

Original Research Article

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Determination of Bioefficacy and Phytotoxicity of Fungicide Taqat 75% WP (Captan 70% + Hexaconazole 5%) against Leaf Spot and Fruit Spot Diseases in Tomato Crop

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ABSTRACT

Several pathogens attack the tomato crop during its cropping season. The present experiments were carried out to study the disease incidence using Taqat 75% WP during the year 2016-17 and 2017-18. Assessment of the disease severity was done by standard scoring methods and expressed as Per cent Disease Index (PDI). For phytotoxicity of Taqat 75% WP at X dose 750g/ha, 2X dose 1500g/ha and 4X doses 3000g/ha along with the standard check treatments. The observations on leaf injury, wilting, vein clearing, necrosis, epinasty & hyponasty were recorded on ten randomly selected plants before spray at 3, 7 and 15 days after 1st spray. The observations were recorded on leaf spot and fruit spot before application and at different intervals after the application of Taqat 75% WP. Thus, our studies revealed that the per cent disease index (PDI) of Taqat 75% WP (Captan 70%+Hexaconazole 5%) @ 750 g/ha is highly effective in controlling leaf spot and fruit spot diseases of tomato and increasing tomato fruit yield without causing any phytotoxicity to the crop.

Keywords

Tomato, Leaf spot,
Fruit spot,
Plant diseases

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Introduction

Tomato (*Solanum lycopersicum* L.) is a high-value dietary component, contributing to nutrition and livelihood of both rural and urban population the world over. Tomato is an obligatory enthusiastic vegetable and fruit crop belongs to Solanaceae family. It is the

most important tropical vegetable crop widely used throughout the world (Hadian *et al.*, 2011). It is rich in vitamins, minerals, organic acids, and also containing considerable amount of total sugar (3%~4%), total solids (4%~7%), ascorbic acid (15~30 mg/100g), and lycopene (20~50 mg/100g) (Giovannucci, 1999). It is a high-value horticultural crop for

the local market and an important dietary component, contributing to improved nutrition and livelihood for both rural and urban population (Waiganjo *et al.*, 2006). India is one of the major producers of tomato where 0.865 mha area is under tomato cultivation producing 16.826 million tonnes with an average productivity 19.5 tonnes per ha (Shiva *et al.*, 2013). The fruits are used fresh in salads or cooked as a vegetable, in processed form as tomato paste (puree), tomato sauce, ketchup, juice and can also be dried. They are rich in vitamins A and C and are gaining importance because it contains lycopene, a food component known to reduce the incidence of prostate cancer, heart and age related diseases (AVRDC, 2003).

Tomato is fairly adaptable, but grows well in warm conditions with optimum temperatures of 15^oC -25^oC. But, it is attacked by several plant pathogens causing viz. Leaf spot (*Septoria lycopersici*) and fruit spot (*Phytophthora parasitica*). In the present Study, disease incidence and phytotoxicity studies using Taqat 75% WP during the year 2016-17 and 2017-18 were carried. Assessment of the disease severity was done by standard scoring methods, and expressed as Per cent Disease Index (PDI).

For phytotoxicity of Taqat 75% WP at X dose 750g/ha, 2X dose 1500g/ha and 4X doses 3000g/ha along with the standard check treatments. The observations on leaf injury, wilting, vein clearing, necrosis, epinasty & hyponasty were recorded on ten randomly selected plants before spray, 3, 7 and 15 days after 1st spray.

Materials and Methods

A local tomato variety Patharkuchi was grown during *Rabi*, 2016-17 and 2017-18 and the experimental layout was made with nine treatments and three replications in RBD design for the bioefficacy studies with a

spacing of 60x40 cm² and six treatments for the phytotoxicity studies. All the agronomical practices were followed as per the standard package of practices recommendations. Assessment of the disease severity was done by scoring methods as given below and expressed as Per cent Disease Index (PDI).

Bio-efficacy of taqat

On appearance of the diseases, fungicides were sprayed with knapsack sprayer fitted with hollow cone nozzle. The per cent disease incidence on leaves and fruits were recorded before spray initiation and at different intervals after each spray on randomly selected 25 leaves of five plants. Assessment of the disease severity was done by scoring methods as given below and expressed as Per cent Disease Index (PDI) (Table 1& 2).

