Website : www.asthafoundation.in
Progressive Research : An International Journal
Vol 19 (1) : 66-69 (January-2024), Print ISSN : 0973-6417, Online ISSN : 2454-6003
Society for Scientific Development in Agriculture and Technology, Meerut (U.P.) India

Assessment of Different Fungicides on the Management of Rust (*Uromyces fabae* de Bary) Disease of Garden Pea (*Pisum sativum* L.)

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Abstract

The present study was conducted during *Rabi* season of 2023-24 at the experimental field of Madhyanchal Professional University, Bhopal (M.P.) to assessment of different fungicides on the management of rust disease of garden pea. Seven treatments including control with three replications were taken up by using RBD. Treatments of foliar spray of propiconazole (Tilt 25 % EC) @ 0.1 % (T1), tebuconazole (Folicure 25.9 % EC) @ 0.2 % (T2), difenoconazole (Score 25 % EC) @ 0.06 % (T3), azoxystrobin (Amistar 23 % SC) @ 0.1 % (T4), chlorothalonil (Kavach 75 % WP) @ 0.2 % (T5), carbendazim + mancozeb (Saaf 75 % WP) @ 0.2 % (T6) and control (Spray of plain water)- T7, were applied at the first initiation of disease symptoms and second at 10 days after the first spray. The data were recorded at 10 and 20 days after the spray. Results revealed that the per cent disease intensity (PDI) was significantly low (11.40 and 14.96 %) in Propiconazole 25 % (EC), followed by Difenoconazole 25 % (EC) with 14.66 and 16.09 per cent, respectively. The highest seed yield was recorded in Propiconazole 25 % (EC) sprayed plot 19.61 q/ha, followed by Difenoconazole 25 % (EC) with 19.40 q/ha, respectively as compared to control which recorded maximum per cent disease intensity (28.74 and 39.85 %) and lowest yield 13.75 q/ha.

Key words : *Assessment, fungicides, management, Uromyces fabae, pea, rabi, percent.*

Introduction

Peas are an important crop because of their diversity of utilization and extensive production area (Boros and Wawer, 2009). Peas are an excellent source of protein, fiber, minerals and vitamins (1,2). One pound of green peas contains 13.7 g fat, 36.1 g carbohydrates, 45 mg calcium, 249 mg phosphorus and 54 mg ascorbic acid (Khan, 1994). Pea seed is a source of vitamins A, B, C and contains 35-40 per cent starch and 4-7 per cent fiber. This makes it an appropriate dietary complement to cereals (3). Beside this, peas are harvested at physiological maturity providing forage for animal feed (4,5). Addition to their ability to fix atmospheric N, peas enhance soil structure and provide breaks for disease control which means they have an important role in modern agricultural systems (1). The total cultivated dry pea area in the world is about 6.2 M ha with an average yield of 1.68 t ha-1 producing an estimated 105 M t. Half of this production is used for livestock feed, and the remaining half for human consumption, mainly in developing countries (6). In India, pea is grown over an area of 0.77 million hectare with a production 0.71 million tonnes and productivity 915 kg/ha (7). Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Orissa, Bihar, Rajasthan, Punjab, Haryana and Uttarakhand are major pea growing state in India. The average yield in major pea growing countries. *viz.,* France (15.5 q ha^{-1}), Hungary (15.5 q ha^{-1}) and Netherland (14.3 q ha^{-1}) (Anonymous, 2002), while in India the average yield is 9.15 q ha^{-1} (7). The wide gap between the attainable yield potentials and farmers field are due to various biotic, a biotic and socio-economic factors. Despite the potential for pea crops in agriculture, they still face challenges due to competition from weeds, insect attack, disease incidence, instability of productivity and a lack of successful nodulation (6). Rust is one of the most important fungal foliar disease of pea in India, which regularly appears in mild to severe form every year especially in late in season, reaching maximum intensity during the pod formation stage (8) have also concluded that rust is one of the major disease of garden pea and it is responsible for substantial losses in grain yield. Many researchers tried to control this disease chemically worldwide (9). The disease can be controlled by applying a number of management strategies including biological, cultural, chemical and planting resistant varieties. Among these, use of resistant varieties and application of fungicides are more effective. Considering above point, this study was undertaken at the experimental field of Madhyanchal Professional University, Bhopal to assessment of different fungicides on the management of rust disease of garden pea.

