AATCC Review

13 July 2025: Received
04 September 2025: Revised
11 September 2025: Accepted
09 October 2025: Available Online

https://aatcc.peerjournals.net/

Original Research Article

Open Access

Effect of different sowing times and cultivars on performance of garden pea (*Pisum sativum var. hortense*) under terai zone of West Bengal, India

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ABSTRACT

An experiment was conducted to study the effect of different sowing times on garden pea cultivars. Treatments consist of four different sowing times (viz, 26th October, 10th November, 25th November and 10th December) and five cultivars (viz, Arka Chaitra, Arka Apoorva, Arkel, Arka Priya and Arka Uttam. The experiment was laid out in a Factorial Randomized Block Design. Analyzed data revealed that sowing at 25th November showed maximum plant height (134.74 cm), maximum pods per plant (17.48), maximum individual pod weight (6.11 g) and maximum pod yield (10.98 t/ha). Among the cultivars, Arkel showed maximum plant height (129.36 cm) and Arka Priya recorded maximum pods per plant (19.62), maximum individual pod weight (6.79 g) and maximum pod yield (11.39 t/ha). Quality parameters such as shelling percent (45.50 %) and protein content of dry green seed (22.18 %) were recorded highest in Arkel. Arka Apoorva showed the highest ascorbic acid content of fresh seed (25.66 mg/100 g fresh). Maximum disease incidence (15.51 %) of collar rot was recorded under the sowing date 26th October (S1), meanwhile the lowest (9.24 %) was noted in 10th December sowing. Arkel (V3) showed the highest disease incidence (14.97 %) and the lowest (9.87 %) in Arka Chaitra (V1). Maximum benefit: cost ratio (3.53) was observed when Arka Priya was sown on 25th November. Garden pea cultivation in the Terai zone faces inconsistent winter temperatures and high humidity, which often disrupt flowering and pod set. Additionally, varying cultivar responses to shifting sowing windows make it difficult to optimize yield stability across seasons. Considering the interaction effect, Arka Priya cultivar along with 25th November sowing, followed by Arka Priya cultivar along with 10th November sowing time and Arka Apoorva cultivar along with 25th November may be suitable for cultivation under the terai zone of West Bengal. This study evaluated how varying sowing times and cultivar choices influence growth, yield, and quality of garden pea under the Terai agro-climatic conditions of West Bengal. The findings identified the most suitable sowing window and high-performing cultivars to optimize regional pea production.

Keywords: *Garden Pea, Growth, Yield, Quality, Benefit Cost Ratio, Cultivar, Disease incidence.*

INTRODUCTION

Garden pea (*Pisum sativum* var *hortense* L.) is a major vegetable crop belonging to the Leguminosae family, with a chromosome number of 2n=2x=14. It is an important cool-season vegetable crop native to the East and Mediterranean regions. And can be cultivated throughout the tropical, sub-tropical and temperate regions of the world. Based on the maturity period, the crop is grouped into early, mid and late types. According to seed, smooth-seeded and wrinkly-seeded types. Most of the garden pea varieties grown in India are early to mid and smooth-seeded varieties. It is rich source of protein (7 %) and carbohydrates (15.8 mg/100g). It also contains Vitamin A (140 IU), Vitamin C (100 mg/100g), potassium (20 mg/100g), phosphorus (140 mg/100g), minerals, dietary fibers and antioxidants [20].

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DOI: https://doi.org/10.21276/AATCCReview.2025.13.04.733

Pea cultivation requires a temperature of 18-22^{0}C for optimum germination. It can withstand light frost and germinate as low as 4-5ºC. The percentage of seeds that germinate drops at temperatures over 25°C. Prevalence of high temperatures at the time of sowing causes wilt and stem fly complex to accumulate, which worsens crop stand and reduces output. As a result, peas grow and develop optimally in regions where the weather gradually changes from cold to warm. Garden pea seeds stay in the ground for a long time; therefore, temperature variations during sowing have a significant impact on the crop [14]. Selecting an appropriate cultivar and timing for sowing are the most crucial elements to consider because variations in climatic conditions and varietal performance affect garden pea growth, yield and quality metrics. Although the climate in India is suitable for growing garden peas, particularly in the Terai region of West Bengal, there is little information available about the optimum sowing time and choice of cultivars for cultivation. Consequently, there is a need gain a better understanding of the process of choosing a suitable sowing time and cultivar of garden peas. In the view of these facts the following experiment was undertaken.

