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GENETIC VARIABILITY STUDIES IN GENOTYPES OF GARDEN PEA (*Pisum sativum* L.)

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ABSTRACT

The present investigation entitled "Genetic variability studies in genotypes of garden pea (*Pisum sativum* L.)" was conducted during *rabi* 2024–25 at the experimental research farm, School of Agriculture, Abhilashi University, Mandi, Himachal Pradesh to assess genetic variability, heritability, correlation and path coefficient analysis for yield and related traits in garden pea. The experiment was laid out in a Randomized Block Design (RBD) with three replications comprising ten genotypes including one check variety (PB-89). The analysis of variance showed significant differences among all the genotypes for different traits, indicating sufficient variability for selection and crop improvement. Based on mean performance, Lincoln, PB-89, Palam Priya, Arka Ajeet and Azad Pea-1 were identified as promising genotypes for important horticultural traits. Among them, Lincoln recorded the highest pod yield per plot (9.25 kg) and pod yield per hectare (178.55 q ha^{-1}), followed by PB-89 (172.59 q ha^{-1}), while Palam Priya was found earliest for flowering and first harvest. High heritability coupled with high genetic gain was observed for number of primary branches per plant, number of pods per plant, pod length and pod yield per plot, suggesting effective selection for these traits. Correlation and path analysis identified number of pods per plant, number of seeds per pod, pod length and average pod weight as major contributors to yield. Lincoln, PB-89 and Arka Aje*et al*so showed lower powdery mildew incidence. Overall, Lincoln emerged as the most promising genotype for future breeding programmes.
***Keywords*:** Garden pea, variability, heritability, correlation, path coefficient, pod yield

Introduction

Garden pea (*Pisum sativum* L.) is an important cool-season vegetable crop belonging to the family Fabaceae with a chromosome number of 2n = 14. It is widely grown throughout the world for its tender green pods and immature seeds, which are consumed as fresh vegetables as well as in processed forms. In India, garden pea is one of the most popular vegetable crops due to its high nutritional value, good market demand and economic importance. Garden pea is a rich source of proteins, carbohydrates, vitamins and minerals. It contains appreciable amounts of vitamin A, vitamin C, phosphorus and iron which make it an important part of a healthy diet. Apart from its nutritional value, pea also improves soil fertility through biological nitrogen fixation and thus plays an important role in sustainable agriculture.

The success of any crop improvement programme depends on the availability of genetic variability among the genotypes. Genetic variability provides opportunities for selecting superior genotypes with desirable traits such as high yield, better quality and early maturity. Therefore, the study of genetic variability is essential for the effective improvement of garden pea. Heritability and genetic advance are important genetic parameters that help breeders understand the inheritance of different traits and the effectiveness of selection. High heritability along with high genetic advance indicates greater chances of improvement through selection. Similarly, correlation

analysis helps in identifying the relationship among different traits, while path coefficient analysis provides information about the direct and indirect effects of various characters on yield.

Since yield is a complex trait influenced by several component characters, understanding genetic variability and trait association is essential for effective selection. Therefore, the present study was undertaken to evaluate different garden pea genotypes for genetic variability, correlation and path coefficient analysis and to identify superior genotypes for use in future breeding programmes.

Materials and Methods

Experimental Site

The present investigation entitled "Genetic Variability Studies in Genotypes of Garden Pea (*Pisum sativum* L.)" was conducted during the winter season of 2024–25 at the Research Farm, School of Agriculture, Abhilashi University, Mandi (H.P.). The experimental farm is situated in the mid-hill zone of Himachal Pradesh under sub-humid climatic conditions, which are favourable for garden pea cultivation. The soil of the experimental field varied from sandy loam to clay loam in texture with a pH ranging from 6.5 to 7.5.

