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Research Article

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Basal Studies of Mortex as a latex yield stimulant of *Hevea brasiliensis*

Emuedo OA*, Omokhafe KO, Ohikhena FU,Uzunuigbe EO, Uwumarongie AMD, Chukwuka AN, Ugiagbe-Ekue U, Omorogbe JA, Ehiwe D

Rubber Research Institute of Nigeria, Iyanomo P.M.B. 1049, Benin City, Edo State, Nigeria

Abstract The efficacy of Mortex as a stimulant for latex production in *Hevea* trees was investigated using NIG 805 clone in the clonal garden of Rubber Research Institute of Nigeria, Iyanomo, Benin City. A total of forty-five (45) trees were used for the experiment; comprising 5 different treatments in three replicates. Each replicate comprised of 3 trees. The investigation spanned a three month period for two consecutive years. Stimulation was done once monthly and tapping done using the ½S, d/3 tapping mode. Data collected include initial volume (volume of latex flow within the first five minutes after tapping), final volume (volume of latex flow two hours after tapping), dry rubber content (DRC) and weight of cup lump. Results were analysed using ANOVA. The result for both years showed a significant difference in the volume of latex produced between trees stimulated with Mortex 50 and Mortex 25. The Mortex 50 stimulated trees produced the highest mean final volume of latex at 184.17ml/tapping/tree, followed by the trees stimulated with Mortex 25 at 119.47ml/tapping/tree. The Mortex 25 stimulated trees gave a higher DRC than Mortex 50, while trees stimulated with Mortex 50 gave a higher cup lump weight. However, it was observed that the control gave the highest DRC.

Keywords *Hevea*; Mortex; Stimulant; Dry Rubber Content

Introduction

The *Hevea* tree is an economic tree crop cultivated primarily for its latex, which is used widely in industries. Prior to the discovery of oil in commercial quantities, coagular (rubber lumps from the *Hevea* tree) was a major source of revenue in Nigeria. However, with the decline in oil revenues worldwide, attention is now being refocused on agriculture as a revenue source. The current attention on *Hevea* has been energized by the Presidential Initiative on Rubber by the President Obasanjo's administration in 2009. This new impetus on rubber production has galvanized the extension of cultivation of the *Hevea* tree from its erstwhile rainforest region of the southern Nigeria to areas around the North central and North Eastern Nigeria by small growers.

The *Hevea* tree is cultivated for its latex, therefore, optimum latex production is of utmost importance to plantation owners as it constitutes the main source of revenue. The *Hevea brasiliensis* (para-rubber) tree is currently the only economically viable source of natural rubber. Natural rubber is widely used in industries due to its good yield of rubber and the excellent physical properties of the rubber products [1-2]. The rubber content of latex is a secondary metabolite in the *Hevea* tree produced in the cytoplasm of highly specialized cells called laticifers located in the phloem [3], and like other secondary metabolites, biosynthesis of natural rubber is impacted by plant hormones.

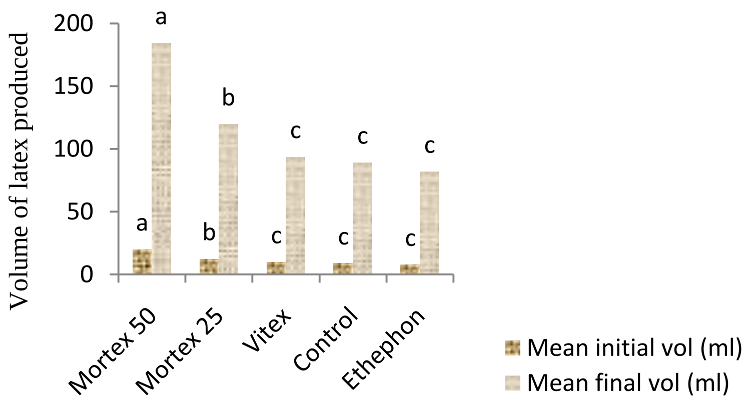
Maximum latex production of the *Hevea* tree requires an efficient tapping system; controlled incision of the bark of the *Hevea* tree for the latex to flow out. The quantity of latex obtained with each successive tapping depends on how easily the latex flows [4], the duration of flow [5] and latex regeneration within the tree [6-7]. Studies have shown that tapping affect latex regeneration time and also increases incidence of tapping panel dryness [8]. Thus, lower tapping frequencies have been widely adapted to ensure sustained exploitation, while stimulants are often used to enhance yield, compensating for the reduced tapping frequencies [9]. Consequently, Scientists have tried to make tapping systems more efficient by the use of stimulants. Over the years, ethylene used in various forms such as ethephon is often applied on the bark of *Hevea* trees to increase latex production. This stimulant enhances latex yield by delaying the plugging index, which increases the duration of latex flow after tapping [10]. Several studies have also shown that tapping frequency is not only reduced with stimulants but also increases land and labour productivity [11-13]. Ethylene increases the pressure and elasticity of the laticifers, thereby decreasing latex coagulation and extending the latex flow time [14]. In order to ensure high and sustained yields, suitable tapping and stimulation systems must be adopted, which have little or no deleterious effects on tree growth, bark renewal, and appearance of the phenomenon of bark dryness [9]. The essence of this study is to investigate the potency of a new stimulant Mortex as an enhancer of increased latex yield on *Hevea* trees, in comparison with other existing stimulants.