MATERIALS AND METHODS

Field related work of the experiment was carried out in the Instructional Farm, Uttar Banga Krishi Vishwavidyalaya, Pundibari, Cooch Behar, West Bengal during the rabi (winter) season of 2023-24. The farm is located 43 meters above sea level at latitude 26^{0}23'51.9" N and longitude 89^{0}23'11.8" E. The region is situated in West Bengal's Terai agro-climatic zone. The experiment was laid out in Factorial Randomized Block Design (FRBD) with four sowing dates *viz,* 26th October 2023 (S1), 10th November 2023 (S2), 25th November 2023 (S3) and 10th December 2023 (S3) and five garden pea cultivars *viz,* Arka Chaitra (V1), Arka Apoorva (V2), Arkel (V3), Arka Priya (V4) and Arka Uttam (V5). The experimental design was laid out in three replications, maintaining a spacing of 45 cm × 10 cm in a plot of size 2.25 m × 1.5 m. Before sowing, seeds were treated with *Rhizobium leguminosarum* @ 20 g/kg of seeds. Recommended dose of fertilizers along with FYM was added during land preparation. The observations on growth and yield parameters of garden pea such as plant height, days to 50 % flowering, number of nodules per plant, nodule dry weight (mg), pod length (cm), number of pods per plant, number of seeds per pod, individual pod weight (g), individual plant yield, plot yield (kg/3.375m^2) and total fresh yield (t/ha) were recorded. With respect to quality parameters, shelling percentage, protein content of dry green seed (%) and ascorbic acid content (mg100/g) of seeds were estimated. Protein and ascorbic acid content were determined as per the methods given by [12]. Collar rot disease incidence was recorded at the seedling stage (two to three weeks after sowing), and Percent Disease Incidence was calculated according to the following formula: Disease Incidence = (Number of disease plants × 100)/Total number of plants. Benefit cost ratio of garden pea cultivation was calculated by determining the cost incurred for per hectare cultivation (C) and cost of price per unit production per hectare (R) by the formula,

Net return=Gross returns (R)-Cost of cultivation Returns (C) (₹/ha) Benefit cost ratio=Net returns/Total cost of cultivation.

RESULTS AND DISCUSSION

Growth and flowering parameters

The effect of different sowing dates on garden pea growth and flowering parameters is given in Table 1. Different sowing time showed a significant effect on growth parameters. Highest plant height (134.74 cm) was recorded on 25th November (S_3) sowing, whereas 26th October sowing showed lowest plant height (93.75 cm). Variations may be attributed to temperature and other environmental conditions.[2] also recorded maximum plant height on 30th November sowing. Minimum time taken for 50 % flowering (48.67 days) was observed when sown on 25th November sowing (S_3) which was statistically *at par* with 10th December sowing meanwhile 26th October sowing (S_1) took longest time for flowering (50.67 days). Similar observations were also reported by [7] and [4]. The maximum number of nodules per plant (10.36) was recorded under the sowing time of 25th November (S_3) and minimum (9.18) was observed in 26th October sowing (S_1). Similar results as affected by different sowing times was also reported by [21]. Highest nodule dry weight (116.13 mg) was observed when sown on 25th November (S_3) and minimum (107.94 mg) was recorded in 26th October sowing (S_1).

Significant effect of different cultivars on growth and flowering parameters was also observed (Table 1). Maximum plant height (129.36 cm) was noted in Arkel (V_3) whilst Arka Apoorva (V_2) showed the lowest plant height (105.41 cm).

The variation in plant height amongst cultivar may be due to their different genetic makeup. [22], [15] and [9] also observed significant variation in plant height on different varieties. Considering days to 50 % flowering, early flowering (45.83 days) was observed in Arkel (V_3) cultivar and late flowering (51.17 days) was observed in Arka Apoorva (V_2) cultivar. Highest number of nodules per plant (10.13) was observed in Arka Uttam (V_5) and the minimum (9.54) in Arka Priya (V_4). Variation in the number of nodules per plant of different cultivars might be attributed to nodule formation ability of the individual cultivars. Similar observations were also reported by [10] and [22]. Highest nodule dry weight (115.90 mg) was recorded in Arkel (V_3) and the lowest nodule dry weight (109.82 mg) was noted in Arka Chaitra cultivar (V_1). Variation in the nodule dry weight of different cultivars may be due to variation in ability in nutrient up take and nitrogen fixation among different cultivars. Previous studies by [10] and [22] also reported differences in nodule dry weight among different garden pea varieties.

