EFFECTS OF NPK (15:15:15) AND INTRA ROW SPACING ON THE GROWTH COMPONENTS AND GRAIN YIELD OF LABLAB (*Lablab purpureus*) VARIETIES IN THE SUDAN SAVANNA, NIGERIA

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ABSTRACT

Field studies were conducted to examine the effects of NPK (15:15:15) fertilizer and intra row spacing on the growth components and grain yield of lablab (*Lablab purpureus*) varieties during 2021 rainy season at Binyaminu Usman Polytechnic farm Hadejia, Jigawa State (latitude 12^0 22′ N and longitude 7^0 46′ E), **and Zakirai, Gabasawa Local Government, Kano State** (12° 60" N, 8° 53' 0" E; 409m. Both sites are located in the Sudan savanna agro-ecological zone of Nigeria. The treatments consisted of three levels of NPK (0, 20 and 40kg ha^{-1}), three intra row spacings (20, 30 and 40cm) using two varieties of lablab (Highworth and Rongai). The treatment was laid out using **Randomized Complete Block Design (RCBD)** and replicated three times. The result showed that application of NPK significantly increased plant height, number of leaves per plant, number of pod per plant, and grain yield at both locations and increased number of leaves at Zakirai only. Grain yield was higher at 40kg NPK ha^{-1} at Zakirai while at Hadejia 20kg NPK ha^{-1} gave satisfactory grain yield. Intra row spacing had significantly affected number of leaves, number of pods, 100 grain weight and grain yield at both locations and 40cm intra row spacing prove to be superior to other spacings. The result also indicated that Highworth out yielded Rongai and recorded superior number of leaves, leaf area, number of pods, 100 grain weight and grain yield at both locations.

Keywords: Lablab, varieties, Highworth, Rongai, , NPK, intra row spacing, Hadejia, Zakirai, Gabasawa, Kano, Nigeria,

INTRODUCTION

Most African countries including Nigeria are presently in the midst of food and feed crises. Legumes in particular are used as green manure cover crops, and rotation with cereal crops (Omokanye 2001). They also improve nitrogen content of the soil through nitrogen fixation (Adu *et al* 1992). Authors revealed that *Lablab purpureus* grew normally on soils with pH 5.0 to 7.8 and showed high capacity for nitrogen fixation, although it showed high mortality at ambient temperatures of >50ºC. They further noted that green and seed yields of *Lablab purpureus* were 50.7 and 1.0 to 2.25t/ha/year, respectively with crude protein of 16.6% and that *Lablab purpureus* is susceptible to aphids at seedling and young pod stages. Sanginga et al (1996) revealed that. *Lablab purpureus* is a promising forage legume for our environment. The authors further stated that lablab hay improved and increased live weight and milk yield of cattle from 4-6 to 6-7 liters per day. The authors also reported that lablab is suitable for human consumption.

Lablab is a legume that thrives well in the dry season between November and February in the Northern Nigeria. It is drought resistant and is usually sown after the normal cropping season, thereby acting as a buffer crop for ruminant feeding during the period of dry season (Adu *et al* 1992). Chemical analysis showed that *Lablab purpureus* contained about 24 % crude protein in its leaf and seed (Ogundipe *et al* 2003). These authors revealed that when the seeds are properly processed, it could be comparable to many oil-seed cakes presently suitable for food and feed formulations. Lablab seeds have low human preference for food and unlike soybean and groundnut cake, its value in livestock feeding has not been fully investigated.

MATERIALS AND METHODS

The experiment was carried out at the research farm Hadejia and Zakirai, Gabasawa Local Government Area, Kano State. The mean annual rainfall for the two locations was 920mm and 904mm respectively with mean monthly temperature of 27.42ºC and 27.76ºC, respectively. Land preparation was done manually while planting follows using two lablab varieties (Highworth and Rongai) at 20, 30 and 40cm intra row spacing and 75cm between rows. 0, 20 and 40kg/ha of N.P.K fertilizer was applied two weeks after planting by placement method at both locations.

