International Journal of Agricultural Research

ISSN 1816-4897

Academic Journals Inc.

www.academicjournals.com

International Journal of Agricultural Research 2 (11): 971-975, 2007
ISSN 1816-4897

Preliminary Investigations on Egyptian Bean (*Lablab purpereus* L.) for Fodder in Semi-Arid Nigeria Effects of Phosphorus Fertilizer on Growth Components and Herbage Yield

B.S. Malami and I.A. Abdullahi
Department of Animal Science, Faculty of Agriculture,
Usmanu Danfodiyo University, P.M.B. 2346, Sokoto, Nigeria

Abstract: An experiment was conducted to investigate the effect of phosphorus application on the growth and fodder yield of *Lablab* (*Lablab purpureus*) at 13° 1'N, 5° 15'E. Treatments consisted of factorial combinations of three levels of phosphates fertilizer (0, 40 and 80 kg ha^{-1}) in a Randomized Complete Block Design with three replications at the Usmanu Danfodiyo University Teaching and Research Farm in 2005/2006 cropping season. Plant height, leaf length, leaf width, leaf number, stand count were evaluated in every two weeks for ten weeks to monitor crop growth rate under different sowing methods. Herbage yield was estimated at the end of the tenth week. The treatments consist of three levels of phosphates fertilizer. Results indicated that the levels of phosphorus application had no significant ($p>0.05$) effect on mean stand count at all sampling dates. The mean plant height, leaf length, leaf width and number of leaves were however significantly ($p<0.05$) affected by the phosphorus application. All the parameters observed, with the exception of the stand count, increased with the increasing levels of phosphorus application. Mean drymatter yield of 1208 kg ha^{-1} was obtained at 10 WAP. It was therefore concluded that phosphorus application had a significant effect on the growth components and yield of *Lablab purpureus* in the semi-arid zone of Nigeria.

Key words: Egyptian bean, phosphorus fertilizer, fodder, semi-arid

INTRODUCTION

In Nigeria most of the livestock resources are situated in the arid and semi-arid areas of the FDLPCS (1992). In these areas there is the scarcity of feed all year round due to the climate, particularly rainfall. Similarly, most of the animal populations in the arid and semi-arid regions of the country are grazed on native pastures. According to Aganga and Tshwenyane (2003) increasing production of cultivated pastures is the easiest way to meet the demand for meat and other animal protein sources. *Lablab purpureus* is a fodder legume that combines a great number of qualities that can be used successfully under various conditions. It is palatable to livestock, possess the ability to out-yield other crops, especially during the dry season and serves as cover crop (Murphy and Colucci (1999).

In Nigeria, *Lablab* is a recent addition to the forage crop and is grown mostly in research and experimental farms. Despite the importance of Lablab in our diet and as feed for livestock, the yield obtained by farmers in Nigeria is low because of the problem of neglecting good cultural practices such

Corresponding Author: B.S. Malami, Department of Animal Science, Faculty of Agriculture, Usmanu Danfodiyo University, P.M.B. 2346, Sokoto, Nigeria

as seedbed preparation, correct seed rates, adequate plant spacing, good timing of planting and fertilizer application. The application of phosphorous in relative quantities therefore plays a vital role in plant growth (Crowder and Chheda, 1982). All plants requires phosphorous for growth and development in significantly large quantity. This study was therefore conducted to investigate the effect of phosphorus application on the growth components and herbage yield of *Lablab purpereus* in the semi-arid region of Nigeria.