Table 1 : Details of genotypes used in the study

Sr. No.	Genotypes	Sources
1	Lincoln	IARI, Regional Sation Katrain
2	Arka Ajeet	IIHR Bangalore
3	Azad Pea-1	CSAUAST, Kanpur
4	Palam Priya	CSKHPKV, Palampur
5	DPP-9414	CSKHPKV, Palampur
6	DPP-9411	CSKHPKV, Palampur
7	Green Pearl	Dhaanya Seeds
8	Arka Kartik	IIHR, Bangalore
9	VL-7	VPKAS, Almora
10	PB-89 (Check)	PAU, Ludhiana

Experimental Design

The experiment was laid out in a Randomized Block Design (RBD) with three replications comprising ten genotypes including one check variety.

Table 2 : Experimental details

Location	Research Farm, Abhilashi University
Design	RBD (Randomized block design)
Year	2024-25
Replications	03
Genotypes/Treatments	9+1(Check)
Plot Size	2.70 m × 2.30 m
Spacing	45 cm × 10 cm

Observations Recorded

Five plants were randomly selected and tagged from each plot for recording observations on growth, yield and quality parameters.

Growth, yield and quality Parameters

Observations were recorded on days to 50% flowering, number of primary branches per plant, days to first harvest, plant height, number of pods per plant, number of seeds per pod, pod length, average pod weight, pod yield per plot, pod yield per hectare, shelling percentage and total soluble solids (TSS). The recorded data were subjected to analysis of variance (ANOVA), and genetic parameters including GCV, PCV, heritability, genetic advance, correlation and path coefficient analysis were estimated using standard statistical procedures.

Disease Severity

Severity of powdery mildew was recorded at regular intervals using the disease rating scale described by Mayee and Datar (1986). Based on disease incidence, genotypes were categorized as resistant, moderately resistant, moderately susceptible and susceptible.

Statistical Analysis

The recorded data were subjected to analysis of variance (ANOVA) following the procedure described by Gomez and Gomez (1984) for Randomized Block Design. Genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability (broad sense), genetic advance and genetic gain were estimated using standard statistical methods. Correlation coefficients were calculated according to Al-Jibouri *et al*. (1958), while path coefficient analysis was carried out following the method suggested by Dewey and Lu (1959). Statistical analysis was performed using MS Excel and OPSTAT software.

Results and Discussion

Analysis of Variance

The analysis of variance (ANOVA) was carried out to assess the extent of variability among the garden pea genotypes for different growth, yield and quality traits. The results revealed significant differences among the genotypes for all the characters studied, indicating the presence of sufficient genetic variability in the experimental material. The existence of significant variation among genotypes suggests ample scope for selection and genetic improvement of desirable traits in garden pea. The observed variability may be attributed to differences in the genetic makeup of the genotypes. Similar findings regarding the

presence of substantial variability in garden pea have also been reported by several earlier researchers.

Table 3: ANOVA (Analysis of variance) for various traits in garden pea

Sr. No.	Traits	Mean Sum of squares (MSS)		
		Replications	Treatments	Error
1	Days to 50 % flowering	23.97	94.87*	11.67
2	Number of primary branches/plants	0.02	0.30*	0.02
3	Days to first harvest	66.15	103.51*	18.87
4	Plant height (cm)	13.73	28.87*	7.08
5	Number of pods per plant	0.29	12.47*	0.85
6	Number of seeds per pods	0.16	3.30*	0.27
7	Pod length (cm)	0.31	4.76*	0.25
8	Average Pod weight (g)	0.16	0.83*	0.16
9	Pod yield/plot (kg)	0.23	5.16*	0.47
10	Pod yield/ha (q)	5.50	1542.08*	196.31
11	Shelling percentage	36.55	144.44*	20.67
12	TSS (° Brix)	3.39	9.35*	1.08

Mean Performance of Genotypes

Days to 50 per cent Flowering

Days to 50 per cent flowering is an important trait associated with earliness in garden pea. Significant variation was observed among the genotypes for this character. The values ranged from 91.83 to 110.67 days with a mean of 97.33 days. Among the genotypes, Palam Priya was the earliest to attain 50 per cent flowering (91.83 days), followed by PB-89 (92.38 days) and Arka Ajeet (93.17 days). The maximum number of days to 50 per cent flowering was recorded in DPP-9414 (110.67 days), indicating its late flowering behaviour. These results indicate the existence of considerable variability for earliness among the genotypes studied. Pal and Singh (2013) and Ali *et al*. (2018) also reported significant differences in the performance of genotypes for days to 50 per cent flowering in their respective studies.

