Plant Archives Vol. 26, No. 2, 2026 pp. 2389-2396 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2026.v26.no.2.327

PERFORMANCE EVALUATION OF BROAD BEAN (*Vicia faba* L.) GENOTYPES FOR GROWTH, QUALITY AND YIELD TRAITS UNDER AGROCLIMATIC CONDITIONS OF LUCKNOW

Dilkush Meena[1*], Deepa H. Dwivedi[1], Kaustubh Y. Deshmukh[2], Sarjesh Kumar Meena[1], Tendul Chouhan[1] and Atul Dhakad[1]

[1]Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Vidya-Vihar, Raebareli Road, Lucknow- 226025 (U.P.), India.

[2]Department of Fruit Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola- 444104. (M.H.), India.

*Corresponding author E-mail: dkagri306@gmail.com

(Date of Receiving-21-07-2026; Date of Revision-08-09-2026; Date of Acceptance-20-09-2026)

ABSTRACT

In order to evaluate the growth, yield and quality parameters for selecting superior genotypes, a field experiment was carried out during rabi season in the year 2022-23, at the Research Farm-1, Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Vidya-Vihar, Raebareli Road, Lucknow 226025 (U.P.). The course of investigation comprised of 18 different genotypes of exotic collection borrowed from ICAR-IIVR, laid out in randomized block design. The findings resulted into significant differences with respect to growth, yield and quality traits among the evaluated genotypes. The findings of this study hold significant implications for future breeding programs that can be successfully exploited for selection of superior genotypes with specific trait of importance.

***Key words*:** Broad bean, genotypes, growth, quality, yield, correlation

Introduction

Broad bean (*Vicia faba* L.), a rabi season legume crop with a chromosomal number of (2n=12), is cultivated on across approximately three million hectares globally (Link *et al*., 1999). It is commonly known as faba bean, horse bean, pigeon bean, field bean or bell bean and is referred to as Kala matar or Bakla in India (Singh *et al*., 2013). While its origin is debated, suggests that broad bean likely originated in West or Central Asia rather than Egypt Cubero (1974). The crop is widely consumed as a vegetable in fresh, dried or tinned forms and is an integral part of traditional diets in the Middle East, Mediterranean regions, China and Ethiopia.

Broad bean ranks as the fourth most important legume crop worldwide, next to dry bean, dry pea and chickpea due to its extensive cultivation in temperate and subtropical regions. It is a rich source of plant protein, containing 27–34% protein (Haciseferogullari *et al*., 2003), making it an affordable substitute to meat and fish protein, especially in low-income populations. The plant is sturdy and bushy, reaching up to 4 feet in height, with square stems, compound leaves and distinctive white flowers marked with black or brown spots. Its pods, varying between small- and large-seeded cultivars, contain flat, oval seeds measuring 3 to 6 per pod.

Broad bean thrives as a winter annual in warm temperate and subtropical regions. It can tolerate temperatures as low as 15°C, with an optimal growth range of 18–27°C. The crop is adaptable to various soil types, though it performs best in rich loamy soils. Ideal rainfall for cultivation ranges between 650–1000 mm per year, and it can be grown from sea level to high altitudes. Depending on the cultivar and climatic conditions, the maturation period varies between 90 and 220 days.

Despite its nutritional and agronomic significance, broad bean has historically received limited research

attention. However, interest in its genetic improvement has been rising, driven by its high protein content and yield potential (Pala *et al*., 2000). Soil fertility constraints, particularly nitrogen deficiency, acts as major limiting factor in its production. While chemical fertilizers can enhance productivity, their high cost and environmental concerns seeks alternative source of nutrient. Biological nitrogen fixation, facilitated by Rhizobium-legume symbiosis and vesicular arbuscular mycorrhiza (VAM), has been reported to have synergism with enhanced productivity (El-Wakeil and El-Sebai, 2007).

Genetic variability is fundamental step for breeding programs aimed at improving broad bean agronomic and nutritional quality. However, limited genetic diversity in its gene pool poses a challenge. Breeders rely on techniques such as hybridization, mutation breeding, and polyploidy breeding to enhance genetic variability. The success of a breeding program depends on selecting genetically diverse parents with high adaptability and yield potential. Furthermore, correlation studies between yield and its components help in identifying key traits influencing productivity (Yadav *et al*., 2020).

The degree of heritable variability in any breeding material is the most essential aspect since it influences response to selection. As a result, the presence of sufficient genetic variety is a prerequisite for all crop improvement programmes. Crop breeders may improve any crop by using the right breeding approach if they know how much variability and heritability. The degree of variety available in the gene pool (or) germplasm would be used to identify the source material for genetic improvement. This involves a single-environment evaluation of the assemblage for distinct needs. As a result, the yield and yield quality genetic potential of genotypes was investigated.

Therefore, assessment of germplasms under the prevailing agroclimatic conditions is necessary for selecting the improved genotypes in breeding programme. The present study aimed to evaluate the genetic variability amongst the collection of broad bean accessions for the selection of superior genotype.

