



Management of leaf spot of turmeric (*Curcuma longa* L.) caused by *Colletotrichum capsici* through fungicides

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Abstract

An experiment was conducted to evaluate the efficacy of four fungicides *viz.*, hexaconazole (0.1%), propiconazole (0.1%), tricyclazole (0.1%) and carbendazim + mancozeb (0.1%) for the management of leaf spot disease of turmeric through rhizome treatment + foliar spray and foliar spray alone at 45 and 90 days after planting (DAP). Rhizome treatment with carbendazim + mancozeb gave the best results for rhizome germination (91.13%) followed by propiconazole (88.40%) and hexaconazole (87.33%). Foliar application of propiconazole (0.1%) at 45 and 90 DAP was significantly superior in minimizing percent disease intensity (27.61) with increased fresh rhizome yield (33.96 - 34.33 t ha⁻¹). C:B ratio was the highest (1:2.65) with foliar spray of propiconazole.

Keywords: *Colletotrichum capsici*, *Curcuma longa*, fungicides, leaf spot, turmeric

Turmeric (*Curcuma longa* L.) is one of the most important spice crops cultivated in India. The annual production of turmeric in India is about 1062.5 thousand m t from 199.0 thousands ha. In Uttar Pradesh, the area covered under turmeric cultivation is 1828 ha with production of 5149 mt tonnes (Anonymous 2012). This crop is highly prone to several fungal diseases (Naidu 1988; Purthi 2000). The serious foliar diseases on turmeric reported in UP are leaf spot caused by *Colletotrichum capsici* (Syd.) Butler & Bisby and leaf blotch caused by *Taphrina maculans* Butler. Among them, leaf spot is most important disease resulting in losses of 25.83 - 62.12% fresh weight and 42.10 - 62.10% dry weight of rhizomes (Nair & Ramakrishnan 1973; Hudge & Ghogul 2010). Keeping in view the economic importance of the crop, efforts

were made to evaluate various fungicides for managing the disease.

The field experiments were conducted at Vegetable Research Farm, N.D. University of Agriculture & Technology, Kumarganj, Faizabad from 2010-2012 in sandy loam soil with leaf spot disease susceptible NDH-1 variety. The trial was laid out in randomized block design with nine treatments and three replications. Rhizomes were planted on raised beds of 3 × 1 m size at spacing of 30 × 20 cm in the first fortnight of June. The other normal agronomical practices were adopted to raise the crop except fungicide treatment. Four fungicides *viz.*, hexaconazole (0.1%), propiconazole (0.1%), tricyclazole (0.1%), carbendazim + mancozeb (0.1%) were applied by rhizome treatment as

well as foliar spray at 45 and 90 DAP and foliar spray at 45 and 90 DAP. The observation on germination was recorded at 30 DAP, leaf spot intensity was recorded 15 days after last spray i.e. 105 DAP on 10 randomly selected plants in each replication for disease scoring. The disease rating was recorded by adopting 0-6 scale (Palarpawar & Ghurde 1989), where 0=No infection (Healthy plants), 1=0.1-10% leaf area infected, 2=10.1-20% leaf area infected, 3=20.1-30% leaf area infected, 4=30.1-40% leaf area infected, 5=40.1-50% leaf area infected, 6=> 50% leaf area infected. The percent disease intensity (PDI) was calculated according to the formula suggested by Datar & Mayee (1981) given as below;

$$\text{PDI} = \left[\frac{\text{Sum of rating of infected leaves in plant}}{\text{(Total no. of leaves observed} \times \text{maximum disease score)}} \right] \times 100$$

The percent efficacy of disease control (PEDC) was calculated using the following formula;

$$\text{PEDC} = \left[\frac{\text{(Disease in control - Disease in treatment)}}{\text{(Disease in control)}} \right] \times 100$$

The yield of turmeric (fresh rhizome) in each treatment was recorded and economics of each treatment was worked out by calculating the cost of production, expenditure incurred on the accounts of fungicides, costs and labour charges for spraying. Cost: benefit ratio was determined per treatment per hectare based on the existing selling rates of the turmeric in the local market. The data obtained in all the experiments were statistically analyzed. The percent values were transformed into Arcsine values.

