



## EFFECT OF DIFFERENT PHOSPHORUS FERTILIZATION AND SOWING DATES ON GROWTH AND YIELD OF LABLAB (*Lablab purpureus* L. walp) VARIETIES IN SEMI-ARID ECOLOGICAL ZONE OF RINGIM, JIGAWA STATE, NIGERIA

<sup>1</sup>Surajo, A., <sup>2</sup>Fagam, A. S., <sup>2</sup>Ali, G., <sup>2</sup>Sabo, M. U., <sup>3</sup>Bindawa, M. A. and <sup>3</sup>Yahaya, S. U.

<sup>1</sup>Department of Agricultural Technology,

Binyaminu Usman Polytechnic, Hadejia, Jigawa State.

<sup>2</sup>Department of Crop Production, Abubakar Tafawa Balewa University, Bauchi.

<sup>3</sup>Department of Agronomy, Faculty of Agriculture, Bayero University, Kano.

**Corresponding Author's E-mail:** surajoali85@gmail.com **Tel.:** 08068096811

### ABSTRACT

Field trials were conducted at the Jigawa state Horticultural Farm during 2019, 2020 and 2021 wet seasons to investigate the effect of phosphorus levels and sowing date on the growth and yield of lablab varieties (*Dan Farankachi* and *Dan Inusa*). The treatments consisted of four levels of phosphorus (0, 20, 40 and 60 kgPha<sup>-1</sup>) in the form of single superphosphate and three sowing dates 1st July (S1), 15th July (S2) and 29th July (S3), laid out in randomized complete block design (RCBD) and replicated three times. Data were collected on canopy height, number of branches, leaf area index and pod yield per hectare. The results showed that application of 60 kgPha<sup>-1</sup> and 40 kgPha<sup>-1</sup> resulted to highest growth in terms of canopy height at 4WAS and 8WAS in 2019, 2021 wet season and 2020 wet season and combined, respectively, sowing three had taller plants at 4WAS, and highly significant ( $P \leq 0.01$ ) varietal differences at 12WAS in 2020 and 2021 wet seasons, variety was highly significant ( $P \leq 0.01$ ) at 12 WAS in 2020 wet season and combined. The results showed that application of 60 kgPha<sup>-1</sup> at 4WAS and 12WAS were highly significant ( $P \leq 0.01$ ), and sowing three resulted to highest number of branches per plant at 4WAS. It was further reported that, leaf area index were highly significant ( $P \leq 0.01$ ) interns of phosphorus application and sowing dates at 4 and 12WAS, pod yield was also highly significant ( $P \leq 0.01$ ) in all the seasons. Based on the result of this study, it could be concluded that application of 60 kg P/ha, *Dan Inusa* and sowing date of 29th July could be adopted by farmers for better yield of lablab in the study area, hence recommended for better yield.

**Keywords:** Phosphorus, Sowing Date, Lablab, Growth, Application, Yields.

### INTRODUCTION

Lablab is known for its richness in protein (3.6%) and fiber (1.8%). However, dry seed contain 23.0 - 28.0% protein. The pods are also rich in phenol (1.7- 9.67 mg/100 g) which is a potential antioxidant. It is very important for the fleshy and soft textured green pod, which supplies a good amount of protein, minerals and dietary fiber in vegetarian diet. Its seeds also contain water soluble polysaccharides comprised of rhamnose, xylose, arabinose, galactose, glucose, uronic acid, unidentified sugars and proteins.

Among the agronomic practices, optimum sowing time is considered as an important non-cash input, results in considerable increase in the yield and quality. Sowing time of bean has a very vital role on growth of the plants and yield. Sowing time determines the amount of rainfall and temperature to which the crop is exposed at different growth stages (Zeleeke *et al.*, 2019). Sowing at different dates or staggered sowing increases the availability of produce in the market thereby protects the consumers from paying higher prices. Sowing date is one of



the most important factors which have tremendous effect on growth, development and biological yield of a crop species (Fouda, 2017).

