Management of Botrytis Gray Mold (*Botrytis cinerea* Pers. Ex. Fr.) of Chickpea at Tarahara, Nepal

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Abstract

An experiment was conducted in randomized complete block design with six treatments and four replications at loamy soil of Regional Agriculture Research Station, Tarahara, Nepal during 1997/98 and1998/99 seasons to find out the effect of bioagent *Trichoderma viride* as compared to fungicide Bavistin (carbendazim) for management of Botrytis gray mold (*Botrytis cinerea*) of chickpea (*Cicer arietinum*). Treatments were use of water spray (check), three sprays of *T. viride* (10^7-10^8 spores/ml of water), three sprays of Bavistin @ 0.2%, three sprays of Bavistin @ 0.1% + *T. viride*, two sprays of Bavistin @ 0.2% and two sprays of *T.viride*. The area under the disease progress curve (AUDPC) was the least (193.6) with three sprays of Bavistin (0.2%) followed by two sprays of Bavistin (0.2%) and three sprays of Bavistin + *T. viride* (216.9). The highest mean grain yield of 267.3 kg ha^{-1} was produced by three sprays of Bavistin + *T. viride* followed by three sprays of Bavistin. Three sprays of *T. viride* was inferior to three and two sprays of Bavistin but it was at par with two sprays of *T. viride with* respect to grain yield production and reduction of Botrytis gray mold severity. When AUDPC was regressed against grain yield, a negative correlation was obtained between the disease and the grain yield. The correlation coefficients for the disease and yields during1997/98 and 1998/99 respectively were -0.583, and - 0.490.

Key words: Botrytis gray mold, chickpea, *Trichoderma*

Introduction

Chickpea (*Cicer arietinum* L.) is the second most important pulse crop in Nepal. The crop occupies 19,510 ha and produces 13,990 tons with an average productivity of 717 kg ha^{-1} (CBS, 1998). Its acreage in eastern terai has declined due to flower drop problem in which no pod formation occurs. Flower drop is mainly attributed to attack by Botrytis gray mold (*Botrytis cinerea* Pers. Ex. Fr.). However, some workers indicated that flower drop is due to deficiency of boron, which causes flower abortion in chickpea (Srivastav et al., 1996). Botrytis gray mold (BGM) is the most important disease of chickpea in the eastern terai region of Nepal and is responsible for complete failure of the crop. The disease occurs almost every year and the estimated loss of 66% in the experimental plots and about 15% in farmers fields have been reported (Joshi, 1992). However, more than 80% crop loss was reported due to the disease in Bangladesh, Nepal and north-western India in recent years (Pande et al., 1998). BGM causes severe damage to the crop and yield loss up to 95% can be experienced in some fields, if the conditions are favorable during vegetative and reproductive growth stages of the crop (Pande and Rao, 2000). Some works have been done for its management in India and other parts of chickpea growing countries of this region (Grewal and Laha, 1983; Meeta et al., 1986; Pandey, 1988; Haware et al., 1997; Pande et al., 1998,). In India, spray of *Trichoderma viride* has been recommended for its management (Pande et al., 1998). In Nepal, however, its effect on BGM has not been studied. This study was undertaken to assess the effectiveness of *T. viride* in managing BGM of chickpea as compared to available fungicide, Bavistin.

Materials and Methods

The experiment was carried out at the loamy soil of Regional Agricultural Research Station, Tarahara, Sunsari, Nepal in a randomized complete block design with six treatments and

four replications for two consecutive chickpea growing seasons 1997/98 and 1998/99. The chickpea variety Sita was planted in 3.5- × 2.4-m plot for treatment. The plot was fertilized at the rate of 20:40:20 kg $N_2P_2O_5K_2$ ha^{-1} and the fertilizers used were diammonium phosphate, urea and muriate of potash. Endosulfan was used whenever pod borer (*Helicoverpa armigera*) was problem. The chickpea was planted in Nov and harvested in April. The treatments were check (water spraying only), three sprays of *T. viride* (10^7-10^8 spores ml^{-1} of water) mixed with carboxyl methyl cellulose, three sprays of Bavistin (carbendazim 50 WP) @ 0.2%, three sprays of Bavistin (0.1%) + *T. viride*, two sprays of Bavistin @ 0.2% and two sprays of *T. viride*. Treatments began when plants showed symptoms of BGM and they were repeated at 10 days interval.

