



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2019; 7(5): 2041-2044

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Received: 13-07-2019

Accepted: 15-08-2019

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## Management of leaf spot (*Cercospora arachidicola* and *Cercosporidium personatum*) disease of groundnut by using various test of fungicides

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**Abstract**

Leaf spot caused by *Cercospora arachidicola* and *Cercosporidium personatum* respectively are the major diseases of groundnut under *Konkan* conditions. The maximum AUDPC values of leaf spot in (T<sub>7</sub>) control plot was 573.90 and minimum in the treatment of three spraying of Mancozeb (286.58). Fungicides and plant products tested under natural epiphytotic conditions of leaf spot, three spray of mancozeb (0.25%) with disease intensity 18.79% was the best fungicide followed by propiconazole (0.1%) with disease intensity 23.05%, at an interval of 15 days commencing from 16<sup>th</sup> MW in *rabbi* season under *Konkan* conditions will be the best strategy for management of leaf spot disease management.

**Keywords:** Leaf spot groundnut, AUDPC, PDI, fungicide, botanicals

**Introduction**

Groundnut is an important oil seed crop with high levels of proteins (biological value), carbohydrates, vitamins and minerals (Moss and Rao, 1995) <sup>[10]</sup>.

It is also known as poor man's almond. Groundnut is a crop of global economic significance due to its use as a source of diverse food products. The seed is most important part, which is utilized for the production of edible oil and also eaten as snack food. Groundnut contains about 35-54 per cent oil, 6-24 per cent carbohydrate and 21-36 per cent proteins and therefore it forms a high-energy source (Cobb and Johnson, 1973) <sup>[3]</sup>.

Major groundnut growing countries are China (22%), India (19%), Nigeria (11%) and USA (2%). Globally China (42%) and India (18%), are the largest producers followed by Nigeria (7.7%), USA (4.3%) and Indonesia (1.8%). India has a largest area under groundnut in the world but productivity of groundnut has been rather low (1712 kg/ha) when compared with the world (1819 Kg/ha). In India groundnut crop is cultivated on area of 46.6 lakh hectares and production of 78.1 lakh tones with productivity of 1712 kg/ha during the year 2013-14, while in Maharashtra state it is cultivated on area of 1.96 lakh hectares with productivity of 1163 Kg/ha and production of 2.28 lakh tones during *Kharif* season and 0.71 lakh ha area and 0.97 lakh tonnes production with 1366 kg/ha productivity during Rabi season 2013-14. The major groundnut growing districts in Maharashtra are Dhule, Satara, Kolhapur, Pune, Nashik, Ahmednagar, Parbhani and Jalgaon.

In *Konkan* region groundnut is grown on 8400 hectares area with productivity of 1130 Kg/ha during *Kharif*. While as groundnut crop is cultivated on more than 5000 ha area with 1827 Kg /ha during Rabi season (Anonymous, 2016) <sup>[2]</sup>.

Reduction in the yield due to leaf spots is largely due to damage caused to the leaves as a result of intense spotting and consequent loss in the photosynthetic area (Gerlagh and Bokdman, 1974) <sup>[6]</sup>. Premature leaf fall due to the disease is also a factor contributing to the lower yield. In India, losses in the yield of groundnut crop due to the leaf spots have been estimated to be in the range of 15 to 50% (Sundaram, 1965) <sup>[11]</sup>. In semi-arid tropics, where chemical control is rare, average losses exceeding 50% are quite usual (Garren and Jackson, 1973) <sup>[5]</sup>. Apart from yield losses, the value of the haulms, which is mostly used as fodder for cattle, is also adversely affected (Cummins and Smith, 1973) <sup>[4]</sup>. Normally, early leaf spot is more prevalent in northern groundnut growing states in India. However, recently, it has been assuming a serious status in southern and central states of India. However, the incidence and severity varies among localities and over seasons.

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## Material

### Manures and chemical fertilizers

Farm yard manure (FYM) 10 tonnes/ha was incorporated in the soil before the last harrowing and nitrogen, phosphorus and potassium were applied through straight fertilizers in the form of urea (46% N<sub>2</sub>), single super phosphate (16% P<sub>2</sub>O<sub>5</sub>) and murate of potash (60% K<sub>2</sub>O) to each plot.

### Fungicides

In all four fungicides viz., propiconazole (0.1%), mancozeb (0.25%), marvel (2%) and soapnut rind extract (10%) were used in the present study. Thiram (5g/Kg) was used as a seed dresser.

