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RESEARCH ARTICLE

EFFECT OF FREQUENCY OF HARVEST PLANT POPULATION AND N.P.K FERTILIZER ON THE GROWTH PERFORMANCE OF VERNONIA AMYGDALINA

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Abstract

The trial aimed at assessing the effect of frequency of harvest, plant population and N.P.K fertilizer of Vernonia amygdalina (Bitter leaf) was conducted at the Teaching and Research farm, University of Abuja, Nigeria. Split plot treatment arrangement fitted into a randomized complete Block Design (RCBD) with 3 replications was used. Plant population used were; 10,000 stands/ha and 40,000 stands/ha and 4 weeks frequency of harvest. Data collected were Numbers of branches/plants, Number of leaves /plants, Height/plant, leaf area index and dry matter/unit. The result of the study showed that the number of branches per plant in the plots that received N.P.K fertilizer was greater than those in the control plots. Leaf area per plant was drastically reduced in the control plots compared with those in plots that were treated with N.P.K 200kg and 400kg/ha were not significant. Frequency of harvest has significant effect on the leaf on the leaf area and dry matter weight of the plants. Stands planted at the spacing 1m (10,000 stands/ha) developed more in all the growth parameters than others one year after establishment.

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Introduction:-

Vernonia amygdalina Del. Is a small perennial shrub that grows in tropical Africa which belongs to the family Asteraceae and it is commonly called bitter leaf because of its bitter taste; it is evergreen in nature and flourishes wherever it grows. It is called "ONUGBU" by Igbo of the eastern part of Nigeria who use it as vegetables, "EWURO" by the Yorubas in the western part of Nigeria who use it as medicine while the Hausas of the Northern Nigeria call it "SHIWAKA" and also the Idomas of North Central of Nigeria call it "AFOLO OR AWO". The leaves may be consumed either as vegetables (macerated leaf soup). Aqueous extracts are used as tonics for the treatments of various illnesses (Sweeney et al. 2005). In the wild, chimpanzees have been observed to ingest the leaves when suffering from parasitic infections (Song et al., 2005). Many herbalist and naturopathic doctors recommend aqueous extracts for their patients as treatment for emesis, nausea, diabetes, loss of appetite – induced ambrosia, dysentery and other gastrointestinal tract problems (Opata et al., 2006), until last decade, there were only anecdotal reports and claims to support the health benefit (Ademola and Eloff, 2011). Vernonia amygdalina has been found to have great importance in terms of using it as vegetables, drugs production and even providing life fence for home owners. More than 50% of all modern clinical drugs are of plant origin (Suffness and Douros, 1987). Plant product therefore play an important role in drug development program of the pharmaceutical industry (Baker et al., 1995; Cordell 1995). Furthermore, the consumption of plant material is believed to contribute immensely to

the improvement of the health of man and his plants and animals. *Vernonia amygdalina* has been found to grow in most part of the country, some people plant it in their home gardens and allow it to grow freely on its own without paying much attention to its performance while some use it as live fence (Suffness et al., 1982) but due to development you find out that even those cut replaced with blocks and as a result the plant is going into extinction (Anyaegebu, 2007). Even to get my research material was even a problem, therefore, there is need to grow it as a plantation crop to avoid scarcity.

Therefore, the objectives of this study include; to assess the effect of plant population on the growth of *Vernonia amygdalina*, assess the response of *Vernonia amygdalina* to applied fertilizer one year after application, determine how different population of the plant will respond to fertilizer application, and evaluate the effect of frequency of harvest on the growth performance of *Vernonia amygdalina*.

Materials and Methods:-

Experimental material

The experimental materials used were cuttings of *Vernonia amygdalina* collected from phase 3 Gwagwalada, Abuja. The cuttings were uniform in size and each measured 30cm long.

Experimental treatment

The experimental treatments of which effect were assessed include

1. Plant population (A_1)10,000, (A_2)20,000, (A_3)40,000 stands/ha
2. Fertilizer application were combined based on factorial arrangement and total 9 treatment combinations were obtained. They include; $A_1B_1, A_2B_1, A_1B_3, A_2B_1, A_2B_2, A_2B_3, A_3B_1, A_3B_2, A_3B_3$ respectively

Experimental Design

The experimental design used was Randomized complete Block Design (RCBD) with 3 replications. The replicate contained 9 plots, each plot measure 4m x 4m, separated from each other within the block by 0.5 alleys and between blocks by 2m pathways. To maintain uniformity, the cuttings were planted on the same day. Planting spacing used include; 1m x 1m giving a population of 10,000 stands/ha, 1m x 0.5m giving 20,000 stands/ha and 0.5m x 0.5m = population of 40,000 stands per hectare. Fertilizer application was done within 3 weeks after planting and a band method of application was used. Harvesting was done at 4 weeks interval

Data Collection

Data collected include; Number of branches /plant, Number of leaves/plant, Height/plant, Leaf area index and dry matter/plant, all collected at 4 weeks interval

Data Analysis

All data collected were subjected to Analysis of Variance (ANOVA). Data were analysed Complete Block Design in factorial.