Material and Method

The present investigation entitled, 'Studies on genetic variability of broad bean (*Vicia faba* L.)', was carried out during Rabi season, year 2022-2023 at the Research Farm-1, Department of Horticulture, Babasaheb Bhimrao Ambedkar University Vidya-Vihar, Raebareli Road, Lucknow-226025 (Uttar Pradesh) located at an altitude of 111 meter above mean sea level (MSL) at latitude 26' 50 N and longitude 80' 52 E, distinguished in 5th Agro-climatic zone of Uttar Pradesh by ICAR. The 18 genotypes were planted in a randomized block design with three replications at planting distance of 45 cm row to row and 15 cm plant to plant.

The number of seedlings which emerged in each replication in each treatment were a counted at days after sowing and divided by number of seeds sown resulted into germination percentage. Three randomly selected plants from each replication in each treatment were used to determine plant height, number of branches per plant, number of pods per plant, the number of seed per plant. Plant height is distance measured from the ground level to the tip of the topmost fully formed leaf with the help of measuring scale expressed in centimetres, number of branches per plant were counted and average was expressed at the time of maturity, pods were counted and average was computed for number of pods per plant, seeds were threshed, counted and averaged to express the number of seed per plant. Number of days from the date of seeding and the arrival of first flowering, arrival of 50% flowering, arrival of first fruit, total maturity (When 90% of the plants were straw-coloured and the pods were completely dry) in each replication in each treatment was counted and tabulated headed under days to first flowering, days to 50% flowering, days to first fruit set, days to maturity respectively. Five pods were selected randomly from each line and their length was recorded in centimetres with the help of a meter scale and averaged to record the mean pod length, diameter was recorded in millimetre (mm) with the help of a Vernier callipers and averaged to record the mean pod diameter. For 100 seed weight (gm) a sample of fully matured and well developed cleaned 100 seeds were taken from bulk seeds of 3 randomly selected plants and weighed with the help of an electronic balance. Five randomly selected plants from each entry were taken and their seeds thrashed, winnowed and then weighed and averaged to record average seed yield per plant in gram.

Well-developed fully matured green pod was taken from the field and the juice was extracted from the selected pods. A drop of juice was placed over the prism in the digital refractometer under room temperature conditions (24^{o}C). TSS (^{o}Brix) was recorded for the five fruits for each genotype separately and Total soluble solids content of fruit was calculated to mean, the extracted juice was titrated against N/10 NaOH using phenolphthalein as an indicator Using the water displacement method, the volume of the pod was determined. Water was poured into a wide mouth jar to the brim. The runoff water was collected and measured using a measuring cylinder. Three pods were immersed

in the jar. The average results were determined and expressed in millilitres of pod volume. Specific gravity of Broad bean pod was computed using formula, Specific gravity (g/cc) = weight of pod (gm)/volume of pod (ml)

The experimental data collected in respect of 23 characters on 18 broad bean genotypes was compiled by taking the mean values of selected plants in each plot were subjected for statistical analysis (Panse and Sukhatme, 1985). Correlation analysis for quantitative traits of evaluated Broad bean genotypes was done using GRAPES software (Gopinath *et al*., 2020). Pearson correlation coefficient was used to determine correlation between variables.

Result and Discussion

Germination percentage

The germination percentage of seeds among the genotypes depicted in Table 1 collected from ICAR-IIVR, Varanasi under study ranged from 44.99% to 93.88%, with an overall mean performance of 71.31, EC-841580 exhibited highest germination (93.88) followed by EC-841571 (86.91) while, minimum germination recorded in EC-841587 (44.99). These findings are consistent with results reported by Singh and Bharadwaj (2015) and Kumar *et al*., (2017).

Plant height (cm)

The plant height (Table 1) showed wide variation among 18 genotypes, ranged from 67.55 to 101.99, with an overall mean performance of 82.97 on the basis of mean performance, the shortest plant height was observed in EC-841617 (67.55) whereas, maximum plant height was recorded in EC-628934 (101.99) followed by EC-841595 (99.89). These findings are in accordance with studies reporting a positive relationship between

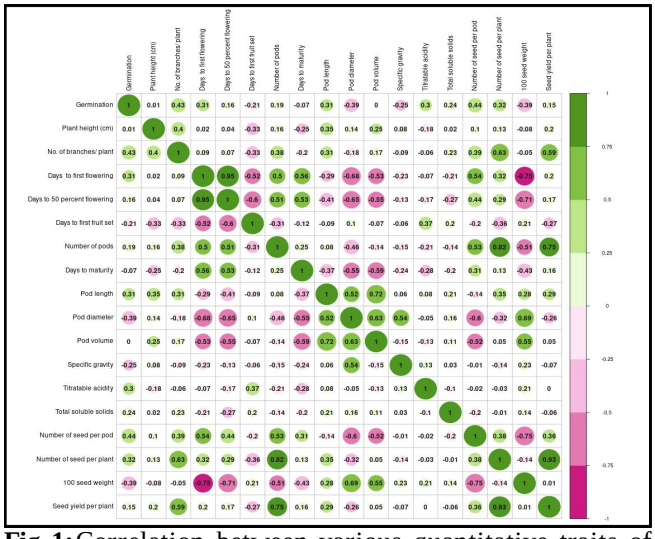


Fig. 1: Correlation between various quantitative traits of evaluated Broad bean genotypes.