### Methods

Studied the bio-efficacy of Carbendazim + mancozeb (12% + 63%) at three concentrations (0.025%, 0.05% and 0.1%) along with sole carbendazim 50 WP (0.1%), mancozeb 75 WP (0.25%) and copper oxychloride 50 WP (0.25%) against ELS and LLS of groundnut. Carbendazim + mancozeb at 0.1 per cent were found to be the best followed by mancozeb 75 WP (0.25%) for control of both the leaf spots (Joshi *et al.* 2000)<sup>[8]</sup>.

Conducted a field experiment to evaluate the efficacy of different fungicides and their doses on *Cercospora* leaf spot of groundnut. Five different fungicides (Chlorothalonil (0.2%), propineb (0.1%), mancozeb (0.1%), nativo (1%) @ 1g/10 L and triazole (0.1%)) having three different doses (prescribed, half and prescribed+half) were used to control *Cercospora* leaf spot of groundnut. Groundnut variety (YH-

14) highly susceptible to *Cercospora* leaf spot was used. The experiment was laid down in RCBD design. Results showed that maximum disease control with high pod yield was observed with nativo (1%) (@ 0.97g/lit) and Triazole (0.1%) treatments. Efficacy of Chlorothalonil was also better than mancozeb and propineb. Maximum disease control and pod yield was observed when nativo was used @ 0.97g/L of water, followed by @ 0.65g/L and 0.32 g/L, respectively. propineb was the least effective in controlling *Cercospora* leaf spot of groundnut as well as having minimum pod yield (Khan *et al.* (2014)<sup>[9]</sup>.

### Experimental site

The field experiment was conducted on variety Konkani Tapora during the *Rabi* season of 2016-17 at the Agricultural research station, Shirgaon, Ratnagiri.

Plan of Layout

Season	:	Rabi, 2016-2017
Plot size	:	3 X 3 m
Spacing	:	30 X 15 cm
Fertilizer dose	:	NPK 25:50:50 kg/ha
Crop	:	Groundnut
Variety	:	Konkan Tapora
Date of sowing	:	11 January 2017
Design of experiment	:	Randomized Block Design ( RBD)
Replications	:	Three
Treatments	:	Seven

### Treatment Details

Table 1: Chemical control of the leaf spots (Tikka) disease with fungicides

Tr. No	Common Name and Formulation	Trade name	Concentration Used (%)
T <sub>1</sub>	Two sprays of Propiconazole 25% EC	Tilt	0.1%
T <sub>2</sub>	Three sprays of Propiconazole 25% EC	Tilt	0.1%
T <sub>3</sub>	Two sprays of Mancozeb 75% WP	Uthane M-45	0.25%
T <sub>4</sub>	Three sprays of Mancozeb 75% WP	Uthane M-45	0.25%
T <sub>5</sub>	Three sprays of Marvel	Marvel	2%
T <sub>6</sub>	Three sprays of Soapnut rind extract	-	10%
T <sub>7</sub>	Control	-	-

### Schedule of spraying

The crop was observed carefully for initiation of disease. Three sprays of fungicides were applied at an interval of 15 days starting from initiation of disease symptoms of Leaf spot. The spray schedule was as under.

- First spraying 17.02.2017
- Second spraying 03.03.2017
- Third spraying 18.03.2017

### Method of recording observations

Five plants per treatment per replication were randomly selected for recording disease incidence of leaf spot separately. Initial observations were recorded before first spray and final observations were recorded 15 days after the last spray.

### A) Per cent disease intensity (PDI)

Per cent disease intensity (PDI) was calculated by the formula.

$$PDI = \frac{\text{Sum of all numerical ratings}}{\text{Total number of leaves examined X Maximum rating}} \times 100$$

### B) Per cent disease control (PDC)

The per cent disease control was calculated by using the formula given below:

$$PDC (\%) = \frac{\text{PDI in control} - \text{PDI in treatment}}{\text{PDI in control}} \times 100$$

### C) Area under disease progress curve (AUDPC)

Further, the area under disease progress curve (AUDPC) was calculated by using the formula as suggested by Wilcoxson *et al.*, (1975)<sup>[12]</sup>.

$$AUDPC = \frac{\sum_{i=1}^k k}{i=15} = \left[ \frac{x_i + x_{i-1}}{2} \right] \times d$$

where,

x<sub>i</sub> = disease severity at the end of *i*th week.

k = number of successive evaluations of leaf spot.

d = days interval between two observations.

