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RESEARCH ARTICLE :

Effect of seed treatment and foliar spray of bioagents and fungicides on the disease severity of Ascochyta blight of chickpea incited by *Ascochyta rabiei*

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SUMMARY : Ascochyta blight (*Ascochyta rabiei*) of chickpea (*Cicer arietinum L.*) is an economically important disease transmitted through the seed and stubble. The experiment was conducted during *Rabi* season of 2015-2016 in Tarai region of Uttarakhand to determine the efficacy of combined action of seed treatment along with foliar spray in preventing the disease. Seed treatment with carbendazim+thiram (1:2) and 3 foliar sprays of pyraclostrobin + metiram was found the best among all in terms of reducing the maximum disease severity of Ascochyta blight to 82.63 per cent. Least per cent disease control over the check was recorded in seed treatment with *T. harzianum* + *P. flourescens* and 3 sprays of chlorothalonil (65.29%).

KEY WORDS :
Field trial, Cicer arietinum, Fungicides, Bioagents, Disease severity

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BACKGROUND AND OBJECTIVES

Chickpea (*Cicer arietinum* L.) belongs to family leguminaceae, commonly known as 'gram' or 'Bengal gram' or çhana' occupies a position of pride among the leguminous crops owing to its great importance both as vegetable and as pulse. In a country like, India where most of the population is primarily vegetarian chickpea has a special place in the daily diet of people due to its high protein content and manifold uses. They are rich source of protein and form an important part of vegetarian diet containing about 18-24% of protein, 38-59% carbohydrate, 3% fiber, 4.8-5.5% oil, 3% ash, 0.2% calcium, and 0.3% phosphorus. (Hulse, 1991).

In spite of the evolution of improved varieties and adoption of recommended package of practices, the average production of this crop is very low in India in comparison to many other countries of the world. Among the various factors, responsible for lowering down its yield, the disease especially those cause by fungi, are considered to be the major ones. The fungus, *Ascochyta rabiei*, is the causal agent of chickpea blight and is the major biotic constraint limiting chickpea production in Northern Indian condition (Nene,

2012). Severe attacks may result in total loss of the crop (Reddy and Singh 1990; Singh *et al.*, 1981; Singh and Reddy 1990; Solh *et al.*, 1994) and, in some years, the disease has even affected international trade (Dusunceli *et al.*, 2007). Pande *et al.* (2005) recently reviewed the biology and management options of Ascochyta blight of chickpea.

It is an important foliar disease of chickpea problematic in areas where cool (15-25ºC) and humid weather (>150 mm rainfall) prevails during the crop season (Pande *et al*., 2005). In India, Ascochyta blight is largely distributed in the Indo-Gangetic Plain and known to occur widely in North Western Plain Zone covering Jammu, Punjab, Haryana, Western UP and North West Rajasthan and causing a yield loss of about 50-90 per cent (Grewal and Pal, 1986). Ascochyta blight of chickpea is the main reason behind yield instability of chickpea particularly in Northern Indian condition.

Disease management is an integral component of overall integrated crop management practices. Use of fungicides, botanicals and bioagents has been found effective in managing the foliar diseases of chickpea. Various systemic and non systemic fungicides, different plant extracts and different bioagents have been tested against *Ascochyta rabiei* (Pass.) Labr. for controlling the Ascochyta blight disease and minimizing the crop losses. Various workers have tested several fungicides, botanicals and bioagents over a period of time and have been found effective at different concentration at different places (Demirci *et al.*, 2003; Shtienberg *et al.*, 2006; Jabeen and Javaid, 2010, Benzhora *et al.*, 2011). Inspite of many limitations of pesticides, chemicals still play a dominating role in pest management programme. Search for newer and safer chemicals, their combinations and alternative is a continuous process. One aim of the current work was therefore, to determine the effect of

Table A : Seed dressing fungicides and bioagents used for testing against Ascochyta blight of chickpea under field conditions

Sr. No.	Treatments (Foliar spray + Seed treatment)
1.	Tebuconazole+Flupyram (seed treament with Thiram + Carbendazim (2:1) @ 3g/kg seed)
2.	Tebuconazole+Flupyram (seed treament with *Trichoderma harzianum* PBAT-21 + *Pseudomonas fluoresens* PBAP-27 @ 10g/kg seed)
3.	Chlorothalonil (seed treament with Thiram + Carbendazim (2:1) @ 3g/kg seed)
4.	Chlorothalonil (seed treament with *Trichoderma harzianum* PBAT-21 + *Pseudomonas fluoresens* PBAP-27 @ 10g/kg seed)
5.	Carbendazim (seed treament with Thiram + Carbendazim (2:1) @ 3g/kg seed)
6.	Carbendazim (seed treament with *Trichoderma harzianum* PBAT-21 + *Pseudomonas fluoresens* PBAP-27 @ 10g/kg seed)
7.	Pyraclostrobin+Metiram (seed treament with Thiram + Carbendazim (2:1) @ 3g/kg seed)
8.	Pyraclostrobin+Metiram (seed treament with *Trichoderma harzianum* PBAT-21 + *Pseudomonas fluoresens* PBAP-27 @ 10g/kg seed)
9.	Control

