

EFFECT OF BIOFERTILIZERS ON ECONOMICS OF INDIAN BEAN (*Lablab purpureus* L.)R. P. Singala¹, B. M. Nandre², Dhawani Patel³, Yogesh Pawar⁴ and V. R. Wankhade⁵¹ P.G. student, Department of Vegetable Science, College of Horticulture, SDAU, Jagudan² Assistant Professor, Department of Horticulture, College of Agriculture, SDAU, Tharad³ Assistant Professor, Department of Floriculture and Landscape Architecture, College of Horticulture, SDAU, Jagudan⁴ Scientist, Krishi Vigyan Kendra, SDAU, Deesa⁵ Assistant Professor, Department of Horticulture, C.P. College of Agriculture, SDAU, Sardarkrushinagarbmnandre@gmail.com

(MS Received: 23.11.2023; MS Revised:30.12.2023; MS Accepted:01.01.2024)

MS 3129

(RESEARCH PAPER IN HORTICULTURE,)



Abstract

The research programme entitled, “effect of biofertilizers on economics of Indian bean (*Lablab purpureus* L.)” was carried out during kharif season 2020-21 at College farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Dist. Mehsana, Gujarat, India. There were twelve treatments having the various combinations of varieties (GJIB 2, GJIB 11, GNIB 22, and Arka Jay) along with different biofertilizers (*Rhizobium*, PSB, *Rhizobium* + PSB). Treatments were replicated thrice in a randomized block design with factorial concept. The observations were recorded and subjected to statistical analysis as per the standard procedure. Variety GJIB 11 (v2) recorded maximum seeds per pod (5.20) and root nodules per plant at 60 DAS (31.56) and at harvest (40.28), pod length (13.13 cm) and crude protein content (22.93 %). Application of biofertilizer *Rhizobium* + PSB (b3) increased root nodules per plant at 60 DAS (31.88) and at harvest (40.88) and crude protein content (22.86 %) of Indian bean. The interaction effect of varieties and biofertilizers were found non significant for all characters. From economic point of view, maximum gross return (5,88,640 Rs/ha), net return (4,79,449 Rs/ha) and benefit cost ratio (5.39) were received by the treatment combination of v2b3 (Variety GJIB 11 with biofertilizer *Rhizobium* + PSB).

Key words – biofertilizers, Indian bean, economics, kharif.

Introduction

Indian bean is one of the most ancient among cultivated legume species and presently grown throughout the tropical regions in Asia, Africa and America. Its green pods and seeds are highly nutritive in nature and are rich in carbohydrates (6.7 g), protein (3.8 g), fat (0.7 g), minerals (0.9 g), magnesium (34.0 g), calcium (210 mg), phosphorus (68.0 mg), sodium (55.4 mg), iron (1.7 mg), potassium (74.0 mg), Sulphur (40.0 mg), vitamin A (312 IU), riboflavin (0.06 mg), vitamin C (9.0 mg), nicotinic acid (0.7 mg) and fiber (1.8 g) per 100 g of edible portion. (Thamburaj and Singh, 2003). Indian bean is an excellent drought tolerant crop to be grown in dry lands with limited rainfall. In India, the average yield of green pods varies from 96.43-153.32 q/ha (Dewangan *et al.*, 2018). It is a multipurpose crop grown for pulse, vegetable and forage. It is also able to grow in a wide range of environments. The seed treatment can be done with any of two or more bacteria. There is no side (antagonistic) effect. The important things that have to be kept in mind are that the seeds must be first coated with *Rhizobium*, *Azotobacter* or *Azospirillum* culture. When each seed gets a layer of these bacteria, then the phosphate solubilizing bacteria (PSB) inoculants has to be coated as an outer layer. This method will provide a maximum number of all bacteria required for better results. Biofertilizers play an important role in increasing availability of nitrogen and phosphorus. They increase the biological fixation of atmospheric nitrogen and enhance phosphorus availability to the crop. The seeds treated with bacterial culture of *Rhizobium* increase nodulation and influence yield as well as economize the input cost of fertilizer to some extent. It also renders protection against soil deterioration and environmental pollution caused by heavy use of chemical fertilizers. The efficient strain of *Rhizobium* can fix about 90 kg of nitrogen per hectare in one season and enrich soil nitrogen (Mishra *et al.*, 2013). Among the biofertilizers, PSB possess the ability to bring insoluble phosphate in soluble form by secreting organic acid which is available for plant. PSB also decomposes soil protein and produce ammonia, which may serve as source of nitrogen for crop growth and thereby increase soil micro flora, causes reduction in toxic substances produced by plant pathogens. Inoculation of seeds with *Rhizobium* and PSB culture increase nodulation, crop growth, nutrient uptake and crop yield (Shrivastava and Ahlawat, 1993). Nowadays, use of biofertilizers in crops is a hot trend and it increases quality and economics without any adverse effects on the environment as well as soil. Many researches on Indian bean and other leguminous crop shows that crop responded well to biofertilizers application. Considering the above facts in view, an experiment “Quality and economics as influenced

by biofertilizers on different varieties of Indian bean (*Lablab purpureus* L.)” was planned.

