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Studies on Growth, Yield and Quality of Edible Poded Dolichos Bean As Affected By NPK Fertilization

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ABSTRACT

A field experiment was conducted to investigate the effect of different N, P and K levels on growth, yield and quality parameters of edible poded dolichos bean at Kittur Rani Channamma College of Horticulture, Arabhavi, during the growing period of 2016-17 and 2017-18. The nitrogen (0 and 25 kg/ha), phosphorus (0, 50 and 75 kg/ha) and potassium (0, 25 and 50 kg/ha) were applied in eighteen different combinations. Among indivisual NPK levels, the higher level of nitrogen (25 kg N/ha), phosphorus (75 kg P_2O_5/ha) and potassium (50 kg K_2O/ha) recorded significantly maximum growth (plant height, number of primary branches, number of leaves), pod yield (162.32, 184.14 and 164.75 q/ha) and quality parameters (fiber, sugar and protein) of dolichos bean compared to lower levels in both the years (2016-17 and 2017-18) and pooled data, respectively. Similarly, among NPK interaction levels, higher fertilizer dose of 25-75-50 kg N-P_2O_5-K_2O/ha (T_{18}) registered the highest value for growth and yield parameters but it was on par with 25-75-25 kg N-P_2O_5-K_2O/ha (T_{17}) for all the characters except number of leaves and days to crop maturity during both the experimental years as well as in pooled data. Therefore, for obtaining high yield with good nutritive value, NPK fertilizer must be applied at the rate of 25-75-25 kg/ha under the Arabhavi (Karnataka) condition.

Key words: Dolichos bean, Fertilizer, Nitrogen, Phosphorus, Pooled data, Potassium.

INTRODUCTION

Dolichos bean (*Dolichos lablab* L.) is one of the most ancient crop which occupies unique position both as vegetable and pulse purpose, belongs to leguminosae family having chromosome number 2n=22. The fresh green pods are the economic part, the highly nutritive, eaten after cooking and it is the best source of digestible vegetable protein (20 to 25%) required for human health, because of this, this crop is considered as a poor man's meat (Joshi and Rahevar, 2015). Being a legume, it has ability to fix nitrogen into soil thereby improving soil fertility and crop yields in an economic and environment friendly manner. Hence, it is highly remunerative crop having multiple uses and well suited to all most all agro-climatic regions (Kharbamon *et al.,* 2017). Within India, lablab as an edible poded vegetable crop mostly cultivated in Karnataka and adjoining districts of Tamil Nadu, Andhra Pradesh and Maharashtra. In Karnataka, it is grown mainly in Bengaluru, Dharwad, Belgavi, Bidar and Hassan districts which contributes a major share, accounting for nearly 90 per cent in terms of both area and production in the state but average productivity of lablab bean crop is quite low (12 t/ha of edible green pod yield) due to several production constraints.

The major limiting factors, which contribute to the crop yield, include; use of local cultivars, imbalanced nutrition and cultural practices. If the crop is managed properly, green pods are produced continuously for several months. Application of balanced fertilizer increases vegetative growth and improves yield and quality of the produce. Being a leguminous crop, dolichos bean is highly responsive to nitrogenous fertilizer application especially in early stage (Sammauria *et al.,* 2009). Nitrogen promotes the leaf, stem, other vegetative growth and increase the protein content. Application of phosphorus influences symbiotic nitrogen fixation and serves dual purpose in legume by increasing the yield and quality of green pods of current as well as succeeding crop of the dolichos bean (Turuko and Mohammed, 2014). Potassium is often referred as the quality element for crop production due to its positive interaction with other nutrients (especially with nitrogen). Potassium plays a crucial role in legumes by enhancing the production of starch and sugar that benefit the symbiotic bacteria and thus enhances the fixation of nitrogen (Rustamani *et al.,* 1999). Dolichos bean as an edible poded vegetable is growing in a limited area in Karnataka and does not have a separate recommended package of practices, however, farmers are growing this crop by adopting the recommended fertilizers dose used for field type of dolichos bean. Therefore, the present study was undertaken to find out the

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best level of NPK for optimum growth and higher green pod yield under agro-climatic conditions of Arabhavi in Belgaum district of Karnataka.

