The Andhra Agric. J 65 (1): 118-123, 2018

Effect of fungicides and botanicals in the management of Alternaria leaf spot in sesame

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ABSTRACT

Field experiment was carried out in Agricultural College, Bapatla during late *kharif* 2016-17. The present study was taken up to compare the efficacy of botanicals in managing *A. sesami* with that of chemical fungicides. All fungicides and botanicals tested were significantly effective in controlling the disease over control. The results indicated that propiconazole @ 0.1% was found superior with low PDI (53.89 %) in controlling the disease. Per cent decrease in PDI over control was 35.50 % in propiconazole @ 0.1% treated microplot which was followed by chlorothalonil @ 0.2% 25.54 % among fungicides. However, neem leaf extract @ 5 % was found best among the botanicals with a PDI of 65.00 % reducing the disease by 22.20 % over control after two weeks of second spray.

Key words: *Alternaria leaf spot, neem leaf extract, propiconazole, sesame*

Sesame (*Sesamum indicum* L.) is one of the ancient oilseed crops and is being used by mankind since years. The cultivated sesame originated from wild populations of South Asia, either the western Indian peninsula, or the Punjab and parts of Pakistan (Fuller, 2003). Sesame flourishes well in the tropical and sub-tropical regions, in plains as well as at an elevation of 4000 ft. It is sensitive to low temperatures. In Northern India, it is mostly cultivated as *kharif* crop while in Andhra Pradesh it is taken up, as rain fed crop (May- September) and as *rabi* crop (November-January). In India sesame is cultivated in area 18.93 lakh ha with an annual production of 7.38 lakh tonnes and with a productivity of 413 kg ha^{-1}. India has global market for white seeded types. In Andhra Pradesh, it occupies an area of 0.61 lakh ha with an annual production of 0.20 lakh tonnes with an average productivity of 321 kg ha^{-1} (Ministry of Agriculture and Farmers' Welfare, GOI, 2016-17).

Sesamum is attacked by several infectious plant pathogens that are responsible for major yield losses. Among important sesame diseases, Alternaria leaf spot is prevalent in all the sesame growing areas of the world (Verma *et al.,* 2005; Ojiambo *et al*., 2003; Kolte, 1985; Bhale *et al*., 1998).

This experiment was conducted to study the efficacy of both fungicides which were available in market and botanicals in controlling Alternaria leaf spot and Yield economics.

MATERIAL AND METHODS

The experiment was conducted during late *kharif* 2016-17 at the Agricultural College Farm, Bapatla, Guntur, Andhra Pradesh. The experiment was laid out in randomized block design (RBD) with four replications. Susceptible variety Swetha Til was sown with a spacing of 30 cm X 15 cm. The treatments comprised of seven (three fungicides and three botanicals) *viz.,* mancozeb @ 0.25%, chlorothalonil @ 0.2%, propiconazole @ 0.1%, neem leaf extract @ 5%, tulasi leaf extract @ 5% and *Lantana camara* leaf extract @ 5%. Two foliar sprays were scheduled, with the initial spray being initiated with the initation of the disease and the latter was given fifteen days after first spray. Data on yield and per cent disease severity were recorded at weekly intervals from each micro plot and disease was scored from initial appearance of symptoms till two weeks after second spray by adopting modified (0-9) scale of Mayee and Datar (1986).The per cent disease index (PDI) was computed by using the formula given by Wheeler, 1969.

$$PDI = \frac{\text{Sum of all the numerical ratings}}{\text{No.of observations} \times \text{Max. disease grade}} \times 100$$

RESULTS AND DISCUSSION

Before spray schedule, there was no significant difference in disease severity in the microplots indicating uniform distribution of inoculum in the experimental plot (Table 1). After a week of first spray, significant difference in Alternaria leaf spot disease severity (PDI) was observed in treated plots and ranged between 31.66 and 44.44 %. All fungicides tested were found significantly effective in managing the disease over control (54.71 %). Among the fungicide treatments, propiconazole @ 0.1% was found significant in controlling disease (31.66 % PDI) as against control (54.71 % PDI) and among botanicals neem leaf extract was found effective (PDI of 36.10%) in controlling the disease over other botanicals.

After two weeks of first spray propiconazole @ 0.1 % was found significantly superior over other treatments (PDI 36.10 %) in controlling the disease. However, all treatments were found effective (36.10 to 63.33 %) control (64.99 % PDI). Effect of neem leaf extract @ 5 % was found significantly superior (49.43% PDI) over other botanicals. Among the treatments, propiconazole @ 0.1% was found with 44.45% decrease in disease over control and minimum decrease control was observed in *L. camara* @ 5 % leaf extract treated microplots (2.55%).

