

Management of foliar diseases of turmeric

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Turmeric (*Curcuma longa*, L.) is an important condiment and a useful dye, with varied uses in drug and cosmetic industries. This crop is affected mainly by leaf blotch and leaf spot disease in West Bengal. So, an experiment was conducted at UBKV farm with 9 treatments (including control) to manage the foliar disease of turmeric at field level using different chemicals. Out of those 9 treatments it was found that rhizome treatment as well as foliar spray with carbendazim + mancozeb (0.1%) at 45 and 90 days after planting was the best treatment in controlling both leaf blotch and leaf spot disease of turmeric. This treatment was closely followed by rhizome treatment as well as foliar spray with propiconazole (0.1%) at 45 and 90 days after planting. The best treatment produced lowest disease of 18.00 and 19.84 PDI in case of leaf blotch and leaf spot respectively and also produced the highest yield of 8.37 Kg/plot (16.87 t/ha) among all the treatments.

Key words: Turmeric, leaf blotch, leaf spot, carbendazim+mancozeb, propiconazole

INTRODUCTION

Turmeric (*Curcuma longa* L) the ancient and sacred spice of India known as Indian saffron is an important commercial spice crop grown in India. India is the largest producer, consumer and exporter of turmeric in the world. India dominates the world production scenario contributing 78% followed by China (8%), Myanmar (4%), etc. In 2008-09, national production of turmeric has been 821.2 thousand tonnes from 181.1 thousand hectares area with a productivity of 4.54 t/ha [Source: Department of Agriculture and Cooperation (Horticulture Division)] whereas West Bengal produces 35.372 thousand tonnes of turmeric from an area of 15.216 thousand hectares with a productivity of

2.32 t/ha. The main turmeric producing 'states in India are Andhra Pradesh, Tamil Nadu, Odisha, Karnataka, West Bengal and Gujarat. The productivity of West Bengal is very low at 2.66 t/ha (Source: Directorate of Arecanut and Spices Development (DASD), Calicut). One of the factors of this low productivity in West Bengal is different foliar diseases mainly leaf blotch and leaf spot of turmeric. Leaf spot is caused by *Collectotrichum capsici* [(Syd.) Butler & Bisby] and leaf blotch is caused by *Taphrina maculans* Butler. The loss caused by these diseases may vary from 20 to more than 60% in some cases (Nair and Ramakrishnan, 1973). So, to increase the productivity some chemicals are tested in the field to minimize the disease incidence.

MATERIALS AND METHODS

The present experiment was conducted for four

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years in Uttar Banga Krishi Viswavidyalaya, Pundibari, Coochbehar from 2008-2011. Turmeric seed rhizomes were planted in raised beds of 3 m x 1 m size. The plant to plant and row to row distances were 20 cm and 30 cm respectively. The fertilizer at the rate of N: P: K:: 60:60: 60 kg/ha and FYM at the rate of 10 – 15 Kg / plot were applied. N was applied in two equal split doses viz., at sowing and at 90 days after planting (DAP). Entire P was applied as basal and K was applied in two split doses viz., at sowing and 90 DAP. Other intercultural operations were practiced as par recommended for commercial cultivation of turmeric. The experiment was laid out in Randomized Block Design (RBD) with 3 replications. The variety TCP 2 (Suranjana) was taken for this experiment to test against 9 treatments as presented in Table 1.

45 and 90 days after planting (T_4) has recorded lowest leaf blotch disease severity of 14.96, 10.07 and 22.63 and lowest leaf spot disease severity of 14.89, 10.37 and 27.74 in 2008, 2009 and 2010 respectively which is followed by only spraying with carbendazim + mancozeb (0.1%) at 45 and 90 days after planting (T_8) in 2008 and 2009 (leaf blotch PDI of 15.11 and 11.26 and leaf spot PDI of 15.41 and 11.85 respectively) and rhizome treatment as well as foliar spray with propiconazole (0.1%) at 45 and 90 days after planting (T_2) in 2010 (leaf blotch PDI of 23.87 and leaf spot PDI of 29.63). These 3 treatments are statistically at par with each other. In 2011 the best treatment was found to be rhizome treatment as well as foliar spray with hexaconazole (0.1%) at 45 and 90 days after planting (T_1), which recorded lowest leaf blotch

