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EFFECTS OF PLANT SPACING AND POULTRY MANURE APPLICATION RATES ON THE GROWTH PERFORMANCE OF AFRICAN YAM BEAN CULTIVATED IN OWERRI SOUTH-EASTERN NIGERIA

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Abstract
The paper examined Effects of Plant Spacing and Poultry Manure application rates on the growth performance of African Yam Bean cultivated in the South-Eastern Nigeria. Five research question and one hypothesis guided the study. The study adopted factorial experimental research design, using Randomized Complete Block Design (RCBD). The population for the study was 2000 African yam bean seeds, (A Y B), while 1080 AYB were purposively selected as samples for the study. The study was made up of six experimental groups (E_1–E_6), 60 x 10cm, 60 x 15cm, 70 x 10cm, 70 x 15cm, 75 x 10cm and 75 x 15cm with three replicates for each group (R_1–R_3) and six sub-groups for each replicate (a–f) bringing the study to 108 clusters. Each cluster received a total of 10 randomly assigned AYB seeds for the experiment. Data were collected on growth performance which include height, leaf area, number of leaves and branches by the researcher and three research assistants. Data were obtained using meter rule, thread, observation and templates developed by the researcher among others. Frequency count, percentage, mean and Analysis of Variance (ANOVA) were used for data analysis at 0.05 level of significance. Frequency, percentage and mean were used to answer the research question, while one-way ANOVA was used to test the null hypothesis at 0.05 level of significance. Statistical means were separated using Scheffe's Test. The findings of the study reveal that African Yam-Bean planted at different spacing with different rates of Poultry Manure Application, performance focused on height, leaf area, number of leaves, and branches of the experimented plants at 756.22cm with a SD of 87.85 and 324cm with SD of 13.67, S_5P_S and S_1P_1 plants had the highest and lowest height respectively. Varying plant spacing has direct effect on the growth performance. It was recommended that optimum spacing and Poultry Manure Application rate should always be considered as too much or too little are ta economic disadvantage.
Key Words: *African yam beans, plant spacing, poultry manure, growth performance, South Eastern Nigeria.*

Introduction

African Yam Beans (AYB – *Sphenostylis stenocarpa*) is a perennial leguminous plant which belongs to the family of Fabaceae, and is indigenous to Central and West Africa and is grown for its edible seeds (Heuze & Tran, 2016; Aremu, Ige, Ibirinde, Raji, Abolusoro, Ajiboye, Obaniyi, Adekiya & Asaleye, 2020). AYB produces grains and tubers which are of high nutritional value and great economic importance (George, Obilana, & Oyeyinka, 2020).It is a nutritious plant with its seed having proximate nutrient composition of 26.88 - 28.36% crude protein, 1.78 - 2.48% ether extract, 3.95 - 5.30% crude fibre, 5.66 - 11.85% moisture content, 3.79 - 5.61% ash and 58.62 - 61.95% nitrogen free extract in the seed (Onuoha, Harry & Eze, 2017). In South Eastern Nigeria, names of AYB based on locality and dialect include: *Odudu, Akidi, Okpodudu, Uzoaki, Sese, Aniriri, Ijiriji* and *Azama,* among others. These multiplicities of names points to the status and significance of the crop in the trado-cultural settings of many communities in Nigeria and across Africa.

While the crop is usually grown for its beans in Nigeria, in other parts of Africa like Cote d'Ivoire, Ghana, Cameroon, Gabon, Democratic Republic of Congo, Ethiopia and parts of East Africa, they are also grown for the tuber (Adesiyun, 2020).Even with its enormous qualities, several studies have argued that AYB is understudied (Adesiyun, 2020; George, Obilana, & Oyeyinka, 2020) and underutilized (National Research Council, 2006; Oke, Sobowale & Ogunlakin, 2013; Shitta, Edemodu, Abtew & Tesfaye, 2021). In the concept of this study, African yam bean is a nutrient-dense food crop whose seeds contain about 20 – 29% protein, along with essential amino acids, making it a valuable dietary component in regions with limited protein sources. Factors surrounding the understudy of AYB might be linked to less awareness of the existence of the rich crop (Nwokolo, 1996; George, Obilana & Oyeyinka, 2020), while its low utilization in regions might be linked to quality and quantity of output which is largely influenced by farming operations such as plant spacing, among others.

