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GROWTH AND YIELD OF SESAME (*Sesamum indicum* L.) AS AFFECTED BY POULTRY MANURE, NITROGEN AND PHOSPHORUS AT SAMARU, NIGERIA

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ABSTRACT

Field trials were conducted during the rainy seasons of 2005, 2006 and 2007 to study the growth and yield of sesame as affected by poultry manure, nitrogen and phosphorus. The experiments consisted of four levels of poultry manure (0, 5.0, 10.0, and 15.0 t ha^{-1}), three levels of nitrogen in the form of urea (0, 60, and 120 kg N ha^{-1}) and three levels of phosphorus in the form of single super phosphate (0, 13.2 and 26.4 kg P ha^{-1}). The thirty six treatment combinations were laid out in a split-plot design with three replications. The factorial combination of N and P were assigned to the main plot while poultry manure was assigned to the sub-plot. The results showed that leaf area index and net assimilation rate were highest at 15 t ha^{-1} of poultry manure, 120 kg N ha^{-1} and 13.2 kg P ha^{-1}. Grain yield per hectare was optimized at 5 t ha^{-1} of poultry manure, 60 kg N ha^{-1} and 13.2 kg P ha^{-1}. Applications of 5 t ha^{-1} of poultry manure, 60 kg N ha^{-1} and 13.2 kg P ha^{-1} seems to be the ideal rates of poultry manure, nitrogen and phosphorus for increased yield of sesame in the northern guinea savanna agro ecological zone and is therefore recommended.

Key words: Leaf area index, Crop growth rate, Net assimilation rate, Grain yield, Sesame.

INTRODUCTION

Sesame (*Sesamum indicum* L.) is a crop of great antiquity which is widely grown in tropical and subtropical regions of Asia, Africa, South and North America and to some extent in Russia for edible oil and for animal feed purposes. Among the traditional sesame growers in Nigeria (particularly in the north central part), fertilizer application has not been a common practice because it is considered as a minor crop and can do well even on poor soils (Haruna and Usman, 2005). Unfortunately, growth and yield of the crop are generally low compared with the growth and yield obtained when fertilizer is applied. For instance, in Nigeria, the average yield of sesame obtained by farmers is 300 kg ha^{-1} compared with 1,960 kg ha^{-1} in Venezuela, 1,083 kg ha^{-1} in Saudi Arabia, 517 kg ha^{-1} in Ivory Coast and 510 kg ha^{-1} in Ethiopia (Abubakar *et al*., 1998).

Poultry manure has long been recognized as the most desirable organic fertilizer. It improves soil fertility by adding both major and essential nutrients as well as soil organic matter which improve moisture and nutrient retention (Farhad *et al*., 2009). Addition of N and P fertilizer enhances root development, which improves the supply of other nutrients and water to the growing parts of the plants, resulting in an increased photosynthetic area and thereby more dry matter accumulation (Ali *et al*., 2010).

Reports of nutrition studies carried out in the tropics have shown significant increase in plant height, number of branches per plant leaf area index, crop growth rate total dry matter and grain yield per unit area due to nitrogen and phosphorus application (Okpara *et al*., 2007).

Considering the low nutrient status of Savanna soils (particularly, nitrogen and phosphorus as well as organic matter), there is the need for integrated use of organic and inorganic fertilizers in a balanced proportion than when either is used alone for increased and sustainable growth and yield of crops. This study, therefore, seeks to assess the growth and yield of sesame under varying rates of poultry manure, nitrogen and phosphorus.

MATERIALS AND METHODS

Field Experiments were conducted during the rainy seasons of 2005, 2006 and 2007 at the Institute for Agricultural Research (IAR) Farm, Ahmadu Bello University, Samaru, (11^{o} $11^{/}$ N; 07^{o} $38^{/}$E, 686m) above sea level, located in the northern Guinea Savanna agro-ecological zone of Nigeria. Annual rainfall ranges from 790 – 1300mm while, the mean air temperature ranges from 21 to 30^{o}C (Owunibi and Yayock, 1981). The soil of the area has been broadly described as well drained, often leached, ferruginous tropical soil (Klinkenberg and Higgins, 1968). It is characterized by low pH, organic matter, available phosphorus and nitrogen.