vegetative and yield traits in broad bean (Singh *et al*., 2013; Shrifi, 2014; Ammar *et al*., 2015, Ahmed *et al*., 2016; Kumar *et al*., 2017; El-Sayed *et al*., 2020 and Kumar *et al*., 2026) and Raja *et al*., 2023)

Number of branches per plant

The data presented in Table 1 reveals that, number of branches per plant varied from 3.61 to 6.66, with a mean of 5.26, the minimum branches was recorded in EC-841532 (3.61) followed by EC-841603 (3.71) while, the maximum number of branches were recorded in EC-628940 (6.66), EC-841580 (6.66) followed by EC-628934 (6.31) and EC-841563 (6.21). These outcomes are in conformity with results reported by Ahmed *et al*., 2016; Lourembam *et al*., 2022; Raja *et al*., 2023 and Kumar *et al*., 2026.

Days to first flowering

The tabular data in Table 1 depicts that, the days to first flowering varied from 48.75 to 68.30, on the basis of mean performance 58.90, the earlier flowering appeared in EC-841577 (48.75), followed by EC-628930 (50.77), EC-841579 (51.21) whereas, the days to first flowering in EC-841540 (68.30) occurred at last. Similar findings were reported by Kumar *et al*., (2026).

Days to 50% flowering

The data showed in Table 1 suggests that, the days to 50% flowering varied from 50.11 to 70.87, with an overall mean performance of 61.71 in context to mean performance, the earliest 50% flowering was observed in EC-841577 (50.11) followed by EC-628930 (52.42) whereas, the 50% flowering occurred very late in EC-628940 (70.87) followed by EC-841540 Akin results focusing on early maturity and yield stability has been documented by Bakry *et al*., (2016); Kumar *et al*., (2026); Ahmed *et al*., (2016); Singh *et al*., (2017); Lourembam *et al*., (2022) and Raja *et al*., (2023).

Days to first fruit set

Days to first fruit set from flowering ranged from 13.74 to 25.11, with an overall mean performance of 20.09. On the basis of mean performance, the earlier days to first fruit setting from flowering was recorded in EC-628940 (13.74) and EC-841540 (13.77) followed by EC-841580 (15.12), whereas, the days to first fruit setting from the flowering in EC 591828 (25.11) followed by EC-628930 (23.78) occurred at last. (Table 1) These results aligns with the findings of Kumar *et al*., (2026).

Number of pods per plant

The data in Table 1 depicts that, the number of pods per plant varied from 5.11 to 20.58, with a mean performance of 11.46, the minimum number of pods per

Table 1: Growth characters of broad bean and their mean performance.

S.N.	Genotypes	GM	PH	NBP	DFF	DF	DFFS	NPP	DM
1	EC-841540	65.86	82.89	4.80	68.30	70.44	13.77	9.88	132.45
2	EC-628934	71.08	101.99	6.31	59.88	61.44	20.47	15.87	125.11
3	EC-841595	77.88	99.89	5.88	56.15	59.87	15.74	12.45	118.77
4	EC-628940	78.09	89.88	6.66	65.99	70.87	13.74	20.58	126.77
5	EC-1521	69.45	76.85	5.31	58.22	60.43	21.46	11.78	129.11
6	EC-841532	61.55	70.66	3.61	59.99	64.11	22.25	16.87	126.77
7	EC-841587	44.99	93.99	4.61	58.87	62.43	21.75	9.65	122.42
8	EC-591828	75.55	83.89	5.31	59.54	62.43	25.11	10.22	126.77
9	EC-841577	70.88	82.56	5.99	48.75	50.11	22.12	9.22	112.44
10	EC-841580	93.88	80.25	6.66	66.35	66.77	15.12	15.54	123.45
11	EC-841563	68.87	85.66	6.21	57.97	61.42	22.12	14.65	112.44
12	EC-841597	69.55	73.66	4.51	62.57	64.45	20.12	13.54	121.44
13	EC-841603	81.55	80.56	3.71	61.54	62.12	21.45	11.33	124.45
14	EC-841617	76.84	67.55	5.72	55.11	59.13	23.12	9.65	125.11
15	EC-628939	53.52	70.99	4.77	54.88	57.87	22.75	7.81	128.44
16	EC-841579	57.94	85.24	4.65	51.21	58.75	16.79	5.11	115.11
17	EC-628930	79.26	85.02	4.71	50.77	52.42	23.78	6.54	119.12
18	EC-841571	86.91	81.99	5.25	64.09	65.78	19.88	5.66	119.44
	Mean	71.31	82.97	5.26	58.90	61.71	20.09	11.46	122.76
	Range	44.99-93.88	67.55-101.99	3.61-6.66	48.75-68.30	50.11-70.87	13.74-25.11	5.11-20.58	112.44-132.45
	SE(d)±	2.40	2.88	0.20	2.11	2.33	0.74	0.44	4.56
	C.D. at 5%	4.89	5.89	0.41	4.31	4.75	1.51	0.90	9.31
	CV (%)	4.12	4.26	4.63	4.39	4.62	4.51	4.70	4.54