MATERIALS AND METHODS

The field experiments were carried out to evaluate the effect of different nitrogen, phosphorus and potassium levels on growth, yield and quality of edible poded dolichos bean at experimental field of Department of Vegetable Science, Kittur Rani Channamma College of Horticulture, Arabhavi, Karnataka during the growing period of 2016-17 and 2017-18. The experiments were laid out in factorial randomized complete block design with three replications, measuring a net plot size of 2.7 m × 2.4 m. A composite sample of 30 cm deep soil was used for physical and chemical analysis. The soil of the experimental site was sandy clay loam, having pH (8.22), EC (0.54 dS/m), O.M (0.57%), available N (181.88 kg/ha), available P (62.38 kg/ha) and K (223.31 kg/ha). The healthy and disease free authentic seeds of dolichos bean variety 'Arka Amogh' were used for conducting experiments. Two seeds per pit were sown in recommended spacing of 45 cm × 15 cm. The nitrogen (0 and 25 kg/ha), phosphorus (0, 50 and 75 kg/ha) and potassium (0, 25 and 50 kg/ha) were applied in eighteen different combinations. Full dose of fertilizers (nitrogen, phosphorus and potassium) in the form of urea, single super phosphate and muriate of potash, respectively were applied to soil before seed sowing as per the treatment requirements. All other cultural operations were kept normal and uniform for all treatments as per package of practices recommended by University of Horticultural Sciences, Bagalkot (Anonymous, 2015). The observations were recorded by selecting five plants randomly from each plot. Quality parameters like pod protein (The total calorimetric method by Lowry *et al.,* 1951), fibre (Proskey *et al.,* 1988) and sugar (John, 1985) content were assessed from the freshly harvested pods. Two years experimental data as well as pooled data were analyzed statistically with the analysis of variance at 5% probability level as per the statistical methods *i.e.* Fisher's method described by Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

Effect of NPK fertilization on growth parameters of dolichos bean

The data regarding on growth parameters of dolichos bean *viz.*, plant height, number of branches per plant, number of leaves per plant at various growth stages, dry matter content at harvest and days taken to crop maturity were significantly influenced by N, P, K and their interaction during both the seasons and in pooled data analysis (Table 1).

The plant height was maximum (89.65, 91.69 cm and 88.63 cm) when they were applied with higher doses of nitrogen 25 kg N/ha (N_2 level), phosphorus (75 kg P_2O_5/ha) and potassium (50 kg K_2O/ha) respectively than the lower doses of nitrogen (0 kg N/ha), phosphorus (50 kg P_2O_5/ha) and potassium (25 kg K_2O/ha) respectively in pooled analysis of 2016-17 and 2017-18 experimental years. Among the different interactions of nitrogen, phosphorous and potassium (N-P_2O_5-K_2O), the plant height at harvest was recorded significantly maximum (98.13, 98.57 and 98.35 cm) in 25-75-50 kg N-P_2O_5-K_2O/ha (T_{18}) which was on par with T_{17} in 2016-17, 2017-18 and in pooled data respectively. On pooled basis, plant height was significantly varied from 90.95 cm in recommended fertilizer level of 25-50-25 kg N-P_2O_5-K_2O/ha (T_{14}) to 98.35 cm in highest fertilizer level of 25-75-50 kg N-P_2O_5-K_2O/ha. The individual effect of NPK was significantly varied for production of primary branches and recorded more in N_2 (8.19, 8.10 and 8.14) over N_1 level in first (2016-17), second (2017-18) season and in pooled data, respectively. Significantly higher number of primary branches per plant (8.73) was recorded by P_3 (75 kg P_2O_5/ha) over P_2 (7.92) and P_1 (6.53) level in pooled basis whereas, linear and significant increase in number of primary branches was recorded with increase in potassium level from K_1 (7.57) to K_3 (8.00). Similar trend was also noticed in 2016-17 and 2017-18 successive growing seasons. The marked variations amongst the NPK interaction levels were also noticed for production of primary branches during both the years. Pooled data showed that maximum number of primary branches (9.33) was recorded at highest fertilizer level of 25-75-50 kg N-P_2O_5-K_2O/ha compared to the recommended fertilizer level (25-50-25 kg N-P_2O_5-K_2O/ha) at harvest but it was at par with T_{17}. Similar trend was also noticed in both the growing seasons. Similar results of interaction effect on plant height and number of branches were also noticed by Sammauria *et al*. (2009) in cluster bean.

In indivisual effect of nitrogen, number of leaves (63.04) was recorded maximum in N_2 (25 kg N/ha) over N_1 level in pooled analysis. Likewise, more number of leaves (66.64 and 62.33) were produced in higher level of phosphorus (75 kg P_2O_5/ha) and potassium (50 K_2O/ha) which were significantly superior over lower levels (50 kg P_2O_5/ha and 25 K_2O/ha) in pooled analysis, respectively. The similar trend was also noticed in both the experimental years (2016-17 and 2017-18). There was a gradual increase in number of leaves with the increase of fertilizer doses and the maximum number of leaves (77.30, 75.49 and 76.39) was recorded in higher nutrient level of 25-75-50 kg N-P_2O_5-K_2O/ha (T_{18}) followed by T_{17} and T_{16}. The similar trend was also noticed in both the experimental years (2016-17 and 2017-18). The significant increase in growth parameters noticed under higher level of N, P, K and their interaction was attributed by better utilization of plant nutrients and might have resulted in the luxuriant crop growth due to enhanced cell division, elongation and differentiation as compared to lower fertilizer level. Similar results in growth parameters also confirmed by findings of Shrikanth *et al.* (2008). The total dry matter accumulation in dolichos plant was significantly higher (24.93, 24.15 and 24.54 g) in 25 kg N/ha (N_2) than without nitrogen (N_1) application in 2016-17, 2017-18 growing seasons and in pooled data, respectively. Significantly higher

Table 1: Growth attributes of edible poded dolichos bean as influenced by different levels of nitrogen, phosphorus and potassium.