The disease was scored using 1-9, scale as used by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) (Pande and Rao, 2000) in which 1 means no symptom and 9 means more than 75 percent leaves necrotic. The disease was scored four times on whole plot basis. The latest (last week of March) disease scores were presented for interpretation. Area under the disease progress curve (AUDPC) was calculated following the method used by earlier workers (Shaner and Finney, 1977). Grain yield data and terminal disease scores were analyzed using MSTAT-C computer program and AUDPC was regressed against grain yield (Gomez and Gomez, 1983).

Results and Discussion

Effect of spray on BGM severity

The terminal BGM score was the lowest when three sprays of Bavistin (0.2%) were applied (Table 1). The second lowest terminal score was in case of three sprays of Bavistin (0.1%) + *T. viride* in 1997/98. In 1998/99, however, the lowest disease score was recorded in three sprays of Bavistin (0.2%) followed by two sprays of Bavistin (0.2%). Means of two BGM scores of two seasons indicated that three sprays of Bavistin (0.2%) was the most effective in reducing the severity of BGM followed by two sprays of Bavistin (0.2%) and three sprays of Bavistin (0.1%) + *T. viride*. There were slight differences in the disease scores in the first year and the second one. In India, it was reported that Bavistin was found effective in reducing BGM severity and increasing the grain yield of chickpea (Grewal and Laha, 1983; Meeta et al., 1986; Rawal, 1987; Pandey, 1988). Our finding is that Bavistin was effective in reducing BGM severity. Studies carried out at Pantnagar, India indicated that three sprays of *T. viride* was as good as three sprays of Ronalin in reducing BGM severity. In our experiment, however, three sprays of *T. viride* was found inferior to three sprays of Bavistin in reducing the severity of BGM.

Table 1. Effect of bioagent *Trichoderma viride* and fungicide Bavistin on Botrytis gray mold (BGM) scores, grain yield and area under the disease progress curve (AUDPC) at Regional Agricultural Research Station, Tarahara during 1997/98 and 1998/99 seasons

SN	Treatment/s	BGM score, 1-9		AUDPC		Grain yield, kg ha^{-1}	
		1997/98	1998/99	1997/98	1998/99	1997/98	1998/99
1	Check	7.8a†	6.5a	256.6a	248.3a	29.4	251.1 b
2	3 sprays of *T. viride*	7.8a	6.3 b	247.9ab	245.5ab	16.3	315.5ab
3	3 sprays of Bavistin @ 0.2%	4.5c	5.0 b	194.1c	193.6c	52.3	409.5a
4	3 sprays of Bavistin @ 0.1% + *T. viride*	6.0b	6.8a	217.7bc	216.0b	65.7	468.8a
5	2 sprays of Bavistin @ 0.2%	6.0b	6.0a	215.6c	215.6bc	103.7	286.7 b
6	2 sprays of *T. viride*	7.8a	6.3a	248.5a	244.6a	18.6	296.4ab

† Means followed by the same letters are not significantly different ($P \leq 0.05$).

Effect of sprays on AUDPC

During 1997/98, AUDPC varied from 194.1 to 256.6. It was the highest (256.6) in the control plot followed by two sprays of *T. viride* (248.5) and three sprays of *T. viride* (247.9). It was the lowest (194.1) in three sprays of Bavistin. In 1998/99, the AUDPC values again varied from 193 to 248.3. It was the highest in the control plot

followed by two and three sprays of *T. viride* respectively (Table 1).

Use of three sprays of Bavistin (0.1%) + *T. viride* had lower AUDPC (216.0) in both the seasons. Although the grain yields varied from one year to the next, AUDPC values did not vary. Bavistin was effective in reducing BGM severity significantly as compared to *T. viride*. This is in contrast to the finding of Pantnagar, India, where the effect of three sprays of *T. viride* was as good as three sprays of Ronalin (Haware et al. 1997). The effect of three sprays of Bavistin (0.01) + *T.viride* was better in reducing the severity of BGM than three or two sprays of *T. viride* as *T. viride* was less sensitive to Bavistin (Akbari and Parakhia, 2000).

Effect of spray on grain yield

In 1997/98 grain yield was very poor and it ranged from 16.3 to 103.7 kg ha^{-1}. It was mainly due to the effect of incidence of wilt (*Fusarium* spp.) for which no control measure was applied.

