Effect of Plant Density on Vegetative Growth and Yield Performance of Different Varieties of French Bean under Irrigated Condition

French bean (*Phaseolus vulgaris* L.) a non-traditional grain legume, has shown tremendous production potential during winter (rabi) under North Indian condition (Ali and Kushwaha, 1987). It is extensively grown as an excellent vegetable both in the form of immature pods and dried seeds. French bean, being a leguminous and short duration crop, may be used as a soil improving crop in rotation and in cropping system and commonly known as Rajmash . Among the various factors that contribute towards the attainment to potential yield of french bean., optimum plant spacing or plant population is one of the important factor. Optimization of plant density for high yielding genotypes by following suitable inter as well as intra row spacing is essential. Number of branches/plant increased with increased intra row spacing. (Chatterjee and Som 1991). Plant dry weight was increased with increase in row spacing of 30 cm (2.22 lakh plants/ha) as compared with closer row spacing of 22.5 cm (3.33 lakh plants/ha). (Koli and Akashe, 1995) Hence, study was conducted at Marathwada Agricultural University , Parbhani (Maharashtra) for optimization of plant population for variation of French bean. The field experiment was conducted during rabi season of 2003-2004. Soil was medium dark gray in colour and about 100 cm deep with pH 8.17. Experiment was laid out in split plot design with three replications. The four varieties namely HPR -35, PDR- 14, HUR - 15 and VL- 63 were allotted to the main blocks randomly in each replication and three spacing (plant densities) i.e. 30 x 10 cm (3.33 lakh plants/ha), 45 x 10 cm (2.22 lakh plants/ha) and 45 x 15 cm (1.48 lakh plants/ha) were allotted randomly in each sub block. The growth performance were recorded in terms of plant height, number of leaves, leaf area, number of branches per plant at various growth stages with an interval of 20 days from 30 days onwards after sowing up to harvest . Similarly yield attributes viz., number of pods per plant , weight of pods per plant, number of grains per pods, number of grains per plant, weight of grains per plant and 100 grain weight were recorded . From table 1, it is revealed that the interaction effect between the varieties and plant density in respect of vegetative growth performance was significant. The plant height (33.54 cm)under the variety V_1 (PDR-14)) was recorded significantly superior over the rest of the treatments. However, the varieties V_3 and V_4 recorded at par plant height .Similar trend was observed in respect of branches per plant and functional leaves. The significantly highest number of branches per plant(6.63) and functional leaves per plant (3.36) was recorded under the variety V_2 over the other treatments .The significantly highest mean leaf area was recorded under the treatment V_2 while rest of the

Table 1. Influence of different varieties of french bean and plant population on yield and yield attributing characters at harvest

Treatment	Plant height (cm)	Branches per plant	Functional leaves per plant	Mean leaf area	Grains per pod	Grains per plant	Pod weight (gm)	Grain yield per plant(gm)	Test weight (gm)	Grain yield (q/ha)	Biological yield (q/ha)	Straw yield (q/ha)
Varieties												
V1: HPR-35	29.05	4.40	0.51	2.13	2.60	20.46	8.74	7.49	3870	10.49	29.36	19.37
V2: PDR-14	33.54	6.63	3.36	3.05	3.02	27.78	12.92	11.05	42.04	13.41	44.62	31.14
V3: HUR-15	30.52	5.17	0.70	2.41	2.87	24.80	10.72	8.58	34.98	11.58	35.97	25.51
V4 : VL-63	31.20	5.30	1.20	2.61	2.77	24.96	10.83	8.84	34.98	11.73	36.33	24.60
SE+	0.24	0.14	0.28	0.14	0.63	0.62	0.19	0.17	0.34	0.11	0.89	0.99
CD at 5%	0.75	0.43	0.83	0.42	0.10	1.86	0.57	0.51	1.02	0.34	2.67	2.98
Plant density												
S₁ : 3.33 lakh plants/ha(30 x 10 cm)	32.24	4.77	1.19	2.02	2.79	21.73	9.70	8.33	34.45	12.97	43.34	30.57
S₂:2.22 lakh plants/ha (45 x 10 cm)	30.64	5.65	1.52	2.61	2.92	25.86	11.28	9.05	38.57	11.40	35.00	24.97
S₃: 3.33 lakh plants/ha (45 x 15 cm)	30.36	5.71	1.62	3.04	2.95	25.95	11.38	9.33	39.53	11.04	32.97	20.93
SE+	0.23	0.10	0.15	0.06	0.02	0.90	0.30	0.23	0.31	0.17	1.01	0.94
CD at 5%	0.70	0.31	NS	0.19	0.07	2.71	0.90	0.60	0.93	0.52	3.05	2.83
Interaction (V X S)												
SE+	0.47	0.21	0.12	0.12	0.04	1.80	0.60	0.47	0.62	0.35	2.03	1.89
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Grant Mean	31.06	5.38	2.55	2.55	2.84	24.5	10.79	8.95	37.59	11.80	25.11	25.41

