



## Management of Fungal Foliar Diseases of Groundnut

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### ABSTRACT

Field experiment was conducted at Agricultural college farm, Bapatla during late *kharif* 2016-17 on sandy soils to study the efficacy of seven fungicides on fungal foliar diseases of groundnut and on yield. The results indicated that foliar spray of trifloxystrobin + tebuconazole @ 0.09% showed significant reduction of early leaf spot (25.56%), late leaf spot (32.42%) and rust (18.56%). Highest number of pods per plant (15.33), pod yield (1537.03 kg ha<sup>-1</sup>) and B.C ratio (0.95) were also recorded by foliar spray of trifloxystrobin + tebuconazole @ 0.09%.

**Key words :** *fungicides, groundnut, rust, tikka leaf spot.*

Groundnut [*Arachis hypogaea*.L.], also known as Peanut, is an important leguminous oilseed crop belongs to the family Fabaceae (Mali and Bodhankar, 2009). It is very important cash crop for small scale farmers. Groundnut kernel has high protein (25-28%) and oil content (43-55%) (Naeem *et al.*, 2009). It is mainly grown as cash crop for oilseed, food and as animal feed. The low productivity of the crop is ascribed mainly due to foliar diseases namely early leaf spot caused by *Cercospora arachidis* S. Hori (teleomorph *Mycosphaerella arachidis* Deighton) and late leaf spot caused by *Phaeoisariopsis personata* (Berk and Curtis) Deighton (teleomorph *Mycosphaerella berkeleyi* Jenk.) are the major destructive diseases of groundnut worldwide (Jackson and Bell, 1969; Backman and Crawford, 1984; Smith *et al.*, 1992).

Problems related to leaf spot diseases may cause complete defoliation and yield losses of up to 50 % or more. The leaf spot disease epidemics are affected by weather patterns such as hot and wet conditions (Shew *et al.*, 1988). They reduce the photosynthetic area and cause abscission of leaflets (Subramanyam and Ravindranath, 1988). This experiment was conducted to study the cost effective chemical control of fungal foliar diseases.

### MATERIAL AND METHODS

The experiment was conducted during late *kharif* 2016-17 at the Agricultural College Farm, Bapatla, Guntur district. The experiment was laid out in randomized block design with the variety K-6 following the recommended spacing of 30 x 10cm and was replicated thrice. The treatments comprised of eight (seven fungicides including control) *viz.*, Azoxystrobin 23 SC @ 0.1%, Tebuconazole 25 EC @ 0.1%, Tebuconazole + Trifloxystrobin 75 WG (50%+25% w/w) @ 0.09%, Chlorothalonil 75 WP @ 0.25%, Thiophanate methyl 70% w/w @ 0.25%, Mancozeb 63% WP + Carbendazim 12% WP @ 0.1% and Wettable sulphur @ 0.3%.

Recommended dose of nitrogen, phosphorus and potassium at 30: 40: 50 kg ha<sup>-1</sup> was applied in the form of urea, single super phosphate and muriate of potash, respectively. The entire quantity of phosphorus was applied as basal dose. Nitrogen and potassium were applied at the time of sowing and at flowering stage in equal splits. 500 kg ha<sup>-1</sup> gypsum was applied at flowering stage. Spraying was done thrice from occurrence at two weeks interval. Weeding and inter cultivation activities were carried out regularly and irrigation was given at alternate days.

## Collection of Experimental Data Disease Severity

Severity of fungal foliar diseases *viz.*, early leaf spot was recorded in each treatment plot at one week after first spray, later due to more disease severity the leaves were gradually defoliated and there is no occurrence of disease after two weeks, late leaf spot and rust were recorded in each treatment plot at weekly interval for three successive sprays which were done at 15 days interval based on the standard 9 point scale (Subrahmanyam *et al.*, 1995) (Table 1 and 2). The Per cent Disease Index (PDI) was computed from the above scale by using the following formula (Wheeler, 1969).

$$\text{PDI} = \frac{\text{Sum of all the numerical ratings}}{\text{Number of observations} \times \text{maximum disease grade}} \times 100$$

## Growth and yield parameters

Observations on number of pods per plant was recorded on five randomly selected plants from each treatment plot at harvesting stage and yield per plot was recorded.

