EFFECT OF WEEDING FREQUENCY AND FERTILIZER RATES ON THE GROWTH PERFORMANCE AND BUDDING SUCCESSES OF HEVEA ROOTSTOCK SEEDLING IN A HUMID FOREST AREA OF SOUTH EASTERN NIGERIA

Esekhade, T.U., Okore, I.K., Ogidi, E.G.O. and Arasowan, J.
Rubber Research Institute of Nigeria, Substation, P.M.B. 02 Akwete, Abia State
ogidyke@yahoo.com, +2348037642788

ABSTRACT
The effect of weeding frequency and fertilizer (N.P.K.Mg: 20:10:10:5) rates on the growth and budding successes of Hevea brasiliensis Muell. Arg.-(Natural rubber) rootstock seedlings was evaluated at the nursery field of Rubber Research Institute of Nigeria, Akwete Substation. The weeding frequencies consisted of 24,12,8 and 4 times weeding per year, while the fertilizer rates were 200,100 and 0 kg/ha. Thus, having a 5x3 factorial experiment fitted into a randomized complete block design with three replications. The result showed that seedlings in field weeded 12 times/yr had a significantly ($P<0.05$) taller seedlings with wider stem girths compared to the plots weeded 6 or 4 times/yr .The fertilizer rate effect indicated no significant difference in growth performance and budding successes of seedlings that received 200 kg/ha and those that had 100 kg/ha N.P.K.Mg. The interaction between weeding frequencies and fertilizer rates was significant with seedlings that received 100 kg/ha N.P.K.Mg 20:10:10:5 and 12 times weeding per year being more robust and with a mean budding success of 76.2 % relative to other treatment combination; hence could be said to be a more suitable fertilizer rate and weeding frequency for Hevea seedling root stock mainly in a humid forest region.

Keywords: weed control, Hevea, nursery, fertilizer

INTRODUCTION

Establishment of a viable and economically productive plantation depends among other factors on the quality of planting material. The production of quality Hevea planting material starts with good and economic management of seedling rootstock nursery (Okore et al., 2010). Sustainable weed control mechanism and suitable fertilizer management strategy are two major challenges in Hevea rootstock nursery development. Weed control in ground bed nursery has been reported to account for over 60 % while fertilizer management account for 10 % of the total production cost of Hevea planting material in major rubber producing countries of Southeast Asia (Kuan,1993). These have been attributed to the intensity of weeding needed for optimum growth and the close spacing of the seedlings in the nursery (Delabarre and Serier, 2000). Similarly, soil fertility challlenges in rubber supporting soils affect the productivity of young seedlings in terms of vigour and budding success in the nursery (Okore et al.,2007). Hence the need to study and develop a suitable fertilizer management programme for successful nursery seedling performance. There is a paucity of information on the combined effect of weeding frequency and fertilizer rate on the growth performance of Hevea seedling rootstock. Consequently, the objective of this study is to evaluate the combined effect of weeding frequency and fertilizer rate on the Hevea rootstock seedling.

MATERIALS AND METHODS

Field experiment was carried out at the Akwete Substation of Rubber Research Institute of Nigeria between 2008 and 2009 cropping season. Akwete is a typical humid forest area of south eastern Nigeria; lying at latitude 4.8998^0N and longitude 7.3359^0E. The rainfall pattern is bimodal with an annual average 2000 mm and average temperature of 28 ^{0}C Table 1.The soil is identified as Arenic Paleudult (USDA) or Dystric Nitisol(FAO) with sandy alluvium parent material (FDA, 1985). The study was a two factor experiment consisting of a factorial combination of treatments; five weeding frequencies (24, 12 , 8, 6 and 4 times/yr) and three levels of fertilizer (200,100 and 0 kg/ha) applied as N.P.K.Mg 20:10:10:5. The treatments were laid out in a Randomized Complete Block Design (RCBD) with three replications. Pre-sprouted rubber seeds (GTI clones) were sown on the 17th of August 2008 on a manually tilled ground. The planting arrangement was 30x30m (weeding frequency) per experimental unit and 8x8m within each of the 30x30m block for the fertilizer trials with an alley of 2x2m between each of the 8x8m sub block. The seedlings were sown at the spacing of 30x30cm in each block. While the fertilizer treatments were applied at three weeks after planting, the weeding treatments commenced at two weeks after planting with those that received 24 times weeding per year. Data collection on plant height and stem girth were carried out at three month intervals, while budding success (%) was determined at three weeks after budding of the plants at 12 months growth period. All data collected were subjected to analysis of variance using 5x3 factorial approaches as contained in Snedecor and Cochran (1967). Where significant

differences occurred amongst the mean, the means were compared using the least significant difference approach at 5% level of probability.

