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Genotypic Variation in Plant Height, Branching, and Yield Components of Field Pea: Implications for Crop Improvement

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Field pea (*Pisum sativum* L.) is an essential legume crop with significant nutritional value, but its cultivation faces challenges such as reduced light levels and variable yields. This study aimed to evaluate the morphological, phenological, and yield parameters of different field pea genotypes to

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identify high-performing varieties. Experiment was conducted using a randomized complete block design (RCBD), the experiment assessed plant height, number of primary branches, flowering and maturity timings, dry matter partitioning, and yield components. Significant differences were observed among genotypes in plant height, branching, and various yield parameters. The genotype IC381455 exhibited superior performance with the highest values for total dry matter, pod yield per plant, seed yield per hectare, and test weight. It also showed higher leaf, stem, and pod dry weights at multiple growth stages. In contrast, Nippani local-2 consistently recorded the lowest values across these parameters. The highest harvest index was recorded for IPF4-9, indicating effective biomass conversion to seed. The results highlight the genetic variability among genotypes and underscore the importance of selecting high-performing varieties to improve yield and crop quality.

Keywords: Field pea; yield components; test weight; harvest index and genotype variability.

1. INTRODUCTION

Legumes (Leguminosae) are a large group of plants that are significant sources of nutrition for both humans and animals, owing to their high nutritional value. With the continuous growth of the global population, the demand for legumes is increasing, leading to expanded production efforts. Among legumes, the field pea (*Pisum sativum* L.) stands out as a crucial pulse crop, widely utilized in human nutrition. However, field pea cultivation often faces challenges, particularly reduced light levels when grown as an intercrop, which can significantly limit production [1]. Field pea is a self-pollinated diploid species (2n=14 chromosomes) belonging to the Fabaceae family, characterized by green and yellow cotyledons [2]. It thrives in a variety of soil types, ranging from light sandy loams to heavy clays, though it is intolerant to saline and waterlogged conditions. As a winter season crop, field pea requires a cool growing season with moderate temperatures; high temperatures are more detrimental than frost. Additionally, high humidity and cloudy weather can promote the spread of fungal diseases like damping-off and powdery mildew [3].

For successful cultivation, field pea requires well-drained soils free from excessive soluble salts, with a neutral pH range of 6.5 to 7.5. Proper field preparation includes one deep ploughing with a disc or mouldboard plough, followed by 2-3 harrowing and planking operations to ensure good drainage and aeration. Powdery seedbeds should be avoided [4]. Yield variability and instability are major issues for field pea, both within and between sites and seasons, largely due to poor adaptability and low tolerance to biotic and abiotic stresses. Key yield-limiting factors include aphids, low-yielding local varieties, lodging, diseases (such as ascochyta blight and powdery mildew), and pod shattering. High temperatures and soil water deficits are significant abiotic stresses that substantially reduce yields regardless of the growing area [5].

Seed yield in field pea is typically determined by four components: the number of plants per unit area, pods per plant, seeds per pod, and mean seed weight [6]. Efforts to improve yields have focused on maximizing these components. Physiological constraints on productivity include a poor source-sink relationship, lower translocation efficiency at later growth stages, shedding of floral parts, and a low harvest index. Comprehensive studies on the physiological analysis of growth and yield in various crops, including cereals, pulses, oilseeds, and vegetables, have highlighted the importance of growth and yield analysis [7]. Assessing differences in productivity among genotypes involves studying growth and yield parameters [8]. Variations in leaf area and other associated leaf characteristics among genotypes, and their relationship with dry matter accumulation and yield, have been documented in several crops. Thus the present study aims to investigate the morphological and phenological parameters, dry matter partitioning, and yield components in different pea genotypes to identify the best-performing genotype.

2. MATERIALS AND METHODS

The experiment was conducted (2021-2022) using a randomized complete block design (RCBD) with three replications. The gross plot size was 3 m x 2.25 m, while the net plot size was 2.4 m x 2.15 m. Inter-row spacing was maintained at 45 cm and intra-row spacing at 10 cm. The land was prepared by ploughing and harrowing twice, followed by planking to achieve a fine tilth. A basal dose of fertilizer at a rate of 20:40:60 kg NPK per hectare was applied using urea, single super phosphate, and muriate of potash at sowing. Field pea seeds were sourced from AICRP College of Agriculture, Vijayapur, University of Agricultural Sciences, Dharwad, and sown on October 21, 2021, at a depth of 5 cm. Irrigation was provided at critical growth stages, and earthing up was done 30 days after sowing. Weed control was maintained through interculture and hand weeding, and recommended fungicides and insecticides were applied to manage diseases and pests. At physiological maturity, the crop was harvested, and the pods were sun-dried for a day before manually threshing to separate the seeds. The seeds were then cleaned, sun-dried to a moisture content of 13%, and the net plot yield was recorded.