A week after second spray PDI in the treatments ranged between 42.77 and 68.32 % as against 73.33 % PDI in unsprayed check. Propiconazole @ 0.1% was found significantly better over other fungicides and botanicals tested and was followed by chlorothalonil @ 0.2 % (PDI 47.77 %). Neem leaf extract @ 5 % was found to be on par with mancozeb @ 0.25 % with PDI of 51.11 % reducing the disease severity by 30.30 %. There was minimum disease control (PDI 68.32 %) in *L. camara* @ 5 % treated microplots among the other botanicals with a low disease control by 6.83 %

Propiconazole @ 0.1 % (PDI of 53.89 %) was found to reduce the disease by 35.50 % over control (PDI of 83.56 %) and was followed by Chlorothalonil @ 0..2 % (62.22 %) after two weeks of second spray. After two weeks of second spray, neem leaf extract @ 5 % was superior (65.0 %) to mancozeb @ 0.25 % (66.66 %) and other two botanicals tested (72.77 to 75.55 %). Maximum reduction of 35.50 % over control was recorded in propiconazole @ 0.1 % applied microplot and minimum reduction was observed in *L. camara* extracts @ 5 % treated plots (9.58 %).

Singh and Majumdar (2002) reported that propiconazole was most effective fungicides in controlling *A. alternata*. Mesta *et al*. (2003) and Mesta (2006) reported that triazoles were effective fungicide in reducing Alternaria blight of sunflower. Amaresh and Nargund (2004) reported that propiconazole and hexaconazole were most effective systemic fungicides in controlling *A. helianthi* at 2000 ppm. Kamanna *et al.* (2010) observed that chlorothalonil (0.2%) effectively controlled chrysanthemum leaf blight under field conditions. Nagrale *et al.* (2012) reported that the fungicides difenoconazole, propiconazole and hexaconazole were effective in managing the blight of gerbera with 94.21, 93.09 and 92.41 per cent disease control respectively.

Results pertaining to the three fungicides tested in the present study were reported in several crops and differed results were reported. All chemicals tested were reported effective individually in different crops by several workers and the impact of all the three in sesame was reported in the present study. Present findings corroborate with the similar work of Kumar *et al*. (2011) where hexaconazole a member of triazole molecules, was found effective in controlling the incidence of *A. alternata* on chrysanthemum followed by chlorothalonil @ 0.2% and mancozeb @ 0.2%.

The results are in accordance to the earlier work with respect to neem leaf extract and in the present studies it was found on a par with the chemical fungicide mancozeb @ 0.25%. Nwogbaga and Iwuagwu (2015) reported neem leaf extract resulting in least PDI (8.13%) with highest per cent disease control (65.93%) than benlate (11.68%) and hexaconazole (13.35%) and recorded the highest per cent increase in yield (27.23%) and also highest yield of 5.738 tons ha^{-1}. Singh and Majumdar (20011) reported *Allium sativum*, *Azardirachta indica*, *Datura stramonium* and *Ocimum sanctum* to be effective against *A. alternata* while Rajpurohit (2004) reported the botanicals against *A. sesami.* There are reports on the efficacy of neem and other plant resources in increasing yields when *A. solani* infected crop plants were treated.

Table 1. Per cent disease index (PDI) of Alternaria leaf spot of sesame during late *kharif* 2016-17

S. No.	Treatments	Per cent Disease Index (PDI) %								
		Before spray	One week after 1st spray	Percent decrease in PDI over control	Two weeks after 1st spray	Percent decrease in PDI over control	One week after 2nd spray	Percent decrease in PDI over control	Two weeks after 2nd spray	Percent decrease in PDI over control
1	Mancozeb @ 0.25%	45.55 (42.42)	39.44 (38.88)	27.91	46.10 (42.74)	29.07	51.11 (45.62)	30.30	66.66 (54.73)	20.22
2	Chlorothalonil @ 0.2%	43.33 (41.14)	34.71 (36.07)	36.55	42.22 (40.50)	35.03	47.77 (43.70)	34.85	62.22 (52.06)	25.54
3	Propiconazole @ 0.1%	46.11 (42.74)	31.66 (34.22)	42.13	36.10 (36.91)	44.45	42.77 (40.83)	41.67	53.89 (47.21)	35.50
4	Neem leaf extracts @ 5%	46.38 (42.90)	36.10 (36.91)	34.01	49.43 (44.65)	23.94	51.11 (45.62)	30.30	65.00 (53.71)	22.20
5	Tulasi leaf extracts @ 5%	46.11 (42.74)	40.00 (39.21)	26.89	54.44 (47.52)	16.23	59.99 (50.75)	22.23	72.77 (58.54)	14.82
6	*Lantana camara* leaf extracts @ 5%	43.33 (41.14)	44.44 (41.78)	18.77	63.33 (52.71)	2.55	68.32 (55.73)	6.83	75.55 (60.34)	9.58
7	Control	46.96 (43.23)	54.71 (47.69)		64.99 (53.71)		73.33 (58.90)		83.56 (54.73)	
	SEm±	0.07	0.07		0.06		0.05		0.08	
	CD (PÂ0.05)	NS	0.21		0.19		0.17		0.25	
	CV%	3.20	3.31		2.55		2.20		2.73	

