



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
JPP 2018; 7(2): 1571-1574  
Received: 27-01-2018  
Accepted: 28-02-2018

**JK Meena**

Department of Applied Plant  
Science (Horticulture)  
School of Bio-science &  
Biotechnology Babasaheb  
Bhimrao Ambedkar University,  
Vidya Vihar, Rae Bareli Road,  
Lucknow, Uttar Pradesh, India

**RB Ram**

Department of Applied Plant  
Science (Horticulture)  
School of Bio-science &  
Biotechnology Babasaheb  
Bhimrao Ambedkar University,  
Vidya Vihar, Rae Bareli Road,  
Lucknow, Uttar Pradesh, India

**ML Meena**

Department of Applied Plant  
Science (Horticulture)  
School of Bio-science &  
Biotechnology Babasaheb  
Bhimrao Ambedkar University,  
Vidya Vihar, Rae Bareli Road,  
Lucknow, Uttar Pradesh, India

**Correspondence****JK Meena**

Department of Applied Plant  
Science (Horticulture)  
School of Bio-science &  
Biotechnology Babasaheb  
Bhimrao Ambedkar University,  
Vidya Vihar, Rae Bareli Road,  
Lucknow, Uttar Pradesh, India

## Studies on bio-fertilizers on yield and quality traits of French bean (*Phaseolus vulgaris* L.) cultivars under Lucknow condition

JK Meena, RB Ram and ML Meena

**Abstract**

The experiment was undertaken the studies on bio-fertilizers on yield and quality traits of french bean (*phaseolus vulgaris* L.) cultivars. Different bio-fertilizers were taken Azotobacter, Phosphate solubilizing bacteria, Rhizobium, Azospirillum and Vesicular-arbuscular mycorrhizae (VAM). Three varieties PDR-14(Uday), EC-400445 and IPR-98-3-1 were used for investigation. The results revealed that the application of V<sub>1</sub>B<sub>3</sub> (PDR-14 (Uday) + Rhizobium) significantly days to first flowering, and days to 50 per cent flowering, number of pods/ plant, number of grains/ pod, green pod length(cm), green pod width(cm), green pod breadth (cm), single green pod weight, green pod yield/plant (g), green pod yield/plot (kg), green pod yield (q/ha), seed weight (g), moisture (%), total sugars (%), protein (%) and also the same trend in PDR-14 (V<sub>1</sub>) except green pod length in IPR-98-3-1. It is found that PDR-14 (Uday) performed better in respect of yield and quality traits in French bean under Lucknow condition.

**Keywords:** French bean, yield, PSB, rhizobium, VAM, varieties, interaction

**Introduction**

French bean (*Phaseolus vulgaris* L.), 2n= 2x = 22 belongs to family (Fabaceae) is a nutritious vegetable consumed as tender pods, shelled beans and dry beans. French bean a native of central and south America (Swaidar *et al.*, 1992) known as different names viz., kidney bean, haricot bean, snap bean, navy bean, pole bean, bush bean, etc. It is placed in the tribe Phaseolae, subfamily Papilionoidae in the family Fabaceae (Leguminosae) and produce nitrogen fixing nodules on their roots. It is most extensively grown bean because of its short duration and nutritive value. Considering the nutritive value, 100 g of green pod contains 1.7 g protein, 0.1 g fat, 4.5 g carbohydrate, 1.8 g fiber and is also rich in minerals and vitamins. To meet the dietary need for common man to eliminate malnutrition, deficiency disease and to relieve over stress on cereals, there is a greater need to enhance vegetable production like Rjama (Kallo and Pandey, 2002) [5]. The seeds are highly proteinaceous. However, the lake of buildup of naturally efficient rhizobium strain renders the crop to respond to high dose of nitrogen (Jaiswal *et al.* 1997) [4]. It is annual herb grown for green tender pods and dry seeds (*rajmash*). It is the most important legume worldwide for human consumption. The pod size of French bean varies from thin, pencil like to about 2 cm in diameter. It is becoming popular with the farmers of India. The French Huguenots introduced French bean into England. Portuguese took the crop to Africa and other parts of the old world. Introduction of French bean into India is comparatively recent and the Europeans brought it to India in the 19<sup>th</sup> century. These two domestications, which led to two groups of cultivars with contrasting agronomic characteristics. Among the pulses i.e., annual leguminous food crops that are harvested for dry seeds the common bean is by far the most important. Beans is grown in Uttar Pradesh in an area (0.2 m ha) with annual production (0.39 MT) with productivity (25 MT/ha) (NHB 2014-15). In India, it is mainly grown in Himachal Pradesh, UKD, J&K, Punjab, Haryana, Uttar Pradesh, Bihar, Gujarat, Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu. The common bean mostly used as food crop throughout the world, particularly in developing countries as Mesoamerica, Africa, and other countries. Bio-fertilizers play a vital role in maintaining long term soil fertility and sustainability. It may increase yield of crops by 10-30 % (Khandelwal *et al.*, 2012) [6].