Phosphorus is one of the major nutrients required for plant growth and reproduction. Phosphorus, like carbon and nitrogen is an essential element in all living systems. It is often referred to phosphorus as the “energizer” since it helps store and transfer energy during photosynthesis. Phosphorus is required for the synthesis of nucleic acid molecules (DNA, RNA). Also, it is a vital component of the biological energy molecule adenosine tri-phosphate (ATP). Phosphorus is often found in fixed chemical forms that cannot immediately be absorbed by plants (Zhang and Raun, 2006). Fertilization of broad bean with 46 kg P<sub>2</sub>O<sub>5</sub>/ha resulted in substantial increase in seed and biological yields over no fertilizer check (Kubure *et al.*, 2015). A significant effect of phosphorus fertilization levels, i.e., 0 and 25 kg ha<sup>-1</sup> on pods number per plant, seeds number per pod, 100-seedweight, pod length and seed yield Abido and Seadh, 2014). Number of pods/plants, biological and seed yield per plant and unit area of broad bean were increased by application of 40 kg phosphorus/ha. The highest 100-seed weight was obtained from 30 kg phosphorus/ha (Adak and Kibritci, 2016).

## **MATERIALS AND METHODS**

The experiment was conducted in 2019, 2020 and 2021 wet seasons at the Field trials were conducted during the 2019, 2020 and 2021 cropping seasons at the Jigawa State Horticultural Farm Ringim (12° 11'N and 12° 14'N and Longitude of 8° 10' and 8° 38' E) in the semi-arid zone of Jigawa state, Nigeria. The rainfall distribution pattern is unimodal. The soil of the sites was sandy loam. The rainfall starts mostly in June and ends in October with a mean annual rainfall of about 400 - 800 mm. The maximum and minimum temperature of Ringim ranges from 36 to 14°C, respectively. The treatments consisted of factorial combinations of four (4) levels of phosphorous (0, 20, 40 and 60), two (2) local varieties of lablab (Dan Inusa and Dan Farankachi) and three (3) dates of sowing (24 treatment combinations) laid out in a randomized complete block design (RCBD) replicated 3 times.

The seeds of lablab varieties were obtained from the farmers of the research area and sown on the 1st, 15th and 29th of July for all cropping seasons. Two seeds were sown per hill at a depth of 3 - 4 cm and 100 cm apart at a plant-to-plant spacing of 50 cm within a row. Urea at the rate 20 kg·ha<sup>-1</sup> was applied as a starter dose to all the plots while P<sub>2</sub>O<sub>5</sub> was applied as per treatment (0, 20, 40, and 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>). Glyphosate (1.8 kg *a.i.* ha<sup>-1</sup>) was applied before land preparation, while hoe weeding was carried out at 6WAS, supplementary hand pulling was carried out for undesirable weed species that grew above the canopy. The data collected were subjected to analysis of variance to test the significance of treatment effects and the means were separated using Duncan's Multiple Range Test (DMRT).

## **RESULTS AND DISCUSSION**

### **Physico-Chemical Properties of the Soil**

Before land preparation in each site, soil samples were randomly taken from various points at the depth of 0-15cm and 15-30cm using soil auger and the samples were analyzed for soil texture, pH, organic carbon, organic matter, Total Nitrogen, Available Phosphorus, Exchangeable Bases such as Potassium, Magnesium, Calcium, Sodium and Cations Exchange Capacity using standard procedure as described by Black (1965) in the Soil science Laboratory, Faculty of Agriculture and Agricultural Technology, Abubakar Tafawa Balewa University, Bauchi. The results of physical and chemical properties of the soil sample for the experimental site before planting is shown in Table 1. The soil of the study area was predominantly sandy



loam in texture. It was of good drainage and well aerated. The soil was slightly acidic with pH value of 5.90. The available phosphorus was moderately low (4.38 mgkg<sup>-1</sup>) while the exchangeable cations were low especially K<sup>+</sup> (1.02 Cmolkg<sup>-1</sup>), Ca<sup>2+</sup> (3.61 Cmolkg<sup>-1</sup>), Mg<sup>2+</sup> (1.02 Cmolkg<sup>-1</sup>) and Na was (0.11 Cmolkg<sup>-1</sup>). The soil was therefore low in nutrient status (Table 1).