Lablab seeds were collected from **National Animal Production Reassearch Institute (NAPRI) Zaria.** The seeds of *Lablab purpureus* were immersed in hot water (40^{o}C) for 10 minutes and air - dried before planting. The seeds were planted on the 14th and 21st July, 2021, respectively. Each treatment was replicated three times. The experimental design employed was Randomized Completely Block Design (RCBD). Size of each small plot was 2m by 3m. Alleys of 0.5m and 1.5m were left between plots and replicate respectively. The seeds were sown two per hole at a depth of 2.0cm in sandy-loam soil. Data on emergence counts was collected 14 days after planting.

Information on growth parameters such as plant height, number of leaves, leaf area, and leaf area index and crop growth rate were recorded at two weeks intervals. Weeding was done three times using hoe at different interval to reduce weed- crop competition. Yield parameters such as days to 50% and full flowering, days to maturity, number of pods per plant, pod and seed weight, 100 grain weight and the grain yield were all recorded.

Harvesting of the pods was done manually 15-18 weeks after planting. Data collected was subjected to Analysis of Variance (ANOVA) as described by Snedecor and Cochran (1967) using Genstat. Significant treatment means was separated at 5% level of probability using SNK. The magnitude and relationship types between grain yield and some attribute examined are assessed through simple correlation analysis (Little and Hills, 1978).

RESULTS

Table 1 shows the effects of NPK and intra-row spacing on plant height at Hadejia and Zakirai. Plant height was not significantly affected by NPK application at Hadejia but at Zakirai application of 40kgNPKha^{-1} at 6, 8 and 10 WAS resulted in significantly taller plants than the other rates which were at par statistically. Intra-row spacing did not significantly affect the plant height at all the sampling periods at both locations. Both Rongai and Highworth produced plants of statistically similar height. There were no significant interactions between the factors examined on the plant height across all the sampling periods at both locations.

The effects of NPK and intra-row spacing on number of leaves per plant are shown in Table 2. At Hadejia, application of NPK was significant only at 10WAS in which 40kgha^{-1} gave higher number of leaves per plant compared with 0 and 20kgha^{-1} that were statistically similar. At Zakirai, application of NPK was significant on number of leaves per plant at 6 and 8WAS when 40kgha^{-1} was superior to 0 and 20kgha^{-1} that were statistically similar. The effect of intra-row spacing was significant at 6, 8 and 10WAS with application of NPK at 40cm having superior number of leaves per plant compared with the other treatments that were statistically similar. Intra-row spacing did not affect number of leaves per plant at Zakirai. Rongai and Highworth were not significantly differed statistically in respect of number of leaves per plant. There was no significant interaction between the factors at both locations.

Table 1: Effects of NPK and intra-row spacing on plant height (cm) of lablab varieties at Hadejia and Zakirai, 2021 rainy season

Treatment	Hadejia(WAS)				Zakirai(WAS)			
	4	6	8	10	4	6	8	10
NPK (kgNPK)p								
0	18.22	32.83	43.67	56.50	18.22	32.33b	42.67b	56.00b
20	18.89	32.56	44.06	55.06	18.89	32.06b	43.11b	55.44b
40	19.17	32.22	43.67	55.94	19.17	42.61a	51.33a	61.61a
SED	0.540	0.785	0.768	1.069	0.569	0.716	0.729	0.902
Intra-row Spacing (cm)								
20	18.89	32.72	44.22	56.33	19.44	36.06	45.78	58.28
30	18.44	32.28	44.17	55.39	18.72	35.39	45.78	56.78
40	18.94	32.61	43.00	55.78	19.33	35.50	45.56	58.00

SED	0.540	0.785	0.768	1.069	0.569	0.716	0.729	0.902
Varieties								
Rongai	19.00	32.07	43.26	56.26	19.41	35.33	45.33	58.04
Highworth	18.52	33.00	44.33	55.41	18.93	36.00	46.07	57.33
SED	0.441	0.641	0.627	0.873	0.465	0.584	0.595	0.736

Means in a column of any set of treatments followed by same letter are not significantly different at 5% level of probability using SNK..

