



MANAGEMENT OF IMPORTANT DISEASES OF SUNFLOWER UNDER FIELD CONDITIONS

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ABSTRACT

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Three major diseases such as necrosis, Alternaria leaf spot and Powdery mildew affecting sunflower cultivation in Andhra Pradesh. For management of these diseases in an integrated way, seven different treatments were imposed on Sunflower crop at RARS, Nandyal. Among the treatments tested for Alternaria leaf spot, the treatment T₄ (Seed priming (carbendazim 2 g/kg + thiamethoxam 70 WS @ 4 g/kg) + two sprays of Propiconazole @ 0.1% + Azadiractin @ 1.5 ml/l) has given lower Percent Disease Index (PDI) of 23.13 per cent and it is followed by T₃ and all these treatments are on par with each other except T₅. For necrosis disease, the treatment T₂ (Seed priming (carbendazim 2 g/kg + thiamethoxam @ 4 g/kg of seed) + two sprays propiconazole @ 0.1% + thiamethoxam @ 0.2 g/l) has given lower necrosis incidence, followed by the treatment T₆. Significant effect of all the treatments over powdery mildew disease incidence was noted in all the treatments except T₅. The treatment T₄ has given better yield and higher benefit cost ratio of 0.84 than all the treatments, followed by T₃ which has given higher benefit cost ratio of and 0.82. Hence, to manage the Alternaria leaf spot and necrosis of sunflower application of either T₄ or T₂ treatments proved effective.

KEYWORDS: Sunflower, Alternaria leaf spot, Necrosis, Powdery mildew, Propiconazole, Thiamethoxam

INTRODUCTION

Sunflower (*Helianthus annuus* L.) is a major oil seed crop in India. In India, the crop is grown in an area of 5.51 lakh ha, with a production of 4.15 lakh tons and productivity of 752 kg/ha. In Andhra Pradesh and Telangana states the crop is grown in an area of 68000 ha with a production of 62000 tons. (Project Director's report, 2016). More than thirty diseases have been reported on sunflowers worldwide. Among them necrosis, Alternaria leaf spot and Powdery mildew diseases are very important and posing a great problem for its successful cultivation. Alternaria blight caused by *Alternaria helianthi* emerged as a major threat to its cultivation since late 1980's. It can cause leaf and stem lesions, seedling blight and head rot (Sackston, 1981). In India, the losses due to Alternaria blight are estimated upto to 80 per cent. In the similar way, Necrosis disease, which is one of the devastating diseases, caused by Tobacco necrosis virus was reported during 1997. The losses due to the necrosis may vary from 30 to 100%. The causal virus is to be transmitted by thrips with virus infected pollen grains. Virus is present in Parthenium pollen. Powdery mildew disease caused by the fungus *Golovinomyces cichoracearum* and the losses due to the powdery mildew is proportionate to the disease severity

and varies considerably depending on the variety or cultivar, age and stage of plant growth at which the disease occurs. Overall, the diseases in sunflower account for an average yield loss of 25-40 per cent. An attempt was made to manage these diseases with integrated schedule of treatments.

MATERIALS AND METHODS

A field trial was conducted on integrated disease management during *kharif* season of 2015 at RARS farm, Nandyal under AICRP on Sunflower scheme. This experiment was conducted using DRSH-1 hybrid with seven treatments along with check and three replications with RBD design under rainfed conditions. The treatments were listed in Table 1. Regular agronomic practices were followed with a spacing of 60 cm × 30 cm. Plot size was maintained as 4.2 × 3 m and applied 60 kg of N, 30 kg of K per hectare. The treatments were imposed first at 30 days after sowing (Diseases started to appear) and second treatment was imposed 20days after first sowing. Fifteen days after second spray, score for all the three diseases was taken based on disease rating scale. 0-5 scale was followed for necrosis diseases.