**Table 1:** Physical and Chemical Properties of soil from two depths [0-15 and 15-30cm] of the experimental fields during 2019, 2020 and 2021 cropping seasons at Ringim

Soil properties	Values obtained					
	2019		2020		2021	
	0-15cm	15-30cm	0-15cm	15-30cm	0-15cm	15-30cm
<b>Particle size distribution</b>						
Sand (%)	46	56.8	61.8	58.9	61.4	59.7
Silt (%)	25.9	28.4	25.5	26.8	26.0	25.4
Clay (%)	12.2	14.8	12.7	14.3	13.6	14.9
Textural Class	sandy- loam		sandy- loam		sandy-	
<b>loam</b>						
<b>Chemical Composition</b>						
PH in H <sub>2</sub> O (1:2:50)	5.90	5.50	6.10	6.0	5.00	5.60
PH in 0.01M CaCl <sub>2</sub> (1:2:50)	5.10	4.80	4.50	4.70	4.90	4.80
Organic Carbon (gkg <sup>-1</sup> )	7.5	3.9	3.5	2.4	4.3	3.7
Total Nitrogen (gkg <sup>-1</sup> )	0.6	0.4	0.9	0.6	0.7	0.5
Available phosphorus (mg kg <sup>-1</sup> )	5.37	4.38	5.41	5.12	5.72	4.63
<b>Exchange bases {cmol kg<sup>-1</sup>}</b>						
Ca	3.61	2.26	2.10	1.76	2.70	2.00
Mg	1.02	0.87	0.84	0.71	0.74	0.44
K	0.16	0.12	0.14	0.12	0.15	0.11
Na	0.11	0.10	0.12	0.10	0.16	0.14
CEC	5.10	4.70	5.30	4.90	5.20	4.50

## Canopy Height

Table 2 showed effect of phosphorus and sowing date on canopy height of lablab varieties, at different sampling periods in 2019, 2020, and 2021 wet seasons. In 2019, 2020, 2021 wet seasons, phosphorus fertilization, sowing date and varieties did not significantly affect the Canopy Height at 4WAS. The canopy height at 8WAS of lablab as affected by phosphorus, sowing date and variety in 2019, 2020 and 2021 wet seasons shows that, tallest plant was recorded with applications of 60 kg P<sub>2</sub>O<sub>5</sub>ha<sup>-1</sup> at 2019 and 2021, however at 2020 wet season was observed on application with 40 kg P<sub>2</sub>O<sub>5</sub>ha<sup>-1</sup> statistically similar with other samples. Sowing date was highly significantly influenced canopy height of lablab varieties at all trials. S3 recorded longer height and as par with S2. Least canopy height was observed in S1. The effect of phosphorus and sowing date on canopy height of Lablab varieties during 2019, 2020, 2021 wet seasons result shows that phosphorus fertilization was highly significant (P=0.001) in all the trial seasons. Application of 40 kg P<sub>2</sub>O<sub>5</sub>ha<sup>-1</sup> recorded higher canopy except at 2021 and statistically with other treatments. Least effect with lowest canopy height was with control. Highly significant (P=0.001) with application of 40 kgP<sub>2</sub>O<sub>5</sub>ha<sup>-1</sup> was recorded on Lablab at the three sampling periods, also statistically similar effect to other samplings. The varieties were highly significant (P=0.001) at 2020. Dan Farankachi had significantly higher canopy than Dan Inusa. Highly differential response of varieties to plant height was observed at 12WAS in 2020 wet season in this study might be attributed due to their genetic character and adaptability to



growing environment. Similar variations in plant height of Indian bean genotypes were reported by Yadav *et al.* (2015). The significant effect of P rates on plant height could be due to the fact that lablab required phosphorus as one of the major nutrients for growth and reproduction. The result of these studies was in line with the earlier reports of Akhilesh *et al.* (2013) and Jaisankar and Manivanna (2018) that reported plant height of lablab significantly increased with P application.

**Table 2:** Effect of Phosphorus levels and sowing date on canopy height of lablab varieties in 2019, 220 and 2021 wet seasons at Ringim

