Research Article

Evaluation of locally collected germplasm of common bean (*Phaseolus vulgaris* L.) for variability in morphological and yield characters in Swat valley

Ahmad Ali¹, Sher Aslam Khan², Naushad Ali², Sardar Ali², Izhar Hussain², Fazlullah², Hanif Raza², Fayyaz Ahmad³, Mehnaz Saleem⁴ and Attaullah⁵

1. Huazhong Agricultural University Wuhan, China

2. University of Haripur, Pakistan

3. Agriculture Research Institute (N) Mingora Swat, Pakistan

4. Agriculture Research station BaffaManshra, Pakistan

5. KPK Agriculture University, Pakistan

*Corresponding author's email: pbg_hu@yahoo.com

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Abstract

Common bean (*Phaseolus vulgaris* L.); an important legume crop across the globe but is a neglected crop in Pakistan. Morphological and yield characters were evaluated among nine common bean) accessions. These accessions were locally collected from remote valleys of Swat and studied during Kharif 2013 in a randomized complete block design with three replications. Different plant characteristics viz., 50% flowering, days to pod formation, days to maturity, pods plant per plant, pod length, seeds pod per pod, 100-seed weight, and yield per hectare were studied. All the traits were statistically different among all the accessions. Among the tested accessions A3LS matures early while A2TH was the late maturing (106 and 142 days respectively). The accessions “A8TS” out-yielded (2042.3 kg ha⁻¹) all the accessions and was followed by “A2TH” yielding 1968.3 kg ha⁻¹ dry seed production. Over all these genotypes may be further studied and can be used as potential lines in bean breeding programs to develop improved genotypes of common beans. However it is also recommended that “A8TS” and “A2TH” may be further evaluated for two or three seasons for yield stability and then recommended for general cultivation.

Key words: Common bean; Variability; Germplasm; Collection; Analysis of variance

Introduction

The common bean (*Phaseolus vulgaris* L.) is the most important food legume in the world [1]. French bean, dry bean, rajma bean, snap bean and kidney bean etc are also used

synonymously for common beans [2]. The major part of protein consumed by the poor comes from plant sources. Therefore having high protein contents, beans have imperative position in the human diet. It is an important

vegetable crops for human nutrition containing proteins, fibers, vitamins and minerals [3]. Like other legumes, they are also an important source of minerals particularly iron [4]. Common bean is important source of proteins, starch, dietary fiber, vitamins (especially the B group) and minerals (including potassium, iron, zinc, magnesium, manganese and molybdenum). Natural antioxidants especially anthocyanins are present in the bean [5]. It is the most important and widely cultivated pulse crop. It is also known as “grain of hope” being an important component of subsistence agriculture and provide food to about 300 million people in tropics and 100 million people in Africa alone [6]. In Pakistan, domestic production is less than its consumption due to which a large quantity is imported every year. It has a promising future in Pakistan which stresses the attempt to improve its yield through development of the high yielding varieties [7].

Success in any breeding program is dependent on the magnitude of variability present in the germplasm. Therefore, it is necessary to get information about the genetic variability of a population for breeding program [2]. There are many local bean land races types adapted to the regional conditions of Swat, cultivated by the local farmers of the valley. This indicates the potential of great genetic variability that has to be utilized in the breeding programs. The development of new varieties and passing the genetic resources to the following generations without infliction of erosion is only possible through preservation and protection of the present populations. The gene resources obtained from any species do not get included in breeding programs unless they are identified through characterization; even if they are included they are quickly lost [8]. Breeding for high yielding genotypes is important component of any approach aimed to improve the pulse situation at national and

international level. While in bean breeding programs, the breeders have utilized only a small proportion of the genetic variability [9]. The available natural genetic variations for most of the yield affecting characters in the beans are huge and substantial in this region and there is essential for the researchers/breeders to restructure these resources for improving the production and productivity [10]. Yield is the foremost important aspect to determining improvement of a crop. As with other food legumes; seed yield in common bean (*Phaseolus vulgaris* L.) being a quantitative character and is influenced by a number of yield contributing traits and factors. Therefore while; selecting desirable types should be based on yield as well as other yield components controlling parameters. Moreover, information on mutual association among yield and yield components is also indispensable for efficient utilization of the genetic resources in crop improvement program for this crop [11].