2.1 Collection of Experimental Data

Plant Height (cm): The height of five randomly selected and tagged plants was measured in centimeters from base to tip at 30 and 60 days after sowing and at harvest for each treatment.

Number of Primary Branches per Plant: The number of primary branches (excluding the main stem) per plant was counted at 30 days after sowing (DAS), 60 DAS, and at harvest in each genotype.

Days to 50% Flowering: The number of days from sowing to when 50% of the plants in each genotype flowered was recorded.

Days to Physiological Maturity: The number of days from sowing to when the seeds of most plants in a plot showed the appearance of a black spot on the hilum, indicating physiological maturity, was recorded.

Pod Yield per Plant (g): The weight of pods from five randomly selected plants was recorded, and the average weight was calculated and expressed in grams.

Seed Yield per Hectare: Pods from each net plot were threshed, cleaned, and the seed yield was calculated and expressed in kg ha^-1.

Harvest Index (HI): Harvest index was calculated as the ratio of seed yield to biological yield using the formula suggested by Donald [9].

$$\mathrm{HI} = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

Dry Matter Partitioning: Five randomly selected plants from each treatment were uprooted and separated into leaves, stems, and pods. These parts were air-dried and then oven-dried at 65°C until a constant weight was obtained. The dry weights of shoots and pods were recorded, and the total dry weight was calculated on a per plant basis at 30 and 60 days after sowing and at harvest.

2.2 Statistical Analysis

The data were analyzed and interpreted using Fisher's method of analysis of variance (ANOVA) as outlined by Panse and Sukhatme [10]. The level of significance for the F and t tests was set at P = 0.05. Critical difference (CD) values were calculated at the 5% probability level wherever the F test indicated significance.

3. RESULTS AND DISCUSSION

3.1 Plant Height (cm)

Plant height increased from 30 days after sowing (DAS) to harvest. The data on plant height indicated significant variation among the genotypes at all stages (Table 1). The mean plant height ranged from 35.69 cm at 30 DAS to 87.52 cm at harvest. At 30 DAS, the genotype IPFD6-3 exhibited the maximum plant height (45.12 cm), which was statistically similar to HUP-2, P-725, and P-744. The minimum plant height at this stage was recorded in the DWD local genotype (23.84 cm), which was on par with Nippani local-2 (25.80 cm) and Rachana (27.42 cm). The significant differences in plant height among the genotypes at various growth stages suggest inherent genetic variability. At 60 DAS, the genotype IPFD6-3 again recorded the maximum plant height (96.29 cm), while the DWD local genotype had the least (63.50 cm). Significant differences were observed between the genotypes at this stage as well. This variation in plant height can be attributed to genetic differences and the ability of each genotype to exploit available resources effectively. Taller plants may have an advantage in light capture, which is crucial for photosynthesis and growth [11]. However, excessive height may also lead to issues such as lodging, particularly in high-density planting systems [12]. Similarly, at harvest, the maximum plant height was observed in the genotype IPFD6-3 (105.50 cm). The DWD local genotype had the significantly lowest plant height at harvest (72.65 cm). The results are consistent with previous studies that have demonstrated significant genotype-by-environment interactions affecting plant height in field pea (*Pisum sativum* L.) [13]. Therefore, selecting genotypes with optimal plant height is crucial for improving yield and stability across different growing conditions.

3.2 Number of Primary Branches per Plant

The significant differences in the number of primary branches per plant among the genotypes indicate genetic variability in branching potential. The number of primary branches per plant was observed to be low at 30 days after sowing (DAS) and increased slightly at 60 DAS and harvest (Table 1). At 30 DAS, the genotype IPFD6-3 exhibited the maximum number of primary branches per plant (4.10). The genotype DWD Local recorded the least number of primary branches (1.20), which was on par with the genotype Nippani local-2. At 60 DAS, the maximum number of primary branches per plant was recorded in the genotype IPFD6-3 (6.00). The lowest number of primary branches was observed in the DWD Local genotype (3.02). Branching is an important trait that can influence overall plant architecture and yield. More branches can lead to increased sites for pod formation, thereby potentially enhancing yield [14]. However, excessive branching may also lead to competition for resources within the plant, which could negatively impact individual pod and seed development [15]. At harvest, the genotypes IPFD6-3, HUP-2, and P-725 recorded the maximum number of primary branches per plant (6.85, 6.00, and 5.65, respectively). The minimum number of primary branches per plant was recorded in the DWD Local genotype (3.87). The results align with previous studies demonstrating the impact of genotype on the number of primary branches in field pea [16].

