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Short Communication

Management of *Alternaria* Blight of Sunflower through Biopriming and Microbial Seed Treatment

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Sunflower is cultivated in India over an area of 21.62 lakh ha with a production of 12.24 lakh tonnes. Among the major diseases of sunflower, *Alternaria* blight caused by *Alternaria helianthi* is most devastating fungal disease of sunflower in India [1]. The disease is known to cause more than 80 per cent of yield loss under severe epiphytotic conditions [2]. Hiremath and others [3] observed that the infection of *Alternaria helianthi* reduced seed germination by 35% compared with apparently healthy seeds. Biotic agents along with priming agents for managing plant diseases has been considered as a novel approach, as it requires low amounts of bioagents reducing the cost of control and pollution hazards while causing minimum interference with biological equilibrium [4]. The use of bioagents with priming has become an inevitable method of disease control, particularly in sunflowers and in the absence of resistant cultivars. The infusion of fungicides into dormant seeds is a useful and efficient means of plant disease control. Seed treatment with biocontrol agents along with priming may serve as an important means of managing many soil and seed-borne diseases, the process often known as "bio-priming". Bio-priming process had potential advantages over simple seed coating with bioagents. Seed priming often results in more rapid and uniform seedling emergence and may be useful under adverse soil conditions [5]. In the present study some bioagents were tested with biopriming under field conditions for standardizing the biopriming technique for the management of blight disease of sunflower.

A field experiment was conducted during the year 2021-22, at MPKV, Rahuri to standardize the biopriming technique for the management of *Alternaria* blight in sunflower. Total 17 seed samples of sunflower were collected from different sources. Detection of seed borne fungi as well as *Alternaria helianthi* was done using Standard Blotter techniques recommended by the International Seed Testing Association [6].

The percentage occurrence of total seed mycoflora as well as that of *Alternaria helianthi* were calculated and compared. The sample showing the highest incidence of *Alternaria* blight by blotter test was used for further study. Seeds of the sunflower Var. Bhanu was soaked for 12 hours in water and dried in shade upto original moisture content (8-10%). These seeds were subjected to nine seed priming treatments *viz*., seed priming with (i) *T. viride* @10 gm/kg seed; (ii) *T. harzianum* @10 gm/kg seed; (iii) *P. fluorescens* @10 gm/kg seed, (iv) *B. subtilis* @*10 gm/kg seed*, (v) *T. viride* + *P. fluorescens* @ 5 gm each /kg seed*,* (vi) *T. harzianum* + *P. fluorescens* @ 5 gm each / kg seed, (vii) *T. viride* + *B. subtilis* @ 5 gm each /kg seed, *(viii) T. harzianum* + *B. subtilis* @ 5 gm each /kg seed along with (ix) control. The seeds were dried in shade and stored at 25±2ºC for 24 h in a self–sealing plastic bag before being tested under field conditions. The experiment was laid out in a randomized block design with three replications. The treatments were randomly allotted to the plots. A plot size of 4.0 × 3.0 m was maintained with spacing of 45 × 30 cm. Other recommended practices were followed from time to time to raise the crop. Observations on blight disease incidence at 45, 60 and 75 days after sowing were recorded by scoring five plants in each treatment on a 0 to 9 scale of [7], Yield (quintal/ha) were also recorded and percent disease index (PDI) was calculated using the formula given by [8].

$$PDI = \frac{\text{Sum of numerical disease ratings}}{\text{No. of plants /leaves observed} \times \text{Maximum disease rating value}} \times 100$$

In laboratory the effects of biopriming on *Alternaria helianti* was done by adopting Standard blotter method [9].