Treatment (N-P_2O_5-K_2O kg/ha)	Plant height (cm)			Number of primary branches per plant			Number of leaves per plant			Dry matter content per plant at harvest (g)			Days taken to crop maturity		
	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
0 (N_1)	84.95	83.27	84.11	7.47	7.53	7.50	59.53	57.65	58.59	21.96	21.29	21.62	74.22	73.63	73.93
25 (N_2)	89.96	89.34	89.65	8.19	8.10	8.14	63.50	62.59	63.04	24.93	24.15	24.54	75.33	74.78	75.06
SEm±	**0.42**	**0.31**	**0.22**	**0.02**	**0.02**	**0.01**	**0.53**	**0.48**	**0.39**	**0.17**	**0.20**	**0.13**	**0.07**	**0.07**	**0.05**
CD (P≥0.05)	**1.21**	**0.90**	**0.64**	**0.05**	**0.05**	**0.04**	**1.51**	**1.38**	**1.13**	**0.49**	**0.57**	**0.38**	**0.21**	**0.21**	**0.13**
0 (P_1)	81.26	79.92	80.59	6.47	6.59	6.53	54.97	51.99	53.48	17.44	17.18	17.31	73.28	72.44	72.86
50 (P_2)	87.72	86.51	87.11	7.91	7.93	7.92	59.99	59.47	59.73	21.38	21.04	21.21	74.67	74.17	74.42
75 (P_3)	92.07	91.31	91.69	8.82	8.64	8.73	66.99	66.28	66.64	28.20	27.09	27.65	75.83	75.44	75.64
SEm±	**0.51**	**0.38**	**0.27**	**0.02**	**0.02**	**0.01**	**0.64**	**0.59**	**0.48**	**0.21**	**0.24**	**0.16**	**0.09**	**0.09**	**0.06**
CD (P≥0.05)	**1.48**	**1.10**	**0.78**	**0.06**	**0.07**	**0.04**	**1.85**	**1.69**	**1.39**	**0.60**	**0.70**	**0.47**	**0.26**	**0.26**	**0.16**
0 (K_1)	85.42	84.28	84.85	7.54	7.59	7.57	59.57	57.36	58.46	20.28	19.90	20.09	74.11	73.33	73.72
25 (K_2)	86.52	85.31	85.91	7.63	7.60	7.61	59.21	58.90	59.05	22.48	21.68	22.08	74.39	73.94	74.17
50 (K_3)	89.11	88.16	88.63	8.02	7.98	8.00	63.18	61.49	62.33	24.26	23.73	23.99	75.28	74.78	75.03
SEm±	**0.51**	**0.38**	**0.27**	**0.02**	**0.02**	**0.01**	**0.64**	**0.59**	**0.48**	**0.21**	**0.24**	**0.16**	**0.09**	**0.09**	**0.06**
CD (P≥0.05)	**1.48**	**1.10**	**0.78**	**0.06**	**0.07**	**0.04**	**1.85**	**1.69**	**1.39**	**0.60**	**0.70**	**0.47**	**0.26**	**0.26**	**0.16**
0-0-0 (T_1)	76.93	76.27	76.60	6.13	6.07	6.10	51.30	49.63	50.47	17.00	16.33	16.67	70.33	69.00	69.67
0-0-25 (T_2)	81.50	79.60	80.55	6.13	6.13	6.13	55.10	51.97	53.53	17.07	16.90	16.98	73.33	73.00	73.17
0-0- 50 (T_3)	81.87	79.93	80.90	6.20	6.13	6.17	55.27	52.00	53.63	17.20	17.00	17.10	73.67	73.00	73.33
0-50-0 (T_4)	84.70	82.23	83.47	7.20	7.53	7.37	57.57	55.23	56.40	19.10	18.97	19.03	74.00	73.33	73.67
0-50-25 (T_5)	85.03	83.27	84.15	7.33	7.67	7.50	59.07	55.80	57.43	19.93	19.40	19.67	74.33	73.67	74.00
0-50-50 (T_6)	85.77	84.07	84.92	7.67	8.00	7.83	59.87	56.73	58.30	20.50	19.93	20.22	74.33	74.00	74.17
0-75-0 (T_7)	86.10	84.93	85.52	8.80	8.67	8.73	65.10	64.67	64.88	28.30	27.07	27.68	75.00	74.33	74.67
0-75-25 (T_8)	89.80	87.13	88.47	8.87	8.73	8.80	65.57	65.33	65.45	28.93	27.77	28.35	76.33	76.00	76.17
0-75-50 (T_9)	93.30	92.83	93.07	8.93	8.80	8.87	66.97	67.47	67.22	29.57	28.20	28.88	76.67	76.33	76.50
25-0-0 (T_{10})	82.07	80.90	81.48	6.27	6.20	6.23	55.40	52.20	53.80	17.33	17.17	17.25	73.00	73.00	73.00
25-0-25 (T_{11})	82.40	81.27	81.83	7.00	7.47	7.23	55.93	52.73	54.33	17.80	17.23	17.52	74.00	73.33	73.67
25-0-50 (T_{12})	82.77	81.57	82.17	7.07	7.53	7.30	56.83	53.40	55.12	18.23	18.43	18.33	74.33	73.33	73.83
25-50-0 (T_{13})	86.43	85.83	86.13	8.13	8.07	8.10	58.17	62.17	60.17	22.33	22.00	22.17	75.00	74.33	74.67
25-50-25 (T_{14})	91.10	90.80	90.95	8.33	8.13	8.23	62.47	63.07	62.77	22.87	22.53	22.70	75.00	74.67	74.83
25-50-50 (T_{15})	92.83	91.97	92.40	8.80	8.20	8.50	62.83	63.83	63.33	23.53	23.40	23.47	75.33	75.00	75.17
25-75-0 (T_{16})	96.27	95.50	95.88	9.27	9.00	9.13	69.90	69.50	69.70	30.80	28.53	29.67	76.33	76.00	76.17
25-75-25 (T_{17})	97.17	96.83	97.00	9.33	9.13	9.23	72.67	70.90	71.78	34.93	32.60	33.77	76.67	76.33	76.50
25-75-50 (T_{18})	98.13	98.57	98.35	9.47	9.20	9.33	77.30	75.49	76.39	36.50	35.43	35.97	77.33	77.00	77.17
SEm±	**1.26**	**0.94**	**0.67**	**0.05**	**0.06**	**0.04**	**1.58**	**1.44**	**1.18**	**0.51**	**0.59**	**0.40**	**0.22**	**0.22**	**0.14**
CD (P≥0.05)	**3.62**	**2.70**	**1.92**	**0.14**	**0.16**	**0.11**	**4.54**	**4.15**	**3.40**	**1.46**	**1.71**	**1.14**	**0.64**	**0.63**	**0.40**