3.3 Days to 50 Percent Flowering:

The significant variation in days to 50 percent flowering among the genotypes indicates a broad range of phenological adaptations (Table 2). The genotype IC381455 took the maximum number of days to reach 50 percent flowering (53 days), which was statistically similar to the genotypes TRCP-8, TPFD6-3, and IC208399. On the other hand, the genotype DWD local recorded the minimum number of days for 50 percent flowering (42 days), which was on par with the genotypes P-744, KMPR-400, and EC292167. The variation in flowering and maturity times is crucial for plant breeders aiming to develop varieties that can adapt to diverse agro-climatic conditions [17]. Early flowering and maturity can be beneficial for escaping late-season stresses, whereas longer-duration genotypes might yield more due to prolonged photosynthetic activity [18].

Table 1. Genotypic variation in Plant height (cm) and number of primary branches per plant at different stages in field pea

SL. NO.	Genotypes	Plant height (cm)			No. of primary branches plant^{-1}		
		30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
1.	**IPF4-9**	35.10	75.12	84.16	1.40	3.35	4.20
2.	**IPF99-25**	32.14	74.10	83.05	1.45	3.30	4.15
3.	**KPMR-400**	35.84	76.50	85.60	1.60	3.50	4.35
4.	**IC381455**	40.00	82.85	90.50	2.40	4.30	5.15
5.	**IC208399**	38.22	79.23	88.60	2.20	4.10	4.95
6.	**EC292167**	37.76	78.50	87.10	1.90	3.80	4.65
7.	**EC598851**	36.42	76.80	85.50	1.80	3.70	4.55
8.	**P725**	41.68	93.64	101.65	2.90	4.80	5.65
9.	**P744**	40.36	85.26	98.06	2.65	4.55	5.40
10.	**HUP-2**	44.28	95.23	104.05	3.25	5.15	6.00
11.	**IPFD6-3**	45.12	96.29	105.50	4.10	6.00	6.85
12.	**TRCP-8**	30.66	70.50	79.20	1.35	3.25	4.05
13.	**DMR-7**	36.36	76.80	85.50	1.60	3.50	4.35
14.	**RACHANA**	27.42	67.50	76.80	1.30	3.20	4.10
15.	**Nippani local -2**	25.80	65.50	74.60	1.20	3.10	3.95
16.	**DWD Local**	23.84	63.50	72.65	1.12	3.02	3.87
	Mean	**35.69**	**78.58**	**87.66**	**2.01**	**3.91**	**4.76**
	S.Em. +	**1.06**	**2.37**	**2.65**	**0.06**	**0.12**	**0.14**
	CD at 5%	**3.07**	**6.85**	**7.64**	**0.17**	**0.33**	**0.40**

3.4 Days to Physiological Maturity

Significant differences were observed among the genotypes for days to physiological maturity (Table 2). The genotype IC381455 took the maximum number of days to reach physiological maturity (109 days), while the genotype DWD local recorded the least number of days to physiological maturity (99 days). These findings are consistent with previous research on field pea genotypes, which also reported significant differences in phenological traits and their impact on yield and adaptability [19]. Selection of genotypes with appropriate flowering and maturity times is vital for maximizing yield potential and ensuring stability across different environments.

