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### Evaluation of selected fungicides against powdery mildew (*Erysiphe polygoni* DC.) and rust (*Uromyces fabae* de Bary) diseases on field pea (*Pisum sativum* L.)

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#### Abstract

An experiment entitled, "Evaluation of selected fungicides against powdery mildew (*Erysiphe polygoni* DC.) and rust (*Uromyces fabae* de Bary) diseases on field pea (*Pisum sativum* L.)" was conducted in the experimental field of department of plant pathology, Sam Higginbottom institute of Agriculture, Technology & Sciences, Allahabad during Rabi season of 2013-14 Seven treatments including control with three replications were taken up using RBD. Treatments of foliar spray of hexaconazole (contaf 5 % EC), propiconazole (tilt 25 % EC), dinocap (Karathane 48 % EC), mancozeb (indofil M-45 % WP), carbendazim (bavistin 50 % WP), wettable sulphur (sulfex 80 % WP) and control (spray of plain water) were applied at the onset of disease symptoms at 84 DAS. Observations were recorded at 7 and 14 days after spray. Propiconazole @ 0.1 % was found to be the best fungicide which gave good controlled against powdery mildew and rust diseases of field pea (*Pisum sativum* L.), followed by carbendazim as compared to control which recorded maximum disease intensity.

**Keywords:** *Erysiphe polygoni*, field pea, fungicides, management, *Uromyces fabae*

#### Introduction

Pea (*Pisum sativum* L.), is a valuable vegetable as well as pulse crop all over the world. It belongs to the family Leguminosae, self-pollinated crop (Anonymous, 2005) [2]. The field pea is believed to be native to the Mediterranean region of southern Europe and western Asia comprising Italy and south western Asia and India. Later, its cultivation was taken up by many countries like Poland, France, Netherland, Japan, Spain, Pakistan, Myanmar etc. In India, it is cultivated mainly in Up, Mp, Bihar, Punjab, Haryana, Delhi, etc. (Singh and Singh, 2005) [11]. Utter Pradesh alone produces about 60% of total pea produced in India. Besides, Uttar Pradesh Madhya Pradesh and Bihar are the major field pea producing states (Singh *et al.*, 2005) [10]. The productivity of pea in Uttar Pradesh about 14.94 q / ha during the Rabi season 2012-13 (Department of Agriculture, Government of Uttar Pradesh). Pea contains low amount of fat, low sodium, it is cholesterol free, has several minerals including iron, calcium, potassium and phosphorus. Mature seed contains (g/100 g weight food) 10.9 g water, 22.9 g protein, 1.4 g fat, 60.7 g carbohydrates, 1.4 g fibers and 2.7 g ash. The pea has great agronomic value. In crop rotation, it helps improvement of soil fertility and yield of succeeding crops (Rana and Sharma, 1993) [9]. The increasing important of *Uromyces pisi* as the major causal agent of pea rust is becoming evident only recently (Emeran *et al.*, 2005 and Barilli *et al.*, 2009) [5, 4]. It is worldwide distributed pathogen of pea and also reported from faba bean (*Vicia faba* L.), lentil (*Lens culinaris* Medic.) and sweet pea (*Lathyrus sativus* L.), (Emeran *et al.*, 2008 Shroff and chand, 2010) [5]. Considering the high potential of pea in Europe, India, Australia and Mediterranean conditions, emphasize the need of resistance to solve rust problem (Emeran *et al.*, 2005) [5]. Pea rust is an important disease in Utter Pradesh, Uttarakhand and its surrounding areas, resulting adverse effect on grain yield (Singh, 2005) [10]. The fungus *Uromyces fabae* de Bary is an autoecious, urediospores and teliospores on the surface of host plant and completes its life cycle on the same host. In India under field condition, urediospores in the month of March due to the higher temperature. It is assumed to teliospores overwinter in the soil or in association with their alternate host debris (Singh, 2005) [10].

Germination of teliospores takes place between 17-22 °C temperature and at the start of next season producing basidiospores which initiated new infection cycle (Joshi and Tripathi, 2012)<sup>[7]</sup>.

### Materials and Methods

The experiments were carried out during *Rabi* season of 2013-14 at Department of plant Pathology, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad (Deemed-to-be University). The site selected was uniform, cultivable with typical sandy loam soil having good drainage. Allahabad is situated at 25.57 N Latitude and 81.5 E Longitude and at an altitude of 98 m above sea level. Allahabad region has sub tropical and semi arid climate with the monsoon commencing from July and with drawing by the end of September. Experimental plots were laid out as per statistical design. Total area was divided into 21 plots. The seed of pea were sown @ 25-30 kg / ha by dibbling method with spacing of 30 cm between row to row and 10 cm between plant to plant by placing 2 seeds per hill at depth of 4 cm.