treatments were at par each other. which was to the tune of 2.13 to 2.61 cm^2. The influence of plant density was recorded on plant height. The highest plant height was recorded under the plant density S_1 which was significantly superior over the S_2 and S_3 . This might be due to the higher competition among the plants to get more sunlight. Similar results were reported by Ahlawat (1996) and Dhanjal *et al*. (2001). The branches per plant and mean leaf area were on par under the plant density S_2 and S_3 . The functional leaves per plant under these three plant density were non significant. Data presented in table 2, indicates that mean number of grain per pod, number of grain per plant , pod weight per plant , grain weight per plant and weight of hundred seed showed that the interaction effect between the varieties and plant density was non significant. Amongst the four varieties , variety V_2 (PDR-14) was significantly superior over the rest of the treatments in yield attributes . The yield attributes were on par under the varieties V_3 and V_4. The variety V_1 was significantly inferior. These attributes were significantly superior under the

plant density S_3 and on par with S_2 and superior over the plant density S_1. This might be because of more space available between the plants and less competition for space, nutrients, moisture and light. These results are similar to those reported by Dhanjal & Prakash (2001) and Mozumdar *et al.* (2003). From table , it is revealed that the variety V_2 (PDR-14) recorded significantly superior grain yield (13.41 q/ha), biological yield (44.62 q/ha) and straw yield (31.14 q/ha) over all other varieties. These results are in conformity with   Samal et al. (1997). The yield data recorded under the variety V_2 and V_3 were at par and significantly superior over the variety V_1. The significantly superior grain yield was recorded under the plant density S_1. Grain yield recorded under the plant density S_2 and S_3 was on par . Similar trend in respect of biological yield and straw yield was recorded. Thus variety V_2 (PDR-14) and plant density S_1 ((3.33 lakh plants/ha) produced significantly superior yield at Parbhani condition. Non significant effect was recorded between the varieties and plant density

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References

AHLAWATI, P. S., 1996, Response of french bean (*Phaseolus vulgaris* L.) varieties of plant density and phosphorus level. *Indian Jouranal Agricultural Sciences,* **58** : 263-267.

ALI M. AND KUSHWAHA, B. L., 1987, Cultivation of rabi rajmash in plains. *Indian Farming*, **37**:20-23.

CHATTERJEE, R. AND SOM, M.G.,1991, Response of French bean to different rates of P, K and plant spacing. *Crop Research,* **4** : 214 – 217.

DHANJAL, R. AND OM PRAKASH, 2001, Response of frech bean varieties of plant densities and N levels. *Indian Journal of Agricultural Sciences,* **46**:277-281.

KOLI, B. D. AND AKASHE, V. B., 1995, Dry matter production of french bean variety Waghya as influenced by row spacing, plant densities and nitrogen levels. *Current Research*, **24** : 209 – 211.

MOZUMDER, S.N., MONIRUZZAMAN,M. R., ISLAM AND ALAM, S.N., 2003, Effect of planting time and spacing on the yield performance of bush bean (*Phaseolus vulgaris* L.) in eastern hilly area of Bangladesh. *Legume Research*, **26** : 242-247.

SAMAL, K.M., SENAPATI, N. AND SAHU, A.,   1997, Varietal performance and genetic variability in kidney bean (*Phaseolus vulgaris* L.). *Indian Journal Agricultural Sciences*, **67** : 328-329.