3.5 Dry matter partitioning

Leaf Dry Weight: The leaf dry weight increased from 30 days after sowing (DAS) to 60 DAS, after which it decreased at harvest due to leaf senescence. The data on leaf dry weight (g $plant^{-1}$) is presented in Table 2. Significant differences in leaf dry weight were observed among the genotypes at all growth stages. At 30 DAS, the genotype IC381455 recorded the maximum leaf dry weight (4.33 g), whereas the genotype Nippani local-2 had the minimum leaf dry weight (1.45 g). The genotype IC381455 consistently exhibited the highest leaf dry weight across all stages, suggesting superior photosynthetic capacity and potential for higher biomass accumulation. This could be advantageous for overall plant growth and yield, as leaves are the primary sites of photosynthesis [20]. At 60 DAS, IC381455 again showed the maximum leaf dry weight (6.27 g), while Nippani local-2 had the least (2.94 g). At harvest, IC381455 continued to have the maximum leaf dry weight (4.01 g), which was statistically on par with the genotypes IPFD6-3 and Rachana. The minimum leaf dry weight at harvest was recorded in the genotype Nippani local-2 (1.14 g), which was on par with TRCP-8 and EC292167. The results are consistent with earlier studies that have shown significant genotypic variation in leaf biomass production and its impact on crop performance [13]. Selecting genotypes with higher leaf dry weight could be beneficial for breeding programs aimed at improving field pea productivity.

Stem Dry Weight: The stem dry weight increased progressively with crop growth at all stages (Table 2). At 30 days after sowing (DAS), the maximum stem dry weight was recorded for the genotype IC381455 (1.54 g), while the minimum was observed in the genotype Nippani local-2 (0.96 g). At 60 DAS, IC381455 continued to show the highest stem dry weight (3.98 g), whereas Nippani local-2 had the lowest (1.52 g). Increased stem dry weight is often associated with better support for other plant parts, such as leaves and pods, and may contribute to higher overall productivity [21]. At harvest, the genotype IC381455 achieved the maximum stem dry weight (4.27 g), which was significantly higher than other genotypes and comparable to IPFD6-3 and Rachana. Conversely, the minimum stem dry weight at harvest was recorded for Nippani local-2 (1.81 g). These findings align with previous research that highlights the importance of stem biomass in determining crop performance and yield [22].

Pod Dry Weight: Efficient pod development and high dry weight are associated with higher seed production and better crop yield [13]. The pod dry weight varied significantly among the genotypes at 60 days after sowing (DAS) and at harvest (Table 3). At 60 DAS, the genotype IC381455 recorded the maximum pod dry weight (3.08 g $plant^{-1}$), which was statistically similar to the genotypes IPFD6-3 and Rachana. In contrast, the genotype Nippani local-2 had the minimum pod dry weight (0.61 g$plant^{-1}$).At harvest, IC381455 again showed the highest pod dry weight (12.21 g $plant^{-1}$), which was comparable to IPFD6-3 and Rachana. The lowest pod dry weight at harvest was observed in Nippani local-2 (9.74 g $plant^{-1}$). These findings align with previous research that emphasizes the importance of pod biomass in determining yield potential [23]. Selecting genotypes with higher pod dry weight can enhance crop productivity.

Total Dry Matter Production: The observed differences in total dry matter production among the genotypes reflect variations in their overall growth and biomass accumulation capabilities. Total dry matter accumulation varied significantly among the genotypes at all growth stages (Table 3). At 30 days after sowing (DAS), the genotype IC381455 recorded the highest total dry matter production (5.87 g $plant^{-1}$), which was statistically similar to IPFD6-3 and Rachana. Conversely, the genotype Nippani local-2 had the lowest total dry matter (2.41 g $plant^{-1}$). At 60 DAS, IC381455 again showed the maximum total dry matter (13.33 g $plant^{-1}$), with values comparable to IPFD6-3 and Rachana. Nippani local-2 recorded the minimum total dry matter at this stage (5.07 g plant^{-1}). Enhanced dry matter production in genotypes like IC381455 can contribute to improved plant development and higher yields [24]. At harvest, IC381455 achieved the highest total dry matter production (20.49 g plant^{-1}), which was significantly higher than that of other genotypes. The genotype Nippani local-2 had the lowest total dry matter at harvest (12.69 g plant^{-1}). These results are consistent with previous research emphasizing the importance of dry matter accumulation in crop performance and yield determination [25].

3.6 Yield and Yield Components

The data on yield and yield components viz., pod yield per plant, seed yield per hectare, harvest index and test weight (100 grain weight) were differed significantly among the genotypes.

Pod Yield per Plant (g): The variation in pod yield per plant among genotypes highlights differences in their ability to produce and develop pods (Table 4). Effective pod production is essential for maximizing seed yield, as pods directly contribute to the number of seeds produced per plant [25]. The genotype IC381455 achieved the highest pod yield per plant (12.21 g), which was statistically similar to IPFD6-3 (12.07 g) and Rachana (11.97 g). In contrast, the genotype Nippani local-2 exhibited the lowest pod yield per plant. Improved pod yield can be achieved through selective breeding for genotypes that show higher pod production potential [13].