Bioprimed seeds were plated in 9 cm diameter sterile petri dishes containing three layers of sterile blotter moistened with sterilized tap water. Ten seeds were placed in each petri dish and incubated at 20+2^{o}C for 7 days in incubation room under cool white fluorescent light with alternating cycles of 12 h light and 12 h darkness. The effect of biopriming on seed germination and seedling vigour index of sunflower was studied by towel paper method. The experiment was laid out in CRD with four replications and seven treatments in the laboratory. Fifty seeds were placed on each towel paper and rolled carefully to avoid disturbances of seeds from their places. For each treatment eight towels of 50 seeds (400 seeds) were used. The rolled towel paper were kept in slanting position and incubated at 24°C temp. with relative humidity above 85 per cent in seed germinator [10]. A count of normal seedlings was recorded after 7 days. The mean seed germination was calculated. The seed with full growth of plumule and radical were considered as normal. The root and shoot length (cm) of randomly selected 10 normal seedlings from each towel paper were measured and seedling vigour index was calculated by the formula given by [11].

Seedling vigour index (SVI) = [Mean root length (cm) + mean shoot length (cm)] × Germination Percentage (%)

The data obtained in respect of seed germination and field emergence were transformed in to arc sin values and subjected to statistical analysis.

Effect of biopriming and bioaagents on seed borne fungi

Sunflower is a low techno-management crop. Therefore it is cultivated as a rainfed crop in *kharif* and limited irrigation in *rabi* season. But disease is one of the obstacle in sunflower production. *Alternaria* blight caused by *Alternaria helianthi* is most devastating fungal disease of sunflower in India [1]. Seed enhancement encompasses various technologies used to increase the consistency of seed performance meeting biotic and abiotic stresses, thereby improving a crops harvested yield and quality. Seed enhancements technologies have potential to confer abiotic and biotic stresses, improve seed vigour and modify seed emergence capability by reducing seed mycoflora. Seed biopriming is therefore being employed for disease management, quality upgradation and have been found useful for commercial application. Application of beneficial bioagents to seed is a niche that protects seed and reduces the use of seed of pesticides applied. Seed biopriming with *T. harzianum* + *P. fluorescens* registered for better performance over control. Seed primed with *T. harzianum* + *P. fluorescens* may have effected a reduction of stress caused by seed as well as soil borne diseases and other deleterious on pre-emergence of the germinated seeds in comparison to the seeds germinated under without seed priming [12]. Seed biopriming increased root and shoot growth and therefore finally seedling vigour index. Seed priming is a controlled hydration process that involves exposing seed to low water potentials that restricts germination but permits pre-germinative physiological and biological changes to occur [13]. There were significant differences among the treatments for most of the attributes under study. The highest reduction in the incidence of *Alternaria helianthi* up to 79.23% was recorded at 12 hrs pre hydrated seed treatment with *T. harzianum*+ *P. fluorescens* @ 5 gm each /kg seed followed by seed primed with *T. viride* + *P. fluorescens* @ 5 gm each /kg seed (Table 1).

The highest seed germination, root and shoot lengths and vigour index were also recorded at 12 hrs pre

Table 1. Effect of biopriming on association of *A. helianthi* in sunflower seed

Treatment	Association of *A. helianthi* by std. blotter method (%)	Per cent reduction over control
Biopriming with *T. viride* @10 gm/kg seed	18.00 (25.10)*	60.29
Biopriming with *T. harzianum* @10 gm/kg seed	17.67 (24.85)	61.02
Biopriming with *P. fluorescens* @10 gm/kg seed	22.00 (27.97)	51.47
Biopriming with *B. subtilis* @10 gm/kg seed	22.66 (28.43)	50.01
Biopriming with *T. viride*+ *P. fluorescens* @ 5 gm each /kg seed	13.00 (21.13)	71.32
Biopriming with *T. harzianum*+ *P. fluorescens* @ 5 gm each /kg seed	11.00 (19.36)	75.73
Biopriming with *T. viride*+ *B. subtilis* @ 5 gm each /kg seed	17.33 (24.58)	61.77
Biopriming with *T. harzianum*+ *B. subtilis* @ 5 gm each /kg seed	16.00 (23.57)	64.70
Untreated control	45.33 (42.32)	
SE+	0.51	-
CD at 5%	1.51	-
CV %	3.35	-