MATERIALS AND METHODS

This experiment was conducted during the 2005/2006 cropping season at the Usmanu Danfodiyo University Teaching and Research Farm (13° 1'N, 5° 15'E) in a Randomized Complete Block Design (RCBD) with three replications. Used sowing methods are a-broadcasting b-dibbling and c-drilling. The land of the experimental site was prepared manually using hoe. The plots were marked out in to parallel rows, separated by 0.5 m water and footpath. The plots consist of leveled rectangular slightly sunken basin of gross area of 3×4 m^2 (12 m^2) size. A variety of Lablab Highworth was provided by the National Animal Production Research Institute (NAPRI) forage seed store at Shika, Zaria, Nigeria. Sowing was done manually. Seeds were sown at the rate of 3 seeds per stand at intervals of 50×50 cm between and within rows (dibbling and drilling). In broadcasting, seeds were evenly distributed on the plots. A total of 78 g of seeds were sown in each plot. The heights of three plants were measured in each plot randomly at different time intervals for 2, 4, 6, 8 and 10 weeks after planting, to measure the crop growth rate (Harper, 1983). This was done by measuring the plant from the base up to the tip of the tallest leaf with a measuring ruler. The leaf length of the plant was obtained by measuring the leaf from the base of the leaf stalk to the tip, using a ruler. The measurement was taken on randomly selected plants at different time intervals. The leaf width was measured from the widest portion of the leaf using a ruler on randomly selected plants at different time intervals. The number of leaves per plot was taken from three randomly selected stands at different time intervals. Another measured trait is the stand count. This was done by counting the number of established plants per stand in dibbling (50 cm apart). For drilling, a random distance of 50 cm was used to count the number of established stands. In broadcasted plots, stand count was established by using a quadrate at random points. Herbage yield was taken by cutting the height of the plant to about 5 cm above the ground. It was obtained from the net plot area (3×4 m) and the yield was measured using weighing balance scale in kilograms per hectare. All obtained data were subjected to analysis of variance (ANOVA) Gomez and Gomez (1984). Where there were significant differences between treatment means, Least Significant Difference (LSD) method was used for comparison SAS (1988). Some physical and chemical properties of soil of the study area is presented in Table 1.

Table 1: Some chemical properties of the soil of the study area

Parameters	Values (Mean)
pH	5.400
Organic matter (%)	0.550
Nitrogen (N) (%)	0.056
Cation exchange capacity (meg/100 g)	5.100
Sodium (Na^+) (meg/100 g)	4.170
Potassium (K^+) (meg/100 g)	4.720
Calcium (Ca^{2+}) (meg/100 g)	0.350
Magnesium (Mg^{2+}) (meg/100 g)	0.350
Phosphorus (P) (meg/100 g)	0.080

RESULTS AND DISCUSSION

Growth Components

Plant Height (cm)

Mean plant height as affected by phosphorus fertilization at different time intervals is presented in Table 2. Phosphorus application significantly ($p<0.05$) affected the height of plants at 2, 4, 6, 8 and 10 WAP. Plants in plots where phosphorus was applied recorded taller heights as compared to the control. Plants in plots applied 80 kg P ha^{-1} produced ($p<0.05$) the tallest (32) plants. Sulaiman (2006) reported similar value for *Lablab* sown under dibbling but without fertilizer application. This was in line with the earlier reports of Crowder and Chheda (1982) that application of phosphorous in relative quantities play a vital role in plant growth and all plants require phosphorous for growth and development in significantly large quantity.

Leaf Length (cm)

There was a significant ($p<0.05$) effect of phosphorus fertilizer on the leaf length of plants at 2, 4, 6, 8 and 10 WAP. Plots applied with phosphorous had higher plant height as compared to the control. Plots applied 80 kg P ha^{-1} recorded significantly ($p<0.05$) higher leaf length as compared to 0 and 40 kg P ha^{-1} levels of application during all the sampling periods (Table 3). The longest leaves recorded at 10 WAP (11.7 cm) were longer than the longest leaves (9.9 cm) reported by Sulaiman (2006) for dibbling method of sowing.

Leaf Width (cm)

Mean leaf width of plants is presented in Table 4. Phosphorus application significantly affected ($p<0.05$) leaf width at all the sampling periods, except at 8 WAP. Similarly, increased leaf width was

Table 2: Effect of phosphorus fertilizer levels on plant height of Lablab bean cultivated in the field trial at 2, 4, 6, 8 and 10 Weeks After Planting (WAP)

Treatments (kg P ha^{-1})	2	4	6	8	10
	----------(WAP)----------				
0	4.378^{b}	9.356^{b}	12.100^{c}	15.922^{c}	22.977^{b}
40	4.844^{b}	10.522^{ab}	15.178^{b}	17.522^{b}	25.300^{b}
80	6.244^{a}	11.578^{a}	16.611^{a}	19.200^{a}	31.846^{a}
LSD	0.564	1.227	1.159	1.224	3.846