Number of Primary Branches per Plant

The number of primary branches per plant is an important yield contributing trait in garden pea. Significant differences among the genotypes were observed for this character. The number of primary branches per plant ranged from 1.66 to 2.69 with an overall mean of 2.12. The highest number of primary branches was recorded in VL-7 (2.69), followed by Arka Ajeet (2.46), whereas the lowest value was observed in DPP-9411 (1.66). The observed variation indicates the potential for improvement through selection. Gautam *et al*. (2017) and Meena *et al*. (2025) also reported significant variability among pea genotypes for number of primary branches per plant

Days to First Harvest

Days to first harvest is an important indicator of crop maturity and market availability. Significant variation was observed among the genotypes with values ranging from 130.00 to 150.00 days. Palam Priya recorded the earliest harvest (130.00 days), followed by PB-89 (133.00 days), while DPP-9414 took the maximum number of days (150.00 days) to reach harvest stage. Early maturing genotypes are advantageous for obtaining higher market prices and fitting into multiple cropping systems. Sharma and Bora (2013) and Singh and Dhall (2018) also reported significant differences in the performance of genotypes for days to first harvest in their respective studies.

Plant Height (cm)

Plant height is an important growth parameter that influences plant vigour and overall productivity. Significant differences among the genotypes were observed for this trait. Plant height ranged from 44.46 to 53.76 cm with a mean value of 49.25 cm. Among the genotypes, Lincoln recorded the maximum plant height (53.76 cm), which was statistically at par with VL-7 (52.31 cm), Azad Pea-1 (51.73 cm) and Arka Ajeet (51.33 cm). The minimum plant height was observed in DPP-9411 (44.46 cm). The variability observed among genotypes indicates the existence of considerable genetic diversity for this trait. Pal and Singh (2013) and Ali *et al*. (2018) also reported significant differences in the performance of genotypes for days to 50 per cent flowering in their respective studies.

Number of Pods per Plant

Number of pods per plant is one of the most important yield contributing characters in garden pea. Significant differences were observed among the genotypes for this trait. The values ranged from 9.53 to 16.21 pods per plant with a mean value of 12.08 pods. The maximum number of pods per plant was recorded in PB-89 (16.21), followed by Lincoln (14.53), whereas the minimum number of pods per plant was observed in Palam Priya (9.53). The higher number of pods per plant may contribute directly towards increased pod yield. Ahmad *et al*. (2014), Pandey *et al*. (2015) and Katoch *et al*. (2016) also reported significant differences in the performance of genotypes for number of pods per plant in their respective studies

Number of Seeds per Pod

The number of seeds per pod is an important trait affecting yield and pod quality in garden pea. Significant variation was observed among the genotypes for this character. The number of seeds per

pod ranged from 6.58 to 9.82 with an overall mean of 8.01. Lincoln recorded the highest number of seeds per pod (9.82), followed by PB-89 (9.17), while the lowest value was recorded in DPP-9411 (6.58). The observed variability suggests ample scope for selection of superior genotypes. Siddika *et al*. (2013) and Khan *et al*. (2017) also reported significant differences in the performance of genotypes for number of seeds per pod in their respective studies.

