

EVALUATION OF DIFFERENT GENOTYPES OF FRENCH BEAN AT AGRICULTURE RESEARCH STATION, DAILEKH

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ABSTRACT

Seven genotypes of French bean (*Phaseolus vulgaris* L.) obtained from different sources were evaluated at Agriculture Research Station, Dailekh (1300 masl) during August 2008/09 and 2009/10. The genotypes viz; Trishuli, LB-37, LB-31, LB-33, Chaumase/Four Season, Dolpa Local and Salyan Local were experimented in RCBD with three replications in the field condition. Each of these genotypes was recorded for different parameters viz; days to flowering, days to podding, pod length, pod diameter, numbers of picking, harvest duration, number of seeds per pod, hundred seed weight, fresh pod yield and seed yield. Apart from these parameters, some visual observations on the morphology of plant parts were also taken. Two years mean results revealed the significant effect of genotypes on most of the parameters except numbers of fresh pod picking. Excluding LB-31, LB-33 and Dolpa Local, the remaining ones recorded the maximum green pod yields (ropani/kg) such as Trishuli (505 kg), Chaumase (449 kg), LB-37 (467 kg) and Salyan Local (430 kg) with at par fresh pod production. Similarly, those genotypes along with LB-31 were found as promising genotypes for seed production.

Key words: French bean, promising genotypes, pole type, fresh pod yield, seed yield

INTRODUCTION

French bean (*Phaseolus vulgaris* L.) belonging to the family Leguminosae is native of South America. It is domesticated in Mexico, Peru and Colombia about 8000 years ago (Schoonhoven and Voysest, 1991). It is widely cultivated in tropics, sub tropics and temperate regions. In Nepal and most of the tropical Asia, it is a major vegetable crop where indigenous pulses are also preferred (Kay, 1979, Duke, 1981 and Adams, 1985). French bean is consumed as immature tender fruits, green grains as vegetables and dry grain. It has some medicinal properties in control of diabetes, cardiac problems and natural cure for bladder burn. It has both carminative and reparative properties against constipation and diarrhoea respectively (Duke, 1981). French beans are nutritionally rich in vitamin A, vitamin C, iron and calcium which can contribute significantly to mixed diets (Kelly and Scott, 1992).

Bean is an important leguminous vegetable in Nepal. The area under bean is 10594 ha with a total production of 81781 mt and productivity of 7.72 t/ha (CBS, 2010). The consumption of leguminous vegetables in Nepal is only 3.14 kg/head per year. It has been estimated that leguminous vegetables share about 0.5% of the total agricultural GDP and 4.5% of the total GDP produced by vegetables. French bean can be successfully grown under orchards as an inter-crop and it thrives well under poor soil and management conditions. In the hills, numerous local varieties of beans are cultivated from summer to rainy season mostly mixed with the maize, both for green pods and grain for domestic consumption. However, the green pods of these varieties possess strings/ fibers which make them unattractive to the consumers in the urban market. Budhathoki *et al* (1991) suggested identifying fibreless marketable varieties suitable for green pods and grains and their planting times for different parts of hills. In the past, there had been many attempts to seek an appropriate alternative to present cultivated variety Kentucky wonder but found unsuccessful due to either narrow genetic base or discontinued effort (Lohar, 1992). The pole bean genotype 'Gulmi Local' produced the maximum seed yield (729.00 kg ha) in Agriculture Research Station, Dailekh during 1999-2000 (Annual Report, 2010). Agriculture Research Station, Lumle (2002) reported that the new pole type French bean Variety LB-37 was found moderately resistant to bean rust, high pod quality, photo-insensitive and having pod yield potential up to 12 mt/ha in river basin to high hills as sole cropping.

Varieties commonly grown in developing countries are introductions from temperate countries where breeding programmes are more advanced (Ndegwa *et al.*, 2007). French bean is short duration crop and can

successfully be grown under orchards as an inter-crop and as a sole crop. It thrives well under poor soil and management conditions. In the hills, numerous local varieties of beans are cultivated from summer to rainy season mostly mixed with the maize, both for green pods and grain for domestic consumption. In this paper it has been made attempt to evaluate different genotypes of French bean obtained from different sources at Agriculture Research Station, Dailekh.