Treatments	2019			2020			2021		
	4WAS	8WAS	12WAS	4WAS	8WAS	12WAS	4WAS	8WAS	12WAS
Varieties									
Brown	11.67	34.49	42.16	11.22	34.19	44.43a	11.54	31.27	42.35
White	11.64	33.95	39.87	11.81	33.95	38.36b	11.86	33.67	41.81
SE±	0.26	0.49	0.98	0.33	0.49	1.02	0.23	0.49	0.84
LS(0.05)	NS	NS	NS	NS	NS	**	NS	NS	NS
Phosphorus									
0 kg/ha	11.16	31.35b	31.11b	11.36	33.51b	33.89b	11.11	32.60ab	33.63c
20 kg/ha	11.43	33.56ab	34.94b	12.29	32.53b	36.02b	11.73	31.71b	38.87b
40 kg/ha	12.36	35.33a	49.47a	10.95	35.66a	49.24a	11.78	34.44a	46.99a
60 kg/ha	11.68	35.93a	48.54a	11.46	34.58ab	46.43a	12.18	34.82a	48.82a
SE±	0.37	1.03	1.39	0.47	0.70	1.44	0.33	0.80	1.19
LS(0.05)	NS	*	**	NS	*	**	NS	*	**
Sowing Date									
S1	11.55	31.73b	41.46	10.80	32.18b	41.03	11.81	31.27a	42.20
S2	11.85	34.04ab	40.33	12.03	34.27a	42.71	11.63	33.97a	43.06
S3	11.58	36.36a	41.25	11.71	35.76a	40.44	11.66	34.92a	40.97
SE±	0.32	0.90	1.20	0.10	0.60	1.25	0.28	0.69	1.03
LS(0.05)	NS	**	NS	NS	**	NS	NS	**	NS

NS= not significant, \*\* & \* = significant @ 0.01 & 0.05 probability level, respectively.

### Number of Branches

Table 3 shows the effects of sowing dates, phosphorus fertilization and number of branches of lablab varieties during 2019, 2020, 2021 wet seasons at Ringim. This indicated a non-significant response to phosphorus rate and sowing dates in all the seasons. There was however a significant varietal response for the 2019. Dan Inusa had more branches (3.36) than Dan Farankachi (3.00). Significant effects of phosphorus and sowing dates on the number of branches of lablab at 8 WAS during 2019, 2020, 2021 wet seasons. This shows that more branches were observed at plots treated with 40kgPha<sup>-1</sup> in 2019 wet season (11.94) and 60 kgPha<sup>-1</sup> treated plots in 2020 and 2021 wet seasons with 12.39 and 11.61 respectively. The least number of branches were also recorded from 20 kg Pha<sup>-1</sup> treated plot in 2019. There was a highly significant (P=0.001) response to sowing date in all seasons, S3 recorded higher number of branches in all samples. The effect of sowing date, phosphorus fertilization and number of branches of lablab varieties at 12 WAS during 2019, 2020, 2021 was highly significant (P=0.001) phosphorus rate at 40kgPha<sup>-1</sup> treated plots in 2019 and 60 kg Pha<sup>-1</sup> treated plots in 2020 and 2021 wet seasons revealed that maximum number of branches was manifested. The least number were also recorded from 0kgPha<sup>-1</sup> (control) treated plots. There was no significant effect on sowing date in all seasons. There was however a significant (P=0.003) varietal response in 2019 was highly significant (P=0.001), where Dan Farankachi



produced a greater number of branches than Dan Inusa. The significant effect of P rates on plant height at 8 and 12 WAS and combined could be due to the fact that lablab required phosphorus as one of the major nutrients for growth and reproduction. The result of these studies was in line with the earlier reports of Jaisankar and Manivanna (2018) that reported plant height of lablab significantly increased with P application. The highly significant effect of number of branches of lablab to sowing date observed. This might be due to availability of favorable environmental conditions to early sown crop which encouraged uptake of nutrients, increased photosynthesis of individual plant which led to higher dry matter accumulation per plant and ultimately resulted in higher number of branches per plant. The results corroborate with the findings of Joshi and Rahevar (2015), Kharbamon *et al.* (2015) and Choudhary (2016).

**Table 3:** Effect of Phosphorus levels and sowing date on number of branches of lablab varieties in 2019, 220 and 2021 wet seasons at Ringim

Treatment	2019			2020			2021		
	4WAS	8WAS	12WAS	4WAS	8WAS	12WAS	4WAS	8WAS	12WAS
<b>Phosphorus</b>									
0 kg/ha	3.28	10.78ab	8.56b	3.22	10.28b	8.89c	2.61	10.06b	8.17c
20 kg/ha	3.11	9.78b	9.33b	3.00	10.11b	9.78b	3.11	10.33b	9.46b
40 kg/ha	3.17	11.94a	11.67a	2.72	12.06a	11.94a	3.17	11.33a	11.83a
60 kg/ha	3.17	11.78a	11.94a	3.17	12.39a	11.81a	3.11	11.61a	11.71a
SE±	0.16	0.38	0.29	0.16	0.36	0.30	0.17	0.33	0.19
LS	NS	*	**	NS	**	**	NS	**	**
<b>Sowing date</b>									
S1	3.08	9.38b	10.54	2.96	9.83c	10.71	3.13	9.46c	10.12
S2	3.38	11.79a	10.12	2.92	10.83b	10.42	2.96	10.75b	10.33
S3	3.08	12.04a	10.46	3.21	12.96a	10.69	2.92	12.29a	10.08
SE±	0.14	0.33	0.26	0.14	0.33	0.26	0.15	0.27	0.32
LS	NS	**	NS	NS	**	NS	NS	**	NS
<b>Variety</b>									
Brown	3.00	11.22	10.83	3.00	11.08	10.76	2.89	11.22	10.53
White	3.36	10.92	9.92	3.06	11.33	10.43	3.11	10.92	9.83
SE±	0.12	0.27	0.21	0.12	0.27	0.21	0.12	0.27	0.26
LS	*	NS	**	NS	NS	NS	NS	NS	NS

