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Evaluation of fungicides for management of early leaf and late leaf spot of groundnut

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Abstract

Groundnut (*Arachis hypogaea* L.) is an important oilseeds crop suffer from many diseases among them, early and late leaf spots are most widely distributed and economically important foliar diseases of groundnut causing severe damage to the crop. A field trial was carried out with eight fungicides to find out most effective fungicide for management leaf spot of groundnut. Minimum per cent disease index of early (30.76%) and late (59.38%) leaf spot recorded in foliar application of carbendazim 12% + mancozeb 63% WP (0.15%) followed by hexaconazole 5% SC (0.005%). Maximum pod (2302 kg ha⁻¹) and haulm (6128 kg ha⁻¹) yield was also recorded in plot treated with carbendazim 12% + mancozeb 63% WP (0.15%).

Keywords: fungicide, early leaf spot, late leaf spot, pod yield, groundnut

Introduction

Groundnut (*Arachis hypogaea* L.) is one of the most promising oilseed crop (Mensah and Obadoni, 2007) [12]. Total area under groundnut cultivation in India was 41.52 lakh ha which account for total production of 70.77 lakh tones with productivity of 1704 kg/ha. Among the major groundnut growing states, Gujarat alone accounted for 39.1% of the national acreage. Groundnut was grown nearly about 16.25 lakh hectare with 30.54 lakh tones production and productivity of 1,879 kg ha⁻¹ (Anon., 2018) [11]. Groundnut cultivation normally suffers with leaf spot known as "Tikka" disease that appears during warm and humid Kharif season. (Jha *et al.*, 2013) [7]. Early leaf spot (*Cercospora arachidicola*) and late leaf spot (*Phaeoisariopsis personata*) are major destructive disease of groundnut production due to defoliation of leaves (Culbearth, 2000) [4] and caused 50% or more reduction in pod yield (Thakur *et al.*, 2013) [19]. Plant disease management has assumed greater importance in increasing agricultural production. The first symptom of early leaf spot infection on plants appeared on the upper surface of the quadric foliate and usually has light to dark brown center with a yellow halo and 1 to 10 mm in diameter. The late leaf spot infected plants produced dark brown to black, circular to sub-circular 1 to 6 mm in diameter lesions on the lower surface of leaves (Bhaskar, 2006) [3]. Looking to yield loss incurred due to leaf spots in groundnut field, an experiment was carried out to find out most effective fungicide for control of disease. According to Mohammed (2004) [14] control of cercospora leaf spot through systemic fungicides can lead to the increased yield and high haulm quality.

Materials and Methods

A field trial was laid out at Department of Plant Pathology, College of Agriculture, Junagadh Agricultural University, Junagadh during Kharif season. GG-20 groundnut variety was sown in plot having 5.0 × 3.0 m gross and 4.0 × 1.8 m net area with 60 × 10 cm spacing on 29th June 2017. The eight fungicides *viz.*, mancozeb 75% WP (0.2%), carbendazim 50% WP (0.025%), pyraclostrobin 20% WG (0.05%), hexaconazole 5% SC (0.005%), carbendazim 12% + mancozeb 63% WP (0.15%), azoxystrobin 11% + tebuconazole 18.3 % SC (0.015%), zineb 68% + hexaconazole 4% WP (0.15%) were evaluated in randomized block design with three replications. The spraying of fungicides was carried out twice, first after early leaf spot initiation and second after appearance of late leaf spot infection. Control plot was sprayed with water only.

The five plants were selected randomly in each plot and observations on disease severity was recorded from two lower, two middle and one upper leaves individually using 1 to 9 rating scale based on leaf area and stem covered by leaf spot (Subramaniyam *et al.* 1995) [17]. Per cent disease index (PDI) was calculated as follows (Bdliya, 2007) [2].

$$\text{Per cent Disease Index} = \frac{\text{Sum of all individual ratings}}{\text{Total No. of leaves examined} \times \text{Maximum disease rating (9)}} \times 100$$

Results and Discussion

The per cent disease index was calculate before and 10 days after spraying. Total two spraying was done during crop period. First fungicidal spray was given after initiation of early leaf spot and second after late leaf spot initiated.

