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Evaluation of Starter Nitrogen and Phosphorus Fertilizer on the Early Growth and Yield of Cowpea (*Vigna unguiculata* (l.) Walp)

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Abstract

Pot experiment was conducted at the Oyo State College of Agriculture and Technology, Igboora to evaluate the effects of starter Nitrogen and phosphorus fertilizers on the early growth and yield of Cowpea line (IT07K-243-1-10). *The inorganic fertilizers used were Urea and Single Super Phosphate (SSP) applied at the rate of 5 kgN/ha; 10 kgN/ha; 30 kgP/ha, 60 kgP/ha, 5 kgN/ha + 30 kgP/ha, 10 kgN/ha + 30 kgP/ha; and 10 kgN/ha + 60 kgP/ha respectively. The control was without fertilization. Fertilizer was applied a week after planting. The Experiment was laid out in a Complete Randomized Design. The analyzed result showed significant differences in growth parameters including plat height, number of leaves, number of pods as well as seed dry weight. These increases were reported mostly in soils fertilized at 10 kgN/ha + 60 kgP/ha. Plants treated with 10 kgN/ha + 30 kgP/ha had the highest number of nodules (45.75), while control gave the least results*

Keywords: Cowpea, Growth, Starter Nitrogen, Phosphorus, Yield

Introduction

Cowpea (*Vigna unguiculata* (L.) Walp) is a major staple food crop in Sub-Sahara Africa, especially in the dry savannah regions of West Africa. It is a warm - season, annual legume. Cowpea can be used at all stages of growth as a vegetable crop. Cowpea has ability to fix nitrogen from the atmosphere which helps in improving soil fertility. Cowpea seeds are good source of proteins and vitamins for man, animal, and generate income (TJAI, 2010). There are ready markets for cowpea grains and fodder sales in West Africa. Cowpea is said to be drought tolerance and has deep roots that improve soil structure (Singh *et al.,* 2011). FOA, (2012) reported Nigeria as one of the world's largest producers of cowpea with an average production of 2.92 million tonnes followed by Niger with 1.10 million tonnes. Nigerian's farmers harvest and store cowpea fodder for sale at the peak of the dry season this increase their annual income by 25% (Dugje *et al.,* 2009).

Cowpea yield remains low among all leguminous vegetables, half of expected yield despite the dramatic increase in its production in Sub-saharan Africa. Cowpea requires more phosphorus than nitrogen in the form of single super phosphate (SUPA). FOA, 92015) reported that about 30kg of SUPA is recommended for cowpea production. This assists the crop to

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nodulate well and fixes nitrogen from the air. Tropical soils are inherently low in nutrients especially nitrogen and phosphorus. These two nutrients are required in large quantities especially in young cells like shoot and root tips where metabolism is higher and cell division is rapid. It is said to aids flower initiation, seed and fruit development (Haruna and Aliyu, 2011) despite the low soil fertility and poor farming practices in the tropics. Therefore, this study tries to evaluate the effects of starter nitrogen and phosphorus fertilizer on the early growth and yield of cowpea.

Materials and Methods

The Experiment was conducted at the research farm of Oyo State College of Agriculture and Technology, Igboora, Oyo State. The study was conducted during the early season of 2016 in Igboora, The seed of cowpea line IT07K-243-1-10 was sourced from international institute of tropical agriculture (IITA), Ibadan, Oyo State. The experiment was arranged in a Complete Randomization Design (CRD) fitted into plot and the treatments were replicated 4 times. The inorganic fertilizers used were Urea and Single Super Phosphate (SSP) applied at the rate of 5 kgN/ha; 10 kgN/ha; 30 kgP/ha, 60 kgP/ha, 5 kgN/ha + 30 kgP/ha, 10 kgN/ha + 30 kgP/ha; and 10 kgN/ha + 60 kgP/ha respectively. The control was without fertilization. Plant height, number of leaves, and number of days to flowering were measured.. The data collected was subjected to Analysis of Variance (ANOVA) and treatment means were separated using Duncan Multiple Range Test (DMRT) at 5%level of probability.