The percent disease index was calculated by using the formula

$$PDI = \frac{\text{Sum of all disease Ratings}}{\text{Total no. of leaves assessed} \times \text{Maximum Disease grade}} \times 100$$

Disease scoring scale for fruit spot

Fruit spot was assessed based on the total number of fruits in 10 randomly selected plants and number of infected fruits in each plot. Later it was converted to per cent infected fruit and presented in Table 3.

Phytotoxicity of taqat on tomato

For phytotoxicity of Taqat 75% WP at X dose 750g/ha, 2X dose 1500g/ha and 4X doses 3000g/ha along with the standard check treatments. All the field experimental conditions were kept constant. Observations on leaf injury, wilting, vein clearing, necrosis, epinasty & hyponasty were recorded on ten randomly selected plants before spray, 3, 7 and 15 days after 1st spray. The level of

phytotoxicity was estimated by visual assessment on below mentioned scale of 0-10.

Experimental results

The observations on major diseases of tomato *viz.* leaf spot and fruit spot before application and at different intervals after the application of Taqat 75%WP @750 g/ha, its individual products and the standard check fungicides, Captan 50%WP @ 2500 g/ha and Mancozeb 75%WP @ 1500 g/ha along with the untreated control treatment were recorded. The per cent disease index was worked out was analyzed statistically. The data on leaf spot and fruit spot were presented in tables 1, 2, 3 & 4 respectively and the results are discussed below.

Leaf spot disease of tomato

At the time of spray initiation the Per cent Disease Index (PDI) was between 4.89 & 7.56 during two cropping seasons in the year 2016-17 and 2017-18. After the application of fungicides, all the fungicides exhibited significantly superior efficacy against leaf spot disease.

After two applications in the year 2016-17, the mean PDI was minimum in the treatment, Taqat 75% WP @ 750g/ha recording (7.67 PDI) which was followed by Taqat 75% WP @ 500g/ha (10.67 PDI) and Hexaconazole 5% EC @ 750ml/ha (11.00 PDI), Hexaconazole 5%EC @ 500ml/ha (12.93 PDI).

The standard checks treatments, Mancozeb 75% W P @ 1500g/ha recorded 14.37 PDI and Captan 50% WP @ 2500g/ha recorded 16.04 PDI. Maximum PDI of 48.33 was recorded in untreated control (Table 4).

After two applications in the year 2017-18, the mean PDI was minimum in the treatment, Taqat 75%WP @ 750g/ha recording 6.85 which was followed by Taqat 75%WP @ 500g/ha (8.56 PDI) and Hexaconazole 5%EC @ 750ml/ha (9.00 PDI), Hexaconazole 5%EC @ 500ml/ha (10.52 PDI). The standard checks treatments, Mancozeb 75%WP @ 1500g/ha recorded 11.89 PDI and Captan 50%WP @ 2500g/ha recorded 12.37 PDI. Maximum PDI of 48.85 was recorded in untreated control (Table 5).

Fruit spot disease of tomato

Fruit spot disease observation was recorded at 15 days after 2nd spray during the year 2016-17. Among all the treatments, the minimum of 4.70 % fruit spots was in Taqat 75%WP @ 750g/ha. which was followed by Taqat 75%WP@ 500g/ha (6.69%), Hexaconazole 5%EC @ 750ml/ha (6.83%) and Hexaconazole 5%EC @ 500ml/ha (8.29%). The standard checks treatments, Mancozeb 75%WP @ 1500g/ha recorded 10.40% and Captan 50%WP @ 2500g/ha recorded 9.94%. Maximum of 27.70% was recorded in untreated control (Table 3).

Fruit spot disease observation was recorded at 15 days after 2nd spray during the year 2017-18. Among all the treatments, the minimum of 5.10% fruit spots was in Taqat 75%WP @ 750g/ha. Which was followed by Taqat 75% WP @ 500g/ha (7.13%), Hexaconazole 5% EC @ 750ml/ha (7.99%) and Hexaconazole 5% EC @ 500ml/ha (8.87%). The standard checks treatments, Mancozeb 75%WP @ 1500 g/ha recorded 10.28% and Captan 50% WP @ 2500g/ha recorded 10.34%. Maximum of 29.46% was recorded in untreated control (Table 3).