Seed Yield per Hectare: The differences in seed yield per hectare reflect variations in the genotypes' overall productivity. Significant differences in seed yield per hectare were observed among the genotypes (Table 4). Seed yield is influenced by multiple factors, including pod yield, seed number per pod, and seed weight highlighting the importance of these components in achieving high productivity [26]. The genotype IC381455 achieved the highest seed yield per hectare, recording 1504 kg ha^{-1}, which was statistically similar to IPFD6-3 (1337 kg ha^{-1}) and Rachana (1330 kg ha^{-1}). In contrast, Nippani local-2 had the lowest seed yield per hectare at 817 kg ha^{-1}. These results are consistent with previous studies that emphasize the significance of seed yield as a critical measure of crop performance and overall productivity [25].

Table 2. Genotypic variation in days to 50 per cent flowering, days to physiological maturity, leaf dry weight and stem dry weight at different stages in field pea

Sl. No.	Genotypes	Days to 50% flowering	Days to physiological maturity	Leaf dry weight (g plant^{-1})			Stem dry weight (g plant^{-1})		
				30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
1.	**IPF4-9**	48.00	105.00	2.01	3.73	1.93	1.17	2.14	2.25
2.	**IPF99-25**	45.00	103.00	1.63	3.12	1.32	1.12	1.96	2.21
3.	**KPMR-400**	44.00	102.00	2.23	3.51	1.71	1.18	2.39	2.68
4.	**IC381455**	53.00	109.00	4.33	6.27	4.01	1.54	3.98	4.27
5.	**IC208399**	50.00	107.00	1.53	3.03	1.23	1.08	1.82	2.11
6.	**EC292167**	46.00	103.00	1.52	3.02	1.22	1.05	1.75	2.04
7.	**EC598851**	48.00	105.00	3.33	4.83	2.96	1.25	2.81	3.09
8.	**P725**	47.00	104.00	3.02	4.52	2.72	1.24	1.85	2.14
9.	**P744**	43.00	101.00	3.46	4.96	3.16	1.39	3.72	4.01
10.	**HUP-2**	49.00	106.00	3.43	4.93	3.13	1.31	3.69	3.98
11.	**IPFD6-3**	51.00	108.00	4.21	5.71	3.81	1.46	3.95	4.24
12.	**TRCP-8**	52.00	109.00	1.46	2.96	1.16	1.01	1.56	1.85
13.	**DMR-7**	50.00	107.00	1.54	3.04	1.24	1.11	1.93	2.22
14.	**RACHANA**	47.00	104.00	3.68	5.18	3.38	1.42	3.89	4.18
15.	**Nippani local -2**	48.00	105.00	1.45	2.94	1.14	0.96	1.52	1.81
16.	**DWD Local**	42.00	99.00	1.58	3.08	1.23	1.12	1.92	2.43
	Mean	**47.69**	**104.81**	**2.53**	**4.05**	**2.21**	**1.21**	**2.56**	**2.84**
	S.Em. +	**1.48**	**3.26**	**0.07**	**0.12**	**0.06**	**0.04**	**0.07**	**0.08**
	CD at 5%	**4.27**	**9.40**	**0.21**	**0.34**	**0.18**	**0.10**	**0.20**	**0.23**

Table 3. Genotypic variation in pod dry weight (g plant^{-1}) and total dry matter (g plant^{-1}) at different stages in field pea

Sl. No.	Genotypes	Pod dry weight (g plant^{-1})		Total dry matter (g plant-1)		
		60 DAS	At harvest	30 DAS	60 DAS	At harvest
1.	IPF4-9	1.62	10.75	3.18	7.09	14.71
2.	IPF99-25	1.13	10.26	2.66	6.15	13.77
3.	KPMR-400	1.32	10.45	3.47	7.44	15.06
4.	IC381455	3.08	12.21	5.87	13.33	20.49
5.	IC208399	1.07	10.2	2.60	6.06	13.68
6.	EC292167	1.03	10.16	2.57	5.98	13.60
7.	EC598851	1.72	10.85	4.61	10.01	17.63
8.	P725	1.29	10.42	4.27	9.25	16.87
9.	P744	2.78	11.91	4.85	11.46	19.08
10.	HUP-2	2.69	11.82	4.64	10.24	17.79
11.	IPFD6-3	2.94	12.07	5.67	12.60	20.12
12.	TRCP-8	0.85	9.98	2.47	5.37	12.99
13.	DMR-7	1.32	10.45	2.74	6.12	13.74
14.	RACHANA	2.84	11.97	5.10	11.91	19.53
15.	Nippani local -2	0.61	9.74	2.41	5.07	12.69
16.	DWD Local	2.18	11.31	2.65	6.09	13.71
	Mean	**1.78**	**10.91**	**3.74**	**8.39**	**15.97**
	S.Em. +	**0.05**	**0.33**	**0.11**	**0.24**	**0.47**
	CD at 5%	**0.15**	**0.95**	**0.31**	**0.69**	**1.35**