Treatments consisted of factorial combinations of three levels of nitrogen (0, 60 and 120 kg N ha^{-1}) in the form of Urea, three levels of phosphorus (0, 13.2 and 26.4 kg P ha^{-1}) in the form single super phosphate and four levels of poultry manure (0, 5.0, 10.0 and 15.0 t ha^{-1}). The thirty six (36) treatments were laid out in a split-plot design with nitrogen and phosphorus levels assigned to the main-plot, while poultry manure was assigned to the sub-plot. The gross plot area was $13.5m^2$ (4.5mx3m) while the net plot area was $9m^2$ (3mx3m). The experimental area was disc-ploughed and harrowed twice to a fine tilt. This was then followed by ridging at 75cm apart (between rows) and the field marked into plots and replications. The plots were separated by 1.0m unplanted boarder while replications were separated by 2.0 m unplanted boarder. The three levels of phosphorus and the four levels of poultry manure were incorporated into the ridges according to field plan after land preparation and left for two weeks before sowing. Half of the nitrogen levels were applied at 3 weeks after sowing (WAS) while the remaining half was applied at 6 WAS. The planting material used was Ex-Sudan; it is white in colour, of medium in height and medium maturity (85 to 90 days) (RMRDC, 2004). Sesame was planted on the 16^{th}, 19^{th} and 20^{th} July in 2005, 2006 and 2007, respectively. Sesame was sown at 15cm intra-row spacing on ridges spaced 75cm apart. Manual hoe weeding was done at 3, 6, and 9 WAS to keep the experimental plots weed-free.

Five randomly selected plants were cut from the ground level, oven dried at 70^0C to a constant weight and the mean recorded. The data were further used to estimate crop growth rate and net assimilation rate. Leaf area index was determined as described by Watson (1958). Crop growth rate which is the dry weight increment per unit time was computed using data from dry matter production at 6, 8 and 10 WAS as described by Radford (1967). Net assimilation rate was determined at 6, 8, and 10 WAS as describes by Watson (1958).

The crop was harvested on the 23^{rd}, 27^{th} and 28^{th} of October 2005, 2006 and 2007 respectively, when the leaves and the stems changed colour from green to yellow with a reddish tint on them. Harvesting was manually done with the aid of a sickle by cutting the plants at the base close to the ground. Plants from each plot were put in a sack to dry so as to minimize seed loss when capsule dehisces. When the harvested plants were adequately dry, the sacks were gently beaten with sticks in order to release all the seeds from the capsules. The seeds were then separated from the chaff by winnowing. The entire plants in the net plot were used to obtain the seed yield per hectare. The data collected were subjected to analysis of variance using the ‘F’ test to estimate the significance in the effects of the treatments as described by Snedecor and Cochran (1967). Comparisons of treatment means were done using least significant difference (Steel *et al*, 1997).

RESULTS

Leaf area index: Leaf area index (LAI) of sesame as influenced by treatments at 4, 6, 8, and 10 WAS are shown in Table 1. Every increase in the rate poultry manure application significantly increased LAI of sesame at all sampling periods and in all the years. The highest LAI was produced by the application of 15 t ha^{-1} of poultry manure. At 4 and 6 WAS of all the years, and at 8 and 10 WAS of 2007, every increase in the rate of nitrogen application significantly increased LAI. The highest LAI was obtained by the application of 120 kg N ha^{-1}. At 8 and 10 WAS of 2005 and 2006, the highest LAI was obtained by the application of 60 kg N ha^{-1} but was statistically similar to 120 kg N ha^{-1}. Phosphorous fertilizer application significantly increased LAI at all sampling periods and years except at 10 WAS in 2006 where P application had no significant effect on LAI. At 4 and 6 WAS in 2005 and 2006, at 8 WAS in all the years, at 10 WAS in 2005 and 2007 application of 13.2 kg P ha^{-1}, significantly increased LAI compared with zero P but was statistically similar to 26.4 kg P ha^{-1}. In 2006 and 2007 of the same sampling periods, every increase in P application significantly increased LAI up to the highest level of applied P. Interactions between the treatments tested were not significant.