MATERIALS AND METHODS

An experiment was conducted to know the performance of different genotypes of pole type French bean. Different seven genotypes of French bean were collected from Dailekh, Salyan, Dolpa and Lumle, Kaski and they were evaluated for fresh pod and seed production at ARS, Dailekh in 2009. The genotypes included in the study were: Trishuli, LB-37, LB-31, Chaumase (Four Season), LB-33, Dolpa Local and Salyan Local. Different seven genotypes of French bean were planted on 30th August, 2009 and 2010 (for fresh pod) and 31st August, 2009 and 2010 (for seed production) in 5 m x 1.5 m plot size at the spacing of 75 cm X 25 cm. It was maintained 2 seeds / hill during the planting of the seed. Farmyard manure was applied @ 600 kg/ropani and chemical fertilizers @ 2 kg N: 2kg P₂O₅:3kg K₂O/Ropani. Data regarding days to flowering, days to podding, pod length, pod diameter, number of picking, harvest duration, fresh pod yield, seed length, number of seeds/5 pods, 100 seed grain weight and seed yield were gathered and analyzed using Genstat 532-3 version software package.

RESULTS AND DISCUSSION

Days to flowering

Pooled analysis revealed that the genotypes differed significantly ($p < 0.001$). In comparison to other four genotypes, the three genotypes viz., 'Dolpa Local' 'LB-33' and 'Salyan Local' possessed considerably earlier days to flowering with 36.00, 35.83 and 36.67 days respectively. In contrast, two genotypes viz., LB-37 as well as Chaumase equally possessed the late in days to flowering with 41.67 and 40.50 days followed by Trishuli (39.10 days) and LB-31 (39.50 days) (Table 1).

Days to pod formation

Days to podding (DAP) varied significantly among the genotypes ($p < 0.001$). Pooled analysis revealed that it varied from 41.50 DAP to 51.83.00 DAP with a mean value of 47.45 DAP. For days to podding, the genotypes 'Salyan Local' as well as 'Dolpa Local' revealed significantly earlier than the rest of five genotypes. Conversely, the genotypes viz., Chaumase (51.83 DAP), LB-37 (51.33 DAP) and LB-31(51.13 DAP). The well known variety Trishuli gave pods in 47.33 days after planting (DAP) and it was at par with that of LB-33 (45.83 DAP) (Table 1).

Table 1: Performance of different genotypes of French bean at ARS, Dailekh

Genotypes	Parameters					
	Days to flowering			Days to podding		
	2009	2010	Pooled	2009	2010	Pooled
Trishuli	39.00	39.21	39.10	47.67	47.00	47.33
LB-37	41.00	40.33	40.67	51.67	51.00	51.33
LB-31	39.33	39.67	39.50	51.10	51.17	51.13
Chaumase	41.00	40.00	40.50	52.00	51.67	51.83
LB-33	36.33	37.00	36.67	46.00	45.67	45.83
Dolpa Local	35.67	36.33	36.00	43.00	42.00	42.50
Salyan Local	36.00	35.67	35.83	41.33	41.67	41.50
Mean	38.33	38.29	38.31	47.67	47.24	47.45
F-probability	<0.001			<0.001		
LSD	1.519			3.083		
CV%	3.3			5.5		

Pod length (cm)

Pod length also differed significantly among the genotypes ($p < 0.05$). Significantly longer pod length was possessed by the genotype LB-37 (18.37 cm). However, its pod length was at par with those of LB-31 (18.32

cm), Trishuli (16.73 cm) and Chaumase (16.03 cm). The shortest pod length was observed in the genotype Dolpa Local (13.60 cm) followed by Salyan Local (14.08 cm) and LB-33 (14.53 cm) (Table 2).

Pod diameter (cm)

Pod diameter was also observed to differ significantly among the genotypes ($p < 0.001$). Pooled analysis revealed that it varied from 4.35 cm to 3.15 cm with a mean value of 3.65 cm. Significantly higher pod diameter was possessed by the genotype Salyan Local (4.35 cm). Well known variety Chaumase recorded pod diameter of 3.74 cm which was at par with LB-37 (3.83 cm) and LB-31 (3.85 cm) and LB-33 (3.48 cm). The lowest pod diameter was possessed by Dolpa Local and well known variety Trishuli (3.15 cm in both genotypes) (Table 2).