## Results and Discussion

### Effect of Fungicides on development of leaf spot

The area under disease progress curve (AUDPC) in different fungicidal treatments is summarized in (Table. 2). It is revealed that AUDPC differed considerably for different fungicides. The AUDPC values ranged between 286 - 573.90. Highest Area under disease progress curve (AUDPC) was obtained in control (T<sub>7</sub>) plot with value 573.90 during *rabbi*, 2016-17, respectively. The lowest AUDPC value was obtained in plots in the treatment of three sprays of Mancozeb (0.25%) at 15 days interval (T<sub>4</sub>). It was followed by the treatment of three sprays of Propiconazole (328.28% T<sub>2</sub>). The AUDPC value in the treatment of two sprays of Propiconazole (T<sub>1</sub>), three sprays of Marvel (T<sub>6</sub>), three sprays of Soapnut rind extract (T<sub>5</sub>) were comparatively higher than three sprays of Mancozeb (T<sub>4</sub>).

evaluated the efficacy of four fungicides (chlorothalonil (0.2% ) @ 0.2 kg-ha<sup>-1</sup>, copper hydroxide @ of 2.3 kg-ha<sup>-1</sup>, Mancozeb (0.2%) @ 0.25 kg-ha<sup>-1</sup> and Triadimefon (0.01%) @ 0.5 kg-ha<sup>-1</sup>) on groundnut rust (*Puccinia arachidis*) development and grain yield. The fungicide treatments resulted in different levels of disease severity on the two groundnut varieties used [*i.e.* Shulamith (susceptible) and Sedi (moderately resistant) varieties]. Plots sprayed with Triadimefon had significantly ( $p \leq 0.001$ ) lower level (257.37%-days) of AUDPC of groundnut rust than plots treated with other fungicides (Alehegn *et al.* (2017) <sup>[1]</sup>).

### Disease intensity

Results in (Table. 3) revealed that all treatments significantly reduced the leaf spot intensity the per cent disease intensity recorded after 60 DAS before spray treatments was in the range of 5.33% to 6.56% respectively.

The lowest percent disease intensity after first spray (9.06%) was recorded in the plots receiving two sprays (T<sub>3</sub>) of Mancozeb (@ 0.25%) which was significantly lower than other treatments including (T<sub>7</sub>) control (20.90%). The plots receiving three sprays Propiconazole (T<sub>2</sub>) recorded the percent disease severity of (10.88%) which was followed by plots receiving three sprays of Mancozeb (T<sub>4</sub>) (11.78%), two sprays (T<sub>1</sub>) of Propiconazole (12.65%), Soapnut rind extract (T<sub>6</sub>) (16.11%) and Marvel (T<sub>7</sub>) (18.69%) respectively.

The highest per cent disease intensity (T<sub>7</sub>) after first spray (33.57%) was recorded in the control. The lowest percent disease intensity after second spray (18.46%) was recorded in the plots receiving three spray of (T<sub>4</sub>) Mancozeb (0.25%)

which was significantly lower than other treatments and control (43.63%). The plots receiving two sprays of Mancozeb recorded the per cent disease severity of (20.84%) and three sprays of Propiconazole (23.05%) respectively.

The highest percent leaf spot intensity after second spray was recorded from control plot in (T<sub>7</sub> treatment 43.63%) which was followed by plots receiving of Soapnut rind extract (T<sub>6</sub> treatment 34.25%), Marvel (T<sub>5</sub> treatment 31.88%), two sprays of (T<sub>1</sub>) Propiconazole (28.12%), three sprays (T<sub>2</sub>) of Propiconazole (23.05), two sprays (T<sub>3</sub>) of Mancozeb (20.84), and three sprays (T<sub>4</sub>) of Mancozeb (18.46%), respectively.