## RESULTS AND DISCUSSION

At one week after first spraying, tebuconazole + trifloxystrobin 75 WG (50%+ 25% w/w) @ 0.09% was significantly effective in controlling early leaf spot (25.56%) and it was on par with mancozeb 63% WP + carbendazim 12% WP @ 0.1%, chlorothalonil 75 WP @ 0.25%, tebuconazole 25 EC @ 0.1% and thiophanate methyl 70% w/w @ 0.25% recording 25.87%, 26.32%, 27.34% and 27.66% respectively (Table 3). Khan *et al.* (2014) reported that trifloxystrobin 25% WP + tebuconazole 50% WP @ 250g/kg + 500g/kg (Nativo fungicide at 0.97g/l) was the best fungicide to control *Cercospora* leaf spot of groundnut during summer, 2011 and the results of this investigation are in accordance with their reports.

Final observations which were taken at three weeks after third spray, tebuconazole + trifloxystrobin 75 WG (50% + 25% w/w) @ 0.09% was found effective in controlling late leaf spot with 32.42%, followed by chlorothalonil 75 WP @ 0.25% with 36.36% (Table 4). Similar results were

observed by Smith and Litrell, 1980; Culbreath *et al.*, 1992 as chlorothalonil, a broad-spectrum fungicide, among the most effective fungicides registered for leaf spot control and has been the standard fungicide for leaf spot management.

Tebuconazole + trifloxystrobin 75 WG (50%+ 25% w/w) @ 0.09% was effective in controlling rust recording 18.56% PDI, followed by azoxystrobin 23 SC @ 0.1% with 19.76% PDI and were on par with each other (Table 5). The field trial was conducted during *kharif & rabi* seasons of 2016 by Mahapatra and indicated that the premix fungicide Azoxystrobin 7.5% + Propiconazole 12.5% SE 875 g ha<sup>-1</sup> effectively and significantly reduced leaf spot and rust infestation and proportionally increased kernel yield of groundnut by controlling the disease.

The treatment trifloxystrobin + tebuconazole @ 0.09% gave the best results recording 15.33 pods per plant and it was statistically on par with thiophanate methyl @ 0.25% and mancozeb + carbendazim @ 0.1% with 14.33 and 13.67 respectively. Dry pod yield was significantly higher in trifloxystrobin 25% WG + tebuconazole 50% WG @ 0.09% recording 1537.03kg ha<sup>-1</sup> which was statistically on par with wettable sulphur @ 0.3% (1518.52 kg ha<sup>-1</sup>). The highest B:C ratio of 0.95 was obtained for trifloxystrobin + tebuconazole @ 0.09% followed by wettable sulphur @ 0.3% with 0.93 (Table 6).

The present investigation concluded that among all the treatments, combination of Trifloxystrobin + Tebuconazole (Nativo) showed lowest disease severity against early leaf spot, late leaf spot and rust as the combination fungicide has long-lasting protectant activity which helped to increase the yield and was most economical.

## LITERATURE CITED

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**Table 1. Disease rating scale for Early and late leaf spot disease (Subrahmanyam *et al.*, 1995)**

Disease score	Description	Disease severity (%)
1	No disease	0
2	Lesions present largely on lower leaves; no defoliation	1-5
3	Lesions present largely on lower leaves, very few on middle leaves, defoliation of some leaflets evident on lower leaves	6-10
4	Lesions on lower and middle leaves but severe on lower leaves; defoliation of some leaflets evident on lower leaves	11-20
5	Lesions present on all lower and middle leaves; over 50 % defoliation of lower leaves	21-30
6	Severe lesions on lower and middle leaves; lesions present but less severe on top leaves; extensive defoliation of lower leaves	31-40
7	Defoliation of some leaflets evident on middle leaves	41-60
8	Lesions on all leaves but less severe on top leaves; defoliation of all lower and some middle leaves	61-80
9	Defoliation of all lower and middle leaves; severe lesions on top leaves; some defoliation of top leaves evident	81-100
	Almost all leaves defoliated, leaving bare stems; some leaflets may remain, but show severe leaf spots	

