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Mean performance of soybean genotypes for yield and yield attributing traits under mid hill conditions of Himachal Pradesh

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Abstract
Soybean [*Glycine max* (L.) Merrill] 2n=40, is one of the most versatile legume crop. Soybean seeds are known as "the protein that grows on plant". Soybean can fulfill many nutritional demands due to their high protein content, unsaturated fatty acid content (Omega-6 and Omega-3) and minerals like calcium and phosphorus, and they contain vitamins A, B, C and D. In order to assess twenty soybean entries. The current study was carried out at the Research Farm of the School of Agriculture, Abhilashi University, Mandi (H.P.) during the *kharif*, 2023. The mean performance revealed 20 genotypes for all the 11 traits under study *viz*., for days to 50 percent flowering PK472 (45.67), days to 75 percent maturity PK472 (96.00), JS-1335 (96.00), plant height (cm) PK472 (87.65 cm), number of branches per plant JS-1335 (8.52), number of pods per plant PK472 (78.10), pod length (cm) PK472 (4.54 cm), P-6-2 (4.43 cm), JS-1335 (4.41 cm), SL-679 (4.32 cm), VLS-59-1 (4.18 cm), seed yield per plant (g) PK472 (42.73 g), number of seed per pod PK472 (3.00), JS-1335 (3.00), harvest index % DS1214 (29.03), SL-682 (30.35), 100 seed weight (g) PK472 (21.73 g), JS-1335 (21.60 g), P-6-3 (21.50 g), P169-3 (21.20 g), DS 1213 (21.00 g), VLS-59-2 (20.63 g), DS 1214 (20.40 g). Based on the mean performance among best genotypes for seed yield per plant, VLS-59-1(41.90 g), JS-1335 (41.60 g), P-6-1 (41.26 g), PK472(42.73 g).

Keywords: Soybean, yield, legume, vitamins and protein

Introduction
Soybean [*Glycine max* (L.) Merrill] 2n=40, is one of the most versatile legume crop. Soybean is self-pollinated, and member of the Fabaceae family, which is subdivided into the subfamily Papilionaceae. North Eastern China is considered to be the further center of origin (Vavilov, 1951; Leppik, 1971) [10, 16]. Soybeans is a prime source of protein and nutritious vegetable oil. Cultivated soybean usually contain 40% high quality protein that provides sufficient amount of different kinds of amino acids and 20% oil that is composed of 85% poly unsaturated fatty acid with two essential fatty acids (linoleic and linolenic acid) that are not synthesized by the human body (Antalina, 2000) [5] and (Balasubramaniyan and Palaniappan, 2003) [6].

Soybean seeds are known as "the protein that grows on plant". They provide an important source of protein. Soybean plants being a legume, they also fix atmospheric nitrogen, which makes it available to other plants. Soybean can fulfill many nutritional demands due to their high protein content, unsaturated fatty acid content, and minerals like calcium and phosphorus, and they contain vitamins A, B, C and D (Rahman, 1982) [13]. Additionally, a variety of substances found in soybeans have antioxidant properties and are good for human health because they lower the chance of developing a number of health conditions.

An essential component in this situation, soybean may be helpful with dealing with the problems of nutritional deficiencies. Due to its high protein content and reasonable amount of oil for energy, soybean may be considered an ideal diet for people living in under developed and poor countries (Khaleque, 1985) [9]. Soybean protein, compared to most vegetable proteins, contains all of the essential amino acids. Its cardio-friendly oil meets 30% of global vegetable oil requirements and has numerous medicinal properties, including lactose-free fatty acids, antioxidants, folic acid, vitamin B complex, and isoflavones (Mathur 2004) [12].

Soybean production in the world in 2020-2021 was 353.47 million tonnes with an total area of 136.82 million hectares. Brazil ranks first in soybean production with 121.80 million tonnes followed by United States of America 112.55 million tonnes. (PJTSAU, 2024) [3]. In India soybean has sown in around 12.12 million hectares (29.94 million acres) as on 29th Septmber 2023 which is higher than 125.61 lakh hactarers as against 124.79 lakh hectares during 2022-23. Among the states, Madhya Pradesh stood first with 53.35 lakh ha followed by Maharashtra (50.72 lakh ha), Rajasthan (11.44 lakh ha), Karnataka (4.11 lakh ha), (Gujarat 2.66 lakh) and Telangana (1.89 lakh ha). According the first advance estimates 2023-24, Government of India soybean production is estimated at 115.28 lakh tonnes as compared to149.85 lakh tonnes in 2022-23. (Agricoop, 2024) [4]. In Himachal Pradesh, soybean grown under area of 10.754 hectare in 2022-23 with production of 6.090 metric tonnes and productivity of 756.00 kg/ha. (Department of agriculture, Himachal Pradesh, 2023) [2].

