



Response of Different Sowing Dates on Growth and Yield of Different Cultivars of Field Pea (*Pisum sativum* L.)

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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.) productivity is influenced by sowing time and cultivar selection. The present study evaluated the response of three field pea cultivars to three sowing dates under the agro-climatic conditions of Utlou, Manipur, during the 2024–2025 Rabi season. The experiment was conducted at the Research Farm of Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences using a factorial randomised block design with nine treatment combinations and three replications. The sowing dates were 30 December 2024, 10 January 2025, and 20 January 2025, while the cultivars were Rachna, Prakash, and Aman. Growth and yield attributes were recorded during crop development and at harvest. Sowing on 30 December produced the highest mean plant height at harvest (57.27 cm) and grain yield (13.56 q/ha), whereas sowing on 20 January produced the lowest corresponding values of 52.23 cm and 11.66 q/ha. Among the cultivars, Aman recorded the highest plant height at harvest (61.37 cm) and grain yield (13.82

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q/ha). The interaction between sowing date and cultivar was also significant. The 30 December × Aman combination recorded the highest grain yield (14.87 q/ha), while the 20 January × Prakash combination recorded the lowest yield (10.56 q/ha). These results indicate that earlier sowing, particularly with Aman, was associated with improved field pea growth and yield under the conditions of the study.

Keywords: *Pisum sativum* L.; sowing date; cultivar; growth attributes; plant height; yield attributes.

1. Introduction

Pulses occupy a pivotal position in Indian agriculture due to their vital role in ensuring food and nutritional security, sustaining soil health, and supporting the livelihoods of small and marginal farmers. Among the pulse crops, field pea (*Pisum sativum* L.) is an important cool-season legume grown widely across temperate and subtropical regions of the world. It is valued both as a food crop and as a component of sustainable farming systems. The crop is rich in protein, carbohydrates, minerals, and vitamins, making it an important dietary component, especially in vegetarian diets. In addition to its nutritional value, field pea contributes significantly to soil fertility improvement through its ability to fix atmospheric nitrogen in association with *Rhizobium* bacteria. Pea is a highly popular and healthy vegetable that is mostly grown as a winter crop across the world (Khichi et al., 2017). The interaction between sowing date and cultivar is of particular importance in optimising crop productivity. Recent field studies have reported significant effects of sowing date and varietal choice on field pea growth and yield attributes under distinct Indian production environments (Achar et al., 2025; Bind et al., 2025; Ahmed et al., 2020; Chandel et al., 2022; Kumar et al., 2024; Mukherjee et al., 2013; Sirwaiya & Kushwah, 2018).

A variety that performs well under early sowing conditions may not necessarily yield satisfactorily when sown late, and vice versa. This differential response is primarily due to genotype × environment interaction, wherein the expression of genetic potential is influenced by prevailing environmental conditions. Therefore, identifying suitable cultivar–sowing date combinations is essential for maximising growth, yield attributes, and final yield of the crop. Multi-environment evaluations also indicate that field pea performance is shaped by genetic variability and environmental conditions, supporting location-specific evaluation of cultivars (Achenef et al., 2025; Hu et al., 2025; Koeshall et al., 2021; Singh et al., 1996; Tawaha & Turk, 2004).

Growth parameters such as plant height, number of branches, leaf area, and dry matter accumulation are important indicators of crop vigour and photosynthetic efficiency. These parameters are highly sensitive to sowing time and varietal differences. Favourable sowing conditions generally promote better vegetative growth, which in turn supports the development of yield attributes such as the number of pods per plant, the number of seeds per pod, and seed weight. Yield is ultimately the integrated expression of these growth and yield attributes, all of which are influenced by the sowing environment and the genetic characteristics of the cultivar. (Dass et al., 2005; Lamichaney et al., 2021).

However, the combined response of Rachna, Prakash, and Aman to the late-December and January sowing schedule examined in this study has not been adequately documented under the agro-climatic conditions of Utlou, Manipur.

Accordingly, the objective of this study was to evaluate the effects of three sowing dates and three field pea cultivars, including their interaction, on crop growth and yield under the agro-climatic conditions of Utlou, Manipur.

2. Material and Methods

The field experiment was carried out during the Rabi season of 2024–2025 at the Research Farm of Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences, Utlou, Manipur. The experimental site is situated at 24.647° N latitude and 93.757° E longitude, at an elevation of 790 metres above mean sea level. The area falls within the subtropical climatic zone, characterised by cool and dry winters with moderately misty mornings and comfortable daytime temperatures.