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0-5 scale for necrosis incidence

Reaction	Score	Infection %
I	0	No infection
R	1	1 – 10% Incidence
MR	2	11 – 25% Incidence
MS	3	26 – 50% Incidence
S	4	51 – 75% incidence
HS	5	> 75% incidence

Necrosis incidence was calculated in each treatmental plot with the following formula:

Necrosis incidence (%) =

$$\frac{\text{Number of necrosis infected plants}}{\text{Total plant population}} \times 100$$

Ten plants in each treatment were randomly selected for observation of powdery mildew and Alternaria leaf spot diseases at fifty per cent seed filling stage by using 0–9 scale and Percent Disease Index (PDI) was calculated by using the formula given by Wheeler (1969).

0-9 scale for Alternaria leaf spot and Powdery mildew diseases of Sunflower:

Reaction	Score	Infection %
I	0	No symptoms on the leaf
R	1	1% or less than 1% of the leaf area was damage.
MR	3	1 to 5% leaf area damage
MS	5	11-25% of the leaf area damage
S	7	26-50% of the leaf area damage
HS	9	51% or above of leaf area damage

$$\text{PDI} = \frac{\text{Sum of individual disease ratings}}{\text{Total number of leaves observed} \times \text{Maximum disease grade}} \times 100$$

Yield of each treatment was calculated separately and both were analysed statistically by ANOVA. Further, economics and cost benefit ratio for each treatment was computed.

RESULTS AND DISCUSSION

The results revealed that germination percentage was higher in the treatment T₄ (Seed priming (carbendazim 2 g/kg + thiamethoxam 70 WS @ 4g/kg + two sprays of

propiconazole @ 0.1% + Azadarictin @ 1.5 ml/l) and found that there is no treatmental effect on germination (Table 1). For Alternaria leaf spot disease, the results revealed that all the treatments were significantly superior over the control. Among the given treatments, the treatment T₄ (Seed priming (carbendazim 2 g/kg + thiamethoxam 70 WS @ 4 g/kg + two sprays of propiconazole @ 0.1% + Azadarictin @ 1.5 ml/l) has recorded lowest percent disease index (23.13%). It is followed by the treatment T₃ (Seed bioprimering with *T. viride* @ 10 g/kg + spray of propiconazole @ 0.1% + Azadarictin @ 1.5 ml/l), which has given low PDI (24.79%), Whereas control treatment has recorded highest PDI of 49.65 per cent and all the treatments are on par with each other in reducing the Alternaria leaf spot disease except T₅. It was found that all these treatments have one spray of Propiconazole, which is one of the best chemical used for management of Alternaria. These results are supported by Mesta *et al.*, (2011), who has conducted the field experiment for two years on the efficacy of different fungicides on Alternaria leaf blight of sunflower and concluded that foliar spray of propiconazole @ 0.1% has given good results among other treatments. Similarly, Venkataramanamma *et al.*, (2014) concluded that the fungicidal combination of seed treatment with carbendazim 12% + mancozeb 63% (SAAF) @ 2 g/kg of seed + propiconazole @ 0.1% spray at 30 and 45 days after sowing will effectively control Alternaria leaf blight of sunflower. Similar kind of results were reported by Amaresh *et al.*, (2002) who evaluated some fungicides under field conditions and found that propiconazole @ 0.1%, hexaconazole @ 0.1% gave good results in controlling the Alternaria leaf blight of sunflower and these treatments recorded maximum grain yield, oil content, test weight and least per cent disease intensity. At the same time Azadarictin spray in treatments have cumulative effect in reducing the disease severity. Azadarictin effect on Alternaria was supported by the findings of Sumer Singh and Ratnoo (2013), who told that Azadarachtin is also capable of controlling Alternaria blight of Cotton caused by *Alternaria gossypina* along with fungicides. Treatment T₅ also has reduced Alternaria considerably when compared to control.

For necrosis disease, the treatment T₂ (Seed priming (carbendazim 2 g/kg + thiamethoxam @ 4 g/kg of seed) + two sprays propiconazole @ 0.1% + thiamethoxam @ 0.2 g/l) has recorded lowest incidence of 8.06%, followed by the treatment T₆ and it is also on par with the treatment

Table 1. Integrated Disease Management of important diseases of Sunflower during *Kharif*, 2015

