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RESEARCH ARTICLE

Effect of spacing and genotypes on yield attributes and yields of french bean (*Phaseolus vulgaris* L.)

■ C. M. Kamble, A. P. Trivedi, A. S. Bhanvadia, J. J. Ghadiali and B. K. Patel

SUMMARY

A field experiment was carried out at the Regional Research Station, Anand Agricultural University, Anand to access the effect of various spacing and genotypes on yield attributes and yields of french bean (*Phaseolus vulgaris* L.) during *Rabi* seasons of 2019-20 and 2020-21. The experiment consists of twenty-two treatment combinations comprised of two levels of spacing [S_1: 30 x 10 cm and S_2: 45 x 10 cm] and eleven levels of genotypes [G_1: SKAUSJ-WB 185, S_2: Tripura Rajma-1, G_3: Phule Rajma, G_4: Phule Suyash, G_5: RKR 1011-1, G_6: RKR 1033, G_7: GR-1, G_8: Varun, G_9: HPR-35, G_{10}: IPR-98-3-1 and G_{11}: Swarna Safal (ICAR Ranchi)]. The results revealed that 45 x 10 cm spacing recorded significantly higher yield attributes and yields of french bean. While among the various genotypes tested, the significantly higher yield attributes and yields were obtained in Swarna Safal genotype of french bean and it also remained at par with Phule Rajma and GR-1 genotypes.

Key Words : French bean, Spacing, Genotype

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The production of pulses however, does not commensurate with the demand in the country. The per capita availability of pulses in India has been continuously decreasing which is at present 55.90 g/day/capita against the minimum requirement of 85 g/day/capita for balanced diet as recommended by World Health Organization (WHO) and Food and Agricultural Organization (FAO). It is the high time to cultivate pulses crops scientifically with increasing area (Patel *et al.,* 2013).

French bean (*Phaseolus vulgaris* L.) is a leguminous crop and belongs to family Fabaceae. It is also known as *Snap bean, Kidney bean, Common*

bean, Rajma bean, Haircot bean, Dwarf bean, Pole bean, Navy bean, Pinto bean and *String bean*. French bean is the most important leguminous vegetable, mainly grown for the tender vegetable, shelled green beans (Rajma) and dry beans also. In India, it is being grown for tender vegetable, while in the USA, it is grown for processing. It is found in two major groups, bush beans and pole beans. Bush beans are short plants, grows approximately 2 feet height without support, reach maturity and produce all of their pods in a relatively short period of time (Heena *et al*., 2015). Both pole and bush-type French beans are cultivated for green pods in the hills (500–1600 MSL) during summer to autumn.

The world's largest producer of french bean is India and also, the greatest producer and importer of french bean. The area of pea and beans in the agricultural year of 2020-21 was 0.637 M ha with the production of 0.876 MT and the productivity is 1375 kg/ha (Ministry of Agriculture and Farmers Welfare, Govt. of India). Punjab and Haryana having the highest area with higher productivity, western Uttar Pradesh, Andhra Pradesh, and the West Bengal are the major french bean growing areas and it is also grown in Kerala, Karnataka's eastern and coastal regions, Tamil Nadu and some regions of Maharashtra.

The suitable variety and proper spacing are the two important factors for higher crop production. The performance evaluation of different french bean varieties varies under different agro-climatic conditions due to their specific climatic requirement. Therefore, an appraisal of varieties for their variability with respect to growth, yield and quality under different conditions is essential to improve the production. In this context it is very much necessary to evaluate these commercial varieties available, in order to identify high yielding types for increasing production and productivity.

Proper spacing is the most important non-monetary input in crop production, which affects the crop growth, yield and quality to a greater extent. Optimum plant population plays an important role to fully exploit all available resources for growth as it provides optimum growing conditions such as temperature, light, humidity and rainfall.

The improvement of french bean for any quantitative trait involves a proper selection criterion. The plant selected based on phenotype may not perform with the same magnitude in the next generation. Hence, the criteria like heritability, genetic advance and correlation co-efficient provides a measure of association among characters and can serve to identify the character of high yielding ability while making selection from the base population.