Materials and Methods

The study of the assessment of six different fungicides on management of rust disease of garden pea at the

Received : November-2023; Revised : November-2023; Accepted : December-2023

experimental field of Madhyanchal Professional University, Bhopal (M.P.) during *Rabi* season of 2023-24. The experiment was planned in Randomized Block Design (RBD) with three replications and there are seven treatments including untreated control. The unit plot size was 3 m x 2 m. The six fungicides namely, propiconazole (Tilt 25 % EC) @ 0.1 % (T1), tebuconazole (Folicure 25.9 % EC) @ 0.2 % (T2), difenoconazole (Score 25 % EC) @ 0.06 % (T3), azoxystrobin (Amistar 23 % SC) @ 0.1 % (T4), chlorothalonil (Kavach 75 % WP) @ 0.2 % (T5), carbendazim+mancozeb (Saaf 75 % WP) @ 0.2 % (T6) were tested against rust disease of garden pea. Early maturing garden pea variety Kashi Mukti was selected for the study. The crop was sown manually on 24th October with spacing of 30 cm and 10 cm between rows and plants, respectively with seed rate of 75 kg ha^{-1} at depth of 4 cm. The agronomic practices were followed as per package of practices to raise a good crop. The crop was fertilized with basal dose of 20, 60 and 30 kg N, P and K ha^{-1} applied in furrows before sowing, respectively. Timely hoeing and weeding operations were carried out to ensure soil moisture and to remove weeds. The plots were irrigated with three times. The fungicides were sprayed twice at 10 days interval on the standing crop according to the treatments with the initiation of the disease symptoms, control plots were sprayed with plain water. The data were recorded from randomly selected 5 plants/plot for number of pods/plant, length of pod (cm) and seed yield (q/ha).

Per cent Disease Intensity (PDI) : The disease intensity was recorded on pea plant 1 day before spraying and 10 days and 20 days after spraying of fungicides. First spray of fungicides as per treatments, were taken up after initial appearance of disease in crop and further spray was given at 10 days interval. Finally after 2 sprays using 0-5 scales (Anonymous, 2010). Five plants in each plot were tagged and per cent disease intensity was calculated by using following formula (10).

$$\text{Disease intensity (\%)} = \frac{\text{Sum of all disease rating}}{\text{Total number of leaves} \quad \text{maximum grade}} \quad 100$$

Disease rating scales :

Grade	Per cent disease intensity with description
0	No symptoms on leaves
1	1-5% leave are infected
2	6-20% leaves are infected
3	21-40% leaves are infected
4	41-70 % leaves and fruits are infected
5	Above 70 % leaves and fruits are infected

Results and Discussion

The data on per cent disease intensity of rust disease of garden pea at one day before spray is furnished in table 1. The data on per cent disease intensity of rust disease of garden pea at 10 days after spray is furnished in table-1. The data showed that all the treatments were significantly effective over control. Among all the treatments the minimum per cent disease intensity was recorded in T1-propiconazole (11.40%), followed by T3-difenoconazole (14.66%), further T4-azoxystrobin (15.38 %), respectively. The maximum per cent disease intensity was recorded in T0-(28.74 %). The data on per cent disease intensity of rust disease of garden pea at 20 days after spray is furnished in table-1. The data showed that all the treatments were significantly effective over control. Among all the treatments the minimum per cent disease intensity was recorded in T1-propiconazole (14.96%), followed by T3-difenoconazole (16.09%), further T4-azoxystrobin (18.14 %), respectively. The maximum per cent disease intensity was recorded in T0- Control (39.85 %). (11) also observed the similar findings in which they reported that all fungicides resulted significantly better performance over control. Considering per cent disease index (PDI), Propiconazole performed better than other fungicides. The highest PDI of rust disease was observed in control treatment, where as the lowest PDI and per cent disease reduction over control was recorded in propiconazole may be used for controlling rust disease and increasing seed yield of garden pea. (9) also reported that Tilt 25 EC (propiconazole) @ 0.1 % was the most effective fungicide against rust disease. (8,12) also find similar result.

The data on numbers of pods at one before spray is furnished in table-2. The data on numbers of pods at 10 day after spray is furnished in table-2. The data showed that all the treatments were significantly effective over control. Among all the treatment the maximum numbers of pods were recorded in T1-treatment with propiconazole (13.67), followed by T3-difenoconazole (13.33), further T4-azoxystrobin (13.00), respectively. The minimum numbers of pods were recorded in T0 control (8.50). The data on numbers of pods at 20 days after spray is furnished in table-2. The data showed that all the treatments were significantly effective over control. Among all the treatments the maximum numbers of pods were recorded in T1-propiconazole (14.47), followed by T3-difenoconazole (14.27), further T4-azoxystrobin (14.07), respectively. The minimum numbers of pods were recorded in T0-control (9.60). (11) 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 fungicides.

The data on length of pod at one day before spray is furnished in table-3. The data on length of pod at 10 days after spray is furnished in table-3. The data showed that

Table-1 : Per cent disease intensity of rust disease of garden pea at different day's interval as affected by different treatments.