Table 1 : Treatment details

Treatment code	Treatment details
T_1	Rhizome treatment with hexaconazole (0.1%) + Foliar spray with hexaconazole (0.1%) on 45 & 90 DAP
T_2	Rhizome treatment with propiconazole (0.1%) + Foliar spray with propiconazole (0.1%) on 45 & 90 DAP
T_3	Rhizome treatment with tricyclozole (0.1%) + Foliar spray with tricyclozole (0.1%) on 45 & 90 DAP
T_4	Rhizome treatment with carbendazim + mancozeb (0.1%) + Foliar spray with carbendazim + mancozeb (0.1%) on 45 & 90 DAP
T_5	Foliar spray with hexaconazole (0.1%) on 45 & 90 DAP
T_6	Foliar spray with propiconazole (0.1%) on 45 & 90 DAP
T_7	Foliar spray with tricyclozole (0.1%) on 45 & 90 DAP
T_8	Foliar spray with carbendazim + mancozeb (0.1%) on 45 & 90 DAP
T_9	Control (no spray)

DAP: Days after planting

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 and Rao (1987). The per cent disease index (PDI) and per cent efficacy of disease control (PEDC) was calculated using the following formula.

Per cent efficacy of disease control (PEDC) = $\frac{[\text{Disease in control} - \text{Disease in treatment}]}{[\text{Disease in Control}]} \times 100$

RESULTS AND DISCUSSION

From the above 4 year data (Tables 2, 3, 4 and 5) it was found that rhizome treatment as well as foliar spray with carbendazim + mancozeb (0.1%) at

and leaf spot disease severity of 29.41 and 30.78 respectively. This treatment is closely followed by only spraying with hexaconazole (T_5) [leaf blotch PDI of 29.55 and leaf spot PDI of 32.92] which was followed by rhizome treatment as well as foliar spray with carbendazim + mancozeb (0.1%) at 45 and 90 days after planting (T_4) [leaf blotch PDI of 30.18 and leaf spot PDI of 31.77]. These three treatments are statistically at par with each other. The best treatment (T_2) produced consistently good yield (14.82, 17.51, 18.95, 16.24 t/ha in 2008, 2009, 2010 and 2011 respectively) in all the 4 years of testing.

All the treatments showed significantly superior results than control in respect of PDI for both the foliar diseases and yield also. Leaf blotch and leaf spot disease intensity varied from 10.07 – 46.22% and 10.37 – 45.02% respectively during the four

Table 2 : Effects of different treatments on foliar diseases of turmeric (2008)

Treatments	Germination (%)	Disease intensity (PDI)				Yield (Kg/plot)	Projected yield (t/ha)
		Leaf blotch (PDI)	Per cent efficacy of disease control	Leaf spot (PDI)	Per cent efficacy of disease control		
T ₁	92.00	26.07 (30.20)	43.60	23.26 (28.31)	44.91	6.62	13.35
T ₂	89.17	16.44 (22.67)	64.63	17.63 (24.55)	58.24	7.00	14.11
T ₃	89.50	27.63 (30.86)	40.22	25.93 (30.10)	38.58	6.07	12.24
T ₄	90.50	14.96 (21.82)	67.63	14.89 (22.19)	64.73	7.35	14.82
T ₅	92.50	25.19 (29.75)	45.50	24.44 (28.76)	42.11	6.51	13.12
T ₆	92.83	16.89 (23.50)	63.46	16.41 (22.54)	61.13	6.95	14.01
T ₇	92.00	28.74 (32.10)	37.82	27.41 (30.47)	35.08	6.17	12.44
T ₈	89.67	15.11 (22.54)	67.31	15.41 (21.85)	63.50	7.30	14.72
T ₉	91.00	46.22 (42.72)	-	42.22 (40.28)	-	5.15	10.38
SEm ±	1.538	1.871	-	2.156	-	0.272	-
CD (at 5%)	4.308	5.242	-	6.042	-	0.762	-

