



Studies of Spacing on Growth and Yield of Different Varieties of Field Pea (*Pisum sativum* L.)

Kamjoy Khular Lamkang ^{a*},
Kshetrimayum Manishwari Devi ^a, Kalpana Athokpam ^a,
Kenedy Waikhom ^a and Poireinganba Khumanthem ^a

^a Department of Agronomy, Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences Utlou, Bishnupur District, Manipur, India.

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

A field experiment was conducted to find out the "Studies of spacing on growth and yield of different varieties of field pea (*Pisum sativum* L.)" during the *rabi* season of 2023-24 was conducted at Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences, located at Utlou, Bishnupur District, Manipur, India. The treatment comprised three different spacing (S₁- 20×10 cm, S₂- 30×10 cm, and S₃- 40×10 cm,) and three varieties V₁- Rachna, V₂ –Aman, and V₃- Prakash with a total of nine treatment combinations. The experiment was laid out in a Factorial Randomized Block Design (FRBD) with three replications. The results revealed that the individual effect of spacing and varieties significantly enhanced the growth attributes and yield attributes for all the growth stages

*Corresponding author: E-mail: juniorkhular@gmail.com;

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recorded. The spacing S_3 - 40 × 10 cm and varieties V_2 – Aman recorded maximum growth and yield attributes. The interaction of spacing and varieties was found to be non-significant for all the stages recorded but the treatment combination of S_3V_2 (40 × 10 cm + Aman) recorded maximum growth and yield attributes. Thus, from the experiment, it can be concluded that the application of S_3V_2 (40 × 10 cm + Aman) is more favorable for attaining sustainable higher profits and productivity in the cultivation of peas during the Rabi season in Manipur.

Keywords: Pea; spacing; varieties; growth; yield.

1. INTRODUCTION

Pea (*Pisum sativum* L.) is a widespread leguminous crop grown in the rabi season throughout the world. Pea crops have a strategic position in Indian agriculture as they are an excellent source of dietary protein and a mini-nitrogen plant that has an ameliorative effect on soil. It helps in improving the physical, chemical, and biological properties of soil and also utilizes natural resources in a better way (Kolb et al., 2017). Fewer inputs particularly irrigation and fertilizer are needed in the cultivation of peas. It improves soil fertility due to fixation of nitrogen by rhizobium bacteria. Nutritionally, pea contains, 7.2 g, fats 0.1 g of, minerals 0.8 g of, carbohydrates 15.8 g of, calcium 20 mg of, magnesium 34 mg, copper 0.23 mg of, iron 1.5 mg, and vitamin C 9.0 mg/100 g of an edible portion (Sepehya et al., 2015).

Spacing is also one of the important parameters, that ultimately affects nutrient uptake, growth, and yield of the plant. Increase in spacing, the total population decreases, but with more nutrition the individual plant grows better and gets more yield, and vice-versa. The increase or decrease of row spacing and plant population has a definite pattern in relation to the yield. Among various agronomic yield-limiting factors, planting pattern is considered of great importance. Lone et al., (2009) stated that the optimum plant density with proper geometry of planting is dependent on variety, its growth habit, and agroclimatic conditions. Optimum spacing is necessary to obtain maximum yield in any crop by reducing the competition among the plants for light, nutrients, moisture, etc. Optimum spacing for any crop varies considerably due to the environment under which it is grown and different varieties.

In agriculture, varieties are essential for enhancing productivity and are chosen based on their ability to grow in specific environments and maximize yield potential. The growth and yield of a crop are influenced by several factors, and

selecting the right variety plays a crucial role in improving both. Each variety has a genetic potential for growth, which defines its maximum size, growth rate, and ability to produce leaves, flowers, and roots. This potential is determined by genes that regulate cell division, elongation, and differentiation. Varieties with superior genetic growth potential can achieve better vegetative growth, which supports higher yield outcomes. Keeping these points in view, the present investigation entitled “Studies of Spacing on Growth and Yield of Different Varieties of Field Pea (*Pisum sativum* L.)” was conducted during rabi 2023-24 at the farm of Pandit Deen Dayal Upadhyay Institute of Agriculture Science, Utluou, Bishnupur, Manipur.

