Research Article

Bio-Efficacy and Phytotoxicity of Tebuconazole 430 SC on Onion Purple Blotch under Field Condition

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Abstract

Onion (*Allium cepa*) belonging to the family Alliaceae is one of the most widely cultivated crops in the world. Successful cultivation of onion in recent years has met with different problems such as pests and diseases. Among the various fungal diseases, purple blotch caused by *Alternaria porri* (Ellis) Cif. is one of the most serious disease of onion which causes extensive damage to bulbs as well as seed crop. Therefore, a field experiment was carried out on the effect of Tebuconazole 430 SC during 2015-16 and 2016-2017, *Kharif* at College of Horticulture, Hiriyur. Experimental results revealed that all the treatments significantly reduced the purple blotch disease severity over untreated control. Tebuconazole 430 SC @ 2.00 mL/lit is most effective in management of onion purple blotch with least PDI of 6.67 and 6.50 which is followed by the same fungicide @ 1mL/lit with PDI of 7.67 and 7.58 when compared to the other treatments and also compared to control where the PDI recorded was 29.33 and 26.33 with yield level of 18 t/ha and 16.5 t/ha in Tebuconazole 430 SC @ 2.00 mL/lit and Tebuconazole 430 SC @ 1.00 mL/ lit respectively and there were no phytotoxicity symptoms like epinasty, hyponasty, vein clearing, yellowing, necrosis, leaf margin burning, rossetting and wilting were observed in different concentrations of Tebuconazole 430 SC @ 2.00 mL/lit and 1.00 mL/lit.

Keywords: Onion, Purple blotch, Tebuconazole

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Introduction

Onion (*Allium cepa* L.) (2n=16) is one of the major bulb crops of India. It belongs to the genus Allium of Alliaceae family. According to Vavilov [1] the primary centre of origin lies in central Asia. The near east and Mediterranean are the secondary centers of origin. Onion is known for its flavour, pungency and also as an eco-friendly stored grains protectant. The chief component which is responsible for pungency in onion is an alkaloid "Allylpropyl disulphide". It is being used in several ways as fresh, frozen, dehydrated bulbs and green bunching types. Dehydrated bulbs or onion powder is in great demand, which reduces the transport cost and storage losses.

In India, onion is grown in an area of 1.02 million ha with a production of 14.82 m tonnes and productivity of 14.61t ha-1. Anonymous [2]. The prominent onion growing states are Maharastra, Gujarat, Uttar Pradesh, Orissa, Karnataka, Tamil Nadu and Andhra Pradesh. In Karnataka, it occupies an area of 0.15 m ha with the production of 2.38 m tones and productivity of 16.05 t ha-1 Anonymous [2]. Dharwad, Chitradurga, Bijapur, Bellary and Gulbarga are major district of onion cultivation. Karnataka is the second leading producer of onion in India. It contributes 18.6 per cent to the total onion production in the country. In Karnataka, Dharwad occupied the highest area of 26,978 hectares and the production is 4,35,276 metric tonnes with the productivity of 16.13 tonnes per hectare. Dharwad alone contributes 20 per cent of the total state production. Chitradurga is the second leading producer in the state with area, production and productivity of 16,784 hectares, 3.33 lakh tonnes and 19.89 tonnes per hectare respectively. The four major districts *viz*., Dharwad, Chitradurga, Gadag and Bijapur are contribute 59 per cent of the total production in the state

Several factors have been identified for the low productivity of onion in India. The most important factors responsible are the diseases like purple blotch, downy mildew, Stemphylium blight, basal rot and storage rots and non-availability of varieties resistant to biotic and abiotic stresses Yadav *et al* [3].

Among the foliar diseases, purple blotch is one of the most destructive diseases, commonly prevailing in almost all onion growing pockets of the world, which causes heavy loss in onions under field conditions. For the first time the purple blotch of onion caused by *Alternaria cepulae* was observed by Ponnappa [4] in Karnataka. This was not

recognized as a major foliar and inflorescence disease until recently, however now a day it is one of the important diseases. The name "Purple blotch" for this disease was proposed by Nolla [5]. He named the causal organism as *Alternaria alli* which was later amended as *Alternaria porri.*

Purple blotch of onion is noted as a major disease throughout the world including Bangladesh (Ahmed and Hossain [6]; Meah and Khan [7]; Bose and Som [8] and Castellanos-Linares *et al* [9]. In India purple blotch of onion is a major devastating and widespread disease and causes serious yield reduction. Ahmed and Goyal [10]

The pathogen *Alternaria porri* belongs to class Deutromycetes, order Moniliales, family Dematiaceae, genus *Alternaria* and species *A. porri* destructs the leaf tissue which destroys the stimulus for bulb initiation and delays bulbing and maturation Lilly and Barnet [11]. Severe attack on flowering alliums can completely girdle flower stalks with necrotic tissue, causing their collapse and total loss of seed production capacity. Further, seed infection causes more severe economic loss in seed production. Over the recent decades purple blotch has become menace to onion growers in India. There are no resistant varieties available for cultivation in India against purple blotch. With increase in production of onion in the country, the emphasis was laid on export of onion. Hence, to increase the further production and productivity of onion, the disease incidence has to be reduced.