The interaction effect of sowing time and cultivar pertaining to growth parameters like plant height and days to 50 % flowering was non-significant. However, in the number of nodules per plant as well as nodule dry weight (mg) significant interaction was recorded. Highest number of nodules per plant (11.13) was observed in Arka Uttam when sown on 25th November and lowest number of nodules per plant was seen in Arka Chaitra (8.19) when sown on 26th October. Maximum nodule dry weight (120.41 mg) was recorded in Arka Uttam under the sowing date 25th November and minimum nodule dry weight (102.55 mg) was observed in Arka Priya when sown on 10th November.

Table 1: Effect of the different sowing times and cultivars on the growth and flowering characters of Garden pea

Treatment	Plant height (cm)	Days to 50% flowering (days)	Number of nodules per plant	Nodule dry weight (mg)
Sowing time (S)				
26th October (S_1)	93.78	50.67	9.18	107.94
10th November (S_2)	113.58	49.80	9.81	114.57
25th November (S_3)	134.74	48.67	10.36	116.13
10th December (S_4)	121.92	48.87	9.88	113.76
S. Em (±)	**1.48**	**0.52**	**0.05**	**0.72**
C.D. (P=0.05)	**4.26**	**1.50**	**0.14**	**2.06**
Cultivars (V)				
Arka Chaitra (V_1)	113.23	49.50	9.69	112.63
Arka Apoorva (V_2)	105.41	51.17	9.64	112.61
Arkel (V_3)	129.36	45.83	10.06	115.90
Arka Priya (V_4)	112.47	51.08	9.54	109.82
Arka Uttam (V_5)	119.57	49.92	10.13	114.55
S. Em (±)	**1.66**	**0.58**	**0.06**	**0.80**
C.D. (P=0.05)	**4.76**	**1.67**	**0.16**	**2.31**
Interaction (S×V)				
S. Em (±)	**3.31**	**1.17**	**0.11**	**1.61**
C.D. (P=0.05)	**N.S.**	**N.S.**	**0.32**	**4.61**

N.S. = non-significant

Yield parameters

The data of yield attributing characters and the yield of Garden pea are presented in Table 2. The effect of different sowing times on yield parameters was significant. The results indicated yield associated characters like pod length (10.28 cm), pods per plant (17.48), number of seeds per pod (7.03), individual pod weight (6.11 g), pod yield per plant (96.53 g) and total fresh pod yield (10.98 t/ha) was found to be maximum in plants sown on 25th November (S_3). Similar trend of higher yield associated characters and yield in November sowing was reported by [13] and [14]. As compared to subsequent sowing dates the garden pea sown on 25th November received a more favourable environmental condition which led to better fertilization, accumulation of carbohydrates, vigorous growth and higher number of pod development over the other sowing dates. [16] also reported that garden pea sown on 2nd week of November produces higher yield.

Yield parameters were significantly affected by different cultivars. Among the cultivars, Arkel showed highest pod length (10.50 cm) and seeds per pod (6.88) while Arka Priya recorded highest pods per plant (19.62), individual pod weight (6.79 g), pod yield per plant (100.21 g) and total fresh pod yield (11.39 t/ha). [10] and [6] also reported similar results in pod length and yield in Arkel and Arka Priya. Among the cultivars, Arka Priya underperformed with minimum pod length (8.73 cm) and Arkel showed minimum individual pod weight (4.52 g), pod yield per plant (68.13 g) and total fresh pod yield (7.75 t/ha). This could be due to variation in genetic makeup amongst the cultivars, along with adaptivity to low temperature generally occurring in November. [1] also recorded similar observations regarding the variation in yield of different garden pea varieties.

The interaction effect of different sowing dates and cultivars on the yield parameters was observed to be non-significant except in pod length (cm). A combination of Arka Priya (V_4) under sowing time 25th November (S_3) showed the most synergistic effect regarding yield of fresh pods.