MATERIAL AND METHODS

A field experiment was conducted at the Regional Research Station, Anand Agricultural University, Anand to evaluate the effect of various spacing and genotypes on yield attributes and yields of french bean (*Phaseolus vulgaris* L.) during *Rabi* seasons of 2019-20 and 2020-21. The experiment was laid out in Randomized Block Design with factorial concept and replicated three times. There were 22 treatment combinations comprising 2 levels of spacing and 11 levels of genotypes. The soil of experimental field was loamy sand in texture, low in nitrogen, medium in available phosphorus and high in available potash. Urea and SSP were applied as a source of nitrogen and phosphorus prior to sowing at the rate of 25 kg N: 50 kg P_2O_5 per ha. Sowing was done under dry condition on 14th December, 2019 and 29th November, 2020. Seed index was estimated by taking weight of 100 seed randomly from yield of each treatment plot.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect of spacing and genotypes on number of pods per plant :

The data presented in Table 1 showed that significantly higher pods plant^{-1} (4.913, 5.028 and 4.971) recorded during both the years and in pooled analysis, respectively in 45 × 10 cm and significantly lower (4.168, 4.270 and 4.219) pods plant^{-1} was observed in 30×10 cm spacing.

The data also showed that among the genotypes, Swarna Safal recorded significantly higher pods plant^{-1} (5.412, 5.545 and 5.479) in both the years and in pooled analysis, respectively than remaining genotypes except Phule Rajma, SKAUSJ-WB 185 and GR-1 found at par in both the years and pooled. Tripura Rajma genotype recorded significantly lower pods plant^{-1} (3.846, 3.941 and 3.893) during both the years and in pooled analysis, respectively followed by HPR-35, varun, IPR-98-31, RKR 1033 and RKR 1011-1.

The pods plant^{-1} of french bean significantly affected

by the interaction effect of spacing and genotype (Table 2). Accordingly, variety Swarna Safal showed the highest pods plant^{-1} with 45 × 10 cm plant spacing which was at par with Phule Rajma and GR-1 at spacing of 45×10 cm in both the years and pooled analysis, and the lowest pods plant^{-1} was observed in Tripura Rajma-1 when sown at 30×10 cm spacing.

Difference in growth characters might be due to genetic variability within genotype itself or due to the environmental effects. Genotypes greatly vary in their performance under different agro climatic conditions. Similar findings were also reported by Muthuramu *et al*. (2015), where they recorded the highest number of green pods per plant (19.08) was recorded in Arka Anoop followed by Arka Suvidha (16.6) and Arka Komal (13.8) which could be the important yield contributing trait. Amanullah *et al*. (2006) reported that the pods per plant varied significantly from 12 (CB- 10) to 27 (CB -16). The variation in pod numbers could be due to the genetic variability of different germplasm. The maximum number of pods per plant was recorded in cluster-III (78.55) which was significantly superior over the remaining genotypes under study (Kumar *et al*., 2014). The significant differences among the genotypes with respect to number of pods per plant were also reported by Anjanappa *et al*. (2000), Ramana *et al*. (2010), Das *et al*. (2014) and Santhi *et al*. (2015) in genotypes of french bean and Bhutia *et al*. (2017) in green peas under different locations.

Effect of spacing and genotypes on number of seeds per pod :

The data offered in Table 1 displayed significantly higher seeds pod^{-1} (4.960, 4.966 and 4.963) recorded during both the years and in pooled analysis, respectively in 45×10 cm and significantly lower (4.359, 4.364 and 4.362) seeds pod^{-1} was observed in 30×10 cm spacing. This might be due to wider spacing provided plant to utilize available resources more efficiently without much competition which promote the better plant growth and

Table 1: Effect of various spacing and genotypes on yield attributes of french bean