GM: Germination%; PH: Plant height (cm); NBP: No. of branches/ plant; DFF: Days toFirst flowering; DF: Days to 50% Flowering; DFFS: Days to first fruit set; NPP: Number of podsper plant; DM: Days to maturity

plant occurred in EC-841579 (5.11) followed by EC-841571 (5.66) and 628930 (6.54) whereas, highest number of pods were recorded in EC-628940 (20.58) followed by EC-841532 (16.87). Similar findings corroborate the results reported by Alghamdi (2009), Mahmoud *et al*., (2018), Kumar *et al*., (2026) and Ammar *et al*., (2015).

Days to maturity

Days to maturity (Table 1) varied from 112.44 to 132.45, with an overall mean performance of 122.76. Genotype EC-84177 matured earlier (112.44) by 20 days followed by EC-841563 (112.44) and EC-841579 (115.11) whereas, the maximum days to maturity was observed in EC-841540 (132.45) followed by EC-1521 (129.11) and EC-628939 (128.44). Earliness is desirable character in legume vegetables in order to fetch higher returns in early season. This result is consistent with the findings of Ammar *et al*., (2015); Ahmed *et al*., (2016); Singh *et al*., (2017); Sheelamary *et al*., (2015) and Kumar *et al*., (2026).

Pod length (cm)

The data in Table 2 depicts that, Pod length of studied genotypes ranged from 5.67 to 9.39 with an overall mean performance of 6.82. The minimum pod length was found in genotype EC-841587 (5.67), followed by EC-841563 (6.07) significantly, maximum pod length was observed in genotype EC-841577 (9.39) followed by EC-628934 (8.41). Larger pod size is an important quality attribute influencing market preference and yield. Comparable results in pod traits have been earlier reported by Suso *et al*., (1996); Shrifi (2014); Sheelamary *et al*., (2015); Singh and Bharadwaj (2015) El-Naim *et al*., (2017); Singh *et al*., (2017); Lourembam *et al*., (2022) and Kumar *et al*., (2026).

Pod diameter (mm)

The data presented in Table 2 showed that, pod diameter varied from 11.99 to 18.47 with a mean of 15.00, the genotype EC-628940 recorded minimum pod diameter (11.99) followed by EC-591828 (12.88) whereas, maximum pod diameter was exhibited by genotype EC-841577 (18.47) followed by EC-841579 (18.19). (Table 4.2.2) The results of this study are in complete accord with Ghobary and Mohamed (2014) and Kumar *et al*., (2026).

Pod volume (ml)

Pod volume (Table 2) showed greater variation ranging from 24.06 to 55.09 with a mean performance of

Table 2: Mean performance of broad bean for pod quality traits.

Sr. No.	Genotypes	Pod length (cm)	Pod diameter (mm)	Pod volume (ml)	Specific gravity	Titratable acidity	Total soluble solids
1	EC-841540	6.31	14.63	30.09	0.77	0.37	6.05
2	EC-628934	8.41	16.42	26.09	1.21	0.48	7.65
3	EC-841595	7.84	16.37	45.08	0.99	0.39	7.45
4	EC-628940	6.35	11.99	24.09	0.87	0.41	7.91
5	EC-1521	6.31	12.99	25.09	0.78	0.38	5.99
6	EC-841532	6.84	14.77	28.09	0.97	0.49	6.55
7	EC-841587	5.67	14.67	26.05	0.96	0.57	5.81
8	EC-591828	6.27	12.88	24.09	0.82	0.59	5.99
9	EC-841577	9.39	18.47	55.09	0.84	0.54	7.89
10	EC-841580	7.31	12.94	25.09	0.99	0.66	5.59
11	EC-841563	6.17	14.77	32.09	0.89	0.48	7.38
12	EC-841597	6.11	15.54	24.11	1.16	0.51	6.36
13	EC-841603	7.27	14.69	30.09	0.88	0.59	6.48
14	EC-841617	6.18	14.37	27.09	0.98	0.56	7.68
15	EC-628939	6.17	16.53	24.09	1.14	0.46	8.59
16	EC-841579	6.71	18.19	32.08	1.31	0.51	5.42
17	EC-628930	6.59	15.32	28.07	0.93	0.54	8.39
18	EC-841571	6.77	14.38	24.06	0.99	0.56	9.38
	Mean	6.82	15.00	29.47	0.97	0.51	7.03
	Range	5.67-9.39	11.99-18.47	24.06-55.09	0.77-1.31	0.37-0.66	5.42-9.38
	SE(d)±	0.25	0.53	1.18	0.04	0.02	0.26
	C.D. at 5%	0.51	1.08	2.40	0.07	0.04	0.53
	CV (%)	4.47	4.33	4.89	4.45	4.68	4.48

29.47. The minimum pod volume was found in genotype, EC-841571, EC-628939, EC-841597, EC-591828, EC-628940 (24ml), followed by EC-841580 (25ml) whereas, maximum pod volume was observed in genotype EC-841577 (55ml) followed by EC-841595 (Table 4.2.2). This observation echoes the conclusions drawn by Kumar *et al*., (2026).

