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

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### Abstract

An experiment was conducted at Kammarpally (Andhra Pradesh) to evaluate the efficacy of four fungicides *viz.*, Propiconazole (0.1%), Hexaconazole (0.1%), Tricyclazole (0.1%) and Carbendazim + Mancozeb (0.1%) for the management of leaf spot disease (*Colletotrichum capsici*) of turmeric (*Curcuma longa* L.). Rhizome treatment with Carbendazim + Mancozeb (0.1%) gave the best results for germination (90.52%) and rhizome treatment and foliar application of Propiconazole (0.1%) at 45 and 90 days after planting (DAP) were significantly superior in reducing the disease index (20.01%) of leaf spot disease and increasing the fresh rhizome yield (17.13 t ha<sup>-1</sup>) as compared to other fungicides tested. The high cost – benefit ratio was achieved in rhizome treatment and foliar application of Carbendazim + Mancozeb at 45 and 90 DAP (1:1.92).

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

### Introduction

Turmeric (*Curcuma longa* L.) is intensively cultivated in the districts of Nizamabad, Guntur, Kadapa, Karimnagar, Warangal, Adilabad and parts of Khammam in Andhra Pradesh (AP). The important foliar diseases on turmeric reported in AP are leaf spot caused by *Collectotrichum capsici* [(Syd.) Butler & Bisby] and leaf blotch caused by *Taphrina maculans* Butler. Leaf spot is severe in Kadapa, Kurnool, Guntur, Krishna, Nizamabad and Godavari districts of AP. Leaf spot generally appears in the last week of August or first week of

September i.e when the crop is two months old. *C. capsici* is reported to reduce dry rhizome yield by 62.7% (Nair & Ramakrishnan 1973). Since the local clones are highly susceptible to this disease, efforts were made to evaluate various fungicides for management of the disease.

### Materials and methods

The field experiments were conducted at Horticultural Research Station, Jagtial (AP) from 2008–2010 and at Turmeric Research Station, Kammarpally (AP) during 2010–2011, in shallow, red chalka soils for three years with

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duggirala red variety. Duggirala red is susceptible to leaf spot and showed disease incidence ranging from 55.58 to 60.56% under natural condition (previous findings at HRS, Jagtial, without any spray). 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 a spacing of 30 × 15 cm in the first fortnight of July. Fertilizers like nitrogen (N), phosphorus (P) and potassium (K) were applied @ 190 kg, 75 kg and 120 kg per hectare in the form of urea, single super phosphate and muriate of potash, respectively, as per the recommendations of the Acharya NG Ranga Agricultural University. N was applied in four equal split doses *viz.*, at sowing, 40, 80 and 120 days after planting (DAP). Entire P was applied as basal and K was applied in two split doses *viz.*, at sowing and 80 DAP. Irrigation and weeding operations were carried out as and when necessary. Four fungicides *viz.*, Propiconazole (0.1%), Hexaconazole (0.1%), Tricyclazole (0.1%) and Carbendazim + Mancozeb (0.1%) were applied by rhizome treatment as well as foliar application at 45 and 90 DAP and foliar spray alone at 45 and 90 DAP (Table 1). A sticker, APSA 80 @ 0.1%, was mixed with the spray fluid for foliar application.

Observation on germination was recorded at 30 DAP, disease severity was recorded 20 days after last spray *i.e.* 110 DAP on 10 randomly selected plants in each replication for disease scoring. All the leaves of ten selected plants were individually scored based on 0–9 scale as suggested by Rao & Rao (1987). The percent disease index (PDI) and percent efficacy of disease control (PEDC) was calculated using the following formula.

Percent efficacy of disease control (PEDC) =

$$[\text{Disease in control} - \text{Disease in treatment} / \text{disease in Control}] \times 100$$

The yield of turmeric (fresh rhizome) in each treatment was recorded and economics of disease control was determined using cost:benefit ratio.

## Results and discussion

All fungicidal treatments showed significantly superior effect over the control on germination, PDI and yield. The disease intensity varied from 16.46 to 41.93% during the three years of study. The pooled analysis for this trial was worked out from 2008–09 to 2010–11 and results are presented in Table 2. All the fungicidal treatments showed significantly less disease incidence than the control during the three years of investigation. Least disease incidence

**Table 1.** Treatment tested

| Treatment code | Treatment details   |
|----------------|---|
| T1             | Rhizome treatment with Hexaconazole (0.1%) + foliar spray of Hexaconazole (0.1%) on 45 and 90 DAP                   |
| T2             | Rhizome treatment with Propiconazole (0.1%) + foliar spray of Propiconazole (0.1%) on 45 and 90 DAP                 |
| T3             | Rhizome treatment with Tricyclazole (0.1%) + foliar spray of Tricyclazole (0.1%) on 45 and 90 DAP                   |
| T4             | Rhizome treatment with Carbedazim + Mancozeb (0.1%) + foliar spray of Carbedazim + Mancozeb (0.1%) on 45 and 90 DAP |
| T5             | Foliar spray of Hexaconazole (0.1%) on 45 and 90 DAP  |
| T6             | Foliar spray of Propiconazole (0.1%) on 45 and 90 DAP   |
| T7             | Foliar spray of Tricyclazole (0.1%) on 45 and 90 DAP  |
| T8             | Foliar spray of Carbedazim + Mancozeb (0.1%) on 45 and 90 DAP   |
| T9             | Check   |