Table B: The description of the rating scale used in the present study

Rating	Description	Reaction
1	No infection on any part of the plant.	Asymptomatic (A)
2	Minute lesions on lower leaves, flower and pods covered under dense canopy, usually not visible.	Resistant (R)
3	Lesions on less than 5% of the leaves, flowers and pods covered and dense plant canopy.	
4	Lesions and some fungal growth (conidiospores and conidia) can be seen on up to 15% of the leaves, flowers and pods and branches covered under dense plant canopy.	Moderately Resistant (MR)
5	Lesions and slight fungal growth on up to 25% of the leaves, flowers, pods, stems and branches covered under dense plant canopy.	
6	Lesions and fungal growth on up to 40% of the leaves, flowers, pods, stems branches and defoliation, 25% of the plants killed.	Susceptible (S)
7	Large lesions and good fungal growth on up to 60% of the leaves, flowers, pods, stems branches, defoliation common, drying of branches and 50% of the plants killed.	
8	Large Lesions and profuse fungal growth on up to 80% of the leaves, flowers, pods, stems, branches, defoliation, drying of branches and 75% of the plants killed.	Highly susceptible (HS)
9	Large lesions and very profuse fungal growth on up to 100% of the flowers, pods, stems branches, almost complete defoliation, drying of plants and 100% of the plants killed.	

combined action of seed treatment along with foliar spray in preventing the disease.

RESOURCES AND METHODS

The Present investigations were carried out at Department of Plant Pathology, G.B. Pant University of Agriculture and Technology, Pantnagar. Field trial was carried out at N.E. Borlaug Crop Research Centre (NEBCRC) for *Rabi* season 2015-16. Topographically, Pantnagar falls in the humid-subtropical climate of North West Plain Zone (NWPZ) commonly known as *Tarai* at the foothills of lower Himalayas-Shivalik range. It is situated at 29^0 N latitude and 79.73^0E longitude, at an altitude of 243.8 metre above the mean sea level (MSL).

The experiment was conducted during *Rabi* season 2015-2016 in a Randomized Block Design (RBD) with three replications. The size of each plot was 4.0 x 2.0 m^2 with a row to row spacing of 30 cm and plant to plant 10 cm. A highly susceptible variety, H 208 was used in the present study. A control plot is also maintained without any seed treatment. All the plots were screened under natural disease occurrence condition. A uniform fertilizer dose (N_{20} P_{40} K_{50} Kg/ha) was applied in each plot. Indoxacarb 0.0075 per cent in 750 L of water per hectare was sprayed twice on the crop at fifteen days interval to prevent crop damage from gram pod borer and other foliage insects. The selected bioagents and seed protectant fungicides (Table A) are used for seed treatment before sowing followed by spraying with different fungicides with first appearance of disease. Then observation was taken on per cent disease index after spraying of fungicides at seven days interval by using 1-9 rating scale.

Disease evaluation :

Plants selected for disease assessment were the 10 at the centre of the second and third rows (5 from each row) of each of the sub-plots. Disease severity on vegetative parts of the plants was assessed at 7 day intervals after detection of the first symptoms, using a 1-9 scale given by Pandey *et al.*, 2009 (Table B). Where 1 denotes no disease and 9 denotes a dead plant. But in ambiguous cases it was sometimes necessary to use the % of broken branches as an additional criterion.

Per cent disease index (PDI) was calculated by using following formula described by McKiney (1923).

$$PDI = \frac{\text{Sum of all disease rating}}{\text{Total number of plants observed} \times \text{maximum rating value}} \times 100$$

The data obtained in the field experiments were analyzed statistically by Factorial Randomized Block Design (FRBD) using STPR programme (GBPUA&T statistical software), and MS Excel. Data recorded were compared by the means of critical differences at five per cent level of significance in field condition.

OBSERVATIONS AND ANALYSIS

The result presented in Table 1 and Fig. 1 indicates the effect of seed treatment and foliar spray of bioagents and botanicals on the disease severity that showed marked differences in disease severity percentage.