The highest per cent disease intensity after third spray (T<sub>7</sub> treatment 43.63%) was recorded in the control plot which was significantly higher than other treatments. After third spray, the plots receiving three sprays (T<sub>4</sub>) of Mancozeb recorded percent disease intensity of (18.46%) which was statistically at par with plots receiving two sprays (T<sub>3</sub>) of Mancozeb (20.84%) followed by three sprays (T<sub>2</sub>) of Propiconazole (23.05%), two sprays (T<sub>1</sub>) of Propiconazole (28.12%), three sprays (T<sub>5</sub>) of Marvel (31.88%), and three sprays (T<sub>6</sub>) Soapnut rind extract (34.25%) respectively. The fungicide Mancozeb three sprays (T<sub>4</sub>) of (18.46%) were statistically at par with Two sprays (T<sub>3</sub>) of Mancozeb (20.84%) followed by Propiconazole (23.05%), and Soapnut rind extract (34.25%), was statistically significant with Mancozeb. Mancozeb (0.25%) was the best fungicide followed by Propiconazole (0.1%); marvel (2%) and Soapnut rind extract (10%) respectively, for reducing severity of leaf spot.

Hossain and Hossain (2014) tested the effectiveness of foliar spray with 33 plant extracts against leaf spot (Tikka) of groundnut caused by *Cercospora arachidicola* and *Cercosporidium personatum*. Bavistin and BAU-Biofungicide were included in the experiment as checks and spray of plain water represented control. Almost all treatments gave considerable reduction in disease incidence and increase in growth parameters, pod and haulm yield compared to control. The most effective materials were bavistin 50 WP, BAU-Biofungicide, leaf extract of neem, tomato, datura black, and datura white. The materials decreased spot number per leaf, defoliation per plant, incidence of leaf spot, and number of infected leaf per plant by 35.45-60.07, 42.06-72.20, 51.97-63.58, and 38.33 to 46.89% and increased pod yield and haulm yield by 64.37-111.41 and 32.35-74.71%, respectively. The materials may be recommended against the disease after economic analysis.

**Table 2:** PDI and AUDPC values of leaf Spot of groundnut

Date	17-02-17		03-03-17		18-03-17		02-04-17		Total	
Tr.	PDI	AUDPC	PDI	AUDPC	PDI	AUDPC	PDI	AUDPC	PDI	AUDPC
T <sub>1</sub>	5.82	0.00	12.65	138.53	21.89	259.03	28.12	375.03	68.48	772.59
T <sub>2</sub>	5.33	0.00	10.88	121.58	20.72	236.98	23.05	328.28	59.98	686.84
T <sub>3</sub>	5.50	0.00	9.06	109.15	18.74	208.45	20.84	296.80	54.14	614.4
T <sub>4</sub>	6.08	0.00	11.78	134.00	19.42	234.03	18.79	286.58	56.07	654.61
T <sub>5</sub>	6.48	0.00	16.11	169.43	21.89	259.03	28.12	375.03	84.51	962.14
T <sub>6</sub>	5.33	0.00	18.69	180.10	23.76	318.33	31.87	417.18	79.65	915.61
T <sub>7</sub>	6.56	0.00	20.90	205.95	33.56	408.48	42.96	573.90	103.98	1188.33

**Table 3:** Effect of fungicides on intensity of Leaf spot

Sr.no	Treatments	Percent disease intensity **			
		At first appearance after (60DAS)	After first spray (75DAS)	After second spray (90DAS)	After third spray (105DAS)
T <sub>1</sub>	2 spray of Propiconazole (@ 0.1%)	5.82 (13.88)	12.65 (20.78)*	21.89 (27.87)	28.12 (31.97)
T <sub>2</sub>	3 Sprays of Propiconazole (@ 0.1%)	5.33 (13.29)	10.88 (19.21)	20.72 (27.05)	23.05 (28.69)
T <sub>3</sub>	2 sprays of Mancozeb at (@ 0.25%)	5.50 (13.52)	9.06 (17.45)	18.74 (25.59)	20.84 (27.15)
T <sub>4</sub>	3 sprays of Mancozeb at (@ 0.25%)	6.08 (14.17)	11.78 (20.07)	19.42 (26.15)	18.79 (25.44)
T <sub>5</sub>	3 sprays of Soapnut rind extract (@ 10%)	6.48 (14.75)	16.11 (23.59)	21.89 (31.71)	28.12 (35.82)
T <sub>6</sub>	3 sprays of Marvel (@ 2%)	5.33 (13.32)	18.69 (25.61)	23.76 (29.16)	31.88 (34.37)
T <sub>7</sub>	Control	6.56 (14.83)	20.90 (27.20)	33.57 (35.40)	42.96 (41.33)
	S.E ±	0.85	1.00	0.93	0.82
	C.D at 5%	2.63	3.09	2.85	2.53

(\*Figures in parentheses are arc sine transformed values.) \*\*Mean of Three Replication

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