dry matter per plant (27.65 g and 23.99 g) was recorded with higher level of phosphorus (75 kg P_2O_5/ha) and potassium (50 K_2O/ha) which were significantly superior over lower levels of phosphorus (50 kg P_2O_5/ha) and potassium (25 K_2O/ha) levels in pooled analysis, respectively. The similar trend was also noticed in both the experimental years (2016-17 and 2017-18). The NPK interaction has promotive effect on dry biomass and recorded maximum dry weight of plant (35.97 g) in plants supplied with higher dose of fertilizer (25-75-50 kg N-P_2O_5-K_2O/ha) followed by T_{17} (33.77 g) and T_{16} (29.67 g) which showed 11 (13.27 g), 9 (11.07 g) and 3 (4.1 g) per cent higher over recommended fertilizer level of 25-50-25 kg N-P_2O_5-K_2O/ha (22.70 g). The interaction effects during 2016-17 and 2017-18 experimental years also followed similar trend as that of pooled analysis. The higher dry matter production with higher level of N, P, K and their interaction was mainly due to higher green biomass and its accumulation in various plant parts. Similar results have also been noticed by Shrikanth *et al.* (2008). Days to physiological maturity differed significantly with NPK and their interaction levels in 2016-17, 2017-18 growing seasons and pooled data (Table 1). Days increased significantly (75.33, 74.78 and 75.06 days) with increased N levels (25 kg N/ha) in 2016-17, 2017-18 and in pooled data, respectively. Similarly, with increased application of P and K levels, number of days to physiological maturity was significantly recorded maximum in P_3 (75.64 days) and K_3 (75.03 days) level compared to lower levels of phosphorus (50 kg P_2O_5/ha) and potassium (25 K_2O/ha) in pooled analysis, respectively. The similar trend was also noticed in both the experimental years (2016-17 and 2017-18). Among the interaction effects of NPK, significantly maximum days (77.33, 77.00 and 77.17) were recorded in higher fertilizer dose of 25-75-50 kg N-P_2O_5-K_2O/ha (T_{18}) followed by T_{17} (76.50 days) and T_9 (76.50 days) which confirmed the findings of Shrikanth *et al.* (2008).