Table 2: Performance of different genotypes of French bean at ARS, Dailekh

Genotypes	Pod length (cm)			Pod Diameter (cm)		
	2009	2010	Pooled	2009	2010	Pooled
Trishuli	16.93	16.53	16.73	3.10	3.20	3.15
LB-37	18.27	18.47	18.37	3.83	3.84	3.83
LB-31	18.30	18.33	18.32	3.90	3.80	3.85
Chaumase	16.13	15.93	16.03	3.73	3.74	3.74
LB-33	14.73	14.33	14.53	3.50	3.47	3.48
Dolpa Local	13.63	13.57	13.60	3.13	3.16	3.15
Salyan Local	14.40	13.77	14.08	4.40	4.30	4.35
Mean	16.06	15.85	15.95	3.66	3.64	3.65
F-probability			<0.021			<0.001
LSD			3.250			0.463
CV%			17.2			10.7

Numbers of picking: In all the genotypes (Trishuli, LB-37, LB-31, Chaumase, LB-33 and Salyan Local), it was possible to pick the fresh pods for 5 times except in Dolpa Local (4.67) with mean numbers of picking (4.95), however there was not significant variation among the genotypes ($p < 0.079$) (Table 3).

Harvest duration (days): Pooled analysis on harvest duration (days) showed that it varied significantly among the genotypes ($p < 0.001$). It varied from 22.33 days to 29.17 days with a mean value of 25.40 days. Significantly longer harvest duration was possessed by the genotype LB-33 (29.17 days) which was at par with Salyan Local (28.33 days). Well known variety Chaumase possessed the shortest harvest duration of 22.33 days which was at par with LB-37 (22.67 days) and LB-31 (22.83 days). The well known variety Trishuli was possible to harvest for 26.83 days and it was at par with Dolpa Local (25.67 days) and Salyan Local (28.33 days) (Table 3).

Green pod yield (kg/ropani): The fresh pod yield varied significantly ($p < 0.001$) from 247.00 kg/ropani to 505.00 kg/ropani with a mean value of 407.00 kg/ropani. Pooled analysis revealed that the genotype 'Trishuli' contributed to the highest fresh pod yield (505 kg/ropani) inconsiderably followed by LB-37 (467.00 kg/ropani), Chaumase (449.00 kg/ropani) and Salyan Local (430.00 kg/ropani). To the contrary, the genotype 'Dolpa Local' contributed to the least fresh pod yield (247.00 kg/ropani) (Table 3).

Table 3: Performance of different genotypes of French bean at ARS, Dailekh

Genotypes	Numbers of picking			Harvest Duration (Days)			Green pod yield (kg/ropani)		
	2009	2010	Pooled	2009	2010	Pooled	2009	2010	Pooled
Trishuli	5	5	5	26.67	27.00	26.83	496	513	505
LB-37	5	5	5	22.67	22.67	22.67	458	476	467
LB-31	5	5	5	23.00	22.67	22.83	355	373	364
Chaumase/	5	5	5	22.33	22.34	22.33	445	453	449
LB-33	5	5	5	29.33	29.00	29.17	379	389	384
Dolpa Local	4.7	4.7	4.7	26.33	25.00	25.67	227	268	247
Salyan Local	5	5	5	28.67	28.00	28.33	421	439	430
Mean	4.95	4.95	4.95	25.57	25.24	25.40	397	416	407
F-probability			0.079			<0.01			<0.01
LSD			NS			2.136			100.7
CV%			4.2			7.1			20.9

Seed length (mm): The seed length varied significantly ($p < 0.001$) among the genotypes. It varied from 10 mm to 15.58 mm with mean length of 13.37 mm. The length of seeds in four genotypes viz., Dolpa Local (15.58 mm), Trishuli (15.18 mm), LB-33 (15.03 mm) and LB-37 (14.22mm) were considerably maximum but significantly shortest seeds were noted in three genotypes viz., Chaumase (10.00 mm), LB-31 (11.83 mm), and Salyan Local (12.00 mm) (Table 4).

Number of seeds/5 pods: Pooled analysis revealed that the number of seeds per five pods varied significantly ($p < 0.001$) among the genotypes (Table 4). The maximum number of seeds per five pods was recorded by the genotype LB-37 (40.27). Two well known varieties Chaumase and Trishuli possessed 38.62 and 37.67 seeds respectively in five pods and they were at par with each other. The least seeds per five pods were given by Salyan Local (19.61) and it was followed by the genotypes Dolpa Local (31.63), LB-31 (33.23) and LB-33 (35.02).

