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Evaluation of per se performance of parental line and their hybrids for their yield and yield attributing traits in Gardenpea (*Pisum sativum* (L.) var *hortense.*)

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Abstract
The present work entitled "Evaluation of per se performance of parental lines and their hybrids for yield and yield contributing characters in Garden pea *(Pisum sativum var hortense)*" was conducted at the Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture and Technology Kanpur. The experiment was laid out in randomized block design (RBD). Five Parental line GS-10, AP-3, AP-1, KS-282 and C18-3 were grown in *Rabi*2022 and mated into 5x5 Half-Diallel mated design and further the 10 F1s were grown in *Rabi* 2023. The result of the study revealed that among the Parents AP-1 performed better in case of Days to first flowering (46.43 DAS), days to edible pod maturity (52.98), number of pods per plant (10.166) and width of pod (1.43 cm) and AP-3 performed better in case of weight of 20 healthy pods (72.87gm), edible pod yield q per ha (72.561q/ha) and plant height (55.8cm). Among their hybrids AP-1XC18-3 perform better in case of days to flowering (44.133 days), days to edible pod maturity (51.62 days), pod length (10.24cm), pod width (1.47) and weight of 20 healthy pods at edible stage (80.00gm).

Keywords: Pea, hybrids, per se performance and yield

Introduction
Garden pea (*Pisum sativum var. hortense*) is a native of Southern Europe and has been cultivated since before the beginning of Christian era. Peas are well known to the Greeks and Romans which belongs to family Leguminosae or Fabaceae Central Asia, Mediterranean, and Abyssinia are the centers of origin of pea. It's seeds are rich source of protein(15.8–32.1%) for humans (Al Bari *et al*., 2021) and also serve as a source of starch (18.6–54.1%), soluble sugars (5%), oil (0.6–5.5%), antioxidants, anti-inflammatory agents, vitamins A, B, E, K and C, omega-3 fatty acid & omega-6 fatty acid. Peas are high in potassium, folate, calcium and digestible fibres (5.9%–12.7%), all of which support gut health, provide cardiovascular aids and help to prevent some malignancies.
In pea breeding and agricultural practices, understanding the mean performance of different parents and their hybrids is essential for several reason. Firstly it allow breeder to select and develop varieties that exhibit desirable traits such as high yield and its related trait like early flowering, early maturity, maximum number of pods etc. Secondly, it enable growers to make informed decision about which varieties to cultivate based on their specific agro-climatic condition, market demand, and intended use (eg. fresh market, processing or organic production) Mean performance of garden pea lines represent their average performance across various characters under specific growing condition. These lines are developed by the use of traditional breeding methods, aimed to combine favourable characters from parents plant. Evaluation their mean performance includes assessing factors like early flowering, fruiting, maturity, plant height, number of pods per plant, weight of 20 healthy pods, length and width of pod and yield of pods. Apart from this, commercial hybrids are produced by crossing of two of more genetically diverse parents line. Hybrids are valued for their hybrid vigour, which can result in

significantly higher yield and improved uniformity compared to their parents. Evaluating the mean performance of pea hybrids involves testing them across different environment and comparing their performance metrics with standard varieties. This analysis assesses how each cross contributes to the overall performance of the traits under consideration, helping to identify superior combination for further breeding programs. Devi *et al*., 2021 [13]; Singh *et al*., 2022 [12]; Parental lines or varieties used to hybridization to evaluate the combining ability of other lines or hybrids. They play a crucial role in hybrid breeding programme by helping breeders predict the performance of resulting hybrids and select for desirable genetic combinations. By analysing the mean performance across different varieties or treatments, researchers can gain insights into the factors influencing pea cultivation and optimize agricultural practices for improved crop outcomes Shah *et al.* 2016 [9]; Afreen *et al*. 2017 [1]; Datta and Das 2018 [2]; Sharma *et al*. 2020 [11]; Dutta *et al*. 2021 [3]; Luitel 2023 [6]. In conclusion, understanding the mean performance of genotypes and their hybrids is vital for both breeders and growers to achieve sustainable agriculture and meet market demands.The advancements in breeding technology for garden pea have significantly boosted yield potential. Through precise genetic selection, enhanced disease resistance and improved trait integration, modern breeding sustained agricultural productivity and resilience in the face of evolving environmental challenges, securing a bright future for pea cultivation globally.

Method and Material

Experimental site and location

The present investigation entitled "Biometrical analysis for yield and yield contributing characters in Table pea (Pisum sativum var. hortense L.)" was carried out at Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) during 2023-2024.The Vegetable Research Farm is about 10 km away from Kanpur Central Railway Station in the north western part of Kanpur City. It is located in front of Indian Institute of pulse research (IIPR) Kanpur.