Specific gravity (g/cc)

Data depicted in Table 2 suggests that, the specific gravity varied from 0.77 to 1.31 with an overall mean performance of 0.97. On the basis of mean performance, the minimum specific gravity was found in genotype EC-841540 (0.77) whereas, maximum specific gravity was observed in genotype EC-841579 (1.31) followed by EC-628934 (1.21). Variability in specific gravity and related traits in faba bean has also been reported by Ghobary and Mohamed (2014) and Kumar *et al*., (2026).

Titratable acidity (g/l)

The data presented in Table 2 reveals that, the titratable acidity varied from 0.37 to 0.66 with an overall mean performance of 0.51. On the basis of mean performance, the minimum titratable acidity was found in genotype EC- 841540 (0.37), while, maximum titratable acidity was recorded in genotype EC-841580 (0.66). Similar differences in titratable acidity of broad bean pods have been reported by Yadav *et al*., (2020) and Kumar *et al*., (2026).

Total soluble solids

Total soluble solids (Table 2) varied from 5.42 to 9.38 with an overall mean performance of 7.03. On the basis of mean performance, the minimum TSS was found in genotype EC-841579 (5.42). followed by EC-841580 (5.59) and EC-841587 (5.81) whereas, maximum TSS were observed in EC-841571 (9.38) followed by EC-628939 (8.59) and EC-628930 (8.39). Similar variation in terms of quality traits has been discussed earlier by Ghobary and Mohamed (2014); Singh *et al*., (2017); Yadav *et al*., (2020) and Kumar *et al*., (2026).

Number of seed per pod

The data depicted in Table 3 reveals that, the number of seed per pod ranged from 1.89 to 3.99, with a mean performance of 2.92. On the basis of mean performance, the minimum number of seed per pod was found in genotype EC-841577(1.89), followed by EC-841579 (2.28) and EC-841617 (2.48), whereas, maximum number of seed per pod were observed in genotype EC-841580 (3.99) and EC-1521 (3.88) followed by EC-841597(3.49) and EC-828934 (3.52). This study confirms the earlier

work of Aziz and Osman (2015); Ahmed *et al*., (2016); Suso *et al*., (2016); Khan *et al*., (2019); Lourembam *et al*., (2022); Raja *et al*., (2023) and Kumar *et al*., (2026).

Number of seed per plant

Number of seed per plant (Table 3) varied from 11.99 to 60.15, with an overall mean performance of 29.95. The minimum number of seed per plant was found in genotype EC-841579 (11.99), followed by EC-841571 (14.48) whereas, maximum number of seed per plant were observed in genotype EC-628940 (60.15) followed by EC-841580 (55.27). These findings are in close agreement with earlier studies revealing that, seed number is major yield determinants of broad bean accord to Suso *et al*., (2016); Mahmoud *et al*., (2018); Khan *et al*., (2019) and Kumar *et al*., (2026).

100 seed weight (gm)

The data of 18 genotypes presented in Table 3, under course of investigation showed wide variation of 100 seed weight ranging from 38.67 to 110.31, with an overall mean performance of 61.22. On the basis of mean performance, the minimum 100 seed weight was recorded in genotype EC-1521(38.67gm) followed by EC-841571(43.67 gm) whereas, the maximum 100 seed weight observed in EC-841577 (110.31gm) followed by EC- 841579 (87.38 gm). The cumulative effect of seed weight on yield and market value in broad bean has also been addressed earlier by Shrifi (2014); Singh *et al*., (2017) Khan *et al*., (2019); Lourembam *et al*., (2022); Raja *et al*., (2023) and Kumar *et al*., (2026).

Seed yield per plant

The data in Table 3 showed that, the seed yield per plant varied from 6.59 to 29.59 with a mean performance of 16.96. The minimum seed yield per plant was recorded in genotype EC-841571 (6.59) followed by EC-841579 (8.99) whereas, the maximum seed yield per plant observed in EC-628940 (29.59) followed by EC-841580 (26.75). Similar inferences with respect to cumulative effect of yield attributes on seed yield had been investigated by Alghamdi (2009); Aziz and Osman (2015); Kumar *et al*., (2017); Singh *et al*., (2017); Raja *et al*., (2023) and Kumar *et al*., (2026).

