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Different Sowing Dates and its Influence on Disease Severity of Pea Rust

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ABSTRACT: The study faced a number of difficulties, including the fact that late planting of the crop reduced output and made rust disease more severe, which causes crop loss. As a result, there is a growing awareness of the use of Punjab-89 as a main season variety around the world.

A field experiment was conducted during the Rabi season 2021- 2022 at the Agricultural Research Farm of Lovely Professional University, Jalandhar, Punjab with seven treatments combinations of three sowing times S1 (3rd November), S2 (13th November), S3 (23rd November) in sub plots were tested in randomized block design with three replications. Plant growth parameters like germination percentage, plant height (cm), number of pods/plant, number of grains/pod, pod length (cm), and yield (kg/plot) were recorded significantly. Treatments of foliar spray of neem leaf extract @ 3%(T1), garlic clove extract @ 3% (T2), ginger rhizome extract @ 3% (T3), hexaconazole (Contaf plus 5% SC) @ 0.1% (T4), propiconazole (Tilt 25% EC) @ 0.1% (T5) carbendazim (Bavistin 50%WP) @ 0.2 % (T6) and control (Spray of plain water) (T7), were applied at the first initiation of disease symptoms. Results showed that the percent disease intensity (PDI) was significantly low in propiconazole at 25% (EC), followed by hexaconazole at 5% (SC) and carbendazim at 50% (WP). Plant yield attributes like germination percentage (%), plant height (cm), pod length (cm), number of pods/plant, number of grains/pod and yield (kg/plot) were recorded as significantly superior with crop sown on S1 (3rd November) with propiconazole as compared to others treatments.

Keywords: Sowing dates, Treatments, Hexaconazole, carbendazim, Pea Rust.

INTRODUCTION

Field pea (*Pisum sativum* L.) is a commercial crop in India, which is also known as the 'Queen of pulses' (Jain, *et al.,* 2019). It comes under Fabaceae family, is one of the principal legume vegetable crops grown throughout the world (Kumar *et al.,* 2021). Pea is a cool season, hardy leafy annual with climbing or hollow trailing stems (1.8 mt) along with a well-developed tap root system, bearing nitrogen-fixing nodules (Rubatzky *et al.,* 1997). The plant is either dwarf or tall usually 30-150 cm long. Among grain legumes, pea (*Pisum sativum* L.) is the second most important food legume crop in the world because of its high yield potential (Singh, *et al*., 2020). 100 gms of green peas contains 0.4 g fat, 14.5 g carbohydrates, 25 mg calcium, protein 5.4 gm, and so on (Dhall, 2017). The important pea-growing countries are Canada, Russia, China, India, and the United States. India occupies the fourth position in the area and 5th position in production. In India, dry peas are cultivated on an area of 616508 ha with a production of 796735 tonnes (FAOSTAT, 2020). Uttar Pradesh, Madhya Pradesh, Jharkhand, Punjab, Himachal Pradesh, West Bengal, Haryana, Bihar, Uttarakhand, Orissa, and Karnataka are major pea-growing states in India (Singh, 2011). Uttar Pradesh accounts for more than half of the country's total pea production. Pea grows on all types of soils but well-drained fertile loamy soils are best for the crop. Peas do best in soils having pH of 6.0 to 7.5 (Anonymous (2019). Pea can be grown on all kinds of soils except heavy soils (pea cultivation). The optimum mean temperature for growth is 20-25°C. The crop is damaged more seriously by frost. The optimum and base germination temperatures are around 20 °C and -1.1 °C, respectively (Raveneau *et al.,* 2011). The effect of different dates of sowing on the rust of field peas was studied about weather parameters during crop seasons (Singh, D., *et al.,* 2012). And they observed that the temperature (17.50 and 15.50°C) during the growth of crops sown from November 29 to December 13 crop season was favorable for the development of the disease. Despite the potential for pea crops in agriculture, they still face challenges due to competition from weeds, insect attacks, disease incidence, instability of productivity, and a lack of successful nodulation (Soni & Singh 2019). Singh and Tripathi (2004) have also concluded that rust is one of the major diseases of field pea and it is responsible for substantial losses in grain yield. Many researchers tried to control this disease chemically worldwide (Rahman *et al.,* 2005; Ahmed *et al.,* 2006).