Effect of NPK fertilization on yield parameters of dolichos bean

The data recorded on yield parameters as significantly influenced by individual NPK and their interactions levels in 2016-17, 2017-18 growing seasons and in pooled analysis which is presented in Table 2. On pooled basis, significantly maximum number of pods per plant (134.18, 142.58 and 134.53) were observed in higher levels of nitrogen (25 kg N/ha), phosphorus (75 kg P_2O_5/ha) and potassium (50 kg K_2O/ha) compared to lower levels. Similar observations were also made during both the years of the study. Among the interaction effect of NPK fertilizers, on pooled basis, significantly more number of pods per plant (148.78) were recorded in higher fertilizer dose of 25-75-50 kg/ha (T_{18}) followed by T_{17} (146.20) and T_9 (143.35). Similar trend was also noticed during both the years (2016-17 and 2017-18) of experiment. On pooled basis, pod length (11.86 cm, 11.96 cm and 11.86 cm) and pod width (1.62 cm, 1.68 cm and 1.64 cm) were recorded maximum in higher level of nitrogen (25 kg N/ha), phosphorus (75 kg P_2O_5/ha) and potassium (50 kg K_2O/ha) over lower levels. Similar trend was also noticed during both the years (2016-17 and 2017-18) of experiment. However, effect of nitrogen on pod width showed non significant result in first season and in pooled data analysis. Higher yield attributing characters in higher fertilizer dose are mainly due to more number of productive branches by higher level of nitrogen, phosphorus and potassium application thereby increased number of pods per plant and other characters. Likewise, among the interaction effect of NPK, on pooled basis, maximum pod length (12.17 cm) and pod width (1.74 cm) were also recorded under higher fertilizer dose of 25-75-50 kg N-P_2O_5-K_2O/ha (T_{18}) compared to recommended dose. Similar trend was also noticed during both the years of investigation. These results can be due to the fact that better utilization of NPK which enhanced photosynthetic activity, accumulation and translocation of assimilates from source to sink resulting in improved yield attributing characters in higher dose of fertilizers. These results confirmed the finding of Palankar and Malabasari (2014) in cluster bean.

Pod yield of dolichos bean var. Arka Amogh was significantly influenced by individual NPK and their interaction during both the years of the experiments (Table 2). The nitrogen (N) levels showed a significant effect on pod yield per plant in dolichos bean, which recorded significantly maximum in N_2 (140.20, 138.95 and 139.57 g) than N_1 level in 2016-17, 2017-18 and in pooled data analysis, respectively. Similarly, on pooled basis, the higher level of phosphorus (75 kg P_2O_5/ha) and potassium (50 kg K_2O/ha) produced significantly higher pod yield per plant (154.31 g and 141.21 g) compared to lower levels, respectively. Similar trend was also noticed in 2016-17 and 2017-18 growing seasons. On pooled basis, significantly higher fertilizer dose of 25-75-50 kg N-P_2O_5-K_2O/ha (T_{18}) produced more pod yield per plant (163.95 g) followed by T_{17} and T_9 treatment combinations which showed maximum improvement of 30.78 g (17%) and 30.79 q (26%) over recommended fertilizer level T_{14} (25-50-25 kg N-P_2O_5-K_2O/ha). Similarly, T_{18} also recorded significantly higher pod yield per plant but it was on par with T_{17} in first season (2016-17) whereas in second season (2017-18) the trend was same as followed in pooled data. Pod yield per hectare of dolichos bean var. Arka Amogh as influenced by NPK individually, their interaction and pooled data are presented in Table 2. On pooled basis, the higher level of nitrogen (25 kg N/ha), phosphorus (75 kg P_2O_5/ha) and potassium (50 kg K_2O/ha) produced significantly higher pod yield per hectare (162.32, 184.14 and 164.75 q) compared to lower levels, respectively. Similar trend was also noticed in 2016-17 and 2017-18 growing seasons. Among the NPK interaction levels, in pooled data, maximum pod yield was recorded at T_{18} (198.44 q/ha) followed by T_{17} (193.43q/ha) and T_9 (190.20 q/ha). Similar result trend was also noticed in first (2016-17) and second (2017-18) season of experiments. Maximum pod yield was recorded at T_{18} which showed maximum

Table 2: Pod yield of dolichos bean as influenced by different levels of nitrogen, phosphorus and potassium.