The present work entitled “Evaluation of per se performance of parental lines and their hybrids for yield and yield attributing traits in garden pea (*Pisumsativum var. hortense* L)” was conducted at the Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. The experiment was laidout in randomized block design (RBD). Five Parental line GS-10, AP-3, AP-1, KS-282 and C18-3 were grown in *Rabi*2022 and mated into 5x5 Half-Diallel mated design and further the 10 F1s were grown in *Rabi* 2023. The plot size is 23m x 12m; Spacing 45x10 cm.

Statistical analysis

The data recorded in parents and their hybrids for pod yield and its attributing traits in each entry of both the replications were first subjected to Analysis of Variance (ANOVA) as per the method outlined by Panse and Sukatme (1967). All the sources of variation were tested against error for significance by comparing the calculated “F”value with table ‘F’ value at 1% and 5% probability levels. The correlation coefficient was done as per method of Al-Jibourie *et al*. (1958).

Table 1: Genotypes and their sources

S.No	Genotype	Source	Features
1	GS-10	C,S Azad, Kanpur	Late maturity, more no of seeds/pod, high yield, small seeded
2	AP-3	C,S Azad, Kanpur	Early maturity, medium seed size, sweet in taste
3	AP-1	C,S Azad, Kanpur	Late fruiting, more pods bearing, medium seed size
4	KS-282	C,S Azad, Kanpur	Late maturity, very tall, higher yielder, bold seeded
5	C18-3	C,S Azad, Kanpur	Late maturity, late fruiting, very bold seeded

Table 2: Mean values for yield and yield attributing traits of parents and their F1’s in garden pea. For days to flowering, first fruit knod, plant height, days to edible maturity, number of pods per plant, weight of 20 healthy pods, pod length, pod width and edible yield

S. No.	Parent / crosses	Days to flowering (DAS)	first fruit set knot	Plant height (cm)	Days to edible plucking	Number of pods/ plant	Weight of 20 healthy pods(gm)	Length of health pod(cm)	Width of health pod(cm)	Edible pod yield q/ha
1	GS-10	52.12	12.066	71.8	59.41	9.566	65.93	9.283	1.213	70.1633
2	AP-3	47.99	11.066	55.8	54.78	8.933	72.87	9.343	1.326	72.561
3	AP-1	46.43	10.33	63.1	52.98	10.166	58.13	9.153	1.43	65.6977
4	KS-282	49.09	9.866	65.1	56.67	7.9	71.87	9.547	1.376	62.8851
5	C18-3	50.303	10.7	71.4	57.46	7.766	60.27	9.47	1.396	51.6547
6	GS-10 X AP-3	47.38	10.433	55.16	55.52	11.256	68.80	10.02	1.243	85.932
7	GS-10 X AP-1	52.46	10.3	64.7	59.47	13.5	61.33	9.16	1.343	91.9373
8	GS-10XKS282	55	9.4	71.53	62	12.666	69.27	9.577	1.246	97.3798
9	GS-10 XC18-3	49.8	9.3	55.73	56.89	14.8	65.60	9.07	1.216	109.5285
10	AP-3 X AP-1	55.23	10.633	74	62.34	12.7	59.33	9.25	1.31	83.4886
11	AP-3 X KS282	47.1	10.933	71.03	54.57	14.933	63.13	10.11	1.336	105.3353
12	AP-3 X C18-3	52.83	10.833	70.63	59.81	15.9	54.20	8.557	1.346	95.1336
13	AP-1 X KS282	52.5	11.2	62.73	60.56	10.833	66.53	9.227	1.35	79.5869
14	AP-1 X C18-3	44.133	9.8	73.8	51.62	10.733	80.00	10.24	1.47	95.1644
15	KS-282 XC18-3	50.033	10.86	73.9	58.12	13.866	56.07	9.01	1.306	85.8775
	C.D.	3.677	1.153	6.505	2.553	1.932	9.782	18.20	0.196	19.728
	SE(m)	1.263	0.396	2.234	0.877	0.663	3.36	0.388	0.069	6.775
	SE(d)	1.786	0.56	3.159	1.24	0.938	4.751	0.549	0.098	9.581
	C.V.	4.36	6.523	5.801	2.646	9.819	8.967	7.152	8.996	14.056

As data presented in Table 2 clearly showed that among the parents the minimum number of days to flowering observed in AP-1 (46.43 DAS) followed by AP-3 (47.99 DAS) and KS-282 (49.09 DAS). Among the 10 cross, the first cross AP-1 X C18-3 which shows earliest flowering (44.133 DAS) followed by AP-3 X KS-282 (47.1 DAS) and GS-10XAP-3(47.38 DAS). Latest flowering observed in AP-3 X AP-1(55.233 DAS) followed by GS-10X KS-282(55DAS).Ranged from 44.13 to 55.23 days. The mean value of days to first flowering is 50.1599 days. The result are in agreement with the finding of Khichi *et al.* (2017) [5] and Kanwar *et al*. (2020) [4]

