

Research and Reviews: Journal of Agriculture and Allied Sciences

Effect of Major Nutrient and Picking Stage on Seed Yield and Quality of Cluster Bean (*Cyamopsis tetragonoloba* L. Taub).

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Research Article

Received: 02/06/2014

Revised : 07/07/2014

Accepted: 15/07/2014

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Keywords: Cluster bean, picking stage, Major nutrients

ABSTRACT

A field experiment was conducted at Agriculture Research Station, Bagalkot during *Kharif* 2013 to study the effect of nutrients and picking stages on seed yield and quality of cluster bean. The results indicated that the fertilizer level of 25:94:75 (NPK Kg/ha) noticed significantly higher plant height (78.98 cm), number of pods per plant (31.00), pod weight per plant (22.33 g), number of seeds per pod (8.46), seed yield per plant (9.49 g), seed yield per ha (835 kg). Further, this fertilizer dose induced early flower initiation and the day to 50 per cent flowering was lowered (30.70 and 36.39 days). Better seed quality parameter such as 100 seed weight (3.53 g), germination percentage (91.56 %), shoot length (15.62 cm), root length (15.21 cm), seedling vigour index (2791), seedling dry weight (189.89 mg) were noticed. Lower (1.29 dSm⁻¹) EC of seed leachate was recorded over F₂ and F₁ treatments. Among the different picking stages, 100 DAS recorded significantly higher pod yield per plant (21.60 g), seed yield per plant (9.20 g) and seed yield per ha (817.57 kg) along with seed quality parameters viz., 100 seed weight (3.52 g), germination (92.00 %), shoot length (16.04 cm), root length (15.87 cm), seedling dry weight (191.44 g), seedling vigour index (2919.07) and moisture content (19.11 %).

INTRODUCTION

Cluster bean (*Cyamopsis tetragonoloba* L. Taub) belongs to family Leguminosae and is one of the important vegetable crops. It is primarily grown for its tender green pods and gum extraction in arid and Semi-arid region of our country. The growth, seed yield and quality of seed crop are largely influenced by the nutrient fertility status of the soil apart from genetic potential of the variety. Altering the soil nutrients and fertility status by providing balanced and adequate major nutrients like nitrogen, phosphorus and potassium as per the crop requirement is one of the easiest ways to boost up productivity of cluster bean. Seed development and maturation study is important because the seeds may be harvested to ensure good yield associated with viability, vigour and field performance [5]. At physiological maturity seed achieve desirable characteristics and will have maximum viability and vigour. So it is necessary to harvest crop at physiological maturity to attain desirable quality seeds. Keeping in this view, present experiment was laid out with the objective of studying the effect nutrient and stage of picking on seed yield and quality of cluster bean.

MATERIAL AND METHODS

The experiment was conducted at Agriculture Research Station, Bagalkot during *kharif* 2013. The soil was deep black having pH of 6.7 the soil had organic carbon (0.5), Available nitrogen (218 kg/ha),

Available phosphorus (26.5 kg/ha) and Available potassium (370 kg/ha) and the factorial experiment was laid out in RCBD with 9 treatment combination of three fertilizer levels (F₁-25:56:45NPK kg/ha, F₂-25:75:60NPK kg/ha and F₃-25:94:75NPK kg/ha) and three picking stage (P₁- Picking at 100 DAS, P₂- Picking at 110 DAS and P₃- Picking at 120 DAS). Calculated dose of fertilizer were applied at the time of sowing and all the other crop management practices were followed as per recommendation. Irrigation was provided whenever required.

The pods were picked at 100, 110 and 120 days after sowing (DAS). The field observations on days to 50 per cent flowering, pods per plant, pod weight per plant, seeds per pod and seed yield per hectare and all seed quality parameters viz., moisture content, 100 seed weight, germination [3], vigour index (VI= Germination x Seedling length) [4], speed of germination [7], seedling dry weight [6] and electrical conductivity were made as per ISTA Rules.

RESULTS AND DISCUSSION

Effect of nutrients

Among the different fertilizer level fertilizer level of F₃ (25:94:75NPK kg/ha) recorded significantly the highest plant height (78.98 cm) followed by F₂ level (77.16 cm) (F₂-25:75:60NPK kg/ha) as against dosage of 25:56:45NPK kg/ha (F₁) (74.76 cm). The significant increase in growth parameters noticed under higher fertilizer dose was attributed to greater availability of plant nutrients and it might have resulted in the luxuriant crop growth due to enhanced cell division, elongation and differentiation as compared to lower fertilizer level of 25:56:45NPK Kg/ha. Similar results regarding growth parameters were also confirmed by findings of Patil [15] in cluster bean and Shrikantha [17] in lablab bean. The significant variations due to fertilizer levels were seen for flowering parameters. Significantly less number of days to flowering and 50% flowering (33.78 and 35.67 days respectively) were seen in the lower fertilizer level of 25:56:45NPK kg/ha compared to higher dose of fertilizer of 25:94:75 NPK kg/ha (37.00 and 38.78 days). This might be due to the fact that the plants fertilized with lower fertilizer dosage creates stress resulting early initiation of reproductive phase. These results are in conformity with the findings of Amaregouda [2] in garden pea and Shrikanth [17] in lablab bean. The significantly more number of pods per plant (31.00), pod weight per plant (22.33 g), number of seeds per pod (8.46), seed yield per plant (9.49 g), seed yield per plot (439.92 g) and seed yield per ha (835 kg) were noticed in the fertilizer level of 25:94:75NPK Kg/ha (F₃) as against fertilizer level of 25:56:45NPK Kg/ha. (F₁) (26.07, 19.83g, 8.15, 8.55g, 396.41g, and 764.09 kg, respectively). This increase in seed yield and its components might be attributed to the enhanced photosynthetic activity, accumulation and translocation of assimilates from source to sink resulting in heavier and bolder seeds. These results are in agreement with those of Amaregouda [2] in pea and Malik *et al.* [12] in green gram.