Correlation analysis

Correlation analysis among sixteen quantitative traits was conducted to assess the nature and magnitude of association between seed yield and its component traits, and to identify reliable selection indices for genetic improvement. Seed yield per plant exhibited a highly significant and strong positive correlation with number of seeds per plant (r = 0.93) and number of pods (r = 0.75), confirming these as the most important direct determinants of yield. Moderate positive associations were recorded with number of branches per plant (r = 0.59) and number of seeds per pod (r = 0.36). Weak positive correlations were observed with plant height (0.20), days to 50% flowering (0.17), days to maturity (0.16), and germination (0.15), while weak negative correlations were noted with days to first fruit set (-0.27) and pod diameter (-0.26). Quality traits such as pod volume, specific gravity, titratable acidity, total soluble solids, and 100-seed weight showed negligible association with yield.

Table 3: Mean performance of broad bean (*Vicia faba* L.) for yield parameters.

Sr.	Genotypes	NSPP	NSP	SW	SYP
1	EC-841540	2.51ss	23.19	51.29	11.89
2	EC-628934	3.52	46.49	48.88	23.78
3	EC-841595	2.88	26.91	59.58	17.28
4	EC-628940	3.28	60.15	46.38	29.59
5	EC-1521	3.88	30.44	38.67	17.16
6	EC-841532	2.48	37.44	50.52	17.09
7	EC-841587	2.49	23.98	82.09	19.32
8	EC-591828	3.11	17.65	44.55	13.54
9	EC-841577	1.89	41.05	110.31	21.89
10	EC-841580	3.99	55.27	51.57	26.75
11	EC-841563	3.11	30.72	47.41	14.19
12	EC-841597	3.49	25.09	48.39	16.79
13	EC-841603	2.87	23.81	51.34	13.99
14	EC-841617	2.48	35.59	83.31	18.89
15	EC-628939	2.68	18.91	82.51	15.49
16	EC-841579	2.28	11.99	87.38	8.99
17	EC-628930	2.68	15.88	74.19	12.08
18	EC-841571	2.88	14.48	43.67	6.59
	Mean	2.92	29.95	61.22	16.96
	Range	1.89-3.99	11.99-60.15	38.67-110.31	6.59-29.59
	SE(d)±	0.11	0.98	2.47	0.64
	C.D. at 5%	0.22	2.00	5.04	1.30
	CV (%)	4.45	4.01	4.94	4.59

NSPP: Number of seed per pod; NSP: Number of seed per plant; SW: 100 seed weight; SYP: Seed yield/plant (gm)

These findings align well with previous reports in faba bean. Hiywotu *et al*., (2023) reported highly significant positive correlations of grain yield with number of pods per plant, number of branches per plant and 100-seed mass in Ethiopian faba bean accessions, suggesting the possibility of simultaneous improvement of these traits through selection. Similarly, Salem (1982) found significant positive correlations for seed yield per plant with weight of pods per plant and number of pods per plant, and concluded that these traits hold value for indirect selection. The strong association between seed yield and

number of seeds per plant observed here is consistent with the yield structure study by Neal and McVetty (1984), which identified pods per plant and seeds per plant as key determinants of yield variability.

Among component traits, number of pods was strongly correlated with number of seeds per plant (0.82) and seeds per pod (0.53), and moderately with days to first flowering (0.50) and days to 50% flowering (0.51), but negatively with pod diameter (-0.46) and days to first fruit set (-0.31). The moderate positive correlation of seed yield with number of branches per plant (r = 0.59) corroborates earlier findings in faba bean. Gupta *et al*., (1998) reported high heritability followed by high genetic advance for fruiting branches per plant, pods per plant, and seed yield per plant, indicating scope for improvement through selection. Abo Ertiro *et al*., (2023) also identified number of pods per plant as exerting a positive direct effect on seed yield in path analysis, reinforcing the importance of pod-bearing capacity in yield determination.

The negative correlations observed between seed yield and days to first fruit set (r = -0.27) and pod diameter (r = -0.26) warrant attention. The negative association with pod diameter suggests a trade-off between pod bulkiness and yield, consistent with the inverse relationship between pod diameter and number of pods (r = -0.46). This finding is supported by the yield component compensation phenomenon documented in faba bean, whereby negative correlations among yield components are commonly observed due to limited assimilate availability. The strong negative correlation of 100-seed weight with number of seeds per pod (r = -0.75) further exemplifies this compensatory relationship.

Days to first flowering and days to 50% flowering were almost identical (r = 0.95) and both showed strong negative correlations with 100-seed weight (-0.75 and -0.71), pod diameter (-0.68 and -0.65), and pod volume (-0.53 and -0.55). The near-perfect correlation between these two phenological traits confirms that they essentially measure the same biological event. The negative associations of these flowering-time traits with 100-seed weight and pod diameter indicate that early-flowering genotypes tended to bear bolder seeds and larger pods, whereas late-flowering genotypes compensated with higher pod and seed number, aligning with the concept of yield component compensation.