Treat.	No. of pods per plant			No. of seeds per pods			Seed index (g)		
	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
Spacing (S)									
S_1	4.17	4.27	4.22	4.36	4.36	4.36	32.37	32.99	32.68
S_2	4.93	5.03	4.98	4.96	4.97	4.96	36.36	37.05	36.71
S.E.±	0.07	0.07	0.05	0.08	0.07	0.05	0.49	0.47	0.34
C.D. (P=0.05)	0.210	0.208	0.146	0.22	0.21	0.15	1.40	1.33	0.95
Genotypes (G)									
G_1	5.07	5.18	5.12	4.95	4.95	4.95	35.28	35.95	35.62
G_2	3.85	3.94	3.89	4.09	4.10	4.10	30.30	30.88	30.59
G_3	5.31	5.42	5.37	5.15	5.16	5.15	38.70	39.44	39.07
G_4	4.69	4.79	4.74	4.51	4.52	4.52	34.52	35.18	34.85
G_5	4.30	4.41	4.35	4.70	4.70	4.70	33.99	34.63	34.31
G_6	4.24	4.34	4.29	4.60	4.60	4.60	33.38	34.01	33.70
G_7	5.27	5.38	5.33	5.01	5.01	5.01	36.80	37.49	37.15
G_8	3.95	4.05	4.00	4.28	4.28	4.28	31.45	32.05	31.75
G_9	3.92	4.01	3.96	4.21	4.22	4.22	31.36	31.96	31.66
G_{10}	3.98	4.08	4.03	4.47	4.47	4.47	31.73	32.33	32.03
G_{11}	5.43	5.55	5.49	5.30	5.304	5.30	40.53	41.30	40.91
S.E.±	0.17	0.17	0.12	0.18	0.172	0.12	1.15	1.10	0.80
C.D. (P=0.05)	0.49	0.49	0.34	0.51	0.491	0.35	3.29	3.13	2.24
S × G interaction									
S.E.±	0.24	0.24	0.17	0.25	0.24	0.17	1.63	1.55	1.12
C.D. (P=0.05)	0.70	0.69	0.48	NS	NS	NS	NS	NS	NS
CV%	9.30	9.01	9.16	9.40	9.04	9.11	8.21	7.67	7.94

NS= Non-significant

untimely produce higher number of seed per pod.

The data likewise presented that among the genotypes, Swarna Safal noted significantly higher seeds pod^{-1} (5.298, 5.304 and 5.301) in both the years and in pooled analysis, respectively than rema123

ining genotypes except Phule Rajma, SKAUSJ-WB 185 and GR-1 found at par in both the years and pooled. Tripura Rajma genotype recorded significantly lower seeds pod^{-1} (4.094, 4.098 and 4.096) during both the years and in pooled analysis, respectively followed by HPR-35, varun, IPR-98-31, Phule Suyash, RKR 1033 and RKR 1011-1.

The variation in number of seeds per pod might be due to genetic variability in different germplasm. The results of this study collaborate with Sarangi *et al*. (2010) who reported that the number of seeds per pod was highest in Kentuky Wonder (7.77) whereas the lowest in Contender and Pusa Parvati (5.58). Das *et al*. (2014) reported that the variation in number of seeds per pod was 7.45 to 20.19 which could contribute to the final yield of french bean. Noor *et al*. (2014) noticed that number of seeds per pod was significantly varied among the french bean genotypes. The highest number of seeds per pod was obtained for BARI bush bean-1 (5.80) whereas the lowest was for BB-20 (3.88). Similar findings were also reported by Roy *et al*. (2003), Ramana *et al*. (2010), Kumar *et al*. (2014) in french bean and Reddy *et al*. (2017) in cluster bean.

Effect of spacing and genotypes on seed index of french bean :

The data presented in Table 1 indicated that significantly higher seed index (36.36, 37.05 and 36.71 g) recorded during both the years and pooled analysis, respectively in 45 ×10 cm and significantly lower (32.37, 32.99 and 32.68 g) seed index was observed in 30×10 cm spacing.

The data similarly presented that among the genotypes, Swarna Safal noted significantly higher seed index (40.53, 41.30 and 40.91 g) in both the years and in pooled analysis, respectively than remaining genotypes except Phule Rajma found at par in both the years and pooled. Tripura Rajma genotype recorded significantly lower seed index (30.30, 30.88 and 30.59 g) during both the years and in pooled analysis, respectively followed by HPR-35, Varun, IPR-98-31, RKR 1033 and RKR 1011-1. These variations in 100-seed weight among different cultivars might have been due to genotypic variations and at narrow spacing plants produced lighter seeds because of competition among plants for available nutrients, moisture and sun light which reduced 100-seed/ grain weight.