Materials and Methods

The experiment was conducted during *kharif* season, 2023 at the Research Farm of School of Agriculture, Abhilashi University (H.P). The experimental farm is situated at 31°.559'155" N latitude and 77°.009'466" E longitude at an elevation of 1385 meter. Agro-climatically, the location represent the mid hill zone of Himachal Pradesh (Zone II) and is characterized by hot and sub -humid tropical climate with high mean annual rainfall of about 1876 mm for annum. The soil is acidic in nature with pH ranging from 5.0 to 5.6 and soil texture is silty clay loam. In total 20 soybean genotypes which included seventeen genotypes along with three checks, Bragg, Shivalik and Hardee were evaluated in RBD design with two replications. The list of genotypes along with their source is given in table 1.

Table 1: The list of genotypes along with their source is given

Number of genotypes	20 (17 Entries and 3 checks)
Design	RBD (Randomized Block Design)
Replication	2
Spacing	45 cm
Plot size	2 m × 0.45 m
Seed rate	55-65 kg/ha
Date of sowing	20-06-2023
Date of harvesting	04-10-2023

Table 2: List of accession and source of soybean accession

Sr. No.	Accession	Source
1.	SL-682	CSKHPKV, Palampur
2.	P-6-1	CSKHPKV, Palampur
3.	P-6-2	CSKHPKV, Palampur
4.	P-6-3	CSKHPKV, Palampur
5.	SL-679	CSKHPKV, Palampur
6.	DS1213	CSKHPKV, Palampur
7.	DS1214	CSKHPKV, Palampur
8.	DS1215	CSKHPKV, Palampur
9.	PK472	CSKHPKV, Palampur
10.	AVT12204	CSKHPKV, Palampur
11.	AVT12206	CSKHPKV, Palampur
12.	AVT12207	CSKHPKV, Palampur
13.	JS-1335	CSKHPKV, Palampur
14.	JS-1341	CSKHPKV, Palampur
15.	P169-3	CSKHPKV, Palampur
16.	VLS-59-1	CSKHPKV, Palampur
17.	VLS-59-2	CSKHPKV, Palampur
18.	Shivalik (C)	CSKHPKV, Palampur
19.	Bragg (C)	CSKHPKV, Palampur
20.	Hardee (C)	CSKHPKV, Palampur

Results and Discussion

Analysis of variance (ANOVA)

Analysis of variance of the present investigation revealed significant mean sum of square due to genotypes for all the 11 traits under study for days to 50% flowering, days to 75% maturity, plant height (cm), number of branches per plant, number of pods per plant, number of seeds per pod, pod length (cm), seed yield per plant (g), harvest index (%), 100 seed weight (g) indicating thereby presence of sufficient genetic variability and scope of selection for these traits.

Table 3: Analysis of variance (ANOVA)

ANOVA Summary				
Sl. No.	Source	Mean Sum of Squares (MSS)		
		Replication	Treatment	Error
	Degrees of freedom	2	19	38
1	Days to 50% flowering	0.650	4.933**	1.983
2	Days to 75% maturity	5.0170	6.508**	2.455
3	Plant Height (cm)	36.8050	413.659**	21.988
4	Number of branches per plant	0.1090	3.175**	0.241
5	Number of pods per plant	0.7760	151.243**	12.279
6	Pod length (cm)	0.0240	0.184**	0.012
7	Number of seed per pod	0.7280	201.331**	11.647
8	Harvest Index (%)	0.0670	0.789**	0.102
9	100 seed weight (g)	1.5490	82.318**	8.798
10	Seed yield per plant	0.3980	5.238**	2.078

**Significance at 1% level of significance
*Significance at 5% level of significance

The range and mean performance of 11 characters in 20 genotypes for seed yield and its attributing traits are presented in Table (4). The details of the results obtained are clarify below:

Table 4: Mean performance of different quantitative characters

Sl. No.	Genotypes	Days to 50% flowering	Days to 75% maturity	Plant Height (cm)	Number of branches per plant	Number of pods per plant	Pod length (cm)	Seed yield per plant (g)	Number of seed per pod	Harvest Index (%)	100= seed weight (g)
1	SL-682	46.67	100.33	51.42	5.64	51.32	3.91	21.47	2.67	30.35	17.20
2	P-6-1	49.00	98.33	65.45	6.16	67.91	3.97	32.33	2.33	35.16	19.50
3	P-6-2	49.00	101.00	67.09	5.97	60.24	4.43	41.26	2.00	36.53	18.94
4	P-6-3	49.67	98.67	49.61	6.44	75.52	3.89	38.90	1.00	51.78	21.50
5	SL-679	49.67	99.67	69.41	5.66	69.31	4.32	23.47	2.67	31.21	20.23
6	DS1213	48.00	101.00	52.08	6.62	70.65	3.79	25.87	2.00	36.54	21.00
7	DS1214	49.00	98.33	73.30	7.58	65.05	4.13	20.80	2.67	29.03	20.40
8	DS1215	48.67	97.33	50.23	5.11	58.96	3.77	38.83	2.00	38.94	19.57
9	PK472	45.67	96.00	87.65	8.44	78.10	4.54	42.73	3.00	31.63	21.73
10	AVT12204	49.67	99.33	63.44	5.42	60.82	3.90	35.93	2.00	36.19	18.87
11	AVT12206	48.00	97.67	75.07	6.57	59.34	3.79	24.00	2.33	31.16	17.47
12	AVT12207	49.33	99.33	53.74	7.39	67.17	3.85	39.00	2.00	42.49	18.20
13	JS-1335	46.33	96.00	86.52	8.52	76.80	4.41	41.60	3.00	32.53	21.60
14	JS-1341	49.00	99.67	70.34	6.26	60.89	4.11	26.04	2.00	36.28	19.43
15	P169-3	48.00	98.00	59.63	5.32	67.40	3.66	23.67	2.67	38.61	21.20
16	VLS-59-1	49.33	100.33	55.68	6.34	75.42	4.18	41.90	2.00	39.94	19.23
17	VLS-59-2	49.67	98.33	53.56	5.25	62.97	3.83	38.23	2.00	33.39	20.63
18	Shivalik (C)	47.33	98.00	51.73	7.51	66.62	4.05	41.90	3.00	40.59	19.97
19	Bragg (C)	49.33	98.33	68.05	6.45	74.90	3.97	29.07	2.00	39.95	18.50
20	Hardee (C)	50.67	100.67	73.86	7.62	64.99	3.88	23.67	3.00	36.55	19.87
Mean		48.60	98.82	63.89	6.51	66.72	4.02	32.53	2.32	36.44	19.75
CV		2.90	1.59	7.34	7.55	5.25	2.72	10.49	13.77	8.14	7.30
Sem		0.81	0.90	2.71	0.28	2.02	0.06	1.97	0.18	1.71	0.83
CD at 5%		2.33	2.59	7.75	0.81	5.79	0.18	5.64	0.53	4.90	2.38
CD at 1%		3.12	3.47	10.38	1.09	7.76	0.24	7.56	0.71	6.57	3.19
Minimum		45.67	96.00	49.61	5.11	51.32	3.66	20.80	1.00	29.03	17.20
Maximum		50.67	101.00	87.65	8.52	78.10	4.54	42.73	3.00	51.78	21.73