Results and Discussion:-

Number of branches per plant

The production and development of lateral branches in *Vernonia amygdalina* as influenced by different plant population, the residual effect of N.P.K fertilizer and frequency of harvest is shown in Table 1. The plants were one year in the field when the second study commenced. Six weeks after the initial pruning stand given N.P.K fertilizer produced more branches than those in the control plots. However the difference in branch production of the stands treated with 200kg/ha and 400kg/ha was not statistically significant. But from 10 weeks after the initial harvest to the 18th week, number of branches per plant remained fairly the same as indicated by statistical analysis. This development may confirm the report of earlier authors like Sweeney (2005) that described *Vernonia* as a unique plant because most of its trait (60%) is genetically controlled. Thus branching ability of the plant may be one of such traits in the plant that are under genetic control. But differences in plant population caused a difference ($p > 0.05$) in the branching of the plant. Thus stands planted at the spacing of 1m x 1m (10,000 stands/ha) developed more branches than others. Stands planted at that spacing had more spaces for development and more access to the limited natural resources.

Table 4.1:- Number of branches (g)/ plant of vernoniaamygdalinainfluenced by plant population and Fertilizer application .

Harvest Intervals (weeks)	Plant population	Fertilizer 0	Rate 200 Kg/Ha	400	Mean
6	10,000	5.91	10.53	12.31	9.58
	20,000	5.65	10.34	12.11	9.37
	40,000	3.23	7.35	8.87	6.48
	Mean SE	4.93 3.56	9.41 3.56	11.09	
10	10,000	8.22	10.96	12.34	10.15
	20,000	6.45	8.72	9.43	8.2acing had more spaces for development and more access to the limited natural resources.
	40,000	4.76	5.88	7.12	5.92
	Mean SE	6.48 1.46	8.52 1.46	10.29	
14	10,000	10.98	10.88	11.34	11.07
	20,000	7.61	7.92	8.90	8.14
	40,000	5.87	5.55	7.21	6.21
	Mean SE	8.15 0.87	8.12 0.87	9.15	
18	10,000	11.16	11.98	12.40	11.85
	20,000	8.56	8.79	10.77	9.37
	40,000	5.64	6.13	7.22	6.33
	Mean SE	8.45 1.76	8.97 1.76	10.13	

Number of leaves per plant

Leaf production in Vernonia amygdalina was still significant with N.P.K fertilizer application one year after the application, (Table 2). In the control plots, frequency of harvest has a significant effect on leaf production, hence the number of leaves tend to reduce drastically with increase in frequency of cutting. But in the plots that received N.P.K. fertilizer, the number of leaves per plant did not decrease as harvest period progressed up till the 14th week after the initial pruning beyond which decrease in leaf production set in. regular harvesting of the shoots stimulates new growth thus retarding flower limitation (Akah and Ekekwe, 1995). The decrease may indicate that the residual effect of the fertilizer applied is gradually fading away after one year and two months of its application. This observation on the number of leaves per plant was similar to that of the leaf area per plant, (Table 3). Table 2 Number of leaves of Vernonia amygdalina as influenced by plant population, fertilizer and Frequency harvest.

Table 4.2:- Number of leaves / plant of vernoniaamygdalina as influenced by plant population and Fertilizer application .

Harvest Intervals (weeks)	Plant population	Fertilizer 0	200	400	Mean	SE
6	10,000	45.00	65.33	78.25	62.86	3.2
	20,000	40.12	63.11	74.23	59.15	
	40,000	30.22	55.78	60.48	48.83	
	Mean SE	38.45 4.67	61.14 4.67	70.99		
10	10,000	30.11	118.43	120.23	89.59	4.3
	20,000	28.88	103.55	114.98	82.47	

	40,000	20.30	86.56	93.78	66.88	
	Mean	6.48	8.52	10.29		
	SE		5.34			
	10,000	28.94	156.44	165.23	116.87	
14	20,000	26.33	145.76	168.91	113.67	9.00
	40,000	23.51	83.45	97.32	68.09	
	Mean	26.26	128.55	143.83		
	SE		21.45			
	10,000	28.02	158.43	160.50	115.65	
	20,000	23.87	144.59	145.66	104.71	13.00
18	40,000	21.44	76.00	98.23	65.22	
	Mean	24.44	126.36	134.79		
	SE		28.67			