Early leaf spot

Perusal of data presented in Table 1 revealed that all the fungicides tested in field condition were significantly reduced disease as compared to control. In case of early leaf spot, minimum disease index (30.76%) was recorded in carbendazim 12% + mancozeb 63% WP (0.15%) closely followed by hexaconazole 5% SC (0.005%), azoxystrobin 11% + tebuconazole 18.3% SC (0.015%) and mancozeb 75% WP (0.2%) where 31.95, 36.70 and 40.78 per cent disease were recorded, respectively. They were statistically at par with each other. Carbendazim 50 % WP (0.025%) was found mediocre to reduced early leaf spot where 44.23 per cent disease index was recorded. Fungicides *viz.*, pyraclostrobin 20 % WG (0.05%) and zineb 68% + hexaconazole 4% WP (0.15%) were found inferior in reducing early leaf spot with 50.45 and 51.62 per cent disease index, respectively.

Maximum disease control (53.29%) was recorded in foliar application of carbendazim 12 % + mancozeb 63 % WP (0.15%) and minimum (21.62%) in zineb 68 % + hexaconazole 4 % WP (0.15%). The disease control in hexaconazole (0.005%), azoxystrobin + tebuconazole (0.015%), mancozeb (0.2%), carbendazim (0.025%) and pyraclostrobin (0.05%) were 51.49, 44.28, 38.08, 32.84 and 23.40 per cent, respectively. Present result are agreement with finding of Vyas *et al.* (1986) [20], Joshi *et al.* (2000) [11] and Ghewande *et al.* (2002) [5]. They also achieved good control of leaf spot of groundnut through foliar application of carbendazim + mancozeb.

Mercer (1974) [13] and Singh and Naik (1977) [16] recorded best control of leaf spot of groundnut through foliar application of carbendazim (0.01%). Whereas, Jadeja *et al.* (1999) [6] found hexaconazole (0.02%) to be the best for the management of leaf spots of groundnut.

Late leaf spot

In case of late leaf spot, minimum disease incidence (59.38%) was recorded in foliar application of carbendazim 12% + mancozeb 63 % WP (0.15%) closely followed by hexaconazole 5 % SC (0.005%) and azoxystrobin 11 % + tebuconazole 18.3 % SC (0.015%), mancozeb 75% WP (0.2%), carbendazim 50% WP (0.025%) and zineb 68% + hexaconazole 4% WP (0.15%) with 60.79, 67.81, 71.66, 73.43 and 74.31 per cent disease index, respectively. They were statistically at par with each other. Maximum per cent

disease index (88.10%) was recorded in control (unsprayed plot).

Maximum disease control (32.60%) was recorded in carbendazim 12% + mancozeb 63% WP (0.15%). The effectiveness of carbendazim + mancozeb (0.25%) against late leaf spot of groundnut has been reported by Sunkand (2012) [18] and Johnson *et al.* (2007). The disease control in hexaconazole 5 % SC (0.005%), azoxystrobin 11% + tebuconazole 18.3% SC (0.015%), mancozeb 75% WP (0.02%), carbendazim 50% WP (0.025%) and zineb 68% + hexaconazole 4% WP (0.15%) were 31.00, 23.03, 18.66, 16.65 and 15.65 per cent, respectively. Johnson and Subrahmanyam (2010) [8] achieved good control of leaf spot of groundnut in hexaconazole (0.2%) at 75 DAS. Nath *et al.* (2013) [15] recorded tebuconazole (0.1%) and mancozeb (0.25%) as most effective against *C. personatum* of groundnut. Minimum disease (11.35%) was recorded in pyraclostrobin 20% WG (0.05%).

Pod and haulm yield

The groundnut pod and haulm yield was higher in all treatment as compared to control. Significantly maximum pod yield (2302 kg ha⁻¹) was recorded in carbendazim + mancozeb 0.15% followed by hexaconazole 0.005%, mancozeb 0.2% carbendazim 0.025% and azoxystrobin + tebuconazole 0.015% with 2164, 2091, 2025 and 1966 kg ha⁻¹, respectively. They were statistically at par. Pod yield in zineb + hexaconazole 0.15 % (1895 kg ha⁻¹) was at par with pyraclostrobin 0.5 % (1537 kg ha⁻¹). Minimum pod yield was recorded in untreated control plot (1313 kg ha⁻¹).