The range of variations for days to 50 percent flowering from 45.67 to 50.67 days. 48.60 days was the mean for these characters. PK472 (45.67) was earliest for days to 50 percent flowering followed by JS-1335 (46.33), SL-682 (46.67). The range of variation for days to 75 percent from 96.00 to 101.00 days. This character's mean was 98.82 days. PK472 (96.00), JS-1335 (96.00) was earliest for days to 75 percent maturity followed by DS1215 (97.33), AVT 12206 (97.67), P169-3 (98.00). Plant height ranged from 49.61 to 87.65 cm with a mean value 63.89 cm. The maximum plant height was observed in variety PK472 (87.65 cm) were found superior than AVT 12206 (75.07 cm), JS-1335(86.52 cm). The average number of branches per plant was 6.51, with a range of 5.11 to 8.52. The maximum number of branches per plant was observed in variety JS-1335 (8.52) were found superior than PK472 (8.44). Number of pods per plant ranged from 51.32 to 78.10 with mean value 66.72. The maximum number of pods per plant was observed in variety PK472 (78.10), were found superior than JS-1335 (76.80), P-6-3 (75.52), VLS-59-1 (75.42). A mean value of 4.02 cm was found for pod length, which varied from 3.66 to 4.54 cm. Varieties showed the maximum pod length i.e. PK472 (4.54 cm), P-6-2 (4.43 cm), JS-1335 (4.41 cm), SL-679 (4.32 cm), VLS-59-1 (4.18 cm), DS1214 (4.13 cm), JS-1341 (4.11 cm) were found superior than P-6-2 (4.43 cm), JS-1335 (4.41 cm), SL-679 (4.32 cm), VLS-59-1 (4.18 cm),

DS1214 (4.13 cm), JS-1341 (4.11 cm). Seed yield per plant (g) ranged from 20.80 to 42.73 (g) with mean value 32.53 (g). The maximum seed yield per plant (g) was observed in variety PK472 (42.73 g) were found superior than VLS-59-1 (41.90 g), JS-1335 (41.60 g), P-6-1 (41.26 g). Number of seed per pod ranged from 1.00 to 3.00 with mean value of 2.32. The maximum number of seed per pod was observed in PK472 (3.00), JS-1335 (3.00) followed by SL-682 (2.67), P-6-1 (2.33), SL-679 (2.67), DS1214 (2.67) AVT12206 (2.33), P169-3 (2.67). The harvest index had a mean value of 36.44% with a range of 29.03 to 51.78%. Variety DS1214 (29.03), SL-682 (30.35), and P-6-1 (35.16) had the lowest harvest index, whereas P-6-2 (36.53), DS 1213 (36.54), AVT 12204 (36.19), and JS-1341 (36.28) were judged to be inferior. The range of 100 seed weight (g) was 17.20 to 21.73, with a mean of 19.75 g. Variety PK472 (21.73 g), JS-1335 (21.60 g), P-6-3 (21.50 g), P169-3 (21.20 g), DS 1213 (21.00 g), VLS-59-2 (20.63 g), DS 1214 (20.40 g), and SL-679 (20.23 g) were found to be superior than JS-1341 (19.43), DS1215 (19.57).

Similar result showed by Ramteke *et al*. (2010) [14] studied analysis of variance was carried out for the data recorded on plant height, branches per plant, 100-seed weight, days to 50% flowering, days to maturity, grain yield. Results revealed highly significant differences among varieties for all the characters. Ekka *et al*. (2016) [8] was conducted analysis of variance was significant for all characters days to 50% flowering, plant height (cm), branches per plant, pods per plant, days to maturity, pod length (cm), seeds per pod, seed index (100 seed weight), seed yield per plant (g). Mahbub *et al*. (2016) [11] conducted an experiment to estimate analysis revealed that all the characters days to fifty percent flowering, days to maturity, plant height, number of branches per plant, number of pods per plant, pod length, number of seeds per pod, seeds per plant, hundred seed weight and seed yield per plant were significantly affected due to various soybean genotypes. Amogne *et al*. (2020) [17] analysis of variance, high significant difference exhibited by days to flowering, days to maturity, plant height, branches per plant. Bhuva *et al*. (2020) [7] investigated seventy soybean genotypes to analysis of variance revealed significant variations for all the characters. Thakur *et al*. (2022) [15] studied the analysis of variance revealed that the genotypes varied considerably for days to fifty percent flowering, days to seventy percent maturity, plant height, number of branches per plant, number of pods per plant, pod length, number of seeds per pod, seed yield per plant, hundred-seed weight, biological yield per plant and harvest index showing the genetic divergence of the planting materials from one another.

