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CHEMICAL CONTROL OF GRAM BLIGHT

M. Bashir and M. B. Ilyas*

ABSTRACT

Foliar applications of fungicides varied in their effectiveness in reducing disease ratings, per cent pod infection and per cent gram seeds with symptom lesions of *Ascochyta rabiei*. Daconil, Benlate + Daconil and Captan were the most effective spray treatments in reducing disease ratings and per cent pod infection, while Daconil, Benlate + Daconil, Captan, Benlate + Dithane M – 45 and Dithane M – 45 alone were the most effective treatments which reduced seeds with lesions of *A. rabiei*. The most effective spray treatments which significantly increased yield of gram crop, in descending order, wereBenlate + Dithane M – 45, Benlate + Daconil, Captan, Daconil, Morestan, and Benlate + Karathane. Sprays of Brassicol and Karathane were phytotoxic; the phytotoxicity of the former resulted in significant decrease of gram yield.

INTRODUCTION

Gram (*Cicer arietinum* L.) ranks first among all the legume crops and is grown extensively over more than 900 thousand hectares with an average yield of 550 kg/ha (Haq *et al.*, 1981) as compared to 700 kg/ha in India (Singh and Auckland, 1975). Many factors contribute towards low production of gram in Pakistan. Among these, the most important limiting factor is the occurrence of potentially destructive blight disease caused by the fungus *Ascochyta rabiei* (Pass.) Lab. The disease appears in epiphytotic proportions in areas where rainfall or relative humidity or both are high during the growing seasons (Kaiser, 1972). The disease perpetuates from season to season either through infected gram seed or through infected plant parts lying in the field (Kaiser, 1972, Naid and Nirula, 1979). During the last two years the disease has caused a total failure of the crop in gram growing tracts of the country.

Although, the most ideal way of controlling this disease is through the use of resistant varieties, but the use of chemicals, though expensive than

* Department of Plant Pathology, University of Agriculture, Faisalabad.

genetic resistance, may also be resorted to as an appropriate alternative control measure (Kaiser 1973), until resistant varieties become available. The present studies aim at investigating the *in vitro* and *in vivo* effect of foliar application of various fungitoxicants for the control of gram blight.

MATERIALS AND METHODS

Greenhouse Evaluation of Foliar Spray of Fungicides

The seeds of cultivar C-727 were planted in each of 78 earthen pots (size 9'' × 12''), filled with sterilized field soil and placed in the greenhouse. After fourteen days of seedling emergence, thinning was done and five plants per pot were left. At mid-pod stage, the plants were sprayed with each of the test chemicals at the rate of one pound (a. i.) per 100 gallons of water : Benlate (Benomyl), Daconil (Chlorothalonil), Brassicol (PCNB), Captan (Orthocide), Dithane M – 45 (Mancozeb), Quinolate (Quinomethionate), Karathane (Dinocap) and Morestan (Oxythioquinox), alone and in combinations : Benlate + Daconil, Benlate + Brassicol, Benlate + Dithane M – 45 and Benlate + Karathane in *1:1 ratio*. Five fungicidal sprays were given, each at 7 days interval. Non-sprayed plants served as control. Each fungicidal spray was followed by a spray of spore suspension (18,000 – 20,000 spores/ml) of *Ascochyta rabiei*. All pots were placed under moist cloth nets to provide adequate humidity for spore germination and infection. Data regarding disease severity and 100-grain weight was recorded at plant maturity. Disease severity was measured using the following 0-5 grade scale of Morrall and Mckenzie (1974):

Where,

0 = Healthy; no lesions available on any plant in the plot.

1 = Trace; A few scattered lesions on the plants, usually found on the plants with careful searching.

2 = Slight; lesions commonly observed on plants, lack of defoliation and damage not great or in only one or two plants.

3 = Moderate; lesions very common and damaging.

4 = Severe; all plants in plots with extensive lesions, defoliation and dying branches but few, if any, plants totally killed.

5 = Dead; all plants or all but parts of a few plants killed completely.