Treatment	Number pods per plant			Pod length (cm)			Pod width (cm)			Pod yield (g/plant)			Pod yield (q/ha)		
(N-P_2O_5-K_2O kg/ha)	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
0 (N_1)	130.74	129.66	130.20	11.57	11.45	11.51	1.62	1.58	1.60	134.06	132.28	133.17	154.16	151.52	152.84
25 (N_2)	134.97	133.38	134.18	11.89	11.84	11.86	1.63	1.61	1.62	140.20	138.95	139.57	163.25	161.38	162.32
SEm±	**0.30**	**0.23**	**0.19**	**0.02**	**0.03**	**0.02**	**0.01**	**0.01**	**0.01**	**0.46**	**0.42**	**0.36**	**0.68**	**0.62**	**0.53**
CD (P≥0.05)	**0.87**	**0.68**	**0.54**	**0.04**	**0.08**	**0.05**	**NS**	**0.02**	**NS**	**1.31**	**1.20**	**1.03**	**1.95**	**1.77**	**1.53**
0 (P_1)	121.28	120.79	121.04	11.06	11.03	11.05	1.53	1.49	1.51	116.31	115.38	115.85	127.87	126.49	127.18
50 (P_2)	133.83	132.07	132.95	11.70	11.63	11.67	1.62	1.62	1.62	139.64	138.27	138.96	162.43	160.40	161.42
75 (P_3)	143.46	141.71	142.58	11.92	12.00	11.96	1.69	1.67	1.68	155.43	153.18	154.31	185.82	182.46	184.14
SEm±	**0.37**	**0.29**	**0.23**	**0.02**	**0.04**	**0.02**	**0.01**	**0.01**	**0.01**	**0.56**	**0.51**	**0.44**	**0.83**	**0.76**	**0.65**
CD (P≥0.05)	**1.07**	**0.83**	**0.66**	**0.05**	**0.10**	**0.06**	**0.02**	**0.02**	**0.02**	**1.61**	**1.47**	**1.26**	**2.39**	**2.17**	**1.87**
0 (K_1)	128.93	128.42	128.67	11.46	11.33	11.39	1.59	1.57	1.58	130.22	128.37	129.29	148.48	145.73	147.10
25 (K_2)	134.10	132.64	133.37	11.59	11.58	11.59	1.60	1.59	1.59	139.39	137.83	138.61	162.05	159.71	160.88
50 (K_3)	135.54	133.51	134.53	11.89	11.82	11.86	1.65	1.63	1.64	141.77	140.64	141.21	165.59	163.92	164.75
SEm±	**0.37**	**0.29**	**0.23**	**0.02**	**0.04**	**0.02**	**0.01**	**0.01**	**0.01**	**0.56**	**0.51**	**0.44**	**0.83**	**0.76**	**0.65**
CD (P≥0.05)	**1.07**	**0.83**	**0.66**	**0.05**	**0.10**	**0.06**	**0.02**	**0.02**	**0.02**	**1.61**	**1.47**	**1.26**	**2.39**	**2.17**	**1.87**
0-0-0 (T_1)	117.73	117.47	117.60	10.40	10.17	10.28	1.40	1.40	1.40	111.47	111.07	111.27	120.69	120.10	120.40
0-0-25 (T_2)	120.93	120.27	120.60	11.20	11.00	11.10	1.53	1.50	1.52	115.57	114.00	114.78	126.77	124.44	125.60
0-0- 50 (T_3)	121.40	120.83	121.12	11.23	11.07	11.15	1.61	1.53	1.57	117.23	116.47	116.85	129.23	128.10	128.67
0-50-0 (T_4)	130.73	130.30	130.52	11.37	11.40	11.38	1.63	1.60	1.62	130.67	128.20	129.43	149.14	145.48	147.31
0-50-25 (T_5)	131.13	130.43	130.78	11.53	11.47	11.50	1.60	1.61	1.60	138.20	137.47	137.83	160.30	159.21	159.75
0-50-50 (T_6)	133.73	131.13	132.43	11.60	11.53	11.57	1.63	1.62	1.63	142.17	140.20	141.18	166.17	163.26	164.72
0-75-0 (T_7)	132.17	132.73	132.45	11.73	11.70	11.72	1.70	1.63	1.67	134.10	130.83	132.47	154.22	149.38	151.80
0-75-25 (T_8)	144.27	141.70	142.98	12.08	12.05	12.06	1.70	1.67	1.68	157.80	154.80	156.30	189.33	184.89	187.11
0-75-50 (T_9)	144.60	142.10	143.35	12.17	12.11	12.14	1.73	1.70	1.72	159.30	157.47	158.38	191.56	188.84	190.20
25-0-0 (T_{10})	118.53	118.20	118.37	11.07	11.00	11.03	1.51	1.50	1.51	112.90	112.43	112.67	122.81	122.12	122.47
25-0-25 (T_{11})	123.63	123.83	123.73	11.23	11.80	11.52	1.57	1.50	1.53	119.73	118.10	118.92	132.94	130.52	131.73
25-0-50 (T_{12})	125.43	124.17	124.80	11.23	11.17	11.20	1.57	1.50	1.53	120.97	120.23	120.60	134.77	133.68	134.22
25-50-0 (T_{13})	132.17	130.53	131.35	11.73	11.70	11.72	1.61	1.60	1.60	136.77	134.90	135.83	158.17	155.41	156.79
25-50-25 (T_{14})	137.33	134.50	135.92	11.97	11.73	11.85	1.62	1.63	1.63	143.53	142.80	143.17	168.20	167.11	167.65
25-50-50 (T_{15})	137.87	135.50	136.68	12.00	11.97	11.98	1.63	1.67	1.65	146.50	146.07	146.28	172.59	171.95	172.27
25-75-0 (T_{16})	142.23	141.27	141.75	12.03	12.00	12.01	1.70	1.67	1.68	155.43	152.77	154.10	185.83	181.88	183.85
25-75-25 (T_{17})	147.30	145.10	146.20	12.10	12.05	12.07	1.73	1.71	1.72	161.50	159.80	160.65	194.77	192.10	193.43
25-75-50 (T_{18})	150.20	147.35	148.78	12.23	12.12	12.17	1.74	1.73	1.74	164.47	163.43	163.95	199.21	197.68	198.44
SEm±	**0.91**	**0.70**	**0.56**	**0.05**	**0.05**	**0.05**	**0.02**	**0.02**	**0.01**	**1.37**	**1.25**	**1.07**	**2.03**	**1.85**	**1.59**
CD (P≥0.05)	**2.61**	**2.03**	**1.62**	**0.13**	**0.14**	**0.14**	**0.06**	**0.06**	**0.04**	**3.94**	**3.60**	**3.09**	**5.85**	**5.32**	**4.58**

NS- Non Significant at P > 0.05.

