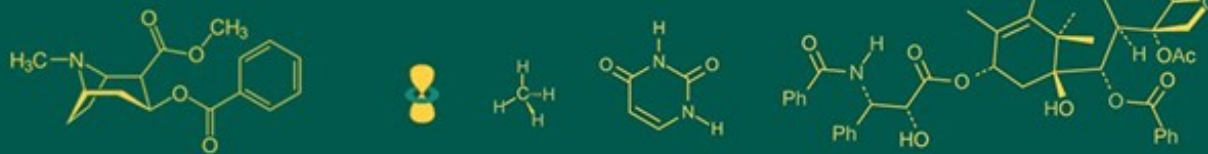


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Ashwini

Department of Plant
 Pathology, University of
 Agricultural Sciences,
 Raichur, Karnataka, India

Poornima

AICRP on Sunflower, MARS,
 University of Agricultural
 Sciences, Raichur, Karnataka,
 India

Gururaj Sunkad

Director of Education,
 University of Agricultural
 Sciences, Raichur, Karnataka,
 India

Sredevi S Chavan

Department of Plant
 Pathology, University of
 Agricultural Sciences,
 Raichur, Karnataka, India

Vikas V Kulkarni

AICRP on Sunflower, MARS,
 University of Agricultural
 Sciences, Raichur, Karnataka,
 India

**Corresponding Author:
 Ashwini**

Department of Plant
 Pathology, University of
 Agricultural Sciences,
 Raichur, Karnataka, India

Bio-intensive approach for the management of *Alternaria blight* of sunflower

Ashwini¹, Poornima², Gururaj Sunkad³, Sredevi S Chavan⁴, Vikas V Kulkarni⁵

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ABSTRACT

Sunflower is an important oilseed crop belonging to Asteraceae family known for its edible oil production in the world. Foliar diseases contribute to major yield loss in oilseed crops. Among them, *Alternaria blight* of sunflower is one of the destructive foliar disease which affects the productivity of crop and causes yield loss upto 80 per cent under severe conditions. Integrating the bio-agents along with fungicides helps in managing the disease as well as improve the productivity of the crop. Evaluation of bio-agents involving *Trichoderma harzianum*, *Pseudomonas fluorescens* and fungicides with 8 treatments was undertaken in field conditions against *Alternaria blight* of sunflower during kharif 2025. Among the treatments T_4 (seed treatment with *P. fluorescens* @ 10 g kg⁻¹ seed followed by foliar spray of *P. fluorescens* @ 10 g L⁻¹ at 45 days after sowing (DAS) and difenoconazole + propiconazole @ 0.25 ml L⁻¹ at 60 DAS) was effective with lowest per cent disease index of 30.81 as compared to untreated control (T_8). Our study demonstrates that integration of *P. fluorescens* with fungicide was most effective treatment with high yield, greater disease suppression and superior economic returns.

Keywords: Sunflower, *Alternaria* blight, Bio-agents, Disease management

Introduction

Sunflower (*Helianthus annuus* L.) is edible oilseed crop cultivated in the world throughout the year due to its adaptability to different environmental conditions, tolerance to drought and salinity. The seeds of sunflower contain around 30-40 per cent oil and rich in unsaturated fatty acids like linoleic acid and oleic acid. The crop is not only used for its oil content but also as poultry feed, seed cake (manure for the crop), dietary enrichment (source of Vitamin E) and infusions. According to Department of Agriculture and Farmers Welfare (2026) [1] in India, it is cultivated in states of Karnataka, Tamil Nadu, Andhra Pradesh, Telangana, Maharashtra and others which covers 2.25 lakh hectares with production of 2.70 lakh tonnes. The average yield of sunflower in India is 1201 kg/ha. However, the productivity of sunflower has decreased in the recent years due to biotic stresses like foliar diseases which cause considerable yield losses.

Alternaria blight caused by *Alternaria* sp. is one such important foliar disease affecting sunflower. Initially the appearance of minute chlorotic spots in lower leaves of the plant is noticed which later become concentric necrotic spots. Coalescing of these spots leads to blighting of the leaf. These symptoms also spread to petiole, stem and head of the plant. Under severe disease condition blighting of entire plant occurs. The yield loss varies from 11 to 80 per cent (Rao et al., 2009) [2]. Therefore, management of *Alternaria* blight is important to reduce the yield loss. However, management of the disease using fungicides alone or repeated use of fungicides leads to concerns such as residue accumulation, selection pressure on the pathogen and environment contamination. But utilizing bio-agents only for the complete management disease takes a long time. Hence, integrating bio-agents and fungicides provides effective disease management strategy. The field performance of different combinations varies considerably depending on the environment and cropping seasons. It is necessary to identify effective treatment combinations under regional production conditions. The present experiment was carried out to evaluate the effectiveness of different treatments in management of *Alternaria* blight of sunflower.