Pod Length (cm)

Pod length is an important market and yield related trait in garden pea. Significant differences among the genotypes were recorded for this character. The pod length ranged from 7.09 to 10.55 cm with a mean value of 8.67 cm. PB-89 produced the longest pods (10.55 cm), followed by Green Pearl (9.98 cm) and Lincoln (9.91 cm), whereas the shortest pods were recorded in DPP-9411 (7.09 cm). Longer pods are generally preferred due to their higher seed content and better market acceptability. Sharma and Bora (2013) and Katoch *et al*. (2016) also reported significant differences among genotypes for pod length in their respective studies

Average Pod Weight (g)

Average pod weight directly contributes to total yield and is considered an important economic trait. Significant variation was observed among the genotypes for pod weight. The values ranged from 3.89 to 5.53 g with a mean value of 4.74 g. Lincoln recorded the highest average pod weight (5.53 g), while VL-7 exhibited the lowest pod weight (3.89 g). Genotypes with higher pod weight may be useful in breeding programmes aimed at improving yield. Gautam *et al*. (2017), Aman *et al*. (2021) and Sharma *et al*. (2023) also reported significant differences among genotypes for average pod weight in their respective studies.

Pod Yield per Plot (kg)

Pod yield per plot is an important indicator of productivity under field conditions. Significant differences among the genotypes were observed for this trait. The values ranged from 5.57 to 9.25 kg per plot with a mean value of 6.99 kg. Lincoln recorded the highest pod yield per plot (9.25 kg), followed closely by PB-89 (9.12 kg), whereas the lowest yield was recorded in DPP-9414 (5.57 kg). The superior performance of Lincoln may be attributed to its favourable yield contributing traits. Pandey *et al*. (2015) and Bhardwaj *et al*. (2020) also reported significant differences in the performance of genotypes for pod yield in their respective studies.

Pod Yield per Hectare (q.ha^{-1})

Pod yield per hectare is the ultimate criterion for evaluating the performance of genotypes. Significant variation was observed among the genotypes for this trait. The yield ranged from 113.58 to 178.55 q ha^{-1} with a mean value of 137.21 q ha^{-1}. Lincoln recorded the highest pod yield per hectare (178.55 q ha^{-1}), followed by PB-89 (172.59 q ha^{-1}), while Green Pearl recorded the lowest yield (113.58 q ha^{-1}). These results indicate that Lincoln and PB-89 possess good yield potential and may be utilized in future breeding programmes. Similar findings were reported by Kumar *et al*. (2015), Pandey *et al*. (2015) and Bhardwaj *et al*. (2020).

Shelling Percentage (%)

Shelling percentage is an important quality parameter that determines the proportion of edible seeds obtained from pods. Significant differences were observed among the genotypes for this trait. The values ranged from 40.26 to 60.72 per cent with a mean value of 52.03 per cent. Arka Ajeet recorded the highest shelling percentage (60.72%), followed by Azad Pea-1 (59.41%) and Lincoln (58.72%), whereas the lowest shelling percentage was observed in DPP-9414 (40.26%). Higher shelling percentage is desirable for better quality and market value (Kumar *et al*. 2015; Barcchiya *et al*. 2018).

Total Soluble Solids (°Brix)

Total soluble solids (TSS) is an important quality trait associated with sweetness and consumer preference. Significant variability was observed among the genotypes for this character. The TSS values ranged from 14.31 to 19.27 °Brix with a mean value of 16.79 °Brix. DPP-9414 recorded the highest TSS content (19.27 °Brix), followed by Green Pearl (18.68 °Brix) and Azad Pea-1 (18.48 °Brix), whereas the lowest TSS content was observed in DPP-9411 (14.31 °Brix). Higher TSS content enhances flavour and market acceptability of garden pea pods. (Kumar *et al*. 2015; Pandey *et al*. 2015 and Katoch *et al*. 2016).

Table 4: Mean performance of garden pea genotypes for days to 50 percent flowering, primary branches per plant, days to first harvest, plant height (cm), number of pods per plant, number of seeds per pod and pod length, average pod weight (g), pod yield per plot (kg), pod yield per hectare (q), shelling percentage and TSS (°Brix).