Table.1 Disease scoring scale for leaf spot

Score	Symptoms
0	No symptoms on leaf
1	Very small, irregular spots covering less than 1% of leaf area
3	Small irregular, brown spots covering 1-10% of the leaf area
5	Small lesions, but enlarged with dark brown margin with a grey center covering 11-25% of the leaf area
7	Enlarged lesions, with dark brown margin with a grey center covering 26-50% of the leaf area.
9	Lesions coalesce to form irregular dark brown to black patches covering 51% or more of the leaf area.

Table.2 Scale for phytotoxicity

Score	Phytotoxicity (%)
0	No phytotoxicity
1	1-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

Table.3 Effect of Taqat 75% WP against Fruit spot (*Alternaria* sp.) in Tomato during *Rabi*, 2016-17 and 2017-18

Tr. No	Mean 1 st year	Mean 2 nd year
T1	10.67	8.56
T2	7.67	6.85
T3	21.63	15.48
T4	18.89	13.78
T5	16.04	12.37
T6	12.93	10.52
T7	11.00	9.00
T8	14.37	11.89
T9	48.33	48.85

Fig.1 Effect of Taqat 75% WP against Fruit spot (*Alternaria* sp.) in Tomato during Rabi, 2016-17 and 2017-18

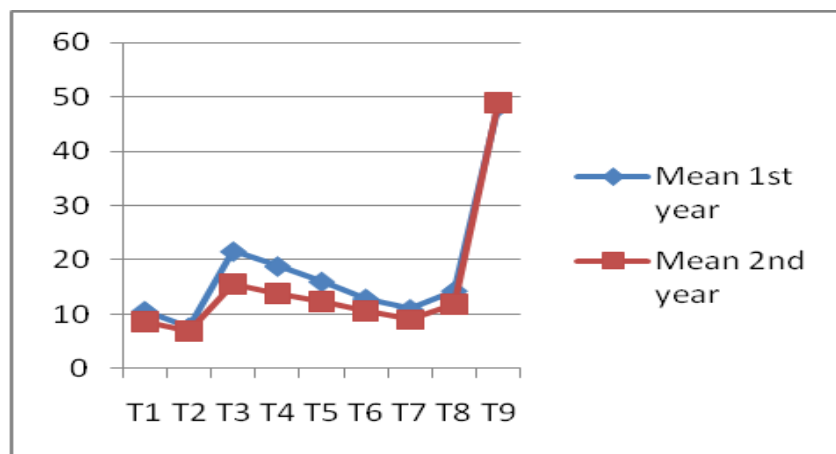


Table.4 Effect of Taqat 75% WP against Leaf spot in Tomato during Rabi, 2016-17

Tr. No	Treatments	Dose/ha (Formulation)	Per cent Disease Index (PDI)					Mean	% control
			Pre-treatment	10 Days After 1st spray	15 Days After 1st spray	10 Days After 2nd spray	15 Days After 2nd spray		
T1	Taqat 75% WP	500g	6.22 (14.42)	7.26 (15.60)	10.67 (18.93)	11.56 (19.84)	13.19 (21.25)	10.67	77.93
T2	Taqat 75% WP	750g	5.48 (13.53)	6.07 (14.24)	7.26 (15.44)	8.15 (16.56)	9.19 (17.55)	7.67	84.14
T3	Captan 50% WP	700g	5.78 (13.90)	16.89 (24.18)	21.19 (27.39)	23.11 (28.70)	25.33 (30.21)	21.63	55.25
T4	Captan 50% WP	1050g	6.07 (14.25)	13.93 (21.88)	18.52 (25.47)	20.44 (26.87)	22.67 (28.40)	18.89	60.92
T5	Captan 50% WP	2500g	6.22 (14.42)	11.41 (19.67)	15.56 (23.21)	17.63 (24.80)	19.56 (26.23)	16.04	66.82
T6	Hexaconazole 5% EC	500ml	7.11 (15.45)	9.19 (17.59)	12.00 (20.19)	14.67 (22.50)	15.85 (23.43)	12.93	73.26
T7	Hexaconazole 5% EC	750ml	5.04 (12.35)	7.70 (16.10)	10.67 (19.05)	12.00 (20.22)	13.63 (21.65)	11.00	77.24
T8	Mancozeb 75% WP	1500g	4.89 (11.94)	10.81 (19.19)	13.63 (21.64)	15.85 (23.45)	17.19 (24.47)	14.37	70.27
T9	Untreated control	-	7.56 (15.95)	31.11 (33.85)	49.04 (44.43)	55.26 (48.01)	57.93 (49.55)	48.33	
	S.Em ±		1.49	0.96	1.16	0.84	0.88		
	CD at 5%		4.46	2.88	3.48	2.52	2.63		