Crop growth rate: Crop growth rate of sesame as affected by treatments at 6, 8, and 10WAS in all the years of study are shown in Table 2. At 6 and 8WAS and in all the years, each increase in the rate of poultry manure consistently increased CGR significantly. At 10WAS, in 2005 and 2007, application of 5 t ha^{-1} of poultry manure produced significantly higher CGR compared with other levels of application, while in 2006, application of 5 t ha^{-1} was significantly better than plots without manure but was statistically at par with plots that received 10 and 15 t ha^{-1} of poultry manure. No interactions between the treatments tested were significant. Each increase in the rate of nitrogen application significantly increased CGR of sesame at 6WAS in all the years. At 8 WAS and in all the years of study, application of 60 kg N ha^{-1} significantly produced the highest CGR. Increasing the rate from 60 to 120 kg N ha^{-1} significantly decreased CGR. At 10WAS and in all the years, application of 60 kg N ha^{-1} significantly increased CGR of sesame compared with the control. Increasing the rate of N from 60 to 120 kg N ha^{-1} produced no further significant increase in CGR. Phosphorus application generally increased CGR of sesame. At 6WAS in 2005, each increase in the rate of applied P significantly increased CGR of sesame up to the highest rate. In 2006 and 2007 of the same sampling period, at 8WAS in 2005 and 2006 and at 10WAS in all the years, application of 13.2 kg P ha^{-1} produced significantly higher CGR when compared with the control, but was statistically similar to 26.4 kg P ha^{-1}. At 8WAS in 2007, 13.2 kg P ha^{-1} produced significantly higher CGR compared with the control and 26.4 kg P ha^{-1}.

Net assimilation rate: At 6WAS in 2005, application of 15 t ha^{-1} poultry manure significantly produced the highest NAR compared with other levels of applied manure (Table 3). Applications of 5 and10 t ha^{-1} of poultry manure produced similar NAR but were significantly better than the control. At 6WAS in 2006, at 8 WAS in 2007 every increase in the rate of poultry manure significantly increased NAR of sesame up to the highest level of manure application. At 8WAS in 2005 and 2006, 10WAS in 2007, 10 t ha^{-1} of poultry manure produced significantly higher NAR compared with the control. However, no further increase in NAR was recorded when the application rate was increased from 10 to 15 t ha^{-1}. At 6WAS in 2007, 10WAS in 2005 and 2006, poultry manure application had no significant effect on the NAR of sesame. Interactions between the treatments tested were not significant. Each increase in the rate of nitrogen application at 6WAS in all the years of study significantly increased NAR. At 8WAS in 2005 and 2006, at 10 WAS in 2005 and 2007, application of 120 kg N ha^{-1} produced significantly higher NAR compared with zero and 60 kg N ha^{-1}. At 8WAS in 2007, applications of 60 kg N ha^{-1} produced significantly higher NAR compared with unfertilized plots but were statistically similar with 120 kg N ha^{-1}. At 10WAS in 2006, nitrogen application had no significant effect on NAR. At 6WAS in 2005 and 2006, at 8WAS in 2005 and at 10WAS in 2005, application of 13.2 kg P ha^{-1} produced significantly higher NAR compared with plots that received no P but was similar to 26.4 kg P ha^{-1} in NAR. At 6WAS in 2007, at 8 WAS in 2006 and 2007, at 10WAS in 2006 and 2007 P application had no significant effect on NAR.

Table 1: Effects of poultry manure, nitrogen and phosphorus on the leaf area index of sesame during the rainy seasons of 2005 – 2007 at Samaru.

	Weeks after sowing											
Treatments	**4**			**6**			**8**			**10**		
	2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007
Manure (t ha^{-1})												
0	0.17d	0.13d	0.11d	0.23d	0.25d	0.16d	0.50d	0.39d	0.26d	0.63d	0.56d	0.44d
5.0	0.25c	0.20c	0.17c	0.51c	0.39c	0.26c	0.87c	0.67c	0.53c	1,12c	0.97c	0.83c
10.0	0.31b	0.24b	0.22b	0.60b	0.46b	0.32b	1.07b	0.82b	0.69b	1.26b	1.09b	0.97b
15.0	0.34a	0.27a	0.25a	0.67a	0.52a	0.37a	1.35a	1.04a	0.91a	1.54a	1.30a	1.18a
SE$\pm$	0.006	0.005	0.004	0.011	0.008	0.006	0.022	0.020	0.020	0.028	0.026	0.024
Nitrogen(kg ha^{-1})												
0	0.17c	0.13c	0.09c	0.33c	0.26c	0.14c	0.74b	0.57b	0.44c	0.91b	0.77b	0.60c
60	0.27b	0.21b	0.19b	0.54b	0.42b	0.29b	1.03a	0.79a	0.64b	1.22a	1.02a	0.91b
120	0.37a	0.28a	0.28a	0.71a	0.54a	0.41a	1.07a	0.83a	0.71a	1.29a	1.15a	1.06a
SE$\pm$	0.007	0.006	0.006	0.014	0.011	0.009	0.026	0.021	0.019	0.027	0.078	0.018
Phosphorus(kg ha^{-1})												
0	0.23b	0.18c	0.15c	0.45c	0.35b	0.23c	0.86b	0.66b	0.53b	1.04b	0.91	0.77b
13.2	0.28a	0.21b	0.19b	0.53b	0.42a	0.28b	0.99a	0.76a	0.63a	1.22a	1.05	0.91a
26.4	0.30a	0.24a	0.22a	0.59a	0.45a	0.32a	0.99a	0.77a	0.63a	1.15ab	1.00	0.88a
SE$\pm$	0.007	0.006	0.006	0.014	0.011	0.009	0.026	0.021	0.019	0.027	0.078	0.018
Interactions												
N X P	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
N X M	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
P X M	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
N X P X M	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Means followed by the same letter(s) within the same treatment group and column are not statistically different at 5% level of significant. NS= Not significant.

