

Full Length Research Paper

Efficacy of azoxystrobin 25 SC along with bioagents on chilli powdery mildew diseases under field condition

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Accepted 20 September, 2019

Field trials were conducted to determine the bioefficacy of Azoxystrobin 25 SC against Powdery mildew of Chilli. Three sprays with Azoxystrobin at 150 a.i, 125 g a.i and 100 g a.i/hac were introduced on chilli plants for controlling the spread of *Leveillula taurica*. The results for the first and second season revealed that maximum control of powdery mildew disease is by Azoxystrobin at 150 g a.i/hac giving the maximum reduction of about 91.15 and 90.95 compared to the second season recording of 86.07 and 84.06, respectively.

Key words: Bioefficacy, yield, Azoxystrobin 25 SC, powdery mildew, *Leveillula taurica*.

INTRODUCTION

Chilli (*Capsicum annum*) is the fourth most important vegetable crops in the world and first in Asia, with world production approximately 122.34 million tonnes of fresh chilli and 2.8 tonnes of dry chilli in 2010 (Indian Horticultural Database). The most important producers and exporters of chilli include China, India, Mexico, Morocco, Pakistan, Thailand and Turkey. Demand for chilli in the world is increasing every year (FAO, 2004). Chilli is a very remunerative spice crop of the Indian subcontinent (Sharma et al., 2005) and occupies an area of about 0.81 million ha (Suthin Raj and Christopher, 2009) which accounts for 25% of the world production (Chandra Nayaka et al., 2009). Chilli suffers from many diseases caused by fungi, bacteria, viruses, nematodes and also abiotic stresses. Among the fungal diseases, powdery mildew, leaf spot and anthracnose or fruit rot are the most prevalent ones. The powdery mildew caused by *Leveillula taurica* (Lev.) Arn. is a major constraint in chilli production in India causing heavy yield loss ranging from 14 to 20%, due to severe defoliation and reduction in photosynthesis, size and number of fruits per plant

(Mathur et al., 1972; Sivaprakasam et al., 1976; Gohokar and Peshney, 1981). The disease has attained the economic status in the state. However, there is a dearth of systematic research work being carried out on loss assessment and management of the important disease of chilli. A number of management approaches, viz., development of tolerant varieties, application of fungicides, cultural practices and combination of approaches leading to integrated management of the disease have been evaluated and recommended (Negron et al., 1991; Dhruj et al., 2000; Pawar et al., 1985b). Understanding the mechanism of resistance and also host plant resistance through slow mildewers are important components in the disease management, when vertical resistance in the varieties is not at all available. Effective management of this disease is a necessary strategy using systemic fungicides for controlling spread of pathogen. Therefore, the present investigation was undertaken with Azoxystrobin 25 SC for its bio efficacy against Powdery mildew disease on chilli.

MATERIALS AND METHODS

Field studies

A new formulation Azoxystrobin 25 SC w/w of United

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Table 1. Effect of different fungicides and bioagents on the incidence of powdery mildew of chilli under field condition (Season I) (Kinathukadavu-Coimbatore).

Treatment	PDI on leaves		Per cent decrease over control	PDI on fruits		Per cent decrease over control	Yield	Yield Increase over control
	Before Spray	After 3 rd Spray		Before Spray	After 3 rd Spray			
Azoxystrobin @ 100 g a.i ha	10.12 (18.53) ^b	8.00 (16.43) ^b	77.20	10.24 (18.63) ^b	8.89 (17.26) ^b	65.60	26.11 ^a	53.58
Azoxystrobin @ 125 g a.i / ha	6.28 (14.42) ^a	4.00 (11.54) ^a	88.60	4.98 (12.79) ^a	2.78 (9.46) ^a	88.50	26.57 ^b	56.29
Azoxystrobin @ 150g a.i /ha	5.49 (13.44) ^a	3.11 (10.14) ^a	91.10	4.26 (11.83) ^a	2.22 (8.53) ^a	90.95	27.18 ^a	59.88
Azoxystrobin @ 125 g a.i	6.88 (15.12) ^a	4.46 (12.11) ^a	87.30	6.21 (14.42) ^a	3.35 (10.47) ^a	86.40	24.00 ^c	50.60
Hexaconazole @ 60 g a.i/ha	10.48 (18.63) ^b	8.44 (16.85) ^b	75.90	11.14 (19.46) ^b	8.89 (17.26) ^b	63.70	23.17 ^c	36.29
Chlorothalonil @ 600 g a.i/ha	18.91 (25.71) ^c	16.00 (23.58) ^c	54.40	14.68 (22.46) ^c	12.26 (20.44) ^c	50.00	22.43 ^d	31.94
<i>P.fluorescens</i> (Pf 1)@ 0.2%	20.38 (26.78) ^c	18.12 (25.18) ^d	48.39	16.22 (23.73) ^d	14.87 (22.63) ^d	41.26	22.00 ^d	29.41
<i>B.subtilis</i> @ 0.2%	22.63 (28.39) ^d	20.42 (26.85) ^e	41.83	17.43 (26.65) ^e	16.48 (23.89) ^e	32.59	21.04 ^d	23.76
Control	38.28 (38.17) ^e	35.11 (36.33) ^f	-	27.32 (31.50) ^f	24.45 (29.60) ^f	-	17.00 ^e	

Values are means of three replications;

Figures in the parentheses represent arcsine transformed values;

The common letters show non- significant differences among the treatments based on DMRT.

