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Effect of date of sowing and weed management practices on the growth, yield attributes and yield of field pea (*Pisum sativum* L.) in vertisols of Chhattisgarh

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Abstract

The experiment was carried out in Split Plot Design with 15 treatment combinations of three different sowing dates viz., (D1: 01 November, D2: 20 November and D3: 10 December) and five weed management practices viz., (W1: Weedy check, W2: Weed-free, W3: Two hand weeding at 20 and 40 DAS, W4: Metribuzin 250 g a.i. ha⁻¹ as PoE and W5: Imazethapyr + Imazamox (pre-mix) 70 g a.i. ha⁻¹ as PoE) were replicated thrice at DKS College of Agriculture and Research Station, Bhatapara, Chhattisgarh. The results of this experiment reveals that the growth parameters of field pea viz., plant height, total no. of branches and dry matter accumulation and yield attributes viz., no. of pods plant⁻¹, pod length, no. of seeds pod⁻¹, seed index (100 seeds weight), seed yield and straw yield were significantly higher under 01 November (D₁) date of sowing with two hand weeding at 20 and 40 DAS (W₃) while it was found superior under weed free (W₂) condition due to no weed competition. The highest harvest index was recorded in 01 November (D₁) with weed free (W₂). The interaction effect of date of sowing and weed management practices had significant influence on plant height and seed yield, while non-significant on other growth parameters and yield attributes.

Keywords: Pea (*Pisum sativum* L.), sowing date, growth, yield

Introduction

Field pea (*Pisum sativum* L.) is the third most significant pulse crop globally and the most popular *rabi* pulse crop after lentils and chickpeas in India. It belongs to the family Fabaceae and subfamily Papilionoideae. The genus *Pisum* composes of five species, among all of them only one species i.e., *Pisum sativum*, chromosome no. is 2n=14 is cultivated. Field pea is a good source of protein and primarily used for human consumption and also used as livestock feed. It contains 15-35% protein, 20-50% starch, 4-10% sugar, 2-4% minerals and 0.6-1.5% fat (Makasheva, 1983) [7]. In India, the cultivated area of field pea is about 0.76 million ha with an annual production of about 1.04 million tonnes and estimated yield of field pea is 13.18 q ha⁻¹ [Anonymous. 2021. (b)] [2]. In Chhattisgarh, the field pea is mostly grown in *rabi* season. Cultivated area of field pea in Chhattisgarh is 13690 ha with production of 5354 metric ton. In Balodabazar district of Chhattisgarh, cultivated area and production is about 429 ha and 145 metric ton respectively [Anonymous. 2023. (a)] [1].

The most significant non-monetary input for the vegetative growth and increased crop productivity is timely sowing of crops. The choice of optimum sowing date, the favourable weather conditions for different pea varieties is very important factor to leading higher seed yields. The optimum temperature for seed germination is about 22 °C however, it can germinate up to 5 °C but at slow rate. Peas grow best at mean temperature of 13-18 °C (Singh and Singh, 2011) [13].

It is imperative to find out optimum date of sowing and effective weed management practices for better growth and yield of field pea. The present investigation was carried out to evaluate the combine effect of date of sowing and weed management practices on the growth and yield of irrigated field pea.

Materials and Methods

The present investigation was carried out at the Instructional Farm, DKS College of Agriculture and Research Station in Bhatapara, Chhattisgarh, during *rabi* season of 2023–24 to find the effect of date of sowing and weed management practices on the performance of irrigated field pea (*Pisum sativum* L.). The experimental field was neutral in pH and clayey texture soil. The range of mean maximum and minimum temperatures 24.8 to 38.9 °C and 10.1 to 23.6 °C during the crop growth and development period was respectively. The range of the relative humidity 63.7-90.3%, bright sunshine 1.8 to 9.2 hrs day⁻¹, wind speed 0.1 to 4.5 km hr⁻¹ and daily evaporation 13.8 to 47.3 mm was respectively.