Material and Methods

A field experiment was carried out on bio-intensive management of *Alternaria* blight of sunflower during Kharif 2025 at Main Agricultural Research Station (MARS), Raichur. The experiment was laid out in RBD with 8 treatments and 3 replications using sunflower hybrid KBSH-44. Seed treatment followed foliar sprays at 45 DAS and 60 DAS were done. The observations on the per cent disease incidence were taken before 1st spray, after 1st spray and after 2nd spray. In each treatment block around 20 plants were tagged for observations. Apart from PDI, per cent disease control, yield and B:C ratio were also considered. The scoring of the disease was done using 0-9 scale given by Mayee et al. (1986) [3].

$$\text{Per cent Disease Index} = \frac{\text{Sum of individual disease rating scale}}{\text{Total number of observations}} \times \frac{100}{\text{Maximum disease scale}}$$

The treatment details are as follows:

Results

All the treatments reduced the severity of the disease but the extent of disease suppression varied among the treatments. There were relatively smaller differences in the PDI before 1st spray and the severity of the disease from 9.12 in T_4 to 14.42 per cent in T_8 . This shows that the treatments had already produced some differences in the disease expression by the time of initial disease assessment. After the foliar spray at 45 DAS, the observations show that T_4 recorded least PDI of 21.62 followed by T_7 and T_2 with PDI 23.37 and 25.17 respectively. Whereas T_1 showed the highest PDI of 32.40 after untreated control (35.76). The treatment involving *Pseudomonas fluorescens* as both seed treatment and foliar spray showed lowest disease severity after the first spray. This indicates that the treatments involving *P. fluorescens* showed greater disease suppression compared to *T. harzianum* treatments under the conditions of the experiment.

Table 1. Bio-intensive management treatments evaluated against *Alternaria* blight of sunflower during Kharif 2025

Treatment	Treatment details
T1	Seed treatment with <i>Trichoderma harzianum</i> @ 10 g kg ⁻¹ seed followed by foliar spray with <i>T. harzianum</i> @ 10 g L ⁻¹ at 45 DAS + propiconazole @ 1 ml L ⁻¹ at 60 DAS
T2	Seed treatment with <i>Pseudomonas fluorescens</i> @ 10 g kg ⁻¹ seed followed by foliar spray with <i>P. fluorescens</i> @ 10 g L ⁻¹ at 45 DAS + propiconazole @ 1 ml L ⁻¹ at 60 DAS
T3	Seed treatment with <i>T. harzianum</i> @ 10 g kg ⁻¹ seed followed by foliar spray with <i>T. harzianum</i> @ 10 g L ⁻¹ at 45 DAS + difenoconazole + propiconazole @ 0.25 ml L ⁻¹ at 60 DAS
T4	Seed treatment with <i>P. fluorescens</i> @ 10 g kg ⁻¹ seed followed by foliar spray with <i>P. fluorescens</i> @ 10 g L ⁻¹ at 45 DAS + difenoconazole + propiconazole @ 0.25 ml L ⁻¹ at 60 DAS
T5	Seed treatment with <i>T. harzianum</i> @ 10 g kg ⁻¹ seed followed by foliar spray with <i>P. fluorescens</i> @ 10 g L ⁻¹ at 45 DAS + propiconazole @ 1 ml L ⁻¹ at 60 DAS
T6	Seed treatment with <i>P. fluorescens</i> @ 10 g kg ⁻¹ seed followed by foliar spray with <i>T. harzianum</i> @ 10 g L ⁻¹ at 45 DAS + propiconazole @ 1 ml L ⁻¹ at 60 DAS
T7	Seed treatment with mancozeb @ 2 g kg ⁻¹ seed followed by foliar spray with hexaconazole @ 1 ml L ⁻¹ at 45 and 60 DAS
T8	Untreated control

The differences in PDI of the treatments recorded after second spray i.e 60 DAS was significant. Here T_4 showed minimum PDI of 30.81 followed by T_7 (33.29) and T_2 (34.73). But the highest disease severity was observed in T_8 (52.78 %) followed by T_1 (45.16 %). The C.D value of 1.97 was noticed at 5 per cent in the present experiment indicating the differences among treatments were distinguishable statistically under field conditions.