Quality parameters

Effect of sowing time, cultivars and the interaction on quality parameters are presented in Table 2**.** Sowing time effect was non significant on shelling percentage. However, the highest shelling per cent (45.07 %) was recorded under the sowing date of 25th November (S_3). Effect of sowing time was recorded to be nonsignificant on protein content of garden pea. However, highest protein content (21.56 %) was recorded under the sowing date on 10th November and lowest protein content (21.15%) was observed when sown on 26th October. [2] observed the highest protein content in 30th November sowing. More or less similar findings was also reported by [5]. Ascorbic acid content of garden pea varied significantly with respect to different sowing times. The highest ascorbic acid content (22.74 mg/100 g fresh) was recorded when sown on 25th November and lowest (21.97 mg/100g fresh) on 26th October sowing. Similar observations were also recorded by [3] and [8].

Significant effect of different cultivars on quality parameters was observed. Highest shelling percent (45.50 %) was recorded in Arkel and lowest (42.50%) in Arka Chaitra. Differences in the shelling percent might be due to the variation in pod characters and seed formation ability of the different cultivars. Shelling percent variation in different cultivars was also reported by [1] and [10]. The highest protein content was recorded in Arkel (22.18 %) and the lowest (20.60%) in Arka Apoorva which was statistically *at par* with Arka Chaitra (20.86%). [1] also reported variation in protein content of different garden pea cultivars ranging from 20.13 % to 24.13 %. Variation in protein content in different cultivar might be due to genetic constitution of different varieties. Significantly highest ascorbic acid content (25.66 mg/100g) was recorded in Arka Apoorva and lowest ascorbic acid content (20.04 mg/100 g fresh) in Arka Apoorva. Variation in ascorbic acid content was observed by [10], ranging of 19.63 mg to 29.55 mg. So, the findings of the present experiment are in line with the findings of [10] and [22] in garden pea. The interaction effect of sowing time and cultivars regarding shelling percent, protein content of dry green seed and ascorbic acid content was non-significant.

Disease incidence

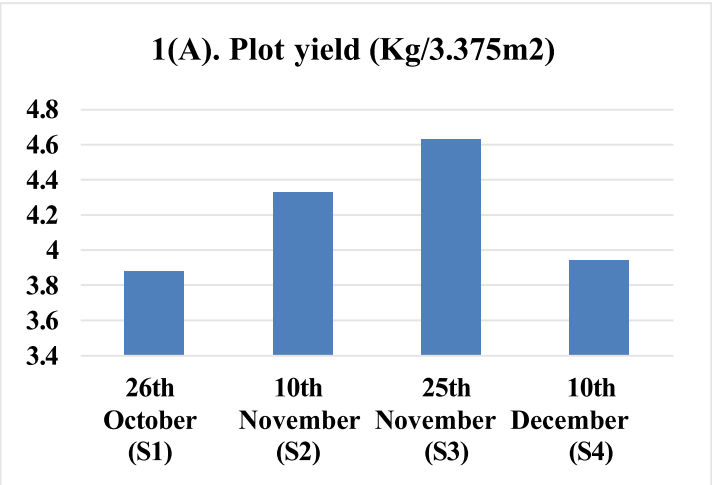
Effect of different sowing dates and cultivars on collar rot disease incidence (%) are presented in table 2. With respect to sowings dates, maximum disease incidence (15.51 %) was recorded under the sowing date 26th October (S_1), meanwhile the lowest (9.24 %) was noted in 10th December. Lower temperature during the crop's seedling stage, which makes it less conducive for collar rot infection, may be the reason for the decreased incidence of collar rot with delayed sowing [18]. Previous studies by [19] and [17] in chickpea also reported lower disease incidence of collar rot for later sowing dates as compared to the early sowing. Among the different cultivars, the highest disease incidence (14.97 %) was recorded in Arkel (V_3) and the lowest (9.87 %) in Arka Chaitra (V_1). Significant interaction between the different sowing dates and cultivars on disease incidence was also recorded. The treatment combination of 10th December (S_4) sowing and Arka Chaitra (V_1) recorded the lowest disease incidence (8.24).