Fifteen treatment combinations comprising of three different sowing dates viz., (D1: 01 November, D2: 20 November and D3: 10 December) and five weed management practices viz., (W1: Weedy check, W2: Weed-free, W3: Two hand weeding at 20 and 40 DAS, W4: Metribuzin 250 g a.i. ha⁻¹ as PoE and W5: Imazethapyr + Imazamox (pre-mix) 70 g a.i. ha⁻¹ as PoE) were replicated thrice in Split Plot Design taken under study to estimate response in growth and yield of field pea.

The field pea variety paras were sown at spacing 30 cm × 10 cm (row × plant) using seed rate 80 kg ha⁻¹. The gross and net plot size was 6 m × 5 m and 4.8 m × 4.6 m, respectively. The recommended dose of fertilizer was applied at dose of nitrogen 20 kg ha⁻¹, phosphorus 50 kg ha⁻¹, and potassium 20 kg ha⁻¹ at the sowing time through urea, DAP and MOP, respectively. Hand weeding was performed as per treatment, Metribuzin and Imazethapyr + Imazamox (pre-mix) were applied at 20 DAS. The only source of irrigation was used to irrigate field pea through sprinklers. Other practices were in accordance with the recommended package for the region. The observed data were recorded from randomly selected and tagged plants from each treatment excluding the border plant. The data obtained on various observations for each treatment were subject to 'Analysis of variance' as recommended by R. Rangaswamy (2005) [11]. Harvest index (HI) was worked out using the following formulas:

$$a) HI (\%) = \frac{\text{Economic yield (kg ha}^{-1}\text{)}}{\text{Biological yield (kg ha}^{-1}\text{)}} \times 100$$

Result and Discussion

Growth parameters

Under present investigation, the growth parameters viz., plant height, total number of branches plant⁻¹ and dry matter accumulation plant⁻¹ were recorded. The significant effect was found on all the stages of growth and parameters. The relevant data of growth parameters were presented in Table 1.

It is revealed from the data that plant height was significantly influenced by date of sowing and weed management practices. The maximum plant height, total number of branches plant⁻¹ and dry matter accumulation plant⁻¹ were recorded on sowing date 01 November (D₁) while minimum on 10 December (D₃). The optimum date of sowing relatively favours optimum temperature and longer time period for growth and development and also controls the all the categories of weeds that results less competition between crop and weeds for growth resources which affects the growth parameters. These results are in line with those of Jilani *et al.* (2016) [6] and Sirwaiya and Kushwah (2018) [15].

Maximum plant height, total number of branches plant⁻¹ and dry matter accumulation plant⁻¹ were recorded in treatment two hand weeding at 20 and 40 DAS (W₃) while minimum in weedy

check (W₁) due to higher weed infestation. The weed free (W₂) was found superior over all weed management practices. These findings are consistent with Sajid *et al.* (2012) [12] and Sirwaiya *et al.* (2018) [14].

Yield Attributes

The relevant data of yield attributes were presented in Table 2. The number of pods plant⁻¹ and number of seeds pod⁻¹ had significantly influenced by date of sowing while pod length pod⁻¹ (cm) and seed index (100 seeds weight) had non-significant effect on it. The maximum number of pods plant⁻¹, number of seeds pod⁻¹, pod length pod⁻¹ (cm) and seed index (100 seeds weight) were recorded under 01 November (D₁) which was followed by D₂ > D₃. Every delay in sowing resulted reduction in number of pods plant⁻¹, pod length, number of seeds pod⁻¹ and also effects seed index (100 seeds weight). Brar *et al.* (1994) [4] also recorded the highest no. of pods plant⁻¹ on 17 November, this date provides favourable weather condition for development of pods which resulted in vigorous plant, higher yield attributes and also productivity. These findings concur with those of Waheed *et al.* (2015) [16].