Planting space technically called plant spacing refers to the distance between cultivated crops on the same piece of land. It is the consistent distribution of crops on a cultivated land (Negash & Mulualem, 2015). Planting space is the intentional arrangement of crops to be able to get the desired plant population (National Agricultural Advisory Services, NAAS, 2020). In this study, planting space refers to the distance between a sown AYB seed and the next on the same row and between rows. It determines the number of plants, plant density and population on the farm. The number of plants per unit area of cultivated land affects crop yield by moderating competition among plants for nutrients, moisture, sunlight and other growth sources (Agrawal, 2023). The number of acceptable crops, such as AYB, is paramount for obtaining high yields.

According to NAAS (2020), yield per plant decreases gradually as plant population per unit area increases, but yield per unit area increases up to certain level of population and competition for space and nutrient may set in which will in turn affect the yield. Therefore, under low plant population due to increased spacing, individual plant yield could be more but total that also depend on the manure available to the crop

Regardless of the crop, proper plant spacing allows good air movement around the plants to minimize common diseases (United States Agency for International Development, USAID, 2012). Many disease agents require a moist or humid environment to develop. Thus crowded planting, reduced airflow prevents moisture from evaporating from leaf surfaces, increasing the likelihood of foliar diseases (Toscano, 2022). The author further explained that good air circulation through proper plant spacing helps reduce fungal diseases in the garden.

According to USAID (2012), significant differences in plant yields can occur if optimum planting space are not used in the farm plot. Failure of cultivated plants to perform optimally represents lost income. Therefore, before planting crop, including AYB seeds, it is important to consider the amount of space the plant requires to grow well and other farming

activities such as poultry manure application. Poultry Manures are waste products or excreta from birds which are applied into the soil as manure. The utilization of poultry manure is an integral part of sustainable agriculture. Animals' manures have been used effectively as fertilizer for centuries. Poultry manure as a fertilizer has been part of organic crop production for centuries and has long been recognized as perhaps the most desirable of these natural fertilizers because of its high nitrogen (Sloan et al., 2003). Poultry manures supply other essential plant nutrients and serve soil amendment by adding organic matter. Organic matter in soil improves moisture and nutrient retention. Organic matter in soil improves moisture and nutrient retention. The increased size and frequent clean-out of many poultry operations make poultry dropping available in sufficient quantities and on a timely basis to supply most fertilization needs. The poultry manure compost has lots of beneficial aerobic bacteria and fungi growing in it for soil building and plant fertilization. The nitrogen and nutrient content in poultry manure is high. It has been established that poultry manure has a make-up of 1.80% nitrogen, 1.5% phosphate and approximately nitrogen - phosphorus - potassium (NPK) ratios of 2:2:1 (Sloan et al., 2003). Poultry droppings when used as soil amendment is known to improve soil structure, water holding capacity, infiltration rate and hydraulic conductivity of the soil.

Mbagnon and Bationo (1995), Mbuh et al (2001) reported that poultry droppings decompose faster and has higher biological oxygen demand (BOD) ratio and also reported that half-life of poultry droppings was 83 days compared to other organic manure and rate of its mineralization is faster. Ojeniyi et al (2001) found that yields of A Y B crop were improved by poultry droppings. Mbagnon et al (2000) reported that application of poultry droppings on soils increased soil aggregate stability, infiltration rate and hence reduces bulk density.