Genotypes	Days to 50 percent flowering	Primary branches per plant	Days to first harvest	Plant height (cm)	Number of pods per plant	Number of seeds per pod	Pod length	Average Pod weight (g)	Pod yield per plot (kg)	Pod yield per hectare (q)	Shelling percentage	TSS (°Brix)
Lincoln	94.53	2.13	135.00	53.76	14.53	9.82	9.91	5.53	9.25	178.55	58.72	15.41
Arka Ajeet	93.17	2.46	137.00	51.33	12.67	8.71	7.42	4.91	7.68	148.82	60.72	15.12
Azad Pea-1	99.29	2.07	142.00	51.73	11.24	7.73	9.59	5.09	7.09	137.36	59.41	18.48
Palam Priya	91.83	1.95	130.00	48.36	9.53	8.82	8.11	5.14	6.05	121.64	54.66	17.42
DPP-9414	110.67	1.98	150.00	50.57	10.73	7.19	8.19	4.13	5.57	119.28	40.26	19.27
DPP-9411	96.76	1.66	138.00	44.46	10.66	6.58	7.09	4.43	6.15	120.24	48.41	14.31
Green Pearl	101.54	1.73	145.00	45.99	10.93	7.46	9.98	4.27	5.86	113.58	49.73	18.68
Arka Kartik	95.19	2.06	139.00	47.33	11.26	7.52	8.58	4.99	6.82	132.89	53.93	15.66
VL-7	97.89	2.69	136.00	52.31	13.06	7.11	7.24	3.89	6.34	127.12	42.48	15.57
PB-89 (Check)	92.38	2.26	133.00	46.68	16.21	9.17	10.55	5.05	9.12	172.59	51.97	18.01
Mean	97.33	2.12	138.50	49.25	12.08	8.01	8.67	4.74	6.99	137.21	52.03	16.79
Min	91.83	1.66	130.00	44.46	9.53	6.58	7.09	3.89	5.57	113.58	40.26	14.31
Max	110.67	2.69	150.00	53.76	16.21	9.82	10.55	5.53	9.25	178.55	60.72	19.27
SE(m)±	1.97	0.07	2.51	1.54	0.53	0.30	0.29	0.23	0.40	8.09	2.63	0.60
CD@5%	5.86	0.21	7.45	4.56	1.59	0.89	0.86	0.68	1.18	24.04	7.80	1.78

Disease severity (%)

The severity of powdery mildew varied among the different garden pea genotypes and ranged from 8.76% to 58.80%, with an average of 28.45%. The highest disease severity was recorded in Green Pearl (58.80%), followed by VL-7 (47.83%), Azad Pea-1 (39.33%), and DPP-9411 (36.50%). On the other hand, the lowest severity was observed in Lincoln (8.76%), followed by PB-89 (10.07%), Arka Ajeet (13.17%), and Palam Priya (16.18%). Based on the disease reaction, Lincoln and PB-89 were found to be resistant, Arka Ajeet and Palam Priya were moderately resistant, Azad Pea-1, DPP-9414, DPP-9411, and Arka Kartik were moderately susceptible, while Green Pearl and VL-7 were susceptible to powdery mildew. The differences in disease severity among the genotypes may be due to their genetic makeup and level of resistance (Rana *et al*., 2023). Genotypes with lower disease severity can be useful in breeding programmes for developing powdery mildew-resistant varieties.