There is an urgent need to enhance the yielding ability of bean cultivars to make pulse cultivation a profitable venture. It also needed to characterize the local germplasm for the identification of best lines and preserving the germplasm for future use. Based on the above discussion, the present study was designed with the objectives to characterize the locally collected germplasm for genetic variability and to identify better performing lines for the inclusion national pulse improvement program.

Materials and methods

The present study was conducted in Swat, Khyber Pukhtunkhwa during Kharif 2013 on the farmer's fields. The experimental materials were comprised of nine locally collected types of common bean. The accessions were collected from different remote pockets of Upper Swat valley during spring 2013. The field was thoroughly prepared and laid out in randomized

complete block design with three replications. The sowing was done in June 2013. Data was recorded on the parameters including days to 50% flowering, days to pod formation, days to maturity, branches plant⁻¹, pods plant⁻¹, pod length, seed pod⁻¹, 100-seed weight and yield ha⁻¹. The recorded data were subjected analysis of variance using statistical package *Statistix* version 8.1. F-test was performed detect the significance of genotypic effect and LSD (0.05) was used for mean comparisons.

Results and discussion

Analysis of variance revealed that mean squares of the genotypes for days to 50% flowering, days to pod formation, days to maturity, number of branches plant⁻¹, pods plant⁻¹, pod length, seed pod⁻¹, 100 seed weight and yield ha⁻¹ were significant at alpha level 0.01 and 0.05 (Table 1). Ahmad and Kalamuddin[12], Fivawo and Msolla[13],

Gulparvar and Pirbalouti[14], Nechiforet *et al.*, [11], Sofi *et al.*, [6], Trindade *et al.*, [15], Krause *et al.*, [16], Roy *et al.*, [17], Rafi and Nath[2], Rai *et al.*, [10] and Teixeira *et al.*, [18] had reported similar results. Days to 50% flowering revealed significant differences among the tested accessions and ranged between 39.66 and 57.66 days (Table 2). These results agree with the results of Fivawo and Msolla[13], Madakbas and Ergin[8] and Krause *et al.*, [16], who reported significant differences for this character. Days to pod formation revealed significant differences among the tested accessions and ranged between 45.66 and 68 days. Days to maturity revealed significant differences among the tested accessions and ranged between 107.67 and 142 days (Table 2). Fivawo and Msolla[13], Sofi *et al.*, [6], Krause *et al.*, [16] and Rafi and Nath[2] have also reported similar results.

Table 1. Analysis of variance for 9 traits of common bean (*Phaseolus vulgaris* L.)

Sov	Df	Days to 50% flowering	Days to pod formation	Days to maturity	Branches plant ⁻¹	Pods plant ⁻¹	Pods length	Seed pod ⁻¹	100 seed weight	Yield ha ⁻¹
Reps	16	9.000	4.111	9.481	0.40001	1.9813	0.26351	0.01219	13.129	14931
GMS		93.0833*	219.667*	499.704*	3.93488*	43.1272*	2.84810*	0.58277*	813.130*	19836*
EMS		4.0833	8.028	7.106	0.26038	0.7592	0.1047	0.74092	41.513	3934
F value		22.80	27.36	70.32	15.11	56.80	16.71	7.78	19.59	50.42