Figures in parenthesis are angular transformed value

Table 3 : Effects of different treatments on foliar diseases of turmeric (2009)

Treatments	Germination (%)	Disease intensity (PDI)				Yield (Kg/plot)	Projected yield (t/ha)
		Leaf blotch (PDI)	Per cent efficacy of disease control	Leaf spot (PDI)	Per cent efficacy of disease control		
T ₁	90.00	21.04 (27.30)	42.04	20.89 (27.20)	40.50	7.30	14.72
T ₂	93.33	12.44 (20.65)	65.73	12.74 (20.91)	63.71	8.59	17.31
T ₃	90.00	23.48 (28.98)	35.32	24.89 (29.93)	29.11	7.03	14.18
T ₄	93.67	10.07 (18.50)	72.26	10.37 (18.79)	70.46	8.69	17.51
T ₅	91.83	23.26 (28.83)	35.92	22.52 (28.33)	35.86	6.90	13.91
T ₆	93.00	14.37 (22.28)	60.41	13.40 (21.47)	61.83	8.07	16.27
T ₇	89.50	24.30 (29.53)	33.06	23.70 (29.13)	32.50	6.71	13.53
T ₈	91.00	11.26 (19.61)	68.98	11.85 (20.14)	66.25	8.14	16.42
T ₉	89.00	36.30 (37.05)	-	35.11 (36.34)	-	5.68	11.45
SEm ±	1.359	1.704	-	1.858	-	0.193	-
CD (at 5%)	3.807	4.773	-	5.205	-	0.541	-

Figures in parenthesis are angular transformed value

years of study. From the 4 year pooled data (2008 to 2011) [Table 6], it was found that rhizome treatment as well as foliar spray with carbendazim + mancozeb (0.1%) at 45 and 90 days after planting (T₄) was the best treatment in controlling both leaf blotch and leaf spot disease of turmeric. This treat-

ment was closely followed by rhizome treatment as well as foliar spray with propiconazole (0.1%) at 45 and 90 days after planting (T₄) and only foliar spray with carbendazim + mancozeb (0.1%) at 45 and 90 days after planting (T₂). T₄ produced lowest disease of 18.00 and 19.84 PDI in case of leaf

Table 4 : Effects of different treatments on foliar diseases of turmeric (2010)

Treatments	Germination (%)	Disease intensity (PDI)				Yield (Kg/plot)	Projected yield (t/ha)
		Leaf blotch (PDI)	Per cent efficacy of disease control	Leaf spot (PDI)	Per cent efficacy of disease control		
T ₁	98.17	28.97 (32.56)	26.82	33.66 (35.46)	23.84	7.73	15.58
T ₂	96.50	23.87 (29.25)	39.71	29.63 (32.98)	32.91/26	8.72	17.58
T ₃	100.00	27.18 (31.43)	31.34	34.32 (35.86)	22.35	7.67	15.46
T ₄	100.00	22.63 (28.41)	42.83	27.74 (31.78)	37.25	9.40	18.95
T ₅	92.67	29.47 (32.88)	25.57	34.81 (36.16)	21.23	7.24	14.60
T ₆	97.67	25.27 (30.18)	36.18	31.52 (34.16)	28.68	8.31	16.75
T ₇	92.67	30.86 (33.75)	22.04	35.23 (36.41)	20.30	7.19	14.50
T ₈	97.67	24.28 (29.52)	38.67	30.71 (33.65)	30.52	8.81	17.76
T ₉	97.67	39.59 (38.99)	-	44.20 (41.67)	-	5.94	11.98
SEm ±	1.321	1.237	-	1.066	-	0.409	-
CD (at 5%)	3.701	3.465	-	2.986	-	1.145	-

Figures in parenthesis are angular transformed value

Table 5: Effects of different treatments on foliar diseases of turmeric (2011)