**Table2. Disease rating scale for rust disease (Subrahmanyam *et al.*, 1995)**

Disease score	Description	Disease severity (%)
1	No disease	0
2	Pustules sparsely distributed, largely on lower leaves	1-5
3	Many pustules on lower leaves, necrosis evident; very few pustule on middle leaves	6-10
4	Numerous pustules on lower and middle leaves; severe necrosis on lower leaves	11-20
5	Severe necrosis of lower and middle leaves; pustules may be present on top leaves, but less severe	21-30
6	Extensive damage to lower leaves; middle leaves necrotic, with dense distribution of pustules; pustules on top leaves	31-40
7	Severe damage to lower and middle leaves; pustules densely distributed on top leaves	41-60
8	100 % damage to lower and middle leaves; pustules on top leaves, which are severely necrotic	61-80
9	Almost all leaves withered; bare stems seen	81-100

**Table 3. Effect of fungicides on early leaf spot severity in groundnut during late *kharif* 2016-17**

Treatments	Per cent disease index (PDI) One week after first spary	Reduction over control
T1 - Azoxystrobin 23 SC @ 0.1%	28.84 *(32.46)	2.44
T2 - Tebuconazole 25 EC @ 0.1%	27.34 (31.51)	7.51
T3 -Tebuconazole + Trifloxystrobin 75 WG (50% +25% w/w) @ 0.09%	25.56 ( 30.35)	13.53
T4 - Chlorothalonil 75 WP @ 0.25%	26.32 (30.84)	10.96
T5 - Thiophanate methyl 70% w/w @ 0.25%	27.66 (31.69)	6.43
T6 - Mancozeb 63% WP + Carbendazim 12% WP @ 0.1%	25.87 (30.55)	12.48
T7 - Wettable Sulphur @ 0.3%	28.39 (32.18)	3.96
T8 - Unsprayed control	29.56 (32.92)	
SEm±	0.53	
CD (P ≤ 0.05)	1.60	
CV (%)	2.90	

\*Figures in parentheses are arcsine transformed values

**Note:** The early leaf spot affected leaves were gradually defoliated, hence there was no occurrence of disease after two weeks of first spray.

**Table 4. Effect of fungicides on late leaf spot severity in groundnut during late *kharif* 2016-17**

Treatment	PER CENT DISEASE INDEX (PDI)								Reduction over control
	One week after first spray	Two weeks after first spray	One week after second spray	Two weeks after second spray	One week after third spray	Two weeks after third spray	Three weeks after third spray		
T1 - Azoxystrobin 23 SC @ 0.1%	12.57 (20.75) *	19.85 (26.38)	21.17 (27.38)	26.84 (31.18)	29.58 (32.93)	48.99 (44.40)	49.73 (74.61)	32.81	
T2 - Tebuconazole 25 EC @ 0.1%	14.92 (22.69)	21.73 (27.25)	24.98 (29.97)	29.72 (33.01)	29.90 (33.13)	44.68 (41.93)	45.28 (69.94)	38.82	
T3 - Tebuconazole + Trifloxystrobin 75 WG (50%+25% w/w) @ 0.09%	11.39 (19.72)	19.54 (26.43)	20.87 (27.17)	23.66 (29.09)	24.52 (29.67)	29.90 (33.13)	32.42 (57.64)	56.20	
T4 - Chlorothalonil 75 WP @ 0.25%	14.33	23.08	23.96	27.06	30.51	35.80	36.36	50.87	
T5 - Thiophanate methyl 70% w/w @ 0.25%	(22.23) 14.18	(28.29) 18.64	(29.29) 19.97	(31.32) 21.59	(33.51) 37.88	(36.73) 47.93	(61.55) 48.41	34.59	
T6 - Mancozeb 63% WP + Carbendazim 12% WP @ 0.1%	(22.11) 14.91	(25.36) 21.46	(26.53) 25.12	(27.66) 27.07	(37.96) 29.73	(43.79) 48.98	(73.54) 42.18	43.01	
T7 - Wettable Sulphur @ 0.3%	(22.71) 14.91	(27.16) 21.46	(30.07) 22.34	(31.33) 24.40	(33.02) 32.84	(44.39) 52.25	(67.73) 56.84	23.20	
T8 - Unsprayed control	(22.71) 15.21 (22.94)	(27.16) 24.84 (29.68)	(28.19) 29.72 (33.02)	(29.58) 32.70 (34.86)	(34.94) 48.84 (44.31)	(46.27) 61.75 (51.77)	(81.18) 74.02 (98.58)		
SEm±	0.36	0.27	0.28	0.56	0.53	0.48	0.51		
CD (P d* 0.05)	1.10	0.84	0.86	1.71	1.62	1.48	1.55		
CV (%)	2.85	1.76	1.70	3.15	2.65	1.97	2.02		