Table 1: Ten years mean monthly rainfall and temperature of RRIN Sub-station Akwete

Months	**Ave rainfall(mm)**	**Temp (^oC)**	
		Min	**Max**
January	16.43	22.13	33.50
February	31.43	23.00	33.68
March	92.48	24.00	33.80
April	148.40	24.50	33.50
May	265.20	24.38	32.75
June	340.90	24.00	30.83
July	311.78	24.00	30.70
August	248.73	23.38	29.60
September	352.65	23.50	30.40
October	170.08	23.63	30.95
November	99.48	24.00	31.60
December	21.98	23.30	33.05
Mean	174.96	23.65	32.03

Source:RRIN weather station report Akwete Substation

RESULT AND DISCUSSION

The combined effect of the treatments (weeding frequency and fertilizer rates) on the height of the seedling rootstock is shown in Table 2. All through the growth period evaluated, plants that received 12 times weeding per year consistently recorded the highest height with values ranging from 65.1 to 158.1m between 3 and 12 months after planting (MAP). However, these values were not significantly higher than those obtained from plots weeded 24 times/year, but were when compared to those weeded 6 and 4 times respectively. The result is in line with reports of Delabarre and Serier (2000) and Punoose and Lakshmanan (2000). These authors in separate works at different locations reported that a minimum of fort nightly weeding is necessary during the initial 2 months of Hevea seedling rootstock for optimum growth performance. Similarly, the effect of the fertilizer rates on seedling height differed significantly between those that received 200 kg NPKMg/ha and those that received none at all, irrespective of the weeding frequency. However, plants that received 200kg NPKMg/ha and those that received 100kg/ha did not differ significantly, although the tallest plants were consistently recorded from the 200kg/ha fertilized plots.

Table 2: Effect of weeding frequency and fertilizer rates on the height (cm) of Hevea rootstock seedling

Weeding Frequency (No/yr)	Growth period after treatment application															
	3MAP				6MAP				9MAP				12MAP			
	→				Fertilizer rates(kg/ha)								←			
	200	100	0	Mean	200	100	0	Mean	200	100	0	Mean	200	100	0	Mean
24	55.5	54.1	46.9	51.1	93.2	89.3	75.9	86.1	130.1	123.2	106.9	120.1	160.9	151	131.9	147.8
12	66.1	76.6	52.6	65.1	94.2	94.3	75.8	88.1	132.3	138.7	98.3	123.1	167.6	194	113	158.1
8	54.7	53.7	54.0	54.1	78.2	80.0	84.5	80.9	105.6	112.2	119.5	112.4	129.3	131	131.7	130.5
6	50.5	49.2	49.2	49.6	76.1	67.8	73.3	72.4	122.3	90.1	92.6	95.7	122.6	104	101.1	109.1
4	53.9	46.2	51.8	50.7	76.2	65.6	69.4	70.4	150.7	90.3	98.1	101.2	150.7	108	113.8	124.2
Mean	56.1	55.9	50.9		83.6	79.4	75.8		128.2	110.9	103.1		146.2	138	118.3	
$LSD_{(0.05)}$	WF=9.2,FR=NS, WFxFR=4.2				WF=12.4,FR=4.6, WFXFR=6.5				WF=18.7,FR=9.6 WFXFR=9.0				FR=13,WFXFR=4.9			

MAP=Months after planting, WF=Weeding Frequency, FR=Fertilizer rates, WFXFR=Weed Frequency X Fertilizer rate interaction

The interactive effect of the treatments on seedling height also differed significantly, with plants under than 12 times weeding per year and 200kgNPKMgha having higher values, relative to other treatment. However, the values did not differ significantly from those received 100kg/ha NPKMg. This implies that adequate nutrient supply can compensate for a slightly prolonged weeding intervals or the other way round. As shown in Table3, the effect of the treatments on stem girth mirrowed those of the height with

seedlings grown under 12 times weeding/year consistently having a significantly wider girth sizes than those grown under 6 and 4 times weeding in that order. The result was consistent all through the growth period evaluated. At 12 MAP, the girth (5.99cm) of plants grown in 8 times weeding/year was not significantly lower than those on plots weeded either 12 or 24 times.