The superiority in the performance of T_4 [Seed treatment with *P. fluorescens* @ 10 g kg⁻¹ seed followed by foliar spray with *P. fluorescens*

@ 10 g L⁻¹ at 45 DAS + difenoconazole + propiconazole @ 0.25 ml L⁻¹ at 60 DAS] was observed with highest per cent disease reduction (41.62) over control, high yield (1310 kg/ha) and high B:c ratio of 2.02 followed by T_7 [Seed treatment with mancozeb @ 2 g kg⁻¹ seed followed by foliar spray with hexaconazole @ 1 ml L⁻¹ at 45 and 60 DAS] with yield of 1256 kg/ha and disease control of 36.92 per cent with B:C ratio of 1.91 as shown in Table 2. This suggests that disease suppression was associated with better yield under field conditions of this study. Economic analysis also shows that T_4 was most effective out of 8 treatments during Kharif 2025.

Discussion

The present study demonstrated that integration of both bio-agents and fungicide in disease management of *Alternaria* blight of sunflower was effective. The superiority of T_4 was seen in both seed treatment as well as foliar spray before fungicidal application. It indicates that the effectiveness of disease management may depend not only on the individual component but also their sequence, compatibility and integration. The treatments with *P. fluorescens* performed well compared to treatments with *T. harzianum*. In case of T_4 and T_2 though both treatments involve *P. fluorescens*, the difference in the performance was associated with fungicidal component used as foliar spray at 60 DAS. The lower disease and high yield in T_4 shows the fungicide combination in this treatment complimented the biological component more effectively as compared to T_2 .

Our results were in consistent with Rajendran *et al.* (2017) [4] seed biopriming with TNAU *Pseudomonas fluorescens* (Pf1) @ 10g/kg seeds followed by spray of Hexaconazole @ 0.1% at 45 days and *P. fluorescens* (Pf1) @ 1.0% at 60 DAS showed less severity of *Alternaria* leaf spot (25.7) with the highest yield of 1471 kg/ha against the control (47.7) which recorded yield of 1111 kg/ha. The suppression of *Alternaria* blight helped preserve the productive leaf area and thereby supporting better seed formation and good yield. Similar results were also observed by Waghe *et al.* (2015) [5] where they studied fungicides, biocontrol agents and botanicals under field conditions. Seed treatment with SAAF at 3 g/kg seed + two sprays of SAAF at 0.2% at 30 and 45 DAS recorded highest disease control (82.82%) with highest seed yield (1686 kg/ha). Whereas, Mohammad (2019) [6] reported that minimum disease severity (16.3%) was observed in T_{11} (foliar application of Difenoconazole @ 0.1%) and it was significantly lower than all other treatments. The highest seed yield was observed in T_{11} (foliar application of Difenoconazole @ 0.1%) and T_{10} (foliar application of Difenoconazole @ 0.05%) treatments. This study follows the experimental results of Balakrishnan *et al.* (2020) [7] where the combination of seed treatment with endophytes *Pseudomonas* sp. 10g/kg of seed + foliar spray at 30 and 45 days after sowing recorded least per cent disease intensity with highest yield among all treatments.

The disease management practices must not only be assessed in terms of disease reduction but also economic feasibility. Here, highest benefit-cost ratio emerged in T_4 with 2.02 (Table 3) which indicates that additional expenditure associated with treatment was justified by increase in economic return. The findings of this experiment suggest that bio-intensive management can be incorporated into management practices through application of compatible components in sequence. But the timing if intervention is also important. Use of bio-agents as seed treatment and initial foliar spray helps the growth of the plant thereby reducing the progression of the disease by different mechanisms like competition, antagonism, parasitism and antibiosis. Fungicide application at later stage 60 DAS protection to the crop.