Prior to the experiment, soil samples (0–15 cm depth) were collected from the experimental field and analysed for physicochemical properties, as presented in Table 3.2. The soil was classified as clay loam, with a slightly acidic reaction (pH 5.5) and an electrical conductivity of 0.8 dS/m, indicating non-saline conditions. The soil had an organic carbon content of 0.87%, with available nitrogen (400 ppm), phosphorus (9.8 ppm), and potassium (167 ppm). The soil had a 50% water-holding capacity, which was suitable for pulse crop cultivation.

Nine treatments with three replications were laid out in a factorial randomised complete block design.

A uniform basal dose of 20:60:40 kg N, P₂O₅, and K₂O per hectare was applied to all plots at the time of sowing. Nitrogen and phosphorus were supplied through urea and diammonium phosphate (DAP), while muriate of potash (MOP) was used as the potassium source. Fertilisers were thoroughly mixed with the soil at sowing to ensure uniform nutrient availability.

Biometric observations on different growth and yield attributes were recorded at various growth stages.

Chart 1. Treatment details

Factor 1 (Date of Sowing – 3 levels)

D1– last week of December D2 - 10 days after 1st sowing D3 – 10 days after 2nd sowing

Factor 2 (Field pea variety)

V1 – Rachna V2 – Prakash V3– Aman

Treatment	Treatment details	Symbols	Variety
T1	1st sowing on 30th December 2024	D1V1	Rachna
T2	1st sowing on 30th December 2024	D1V2	Prakash
T3	1st sowing on 30th December 2024	D1V3	Aman
T4	10 days After 1st sowing (10-01-2025)	D2V1	Rachna
T5	10 days After 1st sowing (10-01-2025)	D2V2	Prakash
T6	10 days After 1st sowing (10-01-2025)	D2V3	Aman
T7	10 days After 2nd sowing (20-01-2025)	D3V1	Rachna
T8	10 days After 2nd sowing (20-01-2025)	D3V2	Prakash
T9	10 days After 2nd sowing (20-01-2025)	D3V3	Aman

3. Results and Discussion

3.1 Response of Different Sowing Dates and Varieties on Plant Height

Plant height of pea cultivars under different sowing dates was recorded at four growth stages, i.e., at 30, 60, and 90 DAS and at harvest. The effect of different sowing dates on plant height was significant throughout the growth period (Table 1). Among the sowing dates, the highest plant heights (9.53 cm, 33.71 cm, 41.93 cm, and 57.27 cm at 30, 60, and 90 DAS and at harvest, respectively) were recorded in D1 (30 December), and these values were significantly higher than those recorded in D2 (10 January) and D3 (20 January). The lowest plant heights (8.81 cm, 29.57 cm, 38.86 cm, and 52.23 cm at 30, 60, and 90 DAS and at harvest, respectively) were recorded in D3 (20 January). The effect of pea cultivars on plant height was also significant at 30, 60, and 90 DAS and at harvest. The highest plant heights (10.23 cm, 34.35 cm, 43.13 cm, and 61.37 cm, respectively) were recorded in V3 (Aman), and these values were significantly higher than those recorded in V1 (Rachna) and V2 (Prakash). The lowest plant heights (7.51 cm, 27.42 cm, 36.52 cm, and 42.66 cm, respectively) were recorded in V2 (Prakash). The interaction effect of different sowing dates and pea cultivars on plant height at 30, 60, and 90 DAS and at harvest was significant. The highest plant heights were recorded in D1V3, whereas the lowest plant heights were recorded in D3V2.

3.2 Response of Different Sowing Dates and Varieties on Number of Branches

The number of branches per plant of pea cultivars under different sowing dates was recorded at four growth stages, i.e., at 30, 60, and 90 DAS and at harvest. The effect of different sowing dates on the number of branches per plant was significant throughout the growth period (Table 2). Among the sowing dates, the highest numbers of branches per plant (2.25, 4.18, 5.86, and 6.36 at 30, 60, and 90 DAS and at harvest, respectively) were recorded in D1 (30 December), and these values were significantly higher than those recorded in D2 (10 January) and D3 (20 January). The lowest numbers of branches per plant (1.94, 3.73, 5.47, and 5.93 at 30, 60, and 90 DAS and at harvest, respectively) were recorded in D3 (20 January). The effect of pea cultivars on the number of branches per plant was also significant at 30, 60, and 90 DAS and at harvest. The highest numbers of branches per plant (2.60, 4.41, 6.38, and 6.71, respectively) were recorded in V3 (Aman), and these values were significantly higher than those recorded in V1 (Rachna) and V2 (Prakash). The lowest numbers of branches per plant (1.40, 3.41, 4.96, and 5.55, respectively) were recorded in V2 (Prakash). The interaction effect of different sowing dates and pea cultivars on the number of branches per plant at 30, 60, and 90 DAS and at harvest was significant. The highest number of branches per plant was recorded in D1V3, whereas the lowest number was recorded in D3V2.