Table 4. Genotypic variation in yield and yield components in field pea

Sl. No.	Genotypes	Pod yield plant^{-1} (g)	Seed yield (kg ha^{-1})	Harvest index (%)	Test weight (100 seed weight, g)
1.	IPF4-9	10.75	1121	50.65	16.68
2.	IPF99-25	10.26	959	47.86	18.09
3.	KPMR-400	10.45	1051	47.01	17.74
4.	IC381455	12.21	1504	44.80	12.35
5.	IC208399	10.2	946	39.55	16.78
6.	EC292167	10.16	907	37.87	14.82
7.	EC598851	10.85	1248	34.32	15.08
8.	P725	10.42	1193	35.33	17.91
9.	P744	11.91	1300	40.88	17.12
10.	HUP-2	11.82	1290	43.45	15.94
11.	IPFD6-3	12.07	1337	40.01	17.08
12.	TRCP-8	9.98	900	39.26	17.56
13.	DMR-7	10.45	1041	40.03	16.63
14.	RACHANA	11.97	1330	40.96	15.87
15.	Nippani local -2	9.74	817	35.78	8.45
16.	DWD Local	11.31	1027	44.64	8.72
	Mean	**10.91**	**1123.18**	**41.40**	**15.43**
	S.Em. +	**0.33**	**32.94**	**1.29**	**0.48**
	CD at 5%	**0.95**	**95.13**	**3.72**	**1.37**

Harvest Index (%): Harvest index, a critical measure of crop efficiency, reflects the proportion of total biomass allocated to seed production. The genotype IPF4-9 recorded the highest harvest index at 53.03%, which was statistically similar to KMPR-400 (51.64%) and IPF99-25 (48.17%). Conversely, the genotype EC598851 had the lowest harvest index at 34.32% (Table 4). It suggests that a smaller proportion of its biomass is being converted into seeds, which could be due to factors such as excessive vegetative growth or inefficiencies in pod and seed development [27]. These findings align with previous research highlighting the importance of harvest index as an indicator of crop performance and yield optimization [2]. Selecting genotypes with higher harvest indices can contribute to more productive and efficient cropping systems.

Test Weight (100 Seed Weight): Test weight, or 100 seed weight (Table 4), is a critical parameter that affects the overall quality and market value of seeds. This trait is crucial for improving seed size and weight, which can enhance both the economic value of the crop and its performance in subsequent planting [28]. The genotype IPF99-25 exhibited the highest test weight at 18.09 g, which was statistically comparable to P725 (17.91 g) and KPMR-400 (17.74 g). In contrast, Nippani local-2 had the lowest test weight at 8.45 g. Low test weight can be indicative of issues such as inadequate nutrient supply during seed development or genetic factors affecting seed formation [29]. These results are consistent with other studies that emphasize the importance of test weight as an indicator of seed quality and its role in determining crop productivity and marketability [30]. Selecting genotypes with higher test weights can lead to improved seed quality and better crop outcomes.

4. CONCLUSION

In conclusion, the study demonstrated significant genetic variability among field pea genotypes concerning key agronomic traits, including plant height, branching, flowering, maturity, and dry matter partitioning. Genotypes such as IC381455, IPFD6-3, and Rachana exhibited superior performance in terms of plant height, pod yield per plant, and seed yield per hectare. Notably, IC381455 consistently showed higher values in leaf, stem, and pod dry weights, contributing to its high total dry matter production and seed yield. The harvest index and test weight results highlighted ICF99-25's superior efficiency in seed production. These findings underscore the potential of selecting genotypes with optimal growth characteristics and yield components for improved field pea productivity. Future breeding programs should focus on integrating these desirable traits to enhance yield stability and crop performance under diverse environmental conditions.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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