Treatments	Germination (%)	Disease intensity (PDI)				Yield (Kg/plot)	Projected yield (t/ha)
		Leaf blotch (PDI)	Per cent efficacy of disease control	Leaf spot (PDI)	Per cent efficacy of disease control		
T ₁	99.67	29.41 (32.84)	27.36	30.78 (33.70)	31.63	8.58	17.30
T ₂	92.50	30.45 (33.49)	24.80	32.43 (34.71)	27.97	7.95	16.03
T ₃	99.50	31.03 (33.85)	23.36	32.84 (34.96)	27.05	7.58	15.28
T ₄	96.83	30.18 (33.32)	25.46	31.77 (34.31)	29.43	8.05	16.24
T ₅	95.50	29.55 (32.93)	27.02	32.92 (35.01)	26.88	7.67	15.47
T ₆	97.83	32.26 (34.61)	20.33	35.14 (36.36)	21.95	7.25	14.62
T ₇	97.50	33.00 (35.06)	18.50	35.31 (36.46)	21.57	6.82	13.75
T ₈	92.17	31.44 (34.11)	22.35	33.91 (35.61)	24.68	7.40	14.92
T ₉	90.50	40.49 (39.52)	-	45.02 (42.14)	-	5.06	10.20
SEm ±	1.477	0.855	-	1.102	-	0.411	-
CD (at 5%)	4.138	2.396	-	3.088	-	1.151	-

Figures in parenthesis are angular transformed value

blotch and leaf spot respectively. Per cent efficacy of disease control (PEDC) for leaf blotch and leaf spot was 55.50 and 52.04 respectively for T₄. This treatment also produced the highest yield of (16.87 t/ha) among all the treatments. This result is in

accordance with Rao *et al* (2012) who also found 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

Table 6: Effect of different treatments on foliar diseases of turmeric (Pooled analysis from 2008 -2011)

Treatments	Germination (%)	Disease intensity (PDI)				Yield (Kg/plot)	Projected yield (t/ha)	Cost Benefit ratio
		Leaf blotch (PDI)	Per cent efficacy of disease control	Leaf spot (PDI)	Per cent efficacy of disease control			
T ₁	94.96	25.30 (30.20)	37.45	26.54 (31.01)	35.85	7.56	15.24	1:1.61
T ₂	92.88	19.45 (26.17)	51.92	22.14 (28.07)	46.48	8.07	16.27	1:1.73
T ₃	94.75	26.63 (31.07)	34.17	19.84 (26.55)	30.02	7.09	14.29	1:1.51
T ₄	95.25	18.00 (25.10)	55.50	27.78 (26.45)	52.04	8.37	16.87	1:1.80
T ₅	93.13	26.47 (30.96)	34.56	22.56 (28.36)	32.85	7.08	14.27	1:1.54
T ₆	95.33	21.14 (27.37)	47.74	29.36 (28.36)	45.47	7.65	15.42	1:1.67
T ₇	92.92	28.77 (32.44)	28.88	21.29 (32.81)	29.03	6.72	13.55	1:1.46
T ₈	92.63	19.57 (26.26)	51.62	41.37 (27.48)	48.54	7.91	15.95	1:1.73
T ₉	92.04	40.45 (39.49)	37.45	(40.03)	35.85	5.46	11.01	1:1.20
SEm ±	1.184	1.355	-	1.201	-	0.208	-	
CD (at 5%)	3.456	3.955	-	3.504	-	0.608	-	

Figures in parenthesis are angular transformed value

effective in reducing leaf spot incidence and increasing the yield of turmeric. The highest cost benefit ratio of 1:1.80 was also found in rhizome treatment as well as foliar spray with carbendazim + mancozeb (0.1%) at 45 and 90 days after planting (T₄) which is followed by rhizome treatment as well as foliar spray with propiconazole (0.1%) at 45 and 90 days after planting (1:1.73) and only foliar spray with carbendazim + mancozeb at 45 and 90 days after planting (1:1.73). This result is also in conformity with Rao *et al* (2012) who reported that 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).

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