### Disease intensity

The disease severity of powdery mildew and rust diseases of field pea was recorded before spraying at seven days interval and finally after 2 sprays using 0-5 scale (Anonymous, 2010)<sup>[3]</sup> we calculate the per cent disease index (PDI) by using following formula:

$$\text{Per cent disease intensity} = \frac{\text{Sum of all disease rating}}{\text{Total number of leaves} \times \text{maximum grade}} \times 100$$

(Wheeler, 1969)

### Results and Discussion

#### 1. Per cent disease intensity of powdery mildew (*Erysiphe polygoni* DC.) and rust (*Uromyces fabae* de Bary) diseases of field pea at different days interval as affected by different treatments.

**1.1 Per cent disease intensity at one day after spray:** The data on per cent disease intensity of powdery mildew and rust of field pea at one day before spray is furnished in table.

#### 1.2 Per cent disease intensity at seven days after spray:

The data on per cent disease intensity of powdery mildew and rust of field pea at 7 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 T2- propiconazole (11.40%), followed by T5-carbendazim (14.66%), T1-hexaconazole (15.38%), T3- dinocap (15.77%), T6- wettable sulphur (15.85%), T4- mancozeb (17.33%). The maximum per cent disease intensity was recorded in T0- (28.74%). All The treatments were significant over control. Among the treatments non significant results were found among (T1, T2, T3, T5, T6) and (T4, T6).

#### 1.3 Per cent disease intensity at fourteen days after spray:

The data on per cent disease intensity of powdery mildew and rust of field pea at 14days 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 T<sub>2</sub> - propiconazole (14.96), followed by T<sub>5</sub>-carbendazim (16.09), T<sub>1</sub>- hexaconazole (18.14) T<sub>3</sub>- dinocap (20.44), T<sub>6</sub>- wettable sulphur (21.55), T<sub>4</sub> mancozeb (22.81). The maximum per cent disease intensity was recorded in T<sub>0</sub>- Control (39.85).

All the treatment were significant over control, Among the treatment non significant results found among (T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> T<sub>4</sub>) and (T<sub>3</sub>, T<sub>4</sub>, T<sub>6</sub>).

The probable reason for such finding may be that, propiconazole fungicide may have interfered with the biosynthesis of fungal sterols and inhibited ergo sterol biosynthesis.

Ergo sterol is essential for the structure of cell wall and its absence causes irreparable damage to the cell wall and fungus dies. It may have also interfered in conidia and haustoria formation. It may have changed the sterol content and saturation of the polar fatty acids leading to alterations in membrane fluidity and behaviour of membrane bound enzymes (Akhileshwari *et al.*, 2012)<sup>[1]</sup>. Several workers have reported that, propiconazole was found to be effective in reducing powdery mildew and rust incidence [Khunti *et al.*, (2002)<sup>[8]</sup>, Singh (2006), Parasad and Dwivedi, (2007)]. Amongst the treatments spray of wettable sulphur and mancozeb were found to be less effective.

**Table 1:** Per cent disease intensity of powdery mildew (*Erysiphe polygoni* DC.) and rust (*Uromyces fabae* de Bary) diseases of field pea at different days interval as affected by different treatments.

Treatments	Concentration (%)	Per cent of disease index (PDI)		
		One day before spray	After spray	
			7 days	14 days
T <sub>0</sub> - Control	-	15.26	28.74	39.85
T1- Hexaconazole	0.2 %	8.47	15.38	18.14
T2- Propiconazole	0.1%	7.54	11.40	14.96
T3- Dinocap	0.1%	10.29	15.77	20.44
T4- Mancozeb	0.25%	12.04	17.33	22.81
T5- Carbendazim	0.1%	10.11	14.66	16.09
T6- Wettable sulphur	0.3%	11.25	15.85	21.55
Overall 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

## 2. Number of pea pods / plant at different days' interval as affected by different treatments

### 2.1 Number of pea pods / plant at one day before spray:

The data on number of pea pods at one before spray is furnished in table 2.

### 2.2 Number of pea pods/ plant at seven days after spray:

The data on number of pea pods at 7 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 number of pea pods were recorded in T<sub>2</sub>- treatment with propiconazole (13.67), followed by T<sub>5</sub>-carbendazim (13.33), T<sub>1</sub>- hexaconazole (13.00), T<sub>3</sub>- dinocap (12.67), T<sub>6</sub>- wettable sulphur (12.33), T<sub>4</sub>- mancozeb (11.93). The minimum number of pea pods were recorded in T<sub>0</sub>-control (8.50).

### 2.3 Number of pea pods / plant at fourteen days after spray:

The data on number of pea pods at 14 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 treatments the maximum number of pea pods were recorded in T<sub>2</sub>- treatment with propiconazole (14.47), followed by T<sub>5</sub>- carbendazim (14.27), T<sub>1</sub>- hexaconazole (14.07), T<sub>3</sub>- dinocap (13.87), T<sub>6</sub>- Wettable sulphur (13.60), T<sub>4</sub>- mancozeb (13.40). The minimum number of pea pods were recorded in T<sub>0</sub>- control (9.60).