2. MATERIALS AND METHODS

The field experiment was conducted at the experimental site of the Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences situated in Utluou, Bishnupur District, Manipur, during the Rabi season of 2023–2024 which is at 24°43'23"N latitude & 93°51'33"E longitude and an altitude of 790 above mean sea level (MLS). The soil of the experimental site was clayey, the soil pH was acidic in reaction (5.2) with high organic carbon content (1.9%). The available nitrogen (188 kg/ha) is low phosphorus (20.0 kg/ha) is medium and potassium (324.0 kg/ha) is high in range according to the TNAU soil rating chart. During the period of experimentation, the monthly maximum and minimum temperature were between 22.3° C - 28.9°C and 4.6°C - 8.8°C, and the maximum and minimum relative humidity were recorded between 93% - 94% and 32% - 57%, respectively. There are nine treatments and three replications laid out in a Factorial Randomized Complete Block Design (FRBD). The treatments were: T_1 S_1V_1 20×10 cm + Rachna T_2 S_1V_2 20×10 cm + Aman T_3 S_1V_3 20×10 cm + Prakash T_4 S_2V_1 30×10 cm + Rachna T_5 S_2V_2 30×10 cm + Aman T_6 S_2V_3 30×10 cm + Prakash T_7 S_3V_1 40×10 cm + Rachna T_8 S_3V_2 40×10 cm + Aman T_9 S_3V_3 40×10 cm + Prakash. A uniform dose of 20 kg nitrogen (as

urea), 60 kg phosphorus (SSP), and 40 kg potash (MOP) were applied to all the treatments during the time of sowing. The biometric observation of different growth and yield attributes was recorded at various crop growth periods.

3. RESULTS AND DISCUSSION

3.1 Effect of Spacing and Varieties on Plant Height (cm)

The data on plant height as influenced by spacing and varieties recorded during 30, 60, 90 DAS and at harvest are presented in Table 1. The individual effect of spacing on the plant height of field peas has been found to be significant for all the growth stages. In general, the spacing, S₃ (40×10 cm) recorded the maximum plant height i.e. 11.69 cm, 30.13 cm, 41.62, cm, and 42.84 cm respectively during 30 DAS, 60 DAS, 90 DAS, and at harvest, and S₁ (20×10 cm) recorded minimum plant height i.e. 10.89 cm, 28.88 cm, 39.31 cm, and 46.29 cm. Again, the varieties, V₂ (Aman) recorded maximum plant height i.e. 12.98 cm, 30.68 cm, 46.29, cm, and 47.22 cm, respectively during 30 DAS, 60 DAS, 90 DAS and at harvest and V₁ (Rachna) recorded minimum plant height i.e. 9.77 cm, 27.92 cm, 35.61 cm, and 36.62 cm respectively during 30 DAS, 60 DAS, 90 DAS and at harvest. The combined effect of spacing and varieties on the plant height of field peas has been found to be non-significant for all the growth stages. Significant enhancement in plant height under different spacing and varieties seems to be due to an increase in cell division which results in the rapid growth of plants obtained by Yadav (2003) in cowpeas and Sen et.al. (2005) in dwarf field peas. These findings are in good lines with those obtained by Khan et

al., (2021), who reported that increased row spacing increases plant height.

3.2 Effect of Spacing and Varieties on Number of Branches Per Plant of Field Pea

The data on the number of branches per plant as, influenced by spacing and varieties recorded during 30 DAS, 60 DAS, 90 DAS and at harvests are presented in Table 2. The individual effect of spacing on the number of branches per plant of field pea has been found to be significant for all the growth stages. In general, the spacing, S₃ (40×10 cm) recorded the maximum number of branches per plant i.e. 1.30, 2.53, 2.95, and 3.93 which was at par with S₂ again S₂ was also at par with S₁ during 30 DAS and 60 DAS but superior at 90 DAS and at harvest. A minimum number of branches per plant was recorded in S₁ (20×10 cm) i.e.1.19, 2.42, 2.74, and 3.7. Again, the varieties, V₂ (Aman) recorded a maximum number of branches per plant i.e. 1.37, 3.12, 3.52, and 4.62, respectively during 30 DAS, 60 DAS, 90 DAS and at harvest and V₁ (Rachna) recorded a minimum number of branches per plant i.e. 1.12, 1.94, 2.31, and 3.20 respectively during 30 DAS, 60 DAS, 90 DAS and at harvest. The combined effect of spacing and varieties on the number of branches per plant of field pea has been found to be non-significant for all the growth stages. Significant enhancement in the number of branches per plant might be due to different row spacing which had sufficient space, nutrients, moisture, and sunlight for better overall development of individual plants. The variation in the production of branches per plant in varieties may be due to the genetic makeup of individual varieties. This result is also obtained by Sajib et al., (2012) and Shaukat et al., (2012), Sajid et al., (2012), Pandey et al., (2022) in pea.

