control (T6) after the 20th week. There, was no evidence of any significant difference between the 4 serum treatments after the 20th week.

The effect of normal fertilizer (T1), as against the control (T6), began to show at the 26th week, and continued thereafter.

From the 8th week onwards, 1:1 diluted serum (T3) proved to be significantly better than normal fertilizer (T1), and after 20th week all four serum treatments were better than T1.

Plant diameter (girth)

During the first 6 weeks no difference was observed between control and treatments. (Table 2).

After the 20th week, all 4 serum treatments showed significantly better results than the control, while only 1:1 diluted serum (T3) started to show response at the 16th week. There was no evidence of any significant difference between the serum treatments (between T2, T3, T4 and T5).

From the 10th week upto the 36th week, 1:1 diluted serum treatment (T3) proved to be significantly better than the normal fertilizer (T1). From the 16th week onwards, undiluted serum (T3) continued to be better than normal fertilizer (T1). and from the 16th week onwards, undiluted serum (T5) continued to be better than normal fertilizer (T1). Between the 12th and 26th weeks, 1:2 diluted serum (T4) proved to be better than normal fertilizer (T1).

The significant response to normal fertilizer treatment (T1) against the control (T6) began to show at the 8th week and continued till the 16th week. After a lag of 10 weeks, it started again on the 28th week and continued till the 38th week.

Table 1. *Mean plant height (cm)*

Week	T1 (Normal fert.)	T2 (Norm. fert. + 1:1 serum	T3 (1:1 serum)	T4 (1:2 serum)	T5 (undiluted serum)	T6 (water)
02	48.35AB	48.40AB	50.90A	48.30AB	42.85B	47.65AB
04	48.50AB	48.70AB	50.90A	48.35AB	43.25B	47.65AB
06	49.67AB	51.69A	53.75A	49.45Ab	44.11B	48.31AB
08	51.29B	54.83AB	59.98A	54.95AB	48.93B	50.71B
10	53.11C	58.01ABC	63.95A	60.49AB	54.50BC	53.44C
12	56.21C	62.94ABC	70.05A	66.12AB	60.16BC	56.28C
14	59.94C	66.21BC	76.07A	70.92AB	66.13BC	61.49C
16	64.87B	70.26AB	78.20A	75.68A	70.65AB	63.61B
18	68.41C	76.78BC	85.23A	81.65AB	75.85BC	72.36C
20	71.89B	79.29AB	87.15A	83.51A	80.49AB	73.30B
22	78.71B	90.90A	96.35A	95.87A	93.84A	77.41B
24	82.59B	94.53A	101.27A	100.32A	96.51A	80.66B
26	96.08B	109.28A	112.10A	106.97A	109.25A	81.44C
28	100.15B	116.48A	121.10A	113.15A	113.75A	83.10C
30	107.67B	123.80A	127.12A	118.65A	125.05A	83.10
32	110.80B	124.25A	128.35A	123.75A	125.70A	83.10C
34	111.35B	124.45A	128.40A	124.10A	125.75A	83.15C
36	113.90B	125.95A	129.10A	127.85A	127.30A	85.20C

Table 2. *Means of plant diameter (GIRTH)*

Week	T1 Normal fert.	T2 (Norm. fert. + 1:1 serum)	T3 (1:1 serum)	T4 (1:2 (serum)	T5 (undiluted serum)	T6 (water)
02	.380A	.387A	.377A	.382A	.395A	.395A
04	.400AB	.396AB	.382B	.389AB	.399AB	.406
06	.388A	.404AB	.406AB	.404AB	.417AB	.427A
08	.409C	.423BC	.445AB	.434BC	.428BC	.461A
10	.420C	.424BC	.476A	.453AB	.434BC	.482A
12	.440B	.492A	.514A	.514A	.474A	.512A
14	.464B	.506AB	.532A	.522A	.497AB	.527A
16	.503C	.580AB	.606A	.587AB	.575AB	.549B
18	.552C	.628AB	.667A	.624AB	.640AB	.579BC
20	.607B	.713A	.750A	.707A	.735A	.610B
22	.728BC	.787AB	.850A	.819A	.833A	.684C
24	.746B	.843A	.886A	.842A	.887A	.732B
26	.869BC	.954AB	1.027A	.967A	1.033A	.820C
28	.942B	1.022AB	1.064A	1.024AB	1.092A	.859C
30	1.025B	1.105AB	1.126A	1.099AB	1.175A	.897C
32	1.036B	1.120AB	1.128AB	1.106AB	1.163A	.919C
34	1.083B	1.162AB	1.183A	1.163AB	1.224A	.974C
36	1.125B	1.184AB	1.213A	1.192AB	1.250A	.994C

