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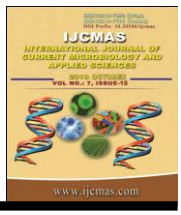

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Formulation of Effective Chemical Management Strategy against Cercospora Leaf Spot Disease of Chilli

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A B S T R A C T

Field experiment was conducted during 2015 and 2016 to find out effective chemical management strategy against one most common disease of Chilli, which occurred throughout the year, i.e., Cercospora leaf spot. Among the six different fungicides treatments tested for spraying. All the treatments showed significantly different results than check. Lowest disease severity was found in Pyraclostrobin + Tebuconazole (Double application) (7.85%). The highest percent disease control was observed with Pyraclostrobin + Tebuconazole (Double application) showing 64.69% disease control followed by Pyraclostrobin + Tebuconazole (Single application) (61%) and Azoxystrobin + Tebuconazole (Double application) (57.98%). The treatment Azoxystrobin + Tebuconazole (Single application) also showed good control over Cercospora leaf spot of Chilli. Considering the yield, highest yield was obtained under Pyraclostrobin + Tebuconazole (Double application) with the estimated production of 1650.55 Kg/ha followed by Pyraclostrobin + Tebuconazole (Single application) and Azoxystrobin + Tebuconazole (Double application) with the production of 1285Kg/ha and 1080 Kg/ha, respectively. Among the treatments, Chlorothalonil (Double application) showed lowest disease control as well as lowest yield.

Introduction

Chilli (*Capsicum annuum* L.) or red pepper, a member of solanaceae is an important economic crop worldwide (Poulos, 1992). It is a remunerative vegetable, spice cum cash crop of the Indian subcontinent.

Among the known five *Capsicum* spp., *Capsicum annuum* is cultivated worldwide (Tong and Boseland, 1999) followed by *Capsicum frutescens* (Boseland and Votaven, 2003)

Chilli is mainly grown in India, Mexico, Japan, Indonesia, Pakistan and China. India ranks second in area and production after China. Andhra Pradesh is the leading chilli producing state contributing to about 58.0 per cent of the country's total production.

Karnataka is the second largest chilli producer (13.0%) followed by Orissa (4.8%), West Bengal (4.8 %), Maharashtra (3.6%) and Gujarat (3.5%). During 2011, India account 40 per cent of the total chilli area in the world, which is about 7.92 lakh hectares with an

annual production of 12.23lac MT of ripe dry chillies (Anonymous, 2012).

Chilli is used as a spice, condiment culinary supplement, medicine, vegetable and as an ornamental plant. Chillies are a good source of vitamin A, B, C (*Ascorbic acid*) and E (*Tocopheral*), oleoresin, carbohydrate and minerals such as calcium, phosphorus, ferrous, sodium and copper in trace amounts and the allied pungent principles viz., dihydrocapsaicin and nordihydrocapsaicin.

Chilli suffers from many diseases caused by fungi, bacteria, viruses, nematodes and also abiotic stresses. Among the fungal diseases, anthracnose or fruit rot, leaf spots, damping off and powdery mildew are the most prevalent ones.

Materials and Methods

An experiment field trial was conducted in randomized block design for consecutive two years 2015-2016 at Instructional Farm, UBKV, Pundibari to study the effect of application of different fungicides for controlling Cercospora leaf spot of chilli. Observations on the severity of Cercospora leaf spot was recorded starting from 30 DAT at an interval of 7 days.

The severity of Cercospora leaf spot was recorded on five randomly selected plants using a disease rating scale 0 to 9 scale was followed as suggested by McKinney (1923). Further, these ratings were converted to per cent disease index (PDI).

Further, theses scales were converted to per cent disease index (PDI) using the formula given by Mckinney (1923).

$$PDI = \frac{\text{Sum of all individual ratings}}{\text{Total number of fruits/ leaves observed}} X \frac{100}{\text{Maximun disease scale}}$$

Six treatments were imposed besides a treatment with unsprayed control. The details of the treatments are furnished in Table 1.

Results and Discussion

The perusal of data in Table 2 indicates that lowest disease severity (7.85%) was found in T_4 treatment which is significantly lower than check. T_4 showed lowest disease severity (7.85%) and highest disease reduction (64.69%) as compared to other treatments and also gave highest yield (1650.55 kg/ha).

This was followed by T_3, T_2 and T_1 also gave good result both in terms of percent disease reduction as well as yield. The disease severity was 8.67 %, 9.34% and 9.93% and disease reduction were 61.00%, 57.98% and 55.33% respectively. The yield were 1285, 1080 and 947 kg/ha respectively.

Highest disease severity was found in T_7 followed by T_6 and T_5, the disease severity were 22.23%, 14.15% and 10.89% respectively.

The disease reduction of T_6 and T_5 were 36.35% and 51.01% respectively and the yield were 736.40 and 888.62 kg/ha.