Grain yield per hectare: Grain yield (kg ha^{-1}) of sesame in 2005, 2006, 2007 and the mean as affected by treatments are shown in Table 4. Application of 5 t ha^{-1} of poultry manure produced significantly higher grain yield compared with other level of applied manure. Increasing the rate of manure from 5 to 10 and 15 t ha^{-1}, significantly depressed grain yield in all the years. In all the years, application of 60 kg N ha^{-1} produced significantly higher grain yield compared with other levels of N application. Yield was reduced by increasing N rate from 60 to 120 kg N ha^{-1}.

Application of 13.2 kg ha^{-1} of phosphorus produced significantly higher grain yield per hectare compared with other levels of P application. Application of 26.4 kg P ha^{-1} significantly reduced grain yield. Highly significant interactions occurred between nitrogen and

Table 2: Effect of poultry manure, nitrogen and phosphorus on the crop growth rate (g w^{-1}) of sesame during the rainy seasons of 2005-2007 at Samaru.

Treatments	Weeks after sowing								
	6			8			10		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
Manure (ton ha^{-1})									
0	1.48d	1.08d	0.77d	2.02d	1.37d	1.19d	1.39c	2.01c	1.94c
5.0	1.95c	1.33c	0.99c	2.60c	1.70c	1.71c	1.60a	2.20a	2.14a
10.0	2.13b	1.43b	1.10b	2.83b	1.83b	1.88b	1.56b	2.16b	2.05b
15.0	2.30a	1.53a	1.23a	3.02a	1.92a	1.98a	1.54b	2.17ab	2.08ab
SE±	0.018	0.010	0.014	0.029	0.022	0.024	0.017	0.015	0.018
Nitrogen (kg ha^{-1})									
0	1.49c	1.11c	0.73c	2.41b	1.66b	1.62b	1.44b	2.06b	1.95b
60	2.07b	1.40b	1.08b	2.71a	1.75a	1.73a	1.57a	2.18a	2.10a
120	2.33a	1.52a	1.25a	2.73a	1.71a	1.72a	1.54a	2.16a	2.10a
SE±	0.027	0.013	0.012	0.024	0.020	0.024	0.020	0.020	0.022
Phosphorus (kg ha^{-1})									
0	1.79c	1.27b	0.93c	2.51b	1.66b	1.64b	1.49a	2.10b	2.01b
13.2	2.00b	1.36a	1.03b	2.68a	1.76a	1.75a	1.55a	2.17a	2.08a
26.4	2.11a	1.40a	1.10a	2.66a	1.70a	1.66a	1.52a	2.13ab	2.07a
SE±	0.027	0.013	0.012	0.024	0.020	0.024	0.020	0.020	0.022
Interactions									
N X P	NS	NS	NS	NS	NS	NS	NS	NS	NS
N X M	NS	NS	NS	NS	NS	NS	NS	NS	NS
P X M	NS	NS	NS	NS	NS	NS	NS	NS	NS
N X P X M	NS	NS	NS	NS	NS	NS	NS	NS	NS

Means followed by the same letter(s) within the same treatment group and column are not statistically different at 5% level of significant.
NS = Not significant

Table 3: Effects of poultry manure, nitrogen and phosphorus on the net assimilation rate (g cm^2 w^{-1}) of sesame during the rainy seasons of 2005-2007 at Samaru.