Means with the different letter(s) superscripts along the column are significant at $p<0.05$

Table 3: Effect of phosphorus fertilizer levels on leaf length of *Lablab* bean cultivated in the field trial at 2, 4, 6, 8 and 10 Weeks After Planting (WAP)

Treatments (kg P ha^{-1})	2	4	6	8	10
	----------(WAP)----------				
0	6.044^{c}	5.911^{b}	6.922^{c}	7.989^{b}	9.033^{c}
40	6.833^{b}	6.978^{a}	7.567^{b}	8.478^{ab}	10.589^{b}
80	7.611^{a}	7.122^{a}	8.167^{a}	8.744^{a}	11.698^{a}
LSD	0.565	0.816	0.562	0.705	0.749

Means with the different letter(s) superscripts along the column are significant at $p<0.05$

Table 4: Effect of phosphorus fertilizer levels on leaf width of Lablab bean cultivated in the field trial at 2, 4, 6, 8 and 10 Weeks After Planting (WAP)

Treatments (kg P ha^{-1})	2	4	6	8	10
	----------(WAP)----------				
0	4.111^{b}	3.811^{b}	4.200^{b}	5.000^{NS}	5.522^{b}
40	4.733^{a}	3.98^{ab}	4.833^{a}	5.256^{NS}	5.911^{b}
80	5.111^{a}	4.444^{a}	4.833^{a}	5.089^{NS}	6.933^{a}
LSD	0.412	0.506	0.325	0.384	0.524

Means with the different letter(s) superscripts along the column are significant at $p<0.05$, NS: Non Significant

recorded with increased level of phosphorus application, except at that period (8 WAP). Plots applied with 80 kg P ha^{-1} recorded longer leaf widths throughout the periods, except at 8 WAP, where 40 kg P ha^{-1} had a mean leaf width of 5.3 cm compared to 5.1 cm recorded in plots with 80 kg P ha^{-1} application. Sulaiman (2006) reported the longest mean leaf width of 7.72 cm for dibbling method of sowing which was slightly longer than the longest mean recorded for 80 kg P ha^{-1} in the present study. This may therefore suggest that not only phosphorus fertilization influence the growth of Lablab in semi-arid Nigeria, but also sowing method.

Number of Leaves

Phosphorus had no significant effect on the number of leaves at 4 WAP, but at 2, 6, 8 and 10 WAP, there was a significant ($p<0.05$) effect on the number leaves of plants. Plots applied with 80 kg P ha^{-1} had higher number of leaves as compared to the plots where 40 and 0 kg P ha^{-1} were applied. The highest mean number of leaves (6.7) was recorded for 80 kg P ha^{-1} at 10 WAP (Table 5), which was higher than the mean value of 3 reported by Sulaiman (2006) for dibbling at the same period in the same environment.

Stand Count

There was no significant ($p>0.05$) effect of phosphorus on stand count of plants at 2, 4, 6, 8 and 10 WAP. Similarly, Sulaiman (2006) reported no significant influence of sowing methods on mean stand count. However, 80 kg P ha^{-1} produced the highest (5) number of stands at 10 WAP (Table 6), which was higher than 2 plants reported by Sulaiman (2006) for dibbling method of sowing. In the present study phosphorus fertilization indicated better endurance of plants throughout the study.

Herbage Yield (kg ha^{-1})

There was a significant ($p<0.05$) effect of phosphorus application on herbage yield. Plots applied with phosphorus recorded higher herbage yield than those plots where phosphorus was not applied. Yields recorded in this study indicated general increase with increasing level of phosphorus application. Higher herbage yield of 1208 kg ha^{-1} was recorded in plots applied with 80 kg P ha^{-1} (Table 7). This was lower than the range of 1820-1900 kg ha^{-1} under rain fed or 2800-5800 kg ha^{-1} reported by Wood (1983) under irrigated plot experiment. However, our values fall within the range of 636-5940 kg ha^{-1} reported by Murphy and Colucci (1999) for unspecified varieties. Our value was also slightly higher than the mean of 1010 kg ha^{-1} reported by Sulaiman (2006) in the same environment and with the same variety.