Thus, the pooled results of fungicidal trial of 2015 and 2016 clearly indicates the T_4 [Pyraclostrobin + Tebuconazole (Double application)] is the best treatment followed by T_3 [Pyraclostrobin + Tebuconazole (Single application)] and T_2 [Azoxystrobin + Difenconazole (Double application)] in reducing disease severity and increasing yield.

Similar work done by Kahn *et al.,* (2005) who used Azoxystrobin and Tebuconazole along with some other fungicides for efficacy of C*cercospora* leaf spot and found that a single, early application of Tebuconazole greatly reduced Cercospora leaf spot (Fig. 1 and 2).

Table.1 Treatment spray schedule

Sl. no.	Treatments	Treatment details	Doses (per litre)	Spray schedule
1	T_1	Azoxystrobin + Difenconazole (Single application)	@ 1 ml	7 days interval
2	T_2	Azoxystrobin + Difenconazole (Double application)	@ 1 ml	7 days interval
3	T_3	Pyraclostrobin + Tebuconazole (Single application)	@ 1 ml	7 days interval
4	T_4	Pyraclostrobin + Tebuconazole (Double application)	@ 1 ml	7 days interval
5	T_5	Carbendazim (Double application)	@ 1gm	7 days interval
6	T_6	Chlorothalonil (Double application)	@ 1.5 gm	7 days interval
7	T_7	Control	-	-

Yield of the crop recorded at harvest and the data were statistically analyzed.

Table.2 Disease severity of Cercospora leaf spot (Pooled)

Treatments	PDI			Disease control over check (%)	Yield (g/plot)	Estimated yield (kg/ha)
	1st Observation	2nd Observation	3rd Observation			
T_1 [Azoxystrobin + Difenconazole (Single application)]	1.56 (1.41)*b	6.74 (2.69)d	9.93 (3.21)cd	55.33	568.33	947.22
T_2 [Azoxystrobin + Difenconazole (Double application)]	2.82 (1.80)a	5.37 (2.41)e	9.34 (3.11)cd	57.98	648	1080.00
T_3 [Pyraclostrobin + Tebuconazole (Single application)]	1.93 (1.54)ab	4.67 (2.27)f	8.67 (3.01)cd	61.00	771	1285.00
T_4 [Pyraclostrobin + Tebuconazole (Double application)]	2.35 (1.71)ab	4.22 (2.17)g	7.85 (2.86)d	64.69	990.33	1650.55
T_5 [Carbendazim (Double application)]	2.44 (1.73)ab	7.56 (2.84)c	10.89 (3.36)c	51.01	533.17	888.62
T_6 [Chlorothalonil (Double application)]	2.38 (1.54)ab	8.74 (3.03)b	14.15 (3.82)b	36.35	441.84	736.40
T_7 [Control]	1.63 (1.55)ab	13.40 (3.73)a	22.23 (4.68)a		263.67	439.45
SE(m)	0.056	0.016	0.077		11.924	
C.D.	0.162	0.048	0.226		34.804	

*Figure in parenthesis is angular transformed values

Table.3 Related yield and relative economics of various fungicidal treatments

Cercospora leaf spot	Yield (kg/ha)	Relative cost (Rs/ha)	Relative yield (kg)	Relative Return (Rs/ha)	Relative net Profit (Rs/ha)
Control	439.45				
T_1 [Azoxystrobin + Difenconazole (Single application)]	947.22	4165	507.77	12694.25	8529.25
T_2 [Azoxystrobin + Difenconazole (Double application)]	1080.00	8330	640.55	16013.75	7683.75
T_3 [Pyraclostrobin + Tebuconazole (Single application)]	1285.00	1428	845.55	21138.75	19710.75
T_4 [Pyraclostrobin + Tebuconazole (Double application)]	1650.55	2856	1211.1	30277.5	27421.5
T_5 [Carbendazim (Double application)]	888.62	1820	439.45	10986.25	9166.25
T_6 [Chlorothalonil (Double application)]	736.40	2410.8	296.55	7413.75	5002.95

Disease Severity Scale

Category	Description
0	No infection
1	<1% of area infected
3	1-10% of area infected
5	11-25% of area infected
7	26-50% of area infected
9	More than 50% of area infected