Growth performance accounts for how fast the seedlings germinate, the root, stems and leaves elongate and how soon the plants reach maturity for the development of fruits and other edible parts while yield performance focuses on the quantity and quality of harvestable edible parts of the plant per cultivated area. Crop yield performance, also known as agricultural output refers to how much grains or other economic parts produced, and by extension how efficient land is used to produce food or agricultural commodities (Hayes, 2022).

According to the author, it is a standard measurement of the amount of agricultural production harvested yield of a crop per unit of land area. Yield is the ultimate measure of crop performance and is clearly of greatest interest to farmer (Condon& Hall, 1997). It is considered the evidence thus, the means to the reward of the farmer for all the efforts put in during cultivation of the crop. Crop yield performance is the measure of seeds or grains which is produced from a cultivated plot of land. It is usually expressed in kilograms per hectare or in bushels per acre (Cherlinka, 2020). According to Cherlinka (2020), the average crop yield per acre or yield performance serves as the evaluation of a farmer's agricultural output on a particular field over a specified period. It is considered to be probably the most important measure of each farmer's performance, as it embodies the result of all the efforts and resources invested by farmers in the development of plants on their fields (Ngoune & Shelton, 2020). In this study, yield performance is the quantity and quality of harvested AYB seeds per cultivated area while considering the spacing adopted and nutrient supply. Poultry manure and NPK fertilizer applied during production stage determine the nutritive value of the final consumable harvest of the plant. A critical challenge in African yam bean production in South-East, Nigeria lies in identifying optimal agronomic practices that support its growth and enhance its yield and nutritive value. Traditional farming methods in the region often involve irregular plant spacing, indiscriminate application of fertilizers, or total neglect of soil fertility amendments. These practices not only reduce the potential yield but also compromise the physiological quality of the crop.

Plant spacing, for instance, plays a vital role in determining how well plants access sunlight, nutrients, and water.

Overcrowded plants compete heavily for resources, leading to stunted growth, poor pod development, and lower biomass accumulation. Conversely, overly wide spacing may lead to underutilization of land resources and reduced total yield per unit area. However, research on optimal spacing for African yam bean, particularly under local ecological conditions in South-East Nigeria, remains limited.

Hence, the study sought to determine the effects of plant spacing and poultry manure on the growth performances of African Yam bean in South-Eastern Nigeria.

Purpose of the study

The main purpose of the study is to determine the effects of planting space and poultry manure on the growth performance of African Yam Bean in South - Eastern Nigeria. Specifically, the study sought to:

a. Evaluate the effects of varying poultry manure rates on the plant height;
b. Evaluate the effects of varying poultry manure rates on the leaf area;
c. Evaluate the effect of varying poultry manure rates on the number of leaves;
d. Evaluate the effects of varying poultry manure rates on the number of branches and
e. Evaluate the effects of varying plant spacing and poultry manure application rates on the growth performance of AYB cultivated in the South Eastern Nigeria.

Research Question

What are the effects of varying plant spacing and poultry manure application rates on the growth performance of AYB cultivated in South Eastern Nigeria?

i. What is the effect of poultry manure rates on the plant heights?
ii. What is the effect of poultry manure rates on leaf area?
iii. What is the effect of poultry manure rates on number of leaves?
iv. What is the effect of poultry manure rates number of branches?
v. What is the effect of varying plant spacing and Poultry Manure application on the growth performance of AYB cultivated in South Eastern Nigeria?

Hypothesis

The following null hypothesis guided the study and was tested at 0.05 level of significance:

Ho_1 There is no significant effect of varying plant spacing and poultry manure application rates on growth performance of AYB cultivated in the South-Eastern Nigeria

Methodology

This study adopted factorial experimental research design using a complete randomized block design (CRBD) with three replicates and was carry out in the demonstration farm of the Department of Agricultural Science Education, Alvan Ikoku Federal University of Education, Owerri.