Table 5: Reaction of powdery mildew disease

Genotype	Mean	Reaction
Lincoln	8.76	Resistant
Arka Ajeet	13.17	Moderately Resistant
Azad Pea-1	39.33	Moderately Susceptible
Palam Priya	16.18	Moderately Resistant
DPP-9414	29.79	Moderately Susceptible
DPP-9411	36.50	Moderately Susceptible
Green Pearl	58.80	Susceptible
Arka Kartik	24.07	Moderately Resistant
VL-7	47.83	Susceptible
PB-89 (Check)	10.07	Resistant

Parameters of Variability

The estimates of genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability, genetic advance and genetic gain revealed the presence of considerable variability among the garden pea genotypes. For all the traits studied, PCV values were higher than the corresponding GCV values, indicating the influence of environmental factors on trait expression. However, the differences between PCV and GCV were generally low, suggesting that most of the variation was genetic in nature.

Among the traits studied, pod yield per plot exhibited the highest GCV (17.87%) and PCV (20.40%), followed by number of pods per plant (16.29% and 18.00%) and pod yield per hectare (15.44% and 18.51%), indicating moderate variability and greater scope for improvement through selection. Moderate estimates of GCV and PCV were also observed for pod length, number of primary branches per plant and number of seeds per pod. In contrast, days to 50 per cent flowering, days to first harvest and plant height recorded relatively lower values of GCV and PCV, indicating comparatively less variability for these traits.

High heritability estimates were recorded for number of primary branches per plant (85.99%), pod length (85.60%) and number of pods per plant (81.93%). High heritability was also observed for number of seeds per pod (78.86%), pod yield per plot (76.74%), TSS (71.84%) and days to 50 per cent

flowering (70.38%), suggesting that these traits were predominantly controlled by genetic factors and could be effectively improved through selection. Moderate heritability was observed for the remaining characters.

The highest genetic gain as per cent of mean (GAM) was recorded for pod yield per plot (32.25%), followed by number of pods per plant (30.37%), number of primary branches per plant (27.63%), pod length (26.96%) and pod yield per hectare (26.52%). High heritability coupled with high genetic gain for these traits indicates the predominance of additive gene action and suggests that direct selection for these characters would be effective in improving yield in garden pea. Similar findings have also been reported by Pandey *et al*. (2015), Barcchiya *et al*. (2018) and Meena *et al*. (2025).

Table 6 : Estimates of parameters of variability for various traits in garden pea genotypes

Sr. No.	Parameters	Range	Mean	Coefficient of variability		Heritability (%)	Genetic gain (%)	GAM (%)
				Genotypic	Phenotypic			
1	Days to 50 % flowering	91.83-110.67	97.33	5.41	6.45	70.38	9.10	9.35
2	Number of primary branches/plants	1.66-2.69	2.12	14.46	15.60	85.99	0.59	27.63
3	Days to first harvest	130.00-150.00	138.50	3.84	4.95	59.93	8.47	6.12
4	Plant height (cm)	44.46-53.76	49.25	5.47	7.69	50.65	3.95	8.02
5	Number of pods per plant	9.53-16.21	12.08	16.29	18.00	81.93	3.67	30.37
6	Number of seeds per pods	6.58-9.82	8.01	12.55	14.13	78.86	1.84	22.95
7	Pod length (cm)	7.09-10.55	8.67	14.15	15.29	85.60	2.34	26.96
8	Average Pod weight (g)	3.89-5.53	4.74	10.00	13.07	58.57	0.75	15.77
9	Pod yield/plot (kg)	5.57-9.25	6.99	17.87	20.40	76.74	2.26	32.25
10	Pod yield/ha (q)	113.58-178.55	137.21	15.44	18.51	69.56	36.39	26.52
11	Shelling percentage (%)	40.26-60.72	52.03	12.35	15.13	66.62	10.80	20.76
12	TSS (° Brix)	14.31-19.27	16.79	9.89	11.67	71.84	2.90	17.26

Correlation Analysis

Correlation coefficients were estimated at both phenotypic and genotypic levels to determine the association among different traits and their contribution towards pod yield. In general, genotypic correlation coefficients were higher than the corresponding phenotypic correlation coefficients, indicating that the observed associations were mainly due to genetic factors and were less influenced by the environment.

