

THE INFLUENCE OF FIRE ON THE SURVIVAL AND RESISTANCE OF *HEVEA BRASILIENSIS* (MUELL. ARG.) TO WIND DAMAGE

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ABSTRACT

One of the Rubber Research Institute of Nigeria (RRIN) out-station experimental plantations situated at Igbotako, Ondo State, Nigeria was engulfed by fire in 2007, and in 2008 there was a heavy storm, which resulted in serious damage to the trees in the field. The experimental field was laid out in a randomized complete block design with four replications involving six clones namely, NIG 800, RRIC 45, RRIM 600, RRIM 614, PB 217 and IAN 710 at 28 stands per plot. The stands were planted at 3.4m x 6.7m apart. For the purpose of this survey, the field was partitioned into two: burned and unburned plots. From each plot, data were collected on the following parameters: survival and wind damage - namely trunk snap, branch breakage and root lodging. The results showed that the wind had more damaging effects on the trees in the burned plot than the unburned plot. However, the response of Hevea trees to wind damage effect and to fire incidence was highly clonal specific, with the clone, RRIM 614 being the most negatively affected with trunk snap (50% - burned and 5% - unburned plot) and branch breakage (5%) in the unburned plot compared to the other five clones in the same plot.

Key words: Fire, Hevea trees, Survival, Wind damage, Trunk snap

J. Agric. Prod. & Tech.2012; 1(2):75-78

INTRODUCTION

Hevea brasiliensis (a natural rubber plant) is an economic tree grown primarily for its latex yield. The expected economic yield (latex production) from the trees on the field depends on several factors, which includes population of surviving Hevea trees in the field. The survival of immature and matured Hevea trees in the field is highly affected by several factors such as incidence of diseases, environmental factors, termites attack (Omokhafe and Sagay, 1996) and fire incidence (Throop & Fay, 1999 and Kirkpatrick et al., 2010).

Fire, apart from its damaging effects has also been reported to have some positive effects such as promoting hunting of wildlife and a wide diversity of plants in areas associated with fire incidence as was reported in Florida, USA (Long, 2006 and Ladrach, 2009). However, the effects of fire on crops growing in the field result in high casualties. In Hevea plantation, fire outbreak would leads to the death of many Hevea trees and predisposed several others to serious wind damages, insect (stem borers) attack and diseases. Such fire incidence is most serious if the residual effect results in irreparable

casualties to the trees. That implies tree death or trunk breakage at the tapping panel region, which makes re-growth almost impossible (Rajakshmy and Jayarathnam, 2000). Trees, which are known for their wind resistance ability becomes susceptible after fire incidence. This is the experience in Rubber Research Institute of Nigeria's experimental plantations situated at Igbotako, Ondo State, Nigeria in 2008 where fire outbreak resulted in serious casualties. This study therefore was stimulated by this experience. The objective of this study therefore, is to evaluate the residual effects of fire incidence on mature Hevea trees plantation.

MATERIALS AND METHODS

This survey was carried out at one of the Rubber Research Institute of Nigeria (RRIN) experimental plantations situated at Igbotako, Ondo State, Nigeria established in 1984. The experiment was originally laid out in a Randomized Completely Block Design (RCBD) with four replications involving six clones. Namely, NIG 800, RRIC 45, RRIM 600, RRIM 614, PB 217 and IAN 710 at 28 stands per plot. The stands were planted at 3.4m x 6.7m apart.

In 2007, after fire engulfed part of the experimental plantation, the field was partitioned into two - burned and unburned plots to monitor the residual effects of the fire on the trees. A year later, precisely in March 2008 there was a heavy storm, which was accompanied by high wind velocity and this caused serious damages to the trees in the field. From each plot, data were collected on survival of trees and on wind damage characteristics, namely trunk snap, branch breakage and root lodging. All data were calculated and reported as percentage. Chi square analysis (Test for Independence) was also carried out to determine whether the Hevea trees' survival or trunk wind damage in the

burned and unburned plots was dependent or independent on the clone. The hypotheses were as follows:

Ho: The rate of tree survival or wind damage in the burned and the unburned plot is dependent on the clones. While, Hi: The rate of tree survival or wind damage in the burned and the unburned plot is not dependent on the clones.