3.3 Response of Different Sowing Dates and Varieties on Pods Per Plant

The number of pods per plant of pea cultivars under different sowing dates was recorded at harvest. The effect of different sowing dates on the number of pods per plant was significant (Table 3). Among the sowing dates, the highest number of pods per plant (9.32) was recorded in D1 (30 December), and this value was significantly higher than those recorded in D2 (10 January) and D3 (20 January). The lowest number of pods per plant (8.71) was recorded in D3 (20 January). The effect of pea cultivars on the number of pods per plant was also significant. The highest number of pods per plant (9.10) was recorded in V3 (Aman), and this value was significantly higher than those recorded in V1 (Rachna) and V2 (Prakash). The lowest number of pods per plant (8.69) was recorded in V2 (Prakash). The interaction effect of different sowing dates and pea cultivars on the number of pods per plant was significant. The highest number of pods per plant was recorded in D1V3, whereas the lowest number was recorded in D3V2.

3.4 Response of Different Sowing Dates and Varieties on Seeds Per Pod

The number of seeds per pod of pea cultivars under different sowing dates was recorded at harvest. The effect of different sowing dates on the number of seeds per pod was significant (Table 3). Among the sowing dates, the highest number of seeds per pod (9.10) was recorded in D1 (30 December), and this value was significantly higher than those recorded in D2 (10 January) and D3 (20 January). The lowest number of seeds per pod (6.40) was recorded in D3 (20 January). The effect of pea cultivars on the number of seeds per pod was also significant. The highest number of seeds per pod (8.50) was recorded in V3 (Aman), and this value was

significantly higher than those recorded in V1 (Rachna) and V2 (Prakash). The lowest number of seeds per pod (6.61) was recorded in V2 (Prakash). The interaction effect of different sowing dates and pea cultivars on the number of seeds per pod was significant. The highest number of seeds per pod was recorded in D1V3, whereas the lowest number was recorded in D3V2.

Table 1. Effect of plant height(cm) of different cultivars of field pea at 30DAS, 60DAS, 90DAS and at harvest as influence by different sowing dates

Treatment	30DAS	60DAS	90DAS	At harvest
Date of sowing				
D1	9.53	33.71	41.93	57.27
D2	9.21	31.65	40.42	54.06
D3	8.81	29.57	38.86	52.23
S.Ed (±)	0.01	0.15	0.14	0.06
C.D(P=0.05)	0.06	0.45	0.45	0.19
Variety				
V1	9.81	33.16	41.56	59.53
V2	7.51	27.42	36.52	42.66
V3	10.23	34.35	43.13	61.37
S.Ed (±)	0.01	0.15	0.14	0.06
C.D(P=0.05)	0.06	0.45	0.45	0.19
Date of sowing x Variety				
D1V1	10.20	35.80	40.80	62.30
D1V2	7.80	28.70	38.40	44.50
D1V3	10.60	36.63	43.43	65.03
D2V1	9.86	33.06	41.46	58.80
D2V2	7.50	27.73	36.36	42.80
D2V3	10.26	34.16	42.60	60.60
D3V1	9.36	30.63	40.63	57.50
D3V2	7.23	25.86	30.80	40.70
D3V3	9.83	32.26	41.16	58.50
S.Ed (±)	0.03	0.25	0.26	0.10
C.D(P=0.05)	0.10	0.78	0.78	0.33

Table2. Effect of no. of branches of different cultivars at 30DAS, 60DAS, 90DAS and at harvest as influence by different sowing dates

Treatment	30DAS	60DAS	90DAS	At harvest
Date of sowing				
D1	2.25	4.18	5.86	6.36
D2	2.07	4.01	5.62	6.14
D3	1.94	3.73	5.47	5.93
S.Ed (±)	0.02	0.01	0.02	0.04
C.D(P=0.05)	0.07	0.03	0.04	0.09
Variety				
V1	2.27	4.11	5.61	6.17
V2	1.40	3.41	4.96	5.55
V3	2.60	4.41	6.38	6.71
S.Ed (±)	0.02	0.01	0.02	0.04
C.D(P=0.05)	0.07	0.03	0.04	0.09
Date of sowing x Variety				
D1V1	2.33	4.36	5.80	6.30
D1V2	1.60	3.60	5.20	5.80
D1V3	2.83	4.60	6.60	7.33
D2V1	2.30	4.16	5.60	6.20
D2V2	1.40	3.43	4.90	5.45
D2V3	2.53	4.43	6.36	6.82
D3V1	2.20	3.80	5.43	6.00
D3V2	1.20	3.20	4.80	5.40
D3V3	2.43	4.20	5.83	5.99
S.Ed (±)	0.04	0.02	0.04	0.07
C.D(P=0.05)	0.12	0.06	0.06	0.16