(Plot Layout)

Group	Spacing (cm x cm)	Poultry manure 1kg/10m^2	1.5kg/10m^2	2kg/10m^2
E_1 (180)	***60 x 10***			
	R_1(60)	10	10	10
	R_2(60)	10	10	10
	R_3(60)	10	10	10
E_2(180)	***60 x15***			
	R_1(60)	10	10	10
	R_2(60)	10	10	10
	R_3(60)	10	10	10
E_3(180)	***70 x10***			
	R_1(60)	10	10	10

	R_2(60)	10	10	10
	R_3(60)	10	10	10
	70 x 15			
E_4(180)	R_1(60)	10	10	10
	R_2(60)	10	10	10
	R_3(60)	10	10	10
	75 x 10			
E_5(180)	R_1(60)	10	10	10
	R_2(60)	10	10	10
	R_3(60)	10	10	10
	75 x 15			
E_6(180)	R_1(60)	10	10	10
	R_2(60)	10	10	10
	R_3(60)	10	10	10

Total = 1,080

The population for the study is 2000 AYB seeds obtained for cultivation in demonstration farm of the Department of Agricultural Science Education, Alvan Ikoku Federal University of Education, Owerri. The size of the seed is not much, hence the need to secure a large population from which sample could be taken from.

From the 2000 seeds, one thousand and eighty (1080) were purposively selected as samples to be planted for the study since they were healthy and disease free seeds. The study was made up of six experimental groups (E1 - E6) with three replicates for each group (R1 - R3) and six sub-groups for each replicate (a - f) bringing the study to a total of 108 clusters for the experiment. Each cluster received a total of 10 randomly assigned AYB seeds for the experiment.

The instrument used for this study was an observational schedule titled "African Yam Beans Experimental Farm Observation Report Sheets (AYBEFORS)" designed by the researcher. This was used for data collection during the experiment. The instrument focused on growth performance of the cultivated AYB thus data were collected on germination rate, plant height, number of leaves, and number of seeds that germinated.

The instrument was face validated by three experts, two from the Department of Agricultural Education and one from the Department of Crop Science, all from the University of Nigeria, Nsukka. The templates were given to the three experts to make criticism, suggestion and recommendations that would help to improve the quality of the template for effective data collection. The suggestions and corrections made by the experts which included the introduction of the weighing method and replications of treatments were incorporated into the final copy of the templates.

Method of Data Analysis

The data collected were analyzed using frequency count, percentage, mean, and Analysis of variance (ANOVA). Frequency, percentage and mean were used to answer the research question; while One way ANOVA was used to test the null hypothesis at 0.05 level of significance. Any null hypothesis with p-value less than 0.05 was rejected and regarded as significant and any null hypothesis whose p-value is equal to or greater than 0.05 was upheld and regarded as not significant. For a post Hoc test, differences between means were separated using scheffe's test.

Research Question 1: What are the effects of varying plant spacing and poultry manure application rate on growth performance of AYB cultivated in the South Eastern part of Nigeria?

Table 1:
Mean ($\bar{x}$) and Standard Deviation (SD) results of the Effects of Varying Planting Space and Manure Application Rate on Growth Performance of AYB Cultivated in the Study Area