The weed management exhibited significant influence on number of pods plant⁻¹ and number of seeds pod⁻¹ while pod length pod⁻¹ (cm) and seed index (100 seeds weight) had non-significant effect on it. Yield attributes under weed free (W₂) condition had superior over all weed management practices. The maximum number of pods plant⁻¹, number of seeds pod⁻¹, pod length pod⁻¹ (cm) and seed index (100 seeds weight) were recorded under two hand weeding at 20 and 40 DAS (W₃) which was followed by W₅ > W₄ > W₁. These findings align with those reported by Sajid *et al.* (2012) [12], Rana *et al.* (2015) [10] and Jilani *et al.* (2016) [6]. The combine effect of sowing date and weed management practices had non-significant effect on field pea.

Yield

The sowing date and weed management practices both exerted significant effect on seed yield and straw yield. The delay sowing affects the seed yield and straw yield results decreasing in yield ha⁻¹. Early sowings had a favorable influence on the growth and development of pea plants, which promoted greater growth and yield qualities and, in turn, higher yield. Similar results have also been reported by and Haq and Ahmed (2021) [5].

The results revealed that the maximum seed and straw yield was recorded under date, 01 November (D₁) which was followed by D₂ > D₃. The maximum seed yield was recorded in weed free (W₂) which followed by W₃ > W₅ > W₄.

The higher weed infestation had reduced the yield due to high crop- weed competition for growth resources. Similar results have also been reported by Bharat *et al.* (2006) [3] and Punia *et al.* (2017) [9].

Every delay in sowing had resulted reduction in harvest index also. The highest harvest index was recorded under 20 November (D₂) and minimum under 10 December (D₃). Weed free (W₂) had maximum harvest index which was superior over all weed management practices. It was followed by W₃ > W₅ > W₄ > W₁. The lower harvest index was caused due to inefficient photosynthetic translocation from source to seeds. Early sowing and weed free condition allowed food material to properly translocate into pods and seeds. The current results are consistent with the research conducted by NR and Singh (2018) [8] and Sirwaiya and Kushwah (2018) [15]. The relevant data of seed yield, straw yield and harvest index were presented in

Table 3.

Conclusion

From this experiment concluded that the growth parameters of field pea viz., plant height, total no. of branches and dry matter accumulation was significantly higher in 01 November (D_1) date of sowing with two hand weeding at 20 and 40 DAS (W_3) while it was found superior under weed free (W_2) condition due to no

weed competition. The yield attributes viz., no. of pods plant⁻¹, pod length, no. of seeds pod⁻¹ and seed index and yield viz., seed yield and straw yield were recorded maximum under 01 November (D_1) with two hand weeding at 20 and 40 DAS (W_3) treatment. The highest harvest index was recorded in 01 November (D_1) with weed free (W_2). There was significant effect on the interaction of date of sowing and weed management practices in plant height and seed yield.

Table 1: Plant height, total no. of branches plant⁻¹ and dry matter accumulation plant⁻¹ was influenced by different sowing dates and weed management practices in field pea