Table 2. Effect of different fungicides and bioagents on the incidence of powdery mildew of chilli under field condition (Season II) (Madampatti –Coimbatore).

Treatment	PDI on leaves		Percent decrease over control	PDI on fruits		Percent decrease over control	Yield	Yield Increase over control
	Before Spray	After 3 rd Spray		Before Spray	After 3 rd Spray			
Azoxystrobin @ 100 g a.i ha	12.44 (20.62) ^b	10.44 (18.81) ^b	72.62	12.87 (20.96) ^b	10.66 (19.00) ^b	56.74	28.60 ^a	47.27
Azoxystrobin @ 125 g a.i / ha	8.98 (17.36) ^a	6.82 (15.12) ^a	82.11	6.97 (15.23) ^a	4.98 (12.79) ^a	81.19	30.12 ^a	55.09
Azoxystrobin @ 150g a.i /ha	7.23 (15.56) ^a	5.31 (13.31) ^a	86.07	6.12 (14.30) ^a	4.22 (11.83) ^a	84.06	30.16 ^a	55.30
Azoxystrobin @ 125 g a.i	8.41 (16.85) ^a	6.12 (14.30) ^a	83.95	7.23 (15.56) ^a	5.46 (13.44) ^a	79.38	26.18 ^b	34.80
Hexaconazole @ 60 g a.i/ha	12.76 (20.88) ^b	10.28 (18.63) ^b	74.04	12.46 (20.62) ^b	10.12 (18.53) ^b	61.78	26.00 ^b	33.80
Chlorothalonil @ 600 g a.i/ha	20.91 (27.2) ^c	18.72 (25.6) ^c	50.91	16.23 (23.73) ^c	14.36 (22.22) ^c	45.77	24.80 ^d	27.70
<i>P.fluorescens</i> @ 0.2%	21.89 (27.83) ^{cd}	19.68 (26.28) ^c	48.40	18.46 (25.40) ^d	16.42 (23.89) ^d	37.93	22.00 ^d	13.28
<i>B.subtilis</i> @ 0.2%	23.48 (28.93) ^d	21.72 (27.76) ^d	43.05	20.30 (26.78) ^e	18.33 (25.35) ^e	30.54	20.00 ^e	2.98
Control	41.38 (39.82) ^e	38.14 (38.12) ^e	-	29.28 (32.71) ^f	26.48 (30.92) ^f	-	19.42 ^e	

Values are means of three replications;

Figures in the parentheses represent arcsine transformed values;

The common letters show non- significant differences among the treatments based on DMRT.

Phosphorus, Limited, Mumbai was used for all studies in the present investigation.

This new formulation was compared with the following fungicides and bio control agents:

Azoxystrobin 23 SC, Hexaconazole 2% SC, Chlorothalonil 75% WP, *P. fluorescens* and *B.*



Figure 1. Efficiency of Azoxystrobin 25 SC against chilli powdery mildew diseases.

subtilis

Two field trials were conducted for this study with the aforementioned fungicides and bio control agents. The trials were laid out in a Randomized Block Design (RBD) with nine treatments and three replications with a plot size of 20 m² and with a spacing of 90 × 60 cm. The recommended package of practices was followed for the trial. The observation on the disease incidence was recorded before initiation of spray and after third spray. The severity of Powdery mildew disease was recorded on 10 plants and in each plant 10 leaves and fruits were selected at random in each replication of the treatment. Percent Disease Index (PDI) was calculated using standard score chart as described earlier:

$$\text{PDI} = \frac{\text{Sum of numerical ratings}}{\text{Total number of leaves observed}} \times \frac{100}{\text{Maximum category value}}$$

Similarly, the incidence of powdery mildew was also scored in 10 plants and 10 leaves were scored at random in each plant and PDI was worked out as per the standard formula. The yield details were also recorded.