Pod length was strongly correlated with pod volume (0.72) and pod diameter (0.52), while pod diameter and pod volume were also strongly interrelated (0.63). The 100-seed weight showed strong positive correlations with pod diameter (0.69) and pod volume (0.55), but a strong negative correlation with number of seeds per pod (-0.75), indicating a clear inverse relationship between seed boldness and the number of seeds accommodated per pod. Biochemical quality parameters such as total soluble solids and titratable acidity generally exhibited weak correlations with the majority of traits, indicating that these parameters varied largely independently of the morphological and yield-related traits.

The correlation study clearly indicated that number of seeds per plant, number of pods and number of branches per plant were the traits most strongly and positively associated with seed yield per plant, and therefore hold the greatest promise as reliable indirect selection criteria for yield improvement. The use of these component traits for indirect selection is particularly valuable because seed yield itself, being a complex polygenic trait, typically exhibits low heritability and is strongly influenced by environmental factors. The largely independent behaviour of pod-size and seed-quality traits from yield points toward the possibility of independently improving yield potential and seed/pod quality traits without major antagonistic effects. However, the negative association of 100-seed weight and pod diameter with flowering duration and seed yield suggests that breeding for very early, high-yielding types may require compensatory selection to maintain seed boldness and this trade-off should be borne in mind while formulating selection strategies.

Conclusion

It may be inferred from the present investigation that, genotypes of broad bean exhibited enormous genetic variability among the existing collection with respect to growth, yield and quality characters of future breeding point of view. EC-628940 is high yielding and EC-841577 is early maturing genotype possessed most valuable traits from farmers perspective These accessions are of great interest for crop improvement and can be suggested as parent in selection or hybridization for enhanced productivity.

References

Abo Ertiro, T., Kebede G.Y., Assen K.Y., Haile G.A. and Gutu D.T. (2023). Variability and association of some morpho-agronomic traits in advanced faba bean (*Vicia faba* L.) genotypes at potential areas of South Eastern Ethiopia. *Asian J. of Research in Crop Science*, **8(4)**, 198–210.

Ahmed, J.O., Abdulla A.R. and Mohammed R.A. (2016). Comparative on yield and its components performance and correlation in some broad bean (*Vicia faba* L.) genotypes at Bakrajo, Sulaimani. *American-Eurasian J. of Agricultural & Envir. Sciences*, **16(4)**, 635–640.

Alghamdi, S.S. (2009). Chemical composition of faba bean (*Vicia faba* L.) genotypes under various water regimes. *Pakistan Journal of Nutrition*, **8(4)**, 477–482.

Ammar, M.H., Anwar F., El-Harty E.H., Migdadi H.M., Abdel Khalik S.M. and Al-Faifi S.A. *et al*. (2015). Physiological and yield responses of faba bean (*Vicia faba* L.) to drought stress in managed and open field environments. *J. of Agronomy and Crop Science*, **201(4)**, 280–287.

Aziz, A.A.A.H. and Osman A.A.M. (2015). Variability, heritability and genetic advance in faba bean (*Vicia faba* L.). *International Journal of Research in Agriculture and Forestry*, **2(9)**, 42–45.

Bakry, B.A., Elewa T.A., El-Kramany M.F. and Wali A.M. (2016). Effect of planting dates on yield and quality of some faba bean varieties. *Journal of Applied Sciences*.

Cubero, J.I. (1974). On the evolution of *Vicia faba* L. *Theoretical and Applied Genetics*, **45(2)**, 47–51.

El-Naim, A.M., Ahmed M.F. and Ibrahim K.A. (2017). Growth and yield of faba bean (*Vicia faba* L.) as affected by different irrigation intervals. *International Journal of Agriculture and Forestry*, **7(1)**, 1–8.

El-Sayed, M.A., Abdelmula A.A. and Abdalla A.H. (2020). Genotypic variability and association analysis in faba bean (*Vicia faba* L.). *Legume Research*, **43(2)**, 205–210.

El-Wakeil, N.E. and El-Sebai T.N. (2007). Role of biofertilizer on faba bean growth, yield and its effect on bean aphid and the associated predators. *Research Journal of Agriculture and Biological Sciences*, **3(6)**, 800–807.

Gopinath, P.P., Parsad R., Joseph B. and Adarsh V.S. (2020). GRAPES: General Rshiny Based Analysis Platform Empowered by Statistics. https://www.kaugrapes.com/home. version 1.0.0. DOI: 10.5281/zenodo.4923220

Ghobary, H.M.M. and Mohamed A.A. (2014). Evaluation of some faba bean genotypes for yield and quality traits. *Journal of Plant Production*, **5(10)**, 1693–1705.

Gupta, G.C., Gupta S.N., Tomer Y.S. and Singh S. (1998**).** Genetic variability, correlation and path analysis in faba bean (*Vicia faba* L.). *The Indian Journal of Agricultural Sciences*, **68(4)**, 212–214.