Field Evaluation of Foliar Application of Fungicides

To evaluate the *in vivo* effectiveness of spray fungicides, one pound (a. i.) of each fungicide per acre per 100 gallons of water was used. A blight sus susceptible gram cultivar C-727 was planted in each sub-plot (6′ × 15′) with 1.5ft. row to row and a nine inches plant to plant distance. The experiment was conducted in randomized complete Block design with 2 ft. distance between replicates. The plants were sprayed five times with each of the 12 test fungicides with a hand sprayer at 7 days interval beginning at 120 day after planting. Spore suspension of *A. rabiei* (18,000 20,000 spores/ml) in tap water was also sprayed after 24 hours of each fungicidal spray. Disease severity rating was estimated 20 days after the last spray treatment, when the plants were reaching physiological maturity.

At maturity the pods from individual treatments were hand picked and were kept separated. A 400-pod sample from each treatment in each replication was evaluated for pod infection. All pods from each replication were hand threshed, weighed and compared with treatments for yield purposes. A sample of 400 seeds from seed lot of each treatment from each replication was drawn and was visually evaluated for per cent seeds with lesions of *A. rabiei* and compared with those from other treatments.

RESULTS AND DISCUSSION

The response of the test fungicides in reducing disease severtiy did not vary significantly both *in vitro* (Table 1) and *in vivo* evaluations (Table 2). Daconil, Benlate + Daconil and Captan were the most effective spray treatments in reducing disease rating both in greenhouse and field, whereas Benlate + Karathane, Morestan, Benlate + Dithane M – 45 and Benlate were intermediate in effectiveness both *in vitro* and *in vivo* evaluations. Dithane M – 45 and Benlate + Brassicol exhibited greater effectiveness in greenhouse test but in field evaluation these were intermediate in behaviour in reducing disease severity. This differential behaviour can be accounted for the differences in the environmental conditions of the greenhouse and the field. Brassicol and Quinolate were the least effective fungicides in reducing disease rating both in the greenhouse and field. Although Karathane and Brassicol exhibited phytotoxicity to the

foliage both in greenhouse and field, but it was more pronounced on the field plants. Karathane toxicity caused smalling and russetting of the foliage, while Brassicol caused yellowing of the leaves, which defoliated much earlier than those of the other treatments. Phytotoxicity of Karathane and Brassicol can be avoided by lowering the dosage rate of the spray. Ilyas and Bhatti (1982) reported no phytotoxicity when Brassicol was applied at the rate of 225 gm (a. i.) per acre, and this dosage was found to be the most effective for the control of gram blight. In present studies double dosage rate (450 gm (a. i.) per acre) resulted in phytotoxicity which weakened the plants and thus making the plants more prone to the attack of *A. rabiei*.

Table 1. *Greenhouse evaluation of spray of fungicides for plant dieases severity and 100-grain weight*

Treatments	Diseases severity rating	100-grain weight (gm)
Daconil	1.0 a*	16.3 dc*
Benlate	2.6 bc	14.3 bc
Brassicol	3.0 c	15.0 cd
Captan	1.4 ab	16.0 dc
Dithane M – 45	1.6 ab	14.3 bc
Quinolate	3.0 c	11.3 a
Karathane	2.6 bc	14.0 b
Morestan	2.0 b	14.6 bc
Benlate + Daconil	1.3 ab	16.7 e
Benlate + Brassicol	1.7 ab	15.6 de
Benlate + Dithane M – 45	2.4 b	15.3 de
Benlate + Karathane	2.0 b	16.3 de
Control	4.0 d	10.3 a

* Any two means not sharing same letter differ significantly at 5 per cent level of significance.