Table 2: Effect of the different sowing times and cultivars on the yield contributing attributes and quality parameters of Garden pea

Treatment	Pod length (cm)	No. of pods per plant	No. of seeds per pod	Individual pod weight (g)	Individual plant yield (g)	Plot yield (kg/3.375m^2)	Fresh pod yield (t /ha)	Shelling percent (%)	Protein content of dry green seed (%)	Ascorbic acid content (mg/100g fresh)	Disease Incidence (%)
Sowing time (S)											
26th October (S_1)	9.49	16.13	6.07	5.06	80.87	3.88	9.20	43.62	21.15	21.97	15.51
10th November (S_2)	9.99	16.84	6.69	5.85	90.10	4.33	10.25	44.29	21.56	22.41	13.03
25th November (S_3)	10.28	17.48	7.03	6.11	96.53	4.63	10.98	45.07	21.39	22.74	11.17

10th December (S_4)	9.59	16.75	6.61	5.57	82.13	3.94	9.34	43.98	21.31	22.18	9.24
S. Em (±)	**0.08**	**0.27**	**0.15**	**0.15**	**1.08**	**0.05**	**0.12**	**0.60**	**0.17**	**0.07**	**0.31**
C.D. (P=0.05)	**0.23**	**0.77**	**0.44**	**0.42**	**3.10**	**0.15**	**0.35**	**N.S.**	**N.S.**	**0.19**	**0.89**
Cultivars(V)											
Arka Chaitra (V_1)	9.87	15.85	6.82	5.24	84.41	4.05	9.60	42.50	20.86	21.36	9.87
Arka Apoorva (V_2)	10.12	16.42	6.70	5.71	93.11	4.47	10.59	44.92	20.60	25.66	14.06
Arkel (V_3)	10.50	15.73	6.88	4.52	68.13	3.27	7.75	45.50	22.18	23.53	14.97
Arka Priya (V_4)	8.73	19.62	5.82	6.79	100.21	4.81	11.39	44.80	21.80	20.04	10.96
Arka Uttam (V_5)	9.97	16.38	6.79	5.99	91.18	4.38	10.37	43.49	21.31	21.04	11.34
S. Em (±)	**0.09**	**0.30**	**0.17**	**0.16**	**1.21**	**0.06**	**0.14**	**0.67**	**0.19**	**0.08**	0.35
C.D. (P=0.05)	**0.26**	**0.86**	**0.49**	**0.47**	**3.47**	**0.17**	**0.39**	**1.93**	**0.53**	**0.22**	1.00
Interaction (S×V)											
S. Em (±)	**0.18**	**0.60**	**0.34**	**0.33**	**2.41**	**0.12**	**0.27**	**1.35**	**0.37**	**0.15**	**0.70**
C.D. (P=0.05)	**0.52**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**2.00**

N.S. = non-significant



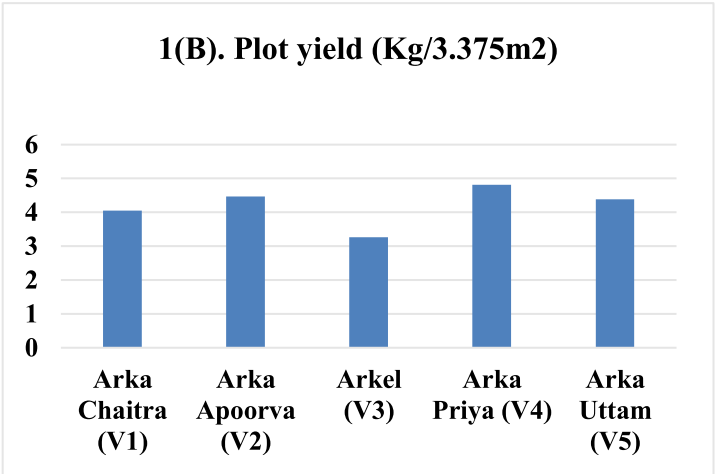
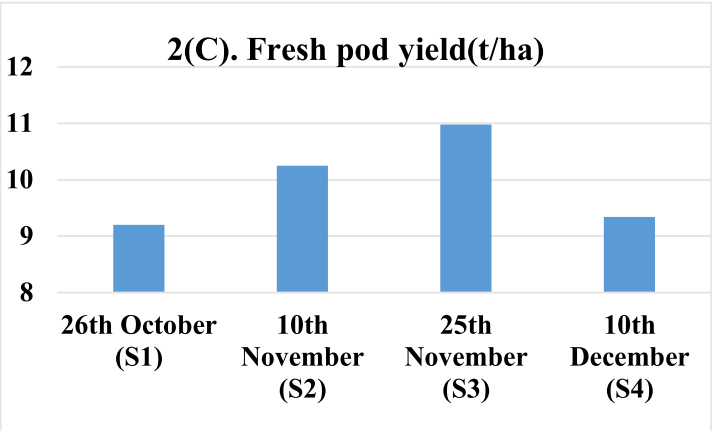