The pooled analysis for this trial was worked out from 2010 to 2012 and results are presented in Table 1. All the fungicidal treatments showed significantly higher effect over the control on germination, disease intensity and yield. The rhizome germination varied from 81.53-91.13%. The maximum germination was found in rhizome treatment + foliar spray of carbendazim + mancozeb (0.1%) on 45 and 90 DAP followed by rhizome treatment + foliar spray of propiconazole (0.1%) at 45 and 90 DAP (88.43%) and rhizome treatment + foliar spray

of hexaconazole (0.1%) on 45 and 90 DAP (87.33%). All the fungicides significantly reduced the disease intensity as compared to control. Among the fungicides, minimum PDI was recorded by foliar spray of propiconazole (27.61) and rhizome treatment + foliar spray (28.50) at 45 and 90 DAP, which were on par with each other. The next best treatment was rhizome treatment + foliar spray of hexaconazole (29.84) and foliar spray of hexaconazole at 45 and 90 DAP (30.23). Tricyclazole and carbendazim + mancozeb were found less effective in managing leaf spot of turmeric. The results are supported by the findings of Rao *et al.* (2012) and Jagtap *et al.* (2013). The highest rhizome yield was observed with foliar spray of propiconazole at 45 and 90 DAP (34.33 t ha⁻¹). Rhizome treatment + foliar spray of propiconazole, hexaconazole, carbendazim + mancozeb at 45 and 90 DAP recorded yield of 33.96 t ha⁻¹, 33.22 t ha⁻¹ and 30.99 t ha⁻¹, respectively. Rhizome treatment + foliar spray and foliar spray of tricyclazole at 45 and 90 DAP were found less effective in increasing fresh rhizome yield. The present findings regarding the superiority of propiconazole in controlling leaf spot disease and increasing rhizome yield are in conformity with the results of Singh *et al.* (2003), Theerthagiri & Ramanujam (2009).

Results obtained on economics and cost: benefit ratio in respect of various treatments revealed that all the treatments significantly reduced the disease intensity and increase the fresh yield, which gave maximum gross and additional income with better C: B ratio over control. The most economical treatment with highest C: B ratio was the propiconazole (1:2.51 and 1:2.65), hexaconazole (1:2.45 and 1:2.32), carbendazim + mancozeb (1:2.22 and 1:2.28) and tricyclazole (1:2.14 and 1:2.21) in rhizome treatment + foliar spray and foliar spray only, respectively. The results obtained on the economics of fungicides for the management of foliar diseases of turmeric and other crops are in conformity with Singh *et al.* (1981), Gorawar *et al.* (2006) and Rao *et al.* (2012). It is concluded that rhizome treatment + foliar spray and foliar spray only of propiconazole (0.1%) at 45 and 90 DAP was

Table 1. Effect of fungicides on management of leaf spot disease of turmeric (Pooled analysis of 2010-12)