Table 5: Effect of phosphorus fertilizer levels on number of leaves of Lablab bean cultivated in the field trial at 2, 4, 6, 8 and 10 Weeks After Planting (WAP)

Treatments (kg P ha^{-1})	2	4	6	8	10
	----------(WAP)----------				
0	2.889^{b}	3.444^{NS}	4.2220^{b}	5.000^{b}	5.556^{b}
40	2.889^{b}	3.555^{NS}	4.2220^{b}	5.111^{ab}	5.889^{b}
80	3.444^{a}	4.111^{NS}	4.7780^{a}	5.778^{a}	6.667^{a}
LSD	0.487	0.669	0.5128	0.755	0.599

Means with the different letter(s) superscripts along the column are significant at $p<0.05$

Table 6: Effect of phosphorus fertilizer levels on stand count of Lablab bean cultivated in the field trial at 2, 4, 6, 8 and 10 Weeks After Planting (WAP)

Treatments (kg P ha^{-1})	2	4	6	8	10
	----------(WAP)----------				
0	4.222^{NS}	3.889^{NS}	3.889^{NS}	4.333^{NS}	4.527^{NS}
40	4.333^{NS}	4.111^{NS}	4.222^{NS}	4.222^{NS}	4.778^{NS}
80	4.986^{NS}	4.265^{NS}	4.333^{NS}	4.378^{NS}	4.889^{NS}
LSD	0.837	0.743	0.529	0.495	0.562

NS: Non Significant

Table 7: Effect of phosphorus fertilizer levels on herbage yield (kg ha^{-1}) of Lablab bean cultivated in the field trial at 2, 4, 6, 8 and 10 Weeks After Planting (WAP)

Treatments (kg P ha^{-1})	Yield (kg ha^{-1})
0	766.6^{c}
40	1025^{b}
80	1208^{a}
LSD	0.073

Means in the same column with different superscript are significantly different ($p<0.05$)

CONCLUSIONS

Results of the present study indicate that phosphorus application improves the herbage yield of *Lablab purpureus C.* Highworth in the semi-arid zone of Nigeria. It indicates that the endurance of the plant was better with phosphorus fertilization. Further research is desirable to evaluate the maximum level of application as indicated by the present study, where herbage yield continue to increase up to the maximum of 80 kg ha^{-1} applied in the study.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the assistance of Dr. H.A. Gwandu and Dr. A. Singh for the design of the experiment and statistical analysis of data.

REFERENCES

Aganga, A.A. and S.O. Tshwenyane, 2003. Lucerne, lablab and *Leucena leucocephala* forages: Production and utilization for livestock production. Pak. J. Nutr., 2: 46-53.

Crowder, L.V. and H.R. Chheda, 1982. Tropical Grassland Husbandry. Longman, London and New York, pp: 562.

FDLPCS., 1992. Federal Department of Livestock and Pest Control Services. Nigerian Livestock Resources. Vol. 2. National Synthesis. Resource Inventory and Management Ltd., St. Heilier, Jersey, United Kingdom.

Gomez, K.A. and G.A. Gomez, 1984. Statistical Procedures for Agricultural Research. 2nd Edn., Longman Group Ltd., Singapore, pp: 344.

Harper, F., 1983. Principles of Arable Crop Production. Blackwell Science Limited, London, pp: 336.

Murphy, A.M. and P.E. Colucci, 1999. A tropical forage solution to poor quality ruminant diets: A review of *Lablab purpureus.* Livestock Research for Rural Development, 11: 2.

SAS., 1988. Statistical Analysis System (SAS/STAT) user's guide release 6.03. Statistical Analysis Systems Institute Inc., Cary NC., pp: 549-640.

Sulaiman, H., 2006. Effect of sowing methods on the growth and fodder yield of Lablab (*Lablab purpureus*) in semi-arid zone, Nigeria. B.Sc. Thesis, Usmanu Danfodiyo University, Sokoto, Nigeria, pp: 35.

Wood, I.M., 1983. Lablab bean (*Lablab purpereus*) for grain and forage production in the Ord River Irrigation Area. Aust. J. Exp. Agric. Anim. Husband., 23: 162-171.