\*Figures in parentheses are arcsine transformed values

**Table 5. Effect of fungicides on rust severity in groundnut during late *kharif* 2016-17**

Treatment	PER CENT DISEASE INDEX (PDI)								Reduction over
	Two weeks after first spray	One week after second spray	Two weeks after second spray	One week after third spray	Two weeks after third spray	Three weeks after third spray	Reduction over		
T1 - Azoxystrobin 23 SC @ 0.1%	13.60 *(21.61)	15.22 (22.93)	15.38 (38.67)	18.77 (25.66)	19.08 (25.88)	19.76 (26.38)	72.99		
T2 - Tebuconazole 25 EC @ 0.1%	13.00 (21.13)	13.74 (21.74)	15.66 (38.49)	17.43 (24.66)	18.32 (25.31)	33.88 (35.58)	53.70		
T3 - Tebuconazole + Trifloxystrobin 75 WG (50% +25% w/w) @ 0.09%	11.42 (19.74)	11.68 (19.97)	12.27 (34.12)	13.00 (21.12)	15.50 (23.17)	18.56 (25.50)	74.63		
T4 - Chlorothalonil 75 WP @ 0.25%	15.96 (23.50)	16.54 (23.97)	18.92 (42.70)	24.41 (29.59)	42.76 (40.82)	43.38 (41.18)	40.72		
T5 - Thiophanate methyl 70% w/w @ 0.25%	15.12 (22.87)	16.52 (23.97)	17.88 (41.57)	32.70 (34.83)	50.17 (45.08)	53.66 (47.08)	26.67		
T6 - Mancozeb 63% WP + Carbendazim 12% WP @ 0.1%	14.30 (22.20)	16.54 (23.98)	19.82 (44.48)	34.03 (35.66)	43.35 (41.16)	45.14 (42.19)	38.31		
T7 - Wettable Sulphur @ 0.3%	17.94 (25.04)	18.23 (25.25)	19.96 (44.51)	42.77 (40.82)	50.62 (45.34)	57.44 (49.25)	21.50		
T8 - Unsprayed control	22.78 (28.49)	23.52 (28.99)	28.54 (53.54)	46.04 (42.70)	60.42 (50.99)	73.18 (58.79)			
SEm±	0.43	0.47	0.62	0.94	0.51	0.54			
CD (P d'' 0.05)	1.32	1.45	1.88	2.86	1.56	1.64			
CV (%)	3.27	3.48	4.24	5.13	2.40	2.30			

\*Figures in parentheses are arcsine transformed values

**Table 6. Effect of fungicides on yield of groundnut during late *kharif* 2016-17**

Treatments	No. of pods per plant	% increase over control	Yield (kg ha <sup>-1</sup> )	% increase over control	Cost of cultivation (Rs ha <sup>-1</sup> )	Gross returns (Rs ha <sup>-1</sup> )	Net returns (Rs ha <sup>-1</sup> )	B:C Ratio
T1 - Azoxystrobin 23 SC @ 0.1%	13.00	18.18	1325.92	12.93	33813	53036.8	19223.8	0.56
T2 - Tebuconazole 25 EC @ 0.1%	12.33	12.09	1344.44	14.51	31963	53777.6	21814.6	0.68
T3 – Tebuconazole + Trifloxystrobin 75 WG (50%+25% w/w) @ 0.09%	15.33	39.36	1537.03	30.91	31423	61481.2	30058.2	0.95
T4 - Chlorothalonil 75 WP @ 0.25%	12.00	9.09	1240.74	5.67	32388	49629.6	17241.6	0.53
T5 - Thiophanate methyl 70% w/w @ 0.25%	14.33	30.27	1503.70	28.07	31963	60148.0	28185.0	0.88
T6 - Mancozeb 63% WP + Carbendazim 12% WP @ 0.1%	13.67	24.27	1340.74	14.19	31243	53629.6	22386.6	0.71
T7 - Wettable Sulphur @ 0.3%	11.67	6.09	1518.52	29.33	31318	60740.8	29422.8	0.93
T8 - Unsprayed control	11.00		1174.07		31063	46962.8	15899.8	0.51
SEm±	0.64		10.65					
CD (P d <sup>**</sup> 0.05)	1.94		32.30					
CV (%)	5.27		1.34					

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