The significantly higher 100 seed weight (3.53 g), germination percentage (91.56 %), shoot length (15.62 cm), root length (15.21 cm), seedling vigour index (2791) and seedling dry weight (189.89 mg) were recorded in the F₃ fertilizer level (25:94:75NPK Kg/ha) followed by F₂ as against fertilizer level of F₁ (25:56:45NPK Kg/ha) (3.53 g, 87.89 %, 13.94 cm, 13.18 cm, 2402 and 170.67 mg, respectively). Whereas EC and seed moisture content were relatively less (1.29 dSm⁻¹ and 15.56%) in the F₃ (25:94:75NPK Kg/ha) and F₁ (25:56:45NPKKg/ha) fertilizer level, respectively. The better seed quality traits noticed in fertilizer level of 25:94:75NPK Kg/ha was probably ascribed to heavier and bolder seeds due to adequate nutrient availability over the other the treatment. Similar results were documented by Kumar *et al.* [14] in French bean and Shrikanth [17] in lablab bean.

Effect of picking stage

Seed yield parameter such as pod yield per plant, seed yield per plant, seed yield per plot, seed yield per ha have shown significant variations due to different picking stage. Significantly higher pod yield per plant (21.60 g), seed yield per plant (9.20 g), seed yield per plot (432.49 g), seed yield per ha (831 kg) were seen when pod harvested at 100 DAS compared to delayed harvesting. The present findings are in agreement with the findings of Mehta *et al.* [14] and Khatun *et al.* [10] in chick pea. Mehta *et al.* [14] also stated that in chick pea all the cultivars attained maximum dry matter accumulation (physiological maturity) at H₂ stage thereafter, dry weight of seed decreased because of restricted supply of nutrients from mother plant to seed due to disruption of vascular connection and utilization in various physiological and metabolic processes like respiration and also due to loss in moisture content in relation to prevailing temperature and relative humidity. These results are conformity with the report of Venture *et al.* [19] in pea.

Table 1: Seed yield parameter of cluster bean as influenced by application of major nutrients and picking stages

Treatment	Plant Height (cm)	Days to flower initiation	days to 50% flowering	Number of pods per plant	Number of seeds per pod	Pod yield per plant(g)	Seed yield per plant(g)	Seed yield per ha(kg)
Fertilizer level								
F₁	74.76	33.78	35.67	26.07	8.15	19.09	8.25	734
F₂	77.16	35.56	37.67	28.84	8.36	20.20	9.10	777
F₃	78.98	37.00	38.78	31.00	8.46	22.33	9.49	815
S.Em±	0.63	0.36	0.39	0.67	0.05	0.47	0.08	7.68
CD at 5%	1.89	1.09	1.18	2.00	0.16	1.40	0.26	23.03
Picking stage								
P₁	77.09	35.56	37.56	28.59	8.43	21.60	9.20	801
P₂	77.22	35.89	37.89	28.98	8.29	20.30	8.87	766
P₃	76.58	34.89	36.67	28.34	8.25	19.65	8.77	758
S.Em±	0.63	0.36	0.39	0.67	0.05	0.47	0.08	7.68
CD at 5%	NS	NS	NS	NS	NS	1.40	0.26	23.03
Interaction								
F₁ x P₁	73.6	33.67	35.67	25.47	8.15	20.39	8.83	755.56
F₁ x P₂	75.6	34.33	36.33	26.20	8.25	19.87	8.47	725.47
F₁ x P₃	75.07	33.33	35.00	26.53	8.05	19.23	8.36	721.23
F₂ x P₁	77.6	35.67	38.00	29.63	8.55	20.91	9.24	795.07
F₂ x P₂	77.8	35.67	37.67	28.07	8.28	19.90	9.11	771.75
F₂ x P₃	76.07	35.33	37.33	28.83	8.25	19.78	8.96	763.27
F₃ x P₁	80.07	37.33	39.00	30.67	8.58	24.31	9.84	852.07
F₃ x P₂	78.27	37.67	39.67	32.67	8.35	21.95	9.34	801.81
F₃ x P₃	78.6	36.00	37.67	29.67	8.45	20.73	9.29	790.12
S.Em±	1.09	0.63	0.68	1.16	0.09	0.81	0.15	13.31
CD at 5%	Ns	NS	NS	NS	NS	NS	NS	NS