Most of the new generation fungicides are highly specific and single site in mode of action. Thus, a novel fungicide with novel mode of action needs to be identified and evaluated under field conditions. Our objective was to determine the efficacy of different doses of newer generation fungicidal formulations of Tebuconazole 430 SC to develop a management module for onion purple blotch.

Material and Methods

The experiment was laid out with randomized block design (RBD). Onion seeds were directly sown in 15cm wide rows in plots of net plot size of 2.5x1.5m. Twenty-five days after sowing; thinning of seedlings was done to maintain a spacing of 10cm between plants and 15 cm between rows. The fertilizer application *i.e.*, FYM (25 t/ha) and NPK (Urea: 65 kg, single Super phosphate: 366 kg, murate of Potash: 46.5kg) and other agronomic practices for cultivation of onion were followed as per recommendations given in package of practice. The field was kept free from weeds by frequent hand weeding during the early crop growth stage. The treatment fungicides were sprayed to the onion plot at the beginning of the disease appearance. Spray schedule was repeated at 14 days interval [12]. The observation of *Alterneria porri* was recorded using 0-5 scale given by Sharma, [13] at before and after each spray.

The details of 0-5 scale is as follows

0 - No disease symptom; 1 - A few spots towards tip covering 10 percent leaf area.; 2 - Several purplish brown patches covering up to 20 percent of leaf area.; 3 - Several patches with pale outer zone covering up to 40 percent leaf area; 4 – Leaf streaks covering up to 75 percent leaf area or breaking of the leaves from center and 5 - Complete drying of the leaves or breaking of leaves from center. Observations are taken after each application.

The per cent disease index (PDI) was calculated by the following formula which was given by Wheeler [14].

$$\text{Per cent disease index (PDI)} = \frac{\text{Sum of the individual disease ratings}}{\text{Number of leaves/flowers observed}} \times \frac{100}{\text{Maximum disease grade}}$$

Observations recorded

1. Per cent Disease Index of onion purple blotch.
2. Phytotoxicity on foliage
3. Yield/ha

The field experiment on bio efficacy and phytotoxicity of Tebuconazole 430 SC against purple blotch of onion was carried out during 2015-16 and 2016-17 at College of Horticulture, Hiriyur, UAHS, Shivamogga. The spray schedule was initiated soon after the disease appearance. The research results of 2015-16 and 2016-17 revealed that the foliar disease of onion purple blotch was observed.

For Phytotoxicity studies

Sl. No	Treatment	g. a.i /ha	Formulation (mL/lt)
1	Untreated check		
2	Tebuconazole 430 SC*	1.00	1.2
3	Tebuconazole 430 SC*	1.50	2.4

Experimental Results

The results of first spray in the year (2015-2016) indicated that there were not much significant differences among the treatments imposed with respect to the reduction of purple blotch. However, the plot treated with Tebuconazole 430 SC @ 2.0 mL/lt has recorded lowest Per cent Disease Index (PDI) (6.67 %) of purple blotch which is followed by Tebuconazole 430 SC @ 1.00 mL/lit (7.67 %) and Tebuconazole 430 SC @ 0.88 mL/lit (12.33 %).However Tebuconazole 430 SC @ 0.75 mL/lit and Tebuconazole 250EC @ 1.5 mL/lit, treatments showed same reduction in PDI (13.67), but it is significantly superior over Zineb @ 2.0 g/lit in managing purple blotch (24.33) (Table 1).

During the second year 2016-17 spray there is no much significant differences among the treatments imposed with respect to the reduction of foliar diseases compare to first season. The diseases severity of purple blotch is less with PDI of 6.50 has been observed after second spray with Tebuconazole 430 SC @ 2.0 mL/lit which is followed by Tebuconazole 430 SC @ 1.00 mL/lit (7.58) and Tebuconazole 430 SC @ 0.88 mL/lit (14.17). However, this treatment is on par with other treatments, but it is significantly superior over Zineb @ 2.0 g/lit in managing purple blotch (26.17) (Table 2).

The results of pooled analysis for two years revealed highest yield was recorded in treatment Tebuconazole 430 SC @ 2.0 mL/l (18 t/ha and 17.67 t/ha) followed by Tebuconazole 430 SC @ 1.00 mL/lit (15.67 and 16.50 t/ha) and Tebuconazole 430 SC @ 0.88 mL/lit (13.17 and 9.37) respectively (Table 1 and 2).