NS= not significant, \*\* & \* = significant @ 0.01 & 0.05 probability level, respectively.

### Leaf Area Index

Table 4 showed effect of phosphorus levels on leaf area index at various sampling periods in 2019, 2020 and 2021 wet seasons. At experiment there was no significant effect of varieties on the leaf area index of Lablab in both seasons. In 2019 at 8 WAS, application 60 kgPha-1 produced significantly ( $P<0.05$ ) higher leaf area index than the control. At 12 WAS, application of 40 Kgha-1 of Phosphorus produced highly statistically ( $P<0.01$ ) similar, but significantly ( $P<0.01$ ) higher leaf area index compared with other Phosphorus levels, than that given by the control which produced the least leaf area index. In 2020 at 4 WAS, 60 kgPha-1 produced highly significant ( $P<0.01$ ) the highest leaf area index and as par with other sample while control produced the least. In 2021 at 4 WAS 40 kgPha-1 produced significantly (0.05) higher leaf area index compared with other Phosphorus levels, at 8 and 12 WAS, 60 kgPha-1 produced highly significant ( $P<0.01$ ) the highest leaf area index while 0 kgPha-1 produced the least.



Phosphorus is mobile in plants and highly concentrated in places of cell division and development, hence its positive role on enhancing number of branches per plant, leaf area and number of leaves per plant could be responsible for enhancing leaf area index. Zhang and Raun (2006) reported that growth attributes such as plant height, leaf area index and number of branches per plant was significantly increased with phosphorus application.

Result showed effect of sowing dates on leaf area index at various sampling periods in 2019, 2020 and 2021 wet seasons. In 2019 at 8 WAS sowing three produced highly significant (0.001) higher leaf area index than least leaf area index was produced at sowing one. At 12 WAS sowing three produced significantly (0.05) similar, compared with other samples least leaf area index was produced at sowing in 2020 at 4 WAS, sowing one produced significantly ( $P < 0.05$ ) the highest leaf area index and as par with other sample while sowing one produced the least. And at 8 WAS also sowing three produced highly significantly ( $P < 0.01$ ) the highest leaf area index while sowing one produced the least as par with sowing two. In 2021 at 4 WAS, sowing two produced significantly ( $P < 0.05$ ) the highest leaf area index while sowing one produced the least and as par with another sample. At 8 and 12 WAS, three produced highly significant (0.01) higher leaf area index. Least leaf area index was produced at sowing one. The significant response of sowing date on lablab Leaf Area Index observed in this study might be due to presence of favorable environmental conditions such as temperature, day length and light intensity during this period. Similar results were obtained Abido and Seadh (2014) in Dolichos bean.

**Table 4:** Effect of Phosphorus levels and sowing date on leaf area index of lablab in 2019, 2020 and 2021 wet seasons at Ringim

