

***In vivo* Evaluation of Fungicides against Chickpea Rust Caused by [*Uromyces ciceris-arietini* (Grognot) Jacz. and Boy]**

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Abstract A field experiment was planned and executed during *rabi* 2014-15. Three systemic, three non systemic and two combi fungicides were evaluated for their efficacy against chickpea rust under natural epiphytotic conditions. Among the eight fungicides tested, the least PDI was observed in Propiconazole (25.84 PDI) followed by Hexaconazole (27.16 PDI) and Difenconazole (29.58 PDI). Highest PDI was observed in control (54.48 PDI). Therefore, Propiconazole, Hexaconazole and Difenconazole can be used for the effective control of chickpea rust at 0.1%. Maximum grain yield was recorded in Propiconazole (12.22 q/ha) followed by Difenconazole (11.33 q/ha) and Hexaconazole (11.11 q/ha). Least yield was recorded in control (9.11 q/

ha). In the present investigation highest benefit cost ratio was observed in Propiconazole (2.11) followed by Difenconazole (1.90) and Hexaconazole (1.88).

Keywords Benifit : Cost ratio, Chickpea rust, Disease severity, Fungicides, Percent Disease Index.

Introduction

Chickpea (*Cicer arietinum* L.), also known as gram or Bengal gram, is the third most important pulse crop after bean (*Phaseolus vulgaris* L.) and pea (*Pisum sativum* L.) on world basis, but is of prime importance in the Mediterranean basin and South Asia. The crop is vulnerable to a number of air-borne and soil-borne diseases, some of which are devastating. Chickpea suffers from 172 pathogens consisting of fungi, bacteria, viruses and nematodes. The foliar diseases, which may severely damage the chickpea under favorable conditions are blight caused by *Ascochyta rabiei*, grey mould caused by *Botrytis cinerea* and rust caused by *Uromyces ciceris-arietini*. In the present study new fungicides were tested under field condition, to know relative efficacy against the management of rust disease.

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Materials and Methods

Field experiment was conducted during *rabi* 2014-15, in order to find out the suitable fungicide in controlling the disease and to estimate the disease severity and losses due to the rust disease on chickpea. Treatments were imposed on first week of January immediately after the appearance of the disease. The details of the experiment are presented below.

Field experiment was laid out in farmer's field at Narendra (District/Taluka-Dharwad) with a plot size of 5 × 3 m and susceptible variety Bheema was used for the study, all the package of practices were followed except disease management. Nine treatments were replicated thrice following completely randomized block design and the crop was sown during first week of November. Treatments were imposed during first week of January immediately after appearance of the disease.

Percent disease index (PDI)

Observations were recorded on rust severity at weekly interval starting from first appearance of the disease by using 0-9 scale. Later the per cent disease index was calculated and data was subjected to statistical analysis.

Rating value	Description
0	No symptoms on leaves.
1	Uredosori covering 1% or less of leaf area.
3	1-10% of the leaf area covered with brown powdery uredosori.
5	Uredosori covering 11-25% for leaf area.
7	Uredosori covering 26-50% of leaf area.
9	Uredosori covering 51% or more of leaf area.

Percent Disease Index (PDI) was calculated by using the following formula.

$$\text{PDI} = \frac{\text{Sum of individual disease rating}}{\text{Total No. of plants observed} \times \text{Maximum disease rating}} \times 100$$

Seed yield

Seed yield per plot was recorded by harvesting each

treatment separately. Further seed yield per plot was converted to seed yield q/ha.

B : C ratio

The economic return in the form of net income, benefit cost ratio was also worked out, taking into account actual cost of cultivation and fungicidal cost including labor charges for spraying.

Results and Discussion

A field experiment was conducted during *rabi*, 2014-15 to evaluate the efficacy of eight fungicides with a control against chickpea rust as explained in material and methods. Disease severity was recorded by following 0-9 scale and Per cent Disease index (PDI) was calculated along with seed yield per plot, yield per ha and B : C ratio.

Disease severity (PDI)

The treatment was imposed at 55 DAS, when the rust started appearing. Thereafter disease severity was recorded at 10 days interval starting from 10 days after spray i.e. on 65th day after sowing (Table 1). The least disease severity was recorded in Propiconazole 25% EC (20.49 PDI) followed by Difenconazole 25% EC (23.49 PDI) and Hexaconazole 5% EC (PDI 23.95). The highest disease severity was recorded in water sprayed control (37.65 PDI).