**Table 2:** Number of pea pods / plant at different days interval affected by different treatments.

Treatments	Number of pea pods / plant		
	One day before spray	After spray	
		7 days	14 days
T <sub>0</sub> - Control	5.33	8.50	9.60
T <sub>1</sub> - Hexaconazole	8.13	13.00	14.07
T <sub>2</sub> - Propiconazole	9.00	13.67	14.47
T <sub>3</sub> - Dinocap	8.33	12.67	13.87
T <sub>4</sub> - Mancozeb	7.67	11.93	13.04
T <sub>5</sub> - Carbendazim	8.73	13.33	14.27
T <sub>6</sub> - Wettable sulphur	8.00	12.33	13.60
Overall 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

## 3. Length of pea pod (cm.) at different day's interval as affected by different treatments

### 3.1: Length of pea pod (cm.) at one day before spray

The data on length of pea pod at one day before spray is furnished in table 3.

### 3.2 Length of pea pod (cm.) at seven days after spray:

The data on length of pea pod at 7 days after spray is furnished in table 3. The data showed that all the treatment were significantly effective over control. Among all the treatment the maximum length of pea pod was recorded in T<sub>2</sub>- hexaconazole (7.99), T<sub>3</sub>- dinocap (7.58), T<sub>6</sub>- wettable sulphur (7.43) T<sub>4</sub>- mancozeb (7.32). The minimum length of pea pod was recorded in T<sub>0</sub>-control (6.61).

### 3.3 Length of pea pod (cm.) at fourteen days after spray:

The data on length of pea pod at 14 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 pea pod was recorded in T<sub>2</sub>- treatment with propiconazole (9.68) followed by T<sub>5</sub>- carbendazim (9.49), T<sub>1</sub>- hexaconazole (9.34), T<sub>3</sub>- dinocap (9.20), T<sub>6</sub>- Wettable sulphur (8.98), T<sub>4</sub>- mancozeb (8.77). The minimum length of pea pod was recorded in T<sub>0</sub>- control (7.72).

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

Treatments	Length of pea pod / plant		
	One day before spray	After spray	
		7 days	14 days
T <sub>0</sub> - Control	5.76	6.61	7.72
T <sub>1</sub> - Hexaconazole	6.01	7.99	9.34
T <sub>2</sub> - Propiconazole	6.12	8.28	9.68
T <sub>3</sub> - Dinocap	5.95	7.58	9.20
T <sub>4</sub> - Mancozeb	5.84	7.32	8.77
T <sub>5</sub> - Carbendazim	6.02	8.11	9.49
T <sub>6</sub> - Wettable sulphur	5.93	7.43	8.98
Overall 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

## Conclusion

Maximum number of pea pods / plant were recorded in propiconazole at 7 days and 14 days after the spray (13.67 and 14.47, respectively), followed by carbendazim (13.33 and 14.27, respectively), hexaconazole (13.00 and 14.07, respectively), dinocap (12.67 and 13.87, respectively), wettable sulphur (12.33 and 13.60, respectively), mancozeb (11.93 and 13.40, respectively) as compared control were reordered minimum number of pea pods / plant (28.73 and 39.85, respectively). Maximum length of pea pod (cm.) was recorded in propiconazole at 7 days and 14 days after the spray (8.28 and 9.68, respectively), followed by carbendazim (8.11 and 9.49, respectively), hexaconazole (7.99 and 9.34, respectively), dinocap (7.58 and 9.20, respectively), wettable sulphur (7.43 and 8.98, respectively), mancozeb (7.32 and 8.77, respectively) as compared control was reordered minimum length of pea pod (6.61 and 7.72, respectively). Maximum grain yield (q / ha) was recorded in propiconazole (19.60 q / ha), followed by carbendazim (19.40 q / ha), hexaconazole (19.18 q / ha), dinocap (18.98 q / ha), wettable sulphur (18.95 q / ha), mancozeb (18.90 q / ha) as compared control was recorded minimum yield (13.75 q / ha) and the highest cost benefit ratio was recorded in propiconazole (1:1.99), followed by carbendazim (1:1.87), hexaconazole (1:1.94), mancozeb (1:1.92), dinocap (1:1.87) as compared control was recorded lowest cost benefit ratio (1:1.48).

Use of propiconazole @ 0.1 % and carbendazim @ 0.1 % are effective for the management of powdery mildew and rust diseases of field pea (*Pisum sativum* L.). These fungicides also promote growth of plant by preventing disease and can be taken up for disease management of powdery mildew and rust of field pea caused by *Erysiphe polygoni* and *Uromyces fabae*, respectively. The results of present experiment are limited to one season under Allahabad agro climatic conditions as such more trials should be carried out in future to validate the findings.

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