RESULTS AND DISCUSSION

The Hevea trees survival and wind damage under burned and unburned plots at RRIN experimental field in Igbotako, Ondo State is as shown in table 1. Visual observation and data information showed that both tree survival and wind damage effects on the trees were more severe in the fire burned plot than the unburned plot. The overall mean tree survival of the burned and the unburned plots is 42 and 59 per cent respectively. Among the six clones planted in the field, RRIC 45 clone had the highest tree survival of 79% in the unburned plot while in the burned plot PB 217 had the highest tree survival value of 57%. The lower percentage survival of trees in the burned plot could be ascribed to the fire that engulfed the area in the previous year (2007). This agrees with the report of Miller, 2000 that the effects of fire on plants can result in injury, subsequent recovery and plant mortality. However, this is contrary to the report of Grelen (1976) that in plantation trees, control burning had no serious casualties on tree survival.

As for wind damage in the form of trunk snap, the burned and the unburned plots had 25% and 0.71% respectively as overall mean of trees trunk snap. The highest damaged clone was RRIM 614 either in the burned (50% wind damage) and unburned plots (5% wind damage) as shown in Table 1. Apart from trunk snap, other wind damage parameters evaluated were branch breakage and root lodging. Only RRIM 614 and IAN 710

clones had record of branch breakage in the unburned plot, and none had root lodging in both the burned and the unburned plots. The response of the trees (clones) to the fire incidence and to the effect of wind is highly clonal specific. This agrees with the report of Peterson et al., (2001) that fire incidence does not favour the growth of woody plant and that the response of plants to fire varies from species to species. Furthermore, the picture is clearer or better understood in clone RRIM 614

with the highest values for trunk snap (50% - burned and 5% - unburned plot) and branch breakage (5%) in the unburned plot which is pointing to the fact that this clone is less resistant to wind damage relative to the other five clones. This is further supported by the non-significant Chi square result, which showed that the rate of tree survival or trunk snap is dependent on the clones ($H_0 = 9.30$ for survival and 1.60 for wind damage at 5df).

Table 1: Hevea trees survival and wind damage under burned and unburned plots at RRIN experimental field in Igbotako, Ondo State

Clone	Unburned Plot					Burned Plot			
	Trees planted/clone	Currently surviving trees / clone	Wind damage*			Currently surviving trees / clone	Wind damage*		
	Trunk snap		Branch breakage	Root lodging	Trunk snap		Branch breakage	Root lodging	
NIG 800	28	12 (43)	-	-	-	15 (54)	3 (17)	-	-
RRIC 45	28	22 (79)	-	-	-	6 (21)	4 (40)	-	-
RRIM 600	28	16 (57)	-	-	-	13 (46)	3 (19)	-	-
PB 217	28	16 (57)	-	-	-	16 (57)	5 (24)	-	-
RRIM 614	28	18 (64)	1 (5)	1 (5)	-	10 (36)	10 (50)	-	-
IAN 710	28	21 (75)	-	-	-	10 (36)	3 (23)	-	-
Mean	28	17 (59)	0.14(0.7)	0.3(1.4)	-	12 (42)	4 (25)	-	-

*: Values in parenthesis represent percentage.

CONCLUSION AND RECOMMENDATION

- Fire outbreak in Hevea plantation has devastating effects on various aspects (survival, growth characteristics, yield, etc) of the tree.
- There should be deliberate effort to make fire guide or trace to keep Hevea tree plantations away from fire incidence.

Acknowledgements: The Authors are grateful to Mr. S. M. Ehika (Assistant Director. Rubber Research Institute of

Nigeria, Main Station, Iyanomo) for his contributions, Messrs. Edeki P., Irekhafa, Efefena F., Igho, Olaniyi Oluyeye and Kehinde Inuyomi (RRIN Experimental Station, Igbotako) for their field assistance.

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