Fig. 1: Effect of different sowing time (A) and cultivars (B) on plot yield (Kg/3.375m^2)



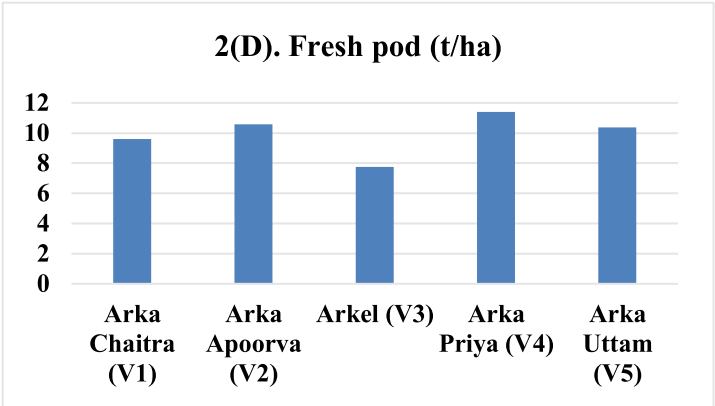


Fig. 2: Effect of different sowing time (C) and cultivars (D) on fresh pod yield (t/ha)

***Economics of garden pea cultivation*:**
The economics of garden pea cultivars under different sowing times are presented in Table 3. Perusal of the data revealed that gross return and net return was influenced to a great extent by sowing time and garden pea cultivars. The highest gross return (₹ 499200) was recorded in Arka Priya when sown on 25th November (S_3V_4) and the lowest gross return (₹284000) was obtained from the S_1V_3 (Arkel when sown on 26th October). While the highest net return (₹ 388950) was recorded in the treatment combination of S_3V_4 (Arka Priya when sown on 25th November). Maximum benefit cost ratio (3.53) was found for the treatment combination of S_3V_4 (Arka Priya when sown on 25th November) and the lowest benefit cost ratio (1.27) was recorded in Arkel when sown on 26th October (S_1V_3).

Table 3: Economics of Garden pea cultivation

Treatment	Gross Cost (₹)	Yield (Kg/ha)	Gross Return (₹)	Net return (₹)	B: C Ratio
S_1V_1	110250	8910	356400	246150	2.23
S_1V_2	110250	9620	384800	274550	2.49
S_1V_3	125184	7100	284000	158816	1.27
S_1V_4	110250	10520	420800	310550	2.82
S_1V_5	110250	9880	395200	284950	2.58
S_2V_1	110250	9740	389600	279350	2.53
S_2V_2	110250	10930	437200	326950	2.97
S_2V_3	125184	8080	323200	198016	1.58
S_2V_4	110250	11860	474400	364150	3.30
S_2V_5	110250	10640	425600	315350	2.86
S_3V_1	110250	10500	420000	309750	2.81
S_3V_2	110250	11670	466800	356550	3.23
S_3V_3	125184	8680	347200	222016	1.77
S_3V_4	110250	12480	499200	388950	3.53
S_3V_5	110250	11580	463200	352950	3.20
S_4V_1	110250	9270	370800	260550	2.36
S_4V_2	110250	10160	406400	296150	2.69
S_4V_3	125184	7150	286000	160816	1.28
S_4V_4	110250	10720	428800	318550	2.89
S_4V_5	110250	9390	375600	257850	2.34

S_1= 26th October, S_2= 10th November, S_3= 25th November, S_4= 10th December, V_1= Arka Chaitra, V_2= Arka Apoorva, V_3= Arkel, V_4= Arka Priya and V_5= Arka Uttam

CONCLUSION
Based on the experimental results, it may be concluded that November 25th sowing reported the highest growth and yield among the various sowing times, as well as quality indicators, followed by 10th November and 10th December sowing date. Among the cultivars, Arka Priya recorded the highest fresh pod yield, followed by Arka Apoorva and Arka Uttam. Considering the yield and benefit cost ratio, Arka Priya cultivar, along with 25th November sowing, followed by Arka Priya along with 10th November sowing time and Arka Apoorva cultivar along with 25th November may be beneficial for garden pea cultivation in the terai zone of West Bengal.