Material And Methods

The experiment entitled, “Quality and economics as influenced by biofertilizers on different varieties of Indian bean (*Lablab purpureus* L.)” was conducted in kharif season, 2020-21, at College Farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan (Gujarat). The experiment was comprised with two factors with four different varieties (GJIB 2, GJIB 11, GNIB 22 and Arka Jay) and three levels of biofertilizers (*Rhizobium* culture, PSB and *Rhizobium* culture + PSB). Plants were sown at a distance of 75 cm × 30 cm. Irrigation was given with drip irrigation system. RDF was given at 25:50:00 NPK kg/ha. The mean data of five selected and tagged plants were recorded on pod length (cm), number of seeds per pod, crude protein content (%) and number of root nodules per plant at 60 days after sowing and at harvest was subjected to statistical analysis following analysis of variance technique (Panse and Sukhatme, 1985) and the detailed economics of the treatment combinations were discussed.

Observations recorded:

ECONOMICS

The gross realization in term of rupees (Rs) per hectare was worked out by considering the prevailing market price of the Indian bean under each treatment. The cost of cultivation was worked out by considering the expenses incurred for input (seeds, manure, fertilizers, pesticides, irrigation *etc.*), cultural operations, manpower, electricity *etc.* from land preparation to final picking of each treatment. The cost of cultivation was deducted from gross realization to work out the net profit. The benefit cost ratio (BCR) was calculated on the basis of formula given below.

$$B : C \text{ ratio} = \frac{\text{Gross income (Rs/ha)}}{\text{Total cost of cultivation (Rs/ha)}}$$

Results And Discussion

Quality parameters (Table 1 and 2)

Pod length (cm)

Maximum pod length (13.13 cm) was recorded in variety GJIB 11 (v₂) while minimum (7.02 cm) was recorded in variety GNIB 22 (v₃). The variation in pod length could be observed to their genetic characters such type of varietal differences was also reported Ananth and Kumar (2018), Ro *et al.* (2019) and Champaneri *et al.* (2020) in Indian bean, Singh (2000) and Anupama *et al.* (2016) in clusterbean, Choudhary *et al.* (2017) in black gram, Kalloo *et al.* (2005) and Khan *et al.* (2017) in vegetable pea, Patil *et al.* (1991), Lal and Rai (2011), Patel *et al.* (2011) and Meena *et al.* (2018) in cowpea.

Number of seeds per pod

Significantly maximum number of seeds per pod (5.20) was observed with GJIB 11 (v_2). However minimum number of seeds per pod (4.13) was recorded with variety GNIB 22 (v_3). The variation in number of seeds per pod could be assigned to their genetic makeup of variety, such type of varietal differences was also reported Singh *et al.* (2011), Ananth and Kumar (2018) and Champaneri *et al.* (2020) in Indian bean, Singh (2000), Kumawat *et al.* (2006), Singhal *et al.* (2014) and Anupama *et al.* (2016) in clusterbean, Patel *et al.* (2011), Pawar *et al.* (2016) and Meena *et al.* (2018) in cowpea.

Crude protein content (%)

Significantly maximum crude protein content (22.93 %) was observed with variety GJIB 11 (v_2), which was statistically at par with variety GNIB 22 (v_3). While minimum crude protein content (22.03 %) was recorded by variety Arka Jay (v_4). Significantly maximum crude protein content (22.86 %) was observed by the biofertilizer *Rhizobium* + PSB (b_3) and minimum was recorded by PSB (b_2) i.e. 22.28 %. These differences in protein content in different varieties occurred due to their varying genetic makeup. The results are in close conformity with findings of Ananth and Kumar (2018) and Ro *et al.* (2019) in Indian bean, Singh (2000), Anupama *et al.* (2016) and Reddy *et al.* (2017) in cluster bean, Kalloo *et al.* (2005) in vegetable pea, Patel *et al.* (2013), Amin *et al.* (2014) and Pawar *et al.* (2016) in cowpea. Seed inoculation with *Rhizobium* +PSB recorded the maximum crude protein content. Increase in crude protein by seed inoculation of *Rhizobium* + PSB may be attributed to increase availability of nitrogen and enhanced availability of phosphorus increase rate of photosynthesis, which is the chief constituent of protein, could have altered the contents to the desirable levels Ramana *et al.* (2011) in French bean. These results corroborate with the findings of Singh *et al.* (2014) in cluster bean, Ramana *et al.* (2011) in Frenchbean, Dekhane *et al.* (2011), Khandelwal *et al.* (2012) and Senthilkumar and Sivagurunathan (2012) in cowpea.