Table 1: Effect of seed treatment and foliar spray of bioagents and botanicals on the disease severity of Ascochyta blight of chickpea

Treatments	Per cent disease index (PDI)			Per cent Disease Control over check*
	1	2	3	
Seed treatment with carbendazim+thiram (1:2) and 3 sprays of Tebuconazole + Flupyram	42.97	33.08	23.16	70.39
Seed treatment with *Trichoderma harzianum* + *Pseudomonas fluroscens* and 3 sprays of Tebuconazole + Flupyram	36.30	27.95	19.57	74.98
Seed treatment with carbendazim+thiram (1:2) and 3 sprays of Chlorothalonil	34.08	26.24	18.37	76.51
Seed treatment with *T. harzianum* + *P. fluroscens* and 3 sprays of sprays of Chlorothalonil	50.38	38.79	27.15	65.29
Seed treatment with carbendazim+thiram (1:2) and 3 sprays of Carbendazim	25.93	19.97	13.98	82.12
Seed treatment with *T. harzianum* + *P. fluroscens* and 3 sprays of Carbendazim	27.41	21.11	14.78	81.10
Seed treatment with carbendazim+thiram and 3 sprays of Pyraclostrobin + Metiram	25.19	19.39	13.58	82.63
Seed treatment with *T. harzianum* + *P.fluroscens* and 3 sprays of Pyraclostrobin + Metiram	28.89	22.25	15.57	80.09
Control	57.78	65.21	78.22	
C.D. (P=0.05)	4.83	2.79	8.37	
CV	16.68			

(*Per cent Disease Control (PDC) on terminal PDI taken at 7 Days after 3rd Spray, 1 Seven days after 1st spray (7DAIS), 2 Seven days after 2nd spray (7DAIIS), 3 Seven days after 3rd spray (7DAIIIS))

The perusal of data given in (Table 1, Fig. 1), it was observed that all treatment combinations were significantly superior in reducing the severity of the disease over the check. Among the treatments, seed treatment with carbendazim + thiram and 3 sprays of pyraclostrobin + metiram was found the best among all by reducing the maximum disease severity of Ascochyta blight to 82.63 per cent recorded at seven days after 3rd spray over the check followed by Seed treatment with carbendazim + thiram (1:2) and 3 sprays of carbendazim and Seed treatment with *T. harzianum* + *P. fluroscens* and 3 sprays of carbendazim with a per cent disease control of 82.12 and 81.10 per cent, respectively.

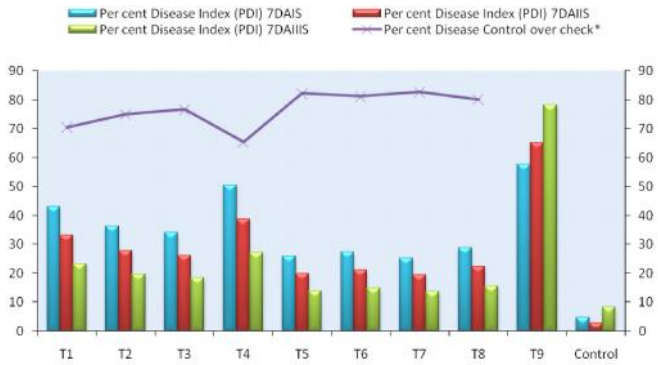

Fig. 1 : Effect of seed treatment and foliar spray of bioagents and botanicals on the disease severity of Ascochyta blight of chickpea

Whereas, least per cent disease control over the check was recorded in seed treatment with *T. harzianum* + *P. fluroscens* and 3 sprays chlorothalonil (65.29%) followed by seed treatment with carbendazim + thiram (1:2) along with foliar spray of Tebuconazole + Flupyram (70.39%), which were observed at seven days after 3rd spray. Considerable works on the use of combination of seed treatment and foliar sprays to control Ascochyta blight of chickpea have been done. Many workers found that integration of *Trichoderma sp*. with fungicides gave significantly higher disease control in several crops as were reported by (Mukhopadhyay, 1994; Vyas, 1994 and Dubey, 2000).

Simillarly, others reported that Benomyl, carbendazim, chlorothalonil, thiabendazole, thiram and mixtures of these were effective in reducing seed to seedling transmission in pulse crops (Kaiser *et al.*, 1973, 2000; Grewal, 1982; Ahmed and Beniwal, 1998; Kimber and Ramsey, 2001).

Summary and conclusion :

Based on the present study, it can be concluded that most of the fungicides and bioagents in combination have good control over Ascochyta blight disease of chickpea. However, Seed treatment with carbendazim + thiram and 3 sprays of Pyraclostrobin + Metiram at 15 days interval each has a greater effect on the disease severity showing highest per cent disease control (82.63%) over the check. Seed treatment with carbendazim + thiram (1:2) and 3 foliar sprays of pyraclostrobin + metiram was found the best among all in terms of reducing the maximum disease severity of Ascochyta blight to 82.63 per cent significantly superior from other treatments. Least per cent disease control over the check was recorded in seed treatment with *T. harzianum* + *P. flourescens* and 3 sprays of chlorothalonil (65.29%).

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