Treatment Groups	Poultry Manure (P)			
	Height ($\bar{x}$±SD) (in CM)	Leaf Area ($\bar{x}$±SD) (in CM)	No of Leaves ($\bar{x}$±SD)	No of Branches ($\bar{x}$±SD)
S1P1	324.00±13.67	2.00±0.75	364.00±25.15	46.00±2.31
S1P2	603.11±14.60	2.75±0.91	616.67±28.41	116.89±9.74
S1P3	524.89±16.89	2.55±0.86	635.11±40.11	113.56±11.91
S2P1	466.22±23.09	2.56±0.11	606.00±46.81	121.78±13.97
S2P2	498.22±17.58	3.03±0.86	536.67±24.33	78.00±41.61
S2P3	534.00±7.55	6.11±0.10	570.22±15.50	81.56±45.67
S3P1	686.89±17.11	3.00±0.45	915.78±62.58	75.56±17.37
S3P2	605.33±12.06	2.53±0.78	607.11±16.93	60.00±0.74
S3P3	549.33±15.30	2.73±0.46	590.00±28.86	56.44±14.69
S4P1	429.56±14.23	2.60±0.93	471.33±26.23	56.00±32.23
S4P2	536.22±17.19	2.49±0.69	507.78±23.86	63.11±32.57
S4P3	362.00±11.01	1.91±0.84	407.56±41.90	52.44±22.06
S5P1	602.89±41.64	4.11±0.74	721.56±16.23	71.78±31.04
S5P2	729.56±10.70	4.74±0.16	1,248.44±25.83	94.00±32.03
S5P3	756.22±87.85	5.17±0.13	1,058.89±30.26	93.11±39.37
S6P1	524.89±18.42	3.28±0.30	298.89±20.42	42.67±13.19
S6P2	566.89±12.57	2.27±0.29	294.44±17.02	47.78±14.43
S6P3	591.56±85.56	3.06±0.11	333.33±20.48	45.78±19.09

Data on Table 1 revealed the growth parameters of AYB planted at different spacing with different rate of poultry manure applications. Performance focused on height, leaf area, number of leaves and branches of the experimented plants. At 756.22 CM with a SD of 87.85 and 324.00 CM with a SD of 13.67, S5P3 and S1P1, plants had the highest and lowest heights respectively. For the average area of leaf for the experimented plants, data on Table 1 showed that S2P3 at 6.11 CM with a SD of 0.10 and S4P3 at 1.91 with a SD of 0.84 had the highest and lowest area of leaves respectively. The average total number of leaves found on the experimented AYB plants were more for S5P2 at about 1,248 with a SD of 25.83 and lowest for S6P2 at about 294 with a SD of 17.02 among the plants. The S2P1 had the highest number of branches at about 122 with a SD 61 .97 while S6P1 had the lowest number of branches at about 43 with a SD of 3.19 among the AYB plants across the groups that received poultry manure as treatment.

H_{01} There is no significant effect in varying planting space and manure application rate on growth performance of AYB cultivated in the South-Eastern part of Nigeria

Table 2:ANOVA test of the Effects of Varying Planting Space and Manure Application rate on Growth Performance of AYB Cultivated in the South Eastern, Nigeria

Growth parameters		Sum of Squares	df	Mean Square	F	Sig.*	R
Height	Between Groups	19487.560	17	1146.327	5.645	.00	S
	Within Groups	29241.002	144	203.063			
	Total	48728.562	161				
Leaf Area	Between Groups	19904.423	17	1170.848	1.609	.07	NS
	Within Groups	104805.884	144	727.819			
	Total	124710.308	161				
No of Leaves	Between Groups	101255.853	17	5956.227	6.270	.00	S
	Within Groups	136793.271	144	949.953			

	Total	238049.124	161				
No of Branches	Between Groups	1006.230	17	59.190	1.936	.02	S
	Within Groups	4402.300	144	30.572			
	Total	5408.530	161				
Cluster Value					**3.865**	**0.02**	**S**

Sig* at p < 0.05; R – Remark; S – Significant; NS – Not Significant

In Table 2, result of the analysed data showed that significant difference (S) exists in height, number of leaves and number of branches among AYB plants as their p-values were 0.00, 0.00 and 0.02 respectively, which were less than the critical value of 0.05 for decision rule. On leaf area, the plants did not differ significantly (NS) as the p-value for the compared means was 0.07 which was higher than the critical value of 0.05. At the cluster level, the average of the parameters for determining growth of AYB revealed an F-value of 3.865 and a p-value of 0.02. The p-value at the cluster level is less than the critical value of 0.05 indicating significant difference. Therefore, the null hypothesis ($\mathbf{H_{01}}$) of no significant effect in varying planting space and manure application rate on growth performance of AYB cultivated in the South Eastern, Nigeria is rejected as significant difference exists among the plants.