Effect of spacing and genotypes on seed yield of french bean :

The data offered in Table 3 clearly exhibited that significantly higher seed yield (1806, 1848 and 1827 kg/

Table 2 : Interaction effect of various spacing and genotypes on number of pods per plant at harvest

Treat.	No. of pods per plant at harvest								
	2019-20			2020-21			Pooled		
	S_1	S_2	Mean	S_1	S_2	Mean	S_1	S_2	Mean
G_1	4.31	5.84	5.07	4.41	5.94	5.18	4.36	5.89	5.12
G_2	3.75	3.94	3.85	3.84	4.04	3.94	3.79	3.99	3.89
G_3	4.69	5.94	5.31	4.80	6.04	5.42	4.75	5.99	5.37
G_4	4.22	5.16	4.69	4.32	5.25	4.79	4.27	5.21	4.74
G_5	4.10	4.50	4.30	4.20	4.61	4.41	4.15	4.56	4.35
G_6	4.04	4.44	4.24	4.14	4.55	4.34	4.09	4.49	4.29
G_7	4.68	5.86	5.27	4.80	5.97	5.38	4.74	5.92	5.33
G_8	3.77	4.13	3.95	3.86	4.23	4.05	3.82	4.18	4.00
G_9	3.77	4.07	3.92	3.86	4.17	4.01	3.81	4.12	3.96
G_{10}	3.79	4.17	3.98	3.88	4.27	4.08	3.83	4.22	4.03
G_{11}	4.74	6.12	5.43	4.86	6.23	5.55	4.80	6.18	5.49
Mean	4.17	4.93		4.27	5.03		4.22	4.98	
	S.E.±		0.24	S.E.±		0.24	S.E.±		0.17
	C.D. (P=0.05)		0.70	C.D. (P=0.05)		0.69	C.D. (P=0.05)		0.48

ha) recorded during both the years and pooled analysis, respectively in 45 ×10 cm and significantly lower (1635, 1673 and 1654 kg/ha) seed yield was observed in 30 × 10 cm spacing.

The data similarly presented that among the genotypes, Swarna Safal noted significantly higher seed yield (2157, 2208 and 2183 kg/ha) in both the years and in pooled analysis, respectively than remaining genotypes except Phule Rajma found at par in both the years and pooled, while GR-1 found at par in both the years.

The seed yield of french bean significantly affected by the interaction effect of spacing and genotype (Table 4). Accordingly, variety Swarna Safal showed the highest seed yield with 45×10 cm plant spacing which was at par with Phule Rajma and GR-1 at spacing of 45×10 cm in both the years and pooled analysis and the significantly lower seed yield was observed in Tripura Rajma-1 when sown on 30×10 cm spacing.

This might be due to higher number of pods plant^{-1}, a greater number of seeds pod^{-1}, number of seeds plant^{-1}, higher 100-seed weight and growth characters *viz.,* plant height, branches, LAI, dry matter accumulation resulting into higher seed yield and stover yield. Thus, these characters turned out to be the major components of seed yield. Such positive interrelationship between seed yield and these attributes has also been reported by Singh *et al*. (2000).

The plant population per unit area was the prime factor in determining the yield. It also indicated that the fewer yields per plant in case of high density were compensated by increased number of plants. Higher grain yield at closer spacing might be due to the higher plant population, there was increase in the proportion of number of pods produced more seed yield. Optimum row spacing plays an important role in contributing to the high yield because thick plant population will not get proper light for photosynthesis and can easily be attacked by diseases. Hence, the standardization of plant spacing is necessary. Singh (2000) proved that the decreasing plant spacing from 40 cm×20 cm to 40 cm×10 cm improved the yield

Table 3 : Effect of spacing and genotypes on yields and harvest index of french bean

Treat.	Seed yield (kg/ha)			Straw yield (kg/ha)			Harvest index (%)		
	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
Spacing (S)									
S_1	1635	1673	1654	2620	2681	2650	38.38	38.39	38.39
S_2	1806	1848	1827	2935	2984	2959	38.07	38.23	38.15
S.E.±	28.8	29.1	20.5	42.75	44.8	30.9	0.08	0.10	0.06
C.D. (P=0.05)	82.1	83.0	57.5	122.0	127.9	86.9	0.24	NS	0.18
Genotypes (G)									
G_1	1854	1898	1876	3044	3105	3075	37.89	37.96	37.93
G_2	1416	1449	1433	2343	2388	2365	37.66	37.77	37.71
G_3	2062	2110	2086	3262	3328	3295	38.76	38.82	38.79
G_4	1823	1866	1845	3001	3062	3032	37.83	37.90	37.87
G_5	1602	1640	1621	2578	2629	2603	38.33	38.42	38.38
G_6	1581	1618	1600	2547	2597	2572	38.30	38.40	38.35
G_7	1989	2035	2012	3191	3256	3223	38.42	38.53	38.48
G_8	1478	1513	1495	2404	2450	2427	38.06	38.15	38.11
G_9	1471	1506	1488	2409	2456	2433	37.89	37.98	37.93
G_{10}	1492	1527	1509	2409	2455	2432	38.23	38.33	38.28
G_{11}	2158	2208	2183	3363	3432	3397	39.11	39.18	39.15
S.E.±	67.5	68.2	48.0	100.3	105.1	72.5	0.19	0.23	0.15
C.D. (P=0.05)	192.7	194.7	134.9	286.2	299.9	203.7	0.55	0.66	0.43
S × G interaction									
S.E.±	95.5	96.5	67.9	141.8	148.6	102.5	0.274	0.329	0.214
C.D. (P=0.05)	272.5	275.4	190.8	404.7	424.1	288.1	NS	NS	0.601
CV%	9.6	9.5	9.6	8.84	9.09	8.95	1.240	1.486	1.369