Treatment	2019			2020			2021		
	4WAS	8WAS	12WAS	4WAS	8WAS	12WAS	4WAS	8WAS	12WAS
<b>Phosphorus</b>									
0 kg/ha	0.63	1.33b	1.44c	0.69	1.36c	1.25c	0.67	1.39b	1.26b
20 kg/ha	0.64	1.57ab	1.95b	0.63	1.31c	1.56b	0.65	1.71ab	1.32b
40 kg/ha	0.70	1.63ab	2.91a	0.67	1.58b	2.30a	0.67	1.94a	2.46a
60 kg/ha	0.62	1.77a	2.73a	0.71	1.90a	2.11a	0.75	1.76a	2.42a
SE±	0.04	0.04	0.11	0.04	0.08	0.09	0.03	0.12	0.09
LS	NS	*	**	NS	**	**	NS	*	**
<b>Sowing Date</b>									
S1	0.69	1.23c	2.26ab	0.61b	1.27b	1.67	0.66b	1.35b	1.69b
S2	0.65	1.54b	2.05b	0.69ab	1.45b	1.91	0.75a	1.83a	1.74b
S3	0.60	1.96a	2.46a	0.72a	1.88a	1.83	0.65b	1.94a	2.15a
SE±	0.03	0.03	0.10	0.03	0.07	0.08	0.03	0.11	0.08
LS	NS	**	*	*	**	NS	*	**	**
<b>Variety</b>									
Brown	0.63	1.50	2.21	0.67	1.55	1.75	0.67	1.75	1.86
White	0.67	1.64	2.30	0.67	1.52	1.86	0.71	1.65	1.87
SE±	0.03	0.03	0.08	0.02	0.06	0.06	0.02	0.09	0.06
LS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS= not significant, \*\* & \* = significant @ 0.01 & 0.05 probability level, respectively.

### Pod Yield per Hectare

Table 5 shows the effect of sowing date, phosphorus rate and pod yield per hectare of lablab varieties during 2019, 2020 and 2021 wet seasons at Ringim. There was a highly significant effect of phosphorus rate on pod yield on lablab in all the seasons, phosphorus at 60



kg ha<sup>-1</sup> manifested highest effect in all seasons, pod yield of 4.816 tha<sup>-1</sup> in 2019 wet season, 5.032 tha<sup>-1</sup> in 2020 wet season, and 5.599 tha<sup>-1</sup> in 2021 wet season were recorded. Least effect was recorded with 0 kg pha<sup>-1</sup>. There was highly significant difference between sowing date on pod yield of lablab in all season. S2 recorded higher pod yield in 2019 and 2020 wet seasons 4.485 tha<sup>-1</sup> and 4.558 tha<sup>-1</sup>, respectively, while S1 in 2021 wet season recorded higher pod (4.732 tha<sup>-1</sup>). Least pods were observed with S3 in 2019, 2021 wet seasons, and in 2020 with S1. Highly significant (P<0.001) varietal effect was observed in 2019 and 2020. Dan Inusa recorded highest pod yield 4.440tha<sup>-1</sup> in 2019 wet season and 4.7615tha<sup>-1</sup> in 2020 wet season while the lowest yield was with Dan Farankachi 4.165 and 4.304 in 2019 and 2020 wet season, respectively. In this study may be due to application of P fertilizer confirms with promoting the formation of nodes and pods in legume. The result is similar with findings of Singh and Singh (2015) and Shubhashree (2007) in lablab. The yield attributing characters might have been favorably influenced in early sowing and therefore, the yield increased. Late sown crops did not attain required vegetative growth and consequently resulted in poor yield. The results are in agreement with the observations recorded by Kharbamon *et al.* (2015). Similar variations in number of pods per plant in lablab were reported by Dass (2015) and Choudhary (2016).

**Table 5:** Effect of phosphorus level and sowing date on pod yield per hectare of lablab varieties in 2019, 2020 and 2021 wet seasons at Ringim

Treatments	2019	2020	2021
<b>Phosphorus (kg/ha)</b>			
0	3.51d	3.81d	3.59c
20	3.85c	4.03c	3.72c
40	4.45b	4.81b	5.29b
60	4.82a	5.03a	5.60a
SE±	0.06	0.03	0.06
LSD (0.05)	**	**	**
<b>Sowing dates</b>			
S1	4.17b	4.30c	4.73a
S2	4.49a	4.56a	4.50b
S3	3.83c	4.40b	4.42c
SE±	0.05	0.02	0.05
LSD (0.05)	**	**	**
<b>Variety</b>			
Dan Farankachi	4.17b	4.30b	4.56b
Dan Inusa	4.44a	4.76a	4.73a
SE±	0.04	0.02	0.74
LSD	**	**	*

NS= not significant, \*\* & \* = significant @ 0.01 & 0.05 probability level, respectively.

## CONCLUSION AND RECOMMENDATIONS

The study concluded that leaf area index were highly significant ( $P \leq 0.01$ ) interns of phosphorus application and sowing dates at 4 and 12WAS, pod yield was also highly significant ( $P \leq 0.01$ ) in all the seasons. Based on the result of this study, it could be concluded that application of 60 kg P/ha, *Dan Inusa* and sowing date of 29th July could be adopted by farmers for better yield of lablab in the study area, hence recommended for better yield.