Materials and Method

The experiment was set out in the Clonal garden of Rubber Research Institute of Nigeria, Iyanomo, in a randomised complete block design. The test clone was NIG 805. A total of forty-five (45) trees were used for the experiment, comprising 5 different treatments in three replicates. The treatments were mortex 25, mortex 50, vitex, ethephon and the control (no stimulation). Each stimulants comprised of 3 trees. Stimulation was done once in 30 days and the trees were tapped using the ½S, d/3 tapping method. Tapping and data collection was carried out over a three month period, (from September to December). The experiment was repeated the following year over the same period (September to December) using the same set of trees. Data collected include initial volume (volume [ml] of latex flow within the first five minutes after tapping), final volume (volume [ml] of latex flow two hours after tapping), dry rubber content (DRC) and weight of cup lump. Dry rubber content was determined using the Metrolac. The latex flow time for each tree was two hours and results were analysed using Analysis of Variance (ANOVA).

Results and Discussion

The results obtained from the data collected showed that the trees stimulated with Mortex 50 gave the highest mean final volume of 184.17 ml/tapping/tree. This was closely followed by the trees stimulated with Mortex 25 with a mean final volume of 119.47 ml/tapping/tree (Fig 1). A similar trend was observed in initial volume with 19.75 ml/tapping/day in Mortex 50 followed by Mortex 25 with 12.10 ml/tapping/day. In both cases, analysis of the results obtained using ANOVA gave significantly lower values of latex volume with the Vitex, Ethephon and control than with the Mortex 25 and Mortex 50 (Fig 1). Similarity of ranking between minimum and maximum latex volume is in line with report of Omokhafe (2001). Analysis of variance of the results showed that there was a significant difference in the initial and final volume of latex produced by the experimental trees for the two consecutive years (Tables 1 and 2). However, Mortex 50 was observed to have given the highest mean final latex volume.



LSD: mean initial vol. = 2.8, mean final vol. = 17.35: a,b,c; means are significantly different

Figure 1: Mean separation of the initial and final volume of latex of the experimental trees

Table 1: Analysis of variance of the initial volume of latex of the experimental trees

Source of Variation	**df**	**SS**	**MS**	**F**	**df**	**SS**	**MS**	**F**
	1st Year				**2nd Year**			
Volume	41	6286.11	153.32	0.96	68	26260.36	386.18	2.29
Treatment	4	11963.45	2990.86	12.68*	4	8797.94	2199.48	13.02*
Interaction	164	18636.71	113.64	0.48	272	36539.95	134.34	0.79
Within	420	13598.30	235.95		690	116530.00	168.88	
Total	629				1034	188128.20		

$p \leq 0.05$: * means significant difference in the volume of latex produced

Table 2: Analysis of variance of the final volume of latex of the experimental trees

Source of variation	**df**	**SS**	**MS**	**F**	**df**	**SS**	**MS**	**F**
	1st Year				**2nd Year**			
Volume	77	1938684	25177.72	1.49	119	4154605	34912.64	4.60
Treatment	4	1648240	412060.10	24.45*	4	691643.5	172910.9	22.76*
Interaction	308	2524634	8196.86	0.49	476	1732272	3639.227	0.48
Within	780	13147220	16855.41		1200	9116584	7597.153	
Total	1169	19258778						