NS=Non-significant

significantly without adversely affecting the pod quality. The highest net returns along with higher rate of net profit were also observed with the closest spacing. Sharma *et al*. (2008) reported that plant density did not affect the green pod yield. However, lower plant density at 45x10 cm spacing showed significant increase in pods/ plant compared to 30x10 cm spacing. Chakravorty *et al*. (2009) Moniruzzaman *et al.* (2009) and Malek *et al.* (2012) also reported that different spacing significantly influenced the various growth, yield attributes and pod yield in french bean.

Effect of spacing and genotypes on straw yield of french bean :

The data presented in Table 3 disclosed that significantly higher straw yield, (2934.92, 2983.74 and 2959.33 kg/ha) recorded during both the years and pooled analysis, respectively in 45 ×10 cm and significantly lower (2619.70, 2681.14 and 2650.42 kg/ha) straw yield was observed in 30 × 10 cm spacing.

The data similarly presented that among the genotypes, Swarna Safal noted significantly higher straw yield (3362.68, 3431.54 and 3397.11 kg/ha) in both the years and in pooled analysis, respectively than remaining genotypes except Phule Rajma, GR-1 found at par in both the years and pooled, while Phule Suyash found at par in 2nd year of experiment. Tripura Rajma genotype recorded significantly lower straw yield during both the years and in pooled analysis, respectively, followed by varun, IPR-98-3-1, HPR-35, RKR 1033 and RKR 1011-1.

The straw yield (kg/ha) of french bean significantly affected by the interaction effect of spacing and genotype (Table 5). Accordingly, variety Swarna Safal showed the highest straw yield with 45×10 cm plant spacing which was at par with Phule Rajma and GR-1 at spacing of 45 × 10 cm in both the years and pooled analysis and the significantly lower straw yield (kg/ha) was observed in Tripura Rajma-1 when sown on 30×10 cm spacing.

Higher straw yield was the result of the cumulative effects of enhanced growth and yield traits. Muthuramu *et al*. (2015) reported that, the maximum straw yield per hectare was recorded in Arka Anoop (28.5 q/ha) followed by Arka Suvidha (28.00 q/ha) and the lowest in Arka Komal (26.90 q/ha).

Effect of spacing and genotypes on harvest index :

The data presented in Table 3 showed that significantly higher harvest index (38.07 and 38.15%) recorded during 1st year and pooled analysis, respectively in 45 ×10 cm; but in 2nd year it was found non-significant. While, the significantly lower (38.38 and 38.39%) harvest index was observed in 30×10 cm spacing in 1st year and pooled analysis, whereas, in 2nd year it was found non-significant.

The data correspondingly presented that among the genotypes, Swarna Safal noted significantly higher harvest index (39.15%) in pooled analysis than remaining

Table 4 : Interaction effect of various spacing and genotypes on seed yield of french bean