Since Quinolate spray was among the least effective fungicides in greenhouse, it had no effect on the increase of yield on 100-grain weight basis as compared to control (Table 1). The most effective treatments, however,

were Benlate + Daconil, Benlate + Karathane, Daconil, Captan, Benlate + Brassicol and Benlate + Dithane M-45, while the remaining were less effective treatments. The spray treatments prevented the gram plants from earlier or promature defoliation as well as from seed infestiation to some extent. Survival of the plants coupled with photosynthetic activity for much longer period on account of fungicide sprays resulted in better grain filling and increase in grain yield on 100-grain weight basis.

Fungicides also varied in their effectiveness in reducing pod infection and per cent seed with lesions of *A. rabiei* (Table 2). Benlate + Daconil, Daconil and Captan were the most effective spray treatments which significantly reduced pod infection, while Daconil, Benlate + Daconil, Captan, Benlate + Dithane M-45 and Dithane M-45 alone were the most effective treatments which reduced seeds with lesions of *A. rabiei*. Ilyas and Bhatti (1982) reported that plants sprayed with Daconil and Captan had significantly lower disease severity, pod infection and seeds with symptom lesions of *A. rabiei* than the control. Besides above mentioned treatments, Benlate + Brassicol, Morestan, Benlate + Karathane, Benlate and Brassicol reduced both per cent pod infection and number of seeds showing lesions of *A. rabiei*. Quinolate was the least effective in reducing both per cent pod infection and symptom lesions on seed.

On account of the phytotoxic effect of Brassicol, sprays of both the Brassicol and Benlate + Brassicol (at the rate of 450 gm (a. i.) per acre) resulted in crop yields significantly lower than that of the control (Table 2). Toxicity of Brassicol can be avoided by lowering the rate of fungicide spray. Ilyas and Bhatti (1982) observed no phytotoxicity due to application of Brassicol applied at the rate of 250 gm (a. i.) per acre, and no increase in grain yield over the control. However, the most effective spray treatments which significantly increased crop yield over the control in descending order were Benlate + Dithane M-45, Benlate + Daconil, Captan, Dithane M-45, each of them giving an increase in yield from 134 to 132 per cent. Treatments with Daconil, Morestan, Benlate and Benlate + Karathane resulted in an increase in grain yield from 94 to 86 per cent, whereas Karathane and Quinolate increased 63.8 and 24.0 per cent grain yield, respectively. Increase in grain yield with the

spray of Benlate (Chopra and Sood, 1980), Daconil and Captan (Ilyas and Bhatti, 1982), Dithane M–45 and Daconil and Dithane M–45 alone (Retig and Tobolsky, 1967), has also been reported.

Table 2. *In vivo effect of spray of fungicides on disease severity, per cent pod infection, per cent seeds with lesions of A. rabiei and grain yield*

Treatments	Disease severity rating	Per cent pod infection	Per cent seed infection	Yield/plot (15′×6′) in gm	Per cent yield increase or decrease over control
Benlate	2.50 d*	2.43 cd*	38.5 e*	1150.5 f*	82.5
Daconil	0.75 a	5.8 a	12.3 a	1206.5 fg	91.4
Brassicol	3.00 de	31.8 f	34.0 de	454.0 a	27.9**
Captan	1.25 a	11.5 b	14.3 a	1466.0 h	132.0
Dithane M–45	2.00 bc	26.5 de	20.5 b	1463.0 h	132.0
Quinolato	3.50 e	67.5 g	62.0 f	786.0 d	24 0
Karathane	2.75 de	29.3 ef	32.5 d	1032.0 e	63.8
Morestan	1.75 b	25.8 cd	30.0 cd	1172.0 fg	86.0
Benlate + Daconil	1.00 b	4.8 a	16.3 ab	1470.5 h	133.0
Benlate + Brassicol	2.50 cd	23.5 cd	26.3 c	529.5 b	16.0
Benlate + Dithane M–45	1.50 b	22.5 cd	19.8 b	1475.0 b	134 0
Benlate + Karathane	2.50 cd	25.0 cd	31.5 cd	1223.5 g	94.0
Control	4.50 f	81.3 h	82.5 g	630.5 c	–

* = Any two means not sharing the same letter differ significantly at 5 per cent level.

** = Decrease over control.

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