Treatments	Weeks after sowing								
	6			8			10		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
Manure (ton ha^{-1})									
0	0.078c	0.072d	0.080	0.111b	0.116b	0.040d	0.539	0.340	0.084b
5.0	0.090b	0.082c	0.083	0.114ab	0.119ab	0.051c	0.527	0.36	0.088ab
10.0	0.090b	0.088b	0.087	0.117a	0.124a	0.063b	0.617	0.357	0.090a
15.0	0.096a	0.097a	0.089	0.123a	0.131a	0.094a	0.598	0.431	0.106a
SE±	0.0010	0.0010	0.0040	0.0040	0.0050	0.0030	0.0400	0.0400	0.0070
Nitrogen (kg ha^{-1})									
0	0.077c	0.074c	0.078c	0.108b	0.111b	0.058b	0.512b	0.298	0.069b
60	0.090b	0.088b	0.084b	0.112b	0.116b	0.064a	0.527b	0.371	0.086b
120	0.095a	0.092a	0.093a	0.128a	0.139a	0.064a	0.671a	0.452	0.121a
SE±	0.0010	0.0010	0.0030	0.0030	0.0040	0.0030	0.0380	0.0290	0.0070
Phosphorus (kg ha^{-1})									
0	0.085b	0.082b	0.082	0.112b	0.116	0.060	0.506b	0.349	0.099
13.2	0.088ab	0.085ab	0.084	0.118a	0.126	0.063	0.556ab	0.386	0.088
26.4	0.090a	0.087a	0.089	0.118a	0.125	0.064	0.649a	0.386	0.089
SE±	0.0010	0.0010	0.0030	0.0030	0.0040	0.0030	0.0380	0.0290	0.0070
Interactions									
N X P	NS	NS	NS	NS	NS	NS	NS	NS	NS
N X M	NS	NS	NS	NS	NS	NS	NS	NS	NS
P X M	NS	NS	NS	NS	NS	NS	NS	NS	NS
N X P X M	NS	NS	NS	NS	NS	NS	NS	NS	NS

Means followed by the same letter(s) within the same treatment group and column are not statistically different at 5% level of significant.
NS= Not significant.

Table 4: Effect of poultry manure, nitrogen and phosphorus on the grain yield (kg ha^{-1}) during the rainy seasons of 2005-2007 at Samaru

Treatments	2005	2006	2007
Nitrogen (kg ha^{-1})			
0	699.68c	732.29c	582.29c
60	998.70a	773.36a	831.43a
120	872.22b	753.15b	732.28b
SE±	4.847	4.303	4.164
Phosphorus(kg ha^{-1})			
0	777.70c	738.51c	678.93c
13.2	946.47a	880.39a	766.82a
26.4	853.42b	794.91b	700.17b
SE±	4.847	4.303	4.164
Manure (t ha^{-1})			
0	696.23d	682.92d	647.95d
5.0	1066.83a	900.73a	835.32a
10.0	856.39b	882.17b	716.54b
15.0	817.31c	732.59c	661.40c
SE±	5.635	5.419	5.633
Interactions			
N X P	**	**	**
N XM	**	**	**
P X M	NS	NS	NS
N X P X M	NS	NS	NS

NS= Not significant at 5% level of significance ** = Significant at 1% level of significance
Means followed by the same letter (s) within the same treatment group and column are not statistically different at 5 % level of significance.

Table 5: Interaction between nitrogen and phosphorus on grain yield (kg ha^{-1}) of sesame during the rainy seasons of 2005-2007 at Samaru.

	2005			2006			2007		
	Phosphorus (kg ha^{-1})			Phosphorus (kg ha^{-1})			Phosphorus (kg ha^{-1})		
Treatment	0	13.2	26.4	0	13.2	26.4	0	13.2	26.4
Nitrogen(kg ha^{-1})									
0	660.05g	962.41b	904.64c	646.18g	801.24d	731.20f	527.75f	636.46d	582.38e
60	955.21b	1138.43a	902.46c	895.02c	1051.90a	973.17b	755.49c	875.98a	862.85a
120	700.41f	770.60d	738.56e	727.02f	788.02d	762.69e	762.66c	788.02b	646.18d
SE±		8.440			7.453			7.213	

Means followed by the same letter(s) within the same year are not statistically different at 5% level of significance

Table 6: Interaction between nitrogen and manure on grain yield (kg ha^{-1}) of sesame during the rainy seasons of 2005-2007at Samaru