F₁-25:56:45NPK Kg/haF₂-25:75:60NPK Kg/ha (recommended dose)F₃-25:94:75NPK Kg/ha

NS- Non significant

P₁- Picking at100 DASP₂- Picking at110 DASP₃- Picking at120 DAS

DAS- Days after sowing

Seed quality parameters are greatly influenced by the stages of pod harvest. The seeds will have maximum quality when pod harvested at physiological maturity. In the present study seed quality parameters viz., 100 seed weight (3.52 g), germination (92.00%), shoot length (16.04 cm), root length (15.87 cm), seedling dry weight (191.44 g), seedling vigour index (2919.07) and moisture content (19.11 %) were maximum with pods harvested at 100 DAS, while EC was minimum (1.17 dSm⁻¹). These results are conformity with Kalavathi *et al.* [8] and Renugadevi *et al.* [16] in cluster bean. At physiological maturity, seeds are said to be completely developed due to maximum accumulation of food reserves, amino acids, phosphorus active substances, dry matter, sugar, water soluble protein and acids and thereafter translocation of food ceases but senescence begins reported by Dhanellappagol *et al.* [4] in chilli.

Similarly in pods harvested later than 100 DAS also recorded lesser seed quality parameters owing to field weathering. Also due to development of build mechanism that involved in the disorganization of cell organells within a few days of physiological maturity as per Mathew [13]. The results are also in conformity with Kalavathi and Ramaswamy [10] in soybean and Vasudevan *et al.* [18] in fenugreek.

Table 2: seed quality parameter of cluster bean as influenced by application of major nutrients and picking stages

Treatments	Germination (%)	100 seed weight	Shoot length	Root length	Seedlin vigour index	DW of seedling	Electrical conductivity (dSm ⁻¹)	Moisture content(%)
Fertilizer								
F ₁	87.89(69.47)	3.24	13.94	13.18	2402	170.67	1.38	15.56
F ₂	89.56(70.94)	3.35	15.02	14.31	2621	181.78	1.33	15.98
F ₃	91.56(72.51)	3.53	15.62	15.21	2791	189.89	1.29	15.92
S.Em±	0.38	0.03	0.19	0.28	36	2.60	0.02	0.32
CD at5%	1.14	0.10	0.57	0.84	108	7.80	NS	NS
Picking stage								
P ₁	92.00(73.15)	3.52	16.04	15.87	2919	191.44	1.17	19.11
P ₂	90.22(71.72)	3.38	14.81	13.82	2578	181.67	1.39	15.08
P ₃	86.78(68.04)	3.21	13.73	13.01	2318	169.22	1.44	13.27
S.Em±	0.38	0.03	0.19	0.28	36	2.60	0.02	0.32
CD at5%	1.14	0.10	0.57	0.84	108	7.80	0.07	0.96
Interaction								
F ₁ x P ₁	89.67(71.240)	3.41	14.67	15.60	2713.67	189.33	1.42	18.71
F ₁ x P ₂	88.00(69.71)	3.35	14.65	12.99	2432.63	170.33	1.50	14.70
F ₁ x P ₃	86.00(67.46)	2.95	12.49	10.93	2060.33	152.33	1.52	13.26
F ₂ x P ₁	91.67(73.20)	3.47	16.50	15.87	2967.27	191.67	1.12	19.56
F ₂ x P ₂	90.00(71.55)	3.30	14.69	13.56	2542.38	185.33	1.42	15.10
F ₂ x P ₃	87.00(68.06)	3.28	13.87	13.51	2354.42	168.33	1.45	13.28
F ₃ x P ₁	94.67(75.02)	3.69	16.94	16.13	3076.27	193.33	1.04	19.06
F ₃ x P ₂	92.67(73.90)	3.48	15.10	14.90	2759.85	189.33	1.33	15.44
F ₃ x P ₃	87.33(68.61)	3.42	14.83	14.59	2537.92	187.00	1.41	13.27
S.Em±	0.66	0.06	0.33	0.48	62	4.50	0.04	0.55
CD at5%	1.98	0.18	0.99	1.46	187	13.50	NS	NS

F₁-25:56:45NPK Kg/haF₂-25:75:60NPK Kg/ha (recommended dose)F₃-25:94:75NPK Kg/ha

NS- Non significant

P₁- Picking at100 DASP₂- Picking at110 DASP₃- Picking at120 DAS

DAS- Days after sowing

Interaction effect on fertilizer levels and picking stage was found to be non significant for the growth, flowering and seed yield parameter.

The seed quality parameter differed significantly due to interaction of fertilizer level and three picking stages. Pod picked at 100 DAS with fertilizer level of 25:94:75NPK kg/ha (F₃P₁) noticed higher seed quality parameter such as 100 seed weight (3.69 g), germination (94.67%), shoot length (16.94 cm), root length (16.13), moisture content (19.06 %) and vigour index (3076) with low EC value (1.16 dSm⁻¹) this may be due to adequate supply of nutrients at peak seed development stage indicate the better seed development and attainment of physiological maturity due to accumulation of more reserve food material and its efficient utilization during germination of seed.

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