Conclusion

The present study revealed the higher estimates of range and mean values for different traits were observed for many characters PK472 was early for mean days to 50 percent flowering, PK472 was early days to 75% maturity. PK472, JS-1335 showed the maximum number of branches per plant. PK472, VLS-59-2, VLS-59-2 showed the maximum number of pods per plant. PK472 maximum pod length. VLS-59-1 (41.90 g), JS-1335 (41.60 g), P-6-1 (41.26 g) showed the maximum seed yield per plant (g). PK472 (3.00), JS-1335 (3.00) showed the maximum number of seed per pod. DS1214 (29.03), SL-682 (30.35), P-6-1(35.16) showed the minimum harvest index. PK472 (21.73 g), JS-1335 (21.60 g), P-6-3 (21.50 g), P169-3 (21.20 g), DS 1213 (21.00 g), VLS-59-2 (20.63 g), DS 1214 (20.40 g), SL-679 (20.23 g) maximum 100 seed weight (g).

On the basis of findings present investigation, it may be concluded that considerable variability exists within the genotypes of soybean. Sufficient genetic variability was observed for all quantitative traits. The genotypes P-6-2, PK472, JS-1335, VLS-59-1 were found to be superior for yield characters.

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References

1. Among A, Atnaf M, Bantayehu M. Correlation and path coefficient analysis in soybean (*Glycine max* (L.) Merrill) genotypes in Dibate, north-western Ethiopia. Int J Sci Eng Res. 2020; 4(6):1-5.
2. Anonymous. Department of Agriculture, Himachal Pradesh; c2023. Available from: https://agriculture.hp.gov.in/en/production-2/
3. Anonymous. Soybean outlook report; c2024. Available from: https://pjtsau.edu.in;
4. Anonymous. Soybean outlook report; c2024 Available from: www.agricoop.gov.in.
5. Antalina S. Modern processing and utilization of legumes. Recent research and industrial achievement for soybean food in Japan. Proceedings of the RILET-JIRCAS Journal of Pharmacognosy and Phytochemistry Workshop on Soybean Research; 2000 Sep 28; Malang, Indonesia.
6. Balasubramaniyan P, Palaniappan SP. Principles and practices of agronomy. Agrbios (India). Field crops. An overview; c2003. p. 45-46.
7. Bhuva RB, Babariya CA, Movaliya HM, Gadhiya JA, Balar VS. Correlation and path analysis for seed yield in soybean [*Glycine max* (L.) Merrill]. Indian J Pure Appl Biosci. 2020;8(4):337-380.
8. Ekka NP, Lal GM. Study on genetic variability and character association in soybean [*Glycine max* (L.)]. Agri Sci Digest. 2016;36(1):69-71.
9. Khaleque MA. A guide book on production of oilcrops in Bangladesh. In: Strengthening the Agricultural Extension Service, Ministry of Agriculture, Government of Bangladesh and FAO/UNDP Project. Dhaka: Khamarbari; c1985. p. 101-110.
10. Leppik EE. Assumed gene centres of peanuts and soybeans. Econ Bot. 1971;25:188-194.
11. Mahbub MM, Rahman MM, Mahmud F, Kabir MMM. Genetic variability analysis in different genotypes of soybean (*Glycine max* (L.) Merrill). Am Eurasian J Agric Environ Sci. 2016;16(1):140-145.
12. Mathur S. Soybean wonder legume. Beverage Food World. 2004;31(1):61-62.
13. Rahman L. Cultivation of soybean and its uses. Dhaka: Citypress; c1982. p. 5-7.
14. Ramteke R, Kumar V, Murlidharan P, Agarwal DK. Study on genetic variability and traits interrelationship among released soybean varieties of India (*Glycine max* (L.) Merrill). Electron J Plant Breed. 2010;1(6):1483-1487.

15. Thakur R, Kumari V, Pal A, Rana P. Genetic variability analysis for agro-morphological and seed yield component traits of soybean (*Glycine max* (L.) Merrill) genotypes under mid hill zone of Himachal Pradesh. IJECC. 2022;12(11):1559-1567.
16. Vavilov NI. The origin, variation, immunity and breeding of cultivated plants. Translated from Russian by K.S. Chester. Chronica Botanica. 1951;1(6):364.
17. Amogne NY, Ayele DW, Tsigie YA. Recent advances in anthocyanin dyes extracted from plants for dye sensitized solar cell. Materials for Renewable and Sustainable Energy. 2020 Dec;9(4):23.