*significant at alpha 0.05

Number of branches plant⁻¹ revealed significant differences among the tested accessions and ranged between 4.12 and 7.26. Number of pods plant⁻¹ revealed significant differences among the tested accessions and ranged between 22.73 and 12.08 (Table 2). The present results are in agreement with the results of Ahmad and Kalamuddin[12], Fivawo and Msolla[13], Nechiforet *et al.*, [11], Sofi *et al.*, [6], Roy *et al.*, [17], Rafi and Nath[2] and Rai *et al.*, [10]. Pod length revealed significant differences

among the tested accessions and ranged between 8.34 and 11.43 cm (Table 2). Sofi *et al.*, [6], Madakbas and Ergin [8]. Krause *et al.*, [16], Rafi and Nath [2], Roy *et al.*, [17] and Rai *et al.*, [10] has also reported similar results for this character.

Number of seeds pod⁻¹ revealed significant differences among the tested accessions and ranged between 5.23 and 6.44 seeds (Table 2). Fivawo and Msolla[13], Nechiforet *et al.*, [11], Sofi *et al.*, [6], Krause *et al.*, [16] and Roy *et al.*, [17] also obtained similar results

for seed pod⁻¹. 100 seed weight revealed significant differences among the tested accessions and ranged between 22.36 and 69.33 gram (Table 2). Similar results had also been reported by Ahmad and Kalamuddin [12], Fivawo and Msolla [13], Nechiforet al., [11], Sofi et al., [6] and Roy et al., [17] for

100-seed weight. Seed yield ha⁻¹ revealed significant differences among the tested accessions and ranged between 1380.8 and 2042.3 kg ha⁻¹ (Table 2). Ahmad and Kalamuddin [12] and Sofi et al. [6] had also reported significant differences for this trait.

Table 2. Mean values of 9 traits of common bean (*Phaseolus vulgaris* L.)

Accessions	Days to 50% flowering	days to 50% flowering g	Days to maturity	Branches plant ⁻¹	Pods plant ⁻¹	Pods length	seed pod ⁻¹	100 seed weight	Yield ha ⁻¹
A1CH	53.33 B	67.33 A	138.67 A	6.80 AB	14.66 D	9.37 CD	6.16 A	28.40 C	1478.0 EF
A2TH	57.66 A	68.00 A	142.00 A	7.26 A	19.68 B	10.53 B	6.05 AB	69.33 A	1968.3 AB
A3LS	43.33 C	46.33 C	106.00 D	5.53 CD	22.73 A	9.68 C	6.00 ABC	30.10 C	1803.3 C
A4LS	44.66 C	48.66 BC	123.67 B	4.66 DEF	12.08 E	8.78 DE	5.23 D	34.83 BC	1622.7 D
A5LS	45.33 C	52.66 B	107.67 D	4.22 F	21.42 A	9.84 BC	6.44 A	22.36 C	1402.3 EF
A6LS	44.66 C	49.66 BC	113.00 C	5.13 DE	19.79 B	9.77 C	6.38 A	34.33 BC	1380.7 F
A7LS	45.00 C	49.66 BC	116.00 C	4.60 EF	12.97 E	11.43 A	5.61 BCD	50.63 AB	1912.3 B
A8TS	43.33 C	49.00 BC	124.00 B	6.26 BC	19.88 B	8.34 E	5.53 CD	63.40 A	2042.3 A
A9PS	39.66 D	45.66 C	112.33 C	4.12 F	18.13 C	8.62 E	5.38 D	32.96 BC	1494.0 E
LSD	3.4977	4.9042	4.6142	0.8832	1.5082	0.7147	0.4738	18.729	108.57
CV (%)	4.36	5.35	2.21	9.45	4.86	4.30	4.66	15.83	3.74

Authors' Contribution

Conceived and designed the experiments: A Ali & SA Khan, Performed the experiments: A Ali, F Ahmad, Attaullah & Fazlullah, Analyzed the data: A Ali, M Saleem & S Ali, Contributed reagents/materials/analysis tools: A Ali, I Hussain, N Ali & H Raza. Wrote the paper: A Ali.

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