Parenthesis represents the arc-sine transformed values

Table 2. Yield economics of sesame during late *kharif* 2016-17

S. No.	TREATMENTS	Cost of cultivation (Rs ha^{-1}) (Rs. ha^{-1})	Yield (kg plot^{-1})	Yield (kg ha^{-1})	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C Ratio
1	Mancozeb @ 0.25%	14753	0.57	424	33072	18319	1.24
2	Chlorothalonil @ 0.2%	14878	0.58	426	33228	18350	1.23
3	Propiconazole @ 0.1%	13953	0.62	463	36114	22161	1.59
4	Neem leaf extracts @ 5%	13253	0.60	441	34398	20445	1.54
5	Tulasi leaf extracts @ 5%	13253	0.56	413	32314	19061	1.44
6	*Lantana camera* leaf extracts @ 5%	13253	0.54	396	30888	17635	1.33
7	Control	13253	0.47	350	27300	14047	1.06
	SEm±			9.71			
	C.D. (PÂ0.05)			9.26			
	CV%			28.86			

The present findings differ with the earlier reports as tulasi leaf extracts were not significantly superior to neem leaf extract in reducing the disease severity. However, they were significantly superior to control. Daya and Ram (1997) reported that leaf extracts of *O. sanctum* was found most effective against *A. brassicae* compared to other leaf extracts. Ariafar and Zacharia (2016) reported that the highest reduction of disease severity was achieved by applying the extract of *O. tenuiflorum* at 10% concentration (45.68%) followed by neem leaf extract (37.27 %) compared to check.

The inhibitory effect of the tested plant extracts may be due to their direct toxic effect on the pathogen as reported by Vijayan (1989). Investigations on the mechanisms of disease suppression by plant products have suggested that the active principles present in plant extracts may either act on the pathogen directly (Amadioha, 2000) or induce systemic resistance in host plants resulting in a reduction of the disease development (Kagale *et al.,* 2004). Neem aqueous extracts are reported to bring metabolic changes in plants like induction of phenol, antioxidant defensive enzymes and phenol accumulation (Paul and Sharma, 2002; Guleria and Kumar, 2006; Aboellil, 2007).

Significantly high yields varying between 396 and 463 kg ha^{-1} were recorded in all the treatments compared to unsprayed check (350 kg ha^{-1}). Propiconazole@ 0.1 % treated microplot has registered highest yield (463 kg ha^{-1}) followed by neem leaf extract @ 5 % sprayed microplots (441 kg ha^{-1}) which was found significantly high over chlorothalonil @ 0.2 % (426 kg ha^{-1}) and mancozeb @ 0.25 % (424 kg ha^{-1}). Yield was least in *L. camara* leaf @ 5 % extract treated microplot (396 kg ha^{-1}). Significant increase in yield in neem leaf extract treatment over chlorothalonil @ 0.2 %, mancozeb @ 0.25 % and other botanicals may be due to the increase in the plant height, number of branches and leaf number at all growth stages from 10-90 days as was reported by Nahak and Sahu (2015).

The net returns varied from Rs. 14,047 to 22,161 ha^{-1}, where the highest net returns was obtained in microplot treated with propiconazole @ 0.1 % (Rs.22,161 ha^{-1}) and was followed by neem leaf extract @ 5 % treated microplot (Rs.20,445 ha^{-1}). The lowest returns were in *L. camara* @ 5 % leaf extract treated microplot (Rs. 17,635 ha^{-1}) than with other treatments. The highest benefit: cost ratio was reported in propiconazole @ 0.1 % treated microplots (1.59) followed by neem leaf extract @ 5 % (1.54) and tulasi leaf extract @ 5 % treated microplots (1.44). The least was observed in chlorothalonil @ 0.2 % treated microplot (1.23) (Table 2).

CONCLUSIONS

Currently, control of Alternaraia leaf spot worldwide was reported to be based on fungicides that are applied preventively. The rate of chemical pollutants is increasing day by day and has a tremendous impact on environment, human health and other living entities, the botanicals proved to reduce the disease to certain extent but only next to fungicides. The results in this study provide important information related to the efficacy of propiconazole and chlorothalonil, and neem leaf extract in effective management of the disease.

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(Received on 20.06.2017 and revised on 11.12.2017)