Table 3. Response of different sowing dates on yields parameter of different cultivars on no. of pods per plant, no. of seeds per pod, pod length(cm) and test weight(g) of field pea

Treatment	Pods per plant	Seeds per pod	Pod length(cm)	Seeds Yield(q/ha)
Date of sowing				
D1	9.32	9.10	8.77	13.56
D2	8.86	7.54	7.40	12.93
D3	8.71	6.40	5.40	11.66
S.Ed ($\pm$)	0.09	0.16	0.07	0.24
C.D (P=0.05)	0.20	0.34	0.16	0.51
Variety				
V1	9.09	7.93	7.24	12.87
V2	8.69	6.61	6.43	11.54
V3	9.10	8.50	7.91	13.82
S.Ed ($\pm$)	0.09	0.61	0.07	0.24
C.D(P=0.05)	0.20	0.34	0.16	0.51
Date of sowing x Variety				
D1V1	9.27	9.29	9.07	13.48
D1V2	8.97	8.16	8.10	12.33
D1V3	9.71	9.87	9.25	14.87
D2V1	8.87	8.16	7.47	13.01
D2V2	8.60	6.02	6.53	11.47
D2V3	9.12	8.46	8.21	14.32
D3V1	8.70	6.63	5.20	12.17
D3V2	8.52	5.56	4.75	10.56
D3V3	8.93	7.19	6.27	12.27
S.Ed ($\pm$)	0.16	0.28	0.13	0.41
C.D(P=0.05)	0.35	0.60	0.27	0.88

3.5 Response of Different Sowing Dates and Varieties on Pod Length

Pod length of pea cultivars under different sowing dates was recorded at harvest. The effect of different sowing dates on pod length was significant (Table 3). Among the sowing dates, the greatest pod length (8.77 cm) was recorded in D1 (30 December), and this value was significantly higher than those recorded in D2 (10 January) and D3 (20 January). The lowest pod length (5.40 cm) was recorded in D3 (20 January). The effect of pea cultivars on pod length was also significant. The greatest pod length (7.91 cm) was recorded in V3 (Aman), and this value was significantly higher than those recorded in V1 (Rachna) and V2 (Prakash). The lowest pod length (6.43 cm) was recorded in V2 (Prakash). The interaction effect of different sowing dates and pea cultivars on pod length was significant. The greatest pod length was recorded in D1V3, whereas the lowest pod length was recorded in D3V2.

3.6 Response of Different Sowing Dates and Varieties on Seed Yield

Grain yield of pea cultivars under different sowing dates was recorded at harvest. The effect of different sowing dates on grain yield was significant (Table 3). Among the sowing dates, the highest grain yield (13.56 q/ha) was recorded in D1 (30 December), and this value was significantly higher than those recorded in D2 (10 January) and D3 (20 January). The lowest grain yield (11.66 q/ha) was recorded in D3 (20 January). The effect of pea cultivars on grain yield was also significant. The highest grain yield (13.82 q/ha) was recorded in V3 (Aman), and this value was significantly higher than those recorded in V1 (Rachna) and V2 (Prakash). The lowest grain yield (11.54 q/ha) was recorded in V2 (Prakash). The interaction effect of different sowing dates and pea cultivars on grain yield was significant. The highest grain yield was recorded in D1V3, whereas the lowest grain yield was recorded in D3V2.

4. Conclusion

The findings of the experiment demonstrate that sowing date and cultivar significantly influenced the growth and yield performance of field pea under the agro-climatic conditions of Utlou, Manipur. Among the sowing dates evaluated, 30 December consistently produced better growth and yield outcomes than 10 January and 20 January. The cultivar Aman also performed better than Rachna and Prakash for the principal growth and yield attributes reported in the manuscript. The interaction between sowing date and cultivar was significant, with the combination of 30 December sowing and Aman recording the highest grain yield of 14.87 q/ha. In contrast, the combination of 20 January sowing and Prakash recorded the lowest grain yield of 10.56 q/ha. The results therefore support the importance of selecting an appropriate sowing time together with a suitable cultivar for field pea production. Within the specific conditions and duration of this experiment, sowing Aman on 30 December provided the most favourable combination for improving crop growth and yield.

5. Limitation

The experiment was conducted at a single location during one Rabi season and evaluated only three sowing dates and three cultivars. Consequently, the observed responses may vary under other seasons, locations, soil conditions, or weather patterns. Multi-season and multi-location validation would therefore be useful before broader recommendations are made.

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Declaration of AI Use

This manuscript was prepared through the intellectual contributions of the author(s) to the study design, data analysis, interpretation of results, and scholarly content. Grammarly and ChatGPT were used solely to assist with grammatical refinement and reference formatting during manuscript revision. The author(s) accept full responsibility for the accuracy, integrity, and final content of the manuscript.

Competing Interests

Authors have declared that no competing interests exist.

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