Treatments	Germination (%)	Alternaria leaf spot (%)	Necrosis incidence (%)	Powdery mildew (PDI)
T ₁ : Seed bioprimer with <i>Trichoderma viride</i> @ 10 g/kg + spray of Propiconazole 0.1 % + @ 0.2 g/l (2 sprays)	96 (78.5)	26.61 (31.07)	09.24 (17.67)	0.0
T ₂ : Seed priming (carbendazim 2 g/kg + thiamethoxam (0.04 %) + two spray propiconazole @ 0.1 % + thiamethoxam 25 WG @ 0.2 g/l	97 (80.07)	26.87 (30.87)	08.06 (16.46)	0.0
T ₃ : Seed bioprimer with <i>T. viride</i> @ 10 g/kg + spray of propiconazole 0.1% + Azadiractin @ 1.5 ml/l	97 (80.07)	24.79 (29.88)	11.04 (19.37)	0.0
T ₄ : Seed priming (carbendazim 2 g/kg + thiamethoxam 70 WS @ 4g/kg of seed + two sprays of propiconazole @ 0.1% + Azadiractin @ 1.5 ml/l	98 (81.91)	23.13 (29.35)	10.83 (19.21)	0.0
T ₅ : Seed bioprimer with <i>T. viride</i> @ 10 g/kg + spray of spraying of <i>Pseudomonas fluorescens</i> @ 5 g/l + Azadiractin @ 1.5 ml/l	97 (80.07)	38.69 (38.48)	11.24 (19.56)	0.0
T ₆ : Seed treatment with <i>T. viride</i> @ 10 g/kg + thiamethoxam @ 4 g/kg of seed + spray of propiconazole 0.1% + Thiomethoxam @ 0.2 g/lt (2 sprays)	96 (78.5)	26.41 (30.59)	08.23 (16.63)	0.0
T ₇ : Control	97 (80.07)	46.62 (44.80)	13.5 (21.54)	21.4
Sem ±	NS	2.17	0.93	
CD at 5 %	NS	6.67	2.87	
CV (%)	--	11.17	8.66	

Table 2. Economics of Integrated Disease management of Sunflower

Treatments	Seed yield (kg ha ⁻¹)	Cost of cultivation (₹ ha)	Gross returns	B:C ratio
T ₁ : Seed biopriming with <i>Trichoderma viride</i> @ 10 g/kg + spray of Propiconazole 0.1% + @ 0.2 g/l (2 sprays)	1460	28550	46720	0.64
T ₂ : Seed priming (carbendazim 2 g/kg + thiamethoxam (0.04%) + two spray propiconazole @ 0.1% + thiamethoxam 25 WG @ 0.2 g/l	1447	28670	46272	0.62
T ₃ : Seed biopriming with <i>T. viride</i> @ 10 g/kg + spray of propiconazole 0.1% + Azadiractin @ 1.5 ml/l	1613	27767	51616	0.84
T ₄ : Seed priming (carbendazim 2 g/kg + thiamethoxam 70 WS @ 4g/kg of seed + two sprays of propiconazole @ 0.1% + Azadiractin @ 1.5 ml/l	1636	27936	52352	0.86
T ₅ : Seed biopriming with <i>T. viride</i> @ 10 g/kg + spray of spraying of <i>Pseudomonas fluorescens</i> @ 5 g/l + Azadiractin @ 1.5 ml/l	1221	27595	39072	0.45
T ₆ : Seed treatment with <i>T. viride</i> @ 10 g/kg + thiamethoxam @ 4 g/kg of seed + spray of propiconazole 0.1% + Thiomethoxam @ 0.2 g/l (2 sprays)	1446	28573	46176	0.62
T ₇ : Control	1194	25500	38208	0.43
Sem ±	82			
CD at 5%	252			
CV (%)	10.3			

T₄. Check has recorded higher incidence of necrosis i.e., 13.5%. Effectiveness of Thiomethoxam 70 WS as a seed treatment and foliar fungicide for management of sunflower necrosis disease was supported by Shirshikar, (2010) who reported that for reducing the necrosis incidence on sunflower, the seed should be treated with thiomethoxam (Cruiser 70 W.S.) at 4 g/kg along with two sprays of the crop with thiomethoxam at 0.05% at 30 and 45 DAS. Azadirachtin is also found to be reduce the thrips population, which is the carrier of necrosis virus infected pollen. Over all, in this trial, necrosis incidence was low because thrips population was low in the month of September, because of heavy rains thrips were washed out.