Number of root nodules per plant at 60 days after sowing

Significantly maximum number of root nodules per plant (31.56) was observed with GJIB 11 (v_2). However, minimum was recorded with variety GNIB 22 (v_3) i.e. 25.00. Significantly maximum number of root nodules per plant (31.88) was recorded with the treatment *Rhizobium* + PSB (b_3). While minimum root nodules were recorded with treatment PSB (b_2) i.e. 24.75.

Number of root nodules per plant at harvest

Significantly maximum number of root nodules per plant (40.28) was observed with GJIB 11 (v_2). However, minimum was recorded with variety GNIB 22 (v_3) i.e. 34.78. Significantly maximum number of root nodules per plant (40.88) was recorded with the treatment *Rhizobium* + PSB (b_3) while minimum was recorded with treatment PSB (b_2) i.e. 34.00. These differences in different varieties occurred due to their varying genetic makeup and suitable soil and climate of this region. The results are in close conformity with findings of Tagore *et al.* (2013) in chick pea, Yadav *et al.* (2019) in cowpea, Sivakumar *et al.* (2013) in cowpea and green gram. Seed inoculation with *Rhizobium* +PSB recorded the maximum number of root nodules per plant. It may be attributed to enhancing symbiotic activity of *Rhizobium* and PSB. Due to this number and size of root nodules increased faster. Also, larger quantity of nitrogen fixation and enhanced availability of phosphorus increases rate of photosynthesis. This finding corroborates with the findings of Karnan *et al.* (2012) and Nadeem *et al.* (2017) in cowpea, Tagore *et al.* (2013) in chick pea, Khan *et al.* (2017) in vegetable pea, Ramana *et al.* (2011) in French bean, Gorade *et al.* (2014) in Green gram.

Economics (Table 3 to 6)

The results in Table 6 revealed that among the twelve treatment combinations, v_2b_3 (variety GJIB 11 with biofertilizer *Rhizobium* + PSB) recorded maximum gross return of Rs. 588640 /ha, net return of Rs 479449 /ha and benefit: cost ratio i.e. 5.39. Whereas, treatment combination v_3b_2 (variety GNIB 22 with biofertilizer PSB) recorded

minimum gross return of Rs 109960 /ha, net return of Rs 729 /ha and benefit: cost ratio i.e. 1.01.

The treatment combinations of v_2b_3 (variety GJIB 11 with biofertilizer *Rhizobium* + PSB) resulted in the maximum gross return, net return and benefit: cost ratio. The interaction between v_2b_3 (variety GJIB 11 with biofertilizer *Rhizobium* + PSB) beneficial for economic return to catch early market. The results are conformity with those reported by Anupama *et al.* (2016) in cluster bean and Patel *et al.* (2013) in green gram.

Conclusion

It can be concluded that for achieving maximum quality and economic return as well as benefit cost ratio, seed of Indian bean variety GJIB 11 should be treated with *Rhizobium* + PSB @ 25 ml per kg.

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Table 1: Response of varieties of Indian bean (*Lablab purpureus* L.) along with biofertilizers on quality parameters

Treatment	Pod length (cm)	Number of seeds per pod	Crude protein content (%)	Number of root nodules per plant	
				At 60 DAS	At harvest
v ₁	8.02	4.40	22.23	28.61	37.33
v ₂	13.13	5.20	22.93	31.56	40.28
v ₃	7.02	4.13	22.87	25.00	34.78
v ₄	7.38	4.27	22.03	27.94	36.67
S.Em.±	0.22	0.11	0.16	0.81	1.19
C.D. at 5%	0.62	0.31	0.45	2.29	3.39
b ₁	8.94	4.48	22.41	28.21	36.92
b ₂	8.73	4.39	22.28	24.75	34.00
b ₃	9.00	4.64	22.86	31.88	40.88
S.Em.±	0.19	0.10	0.14	0.70	8.03
C.D. at 5%	NS	NS	0.39	1.99	2.94
C.V. %	7.31	7.37	2.09	8.55	9.59

Table 2: Interaction effect of varieties and biofertilizers of Indian bean (*Lablab purpureus* L.) on quality parameters