Table 1. Effect of spacing and varieties on plant height (cm)

Treatments	Plant height (cm)			
	30 DAS	60 DAS	90 DAS	At harvest
Spacing				
S ₁ : 20×10 cm	10.89	28.88	39.31	40.98
S ₂ : 30×10 cm	11.24	29.51	40.53	42.04
S ₃ : 40×10 cm	11.69	30.13	41.62	42.84
S.Ed (±)	0.10	0.36	0.42	0.32
C.D. (P = 0.05)	0.21	0.77	0.88	0.67
Varieties				
V ₁ : Rachna	9.77	27.92	35.61	36.62
V ₂ : Aman	12.98	30.68	46.29	47.22
V ₃ : Prakash	11.07	29.92	39.55	42.03
S.Ed (±)	0.10	0.36	0.42	0.32
C.D. (P = 0.05)	0.21	0.77	0.88	0.67

Table 2. Effect of spacing and varieties on number of branches per plant of field pea.

Treatments	Number of branches per plants			
	30 DAS	60 DAS	90 DAS	At harvest
Spacing				
S ₁ : 20×10 cm	1.19	2.42	2.74	3.71
S ₂ : 30×10 cm	1.27	2.48	2.89	3.84
S ₃ : 40×10 cm	1.30	2.53	2.95	3.93
S.Ed (±)	0.04	0.03	0.02	0.02
C.D. (P = 0.05)	0.08	0.07	0.03	0.03
Varieties				
V ₁ : Rachna	1.12	1.94	2.31	3.20
V ₂ : Aman	1.37	3.12	3.52	4.62
V ₃ : Prakash	1.27	2.37	2.74	3.65
S.Ed (±)	0.04	0.03	0.02	0.02
C.D. (P = 0.05)	0.08	0.07	0.03	0.03

Table 3. Effect of spacing and varieties on number of pods, pod length (cm) and seed yield (q/ha) of field pea

Treatments	Number of pods	Pod length (cm)	Seed yield (q/ha)
Spacing			
S ₁	10.19	4.71	11.26
S ₂	10.50	5.25	12.33
S ₃	10.72	6.01	12.86
S.Ed(±)	0.01	0.11	0.04
C.D	0.03	0.23	0.08
Varieties			
V ₁	9.74	4.98	10.60
V ₂	11.08	5.65	13.56
V ₃	10.58	5.34	12.29
S.Ed(±)	0.01	0.11	0.04
C.D	0.03	0.23	0.08
Spacing x varieties			
S ₁ V ₁	9.60	4.23	9.41
S ₁ V ₂	12.50	5.03	10.86
S ₁ V ₃	11.01	4.87	10.30
S ₂ V ₁	10.45	4.81	9.81
S ₂ V ₂	13.66	5.82	11.05
S ₂ V ₃	12.24	5.12	10.64
S ₃ V ₁	11.32	5.90	10.01
S ₃ V ₂	14.43	6.11	11.34
S ₃ V ₃	13.27	6.04	10.81
S.Ed(±)	0.11	0.18	0.03
C.D	0.22	0.39	0.05

3.3 Effect of Spacing and Varieties on Number of Pods per Plant

The data on the number of pods per plant, as influenced by spacing and varieties are presented in Table 3. The individual effect of spacing and varieties on the number of pods per plant of field peas has been found to be significant. Among the different spacing S₃

(40×10 cm) recorded the maximum number of pods per plant i.e. 13.01 and S₁ (20×10 cm) recorded the minimum pods length per plant i.e. 10.87. Among the different varieties, V₂ (Aman) recorded a maximum number of pods per plant i.e. 13.53, and V₁ (Rachna) recorded a minimum number of pods per plant i.e. (10.46). The combined effect of spacing and varieties on the number of pods per plant of field pea has been

found to be non-significant for all the growth stages. This might be due to wider row spacing which gives sufficient space for individual plants for better reproductive growth and increases the pod-bearing ability because easily provides essential plant nutrients in this row spacing. Significant variation in pods per plant may be correlated with the number of branches. A significant interaction between row spacing on a number of pod plants was also reported by Arpita et al., (2022) in peas and Shaukat et al., (2012) in peas.