Table 3: Pod quality components of dolichos bean as influenced by different levels of nitrogen, phosphorus and potassium.

Treatment	Fibre content (g / 100 g)			Protein content (g/ 100 g)			Sugar content (g/ 100 g)		
(N-P_2O_5-K_2O kg/ha)	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
0 (N_1)	1.64	1.60	1.62	2.80	2.77	2.79	1.44	1.42	1.43
25 (N_2)	1.73	1.68	1.71	3.10	3.07	3.08	1.51	1.51	1.51
SEm±	**0.01**	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
CD (P≥0.05)	**0.02**	**0.05**	**0.03**	**0.03**	**0.03**	**0.02**	**0.01**	**0.02**	**0.02**
0 (P_1)	1.51	1.51	1.51	2.53	2.48	2.50	1.33	1.34	1.33
50 (P_2)	1.69	1.65	1.67	2.99	3.00	2.99	1.50	1.48	1.49
75 (P_3)	1.78	1.72	1.75	3.33	3.28	3.31	1.57	1.55	1.56
SEm±	**0.01**	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
CD (P≥0.05)	**0.03**	**0.06**	**0.03**	**0.04**	**0.04**	**0.02**	**0.02**	**0.02**	**0.02**
0 (K_1)	1.64	1.61	1.62	2.84	2.84	2.84	1.43	1.41	1.42
25 (K_2)	1.64	1.62	1.63	2.98	2.94	2.96	1.46	1.45	1.46
50 (K_3)	1.68	1.65	1.67	3.04	2.98	3.01	1.52	1.51	1.51
SEm±	**0.01**	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
CD (P≥0.05)	**0.03**	**0.06**	**0.03**	**0.04**	**0.04**	**0.02**	**0.02**	**0.02**	**0.02**
0-0-0 (T_1)	1.47	1.47	1.47	2.18	2.14	2.16	1.29	1.28	1.29
0-0-25 (T_2)	1.50	1.50	1.50	2.38	2.33	2.36	1.33	1.32	1.32
0-0- 50 (T_3)	1.50	1.50	1.50	2.49	2.35	2.42	1.35	1.34	1.34
0-50-0 (T_4)	1.60	1.57	1.58	2.82	2.84	2.83	1.39	1.34	1.37
0-50-25 (T_5)	1.63	1.60	1.62	2.87	2.87	2.87	1.45	1.44	1.45
0-50-50 (T_6)	1.67	1.60	1.63	2.89	2.87	2.88	1.52	1.50	1.51
0-75-0 (T_7)	1.70	1.63	1.67	2.92	2.90	2.91	1.42	1.39	1.40
0-75-25 (T_8)	1.83	1.77	1.80	3.31	3.26	3.29	1.60	1.58	1.59
0-75-50 (T_9)	1.83	1.80	1.82	3.39	3.35	3.37	1.61	1.59	1.60
25-0-0 (T_{10})	1.50	1.50	1.50	2.64	2.64	2.64	1.31	1.31	1.31
25-0-25 (T_{11})	1.53	1.53	1.53	2.71	2.64	2.67	1.35	1.35	1.35
25-0-50 (T_{12})	1.57	1.53	1.55	2.78	2.75	2.76	1.36	1.42	1.39
25-50-0 (T_{13})	1.70	1.67	1.68	3.06	3.11	3.08	1.53	1.52	1.52
25-50-25 (T_{14})	1.73	1.70	1.72	3.13	3.13	3.13	1.54	1.52	1.53
25-50-50 (T_{15})	1.80	1.77	1.78	3.19	3.16	3.18	1.59	1.55	1.57
25-75-0 (T_{16})	1.87	1.80	1.83	3.40	3.38	3.39	1.62	1.60	1.61
25-75-25 (T_{17})	1.87	1.87	1.87	3.46	3.39	3.43	1.64	1.62	1.63
25-75-50 (T_{18})	1.90	1.87	1.88	3.49	3.42	3.45	1.68	1.67	1.67
SEm±	**0.02**	**0.05**	**0.03**	**0.01**	**0.01**	**0.01**	**0.02**	**0.02**	**0.01**
CD (p≥0.05)	**0.07**	**0.14**	**0.08**	**0.04**	**0.04**	**0.04**	**0.04**	**0.05**	**0.03**

improvement of 20.78 g (17%) and 30.79 q (26%) over recommended fertilizer level T_{14} (25-50-25 kg N-P_2O_5-K_2O/ha). The results of indivisual and interaction effect might be due to increased performance of growth parameters and also complementary effect of optimum combinations of nitrogen, phosphorus and potassium levels. These results confirmed the finding of Shrikanth *et al.* (2008) in dolichos bean.