Treatments		Concentration (%)	Per cent of disease intensity (PDI)	
			One day before spray	After spray
			10 days	20 days
T_0-Control	-	15.26	28.74	39.85
T_1-Propiconazole	0.1 %	7.54	11.40	14.96
T_2-Tebuconazole	0.2 %	10.29	15.77	20.44
T_3-Difenoconazole	0.06 %	10.11	14.66	16.09
T_4-Azoxystrobin	0.1 %	8.47	15.38	18.14
T_5-Chlorothalonil	0.2 %	11.25	15.85	21.55
T_6-Carbendazim + Mancozeb	0.2 %	12.04	17.33	22.81
Overal mean	-	10.71	17.02	21.98
F-test	-	s	s	s
S. Ed. (+)	-	1.398	2.157	2.670
C.D. (P = 0.05)	-	2.963	4.572	5.660

Table-2 : Numbers of pods/plant at different days interval affected by different treatments.

Treatments	Numbers of pods/plant		
	One day before spray	After spray	
		10 days	20 days
T_0-Control	5.33	8.50	9.60
T_1-Propiconazole	9.00	13.67	14.47
T_2-Tebuconazole	8.33	12.67	13.87
T_3-Difenoconazole	8.73	13.33	14.27
T_4-Azoxystrobin	8.13	13.00	14.07
T_5-Chlorothalonil	8.00	12.33	13.60
T_6-Carbendazim + Mancozeb	7.67	11.93	13.04
Overal mean	7.88	12.20	13.33
F-test	s	s	s
S. Ed. (+)	0.117	0.123	0.078
C.D. (P = 0.05)	0.249	0.262	0.166

Table-3 : Length of pod (cm) at different day's interval as affected by different treatments.

Treatments	Length of pod (cm)		
	One day before spray	After spray	
		10 days	20 days
T_0-Control	5.76	6.61	7.72
T_1-Propiconazole	6.12	8.28	9.68
T_2-Tebuconazole	5.95	7.58	9.20
T_3-Difenoconazole	6.02	8.11	9.49
T_4-Azoxystrobin	6.01	7.99	9.34
T_5-Chlorothalonil	5.93	7.43	8.98
T_6-Carbendazim + Mancozeb	5.84	7.32	8.77
Overal mean	5.94	7.62	9.03
F-test	s	s	s
S. Ed. (+)	0.067	0.224	0.276
C.D. (P = 0.05)	0.142	0.474	0.585

all the treatments were significantly effective over control. Among all the treatments the maximum length of pod was recorded in T_1-propiconazole (8.28 cm), followed by T_3-difenoconazole (8.11 cm), further T4-azoxystrobin (7.99 cm), respectively. The minimum length of pod was recorded in T_0-control (6.61 cm). The data on length of pod at 20 days after spray is furnished in table 3. The data showed that all the treatments were significantly effective over control. Among all the treatments the maximum length of pod was recorded in T_2-propiconazole (9.68 cm), followed by T_3-difenoconazole (9.49 cm), further T4-azoxystrobin (9.34 cm), respectively. The minimum length of pod was recorded in T_0- control (7.72 cm). Alam *et al.,* (2007) also find similar results considering yield

Table-4 : Seed yield (q/ha) of field pea as affected by different treatments.

Treatments	Seed yield (q/ha)
T_0-Control	13.75
T_1-Propiconazole	19.61
T_2-Tebuconazole	18.98
T_3-Difenoconazole	19.40
T_4-Azoxystrobin	19.18
T_5-Chlorothalonil	18.95
T_6-Carbendazim + Mancozeb	18.90
Overal Mean	18.40
F-test	S
S. Ed. (+)	0.141
C.D. (P = 0.05)	0.300

contributing characters (number of pods/plant, length of pod and seed/pod) propiconazole performed better than other fungicides.

The data on seed yield of garden pea are furnished in table-4. The data showed that all the treatments were significantly effective over control. Among all the treatments the maximum seed yield was recorded in T_2-treatment with propiconazole (19.60 q/ha), followed by T3- difenoconaole (19.40 q/ha), further T4- azoxystrobin (19.18 q/ha), respectively. The minimum yield was recorded in T0- control (13.75 q/ha). Results showed that the highest seed yield was recorded with spray of propiconazole. These results are in agreement with earlier workers (8,9,12).

Conclusions

From present study, it was concluded that two foliar application of Propiconazole @ 0.1 %, at the interval of 10 days from the first appearance of disease symptoms was found as best treatment to control for rust disease of garden pea. This also concluded that Propiconazole also increased the seed yield and yield attributing characteristics like number of pods/plant, length of pod, number of seeds/pd and seed yield. So, application of fungicides is an important tool for the management of rust disease of pea.

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