Table 2: Effects of NPK and intra-row spacing on number of leaves per plant of lablab varieties at Hadejia and Zakirai, 2021

Treatment	Hadejia(WAS)				Zakirai(WAS)			
	4	6	8	10	4	6	8	10
NPK (kgNPK)								
0	22.33	47.94	94.39	138.9b	22.33	43.22b	86.94b	133.9
20	22.67	47.06	92.67	138.1b	22.33	44.11b	89.00a	133.4
40	22.33	49.22	96.22	142.0a	22.06	46.33a	89.11a	135.4
SED	0.625	1.867	2.218	2.48	0.561	0.697	0.904	2.054
Intra-row Spacing (cm)								
20	22.22	45.56b	87.83b	132.1b	22.11	44.11	87.33	134.7
30	22.44	47.06b	88.50b	132.4b	22.39	44.17	88.17	133.4
40	22.67	51.61a	106.94a	154.5a	22.22	45.39	89.50	134.6
SED	0.625	1.867	2.218	2.48	0.561	0.697	0.904	2.054
Variety								
Rongai	22.44	47.74	95.26	139.9	22.22	45.07	88.56	132.9
Highworth	22.44	48.41	93.59	139.4	22.26	44.04	88.15	135.5
SED	0.511	1.525	1.811	2.03	0.458	0.569	0.738	1.677

Means in a column of any set of treatments followed by same letter are not significantly different at 5% level of probability using SNK, NS = Not Significant.

Table 3 shows the effects of NPK and intra-row spacing on number of pods per plant at both Hadejia and Zakirai. Number of pods per plant was significantly affected by NPK application at both locations with 40kgha^{-1} producing statistically similar number of pods per plant with 20kg ha^{-1} but superior to plots without NPK application. At Zakirai application of 40kg ha^{-1} was superior to 20kg ha^{-1} followed by 0kg ha^{-1}.The effects of intra-row spacing on the number of pods per plant manifested also at both locations with 40cm intra-row spacing producing more pod compared with 20cm followed by control. Significant differences between varieties with regard to the number of pods per plant occurred at all sampling periods at both locations. The Highworth variety produced significantly higher number of pods per plant than the Rongai in all the location. No Significant interaction was observed on number of pods per plant at both locations.

The effects of NPK and intra-row spacing on 100 grain weight at both locations are represented in Table 4. 100 grain weight was significantly affected by NPK application at both locations with 40kg ha^{-1} producing more weight than the other level of NPK which produces statistically comparable 100 grain weight. At Hadejia, increasing NPK level from 0-20kgha^{-1} led to a significant increase in 100 grain weight but further increase to 40 kg ha^{-1} did not resulted in a significant increase in seed weight. At Zakirai, application of 20kg ha^{-1} produced seed weights that were not statistically different from the control (0kg ha^{-1}). However, further increase to 40kgha^{-1} resulted in a significant increase in seed weight. Intra-row spacing affected 100 grain and weight at both locations with 30 and 40cm intra-row spacing producing statistically similar and heavier seeds compared with 20cm spacing in both locations. In addition, significant differences between varieties with

regard to the 100 grain weight were observed at all locations. The Highworth variety produced heavier seeds than Rongai in all the location.

Table 5 shows the effects of NPK and intra-row spacing to lablab on Grain yield at both locations. Grain yield per plot was significantly affected by NPK application at both locations with 40kgha^{-1} producing more weight than the other level of NPK which produces statistically comparable Grain yield per plot. Intra-row spacing also affect Grain yield per plot at both locations with 40cm intra-row spacing producing more weight than the other spacing which produces statistically similar Grain yield per plot. Intra-row spacing statistically influence the Grain yield per plot at both locations. In addition, significant differences between varieties with regard to the Grain yield per plot occurred at all locations. The Highworth variety produces the highest Grain yield per plot than the Rongai variety in all the location. So there were statistical differences with regards to the Grain yield per plot recorded between the varieties

Table 3: Effects of NPK and intra-row spacing on the number of pods per Plant at Hadejia and Zakirai, 2021