Table 2. Bio-intensive management of *Alternaria* blight of sunflower during *Kharif* 2025

Treatments	Treatment details	Percent Disease Index		Per cent reduction over control	Yield (Kg/ha)
		Before 1st spray	After 1st spray	After 2nd spray	
T ₁	Seed treatment with <i>Trichoderma harzianum</i> @ 10g/kg seed followed by foliar spray with <i>Trichoderma harzianum</i> @ 10g/lit at 45 DAS + foliar spray with propiconazole @ 1 ml/lit at 60 DAS	13.63 (21.67)	32.40 (34.70)	45.16 (42.22)	1135 14.43
T ₂	Seed treatment with <i>Pseudomonas fluorescens</i> @ 10g/kg seed followed by foliar spray with <i>Pseudomonas fluorescens</i> @ 10g/lit at 45 DAS + foliar spray with propiconazole @ 1 ml/lit at 60 DAS	10.76 (19.15)	25.17 (30.11)	34.73 (36.11)	1210 34.19
T ₃	Seed treatment with <i>Trichoderma harzianum</i> @ 10g/kg seed followed by foliar spray with <i>Trichoderma harzianum</i> @ 10 g/lit at 45 DAS + foliar spray with (difenoconazole+ propiconazole) @ 0.25 ml/lit at 60 DAS	11.81 (20.10)	27.65 (31.72)	38.12 (38.13)	1197 27.77
T ₄	Seed treatment with <i>Pseudomonas fluorescens</i> @ 10g/kg seed followed by foliar spray with <i>Pseudomonas fluorescens</i> @ 10 g/lit at 45 DAS + foliar spray with (difenoconazole + propiconazole) @ 0.25 ml/lit at 60 DAS	9.12 (17.58)	21.62 (27.71)	30.81 (33.72)	1310 41.62
T ₅	Seed treatment with <i>Trichoderma harzianum</i> @ 10g/kg seed followed by foliar spray with <i>Pseudomonas fluorescens</i> @ 10 g/lit at 45 DAS +foliar spray with propiconazole @ 1 ml/lit at 60 DAS	13.26 (21.35)	30.52 (33.54)	42.90 (40.92)	1165 18.71
T ₆	Seed treatment with <i>Pseudomonas fluorescens</i> @ 10g/kg seed followed by foliar spray with <i>Trichoderma harzianum</i> @ 10g/lit at 45 DAS + foliar spray with propiconazole @ 1 ml/lit at 60 DAS	12.43 (20.64)	28.75 (32.42)	40.42 (39.48)	1184 23.41
T ₇	Seed treatment with mancozeb @ 2g/kg seed followed by foliar spray with hexaconazole @ 1 ml/lit at 45 and 60 DAS	10.63 (19.03)	23.37 (28.91)	33.29 (35.24)	1256 36.92
T ₈	Untreated control	14.42 (22.32)	35.76 (36.73)	52.78 (44.59)	826 --
	S. Em. ±	0.34	0.54	0.65	20.25
	C. D. @ 0.05	1.03	1.63	1.97	61.42

*Figures in parenthesis are arc sine values; Observations were recorded at 7 days after each spray

Table 3. Economics for the bio-intensive management of *Alternaria* blight of sunflower during Kharif 2025

Treatments	Treatments	Yield (Kg/ha)	Total Cost of Cultivation (Rs/ha)	Total income (Rs/ha)	Net profit (Rs/ha)	B:C
T ₁	Seed treatment with <i>Trichoderma harzianum</i> @ 10g/kg seed followed by foliar spray with <i>Trichoderma harzianum</i> @ 10g/lit at 45 DAS + foliar spray with propiconazole @ 1 ml/lit at 60 DAS	1135	33365	85125	51760	1.55
T ₂	Seed treatment with <i>Pseudomonas fluorescens</i> @ 10g/kg seed followed by foliar spray with <i>Pseudomonas fluorescens</i> @ 10g/lit at 45 DAS + foliar spray with propiconazole @ 1 ml/lit at 60 DAS	1210	33365	90750	57385	1.72
T ₃	Seed treatment with <i>Trichoderma harzianum</i> @ 10g/kg seed followed by foliar spray with <i>Trichoderma harzianum</i> @ 10 g/lit at 45 DAS + foliar spray with (difenconazole+ propiconazole) @ 0.25 ml/lit at 60 DAS	1197	32575	89775	57200	1.76
T ₄	Seed treatment with <i>Pseudomonas fluorescens</i> @ 10g/kg seed followed by foliar spray with <i>Pseudomonas fluorescens</i> @ 10 g/lit at 45 DAS + foliar spray with (difenconazole + propiconazole) @ 0.25 ml/lit at 60 DAS	1310	32575	98250	65675	2.02
T ₅	Seed treatment with <i>Trichoderma harzianum</i> @ 10g/kg seed followed by foliar spray with <i>Pseudomonas fluorescens</i> @ 10 g/lit at 45 DAS +foliar spray with propiconazole @ 1 ml/lit at 60 DAS	1165	33365	87375	54010	1.62
T ₆	Seed treatment with <i>Pseudomonas fluorescens</i> @ 10g/kg seed followed by foliar spray with <i>Trichoderma harzianum</i> @ 10g/lit at 45 DAS + foliar spray with propiconazole @ 1 ml/lit at 60 DAS	1184	33365	88800	55435	1.66
T ₇	Seed treatment with mancozeb @ 2g/kg seed followed by foliar spray with hexaconazole @ 1 ml/lit at 45 and 60 DAS	1256	32380	94200	61820	1.91
T ₈	Untreated control	826	28000	61950	33950	1.21