Maximum increased in (42.96%) pod yield was recorded in carbendazim + mancozeb 0.15% followed by hexaconazole 0.005%, mancozeb 0.2%, carbendazim 0.025%, azoxystrobin + tebuconazole 0.015%, and zineb + hexaconazole 0.15% where increased in pod yield was recorded 39.33, 37.21, 35.16, 33.22 and 30.71 per cent, respectively. Minimum increased in pod yield (14.51 %) was recorded in pyraclostrobin 0.5%. Similarly, Johnson *et al.* (1998) [10] achieved good control of leaf spot of groundnut with an increased in yield by 20% in foliar application of carbendazim + mancozeb. Results are agreement with work of Johnson and Subrahmanyam (2003), they recorded minimum PDI of late leaf spot (18.8%) with highest pod yield of 1924 kg/ha in foliar application of hexaconazole.

In case of haulm yield, maximum haulm yield (6128 kg ha⁻¹) was also recorded in plots treated with fungicides *viz.*, carbendazim + mancozeb 0.15% followed by hexaconazole 0.005%, mancozeb 0.2%, carbendazim 0.025% and azoxystrobin + tebuconazole 0.015% which gave 6008 kg ha⁻¹, 5895 kg ha⁻¹, 5828 kg ha⁻¹ and 5633 kg ha⁻¹ haulm yield, respectively. They were at par. Minimum haulm yield was recorded in control (3940 kg ha⁻¹).

Maximum (35.71%) haulm yield increase over control was recorded in carbendazim + mancozeb 0.15% followed by hexaconazole 0.005%, mancozeb 0.2%, carbendazim 0.025%, azoxystrobin + tebuconazole 0.015% and zineb + hexaconazole 0.15% where 34.42, 33.16, 32.40, 30.06 and 21.72 per cent, increased haulm yield were recorded, respectively. Minimum (14.59 %) haulm yield increased over control was recorded in plot treated with pyraclostrobin 0.05%.

Table 1: Field evaluation of fungicides against early (*C. arachidicola*) and late (*P. personata*) leaf spots, pod and haulm yield of groundnut

Treatments		Early leaf spot		Late leaf spot		Pod yield (kg/ha)	Pod yield increase (%)	Haulm yield (kg/ha)	Haulm yield increase (%)
Fungicides	Dose	Per cent disease index [@]	Per cent disease control	Per cent disease index [@]	Per cent disease control				
Mancozeb 75 % WP	0.20%	39.69 (40.78) *	38.08	57.84 (71.66)	18.66	2091	37.21	5895	33.16
Carbendazim 50 % WP	0.025%	41.69 (44.23)	32.84	58.92 (73.43)	16.65	2025	35.16	5828	32.40
Pyraclostrobin 20 % WG	0.05%	45.26 (50.45)	23.40	62.10 (78.10)	11.35	1537	14.57	4613	14.59
Hexaconazole 5 % SC	0.005%	34.42 (31.95)	51.49	51.23 (60.79)	31.00	2164	39.33	6008	34.42
Carbendazim 12 % + Mancozeb 63 % WP	0.15%	33.69 (30.76)	53.29	50.41 (59.38)	32.60	2302	42.96	6128	35.71
Azoxystrobin 11 % + Tebuconazole 18.3 % SC	0.015%	37.29 (36.70)	44.28	55.43 (67.81)	23.03	1966	33.22	5633	30.05
Zineb 68 % + Hexaconazole 4 % WP	0.15%	45.93 (51.62)	21.62	59.55 (74.31)	15.65	1895	30.71	5033	21.72
Control	-	54.26 (65.86)		69.83 (88.10)	-	1313		3940	
S.Em±		2.42		3.45		128		334	
C.D. at 5%		7.36		10.19		390		1014	
CV%		10.15		10.31		11.66		10.76	

[@] Mean of three replication

* Numerals in parenthesis are arcsine re-transformed value

Conclusion

On the basis of present investigation, it can be concluded that the foliar application of carbendazim + mancozeb twice, *i.e.* after initiation of early leaf spot and on appearance of late leaf spot in groundnut significantly reduced the disease and increased the pod and haulm yield as compared to control followed by hexaconazole.

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