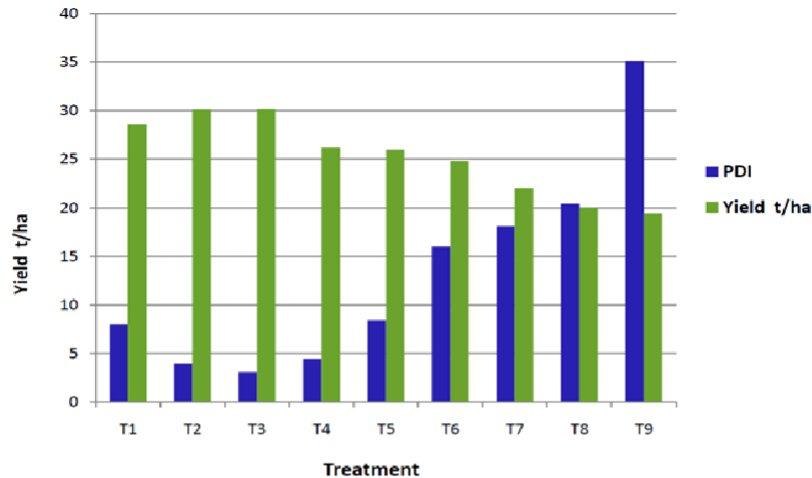
RESULTS

Powdery mildew

The results from two season trails clearly revealed that Azoxystrobin at 150 g a.i/ha provided the maximum control of the powdery mildew, followed by Azoxystrobin at 125 g a.i/ ha (Tables 1 and 2). The effect was noticed both in leaves and fruits when compared to other fungicides. In addition, Azoxystrobin 150 g a.i at 600 g/ha dose recorded the maximum yield of 30.16 t/ha. From this study, it is evident that 150 g ai ha⁻¹ was considered as the optimum dose to combat the disease (Figures 1 and 2). The similar results were also available in the literatures.

Azoxystrobin (Amistar 250 SC) at 250 and 500 ml ha⁻¹ was superior in controlling downy mildew and powdery mildew of grapes as against control and superior with the checks chlorothalonil, mancozeb and sulphur (Jamadar et al., 2004; Reuveni, 2001)

Foliar spraying of Azoxystrobin at 150 g a.i/ha provided the maximum control (PDI 3.11) of the Powdery mildew disease which was on par with its higher dose of Azoxystrobin at 125 g a.i/ha (PDI 4.00), when compared



T1- Azoxystrobin @ 150 g a.i/ha
 T2- Azoxystrobin @ 125 g a.i/ha
 T3- Azoxystrobin @ 100 g a.i/ha
 T4- Azoxystrobin 25 SC(Amister)
 T5- Hexaconazole 60 g a.i/ha
 T6- Chlorothalonil 600 g a.i/ha
 T7- *P.fuorescens*(0.2%)
 T8- *B.subtilis*(0.2%)
 T9- Control

Figure 2. Effect of different fungicides and biocontrol agents against powdery mildew diseases.

to control (PDI 35.11). The spraying of the same chemical at Azoxystrobin at 100 g a.i/ha recorded PDI of 8.00 and proved the next best effective treatment which was however on par with the treatments of Azoxystrobin 25 SC.

DISCUSSION

Audichay and Thakore (2000) concluded that in order to safeguard the opium poppy crop from the powdery mildew to obtain higher seed yield and lower infestation of the disease, single spray of carbendazim (0.1%) or triadimefon (0.1%) as protectant was recommended. Kalra et al. (2000) reported that early planting coupled with application of dinocap reduced the powdery mildew disease severity on coriander. Sharma et al. (2002) reported that hexaconazole (0.05%) sprays were found highly effective in reducing the severity of powdery mildew followed by fenarimol and bitertanol in controlling the powdery mildew of pea. Khunti et al. (2002) reported that application of hexaconazole (0.05%) and penconazole (0.1%) were found effective in managing powdery mildew and *Cercospora* leaf spot of mung bean caused by *Erysiphe polygoni* and *Cercospora canescens*. Fugro et al. (2004) reported that carbendazim 80% WDG

at 250g a.i./ha was most effective in managing powdery mildew of chilli.

Reuveni (2003) reported that azoxystrobin at 40 g 100 l⁻¹ water gave 95.9% reduction over control of grapes downy mildew *P. viticola* in field experiments. Azoxystrobin at 0.3g l⁻¹ as pre-inoculation spray significantly reduced the lesion length (2.75 mm) compared with the water control (26.4 mm) caused by *D. bryoniae* (stem blight) of cucumber (Utkhede and Koch, 2004).

In the present study, maximum yields of 27.18 and 30.16 t/ha were recorded with Azoxystrobin at 150 g ai/ha in the two seasons. The results were in accordance with the following reports: Sendhil Vel (2003) recorded 43.06% increase in yield over farmer practices in the first season and 33.98% increase over farmer practices in the second season trial by azoxystrobin (150 g a.i ha⁻¹) treatment. Anand et al. (2009) reported maximum fruit yield of 10.54 and 10.35 tonnes ha⁻¹ cucumber at azoxystrobin (250 ml ha⁻¹) for the first and second seasons, respectively (4.08 - 4.63 tonnes ha⁻¹)

Conclusion

The systemic fungicides Azoxystrobin 25 SC are effective to control the powdery mildew of chilli. The

information on the efficacy of new fungicide Azoxystrobin at 150 g a.i./ha against powdery mildew of chilli is to fulfill the prerequisite criteria for the selection of appropriate dose of fungicide in order to develop an eco-friendly disease management of Powdery mildew of chilli in the field condition. Presently, there is no phytotoxic symptoms after spraying on the plants even at 2 X dose of Azoxystrobin. As such, azoxystrobin 25 SC on chilli Powdery mildew disease will increase the choice of fungicides.

ACKNOWLEDGEMENT

The authors are thankful to M/S United Phosphorus Limited, Mumbai for funding and providing the valuable suggestions during this research period

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