	2005				2006				2007			
	Manure (ton ha^{-1})				Manure (ton ha^{-1})				Manure (ton ha^{-1})			
Treatment	0	5.0	10.0	15.0	0	5.0	10.0	15.0	0	5.0	10.0	15.0
Nitrogen(kg ha^{-1})												
0	435.62j	1063.88b	868.68f	779.06g	497.13i	950.77c	888.22d	676.49gh	516.20i	654.71f	594.51g	563.37h
60	915.31e	1189.90a	1015.47c	874.11f	852.34e	1126.92a	1046.38b	867.800d	728.38d	986.74a	843.22b	767.39c
120	730.82h	947.27d	805.79g	685.00i	699.27fg	864.51de	711.90f	653.49h	699.28e	864.50b	711.90de	653.46f
SE±		9.760				9.386				9.757		

Means followed by the same letter(s) within the same year are not statistically different at 5% level of significance

phosphorus, and between nitrogen and poultry manure. The result of the interaction between nitrogen and phosphorus showed that at zero and 60 kg N ha^{-1}, increasing the rate of applied P from zero to 13.2 kg ha^{-1}

significantly increased the grain yield of sesame but, when the P rate was increased from 13.2 to 26.4 kg ha^{-1}, grain yield dropped significantly in all the year of study (Table 5). The highest grain yield of sesame was obtained by the applications of 60 kg ha^{-1} and 13.2 kg ha^{-1} while, the least grain yield was obtained by non application of fertilizer N and P (the control plots) in in the year 2005, 2006 and 2007. The results of the interaction between poultry manure and nitrogen revealed that at a given N rate, increasing the rate of applied poultry manure from zero to 5 t ha^{-1} significantly increased the grain yield of sesame but, when poultry manure rate was increased from 5 to 10 and 10 to 15 t ha^{-1}, grain yield dropped significantly in all the year of study (Table 6). The highest grain yield of sesame was obtained by the applications of 60 kg N ha^{-1} and 5 t ha^{-1} of poultry manure while, the least grain yield was obtained by non application of fertilizer N and P (the control plots) in 2005, 2006 and 2007.

DISCUSSION

Leaf area index at 6, 8, and 10WAS in all years was significantly increased by poultry manure and nitrogen application up to 15 t ha^{-1} and 120 kg N ha^{-1} respectively. This could be attributed to increase in mineralized nutrients in manure which improved soil physical and chemical conditions and improved availability of both micro and macro nutrients, and nitrogen that were necessary for the formation of chlorophyll, efficient rooting system and production of biomass (Anonymous, 2007). CGR was significantly increased by poultry manure, nitrogen and phosphorus application up to 15 t ha^{-1} 120 kg ha^{-1} and 26.4 kg ha^{-1} respectively at early stages of growth but, at later stages of growth, was significantly increased by 5 t ha^{-1} of poultry manure, 60 kg ha^{-1} of nitrogen and 13.2 kg ha^{-1} beyond which there was no discernible increase in CGR. This could be due to the fact that at early stages of growth, higher rate of nutrients are needed for increased vegetative growth but at later stages, only little is needed. The significant response of NAR to poultry manure, N and P application could be attributed to the fact that all are contain essential nutrients needed for plant growth and development (Douglas and Philips, 2008). This is in harmony with the findings of Bonsu (2003); Okpara *et al.,* (2007).

Grain yield per hectare of sesame was optimized at moderate rates of applied poultry manure (5 t ha^{-1}) and nitrogen (60 kg N ha^{-1}) and not the highest applied rates as in growth indices. This could be because excessive manure and nitrogen application has been reported to reduce fruit number and yield but enhanced plant growth (Haruna *et al*., 2010). The significant interactions between N and P, nitrogen and poultry manure on the grain yield of sesame is an affirmation of the fact that combined applications of both organic and inorganic manure is essential for increased yield. This finding, corroborated those of Olowe and Busari (2000); Okpara *et al*. (2007); Fathy and Mohammed (2009).

Conclusion: From the foregoing, it can be concluded that the growth characters measured were highest at 15 t ha^{-1} of poultry manure, 120 kg N ha^{-1} and 13.2 kg P ha^{-1}. Grain yield per hectare was optimized at 5 t ha^{-1} of poultry manure, 60 kg N ha^{-1} and 13.2 kg P ha^{-1}. Applications of 5 t ha^{-1} of poultry manure, 60 kg N ha^{-1} and 13.2 kg P ha^{-1} therefore seems to be the ideal rates of poultry manure, nitrogen and phosphorus for increased yield of sesame in this agro ecology and is therefore recommended.

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