Table 3: Post Hoc Test of Significant Difference Effects of Varying Planting Space and Manure Application rate on Growth Performance of AYB Cultivated in the South Eastern Part of Nigeria

Multiple Comparisons

Dependent Variable: Post Achievement

Scheffe

Parameter		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Height	Between Groups	13.62*	1.166	.000	10.74	16.50
	Within Groups	34.56*	1.219	.000	31.55	37.57
	Total	-13.62*	1.166	.000	-16.50	-10.74
Leaf Area	Between Groups	20.95*	1.414	.000	17.45	24.44
	Within Groups	-34.56*	1.219	.000	-37.57	-31.55
	Total	-20.95*	1.414	.000	-24.44	-17.45
No of Leaves	Between Groups	20.95*	1.414	.000	17.45	24.44
	Within Groups	-34.56*	1.219	.000	-37.57	-31.55
	Total	-20.95*	1.414	.000	-24.44	-17.45
No of Branches	Between Groups	20.95*	1.414	.000	17.45	24.44
	Within Groups	-34.56*	1.219	.000	-37.57	-31.55
	Total	-20.95*	1.417	.000	-24.45	-17.47

In the Table 3 above, show the Post Hoc Test using Duncan Multiple Range Test to separate means on the effects of varying planting space and manure application rate on growth performance of AYB cultivated in the South Eastern Nigeria was analyzed. The Table revealed that the differences showed statistical mean differences among all the compared means, indicating that plants in each experimental group showed significantly distinguishable growth parameters.

Discussion of Findings

Effects of varying planting space and poultry manure application rate on growth performance of AYB cultivated in South-Eastern Nigeria

The African Yam Beans (AYB) is considered an important food item in Nigeria and across Africa Cultivation practices are expected to influence the growth and performance of the plant. According to Mofunanya et al. (2020), the height of AYB can vary significantly depending on environmental conditions and cultivation practices. Agbowuro (2021) opined that poultry manure application generally leads to increased AYB height, leaf area, number

of leaves, and number of branches. Studies indicate that AYB treated with poultry manure can exhibit height increases of additional 20-40% (Mofunanya et al., 2020). The results presented in Table 1 highlight the significant effects of varying planting space and poultry manure application rates on the growth performance of AYB. The data indicate that both factors play crucial roles in enhancing various growth parameters, including plant height, leaf area, number of leaves, and number of branches. The tallest plants were observed in the treatment group S5P2 (729.56 mm) and S5P3 (756.22 mm), suggesting that higher rates of poultry manure application with adequate spacing significantly promote vertical growth. This finding is consistent with research, indicating that manure and optimum spacing enhance nutrient availability, which is critical for plant development and overall growth performance (Mofunanya et al., 2020; Gbenga-Fabusiwa, 2021; Ogunlade et al., 2021). Conversely, the shortest plants in S1P1 (324.00 mm) indicate that insufficient poultry manure application and improper spacing limit growth potential for AYB.

The leaf area measurements show that treatment S2P3 (6.11 cm^2) resulted in the largest leaf area, which is essential for maximizing photosynthesis and overall plant vigor. Increased leaf area is often associated with better nutrient uptake and light interception, leading to improved growth performance (Ogunlade et al., 2021). The smallest leaf area is found in S4P3 (1.91 cm^2) suggests that this treatment combination may not provide optimal conditions for leaf expansion, corroborating findings that nutrient deficiencies can hinder leaf development (Aremu et al., 2018).