Powdery mildew disease was recorded as 0% incidence in all the treatments except T₅ and control plot. It was revealed that Propiconazole spray reduces the disease effectively. Many fungicides were tested by Karuna *et al.*, (2015) on Sunflower powdery mildew disease and concluded that spraying of Difenconazole, Propiconazole and triademorph were equally effective in reducing the disease severity of sunflower powdery mildew and recorded good seed yield when compare to other chemicals such as triadimefon, benlate, wetable sulphur and carbendazim. Hiramath *et al.* (2013) found propiconazole was most effective against pea powdery mildew (*E. cichoracearum*) followed by hexaconazole, Difenconazole chemicals.

The economics of fungicides spray and the benefit cost ratio has been worked out for different fungicides on this disease. At the same time higher yields were observed in the treatment T₄ with 1636 kg/ha and which has higher benefit cost ratio of 0.86 of followed by T₃ resulted in 1613 kg/ha, 0.82. It was clearly observed that the treatment T₂ recorded lower necrosis incidence and on par with T₄ in terms of yield. Hence, it was observed that major diseases of sunflower were effectively managed by using the above treatments.

CONCLUSION

The treatment T₄ viz., Seed priming (carbendazim 2 g/kg + thiamethoxam 70WS @ 4 g/kg of seed) + two sprays of propiconazole @ 0.1% + Azdarictin @ 1.5 ml/l was found effective when Alternaria leaf spot is a severe problem and the treatment T₂ viz., Seed priming (carbendazim 2 g/kg + thiamethoxam (0.04 %)) + two spray propiconazole @ 0.1 % + thiamethoxam 25 WG @ 0.2 g/lis is effective when necrosis is severe problem.

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REFERENCES

- Amaresh, V.S and Nargund, V.B. 2002. Field evaluation of fungicides in the management of Alternaria leaf blight of sunflower. *Annals of Plant Protection Sciences*. 10: 331-336.
- Hiramath, B., Lal, A.A., Sobita Simon and Raja. 2013. Efficacy of fungicides against pea powdery mildew. *Annals of Plant Protection Sciences*. 21: 442-444.
- Karuna, K., Shadakshari, Y.G., Jagadish, K.S and Geetha, K.N. 2015. Management of Sunflower powdery mildew caused by *Erysiphe cichoracearum*. *Annals of Plant Protection Sciences*. 23(1): 83-89.
- Mesta, R.K., Benagi, V.I., Srikanth Kulkarni and Basavarajappa, M.P. 2011. Management of Alternaria blight on Sunflower. *Karnataka Journal of Agricultural Sciences*. 24: 149-152.
- Project Directors report, IIOR 2016. Annual group meeting on Sunflower, All India Coordinated Research Project on Sunflower, UAS, Raichur (April, 14-16). pp. 13.
- Rathode, P.K., Mane, P.N., Thakre, A.Y., Deshmukh S.N and Bharkade, U.P. 2010. Management of white fly, *Bemisiatabaci* and Thrips, *Scirtothrips dorsalis* in rabi sunflower with botanicals and Chemicals. *Indian Journal of Plant Protection*. 38(2): 139-143.
- Sackston, W.E. 1981. The sunflower crop and disease: progress, problems, prospects. *Plant Disease*. 65: 643-648.
- Shirshikar, S.P. 2010. Sunflower necrosis disease management with Thiomethoxam. *HELIA*, 33, pp. 63-68.
- Sumer Singh and R.S. Ratnoo 2013. Evaluation of different fungicides and phytoextracts against blight of cotton caused by *Alternaria gossypina*. *Journal of Plant Disease Sciences*. 6(1): 47-51.

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- Venkataramanamma, K., Madhusudhan, P., Neelima, S and Narasimhudu, Y. 2014. Field evaluation of fungicides for the management of Alternaria leaf blight of sunflower. *Indian Journal of Plant Protection*. 42(2): 165-168.
- Wheeler, B. E. J (1969). *An Introduction to Plant Disease*. John Wiley Sons Ltd., London