Figures in the parenthesis are angular transformed values

Table.5 Effect of Taqat 75% WP against Leaf spot in Tomato during *Rabi*, 2017-18

Tr. No	Treatments	Dose/ha (Formula tion)	Per cent Disease Index (PDI)					Mean	% control
			Pre-treatment	10 Days After 1st spray	15 Days After 1st spray	10 Days After 2nd spray	15 Days After 2nd spray		
T1	Taqat 75% WP	500g	4.89 (12.69)	6.52 (14.63)	7.41 (15.70)	9.63 (18.06)	10.67 (19.02)	8.56	82.49
T2	Taqat 75% WP	750g	5.19 (13.15)	5.78 (13.88)	6.07 (14.22)	7.41 (15.66)	8.15 (16.48)	6.85	85.97
T3	Captan 50% WP	700g	5.04 (12.95)	12.30 (20.22)	14.67 (22.42)	16.74 (24.13)	18.22 (25.13)	15.48	68.31
T4	Captan 50% WP	1050g	4.89 (12.76)	10.67 (18.98)	12.89 (21.03)	14.67 (22.49)	16.89 (24.24)	13.78	71.80
T5	Captan 50% WP	2500g	5.19 (13.15)	9.78 (17.94)	11.56 (19.80)	13.33 (21.37)	14.81 (22.50)	12.37	74.68
T6	Hexaconazole 5% EC	500ml	5.19 (13.15)	7.85 (16.24)	9.93 (18.35)	11.56 (19.84)	12.74 (20.88)	10.52	78.47
T7	Hexaconazole 5% EC	750ml	5.48 (13.52)	6.96 (15.27)	8.59 (16.81)	9.78 (18.11)	10.67 (19.05)	9.00	81.58
T8	Mancozeb 75% WP	1500g	5.19 (13.15)	8.89 (17.33)	11.41 (19.72)	13.04 (21.16)	14.22 (22.14)	11.89	75.66
T9	Untreated control	-	6.81 (14.90)	35.85 (36.75)	46.67 (43.06)	53.78 (47.15)	59.11 (50.23)	48.85	
	S.Em ±		0.82	1.57	1.24	0.97	1.24		
	CD at 5%		2.47	4.70	3.71	2.91	3.73		

Figures in the parenthesis are angular transformed values

Effect on yield

All the fungicidal treatments showed the impact on the increase in the fruit yield. Maximum fruit yield of 28.76 tones/ha was recorded in Taqat 75% WP @ 750g/ha. Which was followed by its lower dose of 500g/ha (27.73 tones/ha), Hexaconazole 5% EC @ 750ml/ha recorded 27.26 tones/ha, Captan 50% WP @ 2500g/ha recorded 26.79 tones/ha, Captan 50% WP @ 1050g/ha recorded 26.61 tones/ha and Minimum fruit yield of 22.56 tones was recorded in untreated control (Fig. 1).

Based on experimental results, it can be concluded that Taqat 75% WP (Captan 70% + Hexaconazole 5%) @ 750 g/ha is highly effective in controlling leaf spot and fruit spot

diseases of tomato and increasing tomato fruit yield. Application of Taqat 75% WP is not causing any phytotoxicity to the crop.

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