**Materials and Methods**

The present investigation was carried out at the Horticulture Research Farm 2 of the Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Vidya- Vihar, Rae Bareli Road Lucknow (U. P.) India, during *Rabi* season of

October, 2014 to April, 2015, in well levelled field having proper drainage. Geographically, Lucknow is characterized by sub-tropical climate with hot, dry summer and cold winter. The soil of experimental farm was saline with soil pH 8.2 electrical conductivity 4.0 and sodium exchangeable percentage 15.0. During the period of experimental, meteorological observation were recorded from IISR Lucknow. The experimental material comprising of three cultivar of French bean was collected from IIPR, Kanpur and maintained in the Horticulture Research Farm 2. All recommended package of practices were followed to raise good crop. Experimental field was laid out in Factorial RBD with 18 treatments and replicated thrice. Each block was further subdivided into 18 unit plots. The unit plot size was 1.80 m x 1.00 m, and the row-row and plant to plant spacing was 30cm and 20cm, respectively. Data was recorded on five randomly selected plants per entry per replication for various yield characters namely days to first flowering, days to 50% flowering, number of pods/ plant, number of grains/pod, green pod length (cm), green pod width (cm), green pod breadth (cm), single green pod weight, green pod yield/plant (g), green pod yield/plot (kg), green pod yield (q/ha), seed weight (g), moisture (%), total sugars (%) and protein (%) were recorded on plot basis. Statistical analysis of the data obtained in different set of experiments was calculated following the standard procedure as stated by Panse and Sukhatme.

## Results and Discussion

### Effect of varieties on yield and quality

Effect of varieties on yield and quality traits the representation of mean data of various yield and quality traits of all French bean varieties in (Table 1&2) are showing significant variation. Amongst the varieties in case of duration taken from sowing to first flowering V<sub>1</sub> (PDR-14) took 40.31 days followed by V<sub>2</sub> (EC-400445) 43.32 and V<sub>3</sub> (IPR-98-3-1) 47.06 respectively. They differed statistically significantly from other varieties and can be considered as early flowering one. Whereas, the longest duration for first flowering has been recorded for V<sub>3</sub> (47.06) followed by V<sub>2</sub> (43.32). These can be considered as late flowering. Varieties of French bean Similar findings with respect to days taken to pod set from 50% flowering in common bean has been reported by Kamaluddin and Shahid-Ahmed (2011) [16]. With respect to number of pods per plant (19.06), green pod length (6.34), number of grains per pod 7.99, green pod width (0.83), green pod breadth (0.94), single green pod weight (4.63), green pod yield per plant (97.66 g), green pod yield per plot (3.88 kg), green pod yield per (q/ha) (166.22), 100 seed weight (40.16 g), moisture 10.82 (%), total sugars 7.27 (%) and protein 22.35 (%) in PDR-14 (Uday). The maximum to days to first flowering was recorded under treatment V<sub>1</sub> (PDR-14). However the least V<sub>2</sub> (EC-400445) days to 50% flowering, number of pods per plant, green pod length, number of grains per pod, green pod width, green pod breadth, single green pod weight, green pod yield per plant, green pod yield per plot, green pod yield per (q/ha), 100 seed weight, Moisture (%), total sugars (%) and protein (%) in PDR-14.