Treatment	Pod length (cm)	Number of seeds per pod	Crude protein content (%)	Number of root nodules per plant	
				At 60 DAS	At harvest
v ₁ b ₁	8.02	4.35	22.21	29.33	37.50
v ₁ b ₂	8.01	4.28	22.18	24.50	33.67
v ₁ b ₃	8.04	4.57	22.31	32.00	40.83
v ₂ b ₁	13.11	5.16	22.87	30.83	39.33
v ₂ b ₂	13.10	5.05	22.78	27.50	36.00
v ₂ b ₃	13.18	5.40	23.14	36.33	45.50
v ₃ b ₁	7.25	4.16	22.89	25.17	34.17
v ₃ b ₂	6.45	4.07	22.58	21.50	32.50
v ₃ b ₃	7.36	4.17	23.12	28.33	37.67
v ₄ b ₁	7.39	4.25	21.65	27.50	36.67
v ₄ b ₂	7.35	4.16	21.56	25.50	33.83
v ₄ b ₃	7.40	4.40	22.87	30.83	39.50
S.Em.±	0.38	0.19	0.27	1.40	2.06
C.D. at 5%	1.07	0.55	0.77	3.97	5.88
C.V. %	7.31	7.37	2.09	8.55	9.60

Table 3: Cost of cultivation of Indian bean and other details of operational cost

Sr. No.	Particular		Unit	Cost Rs/unit	Quantity	Value or Cost (Rs ha ⁻¹)
[A]	PRE SOWING OPERATION					
	1	Ploughing (by tractor)	hrs	600	6	3600
	2	Planking (by tractor)	hrs	600	4	2400
[B]	Non-labour input					
	1	Fertilizer application				
		FYM (25 t/ha)	Ton	1000	25	25000
		Urea	Kg	5.9	54.35	321
		SSP	Kg	8	312.5	2500
	2	Irrigation charges (Drip)	hrs	300	18	5400
[C]	Labour input					
	1	Field preparation	MD	260	15	3900
	2	Sowing of seed	MD	260	12	3120
	3	Fertilizer application	MD	260	6	1560
	4	Gap filling (2 times)	MD	260	12	3120
	5	Weeding (4 times)	MD	260	24	6240
	6	Inter culturing	MD	260	10	2600
	7	Plant protection measure	-	-	-	11500
	8	Harvesting cost (10 times)	MD	260	120	31200
[D]	Land revenue		-	50	1	50
[E]	Total fixed cost					102511

Table 4: Treatment wise variable cost Rs/ha of supplemented materials

Treat. No.	Treatment wise cost			Total Cost Rs/ha
	Seed cost (Rs)	Rhizobium (Rs)	PSB (Rs)	
v ₁ b ₁	6500	60	-	6560
v ₁ b ₂	6500	-	120	6620
v ₁ b ₃	6500	60	120	6680

v ₂ b ₁	6500	60	-	6560
v ₂ b ₂	6500	-	120	6620
v ₂ b ₃	6500	60	120	6680
v ₃ b ₁	6600	60	-	6660
v ₃ b ₂	6600	-	120	6720
v ₃ b ₃	6600	60	120	6780
v ₄ b ₁	7500	60	-	7560
v ₄ b ₂	7500	-	120	7620
v ₄ b ₃	7500	60	120	7680

Note: Rate of various items

FYM cost @ Rs 1000 per ton

Urea cost @ Rs 295 per 50 kg

SSP cost @Rs 400 per 50 kg

Rhizobium @ Rs 60 per liter

PSB @ Rs120 per liter

Table 5: Details of treatment wise cost of Indian bean crop

Treatments	Variable Cost A	Variable Cost B	Total variable (A+B) (Rs)
	Common cost (Rs)	Cost of nutrient sources (Rs)	
T ₁	102511	6560	109071
T ₂	102511	6620	109131
T ₃	102511	6680	109191
T ₄	102511	6560	109071
T ₅	102511	6620	109131
T ₆	102511	6680	109191
T ₇	102511	6660	109171
T ₈	102511	6720	109231
T ₉	102511	6780	109291
T ₁₀	102511	7560	110071
T ₁₁	102511	7620	110131
T ₁₂	102511	7680	110191

Table 6: Economics of the various treatment combinations

Treatments	Total cost of cultivation (Rs/ha)	Yield per hectare (kg)	Gross income (Rs/ha)	Net income (Rs/ha)	Benefit Cost Ratio
T ₁	109071	12197.33	487893	378822	4.47
T ₂	109131	11506.00	460240	351109	4.22
T ₃	109191	12888.67	515547	406356	4.72
T ₄	109071	14090.33	563613	454542	5.17
T ₅	109131	12921.67	516867	407736	4.74
T ₆	109191	14716.00	588640	479449	5.39
T ₇	109171	2979.33	119173	10002	1.09
T ₈	109231	2749.00	109960	729	1.01
T ₉	109291	3127.67	125107	15816	1.14
T ₁₀	110071	10996.00	439840	329769	4.00
T ₁₁	110131	10287.67	411507	301376	3.74
T ₁₂	110191	11489.67	459587	349396	4.17