Table 4: Performance of different genotypes of French bean at ARS, Dailekh

Genotypes	Seed length (mm)			Seeds/5pods		
	2009	2010	Pooled	2009	2010	Pooled
Trishuli	15.00	15.37	15.18	38.33	37.00	37.67
LB-37	14.00	14.43	14.22	40.33	40.20	40.27
LB-31	11.33	12.33	11.83	33.33	33.13	33.23
Chaumase	11.00	9.00	10.00	39.00	38.23	38.62
LB-33	15.00	15.07	15.03	35.33	34.70	35.02
Dolpa Local	15.67	15.50	15.58	31.61	31.60	31.63
Salyan Local	11.67	12.33	12.00	20.00	19.22	19.61
Mean	13.38	13.36	13.37	33.76	33.41	33.59
F-probability			<0.001			<0.001
LSD			2.304			1.591
CV%			14.5			4.0

Hundred seed weight (g): Different seven genotypes showed highly significant variation ($p < 0.001$) in hundred seed weight. Quite considerably the heaviest 100 seed weight was observed in Salyan Local (70.77 per 100 seed grain). The well known variety Chaumase had 28.08 g of 100 seed weight which was statistically at par with LB-31(29.88 g). Similarly another known variety Trishuli had 41.75 g of 100 grain weight and it was statistically at par with LB-33 (41.00 g) and LB-37 (43.60 g). The genotype Dolpa Local had 47.25 g of 100 seed grain weight and the mean 100 grain weight was recorded as 43.19 g (Table 5).

Seed yield (kg/ha): The parameter seed yield differed significantly ($p < 0.001$) among the genotypes. Among the genotypes included in the study, LB-31 became the heaviest seed yielder (1638.50 kg/ha) followed by Trishuli (1421 kg), Chaumase (1418 kg) and Salyan Local (1411.50 kg) and they were statistically at par with each other. The least seed was yielded by the genotype Dolpa Local (396.00 kg) followed by LB-33 (1149 kg) and LB 37 (1336 kg). The mean seed yield of the seven genotypes was recorded to be 1252.87 kg per hectare (Table 5).

Table 5: Performance of different genotypes of French bean at ARS, Dailekh

Genotypes	100 seed weight (g)			Seed yield (kg/ha)		
	2009	2010	Pooled	2009	2010	Pooled
Trishuli	41.33	42.17	41.75	1422	1419	1421
LB-37	43.33	43.87	43.60	1333	1339	1336
LB-31	29.33	30.43	29.88	1638	1639	1638
Chaumase	27.67	28.50	28.08	1342	1494	1418
LB-33	40.67	41.33	41.00	1133	1164	1149
Dolpa Local	47.67	46.83	47.25	318	474	396
Salyan Local	70.33	71.20	70.77	1398	1425	1411
Mean	42.90	43.48	43.19	1226	1279	1252
F-probability			<0.001			<0.001
LSD			2.712			230.7
CV%			5.3			15.7

Some visual observations on flower pod and seed

Two well known varieties, Trishuli and Chaumase possessed white flower colour. The genotypes LB-37 and LB-31 had pinkish white colours of flowers, while LB-33, Dolpa Local and Salyan Local possessed yellowish white, pinkish and slightly pink flowers respectively. The varieties Trishuli and Chaumase had green pod colour and two genotypes viz; LB-37 and LB-33 possessed light green pod colour. In LB-31, pods were green with slight pink stripes. Similarly, in Dolpa Local pods were green with light pink spots while it was reddish spots in case of Salyan Local. Seed colour in Trishuli and LB-37 was brown, while it was black in Chaumase and white in LB-33. The genotype LB-31 possessed brown seeds with black and white stripes, while there were reddish stripes in Dolpa Local and Salyan local. All the genotypes possessed kidney shaped seed except Salyan local. Salyan Local had some what round seeds (Table 6).

Table 6: Some visual observations on the morphology of different genotypes of French bean

Genotypes	Parameter			
	Flower colour	Pod colour	Seed colour	Seed shape
Trishuli	White	Green	Brown	Kidney
LB-37	Pinkish white	Light Green	Brown	Kidney
LB-31	Pinkish white	Green with slight pink stripes	Brown with black and white stripes	Kidney
Chaumase	White	Green	Black	Kidney
LB-33	Yellowish white	Light green	White	Kidney
Dolpa Local	Pinkish	Green with light pink spots	Brown with reddish stripes	Kidney
Salyan Local	Slightly pink	Green with reddish spots	Brown with reddish stripes	Roundish

CONCLUSION

In the evaluation of seven genotypes of French bean (Trishuli, LB-37, LB-31, LB-33, Chaumase, Dolpa Local and Salyan Local) obtained from different sources, significant effect of genotypes on most of the parameters except numbers of fresh pod picking. Excluding LB-31, LB-33 and Dolpa Local, the remaining ones recorded the maximum green pod yield (ropani/kg) such as Trishuli (505 kg), Chaumase (449 kg), LB-37 (467 kg) and Salyan Local (430 kg) with at par fresh pod production. Similarly, those genotypes along with LB-31 were found as promising genotypes for seed production also. It needs to be verified in similar other locations also.

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