### Effect of bio-fertilizers

The results of the present study indicated that among the six different bio-fertilizers the best bio-fertilizer is B<sub>3</sub> (Rhizobium) is recorded significantly improvement in various yield and quality traits days to first flowering 40.42 was recorded under treatment B<sub>3</sub> (Rhizobium). However the

maximum days to 50% flowering (47.67), number of pods per plant (19.13), green pod length (9.89), number of grains per pod 7.28, green pod width (0.71), green pod breadth (0.98), single green pod weight (4.13), green pod yield per plant (95.77 g), green pod yield per plot (3.39 kg), green pod yield per 150.63 (q/ha), 100 seed weight (38.09 g), moisture 10.88(%), total sugars 7.42 (%) and protein 21.94(%) in B<sub>3</sub> (Rhizobium). However the least B<sub>0</sub> (control) days to 50 % flowering, number of pods per plant, green pod length, number of grains per pod, green pod width, green pod breadth, single green pod weight, green pod yield per plant, green pod yield per plot, green pod yield per (q/ha), 100 seed weight, moisture (%), total sugars (%) and protein (%) in B<sub>0</sub> control.

### Interaction effect of varieties and bio-fertilizers

The interaction effect of bio fertilizers and varieties had influenced significantly on the parameters (Table 2&3). Days to first flowering was recorded under treatment B<sub>3</sub> (Rhizobium). However the maximum days to 50% flowering, number of pods per plant, green pod length, number of grains per pod, green pod width, green pod breadth, single green pod weight, green pod yield per plant (g), green pod yield per plot (kg), green pod yield per (q/ha), 100 seed weight (g), moisture (%), total sugars and protein significantly days to first flowering (42.11) was obtained from the variety (PDR-14) with rhizobium (B<sub>3</sub>) the maximum days to flowering (37.87) was obtained in control. The maximum days to 50% flowering (47.12), number of pods per plant (23.44), green pod length (9.02), number of grains per pod 7.99, green pod width (0.83), green pod breadth (0.94), single green pod weight (4.63), green pod yield per plant (97.66 g), green pod yield per plot (3.88 kg), green pod yield per 166.66 (q/ha), 100 seed weight (40.16 g), moisture 10.22(%), total sugars 8.12 (%) and protein 24.25(%) in V<sub>1</sub>B<sub>3</sub> (PDR-14 + Rhizobium). Increased yield by the PSB could be due to the greater availability of nutrients in the soil and better nodulation under the influence of inoculation resulting in better growth and development which might be attributed to better mobilization of phosphorus and increased allocation parts and also hormonal balance on the plant system. The findings corroborate with the findings of Menaria (2004) in soybean, Nagar *et al.* (2004) in cluster bean., Rajput *et al.* (2004) in garden pea and Jain *et al.* (1999) [3] in chick pea. Increase in yield by inoculation of rhizobium might be to increased yield Ramana, *et al* (2010) [9]. Total sugars content was found to be increased with the advancement of pod age. These results are in agreement with the finding of Shanmugavelu (1989) [12, 13], who reported the 4.5% carbohydrate in French bean pod. Poly saccharide remaining in pod are broken down into free sugar after boiling, resulting increasing of total sugars. Similar findings have been revealed by Chaudhury *et al.* (2004) [11] in the experiment with different French bean genotypes. Seed protein percentage varied from 16.50 to 17.19% and similar findings observed by Ganie *et al.* (2010) in garden pea. Shanmugavelu (1989) [12, 13] reported that dry seeds of French bean contained 23.1% protein. Sajitha (2007) [11] in garden bean and Naagar (2004) in cluster bean from the above results it is evident that due to better assimilation of photosynthates and added bio-fertilizers might be resulted in the improvement of soil physical, chemical and biological properties, which turn helped in better nutrient absorption by the plant, resulted in better yield. The positive increase in relation to quality traits might be caused due to superior rate of carbohydrates in reproductive part of the plant.

These results are conformity with the findings of Sajitha *et al.* (2007) <sup>[11]</sup> in garden bean and Ved *et al.* (2008) <sup>[15]</sup> in mung bean.

