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Management and yield assessment of turmeric leaf blotch

S. BEHERA*AND P. SIAL

High Altitude Research Station, OUAT, Pottangi - 764039, Odisha, India

**b.sunita10@ rediffmail.com*

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ABSTRACT

A field experiment was conducted during June 2018 to February 2019 at High Altitude Research Station, Pottangi, Koraput district under Odisha University of Agriculture and Technlogy, Bhubaneswar to evaluate various fungicides against leaf blotch of turmeric. Treatments included the fungicides Flusilazole+Carbendazim (0.1%), Hexaconazole (0.1%), Thiophonate Methyle (0.1%), Azoxystrobin+Tabuconazole (0.1%) and Carbendazim+Mancozeb (0.15%) for both rhizome treatment and foliar spray at 60 and 90 days after planting. Among the treatments, rhizome treatment and foliar application with Azoxystrobin+Tabuconazole (0.1%) shown the best result, significantly reduced disease intensity of turmeric leaf blotch (5.62%) and enhanced fresh-rhizome yield 22.33 t ha^{-1} followed by Carbendazim+Mancozeb (0.15%) with (6.77%) disease intensity and 21.45 t ha^{-1} fresh rhizome yield over control with (21.58%) disease intensity and 16.85 t ha^{-1} fresh rhizome yield. High cost-benefit ratio (0.91:1) was achieved with the treatment of Azoxystrobin+Tabuconazole.

Key words: Azoxystrobin, carbendazim, leaf blotch , mancozeb, tabuconazole, turmeric

INTRODUCTION

Turmeric (*Curcuma longa* L.) a rhizomatous perennial belonging to the family Zingiberaceae, is native to tropical South Asia, most probably from India. Commonly known as 'Indian saffron' and is one of the important commercial spice crops. Curcumin and oleoresin are reported to lower the total cholesterol in blood serum (Manjunatha and Srinivasa, 2008). The plant is propagated through rhizomes. The pseudo stems are shorter than leaves. The rhizomes are ready for harvesting in about 7 to 9 months after planting. India is the largest producer, consumer and exporter of turmeric in the world (Anon., 2019). In India, turmeric crop is cultivated in an area of 2.38 lakh ha with a total production of 11.33 lakh ton (Anon., 2018a). The most important foliar diseases of turmeric are leaf spot caused by *Colletotrichum capsici* and leaf blotch caused by *Taphrina maculans* (Vijayakumar, 2017). Leaf blotch disease is commonly occurring in almost all turmeric growing areas of India (Velayudhan et al., 1999). In Odisha, turmeric is an important cash crop grown by tribals for their livelihood. As per the recent data of Agrivikas from National Institute of Agricultural Marketing under Ministry of Agriculture, Government of India, Odisha contributes about 21% of India's turmeric cultivation in terms of area and Kandhamal makes up for over 50 % of the state's total share (Anon., 2018b). Odisha produces turmeric to the tune of 54500 MT from 27860 ha (Anon., 2018b). Kandhamal district stands first in turmeric crop both in terms of area as well as production in the state and Koraput is the second largest producing district followed by Nayagarh and Keonjhar .

Taphrina leaf blotch appears on the lower leaves and usually late in the crop season during October-November. Symptoms appear as small, oval, rectangular or irregular brown spots on either side of the leaves (Fig. 2) at early stage which soon become dirty yellow or dark brown (Fig. 3) at later stage. This disease infects plant leaves as well as leaf sheath. It reduces total photosynthetic blotch area of the plant leaves under severe infection (Maurya et al., 2011). The leaves also turn yellow. In severe cases the plants exhibit a scorched appearance and the rhizome yield is reduced. Yield losses were 37.6 to 52.9% due to attack of this fungus (Panja et al., 2000). Very limited effort was made to develop a management strategy with new systemic fungicides. Hence, the present study was conducted for managing leaf blotch disease in turmeric using new systemic fungicides.

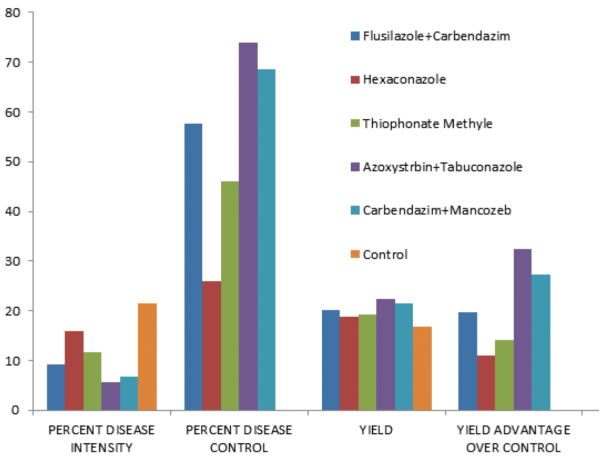

Fig. 1 . Effect of fungicides on leaf blotch of turmeric

Fig. 2. Symptoms of leaf blotch of turmeric (early stage)

Fig. 3. Symptoms of leaf blotch of turmeric (late stage)

MATERIALS AND METHODS

Field experiment was conducted at High Altitude Research Station (HARS), Pottangi, Koraput under Odisha University of Agriculture and Technology (OUAT), Bhubaneswar (Fig. 4). Field trials were laid out with six treatments and three replications in Randomized Block Design. Forty rhizomes were planted on raised beds of 3 x 1 m size at a spacing of 30 x 25 cm. Nitrogen, phosphorus and potassium (NPK) were applied @ 60 kg ha^{-1}, 30 kg ha^{-1} and 90 kg ha^{-1} respectively in the form of urea, single super phosphate and muriate of potash as basal and top dressing. Fungicides such as Flusilazole + Carbendazim (0.1%), Hexaconazole (0.1%), Thiophonate Methyle (0.1%), Azoxystrobin + Tabuconazole (0.1%) and Carbendazim + Mancozeb (0.15%) were applied separately by dipping rhizomes in the fungicide solution before planting followed by foliar application at 60 and 90 DAP. There were six treatments including control.