Treatments	Plant height (cm)					Total no. of branches plant ⁻¹					Dry matter accumulation (g plant ⁻¹)				
	20 DAS	40 DAS	60 DAS	80 DAS	At harvest	20 DAS	40 DAS	60 DAS	80 DAS	At harvest	20 DAS	40 DAS	60 DAS	80 DAS	At harvest
Date of sowing															
D_1 = 01 November	13.54	21.01	86.65	105.82	107.37	4.85	8.80	12.93	18.72	18.85	0.249	2.20	9.62	22.24	38.38
D_2 = 20 November	12.12	19.42	85.16	101.44	103.25	3.64	8.36	12.42	17.39	17.77	0.236	1.84	9.20	21.42	37.89
D_3 = 10 December	10.76	19.01	84.64	92.86	100.03	3.57	7.71	11.78	15.86	16.66	0.219	1.59	8.28	19.94	37.00
S.E.m $\pm$	0.36	0.83	2.66	1.43	3.13	0.29	0.26	0.36	0.53	0.75	0.010	0.07	0.42	0.73	1.26
C.D. 5%	NS	NS	NS	5.61	NS	NS	NS	NS	2.10	NS	NS	0.27	NS	NS	NS
Weed management															
W_1 = Weedy check	10.65	18.24	83.74	90.57	97.08	3.84	7.62	10.87	15.87	16.09	0.210	1.55	7.06	17.95	32.91
W_2 = Weed free	12.24	21.56	87.01	106.71	108.98	4.18	8.98	13.31	18.91	19.55	0.271	2.27	11.25	24.17	41.22
W_3 = Two hand weeding at 20 and 40 DAS	11.79	20.76	86.08	102.31	105.46	4.11	8.58	13.09	17.95	18.67	0.237	2.05	9.73	22.12	39.34
W_4 = Metribuzin 250 g a.i. ha ⁻¹ as PoE	11.11	18.91	84.67	96.65	102.37	4.04	8.20	12.61	17.22	17.71	0.234	1.81	8.74	21.17	38.20
W_5 = Imazethapyr + Imazemox (pre-mix) 70 g a.i. ha ⁻¹ as PoE	11.68	19.60	85.98	101.97	103.87	3.89	8.07	11.98	16.67	16.78	0.221	1.73	8.40	20.60	37.10
S.E.m $\pm$	0.47	0.95	3.30	2.33	4.03	0.25	0.36	0.56	0.69	0.70	0.014	0.10	0.57	1.13	1.41
C.D. 5%	NS	NS	NS	6.80	NS	NS	NS	NS	2.02	2.04	NS	0.30	1.66	3.28	4.11
Interaction															
S.E.m $\pm$	0.82	1.64	5.71	4.04	6.97	0.43	0.62	0.97	1.20	1.21	0.024	0.18	0.99	1.95	2.44
C.D. 5%	NS	NS	NS	11.78	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2: Yield attributes influenced by date of sowing and weed management practices in field pea

Treatments	No. of pods plant ⁻¹	Pod length (cm)	No. of seeds pod ⁻¹	Seed index (g)
Date of sowing				
D_1 = 01 November	19.44	5.22	6.40	17.30
D_2 = 20 November	17.92	5.06	5.93	16.83
D_3 = 10 December	15.40	4.82	5.07	16.44
S.E.m $\pm$	0.62	0.18	0.22	0.56
C.D. 5%	2.42	NS	0.87	NS
Weed management				
W_1 = Weedy check	14.89	4.41	4.33	15.17
W_2 = Weed free	20.40	5.50	7.56	18.18
W_3 = Two hand weeding at 20 and 40 DAS	18.98	5.18	6.44	17.56
W_4 = Metribuzin 250 g a.i. ha ⁻¹ as PoE	16.00	4.92	5.00	16.28
W_5 = Imazethapyr + Imazemox (pre-mix) 70 g a.i. ha ⁻¹ as PoE	17.67	5.14	5.67	17.09
S.E.m $\pm$	0.77	0.25	0.29	0.71
C.D. 5%	2.26	NS	0.84	NS
Interaction				
S.E.m $\pm$	1.34	0.44	0.50	1.22
C.D. 5%	NS	NS	NS	NS

Table 3: Seed yield, straw yield and harvest index influenced by date of sowing and weed management practices in field pea

Treatments	Seed yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)	Harvest index (%)
Date of sowing			
D ₁ = 01 November	1072	1161	47.37
D ₂ = 20 November	974	1010	47.97
D ₃ = 10 December	820	965	43.91
S.Em±	38.24	36.32	-
C.D. 5%	150.16	142.62	-
Weed management			
W ₁ = Weedy check	586	862	40.40
W ₂ = Weed free	1270	1178	49.33
W ₃ = Two hand weeding at 20 and 40 DAS	1102	1148	48.94
W ₄ = Metribuzin 250 g a.i. ha ⁻¹ as PoE	834	952	46.29
W ₅ = Imazethapyr + Imazemox (pre-mix) 70 g a.i. ha ⁻¹ as PoE	984	1087	47.13
S.Em±	36.76	44.67	-
C.D. 5%	107.30	130.37	-
Interaction			
S.Em±	63.67	77.36	-
C.D. 5%	185.84	NS	-

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