Effect of NPK fertilization on quality components of dolichos bean

Dolichos bean is an important nutritious legume and rich in protein, sugar, fibre and essential amino acid content. The indivisual effect of NPK and their interactions were significantly varied for all pod quality parameters during first, second season and in pooled analysis (Table 3). On pooled basis, fiber (1.71, 1.75 and 1.67 g), protein (3.08, 3.31 and 3.01 g) and sugar content (1.51, 1.56 and 1.51 g) were significantly increased with 25 kg N/ha 75 kg P_2O_5/ha and 50 kg K_2O/ha over other N, P and K levels. Protein content was significantly increased with higher level of nitrogen as it is the structural component of amino acids. Among the interaction levels of NPK, higher fibre content (1.90, 1.87 and 1.88 g) was recorded in 25-75-50 kg N-P_2O_5-K_2O/ha (T_{18}) in 2016-17 and 2017-18 experimental years and in pooled analysis, respectively. These results are in conformity with the findings of Ayub *et al.* (2012) in cluster bean. In pooled data analysis, significantly maximum protein (3.45 g) and sugar (1.67 g) content were recorded in T_{18} but it was on par with T_{17} for protein content. Similar trend of pod protein and sugar content were also noticed during first season (2016-17) and second season (2017-18) of the experiment.

CONCLUSION

From these results of two years experimental study, it can be concluded that significantly higher pod yield coupled with better growth and reproductive parameters could be obtained by growing edible poded dolichos bean with fertilizer dose of 25-75-25 kg N-P_2O_5-K_2O/ha which recorded 18 per cent more yield with better quality pods compared to recommended fertilizer dose (25-50-25 kg N-P_2O_5-K_2O/ha).

REFERENCES

Anonymous, (2015). Integrated cultivation practices for horticultural crops (Kannada). University of Horticultural Sciences, Bagalkot (Karnataka), pp. 99-100.

Ayub, M., Nadeem, M.A., Naeem, M., Tahir, M., Tariq, M., Ahmad, W. (2012). Effect of different levels of N and K on growth, forage yield and quality of cluster bean (*Cyamopsis tetragonaloba* L.). Journal of Animal and Plant Sciences. 22(2): 479-483.

John, M.T. (1985). A simple method for the extraction of reducing and non- reducing sugars from carrot and other storage root vegetables. Journal of the Science of Food and Agriculture. 36(1): 55-58.

Joshi, S.K. and Rahevar, H. (2015). Effect of dates of sowing, row spacings and varieties on growth and yield attributes of *rabi* Indian bean (*Dolichos lablab* L.). Indian Journal of Agricultural Research. 49(1): 59-64.

Kharbamon, B., Jha, A.K., Verma, V.K., Choudhury, B.U., Nath, A., Deka, B.C. (2017). Response of planting time and phosphorus dosage on yield and nutrient uptake in dolichos bean (*Lablab purpureus* L.). Indian Journal of Hill Farming. 30(1): 28-34.

Lowry, O.H., Rosebrough, N.J., Farr, A.L., Randall, R.J. (1951). Protein measurement with the folin phenol reagent. Journal of Biological Chemistry. 11(2): 161-171.

Palankar, G.S. and Malabasari, T.A. (2014). Effect of major nutrient and picking stage on seed yield and quality of cluster bean [*Cyamopsis tetragonoloba* (L.) Taub]. Journal of Agriculture and Allied Sciences. 3(4): 8-12.

Panse, V.G. and Sukhatme, P.V. (1978). Statistical Methods for Agriculture Workers. ICAR, New Delhi.

Proskey, L., Asp, N.G., Schweitzer, T.F., Devries, J.W., Furda, I. (1988). Determination of insoluble, soluble and total dietary fiber in foods and food products: Inter. Laboratory Study. AOAC. 71: 1071-1023.

Rustamani, M.A., Memon, N., Leghari, M.H., Dhaunroo, M.H., Sheikh, S.A. (1999). Impact of various fertilizer levels on the incidence of sucking pest complex in cotton. Pak. J. Zoology. 31(4): 323-326.

Sammauria, R., Yadav, R.S., Nagar, K.C. (2009). Performance of cluster bean (*Cyamopsis tetragonoloba*) as influenced by nitrogen and phosphorus fertilization and biofertilizers in western Rajasthan. Indian Journal of Agronomy. 54(3): 319-323.

Shrikanth, Merwade, M.N., Channaveerswami, A.S., Tirakannanavar, S., Mallapur, C.P., Hosamani, R.M. (2008). Effect of spacings and fertilizer levels on crop growth and seed yield in lablab bean (*Lablab purpureus* L.). Karnataka Journal of Agricultural Sciences. 21(3): 440-443.

Turuko, M. and Mohammed, A. (2014). Effect of different phosphorus fertilizer rates on growth, dry matter yield and yield components of common bean (*Phaseolus vulgaris* L.). World Journal of Agricultural Research. 2(3): 88-92.