## REFERENCES

- Abido, W. A. E. and Seadh, S. E. (2014). Rate of variations between field bean Cultivars due to sowing dates and foliar spraying treatments. *Science International*. **2(1)**: 1-12.
- Adak, M.S. and M. Kibritc (2016). Effect of nitrogen and phosphorus levels on nodulation and yield components in faba bean (*Vicia faba* L.). *Legume Res.*, **39(6)**: 991-994.
- Akhilesh Sharma, G. D. Sharma, Yudhvir Singh, Munish Sharma1, Viveka Katoch1 and K. C. Sharma. (2013). Optimum sowing dates and varieties for seed productivity of pole Frenchbean (*Phaseolus vulgaris* L.) under north western Himalayas. *African Journal of Agricultural Research*, **8(48)**, pp. 6196-6201.
- Choudhary, J., Kushwah, S.S., Singh, O.P. and Naruka, I.S. (2016). Studies on genetic variability and character association in Indian bean [*Lablab purpureus* (L.) Sweet]. *Legume Res.* **39(3)**:336-342.
- Dass, I., Shende. V.D., Seth, T., Yadav, Y. and Chattopadhyay, A. (2015). Genetic analysis and interrelationships among yield attributing traits in pole and bush type dolichos bean (*Lablab purpureus* L.). *J. Crop Weed*. **11(2)**: 72-77.
- Fouda, K.F. (2017). Effect of phosphorus level and some growth regulators on productivity of faba bean (*Vicia Faba* L.). *Egypt. J. Soil Sci.*, **57(1)**: 73- 87.
- Jaisankar, P., & Manivannan, K. (2018). Effect of different levels of nitrogen and phosphorus on growth and yield characters of bush bean (dolichos lablab var. typicus). *Plant Archives*, **18(2)**, 2194–2198.
- Joshi, S.K. and Rahevar H.S. (2015). Effect of dates of sowing, row spacings and varieties on growth and yield attributes of *rabi* Indian bean (*Dolichos lablab* L.). *Indian J. Agric. Res.* **49(1)**: 59-64.
- Kharbamon, B., Jha, A.K., Verma, V.K., Choudhury, B.U. and Bidyut, C.D. (2015). Effect of planting time and phosphorus dosage on growth, yield and quality attributes of Indian bean (*Lablab purpureus* L.). *Indian Journal of Hill Farming*. **29 (1)**: 65-71
- Kubure, T. E., V.R. Cherukuri., C. Arvind and I. Hamza (2015). Effect of faba bean (*Vicia faba* L.) genotypes, plant densities and phosphorus on productivity, nutrients uptake, soil fertility changes and economics in Central high lands Ethiopia. *Int. J. of Life Sci.* **3(4)**: 287-305.
- Nikfarjam, S.G. and H. Aminpanah (2015). Effects of phosphorus fertilization and *Pseudomonas fluorescens* strain on the growth and yield of faba bean (*Vicia faba* L.). *IDESIA (Chile)*, **33(4)**: 15-21.
- Shubhashree K.S., (2007). “Response of Rajmash (*Phaseolus Vulgaris* L.) To The Levels of Nitrogen, Phosphorus and Potassium during Rabi in the Northern Transition Zone”.
- Singh, S., Singh, P.K., Singh, D.R., Pandey, V.B. and Srivastava, R.C. (2015). Genetic variability and character association study in dolichos bean. *Indian J. Hort.* **72(3)**: 343-346.
- Yadav, B.V.S., B. Srinivasulu, P.S.S. Reddy and M. Balakrishna (2015). Influence of sowing dates on growth and yield of french bean (*Phaseolus vulgaris* L.) varieties under Rayalaseema region of Andhra Pradesh. *J. Agroecol. And Natural Resource Manage.*, **2(2)**: 145-149.
- Zelege, K. and Nendel, C. (2019). Growth and yield response of faba bean to soil moisture regimes and sowing dates: Field experiment and modelling study. *Agri. Water Manage.*, **213**:1063–1077.
- Zhang, H. and Raun, B. (2006). **Oklahoma soil fertility handbook**. 6th edition. Dep. of Plant and Soil Sci., Oklahoma State Univ. Stillwater.