MATERIALS AND METHODS

The experiment was carried out at Agricultural Research Farm of Lovely Professional University, Jalandhar, Punjab about 31°14'43.8"N and 75°41'44.1"E at an altitude of about 252 m above the mean sea level. The experiment was carried out in a randomized block design with three replications. The three sowing times (3rd November, 13th November, and 23rd November) in the main plots and seven treatments *viz*., neem leaf extract (3%) (T1), garlic clove extract (3%) (T2), ginger rhizome extract (3%) (T3), hexaconazole (Contaf plus 5% SC) @ 0.1% (T4), propiconazole (Tilt 25% EC) @ 0.1% (T5) carbendazim (Bavistin 50%WP) @ 0.2 % (T6) and control (Spray of plain water) - T7, were tested against the yield attributing characters and rust disease of field pea. Land preparation operations included land irrigation, ploughing the land to the depth of 30 cm, disking to the depth of 15 cm, and trowel. Each replication included 3 plots. The seed was sown with a depth of 4-5 cm keeping a distance of 45 cm and 10 cm between the rows and plants respectively. The seed rate of the crop was 35-40 kg/ha. The seeds were covered with soil thoroughly to avoid damage from birds etc. The crop harvesting was done when all plants have tan pods at the bottom and yellow to tan pods in the middle, the grains became hard and dry. For recording observations at different times of sowing with the effect of different treatments and twenty plants in the net plot area were randomly selected and tagged. However, for yield parameter accumulation, twenty plants were randomly selected from the sample rows at regular intervals. The yield was studied after harvesting the crop. The observation recorded during the investigation were tabulated and analyzed statistically to draw a valid conclusion.

Percent Disease Index (PDI). Treatments were imposed at 45 days after sowing by spraying botanicals in each replication and 3 sprays were taken at an interval of 10 days, untreated control was maintained by spraying the distilled water. Observations on disease severity of rust were recorded at 15 days intervals and yield data were obtained. For recording observations, 10 leaves per plant from each plot were selected randomly and intensity was measured by using rust disease severity was recorded by referring to the following 0-9 scale given by Mayee and Datar (1986).

Rating scale (Grade)	Description
0	No symptoms on leaf.
1	Rust pustules small, scattered covering 1% or less of leaf area.
3	Rust pustules more in number covering 1-10% of leaf area.
5	Typical rust pustules covering 11-25% of leaf area.
7	Typical rust pustules covering 26-50% of leaf area.
9	Typical rust pustules covering 51% or more of leaf area.

Further these scales were converted to per cent disease index using formula given by Wheeler (1969)

Disease index (%) =

$$\frac{\text{Sum of all numerical rating}}{\text{Number of leaves examined} \times \text{Maximum grade}} \times 100$$

RESULT AND DISCUSSION

A. Germination percentage

The data on the effect of various treatments on the germination percentage of field pea crop has been presented in Table 1, revealing that significantly higher germination was recorded when the crop was sown on S1 (3rd November) significantly superior to the crop sown on S2 (13th November) and S3 (23rd November). Lowest emergence count of S3 (23rd November) sown crop might be due to delaying the sowing date decreasing the germination percentage and increasing the time from germination to initial and final germination.

Table 1: Response of sowing time on germination (%).

Days After Sowing	7 DAS	15 DAS	30 DAS
S1	69.171	77.46	81.486
S2	61.217	68.783	75.96
S3	55.908	61.693	69.875
C.D.	5.624	6.055	2.701
SE(m)	1.395	0.924	0.412
SE(d)	1.973	1.307	0.583
C.V.	3.891	1.886	0.769

B. Yield attributes

The data are given in Table 2 that sowing time and application of treatments had a significant effect on all growth parameters like plant height (cm), no. of pods plant-1, pods length (cm), and no. of grains pods-1. Significantly higher plant height (cm), no. of pods/plant, pods length(cm), and no. of grains/pods.was found with crop sown on S1 (3rd November) in T5-Propiconazole followed by T4-Hexaconazole, further T6- carbendazim, respectively. Minimum yield parameters were observed in late sown crop (23rd Nov) in T7-Control. This is because favorable temperature and longer time available for the growth and development under earlier sowing could have promoted the growth of the plants and development of the new leaves as against too late sowing crop. Crop obtained a maximum length of the growing period, favorable temperature, and other

climatological parameters for the growth characters which helps in promoting better cell division and cell elongation. Similar results related to plant height (cm) as well as pod length (cm) of pea crops were also corroborated by Kumar *et al.* (2020). Alam *et al.* 2007, also find similar results considering yield contributing characters (number of pods plant-1, length of pod, and seed pod-1) propiconazole performed better than other treatments. Similar results were corroborated by Ali *et al.* (2016) in garden pea, as they reported that delay in sowing leads to a decrease in Yield attributes as compared to timely sown crop. Siddique *et al.* (2002); Tiwari *et al.* (2014) also resulted that maximum production of Yield attributes with early sowing was observed in pea.

Table 2: Response of sowing time and different treatments on yield attributes.