Pod yield per hectare exhibited significant and positive association with number of pods per plant, number of seeds per pod, pod length, average pod weight, pod yield per plot and shelling percentage at both phenotypic and genotypic levels. Among these traits, pod yield per plot showed the strongest positive correlation with pod yield per hectare, followed by number of pods per plant and number of seeds per pod.

Days to 50 per cent flowering showed a significant negative association with pod yield per hectare, average pod weight, shelling percentage and number of seeds per pod, indicating that early flowering genotypes tended to produce higher yield. Number of pods per plant was positively and significantly associated with number of seeds per pod, pod length and pod yield per hectare. Similarly, number of seeds per pod exhibited positive association with pod length, average pod weight and pod yield. These results suggest that improvement in these characters may lead to a corresponding increase in pod yield.

The positive association of pod yield with number of pods per plant, seeds per pod, pod length and average pod weight has also been reported by several earlier workers in garden pea. Similar results were reported by Pandey *et al*. (2015), Katoch *et al*. (2016), Gautam *et al*. (2017), Bhardwaj *et al*. (2020) and Sharma *et al*. (2023).

Table 7: Phenotypic correlation coefficients among various traits in garden pea

Traits	Day to 50% Flowering	Number of primary branches per plant	Days to first harvest	Plant height (cm)	Number of pods per plant	Number of seeds per pod	Pod length (cm)	Average pod weight (g)	Pod yield per plot (kg)	Shelling percentage	TSS (°Brix)	Pod yield per hectare (q)
Day to 50% Flowering	1.000	-0.218	0.736*	-0.111	-0.336	-0.490*	-0.067	-0.580*	-0.536*	-0.537*	0.344	-0.426*
Number of primary branches per plant		1.000	-0.241	0.362*	0.465*	0.175	-0.172	-0.018	0.342	0.091	-0.289	0.332
Days to first harvest			1.000	-0.009	-0.282	-0.487*	0.082	-0.367*	-0.323	-0.278	0.293	-0.322
Plant height (cm)				1.000	0.238	0.292	-0.017	0.197	0.291	0.096	0.128	0.287
Number of pods per plant					1.000	0.512*	0.398*	0.215	0.764*	0.230	-0.089	0.748*
Number of seeds per pod						1.000	0.474*	0.691*	0.644*	0.511*	0.019	0.639*
Pod length (cm)							1.000	0.461*	0.455*	0.272	0.441*	0.506*
Average pod weight (g)								1.000	0.588*	0.643*	-0.020	0.511*
Pod yield per plot (kg)									1.000	0.465*	-0.157	0.777*
Shelling percentage										1.000	-0.171	0.460*
TSS (°Brix)											1.000	-0.249

(Significant at 5% level of significance)

Table 8: Genotypic correlation coefficients among various traits in garden pea.

Traits	Day to 50% Flowering	Number of primary branches per plant	Days to first harvest	Plant height (cm)	Number of pods per plant	Number of seeds per pod	Pod length (cm)	Average pod weight (g)	Pod yield per plot (kg)	Shelling percentage	TSS (°Brix)	Pod yield per hectare (q)
Day to 50% Flowering	1.000	-0.194	0.624*	-0.137	-0.320	-0.482*	-0.063	-0.528*	-0.504*	-0.548*	0.302	-0.412*
Number of primary branches per plant		1.000	-0.245	0.317	0.459*	0.162	-0.178	0.003	0.343	0.085	-0.270	0.333
Days to first harvest			1.000	0.017	-0.283	-0.462*	0.064	-0.378*	-0.334	-0.200	0.325	-0.311
Plant height (cm)				1.000	0.236	0.304	0.006	0.146	0.274	0.090	0.093	0.271
Number of pods per plant					1.000	0.513*	0.402*	0.211	0.764*	0.212	-0.103	0.746*
Number of seeds per pod						1.000	0.479*	0.665*	0.639*	0.491*	0.001	0.635*
Pod length (cm)							1.000	0.442*	0.455*	0.249	0.399*	0.501*
Average pod weight (g)								1.000	0.586*	0.607*	-0.016	0.507*
Pod yield per plot (kg)									1.000	0.435*	-0.169	0.775*
Shelling percentage										1.000	-0.116	0.448*
TSS (°Brix)											1.000	-0.241