DISCUSSION

The results of this study show the potential value of rubber factory effluent as a fertilizer on the growth performance of young *Hevea* seedlings. The results are complementary to those of the preliminary study of Yapa (1987) where only one treatment ie 1:1 diluted crepe serum, was used. In the present study too, 1:1 diluted serum increased the height of plants, as early as from the 6th week onwards. A significant increase in plant height was observed in the second month in treated plants by Yapa (1987). The increase in girth was slow compared to height and a significant increase in girth was observed in the 20th week after treatment which again is in accordance with observation of Yapa (1987).

1:2 diluted serum began to show its effect at later stages of plant growth. This may be due to the dilution factor, as it needs a comparatively longer time to provide the same nutrient level of 1:1 diluted serum.

Undiluted serum treatment indicated the same trend as 1:1 diluted serum, having it effects first on plant height and on diameter later. It appears that even normal serum without dilution can be used without harmful effects as a substitute for fertilizer for young plants.

After the 20th week, plants showed similar response to all serum treatments, irrespective of the dilution factor. This can be attributed to the cumulative effects of serum application, enhancing the soil nutrient levels, after which the soil mass acts as a buffer providing the nutrient requirement of plants.

The effect of normal fertilizer compared to serum treatments is of obvious practical importance, if the latter is to be adopted as an alternative. Although the recommended fertilizer rate increased plant girth even at early stages (from the 6th week), the girth increment was similar to that of the control between the 18th and 26th weeks. The effect of normal fertilizer application on height and girth began to slow down after the 26th week *ie* after the second application of fertilizer in the 24th week. This may perhaps be attributed to some evaporation losses of urea fertilizer of the first application due to excessive exposure on the surface at the early stages when the leaf canopy is also very thin resulting in a low rate of height increments (fig. 1 and 2).

The height advantage gained by plants treated with rubber serum compared to control, at the end of the ninth month period was over 40 cm ie little over 4 cm per month. Yapa (1987) in his preliminary study reported a similar height advantage, 40 cm during a period of 8 months. Mohd & Tayes (1981) have reported a 2–3 cm growth advantage, when rubber effluents were applied on young rubber seedlings. The mean girth advantage gained by plants treated with effluent was 0.22 cm in the