Table 1: Pre and Post cropping system

Element	Post cropping Value	Post cropping Value
pH	5.20	6.01
N (cmo/kg)	0.52	1.10
P (cmo/kg)	3.49	10.5
K (cmo/kg)	0.04	0.40
Ca (cmo/kg)	20.31	20.31
Mg (cmo/kg)	0.50	0.50

Results and Discussion

The soil analysis of the experimental site shows that the soil was moderately acidic in nature with pH 5.20 and relatively low contents of Nitrogen (0.52cmo/kg) and phosphorus (3.49cmo/kg). For Post cropping soil analysis, N (1.10 cmo/kg), P (10.5cmo/kg), K (0.40cmo/kg), Ca (20.31cmo/kg) and Mg (0.50cm0/kg) were recorded. It was observed that there was increase in the plant height and number of leafs of cowpea with age amongst the treatments (Table 2 and 3) though not significant.

Table 2: Evaluation of starter nitrogen and phosphorus fertilizer on Plant Height, number of leaves and Stem Girth of cowpea

Treatments	Plant Height			Number of leaf			Stem girth		
	3WAP	4WAP	5WAP	3WAP	4WAP	5WAP	3WAP	4WAP	5WAP
0	14.00a	19.75a	20.00a	7.75a	10.50a	16.75a	1.50a	1.78a	2.00a
5kgN/ha	17.75a	20.25a	21.75a	15.25a	11.75a	15.50a	2.25a	2.50a	2.80a
10kgN/ha	15.00a	19.88a	25.59a	8.75a	12.25a	18.00a	2.60a	2.85a	3.25a
30kgP/ha	17.75a	19.88a	25.50a	12.5a	20.25	25.25a	2.98a	3.33a	3.63a
60kgP/ha	20.63a	22.63a	25.50a	10.75a	17.25a	25.00a	2.55a	2.98a	3.55a
5kgP+30kgP/ha	15.25a	17.25a	24.25a	9.00a	12.00a	19.50a	2.96a	3.23a	3.28a
10kgN/ha+30kgP/ha	14.50a	16.38a	21.75a	9.25a	12.25a	21.75a	2.75a	2.93a	3.13a
10kgN/ha+60kgP/ha	19.25a	21.50a	25.75a	8.75a	13.00a	24.00a	2.78a	2.95a	3.25a

Means with the same letter are not significantly different using Duncan's Multiple Range Test (DMRT) at 5% level of significance.

At 5 weeks after planting (WAP), cowpea treated with 10 kgN/ha+ 60kgP/ha gave the highest plant height (25.75 cm) and 24 number of leaf while the control had 20.00 cm plant height and 16.75 number of leafs. There was also increase on the stem girth of cowpea across the weeks after planting. However, there was no significant difference at 5% probability level amongst the treatments. Cowpea treated with 60kgP/ha gave the highest stem girth of 3.63 cm while the control the least stem girth of 2.00 cm at 5WAP. This result corroborates the report of Smith et al., (1986) and FPDD (2002) but contradicts those of Dart et al. (1997) and Minchin et al. (1981) that reported significant increase in growth of cowpea on the application of nitrogen fertilizer and, Olaleye et al. (2012) who reported increase in cowpea growth following P application.

As by Daramy et. al., 2017, the nonsignificant effect of nitrogen fertilizer application on cowpea growth and dry matter yield suggested that the nitrogen requirement of cowpea for growth can be met by its own nitrogen fixation ability (Singh, 1997); hence cowpea could manage its nitrogen requirement without nitrogen fertilization (Smith et al., 1986). Another possible explanation in this study might be that the initial available N in the soil was sufficient for the growth of cowpea. Further, this study revealed non-significant effect of phosphorus (P) fertilizer on cowpea growth and this might be due to the slow release of P fertilizer in the soil. Further, the process of P fixation makes P unavailable in the soil for plant use. Plants take up only about 15-30% of applied P, while the 60% is adsorbed to the soil (Olusola, 2009).