(Significant at 5% level of significance)

Path Coefficient Analysis

Path coefficient analysis was carried out to partition the correlation coefficients into direct and indirect effects and to identify the traits contributing most effectively towards pod yield per hectare. Pod yield per hectare was considered as the dependent variable, while the remaining characters were treated as independent variables.

The analysis revealed that number of pods per plant, pod length, number of seeds per pod, average pod weight and shelling percentage exerted positive direct effects on pod yield per hectare. These characters also showed significant positive correlations with yield, indicating their importance as reliable selection criteria for yield improvement in garden pea.

Among all the characters studied, number of pods per plant and pod yield per plot contributed substantially towards yield either directly or through indirect effects via other component traits. The positive indirect effects of pod length, number of seeds per pod and average pod weight further enhanced their contribution towards pod yield. In contrast, days to 50 per cent flowering exhibited a negative direct effect on yield, suggesting that early flowering genotypes may be advantageous for achieving higher productivity.

The results of the present investigation indicate that selection based on number of pods per plant, pod

length, number of seeds per pod, average pod weight and shelling percentage would be effective for developing high-yielding garden pea genotypes. Similar findings have been reported by Kumar *et al*. (2014), Gautam *et al*. (2017), Bhardwaj *et al*. (2020), Sharma *et al*. (2023) and Ankush *et al*. (2024).

Table 9: Estimates of direct and indirect effect of different traits on pod yield per hectare at genotypic level in garden pea variety

Traits	Day to 50% Flowering	Number of primary branches per plant	Days to first harvest	Plant height (cm)	Number of pods per plant	Number of seeds per pod	Pod length (cm)	Average pod weight (g)	Pod yield per plot (kg)	Shelling percentage	TSS (°Brix)	Pod yield per hectare (q)
Day to 50% Flowering	0.089	-0.017	0.056	-0.012	-0.029	-0.043	-0.006	-0.047	-0.045	-0.049	0.027	-0.412*
Number of primary branches per plant	-0.007	0.033	-0.008	0.011	0.015	0.005	-0.006	0.000	0.011	0.003	-0.009	0.333
Days to first harvest	-0.028	0.011	-0.045	-0.001	0.013	0.021	-0.003	0.017	0.015	0.009	-0.015	-0.311
Plant height (cm)	-0.019	0.045	0.002	0.141	0.033	0.043	0.001	0.021	0.039	0.013	0.013	0.271
Number of pods per plant	-0.132	0.189	-0.117	0.097	0.412	0.211	0.165	0.087	0.314	0.087	-0.042	0.746*
Number of seeds per pod	-0.019	0.007	-0.019	0.012	0.021	0.040	0.019	0.027	0.026	0.020	0.000	0.635*
Pod length (cm)	-0.021	-0.059	0.021	0.002	0.134	0.160	0.333	0.147	0.152	0.083	0.133	0.501*
Average pod weight (g)	-0.063	0.000	-0.045	0.017	0.025	0.080	0.053	0.120	0.070	0.073	-0.002	0.507*
Pod yield per plot (kg)	-0.040	0.027	-0.026	0.022	0.060	0.050	0.036	0.046	0.079	0.034	-0.013	0.775*
Shelling percentage	-0.076	0.012	-0.028	0.013	0.030	0.068	0.035	0.085	0.061	0.139	-0.016	0.448*
TSS (°Brix)	-0.096	0.085	-0.103	-0.029	0.033	0.000	-0.126	0.005	0.054	0.037	-0.317	-0.241

(Significant at 5% level of significance)

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