With regards to days to first fruit set knot ranged from 9.3 to 12.066days. The mean value of days to first fruit set knot is 10.5146 days. Among the parents the earlist fruit set knot observed in KS-282 (9.866), AP-1 (10.33) and C18-3 (10.7). Among 10 crosses, the first cross GS-10 X C18-3 which shows earliest fruit set (9.3) followed by GS-10XKS-282(9.4) and AP-1XC18-3(9.8) Latest first fruit set knot observed in AP-1 X KS 282 (11.2000) followed by AP-3XKS-282 (10.933).These result are accordance with Neupane *et al.* (2023) [7]

Plant height ranged from 55.8 cm to 73.9 cm with a general mean of 66.604 cm. Among the parents the lowest plant height was shown by AP-3(55.8 cm) followed by AP-1(63.1 cm) and KS-282 (65.1000 cm) and in crosses GS-10XAP-3 (55.16cm) shows lowest plant height followed by GS-10 X C18-3(55.73cm) and AP-1 X KS – 282 (62.73 cm). Similarly highest plant height was shown by GS-10(71.8cm), KS-282XC18-3 (73.9cm) and AP-1 X C18-3(73.8cm) These result are accordance with Phoem *et al.* (2014)

Days to edible pod maturity ranged from 51.62 to 62.34 days with a mean value of 57.48. Among the parents AP-1 was earliest days to edible fruit maturity (52.98 days) followed by AP-3 (54.78 days) and KS-282 (56.67 days). The F1 hybrid AP-1XC18-3(51.62 days) had earliest days to edible fruit maturity, which was closely followed by AP-3XKS-282 (54.57 days) and GS-10XAP-3(55.52 days). Similarly GS-10(59.41days) had maximum days to maturity in parents and AP-3XAP-1(62.34 days) in crosses. These result are accordance with Sharma *et al.* (2007) [10]

Pod length was varied from 8.55 to 10.24 cm with the mean value of 9.4. Maximum pod length took recorded in parent KS-282(9.54cm), following by and C18-3 (9.4 cm) and AP-3(9.34). The minimum pod length was observed in parent AP-1 (9.153 cm). Among the F1, the maximum pod length was observed in AP-1XC18-3 (10.24cm), which was followed by AP-3XKS-282 (10.113cm) and GS-10 X AP-3 (10.02cm). The hybrids AP-3 X C18-3 (8.5567cm) showed minimum pod length. These result are accordance with Devi *et al*. (2021) [13]

Pod width was varied from 1.2133 to 1.47 cm with the mean value of 1.3276. Among the parental lines, the maximum pod width found in AP-1(1.4300 cm) followed by C18-3 (1.39 cm) and KS-282 (1.37 cm). The minimum pod width was found in parent GS-10 (1.21 cm). The F1 GS-10 X C18-3 (1.21 cm) showed minimum pod width. The best 3 hybrids regarding pod width were AP-1 X C18-3 (1.47 cm) fallowed by AP-1 X KS-282 (1.35 cm) and AP-3 X C18-3 (1.3466cm). These result are accordance with Devi *et al*. (2021) [13]

Yield parameters

Number of pods per plant varied from 7.76 to 15.9with the average value of 11.7012. The parental line AP-1 (10.166) had maximum number of pod per plant followed by GS-10 (9.566) and AP-3 (8.933), whereas C18-3 (7.766 fruits) showed the minimum number of pod per plant. Among the F1 AP-3 X C18-3 (15.9) followed by AP-3X KS-282 (14.933 fruits) and KS-282XC18-3(13.866) had maximum number of pod per plant whereas, AP-1X C18-3 (10.733) showed minimum number of fruits per plant These result are accordance with Phoem *et al*. (2014).

The weight of 20 healthy podranged from 54.20 to 80.00 gm with the mean value of 64.89gm. The parental line AP-3 (72.87gm) had maximum pod weight followed by KS-282(71.87gm) and GS-10(65.93gm), whereas AP-1(58.13gm) showed the minimum pod weight. Among the crosses, AP-1 X C18-3(80.00gm) followed by GS-10 X KS-282(69.27gm) and GS-10 X AP-3 (68.80gm) had maximum pod weight whereas, AP-3 X C18-3(54.20gm) showed least pod weight Devi *et al*. (2021) [13]

The edible Pod yield ranged from 51.6547 to 109.5285 q/ha with the mean value of 83.4883. Among the parental lines, the maximum pod yield was observed in AP-3 (72.561q/ha) followed by GS-10 (70.1633q/ha) and AP-1 (65.6977q/ha). The least pod yield was found in parent C18-3 (51.6547q/ha). The F1 GS-10 X C18-3 (109.5285q/ha) showed maximum pod yield followed by AP-3 X KS-282 (105.3353q/ha) and GS-10 X KS-282(97.3798q/ha). And cross of AP-1 X KS-282 (79.5869q/ha) had minimum pod yield. These result are accordance with Phoem *et al*. (2014).