Table 1 Bio-efficacy and Phytotoxicity of Tebuconazole 430 SC Onion Purple blotch (2015-16)

Sl.no.	Treatments	Dosage (g or mL/lt of water	PDI	Yield (t/ha.)
1	Untreated Control	-	29.33	3.00
2	Tebuconazole 430 SC	0.75	13.67	10.00
3	Tebuconazole 430 SC	0.88	12.33	13.17
4	Tebuconazole 430 SC	1	7.67	15.67
5	Tebuconazole 250 EC (Tebuconazole 25.9% m/m EC)	1.5	13.67	8.50
6	Zineb 75% WP	2	24.33	4.0
7	Tebuconazole 430 SC	2	6.67	18.0
	SEm+		0.92	0.61
	CV%		9.45	10.16
	CD@5%		2.83	1.87

Table 2 Bio-efficacy and Phytotoxicity of Tebuconazole 430 SC Onion Purple blotch (2016-17)

Sl.no.	Treatment	Dosage (g or mL/lt of water	PDI	Yield (t/ha)
1	Untreated Control	-	26.33	1.17
2	Tebuconazole 430 SC	0.75	14.33	9.37
3	Tebuconazole 430 SC	0.88	14.17	8.33
4	Tebuconazole 430 SC	1	7.58	16.50
5	Tebuconazole 250 EC (Tebuconazole 25.9% m/m EC)	1.5	16.33	7.50
6	Zineb 75% WP	2	26.17	3.83
7	Tebuconazole 430 SC	2	6.50	17.67
S. Em. ±			0.82	0.44
CD at 5%			2.54	1.34

Phytotoxicity

There were no phytotoxicity symptoms like epinasty, hyponasty, vein clearing, yellowing, necrosis, leaf margin burning, rossetting and wilting were observed in different concentrations of Tebuconazole 430 SC @ 2.00 mL/lit and 1.00 mL/lit at different days of intervals like 0, 1, 3, 5, 7 and 10 days after spraying (**Table 3**).

The present findings are in close agreement with those earlier reported by Upamanyu [15], Beig *et al* [16], Aujila *et al*. [17], Aujila *et al*. [18] and Bhatia and Chahal [19] who have also reported the superiority of tebuconazole,

propiconazole, difenoconazole and hexaconazole over conventional fungicides in controlling the disease. The more or less similar results were found by Akbari and Parakhia [20]. Raavi *et al*. [21] reported that Tebuconazole 25.9 % EC was very effective in management of Early blight of tomato both under in vitro and field condition. The present findings were also in agreement with the work of Rani *et al*. [22] where they reported that Tebuconazole 25 EC was very effective in the management of early blight of tomato and jamun followed by Difenconazole. The effectiveness of the triazole fungicide tebuconazole may be attributed to their interfeance with the biosynthesis of fungal sterols and inhibit the ergosterol biosynthesis. In many fungi, ergosterol is essential to the structure of cell all and its absence cause irreparable damage to cell wall leading to death of fungal cell and this fungicide cause demethylation of C-14 during ergosterol biosynthesis leading to the accumulation of C-14 methyl sterols. The biosynthesis of these ergosterols is critical to the formation of cell wall in fungi. Lack of normal sterols production slower down or stops the growth of the fungus preventing further infection and invasion of host tissues and hence this fungicide gave good results in the management of purple blotch of onion.

Table 3 Effect of Tebuconazole 430 SC on onion (mean of two years) (2015-16 and 2016-17)

Treatments	**Dose**	**Score values on**																
	(g or	**0 DAA**						**1 DAA**						**3 DAA**				
	mL/lt)	**A**	**B**	**C**	**D**	**E**	**F**	**A**	**B**	**C**	**D**	**E**	**F**	**A**	**B**	**C**	**D**	**F**
Tebuconazole 430 SC	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tebuconazole 430 SC	2.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Untreated check	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		5 DAA						**7 DAA**						**10 DAA**				
		A	**B**	**C**	**D**	**E**	**F**	**A**	**B**	**C**	**D**	**E**	**F**	**A**	**B**	**C**	**D**	**F**
Tebuconazole 430 SC	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tebuconazole 430 SC	2.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Untreated check	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

A: Leaf injury on tips and leaf surface; B: Wilting; C: Leaf vein clearing; D: Necrosis; E: Epinasty; F: Hyponasty; DAA: Days after Application.

Conclusions

Based on the experimental results it has been found that, Tebuconazole 430 SC @ 2.00 ml/lit is most effective in management of onion purple blotch which is followed by the same fungicide @ 1ml/lit when compared to the other treatments and yield level of 18t/ha and 16.5t/ha respectively. Tebuconazole 430 SC @ 2.00 ml/lit was found to be optimum dosage for management of purple blotch and harvest of maximum yield. Tebuconazole 430 SC @ 2.00 ml/lit was found to be non-phytotoxic and was safe to onion crop

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