3.4 Pods Length (cm)

The data on the pod length of plants as influenced by spacing and varieties are presented in Table 3. The individual effect of spacing and varieties on the number of pod lengths of plants of field peas has been found to be significant. Among the different spacing S_3 (40×10 cm) recorded the maximum number of pods length i.e. 6.01 cm and S_1 (20×10 cm) recorded the minimum pods length per plant i.e. 4.71 cm. Among the different varieties, V_2 (Aman) recorded a maximum number of pods length i.e. 5.65 cm, and V_1 (Rachna) recorded a minimum number of pods length i.e. (4.98 cm). The interaction of spacing and varieties on the number of pods and length of the field peas was found to be significant for all the growth stages of the field peas. The maximum number of pods length per plant was found to be for the treatment S_3V_2 (40×10 cm + Aman), i.e. (6.11). The treatment combination of (S_2V_2 , S_3V_1 , S_3V_2 , and S_3V_3) and (S_1V_2 , S_1V_3 , S_2V_1 , and S_2V_3) was recorded to be at par with each other. The lowest number of pods length was for the treatment S_1V_1 (20×10 cm + Rachna), i.e. (4.23 cm). Enhancement in the number of pod lengths under different spacing and varieties seems to be due to the variation in pod length among varieties which accounted for varietal inheritance. Significant interaction between row spacing on pod length was also observed by Alizai et al., (2005) in pea. Significant effects on variety were also reported by Bhutia et al., (2017) in peas.

3.5 Seed Yield (q/ha)

The data on seed yield as influenced by spacing and varieties are presented in Table 3. The individual effect of spacing and varieties on the seed yield of field peas has been found to be significant. Among the different spacing S_3 (40×10 cm) recorded the maximum seed yield i.e. 17.60 q/ha and S_1 (20×10 cm) recorded a

minimum seed yield i.e.13.81 q/ha. Among the different varieties, V_2 (Aman) recorded maximum seed yield i.e.18.46 q/ha, and V_1 (Rachna) recorded minimum seed yield i.e. (13.06 q/ha). The interaction of spacing and varieties on the seed yield of field peas was found to be significant for all the growth stages of field peas. The seed yield ranged from 11.21 q/ha to 21.11 q/ha. The maximum seed yield was found to be for the treatment S_3V_2 (40×10 cm + Aman), i.e. (20.69 q/ha) followed by treatment S_2V_2 (30×10 cm + Aman) i.e. 18.34 q/ha. The lowest seed yield was for the treatment S_1V_1 (20×10 cm + Rachna) i.e. (11.21 q/ha). The variation in seed yield in varieties may be due to a maximum number of nodules per plant, pods per plant, seed yield per plant, and better seed index. This favorable phenomenon resulted in higher yield. Significant interaction between row spacing on seed yield was observed by Hussain et al., (2017) in peas. Significant effects on variety were also reported by Kumar et al., (2018) in field peas. Significant interaction between row spacing and variety on seed yield/plant was also reported by Malek et al., (2012) and Mondal et al., (2014).

4. CONCLUSION

Based on the results from the experiment it can be concluded that the effect of spacing and varieties on the growth and yield of field peas (*Pisum sativum* L.) significantly increases the growth attributes, yield, and yield attributes of field peas. The spacing (40×10 cm) and variety (Aman) were found best for field pea cultivation. The treatment combination S_3V_2 (40×10 cm + Aman) was found most effective of all the other treatments. From this research outputs, we can conclude that the spacing i.e. 40×10 cm, and variety i.e. S_3V_2 (70,810) lead to better net returns.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

I, Kamjoy Khular Lamkang hereby declare that NO generative AI technologies such as Large 254 Language Models (Chat GPT, COPILOT, etc.) and text-to-image generators have been used 255 during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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