During 1998/99 season, grain yield was better and it varied from 251.1 to 468.8 kg ha^{-1}. The highest grain yield (468.8 kg ha^{-1}) was produced by three sprays of Bavistin (0.01) + *T. viride*. Three sprays of *T. viride* and three sprays of Bavistin individually produced 315.5 and 409.5 kg ha^{-1} respectively of grain yield of chickpea (Table 1).

Relationship between AUDPC and grain yield

When AUDPC of BGM was regressed against grain yield, negative correlations were observed in both the seasons (Fig. 1 and 2).

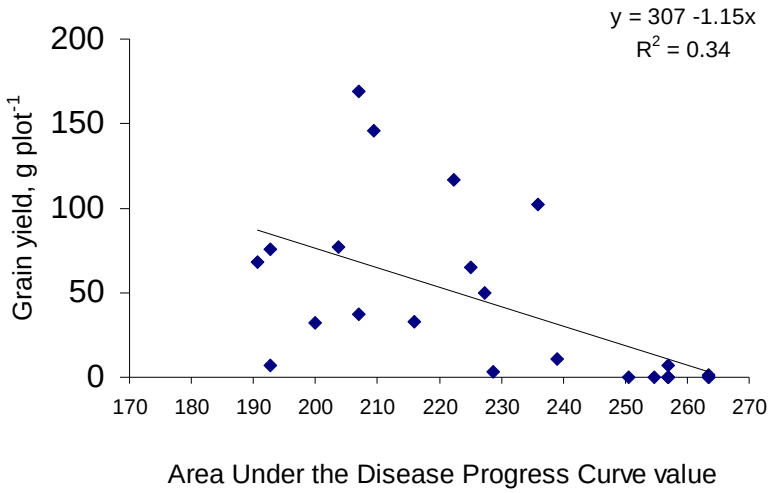

Fig. 1. Relationship between Botrytis gray mold and grain yield of chickpea in 1997/98.

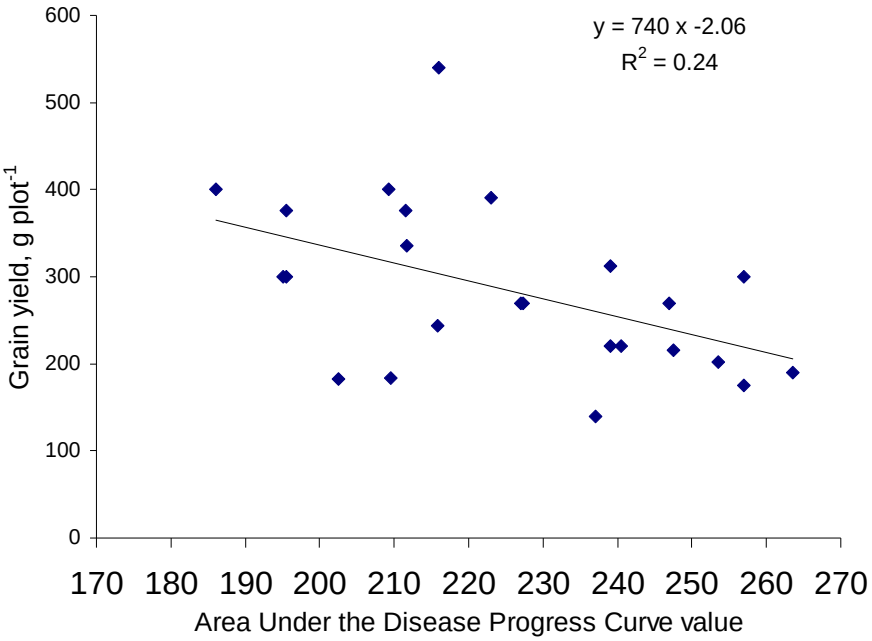

Fig. 2. Relationship between Botrytis gray mold and grain yield of chickpea in 1998/99.

Both the regression equations were the same statistically. It indicted that a unit increase in disease will result in two units decrease of grain yield of chickpea. However, only 30% variation in the grain yield of chickpea was due to variation in AUDPC under Tarahara condition. Rest of the variation in grain yield was attributed to other causes. The correlation coefficients were –0.583 and –0.490 and these were significant at 5% level.

Based on the data of two seasons, it can be concluded that three sprays of Bavistin (@ 0.2%) is effective in reducing the severity of BGM and increasing the grain yield followed by three sprays of Bavistin (0.01) + *T. viride*. *T. viride* was not found superior to Bavistin. Therefore, three sprays of Bavistin is recommended for the management of BGM of chickpea in eastern terai.

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