Hacýseferogullarý, H., Gezer I., Bahtiyarca Y. and Menges H.O. (2003). Determination of some chemical and physical properties of Sakýz faba bean (*Vicia faba* L. var. major). *Journal of Food Engineering*, 475–479.

Hiywotu, A.M., Abate A. and Worede F. (2023). Correlation and path coefficient analysis of yield and yield components of some Ethiopian faba bean (*Vicia faba* L.) accessions. *Acta Agriculturae Slovenica*, **119(1)**, 1–11.

Khan, M.A., Dar Z.A. and Sofi P.A. (2019). Genetic variability and character association studies in faba bean (*Vicia faba* L.). *J. of Pharmacognosy and Phytochem*., **8(3)**, 3405–3409.

Kumar, P., Das R.R., Bishnoi S.K. and Sharma V. (2017). Inter-correlation and path analysis in faba bean (*Vicia faba* L.). *Electronic J. of Plant Breeding*, **8(1)**, 395–397.

Kumar, S., Dwivedi D.H., Kumar P., Singh P., Kumar R. and Kumar S. (2026). Evaluation of broad bean genotypes for yield and quality traits under Lucknow agro climatic conditions. *Plant Archives*, **26(1)**, 2587–2593.

Link, W., Abdelmula A.A., Kittlitz E.V., Bruns S., Riemer H. and Stelling D. (1999). Genotypic variation for drought tolerance in *Vicia faba*. *Plant Breeding*, **118(6)**, 477–483.

Lourembam, E., Sarma P., Wangchu L., Singh S., Deo C., Loitongbam B. *et al*. (2022). Assessment of morphological characters of faba bean (*Vicia faba* L.) genotypes grown in Manipur. *Pharma Innovation*, **11(8)**, 2036–2040.

Mahmoud, M.A., Abdel-Ghany H.M. and El-Hosary A.A. (2018). Yield and yield components of faba bean as influenced by genotypic differences. *Egyptian Journal of Agronomy*, **40(2)**, 183–195.

Neal, J.R. and McVetty P.B.E. (1984). Yield structure of faba beans (*Vicia faba* L.) grown in Manitoba. *Field Crops Research*, **8**, 349–360.

Pala, M., Armstrong E. and Johansen C. (2000). Linking research marketing opportunities for pulses in the 21st century. In *Marketing Opportunities for Pulses in the 21st Century (Current Plant Science and Biotechnology in Agriculture)* (22–26). Kluwer Academic Publishers.

Panse, V.G. and Sukhatme P.V. (1985). *Statistical methods for agricultural research* (8th ed.). ICAR.

Raja, A.A., Karthikeyan S., Raja G.P. and Thamaraiselvi S.P. (2023). Morphological evaluation of the local genotypes of broad bean (*Vicia faba* L.) for yield attributes under the Nilgiris condition. *International Journal of Environment and Climate Change*, **13(10)**, 1916–1924.

Salem, S.A. (1982). Variation and correlations among agronomic characters in a collection of beans (*Vicia faba* L.). *The Journal of Agricultural Science*, 98(2), 417–422Sheelamary, S., & Shivani. (2015). Genetic variability, heritability and correlation of faba bean (*Vicia faba* L.). *International Journal of Advanced Technology in Engineering and Science*, **3(Special Issue)**, 48–51.

Shrifi, P. (2014). Genetic variability for seed yield and some agro-morphological traits in faba bean (*Vicia faba* L.) genotypes. *Acta Agriculturae Slovenica*, **105(1)**, 73–83.

Singh, A.K., Bharati R.C., Manibhushan N.C. and Pedpati A. (2013). An assessment of faba bean (*Vicia faba* L.) current status and future prospects. *African Journal of Agricultural Research*, **8(50)**, 6634–6641.

Singh, R. and Bharadwaj D.R. (2015). Genetic variability studies in faba bean (*Vicia faba* L.). *Journal of Food Legumes*, **28(2)**, 115–118.

Singh, Y., Sharma S., Sekhon B.S., Verma A. and Sharma S. (2017). Performance of broad bean (*Vicia faba* L.) genotypes for pod yield and yield contributing morpho-physiological components under mid hill conditions of North Western Himalayas. *Biotechnology Journal International*, **19(3)**, 1–10.

Suso, M.J., Moreno M.T., Mondragão-Rodrigues F. and Cubero J.I. (1996). Reproductive biology of *Vicia faba*: Role of pollination conditions. *Field Crops Research*, **46(1–3)**, 81–91.

Suso, M.J., Moreno M.T., Mondragão-Rodrigues F. and Cubero J.I. (2016). Reproductive biology of faba bean (*Vicia faba* L.). *Field Crops Research*, **188**, 38–50.

Yadav, P., Kumar S., Dwivedi D.H., Kumar V. and Dayal R. (2020). Evaluation of broad bean (*Vicia faba* L.) genotypes for genetic variability, heritability and genetic advance. *Inter. J. of Enviro. and Climate Change*, **10(11)**, 107–120.