FUTURE SCOPE OF STUDY
Future research on garden pea performance under the Terai Zone of West Bengal may focus on multi-year and multi-location validation of the most promising sowing times and cultivars to capture seasonal variability more accurately. Incorporating physiological and molecular studies could help identify the mechanisms behind temperature and photoperiod sensitivity in different cultivars. Evaluating additional traits such as pest–disease resistance, nutrient-use efficiency, and pod quality parameters will further refine varietal recommendations. Integrating climate-smart practices, predictive modelling, and economic analysis can enhance the robustness of production strategies. Overall, such expanded investigations will support the development of resilient, high-yielding garden pea cultivars tailored to the changing agro-climatic conditions of the Terai region.

DECLARATION
All the authors have declared that there is no conflict of interest.

ACKNOWLEDGMENTS
The authors are grateful to the Department of Vegetable and Spice Crops, Faculty of Horticulture, Uttar Banga Krishi Viswavidyalaya for providing the necessary facilities during the research work.

CONTRIBUTIONS
All authors contributed significantly towards the final make-up of the paper. Conceptualization (Satadal Das, Suchand Dutta, L. Mashine); Data curation (Satadal Das, L. Mashine, Pratiti Debnath and Raushan Kumar); Visualization (Suchand Dutta, Satadal Das and Sekhar Bandopadhyaya); Supervision (L. Mashine, Pratiti Debnath and Raushan Kumar); Writing-original draft (Satadal Das, Suchand Dutta and L. Mashine); Writing-reviewing and editing (Pratiti Debnath, Raushan Kumar and Sekhar Bandopadhyaya).

REFERENCES

1. Acharya S K, Patel G S, Vadodaria J R and Kumar M (2020). Evaluation of varieties of garden pea (*Pisum sativum* L.) with time of sowing in North Gujarat conditions. *Int. J. Agric. Res.* 10(6): 23-32.

2. Ali M Z, Aziz M A, Sarker M A I, Mazumder S, Paul S K, Mujahidi T A, Khan M S A and Bhuiyan M S (2016). Effect of sowing time-based temperature variations on growth, yield and seed quality of garden pea. *Bangladesh agron. j. 19*(1): 29-36. https://doi.org/10.3329/baj.v19i1.29866

3. Chandel A, Sharma A, Sharma P, Manuja S, Rana R S and Rana S (2022). Influence of seeding time, fertility level and genotype on productivity, quality and profitability of garden pea (*Pisum sativum*). *indian. j. Agron.* 67(1): 30-37. https://doi.org/10.59797/ija.v67i1.81

4. Eshanee, Sharma A, Sharma P, Sharma G D, Manuja S and Rana S S (2023). Effect of sowing dates on phenological traits, yield and its contributing attributes on snow pea genotypes. *Legum. Res*. 46(8): 1027-1033. 10.18805/LR-4817

5. Eshanee, Sharma A, Singh J, Dhaliwal Y S and Manuja S (2020). Effect of sowing dates on biochemical parameters of edible pod pea genotypes. *Veg. Sci.* 47(2): 288-290. https://doi.org/10.61180/vegsci.2020.v47.i2.20

6. Haq M T and Ahmed M S (2021). Effect of sowing date on growth and yield performance of pea (*Pisum sativum* L.). *Journal of ELT and Education*, 4(4), 75-79.

7. Islam, M N, Khatun K, Mostarin T, Haq M, Islam M, Biswas B R, Afsun J and Ali M A (2019). Influence of date of sowing and different levels of phosphorus on growth and yield of garden pea (*Pisum sativum* L.). *Asian J. Res. Bot.* 2: 1-13. https://journalajrib.com/index.php/AJRIB/article/view/33.