After 75 DAS, the least PDI was observed in Propiconazole 25% EC (21.64 PDI), followed by Difenconazole 25% EC (24.44 PDI) and Hexaconazole 4% + Zineb 68% WP (25.96 PDI) and Hexaconazole (26.33 PDI). Highest PDI was observed in control (41.06 PDI), followed by Carbendazim 12% + Mancozeb 63% WP (37.53 PDI) and sulfur 80%WP (30.86 PDI).

At 85 DAS, least PDI was observed in Propiconazole 25% EC (25.84 PDI) followed by Hexaconazole 5% EC (27.16 PDI) and Difenconazole 25% EC (29.58 PDI). While highest PDI was observed in control (54.48 PDI). Therefore, Propiconazole, Hexaconazole and Difenconazole

Table 1. *In vivo* evaluation of fungicides against chickpea rust. * Arc sine value.

Treat- ments	Fungicides	Conc. (%)	PDI (DAS)			Test weight (g)	Yield (q/ha)	B : C ratio
			65	75	85			
T ₁	Hexaconazole	0.1	23.95 (29.22)*	26.33 (30.77)	27.16 (30.35)	27.16	11.11	1.88
T ₂	Propiconazole	0.1	20.49 (26.46)	21.64 (27.48)	25.84 (30.44)	29.33	12.22	2.11
T ₃	Mancozeb	0.25	24.81 (29.50)	26.79 (30.85)	34.81 (36.13)	25.33	10.11	1.58
T ₄	Hexaconazole + Zineb	0.2	24.65 (28.11)	25.96 (30.19)	32.09 (34.13)	25.10	10.89	1.76
T ₅	Chlorothalonil	0.2	25.84 (28.91)	29.71 (32.86)	34.56 (35.98)	25.16	10.11	1.33
T ₆	Difenconazole	0.1	23.49 (27.45)	24.44 (29.15)	29.58 (32.91)	28.33	11.33	1.90
T ₇	Carbendazim + Mancozeb	0.2	34.40 (35.86)	37.53 (37.55)	37.69 (37.84)	25.00	10.00	1.54
T ₈	Sulfur	0.3	29.46 (32.68)	30.86 (33.49)	32.38 (33.15)	25.33	9.11	1.35
T ₉	Control	—	37.65 (36.55)	41.06 (39.75)	54.48 (47.67)	24.16	8.44	1.22
Mean			27.19 (31.42)	29.37 (32.80)	34.29 (35.83)	25.79 (30.51)	10.37 (18.77)	
SEm±			1.59	1.71	1.99	0.32	0.38	
CD at 5%			4.79	5.14	5.99	0.97	1.14	

can be used for the effective management of chickpea rust. These results are in agreement with the reports of Khedekar [1].

Propiconazole, Hexaconazole and Difenconazole belong to triazoles group. These fungicides interfere with the biosynthesis of fungal sterols and inhibit ergosterol biosynthesis. Ergosterol is essential to the structure of cell wall and its absence causes irreparable damage to the cell wall and then fungus dies. These change in sterol content and saturation of the polar fatty acids leading to alterations in membrane fluidity and behavior of membrane bound enzymes.

Yield

Yield of individual plot was recorded and converted to per hectare. Seed yield of chickpea in Propiconazole 25% EC treatment was on par with Difenconazole 25% EC and Hexaconazole 5% EC and were significantly superior over all other treatments.

Maximum yield was recorded in Propiconazole (12.22 q/ha), followed by Difenconazole (11.33 q/ha) and Hexaconazole (11.11 q/ha). Least yield was recorded in control (9.11 q/ha), while the remaining treatments were at par with each other. These results are in agreement with the reports of Hemachandra [2], who reported that four sprays of Propiconazole (0.1%) at seven days interval resulted lowest disease severity (20.5%) of pea rust caused by *U. fabae* with highest grain yield (1037.50 kg/ha) followed by Hexaconazole (0.1%).

Maximum test weight (29.33 g) was recorded in Propiconazole followed by Difenconazole (28.33 g) and Hexaconazole (27.16 g). Least test weight was recorded in control (24.16g).

B : C ratio

In the present investigation highest benefit cost ratio was observed in Propiconazole (2.11) followed by Difenconazole (1.90) and Hexaconazole (1.88). Lowest benefit was obtained from unsprayed treat-

ment (1.22). The results are supported by the work of Ashwani et al. [3].

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