Table 3: Effect of weeding frequency and fertilizer rates on stem girth (cm) of Hevea rootstock seedling

Weeding Frequency (No/yr)	Growth period after treatment application															
	3MAP				6MAP				9MAP				12MAP			
	→				Fertilizer rates(kg/ha)								←			
	200	100	0	Mean	200	100	0	Mean	200	100	0	Mean	200	100	0	Mean
24	1.99	2.05	1.68	1.91	2.88	2.7	1.98	2.52	4.65	4.16	2.79	3.87	7.64	6.69	5.23	6.52
12	2.96	1.92	1.64	2.17	2.88	2.68	2.37	2.64	4.77	4.31	3.32	4.13	7.64	7.05	5.30	6.66
8	1.72	1.88	1.90	1.83	2.51	2.58	2.85	2.65	4.04	4.05	4.24	4.11	6.30	6.45	6.37	6.37
6	1.72	1.7	0.87	1.43	2.48	2.24	1.48	2.07	3.60	3.34	3.27	3.62	5.16	5.63	6.72	5.99
4	1.79	1.69	0.70	1.39	2.37	1.28	1.33	1.66	4.25	3.33	3.55	3.49	3.55	4.94	4.23	4.24
Mean	2.04	1.85	1.36		2.62	2.3	2.0		4.26	3.83	3.43		6.15	6.15	5.57	
$LSD_{(0.05)}$	WF=0.54,FR=0.42, WFxFR=0.67				WF=0.14,FR=0.51, WFXFR=1.06				WF=0.45,FR=0.72 WFXFR=2.04				WF=1.52,FR=0.07 WFXFR=1.12			

This could be as a result of the plants above ground vegetation cover which have been found to suppress weed at that growth stage (Okore et al., 2010). The fertilizer effect on stem girth consistently showed wider girth among plants that received 200kgNPKMg/ha. The values did not differ significantly from those under 100kg fertilizer did for the control (without fertilizer). The high dosage of N in the fertilizer may have affected the girth sizes. Okore et al., (2007) observed wider stem girth among Hevea seedling rootstock grown in soils with high organic matter levels which relates to N content. Similarly, the treatment interaction effect mimicked those of the plant height. Table 4 shows that on average, a highly significant budding success (>83%) was achieved from plots weeded 12 times per year at the fertilizer rate of 200kg/ha compared to other treatment except for those that were weeded 24 times/yr at similar fertilizer rate. However, plots that had 100kg/ha fertilizer and weeded 12 times did not differ significantly from those under 24 times/yr weeding and 200kg/ha fertilizer.

CONCLUSION

The rate of fertilizer use and weeding frequency are critical to sustainable nursery management. The result of this study has shown that to some extent, good fertilizer management or soil nutrient application can augment weeding intensity in Hevea nursery.

Table 4: Effect of weeding frequency and fertilizer rates (kg/ha) on the budding success (%) of Hevea seedlings rootstock

Weeding Frequency (No/yr)	Fertilizer rates (kg/ha)			
	200	100	0	Mean
24	86	92	66	81.33
12	90	88	72	83.33
8	81	66	56	67.67
6	59	56	46	53.67
4	48	47	43	46
Mean	54	69	56	
$LSD_{(0.05)}$	WF=23.62, WFxFR=10.15			

REFERENCES

Delabarre,M.A. and Serier,J.B.(2000). Rubber, The Tropical Agriculture, CTA Macmillian Ed.Ltd. London and Oxford pp 25-42.

FDA(Federal Department of Agriculture) (1985).Soil Survey of Eastern Nigeria,G.Lewka Ed.pp312

Kuan,C.Y.(1993).Weed management in rubber 1.Classification of ground covers.Planters Bullentin. Rubber Research Institute of Malaysia,216:75-79.

Okore,I.K.,Akpobome,F.A..,Tijani-Eniola,H. and Oghide,E.A.(2007).Effect of tillage on the growth performance of Hevea seedling rootstock and some fertility indices of sandy acid soil in the humid forest area of Nigeria. Journal of Rubber Research, 10(2)116-126.

Okore,I.K.,Ogieriakhi,S.N.,Akpobome,F.I.,Oghide ,E.A.and Ojiekpon,F.I.(2010). Effect of selected mulching material on weed incidence and growth performance of Hevea seedling rootstock under conservative tillage. Nigneria Journal of Botany 23 (2) 35- 42.

Punoose,K.I.and Lakshmanan,R.(2000).Nursery and field establishment. Natural Rubber Agro Management and crop processing.George,P.J. and Jacon,K. Ed pp 129-148. Rubber Research Institute of India.

Snedecor,G.I.N. and Cochran,W.G.(1967).Statistical methods 6th Edition .Ames. The Iowa State University Press p 593.