**Table 1:** Effect of varieties and bio-fertilizers on yield and quality traits of French bean

Treatment	Days to first flowering	Days to 50 percent flowering	Number of pods/plant	Number of grains/pod	Green pod length (cm)	Green pod width (cm)	Green pod breadth (cm)	Single green pod weight	Green pod yield/plant(g)	Green pod yield/plot (kg)	Green pod yield (q/ha)	100-seed weight
<b>Cultivars</b>												
V <sub>1</sub>	40.31	47.92	19.06	6.34	8.30	0.72	0.89	4.60	96.84	3.41	162.83	37.61
V <sub>2</sub>	43.32	49.58	13.80	5.77	8.61	0.65	0.95	3.50	93.77	2.34	124.00	32.46
V <sub>3</sub>	47.06	53.13	14.92	6.15	8.98	0.66	0.94	4.22	95.77	3.26	152.77	35.60
C.D	0.745	0.674	0.722	0.234	0.244	0.049	0.027	0.085	0.222	0.196	1.019	0.709
S.E.(d)	0.367	0.331	0.355	0.115	0.120	0.024	0.013	0.042	0.109	0.096	0.499	0.349
S.E.(m)	0.259	0.234	0.251	0.081	0.085	0.017	0.009	0.030	0.077	0.068	0.353	0.247
<b>Biofertilizers</b>												
B <sub>0</sub>	45.86	53.37	10.87	4.89	7.80	0.62	0.85	3.97	94.20	2.48	143.88	31.80
B <sub>1</sub>	44.30	50.47	15.70	5.76	8.25	0.68	0.91	4.09	95.28	2.89	145.53	33.72
B <sub>2</sub>	42.89	49.08	17.43	7.28	8.89	0.65	0.94	4.13	95.41	3.33	146.18	36.56
B <sub>3</sub>	40.42	47.67	19.13	6.48	9.89	0.70	0.98	4.08	95.77	3.39	150.63	38.09
B <sub>4</sub>	44.67	51.23	15.07	6.43	8.21	0.71	0.96	4.23	95.25	2.92	145.16	35.05
B <sub>5</sub>	43.24	49.46	17.36	5.69	8.75	0.69	0.91	4.13	95.35	3.00	148.26	36.12
C.D	1.054	0.953	1.021	0.330	0.345	N.S	0.038	0.121	0.314	0.277	1.442	1.003
S.E.(d)	0.518	0.469	0.502	0.162	0.170	0.034	0.019	0.059	0.154	0.136	0.706	0.493
S.E.(m)	0.367	0.331	0.355	0.115	0.120	0.024	0.013	0.042	0.109	0.096	0.499	0.349

**Table 2:** Effect of varieties and bio-fertilizers with interaction on yield and quality traits of French bean.

Treatment	Moisture (%)	Total sugars (%)	Protein (%)
<b>Cultivars</b>			
V <sub>1</sub>	10.82	7.27	22.35
V <sub>2</sub>	10.54	6.51	19.65
V <sub>3</sub>	10.73	6.87	20.08
C.D	N.S	0.293	0.120
S.E.(d)	0.183	0.144	0.059
S.E.(m)	0.129	0.102	0.042
<b>Biofertilizers</b>			
B <sub>0</sub>	12.00	6.35	18.91
B <sub>1</sub>	10.25	6.93	20.97
B <sub>2</sub>	10.56	6.85	21.05
B <sub>3</sub>	10.12	7.42	21.94
B <sub>4</sub>	10.88	6.80	20.37
B <sub>5</sub>	10.37	6.96	20.94
C.D	0.526	0.414	0.169
S.E.(d)	0.259	0.204	0.083
S.E.(m)	0.183	0.144	0.059
<b>Interaction</b>			
V <sub>1</sub> B <sub>0</sub>	12.33	6.98	19.33
V <sub>1</sub> B <sub>1</sub>	10.51	7.08	22.88
V <sub>1</sub> B <sub>2</sub>	10.44	7.12	23.02
V <sub>1</sub> B <sub>3</sub>	10.22	8.12	24.25
V <sub>1</sub> B <sub>4</sub>	11.22	7.33	21.68
V <sub>1</sub> B <sub>5</sub>	10.24	7.02	22.98
V <sub>2</sub> B <sub>0</sub>	11.65	5.64	18.89
V <sub>2</sub> B <sub>1</sub>	10.01	6.69	19.46
V <sub>2</sub> B <sub>2</sub>	11.02	6.52	20.02
V <sub>2</sub> B <sub>3</sub>	10.02	7.06	20.14
V <sub>2</sub> B <sub>4</sub>	10.22	6.21	19.55
V <sub>2</sub> B <sub>5</sub>	10.32	6.98	19.88
V <sub>3</sub> B <sub>0</sub>	12.02	6.45	18.51
V <sub>3</sub> B <sub>1</sub>	10.25	7.02	20.58
V <sub>3</sub> B <sub>2</sub>	10.23	6.92	20.12
V <sub>3</sub> B <sub>3</sub>	10.12	7.08	21.44
V <sub>3</sub> B <sub>4</sub>	11.22	6.88	19.88
V <sub>3</sub> B <sub>5</sub>	10.56	6.90	19.98
C.D	N.S	N.S	0.293
S.E.(d)	0.448	0.353	0.144
S.E.(m)	0.317	0.249	0.102