Treatment	Hadejia	Zakirai
NPK (kg)		
0	157.70b	159.20c
20	165.40ab	165.90a
40	163.40a	163.80b
SED	2.93	2.99
Intra-row Spacing (cm)		
20	106.70c	107.90c
30	158.90b	159.50b
40	220.80a	221.50a
SED	2.93	2.99
Variety		
Rongai	155.70b	156.60b
Highworth	168.60a	169.40a
SED	2.39	2.44

Means in a column of any set of treatments followed by same letter are not significantly different at 5% level of probability using SNK, NS = Not Significant

Table 4: Effects of NPK and intra-row spacing on 100 grain weight of lablab varieties at Hadejia and Zakirai, 2021

Treatment	Hadejia	Zakirai
NPK (kg)		
0	19.92b	19.98b
20	20.18a	19.93b
40	20.38a	20.29a
SED	0.1175	0.471
Intra-row Spacing (cm)		
20	19.58b	19.31b
30	20.36a	20.21a
40	20.54a	20.69a
SED	0.1175	0.471
Variety		
Rongai	19.98b	19.89b
Highworth	20.34a	20.24a
SED	0.0959	0.385

Means in a column of any set of treatments followed by same letter are not significantly different at 5% level of probability using SNK,

Table 5: Effects of NPK and intra-row spacing on Grain yield (kg ha^{-1}) of lablab varieties at Hadejia and Zakirai, 2021

Treatment	Hadejia	Zakirai
NPK ($kgha^{-1}$)		
0	783b	894c
20	828a	928b
40	856a	1011a
SED	17.98	29.00
Intra-row Spacing (cm)		
20	694c	761c
30	789b	911b
40	983a	1161a
SED	17.98	29.00
Variety		
Rongai	770b	885b
Highworth	871a	1004a
SED	14.68	24.60
Interaction		
PxS	**	**
PxV	**	NS
SxV	**	**

Means in a column of any set of treatments followed by same letter are not significantly different at 5% level of probability using SNK, NS = Not Significant, ** = Highly Significant.

Similarly, there were significant interactions between treatments on the Grain yield per plot at both locations as shown in Table 6. The intra-row spacing and NPK interaction at Hadejia shows that keeping intra-row spacing constant at 20 and 40cm, increasing NPK level from 0-20$kgha^{-1}$ did not affect grain yield but further increase to 40kg gave the highest grain yield. At 30cm, increasing NPK level from 0-20 $kgha^{-1}$ gave significant increase in grain yield but further increase to 40$kgha^{-1}$ did not affect the yield. Considering NPK levels, at 0$kgha^{-1}$, 40cm gave the highest yield while the other spacing had statistically similar and lower values. However, at 20 and 40$kgha^{-1}$ each successive increase in spacing from 20-40cm resulted in significant increase in grain yield

At Zakirai, the intra-row spacing and NPK interaction (Table 6) shows that keeping intra-row spacing constant at 20cm, application of 20 and 40$kgha^{-1}$ had similar grain yield that where higher than the control. However, each increase in level 0$kgha^{-1}$.resulted in an increase in grain yield. Considering P level at 0, 20 and 30cm intra-row spacing had similar grain yield that were lower than at 40cm, at zero and 40$kgha^{-1}$ each increase in spacing resulted in significant increase in grain yield

The results of the experiment showed that application of 40$kgha^{-1}$ gave the highest grain yield of lablab at both locations. Higher yield was also obtained at 40cm intra-row spacing and the Highworth variety was found to be superior to Rongai at both locations. Based on the results obtained from the experiment, farmers in the study area could be advised to adopt Highworth variety, application of 20$kgha^{-1}$ at Hadejia only and 40$kgha^{-1}$ at Zakirai only and use of 40cm intra-row spacing in the production of lablab.