Leaf Area per plant and dry matter weight per plant

Analysis has shown that leaf area per plant was drastically reduced in the control plots compared with those in plots that were treated with N.P.K fertilizer. However the difference in leaf area per plant between the stands give N.P.K 200kg and 400kg/ha was not significant. This indicates that the effect of the applied fertilizer perhaps starts fading away after one year of its application. This observation corresponds with that of Harris (1975). Frequency of harvesting as shown in the Table (3) has significant effect on the leaf area of the stands. The implication was that stands of *Vernonia amygdalina* irrespective of fertilizer application have their leave area reduced with increase in the number of time of harvest. This same experience was observed in Attah, (2013). Harvesting of only leaves hampers growth, (Burkil, 2000). This means that farmers should always prune at the time of harvesting. It is worthy to note that phenomena observation made on the leaf area of the plant was the same as that of the number of coppices per plant, (Table 4). A different observation was made on the parameter dry leaf weight. The dry matter weight per plant increased with fertilizer application. Frequency of harvesting effected ($p>0.05$) the parameter after the 14th week of pruning when the weight started to decrease as the frequency of cutting increased. However the difference in the dry weight of the leaves with increase in fertilizer was not significant, ($P>0.05$), an indication that the residual effect of the fertilizer applied was gradually fading away, Processed leaves of *Vernonia amygdalina* are exported from West African in dried or deep frozen form and offered in major markets of African vegetable in Europe (Bakeret et al., 1995).

Table 3:- Leaf area of *vernoniaamygdalina* as influenced by plant population and Fertilizer harvest.

Harvest Intervals (weeks)	Plant population	Fertilizer 0	Rate Kg/Ha 200	400	Mean	SE
6	10,000	0.18	1.97	1.78	1.90	
	20,000	0.13	2.19	2.82	1.71	0.46
	40,000	0.09	1.67	1.60	1.12	
	Mean	0.40	1.94	2.07		
	SE		1.55			
10	10,000	0.15	1.62	1.67	1.15	
	20,000	0.14	2.17	2.81	1.71	0.33
	40,000	0.07	1.65	1.58	1.10	
	Mean	0.12	1.81	2.02		
	SE		1.33			
14	10,000	0.12	1.63	1.66	1.14	
	20,000	0.10	2.11	2.78	1.66	0.04
	40,000	0.08	1.66	1.57	1.91	
	Mean	0.10	1.80	2.00		
	SE		0.56			
	10,000	0.12	1.14	1.49	1.01	
	20,000	0.10	1.98	2.33	1.47	1.30
18	40,000	0.05	1.59	1.34	0.99	

	Mean SE	0.09	1.67 0.78	1.72		
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Table 4:-Number of coppice/plant as affected by plant population, N.P.K. Fertilizer and frequency of cutting

Harvest Intervals (weeks)	Plant population	0	200	400
6	10,000	7.6	13.50	13.60
	20,000	7.7	16.60	16.30
	40,000	6.90	12.60	12.40
	Mean SE	7.40	14.20 3.22	14.10
10	10,000	7.60	12.50	12.40
	20,000	8.60	14.30	14.80
	40,000	7.00	10.60	10.60
	Mean SE	7.70	12.50 3.87	12.60
14	10,000	7.40	10.80	11.30
	20,000	6.50	10.60	10.30
	40,000	5.20	8.60	7.30
	Mean SE	6.40	10.00 2.13	9.60
	10,000	6.60	10.30	11.80
	20,000	6.70	10.40	12.50
	40,000	3.60	8.30	8.40
18	Mean SE	5.60	9.70 2.03	10.90

Table 5:- Dry matter weight of vernoniaamygdalina as influenced by plant population, Fertilizer and Frequency harvest.

Harvest Intervals (weeks)	Plant population	Fertilizer 0	Rate Kg/Ha 200	400	Mean
6	10,000	2.80	14.80	15.90	11.17
	20,000	2.80	14.80	15.80	11.13
	40,000	2.10	13.40	14.40	9.97
	Mean SE	2.60	14.30 4.28	15.40	
10	10,000	5.30	28.60	28.80	20.90
	20,000	4.70	26.60	28.70	20.00
	40,000	4.30	24.60	26.10	18.33
	Mean SE	14.30	26.60 6.34	27.90	
14	10,000	5.90	43.80		
	20,000	5.10	43.80		
	40,000	4.80	36.60		
	Mean SE	5.30	41.40 8.56	48.70	
	10,000	6.20	43.90	48.70	32.93
	20,000	5.40	43.90	45.40	31.57
	40,000	5.00	33.70	38.60	25.70
	Mean SE	5.50	40.50 12.77	44.20	

Conclusion:-

The result of the study showed that the number of branches per plant in the plots that received N.P.K fertilizer was greater than those in the control plots. Leaf area per plant was drastically reduced in the control plots compared with those in plots that were treated with N.P.K fertilizer. The differences in leaf area per plant among the stands given N.P.K 200kg and 400kg/ha were not significant. Frequency of harvest has significant effect on the leaf area and dry matter weight of the plants.

Stands planted at the spacing of 1m by 1m (10,000 stands/ha) developed more in all the growth parameters than others, one year after establishment.

Recommendation:-

In the course of this research, one year after the N.P.K fertilizer was applied, the result of the experiment shows that 1 year after fertilizer application the effect of the fertilizer on the plants tends to be non significant. Therefore, I recommend another dose of the recommended fertilizer rate of 200kg/ha to be re-applied after 1 year of the application. The frequency of harvesting of the leaves should be done at least at 8 weeks interval instead of the 4 weeks been used in the trial. As the result of the importance of the crop.

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