**Table 3:** Interaction Effect of varieties and bio-fertilizers on yield and quality traits of French bean.

Treatment	Days to first flowering	Days to 50% flowering	Number of pods/plant	Number of grains/pod	Green pod length (cm)	Green pod width (cm)	Green pod breadth (cm)	Single green pod weight	Green pod yield/plant (g)	Green pod yield/plot (kg)	Green pod yield (q/ha)	100-seed weight (g)
V <sub>1</sub> B <sub>0</sub>	42.11	50.82	10.99	5.56	7.96	0.65	0.79	4.55	95.57	2.72	160.22	32.52
V <sub>1</sub> B <sub>1</sub>	40.99	48.25	19.22	5.88	8.21	0.72	0.92	4.62	96.97	3.02	160.58	35.12
V <sub>1</sub> B <sub>2</sub>	39.87	47.16	22.42	7.99	8.44	0.69	0.89	4.59	96.99	3.78	162.66	39.98
V <sub>1</sub> B <sub>3</sub>	37.87	47.12	23.44	6.44	9.02	0.75	0.94	4.63	97.66	3.88	166.22	40.16
V <sub>1</sub> B <sub>4</sub>	41.08	49.27	16.33	6.55	7.98	0.83	0.94	4.58	96.94	3.54	163.11	38.22
V <sub>1</sub> B <sub>5</sub>	39.96	44.94	22.00	5.66	8.24	0.73	0.88	4.64	96.95	3.56	164.23	39.66
V <sub>2</sub> B <sub>0</sub>	46.22	52.25	11.11	4.23	7.42	0.63	0.88	3.26	92.22	1.92	120.99	29.68
V <sub>2</sub> B <sub>1</sub>	42.76	49.09	13.66	5.44	8.22	0.64	0.92	3.55	94.02	2.65	122.55	32.50
V <sub>2</sub> B <sub>2</sub>	45.09	50.12	14.22	6.88	9.11	0.64	0.94	3.34	94.12	2.54	124.56	33.48
V <sub>2</sub> B <sub>3</sub>	40.72	46.99	15.52	5.98	9.45	0.65	0.99	3.44	94.22	2.52	128.78	34.55
V <sub>2</sub> B <sub>4</sub>	43.95	51.16	13.55	6.22	8.45	0.64	0.98	3.88	93.99	1.98	121.11	32.02
V <sub>2</sub> B <sub>5</sub>	41.22	47.89	14.75	5.88	9.01	0.71	0.92	3.54	94.06	2.44	127.33	32.56
V <sub>3</sub> B <sub>0</sub>	49.26	57.04	10.52	4.88	8.02	0.60	0.90	4.12	94.82	2.82	150.44	33.22
V <sub>3</sub> B <sub>1</sub>	49.15	54.07	14.22	5.98	8.33	0.68	0.91	4.12	94.86	3.01	153.46	33.55
V <sub>3</sub> B <sub>2</sub>	43.72	49.96	15.66	6.98	9.12	0.64	0.94	4.48	95.14	3.69	151.34	36.22
V <sub>3</sub> B <sub>3</sub>	42.68	48.92	18.44	7.02	11.22	0.71	0.99	4.18	95.44	3.78	156.89	39.56
V <sub>3</sub> B <sub>4</sub>	48.99	53.24	15.33	6.52	8.22	0.68	0.98	4.23	94.84	3.24	151.28	34.92
V <sub>3</sub> B <sub>5</sub>	48.56	55.55	15.35	5.55	9.02	0.65	0.92	4.23	95.04	3.02	153.23	36.16
C.D	1.825	1.650	1.768	0.272	0.598	N.S	N.S	0.209	0.544	0.480	2.497	1.737
S.E.(d)	0.898	0.812	0.870	0.281	0.294	0.059	0.33	0.103	0.267	0.236	1.223	0.855
S.E.(m)	0.635	0.574	0.615	0.199	0.208	0.042	0.023	0.073	0.189	0.167	0.865	0.604