Field view of the experiment

T₄: Seed treatment with *Pseudomonas fluorescens* @ 10g/kg seed followed by foliar spray with *Pseudomonas fluorescens* @ 10 g/lit at 45 DAS + foliar spray with (difenconazole + propiconazole) @ 0.25 ml/lit at 60 DAS



T8: Untreated control

Figure 1. Bio-intensive management of *Alternaria* leaf blight of sunflower under field condition during Kharif 2025

Conclusion

The field evaluation involving bio-agents and fungicide during Kharif 2025 at MARS, Raichur for the management of *Alternaria* blight of sunflower demonstrated significant differences among all the treatments. Seven treatments (T_1 to T_7) reduced the disease incidence compared to the untreated control (T_8) but their effectiveness varied substantially. The most effective treatment was T_4 [Seed treatment with *P. fluorescens* @ 10 g kg⁻¹ seed followed by foliar spray with *P. fluorescens* @ 10 g L⁻¹ at 45 DAS + difenoconazole + propiconazole @ 0.25 ml L⁻¹ at 60 DAS] with lowest disease severity of 30.81 per cent, highest reduction over control of 41.62 per cent and highest yield of 1310 kg/ha. This was supported with highest cost-benefit ratio of 2.02. The next best treatment was T_7 in terms of PDI, seed yield, per cent disease reduction and B:C ratio. Therefore, integrating bio-agent with fungicide was a promising bio-intensive approach for the management of *Alternaria* blight of sunflower. This approach combines biological disease suppression with fungicidal protection. Under the conditions of the present experiment resulted in disease management, productivity and economic feasibility.

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References

1. Department of Agriculture and Farmers Welfare. Unified Portal for Agricultural Statistics (UPAg). Ministry of Agriculture & Farmers Welfare, Government of India. 2026.

2. Rao MSL, Kulkarni S, Lingaraju S, Nadaf HL. Bio-priming of seeds: a potential tool in the Integrated management of *Alternaria blight* of sunflower. *Helia*. 2009;32(50):107-114.
3. Mayee CD, Datar VV. Phytopathometry, Technical Bulletin-I. Marathwada Agril Uni, Parbhani. 1986;46.
4. Rajendran L, Gopalakrishnan C, Selvakumar T, Manivannan N, Viswanathan PL. Effect of TNAU-Pfl seed bio priming and foliar spray of newer fungicides on the incidence of leaf blight of sunflower. *J Biol Control*. 2017;31(2):114-118.
5. Waghe KP, Wagh SS, Kuldhar DP, Pawar DV. Evaluation of different fungicides, bioagents and botanicals against *Alternaria blight* caused by *Alternaria helianthi* (Hansf) of sunflower. *Afr J Agric Res*. 2015;10(5):351-358.
6. Mohammad Nasim. Management of *Alternaria blight* (*Alternaria helianthi* (Hansf.) Tubaki and Nishih.) of sunflower. Punjab Agricultural University, Ludhiana (India). 2019.
7. Balakrishnan S, Ramanathan A, Sudhakar D, Muthamilan M, Mahalingam L, Rajendran L, Seethapathy P. Field evaluation of fungicide, biotic and abiotic inducers for the management of *Alternaria alternata* leaf blight of sunflower. *J Pharmacogn Phytochem*. 2020;9(1):574-575.

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