Conclusion

The comprehensive analysis presented in Table 1 provides valuable insights into the performance of various parents and their hybrids across multiple parameters. These findings highlight significant differences in early flowering, early fruiting, plant height, early maturity, number of pods per plant, weight of pods, length & width of pods and yield of pods among the genotypes.

Among the parental lines evaluated, AP-1 consistently emerged as a top performer in key traits, early flowering, early maturity, pod width, maximum number of pod per plant. This indicates its potential for commercial cultivation. While AP-3 emerged as a good performer in such traits like-weight of 20 healthy pods, height of plant and for pod yield q/ha.

In contrast, GS-10 exhibited relatively lower performance across several parameters, suggesting areas where further improvement or targeted breeding efforts may be beneficial to enhance its agronomic value and market competitiveness.

In F_{1s} the Hybrid combinations such as AP-1XC18-3 displayed superior performance in various parameters like in early flowering, early maturity, maximum pod weight, maximum pod length and pod width and the cross combination GS-10XC18-3 superior in first fruit set knod and maximum pod yield q/ha. indicating successful heterosis and potential for commercial adoption. These hybrids showed enhanced plant vigor and yield potential compared to their parent lines and other hybrid combinations.

Overall, the findings from this study provide breeders, growers, and researchers with valuable data to guide selection and breeding strategies for developing pea varieties with improved agronomic performance and yield stability. Continued research efforts in pea breeding will further refine our understanding and capability to meet the evolving demands of global agriculture and consumer preferences.

Reference

1. Afreen S, Singh AK, Moharana DP, Singh V, Singh P, Singh B. Genetic evaluation for yield and yield attributes in garden pea (*Pisum sativum var. hortense* L.) under North

Indian gangetic plain conditions. Int J Curr Microbiol App Sci. 2017;6(2):1399-1404.
2. Datta S, Das K. Varietal performance of garden pea (*Pisum sativum var. hortense*) under Terai zone of West Bengal. J Appl Nat Sci. 2018;10(3):1032-1036.
3. Dutta AK, Majee SK. Performance of organically grown garden pea varieties in the south Chhotanagpur plateau of eastern India. J Appl Hort. 2021;23(1):78-83.
4. Kanwar PS, Toppo S, Sahu S. Evaluate the performance of genotypes of pea in terms of growth, yield and quality attributes. J Pharmacogn Phytochem. 2020;9(3):2117-2120.
5. Khichi P, Pant R, Upadhayay S. Performance of garden pea varieties for their growth and yield characteristics in Vidharbha region of Maharashtra, India. J Appl Nat Sci. 2017;9(4):2300-2304.
6. Luitel BP, Bhandari BB. Performance of garden pea (Pisum sativum L.) genotypes for growth and yield characters at Dailekh, Karnali Province, Nepal. Nepal Agric Res J. 2023;15(1):20-32.
7. Neupane A, Tripathi V, Swain AR, Sharma JK, Kumar Y, Goutam E. Varietal Mean Performance of Garden Pea (*Pisum sativum var. hortense* L.) Under Subtropical Conditions of Punjab, India. Int J Environ Climate Change. 2023;13(11):1746-1755.
8. Phom AC, Kanaujia SP, Chaturvedi HP. Performance of various genotypes of pea under foothill condition of Nagaland. Ann Plant Soil Res. 2014;16(4):285-288.
9. Shah BH, Hamid FS, Ahmad F, Aslam S, Khan N. Evaluation of different pea (Pisum sativum L.) genotypes for yield and other attributes at Shinkiari, Mansehra. Pak J Agric Res. 2016;29(4).
10. Sharma A, Rana C, Thakur H, Sharma KC. Stability of Garden Pea Genotypes based on GGE Biplot and Regression Model. Legume Res Int J. 2007;1:6.
11. Sharma D, Chauhan A, Jarial K. Performance of pea varieties in different altitude ranges under North-Western Himalayan Region. Int J Curr Microbiol Appl Sci. 2020;9(06):3292-3302.
12. Singh V, Ram CN, Singh N, Kumar D. Evaluation of the Performance of Parental Lines and their F1 Hybrids for Yield and Attributing Traits in Vegetable Pea [*Pisum sativum* (L.) *var. hortense*]. Int J Plant Soil Sci. 2022;34(21):77-86.
13. Devi S, Nagar S, Kumar M, Thakur K, Dogra BS. Mean performance of pea (*Pisum sativum* L.) germplasm under mid hill conditions of Western Himalayan region. J Pharma Innov. 2021;10(4):407-411.