8. Kaur R, Kondal P, Singh N, Maurya V, Sharma A and Kumar R (2024). Effect of spacing and sowing dates on growth, yield and quality of pea (*Pisum sativum* L.). *Int. J. Res. Agron,* 7(2), 238-251. https://doi.org/10.33545/2618060X.2024.v7.i2d.312

9. Kaur S, Singh M and Bharadwaj M (2019). Response of pea cultivars to varying environments in mid hills of Himachal Himalayas. *Int. J. Recent Sci. Res.* 10(12): 36626-36629.

10. Kumar S V, Datta S and Basfore S (2018). Performance of garden pea (*Pisum sativum* var *hortense* L.) varieties under conventional and organic nutrient sources under sub-Himalayan foot hills of West Bengal, India. *Int J Curr Microbiol Appl Sci*. 7(7): 3231-3241. https://doi.org/10.20546/ijcmas.2018.707.377

11. Munakamwe Z, Hill G D and McKenzie B A (2012). Yield response to pea (*Pisum sativum* L.) genotype, population and sowing date. *Open Agric. J.* 6: 47-56. 10.2174/1874331501206010047

12. Sadasivam S and Manickam A (1996). Biochemical methods. Edn 3, New Age International Limited, Publishers, New Delhi, Vol.2 pp, 124-126.

13. Sharma A, Sharma G D and Rana S S (2016). Effect of sowing dates and varieties on fresh pod yield and related traits in garden pea (*Pisum sativum* L.) under sub-humid temperate environment. *Veg. Sci.* 43(2): 202-207. https://doi.org/10.61180/

14. Singh R and Singh PM (2011). Effect of sowing dates and varieties on yield and quality of garden pea seed. *Veg. Sci.* 38: 184-187. https://doi.org/10.61180/

15. Sirwaiya S and Kushwah S S (2018). Assessment of different sowing dates and varieties on growth, yield and quality of seed in garden pea (*Pisum sativum* L*). Int J Curr Microbiol Appl Sci*. 7(3): 1387-1396. https://doi.org/10.20546/ijcmas.2018.703.166

16. Sirwaiya S, Kushwah S S, Bain R P and Mandale P (2018). Study of combined effect of sowing dates and varieties on growth attributes in garden Pea (*Pisum sativum L.*). *J. Pharm. Innov.* 7(5): 709-715.

17. Tamang S, Saha P and Rizal S (2022). Effects of sowing dates on yield and collar rot of chickpea (Cicer Arietinum L.). *Bangladesh j. bot.* 51(4): 721-727. https://doi.org/10.3329/bjb.v51i4.63491

18. Tiwari R, Bhatt L and Dev R (2014). Effect of date of sowing on growth and yield of vegetable pea genotypes under rain-fed mid-hill conditions of Uttarakhand. *Indian J. Hortic.* 71(2):288-291. https://journal.iahs.org.in/index.php/ijh/article/view/1339

19. Tiwari P, Kumar A, Gautam V, Sivaramakrishnan R Sharma R S, Parmar P and Kharte S (2023). Effect of Sowing Time and Seed Treatment in Management of Collar Rot of Chickpea. *Biological Forum–An International Journal*, 15(1), 169-173.

20. Urbano G, Aranda P and Gomez V E (2003). Nutritional evaluation of pea (*Pisum sativum* L.) protein diets after mild hydrothermal treatment and with and without added phytase. *J. Agric. Food Chem.* 51**:** 2415-2420. https://doi.org/10.1021/jf0209239

21. Yadav A K, Chauhan S K, Singh S K and Goyal V (2010). Effect of sowing dates and nitrogen levels on growth and yield of vegetable pea (*Pisum sativum*) and its residual effect on wheat (*Triticum aestivum*) and maize (*Zea mays*) in vegetable pea wheat maize cropping sequence. *Indian J. Agric. Sci.* 80(12): 73-100. https://epubs.icar.org.in/index.php/IJAgS/article/view/2123

22. Yatish V C, Chowdhury R S and Datta S (2021). Evaluation of garden pea (*Pisum sativum* var. *hortense* L.) genotypes under irrigated and rainfed conditions under foothills of Terai agro-ecological region of West Bengal. *Int. J. Stress Manag*. 12(4):332-338. DOI: HTTPS://DOI.ORG/10.23910/1.2021.2264