Treat.	Seed yield (kg/ha)								
	2019-20			2020-21			Pooled		
	S_1	S_2	Mean	S_1	S_2	Mean	S_1	S_2	Mean
G_1	1670	2039	1854	1709	2086	1898	1690	2062	1876
G_2	1420	1412	1416	1453	1445	1449	1437	1429	1433
G_3	1871	2253	2062	1915	2305	2110	1893	2279	2086
G_4	1640	2007	1823	1678	2054	1866	1659	2030	1845
G_5	1600	1604	1602	1638	1642	1640	1619	1623	1621
G_6	1580	1583	1581	1617	1620	1618	1599	1601	1600
G_7	1800	2177	1989	1842	2228	2035	1821	2203	2012
G_8	1480	1476	1478	1515	1511	1513	1497	1494	1495
G_9	1467	1475	1471	1502	1510	1506	1485	1492	1488
G_{10}	1493	1490	1492	1528	1525	1527	1511	1508	1509
G_{11}	1964	2352	2158	2010	2407	2208	1987	2379	2183
Mean	1635	1806		1673	1848		1654	1827	
	S.E.±		95.46	S.E.±		96.49	S.E.±		67.87
	C.D. (P=0.05)		272.46	C.D. (P=0.05)		275.37	C.D. (P=0.05)		190.80

genotypes except Phule Rajma found at par in pooled analysis. Tripura Rajma genotype recorded significantly lower harvest index (38.39%) in pooled analysis, followed by HPR-35, SKAUSJ-WB 185, Varun, IPR-98-31, RKR 1033 and RKR 1011-1.

The harvest index didn't influence significantly by the interaction effect of spacing and genotype in individual years but affects significantly in pooled analysis (Table 6). Accordingly, variety Swarna Safal showed the higher harvest index with 45 × 10 cm plant spacing which was at par with RKR 1011-1, RKR-1033, at spacing of 45 × 10 cm in pooled analysis and the lowest harvest index was observed in Tripura Rajma-1 when sown on 30 × 10 cm spacing.

Conclusion :

On the basis of the present results, it could be concluded that spacing of 45×10 cm recorded

Table 5 : Interaction effect of spacing and genotypes on straw yield of french bean

Treat.	Straw yield (kg/ha)								
	2019-20			2020-21			Pooled		
	S_1	S_2	Mean	S_1	S_2	Mean	S_1	S_2	Mean
G_1	2683	3405	3044	2746	3485	3115	2714	3445	3080
G_2	2354	2331	2343	2409	2386	2398	2382	2359	2370
G_3	2920	3604	3262	2988	3688	3338	2954	3646	3300
G_4	2633	3370	3001	2694	3449	3072	2663	3410	3037
G_5	2581	2575	2578	2642	2635	2639	2612	2605	2608
G_6	2552	2542	2547	2611	2602	2607	2582	2572	2577
G_7	2846	3536	3191	2913	3618	3266	2879	3577	3228
G_8	2408	2400	2404	2465	2456	2460	2437	2428	2432
G_9	2405	2414	2409	2461	2470	2466	2433	2442	2438
G_{10}	2411	2406	2409	2468	2463	2465	2439	2435	2437
G_{11}	3024	3701	3363	3095	3788	3442	3060	3745	3402
Mean	2620	2935		2681	3004		2650	2969	
	S.E.±		141.8	S.E.±		148.6	S.E.±		102.9
	C.D. (P=0.05)		404.7	C.D. (P=0.05)		424.1	C.D. (P=0.05)		289.2

Table 6 : Interaction effect of spacing and genotypes on harvest index of french bean

Treat.	Harvest index (%)		
	Pooled analysis		
	S_1	S_2	Mean
G_1	38.38	37.41	37.89
G_2	37.62	37.71	37.66
G_3	39.04	38.48	38.76
G_4	38.36	37.3	37.83
G_5	38.29	38.37	38.33
G_6	38.24	38.37	38.3
G_7	38.79	38.09	38.44
G_8	38.05	38.06	38.06
G_9	37.87	37.9	37.89
G_{10}	38.24	38.23	38.23
G_{11}	39.39	38.84	39.11
Mean	38.39	38.07	
	S.E.±		0.21
	C.D. (P=0.05)		0.60

significantly higher yield attributes and yields *viz.,* number of pods per plant, number of seeds per pod, seed index, harvest index, seed and straw yield in french bean during 2019-20; 2020-21 and pooled analysis, respectively. In case of genotypes, result revealed that significantly higher yield attributes and yields was observed in Swarna Safal genotype during 2020, 2021 and in pooled analysis, respectively. This genotype was also found closely related to Phule Rajma and GR-1 during the years 2019-20, 2020-21 and in pooled analysis. This is concluded from interaction effect results that Swarna Safal (ICAR Ranchi) found significantly superior in various higher yield attributes and yields at 45×10 cm spacing under middle Gujarat conditions.

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