Table 6: Grain yield of lablab as influence by interaction between NPK, varieties and Intra-row spacing at both locations, 2021

	Hadejia			Zakirai		
	NPK (kgha^{-1})					
Treatment	**0**	**20**	**40**	**0**	**20**	**40**
Intra-row Spacing						
20	683d	717d	683e	783ef	750f	750f
30	733d	817c	817c	850ef	900d	983d
40	933b	950b	1067a	1050c	1133b	1300a
SED		31.1			50.2	
	Intra-row Spacing (cm)					
Treatment	**20**	**30**	**40**	**20**	**30**	**40**
Variety						
Rongai	700d	767c	844b	711e	889cd	1056b
Highworth	689d	811bc	1122a	811d	933c	1267a
SED		25.4			41.0	

Means in any set of treatments followed by same letter (s) are not significantly different at 5% level of probability using SNK.

DISCUSSION

Growth and yield of lablab varieties;

The results indicated that the varieties differed significantly in respect of number of pods, 100 grain weight and grains yield with Highworth having superior values over Rongai. The superiority of Highworth could be genetic as well as its ability to utilize the environmental recourses particularly water, nutrients and light. It is significant to add that, Highworth variety exhibited superior growth and yield attribute in the present experiment indicated that it has higher potential over Rongai. However, the non significant difference between the varieties in respect of plant height is an indication of their morphological similarities.

Effects of lablab to NPK (15:15:15);

Application of NPK fertilizer significantly affected most of characters except germination counts, leaf area, leaf area index per plant, plant dry weight, 50% and full flowering at both locations. The Effects of lablab to NPK could be due to the role of NPK in the growth of leguminous crops. NPK fertilization has been observed to increase diseases resistance, increases root growth, aids nodulation which will in turn improve nitrogen fixation that promote plant growth, increases leaf size, promote pods and seed development and hasten maturity. Significant differences with regards to the yield obtained from different level of NPK application were observed with highest yield recorded at 40kgha^{-1} at Zakirai. Higher yield of lablab was obtained at 40kgha^{-1} at similar finding by Ogedegbe (2011) at Samaru, Northern Nigeria which he attributed this to the role of this nutrient in plant growth.

The Effects of lablab to NPK application, especially in the case of grain yield and other parameters could be attributed to the role of NPK in leguminous crop growth. NPK is involved in energy transfer processes which synthesized and degrade starch and transport nutrients from the soil through the roots to the plant tops. It also enhances cell division, fat formation, flowering, fruiting, seed formation and development of lateral and fibrous roots; it may improve disease tolerant and yield quality (Follett and Wilkinson, 1985). The low Effects to NPK application by lablab at Hadejia could be due to the high soil NPK. Hadejia site is a research farm where every year crops are grown under fairly good fertilizer practices in contrast to Zakirai where the crops are hardly fertilized.

Effects of lablab to intra-row spacing;

The results showed that the intra-row spacing had significant effects on most of the characters examined. Emergence counts, number of leaves per plant, leaf area and leaf area index per plant, number of pods per plant and seed weight, 100 grain weight and grains yield recorded higher values at 40cm in both locations. This could be due to minimum competition for growth factors at wider space. At 20 and 30cm, it is likely that competition for water, nutrients and light among the lablab plants were steep and had negatively affected plant growth particularly branching and leaf development thereby reducing light interception as well as dry matter generation. However, at 40cm spacing competition could be expected to be reduced thus ensuring better growth and higher grain yield arising from abundant environmental recourses such as soil, water, nutrients, and solar radiation. In related studies by Patel *et al*. (2003), it was observed that the row spacing of 40cm recorded more number of pods per plant, 100 grain weight and grain yield.

Interaction;

The significant NPK and spacing interaction on growth and yield component of lablab could be assorted with competition for NPK at the different spacing. At narrow spacing, competition for moisture could be more important than for NPK. Thus high NPK doses may not give high yields. However at wider spacing, increase NPK level supported high crop performance and superior yields due posy soil moisture. The variety and spacing as well as variety and NPK interaction on growth, yield and yield component could be due to differential Effects of the varieties to environmental resources particularly soil nutrients. The superiority of Highworth in term of yield and yield component is an indication of its ability to exploit the environmental resources apart from genetic superiority.

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