Treatments	Germination (%)	Leaf spot disease		Yield increase (%)	Cost: benefit ratio
		PDI	PEDC		
T ₁ - Rhizome treatment + foliar spray of hexaconazole (0.1%) on 45 and 90 DAP	87.33 (69.14)	29.84 (33.09)	35.28 (35.97)	17.92	1:2.45
T ₂ - Rhizome treatment + foliar spray of propiconazole (0.1%) on 45 and 90 DAP	88.43 (70.49)	28.50 (32.19)	42.00 (40.16)	20.55	1:2.51
T ₃ - Rhizome treatment + foliar spray of tricyclazole (0.1%) on 45 and 90 DAP	86.43 (68.42)	33.72 (35.43)	32.95 (34.62)	8.83	1:2.14
T ₄ - Rhizome treatment + foliar spray of carbendazim + mancozeb (0.1%) on 45 and 90 DAP	91.13 (73.05)	35.90 (36.79)	27.72 (31.60)	10.06	1:2.22
T ₅ - Foliar spray of hexaconazole (0.1%) on 45 and 90 DAP	84.53 (67.09)	30.23 (33.21)	37.73 (37.29)	10.56	1:2.32
T ₆ - Foliar spray of propiconazole (0.1%) on 45 and 90 DAP	87.80 (69.32)	27.61 (31.60)	42.35 (40.24)	21.86	1:2.65
T ₇ - Foliar spray of tricyclazole (0.1%) on 45 and 90 DAP	86.10 (68.16)	36.97 (37.42)	23.42 (28.55)	7.66	1:2.21
T ₈ - Foliar spray of carbendazim + mancozeb (0.1%) on 45 and 90 DAP	87.00 (68.52)	38.72 (38.43)	21.08 (27.17)	10.06	1:2.28
T ₉ - Control	81.53 (64.62)	49.94 (44.96)	-	28.17	1:2.09
SEM±	1.35	2.214	4.594	2.18	-
CD (P<0.05)	3.97	6.612	13.722	6.48	-

*Figures in the parentheses are arc sine transformed values; DAP=Days after planting; PDI=Percent disease intensity; PEDC=Percent efficacy of disease control

effective in reducing leaf spot intensity and increasing the yield of turmeric.

References

- Anonymous 2012 Annual report of National Horticulture Board, pp.8-10.
- Datar V V & Mayee C D 1981 Assessment losses in tomato yield due to early blight. *Indian Phytopath.* 34: 191-195.
- Gorawar M N, Hedge V R & Kulkarni S 2006 Biology and management of leaf spot of turmeric caused by *Colletotrichum capsici*. *J. Plant Dis. Sci.* 1: 156-158.
- Hudge B V & Ghogul S V 2010 Losses in yield and quality of turmeric due to leaf spot disease caused by *Colletotrichum capsici*. *Intl. J. Agri. Sci.* 6: 43-45.
- Jagtap G P, Mali A K & Utpal Dey 2013 Bioefficacy of fungicides, biocontrol agents and botanicals against leaf spot of turmeric incited by *Colletotrichum capsici*. *Afr. J. Microbial. Res.* 7: 1865-1873.
- Naidu M R 1988 Price spreads of turmeric and chillies regulated marketing in Guntur district, Andhra Pradesh-A comparative study. *Indian J. Agri. Market.* 2: 117-119.
- Nair M C & Ramakrishnan K 1973 Effect of *Colletotrichum* leaf spot disease of turmeric (*Curcuma longa* L.) on the yield and quality of rhizomes. *Curr. Sci.* 42: 549-554.
- Palarpawar M Y & Ghurde V R 1989 Fungicidal control of leaf spot of turmeric incited by *Colletotrichum curcumae*. *Indian Phytopath.* 42: 576-578.
- Purthi J S 2000 Quality assurance in spice and spice products, modern methods of analysis. Allied Publ. Ltd., New Delhi.
- Rao S N, Kumar K R & Anandaraj M 2012 Management of leaf spot of turmeric (*Curcuma longa* L.) incited by *Colletotrichum capsici* through fungicides. *J. Spices Arom. Crops* 21: 151-154.
- Singh A K, Basandraj A & Sharma B K 2003 Fungicidal management of leaf spot of turmeric. *Indian Phytopath.* 56: 119-120.
- Singh S N, Bhargava P K & Khare M N 1981 Efficacy of fungicides in the control of soybean diseases. *Indian Phytopath.* 34: 107.
- Theerthagiri A & Ramanujam B 2009 Exploitation of plant products and bio-agents for ecofriendly management of chilli fruit rot disease. *J. Plant Prot. Res.* 49: 195-203.