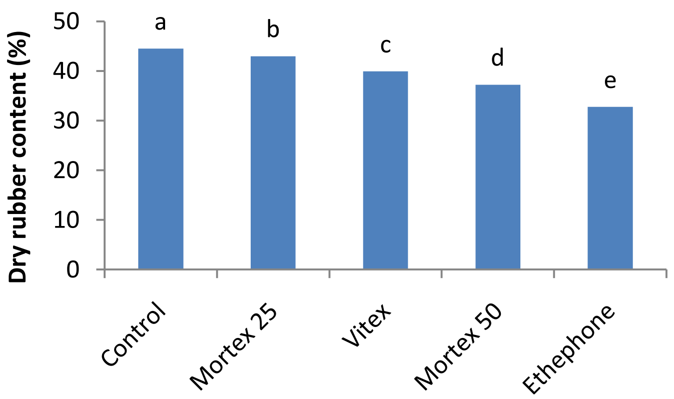
$p \leq 0.05$: * means significant difference in the volume of latex produced

It was however observed that DRC data did not follow the same trend. There was significant variation in DRC between the experimental trees and the control. The control had the highest DRC (Tables 3 and Fig 2). This indicates that an increase in latex volume with Mortex 50 and Mortex 25 may have been at the expense of DRC. The control trees had the highest dry rubber content of 44.5 % followed by the trees stimulated with the Mortex 25 with a mean DRC of 43.00% which is significantly lower than that of the control trees (Fig 2). These findings are in accord with the report of earlier studies, that latex stimulated trees often produce lower DRC. For instance, [15-16], reported that the DRC of latex from ethylene stimulated *Hevea* trees was lower than that of normal conventional tapping. Sainoi and Sdoodee [17] have also reported that increase in latex volume with stimulation may affect latex physiology. This could probably mean that stimulation may have a negative impact on DRC.

Table 3: Analysis of variance of mean rubber content (DRC %) of latex

Source of Variation	**df**	**SS**	**MS**	**F**
Week	11	717.38	65.22	7.78
Treatment	4	1056.57	264.14	31.49*
Error	44	369.03	8.39	
Total	59	2142.98		

$p \leq 0.05$: * means significant difference in dry rubber content of latex produced



LSD = 1.49: a,b,c,d,e; means are significantly different

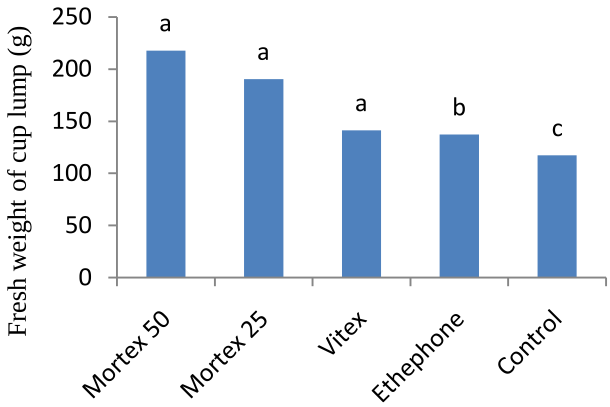
Figure 2: Mean separation of the Rubber Content (DRC %) of latex produced

The results of the analysis of the cup lump on the other hand showed that there was significant variation for weight of cup lump (Table 4). Mortex 50, Mortex 25 and Vitex had the highest weight of cup lump at 217g, 190g and 141g respectively which were not significantly different from each other (Fig 3). The higher the weight of the cup lump, the more the weight of the coagular produced.

Table 4: Analysis of variance of weight of cup lump (g) of latex

Source of variation	df	SS	MS	F
Volume	41	800030.20	191512.93	0.96
Treatment	4	876203.50	219050.90	10.76*
Interaction	164	2306027.00	14061.14	0.69
Within	420	8549323.00	20355.53	
Total	629	12531583.00		

$p \leq 0.05$: * means significant difference in dry rubber content of latex produced



LSD = 60.11: a,b,c; means are significantly different

Figure 3: Mean separation of the fresh weight of cup lump (g)

The experimental trees stimulated with Mortex 50 and Mortex 25 had the highest mean cup lump weight which was significantly different from the control (Fig 3). This is in consonance with reports of Sainoi and Sdoodee [17] and Jetro and Simon [18] that cup lump yields of stimulated tree are significantly higher than those of the non-stimulated trees. The stimulation thus increases the weight of the cup lump.

Conclusion

From the foregoing, it is apparent that though stimulation increases latex volume production and weight of cup lump, a seemingly negative impact was observed on the dry rubber content of the experimental trees. If latex production is of paramount interest to the plantation owner, then simulation may be encouraged. If however, it is the dry rubber content that is of interest, then, non stimulation of the trees may be of interest to maximize DRC. More work may need to be carried out to find out if there may be ways of mitigating this effect.

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