DAP=Days after planting

**Table 2.** Effect of fungicides on management of leaf spot of turmeric (pooled analysis 2008–11)

| Treatment  | Percent germination | Leaf spot         |                   | Yield (t ha <sup>-1</sup> ) | % increase over control | Cost benefit ratio |
|--|---------------------|-------------------|-------------------|-----------------------------|-------------------------|--------------------|
|  |                     | PDI               | PEDC              |                             |                         |                    |
| T <sub>1</sub> : Rhizome treatment + foliar spray of Hexaconazole (0.1%) on 45 and 90 DAP          | 87.27<br>(69.12)*   | 24.47<br>(29.67)* | 30.91<br>(33.77)* | 16.98                       | 26.81                   | 1:1.79             |
| T <sub>2</sub> : Rhizome treatment + foliar spray of Propiconazole (0.1%) on 45 and 90 DAP         | 88.98<br>(70.54)    | 20.01<br>(26.56)  | 40.68<br>(39.58)  | 17.13                       | 27.93                   | 1:1.81             |
| T <sub>3</sub> : Rhizome treatment + foliar spray of Tricyclazole (0.1%) on 45 and 90 DAP          | 86.36<br>(68.28)    | 24.67<br>(29.67)  | 30.35<br>(33.40)  | 15.56                       | 16.21                   | 1:1.65             |
| T <sub>4</sub> : Rhizome treatment + foliar spray of Carbedazim + Mancozeb (0.1%) on 45 and 90 DAP | 90.52<br>(72.05)    | 21.76<br>(27.76)  | 38.56<br>(38.35)  | 18.30                       | 36.67                   | 1:1.92             |
| T <sub>5</sub> : Foliar spray of Hexaconazole (0.1%) on 45 and 90 DAP                              | 84.89<br>(67.13)    | 24.18<br>(29.47)  | 31.73<br>(34.27)  | 16.02                       | 19.64                   | 1:1.74             |
| T <sub>6</sub> : Foliar spray of Propiconazole (0.1%) on 45 and 90 DAP                             | 87.38<br>(69.21)    | 22.76<br>(28.45)  | 35.74<br>(36.69)  | 15.69                       | 17.17                   | 1:1.71             |
| T <sub>7</sub> : Foliar spray of Tricyclazole (0.1%) on 45 and 90 DAP                              | 85.95<br>(67.94)    | 26.06<br>(30.72)  | 26.42<br>(30.92)  | 15.12                       | 12.92                   | 1:1.65             |
| T <sub>8</sub> : Foliar spray of Carbendazim + Mancozeb (0.1%) on 45 and 90 DAP                    | 86.36<br>(68.28)    | 25.17<br>(30.07)  | 28.99<br>(32.58)  | 15.70                       | 17.25                   | 1:1.71             |
| T <sub>9</sub> : Check   | 81.87<br>(64.75)    | 35.42<br>(36.51)  |                   | 13.39                       |                         | 1:1.52             |
| S.Em±  | 1.34                | 0.61              |                   | 0.37                        |                         |                    |
| CD (P<0.05)  | 3.98                | 1.84              |                   | 1.14                        |                         |                    |

\*Figures in the parenthesis are arc sine transformed values; DAP=Days after planting; PDI=Per cent disease index; PEDC=Per cent efficacy of disease control

was observed in rhizome treatment + foliar application of Propiconazole at 45 and 90 DAP and rhizome treatment + foliar application of Carbendazim + Mancozeb at 45 and 90 DAP which were on par with each other with PDI of 20.01% and 21.76%, respectively, and were found significantly superior to other fungicidal treatments. The next best treatment was foliar application of Propiconazole at 45 and 90 DAP which reduced the disease incidence to 22.76%. Highest fresh rhizome yield was achieved in rhizome treatment + foliar application of Carbendazim + Mancozeb at 45 and 90 DAP (18.3 t ha<sup>-1</sup>). Propiconazole, Hexaconazole rhizome treatment + foliar application at 45 and 90 DAP and Hexaconazole sprayed at 45 and 90 DAP recorded 17.13 t ha<sup>-1</sup>, 16.98 t ha<sup>-1</sup> and 16.02 t ha<sup>-1</sup> respectively. Though Propiconazole was effective in reducing the disease incidence,

it did not show considerable increase in rhizome yield. Results of the present study indicated that rhizome treatment with Propiconazole (0.1%) and foliar spray with Propiconazole (0.1%) at 45 and 90 DAP was effective in reducing disease incidence and increasing the yield. The results on foliar application of Propiconazole on reduction of disease incidence and increase in rhizome yield corroborated with the findings of Gopal Krishnan & Gnanamurthy (2002) and Koche *et al.* (2009).

#### Economics of fungicides

The economics for each fungicide was calculated based on mean yield from the pooled analysis. All the treatments were economically beneficial over the control. Rhizome treatment and foliar application of Carbendazim +

Mancozeb (0.1%) gave the best economic return (1:1.92) followed by rhizome treatment and foliar application of Propiconazole (1:1.81). Though Propiconazole (0.1%) was effective in reducing disease incidence (20.01%) and increasing the yield over the control (27.91%) the net returns were less (1:1.81) due to high cost of the fungicide.

It is concluded that, rhizome treatment with Carbendazim + Mancozeb (0.1%) followed by foliar spray of Propiconazole (0.1%) at 45 DAP and foliar spray of Carbendazim + Mancozeb (0.1%) at 90 DAP was effective in reducing leaf spot incidence and increasing the yield of turmeric.

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