## References

- Chaudhury K, Sannigrahi AK, Singh B. Varietal evaluation of French bean for Assam plains, Environment and Ecology. 2004; 17(1):236-237.
- Das R, Thapa U, Debnath S, Lyngdoh YA, Mallick D. Evaluation of French bean (*Phaseolus vulgaris* L.) genotypes for seed production, Journal of Applied and Natural Science. 2014; 6(2):594-598.
- Jain PC, Kushwaha PS, Dhakad US. Response of chick pea (*Cicer arietinum* L.) to phosphorus and biofertilizers. Legume Research 1999; 22(4):241-244
- Jaiswal HK, Singh UP, Singh ON, Rai B. Technological basis for increasing production of French bean in plains. Indian Farming. 1997; 47(1):15-18.
- Kallo G, Pandey AK. Commendable progress in research. The Hindu Survey of India. 2002, 159-163.
- Khandelwal Rohit, Choudhary SK, Khangarot SS, Jat M K, Singh R. Effect of inorganic and bio-fertilizers on productivity and nutrients uptake in cowpea (*Vigna Unguiculata* (L.) Walp). Legume Research. 2012; 35(3):235-238
- Panse VG, Sukhatme PV. Indian Council of Agricultural Research, New Delhi. 1978, 38.
- Rajput RL, Pandey RN. Effect of method of application of bio fertilizers on yield of pea (*Pisum sativum* L.). Legume Research 2004; 27(1):75-76
- Ramana V, Ramakrishna M, Purushotham K, Reddy KB. Effect of bio fertilizers on growth, yield attributes and yield of French bean (*Phaseolus vulgaris* L.). Legume Research. 2010; 33(3):178- 183.
- Rashid Harunor ASM, Hossai MM. Yield and Quality of Green Pod Production of Bush Bean (*Phaseolus vulgaris* L.) As Influenced by Harvesting Time. American-Eurasian J Agric. & Environ. Sci. 2014; 14(11):1221-1227,
- Sajitha JP, Haripriya K, Mahesweri U, Stella D. Impact of organic nutrients on yield and quality of garden pea. Acta Horticulture. 2007; 485-487.
- Shanmugavelu KG. Production technology of vegetable crops. Oxford & IBH publishing Co. Pvt, Ltd. New Delhi. 1989, 446-461.
- Shanmugavelu KG, Production Technology of Vegetable Crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi. 1989, 446-461
- Swaidar JM, Ware GW, Mc.Collum JP. Producing Vegetable Crops. 4<sup>th</sup> ed. Interstate Publishers. USA. 1992, 626.
- Ved R, Ali M, Misra SK, Upadhyay RM. Studied on sulphur, zinc and bio-fertilizers on yield and yield attributes and nutrient content at different growth stage in mung bean. Journal of Food Legumes. 2008; 21(4):240-242.
- Kamaluddin S, Shahid A. Variability, Correlation and path analysis for seed yield and yield related traits in common beans. Indian Journal of Horticulture. 2011; 68 (1):56-60.