The highest number of leaves recorded in S5P2 (124.84 leaves) indicates that this treatment effectively supports leaf production, which is vital for the plant's ability to photosynthesize and grow. This finding aligns with that of Mofunanya et al. (2020) and Aremu et al (2018) emphasizing the importance of nutrient-rich environments for leaf development. In contrast, the low leaf count in S6P1 (29.89 leaves) suggests that inadequate nutrient supply can severely limit leaf growth. The treatment S1P2 exhibited the highest branching (116.89 branches), which can enhance the plant's capacity for nutrient uptake and light interception. Increased branching is often linked to better overall plant health and productivity (Ogunlade et al., 2021). The lower number of branches in S4P3 (52.44 branches) indicates that this treatment may not support robust branching, which could negatively impact yield.

The overall view on growth performance for AYB treated with different rates of poultry manure at different planting spaces suggest that higher application rates of poultry manure, particularly in conjunction with optimal planting spaces, lead to improved growth metrics for the cultivated AYB. The findings provide guides in practices for maximizing the yield potential of AYB, which are an important source of nutrition in many regions of Africa. The variability in standard deviations across treatments also indicates that while some treatments are consistently effective, others may be influenced by environmental factors or specific soil conditions (Aremu et al., 2018).The findings underscore the importance of integrating adequate manure application with appropriate planting strategies to enhance the growth performance of AYB.

There was statistically significant effect in varying planting space and manure application rate on growth performance among the cultivated AYB plants in South Eastern Nigeria as indicated by the ANOVA result. Further, analyses using Duncan multiple range test for the Post Hoc test revealed that all the experimental groups differed statistically from each other. Therefore, varying poultry manure application rate and the planting spaces for AYB cultivation produces different performance outputs. This is because different rates of organic manure application interact differently on the soil and the spacing adopted influence competition for sunlight, water, nutrient and others among the cultivated AYB strands in this study and as indicated by existing studies (Adewale& Nnamani, 2022).

Conclusion

Based on the findings, at 756.22cm with a SD of 87.85 and 324cm with SD. Of 13.67, S_5P_3 and S_1P_1 Plants had the highest and lowest heights respectively.

For the average area of leaf for the experimental plants S_2P_3 at 6.11cm with a SD of 0.10 and S_4P_3 at 1.91 with a SD of 0.84 had the highest and lowest area of leaves respectively. The average total number of S_5P_2 at about 1,2 48 with a SD of 25.83 and lowest for S_6P_2 at about 294 with a SD of 17.2 among the plants. S_2P_1 had the highest number of branches at about 122 with a SD of 13.97 while S_6P_1 had the lowest number of branches at about 43 with SD of 3.19 among the AYB Plants across the groups that received poultry manure as treatment.

African Yam Beans (AYB) is an important economic plant in Africa, particularly in Nigeria where its consumption is on the rise due to its packed nutrient value and versatility as food, feed, and for industrial use. Its cultivation in the South East Nigeria, can be improved upon by providing empirical evidence for favourable cultural practices. The results of this study underscored the importance of integrating appropriate planting strategies with the balanced of poultry manure application to enhance the growth performance of AYB.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. AYB plants in S5P3 (that received 2kg/10m^2 of poultry manure at 75 by 10 cm spacing), S2P3 (that received 2kg/10m^2 of poultry manure at 60 by 15 cm spacing), S5P2 (that received 1.5kg/10m^2 of poultry manure at 75 by 10 cm spacing) and S1P2 (that received 1.5kg/10m^2 of poultry manure at 60 by 10 cm spacing) had better growth performance in height (87.85), leaf area (6.11cm), number of leaves (1248) and branches (122), respectively. There was significant effect in varying planting space and manure application rate on growth performance among the cultivated AYB plants in South Eastern Nigeria.
2. The poultry manure application rates should be guided by the intended purpose of cultivating AYB, as they affect the vegetative growths differently
3. Optimum spacing and poultry manure application rates should always be considered as data showed that too much or too little are at economic disadvantage
4. Extension agents and other farmer orientation agencies should encourage farmers to consider switching to AYB farming and adopting sustainable farming practices to boost production.

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