Fig.1 Disease severity of Cercospora leaf spot on chilli

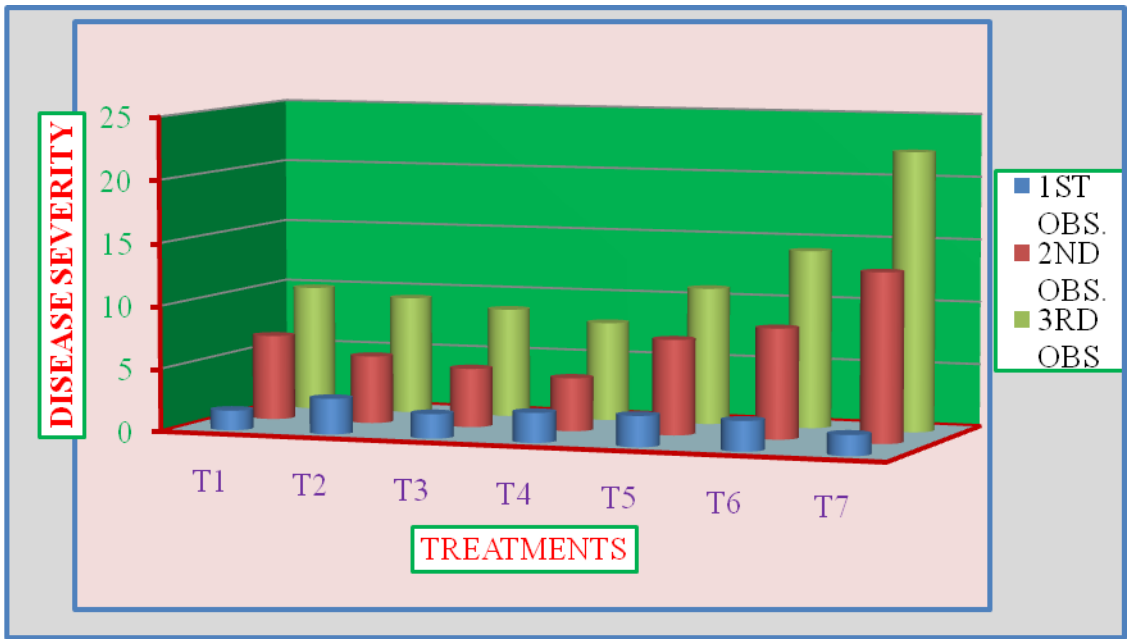
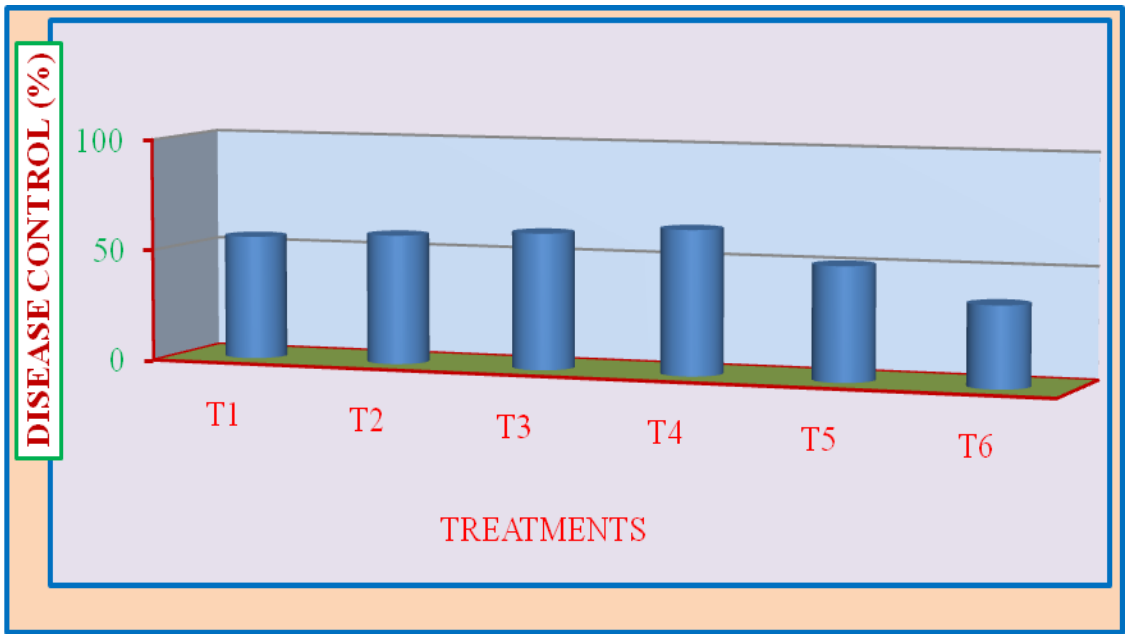


Fig.2 Disease control of Cercospora leaf spot of chilli



A good control of Cercospora leaf spot was found with combined formulation of Tebuconazole (Culbreath *et al.*, 2008). Gastelum *et al.*, (2007) reported that three spray application at weekly intervals of Tebuconazole, Trifloxystrobin, Chlorothalonil provided an excellent control of leaf spot (Table 3). These findings are in line with the present experiment, where strobilurin fungicides, triazoles fungicides and some

other fungicides like Chorothalonil are tested and found effective against Cercospora leaf spot.

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