Table 3: Evaluation of starter nitrogen and phosphorus fertilizer on plant height, number of leaves and stems girth of cowpea

Treatment	Plant Height	Leaf Number	Stem Girth
0	20.00a	16.75a	2.00a
5 kgN/ha	21.75a	15.50a	2.80a
10 kgN/ha	25.50a	18.00a	3.25a
30kgP /ha	25.50a	25.25a	3.63a
60kgP/ha	25.50a	25.00a	3.55a
5kgN/ha+30kgP/ha	24.25a	19.50a	3.28a
10kgN/ha+30kgP/ha	21.75a	21.75a	3.13a
10kgN/ha+60kgP/ha	25.75a	24.00a	3.25a

Means with the same letter are not significantly different using Duncan's Multiple Range Test (DMRT) at 5% level of significance.

Table 4: Evaluation of starter nitrogen and phosphorus fertilizer on days to flowering, number of nodules, number of pods, seed dry weight and root dry weight and number of nodules of cowpea

Treatments	DF	NOP	SDW (g)	RDW (g)	NON
0	41.00a	3.88a	1.75b	1.92a	4.00a
5kgN/ha	44.00a	4.50a	3.25ab	3.45a	16.00a
10kgN/ha	47.50a	5.62a	3.58ab	2.20a	9.75a
30kgN/ha	56.50 a	6.63a	3.05b	2.63a	18.00a
30kgP/ha	47.50a	5.98a	6.02ab	2.00a	32.00a
5kgN/ha +30kgP/ha	55.00a	6.43a	4.48ab	2.88a	31.50a
10kgN/ha+30kgP/ha	55.75a	6.69a	4.90ab	2.55a	45.75a
10kgN/ha+60kgP/ha	55.75a	6.85a	9.15a	5.05a	45.00a

Means with the same letter are not significantly different using Duncan's Multiple Range Test (DMRT) at 5% level of significance.
Legend: DF (Day to flowering), SDW (Seed dry weight), RDW (root dry weight)

Table 5: Means, Mean squares and coefficient of variation of starter nitrogen and phosphorus fertilizer evaluate on cowpea.

Seed attribute	Mean	MS	CV%
Plant height	20.11	41.14ns	27.72
Stem girth	2.82	2.84*	31.38
Numbers of leaves	14.80	70.74ns	43.08
Days to flowering	51.31	148.91ns	15.62
Number of nodules	25.34	978.00*	77.32
Number of pods	5.82	4.82ns	35.18
Seed dry weight	4.52	20.68*	57.31
Root dry weight	2.83	4.19ns	55.22

**significant at 5% level of probability*

There were no significant differences in days to flowering, number of nodules, number of pods, and root dry weight of cowpea amongst the treatments besides seed dry weight of cowpea that was significant ($p<0.05$). Daramy et. al., 2017 reported the finding of IITA (1975) that cowpea produced the same grain yield whether fertilized with N fertilizer or depend on biologically fixed N, indicating that the biological nitrogen fixation process can produce the N required by cowpea provided effective symbiosis is established. Cowpea treated with 60 kgP had the longest days to flowering (56.50) while the control had shortest days to flowering (41.00). Cowpea treated with 10 kgN/ha + 30 KgP/ha gave the highest

number of nodules (45.75) while the control had the lowest number of nodules (4.00). Cowpea treated with 10 kgN/ha + 60kgP/ha had the highest number of pods (6.85) while the control had the lowest number of pod (3.88) also, highest seed dry weight (9.15 g) which was significantly higher than other treatments and the control with the lowest seed dry weight (1.75 g). It was likewise recorded that cowpea treated with 10 kgN/ha + 60kgP/ha had the highest root dry weight (5.05 g) which was significantly higher than other treatments and the control with the lowest root dry weight (1.92 g).

Conclusion

The stand treated with 10kgN/ha+60kgP/ha fertilizer recorded the highest plant height, number of leaves, number of nodules, number of pods, seed dry weight, root dry weight while stand treated with 10kgN/ha+30kgP/ha had the highest numbers of nodules. However, the stand treated with 60kgP/ha recorded the highest average stem girth value and number of days to flowering. Hence it could be suggested that peasant farmer should embrace the usage of either 10kgN/ha+60kgP/ha fertilizer or 10kgN/ha+30kgP/ha.

Conflict of Interests

The authors declare there is no conflict of interest.

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