Treatments	Concentration	Plant Height (cm)			Pod length (cm)			No. of pods/plant			No. of grains/pod			Yield (kg/plot)		
		S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3
Neem Leaf Extract (T1)	3%	41.28	37.77	34.81	8.58	8.03	7.03	19.01	16.99	14.13	7.33	6.90	6.15	9.40	9.09	7.50
Garlic Extract (T2)	3%	38.24	35.14	31.69	8.07	7.54	6.55	18.46	16.11	13.42	6.73	6.50	5.82	8.92	8.43	7.01
Ginger Extract (T3)	3%	35.40	31.41	28.53	7.52	6.85	6.10	17.59	15.48	12.99	7.02	6.22	5.34	7.96	7.01	6.40
Hexaconazole (T4)	0.1%	48.22	44.82	40.96	9.58	9.05	8.19	19.48	18.03	15.07	8.09	7.65	7.17	11.09	10.46	9.02
Propiconazole (T5)	0.1%	50.10	47.91	44.63	10.33	9.53	8.84	20.11	18.50	15.43	8.53	8.13	7.65	12.30	11.10	10.05
Carbendazim (T5)	0.2%	45.45	41.10	37.33	9.07	8.50	7.48	18.18	16.46	14.38	7.73	7.32	6.68	10.03	9.50	8.12
Control (T7)	-	32.15	28.96	24.28	6.92	6.36	5.51	17.16	14.69	12.17	6.32	5.93	5.07	7.16	6.42	5.80
C.D.	-	1.88	0.97	0.42	0.45	0.28	0.42	0.18	0.18	0.15	0.22	0.27	0.24	0.26	0.32	0.28
SE(m)	-	0.60	0.31	0.14	0.15	0.09	0.14	0.06	0.06	0.05	0.07	0.09	0.08	0.08	0.10	0.09
SE(d)	-	0.85	0.44	0.19	0.21	0.13	0.19	0.08	0.08	0.07	0.10	0.12	0.11	0.12	0.15	0.13
CV	-	2.51	1.42	0.67	2.93	1.92	3.30	0.54	0.59	0.60	1.67	2.13	2.16	1.52	2.03	2.00

C. Disease Severity

The data on the percent disease intensity of rust disease was recorded at 15 days intervals and data were obtained in table 3. The data showed that all the treatments were significantly effective over control. Among all the treatments the minimum percent disease intensity was recorded in the S1 crop in T5- propiconazole, followed by T4- hexaconazole, further T6- Carbendazim. The maximum percent disease intensity was recorded in T7- control. Alam *et al.* (2007), also observed similar findings in which they reported that all fungicides resulted in significantly better performance over control. Considering percent disease index (PDI), propiconazole performed better than other fungicides. The highest PDI of rust disease was observed in the control treatment, whereas the lowest PDI and percent disease reduction over control was recorded in propiconazole may be used for controlling rust disease and increasing seed yield of field pea. Rahman *et al.,* (2005) and Ahmad *et al.,* (2006) also reported that Tilt 25 EC (propiconazole) @ 0.1% was the most effective fungicide against rust disease. Singh and Tripathi (2004) also find a similar result.

Table 3: Response of different sowing time and treatments on Disease Severity.

Treatment	Concentration	45 DAS			60 DAS			75 DAS		
		S1	S2	S3	S1	S2	S3	S1	S2	S3
Neem Leaf Extract (T1)	3%	65.333	67.36	69.463	59.037	63.417	67.36	55.173	59.037	63.417
Garlic Extract (T2)	3%	67.057	69.463	71.877	61.133	65.12	69.463	57.09	63.093	65.12
Ginger Extract (T3)	3%	69.933	71.877	72.443	65.12	67.533	71.633	59.037	65.12	67.533
Hexaconazole (T4)	0.1%	61.25	63.457	65.333	55.173	59.037	63.457	51.09	55.173	59.037
Propiconazole (T5)	0.1%	59.183	61.25	63.457	53.153	57.09	60.667	49.343	53.153	57.09
Carbendazim (T6)	0.2%	63.457	65.333	67.36	57.09	61.133	65.333	53.153	57.09	61.133
Control (T7)	-	70.72	72.5	73.493	71.233	71.233	75.447	73.183	74.187	76.557
C.D.	-	0.487	0.54	0.648	0.375	0.362	0.74	1.578	0.363	0.437
SE(m)	-	0.156	0.173	0.208	0.12	0.116	0.238	0.506	0.117	0.14
SE(d)	-	0.221	0.245	0.294	0.17	0.165	0.336	0.716	0.165	0.198
CV	-	0.415	0.446	0.522	0.346	0.317	0.608	1.543	0.331	0.378

CONCLUSION

In conclusion, significantly higher yield attributes were observed concerning plant height (cm), no. of pods/plant, pods length(cm), and no. of grains/pods was found with crop sown on S1 (3rd November) in T5-Propiconazole. Similarly, the minimum percent disease intensity was recorded in the S1 crop in T5-propiconazole.

FUTURE SCOPE

The correlation established between different sowing dates and pea rust will help in reducing the disease severity among the crop by sowing the field pea as a main season of variety, which will improve the production and productivity of the field pea crop.

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Conflict of Interest. None.

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