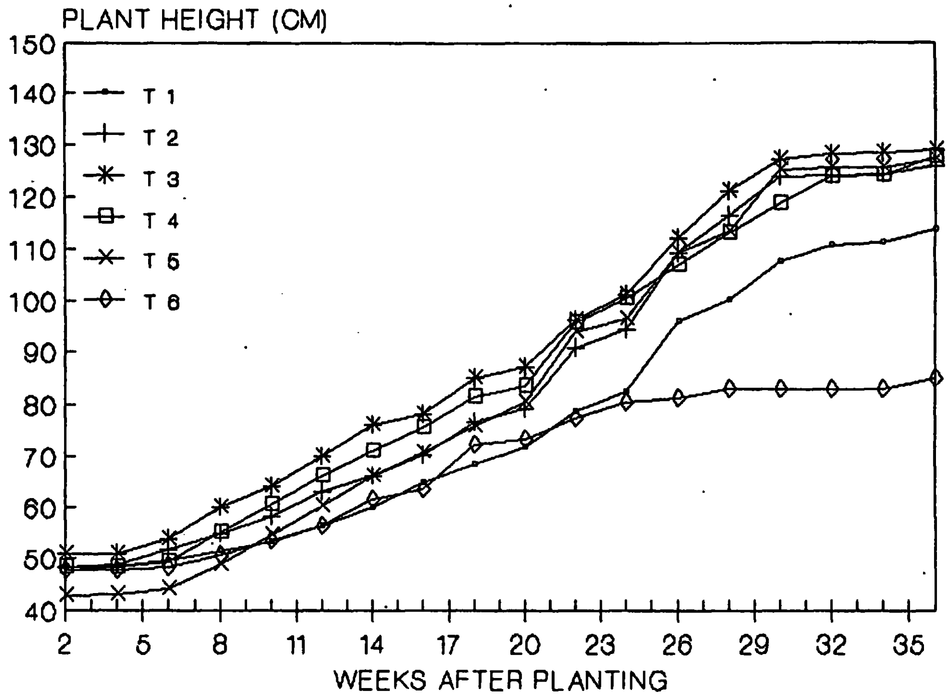

Fig. 1 Effect of treatments on height of plants over a period of 36 weeks from planting

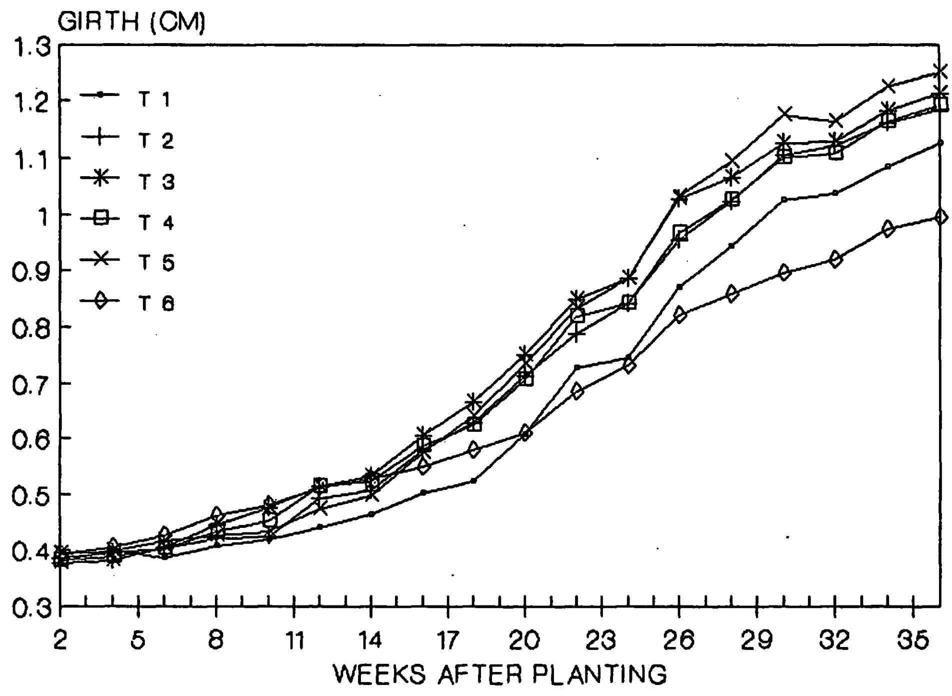

Fig. 2 Effect of treatments on mean girth of plants over a period of 36 weeks from planting

present study compared to 0.25 cm reported by Yapa (1987) in his preliminary study. One striking observation made in the present study was the comparative growth performance of normal fertilizer application and serum treatments. Serum treatments had a mean height advantage of 14 cm over normal fertilizer application whilst corresponding girth advantage was 0.09 cm. This is of particular interest and importance in view of the possibility that normal fertilizer application can be replaced successfully with a serum treatment during the seedling stage. It would be most interesting to see if this could be extended towards more mature stages also.

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