Fig. 4. Research plot at HARS, Pottangi

The treatment details of rhizome and foliar application are furnished in Table 1. The first spray was applied at 60 days after planting (DAP) and the second at 90 DAP. Observation on disease intensity was recorded 20 days after the last spray, i.e., 110 DAP.

The percentage of disease intensity was calculated by following formula.

% Disease Intensity = (Number of infected plants)/ (Total number of plants) x 100

The percentage of disease control was calculated by following formula.

% of Disease Control = (Per cent disease intensity in control - Per cent disease intensity in treatment) / (Per cent disease intensity in control) x 100

Table 1. Effect of fungicides on leaf blotch of turmeric

Sl..	Treatment details	*% disease intensity	% disease control	*Yield (t ha^{-1})	Yield advantage over control (%)	B:C
T1	Flusilazole+Carbendazim (0.1%)	9.16	57.6	20.18	19.76	0.73:1
T2	Hexaconazole (0.1%)	15.96	26.04	18.72	11.09	0.60:1
T3	Thiophonate Methyle (0.1%)	11.66	45.96	19.22	14.06	0.64:1
T4	Azoxystrobin+Tabuconazole (0.1%)	5.62	73.95	22.33	32.52	0.91:1
T5	Carbendazim+Mancozeb (0.15%)	6.77	68.62	21.45	27.29	0.83:1
T6	Control	21.58	-	16.85	-	0.44:1
CD(5%)		4.42		0.89		
SEm±		1.47		0.29		

*Mean of three replications

RESULTS AND DISCUSSION

Statistical analysis of data revealed that all fungicidal treatments showed significantly superior effect over disease intensity and yield. Disease intensity varied from 5.62 to 21.58%, recorded during the course of the study. Results indicated that rhizome treatment, followed by foliar application of Azoxystrobin + Tabuconazole (0.1%) and Carbendazim + Mancozeb (0.15%) were at par with each other (with corresponding per cent disease intensity of 5.62 and 6.77 respectively). The highest per cent of disease control (73.95%) was recorded in treatment of Azoxystrobin + Tabuconazole (0.1%) followed by Carbendazim+Mancozeb (0.15%) with (68.62%) disease control. These treatments were significantly superior over other fungicidal treatments. Highest fresh rhizome yield 22.33 t ha^{-1} was achieved in application of Azoxystrobin+Tabuconazole (0.1%) followed by Carbendazim+Mancozeb (0.15%) with 21.45 t ha^{-1} yield. Similarly Azoxystrobin + Tabuconazole (0.1%) gives the highest yield advantage over control 32.52% followed by Carbendazim+Mancozeb (0.15%) with 27.29%. Similar type of experiment has been carried out by Chopada and Rakholiya (2015) on assessment of yield losses due to leaf blotch of turmeric caused by *Taphrina maculans*.

Economics for each fungicide was calculated based on mean yield analysis (Table 2). All the treatments were economically beneficial over the control. Azoxystrobin + Tabuconazole (0.1%) gave the best economic returns i.e. 0.91:1 among the fungicides tested followed by Carbendazim+Mancozeb (0.15%) with 0.83:1. Results of this study on foliar application of Carbendazim+Mancozeb are in agreement with the studies undertaken by Prasadji et al. (2004) and Singh et al. (2003). Azoxystrobin got excellent inhibition capacity on spore germination and mycelial growth of fungus (Petit et al., 2012) which may be a key factor for its superior impact on management of leaf blotch causing fungus. Being both systemic and contact in nature fungicides like Carbendazim + Mancozeb when applied at regular interval got good impact on management of leaf blotch which corroborates the work undertaken by Rao and Kumar (2013).

Table 2. Economic analysis of treatments on leaf blotch of turmeric

Sl.	Treatments	Yield (t ha^{-1})	Gross return	Cost of cultivation	Benefit	Benefit: cost
T1	Flusilazole+Carbendazim (0.1%)	20.18	605400	349935	255465	0.73:1
T2	Hexaconazole (0.1%)	18.72	561600	349935	211665	0.60:1
T3	Thiophonate Methyle (0.1%)	19.22	576600	349935	226665	0.64:1
T4	Azoxystrobin+Tabuconazole (0.1%)	22.33	669900	349935	319965	0.91:1
T5	Carbendazim+Mancozeb (0.15%)	21.45	643500	349935	293565	0.83:1
T6	Control	16.85	505500	349935	155565	0.44:1

CONCLUSION

Based on the study, it is concluded that rhizome treatment followed by foliar spray with Azoxystrobin+Tabuconazole (0.1%) was the most effective in managing leaf blotch and for increasing yield in turmeric followed by Carbendazim+Mancozeb (0.15%).

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