*Figures in parenthesis are arc sin transformed value

Table 2. Effect of biopriming on seed germination and Seedling Vigour Index (SVI) in sunflower

Treatment	Seed germination (%)	Per cent increase over control	Seedling Vigour Index (SVI)	Per cent increase over control
Biopriming with *T. viride* @10 gm/kg seed	74.67 (59.81)*	9.28	1943	8.12
Biopriming with *T. harzianum* @10 gm/kg seed	75.00 (60.01)	9.76	1956	8.85
Biopriming with *P. fluorescens* @10 gm/kg seed	74.00 (59.35)	8.30	1946	8.29
Biopriming with *B. subtilis* @10 gm/kg seed	73.66 (59.13)	7.80	1923	7.01
Biopriming with *T. viride*+ *P. fluorescens* @ 5 gm each /kg seed	79.00 (62.74)	15.62	2055	14.36
Biopriming with *T. harzianum*+ *P. fluorescens* @ 5 gm each /kg seed	81.33 (64.41)	19.03	2083	15.92
Biopriming with *T. viride*+ *B. subtilis* @ 5 gm each /kg seed	77.00 (61.35)	12.69	2005	11.57
Biopriming with *T. harzianum*+ *B. subtilis* @ 5 gm each /kg seed	78.00 (62.04)	14.15	2016	12.19
Untreated control	68.33 (55.76)		1797	
SE+	0.77	-	33.77	-
CD at 5%	2.28	-	100.32	-
CV %	2.19	-	2.97	-

*Figures in parenthesis are arc sin transformed value

Table 3. Effect of biopriming on field emergence, blight incidence and yield under field conditions in sunflower

Treatment	Field emergence (%)	Per cent increase over control	Blight incidence (%)	Per cent decrease over control	Yield (q/ha)	Increase over control (%)
Biopriming with *T. viride* @10 gm/kg seed	71.00 (57.43)*	9.23	54 (47.61)*	30.77	19.80	10.96
Biopriming with *T. harzianum* @10 gm/kg seed	71.33 (57.66)	9.74	52 (46.17)	33.33	20.38	14.20
Biopriming with *P. fluorescens* @10 gm/kg seed	70.66 (57.21)	8.71	55 (47.87)	29.49	18.62	4.36
Biopriming with *B. subtilis* @10 gm/kg seed	70.33 (57.00)	8.20	57 (49.03)	26.92	18.40	3.11
Biopriming with *T. viride*+ *P. fluorescens* @ 5 gm each /kg seed	73.67 (59.13)	13.34	42 (40.40)	46.15	21.31	19.43
Biopriming with *T. harzianum*+ *P. fluorescens* @ 5 gm each /kg seed	75.00 (60.01)	15.38	39 (38.64)	50.00	21.84	22.42
Biopriming with *T. viride*+ *B. subtilis* @ 5 gm each /kg seed	72.00 (58.05)	10.77	47 (43.27)	39.74	21.04	17.93
Biopriming with *T. harzianum*+ *B. subtilis* @ 5 gm each /kg seed	72.33 (58.27)	11.28	46 (42.70)	41.03	20.82	16.69
Untreated control	65.00 (53.74)		78 (62.06)		17.84	
SE+	0.80	-	3.72	-	0.83	-
CD at 5%	2.40	-	11.13	-	2.50	-
CV %	12.41	-	13.87	-	12.21	-

*Figures in parenthesis are arc sin transformed value

hydrated seed treatment with *T. harzianum*+ *P. fluorescens* @ 5 gm each /kg seed . This treatment increased seed germination by 19.03% and Seedling Vigour Index by 15.92% over control, followed by seed primed with *T. viride* + *P. fluorescens* @ 5 gm each /kg seed (Table 2).

In field studies, 12 hrs pre-hydrated seed treatment with *T. harzianum*+ *P. fluorescens* @ 5 gm each /kg seed was also found effective in increasing the field emergence (75.00%) by15.38% , yield (21.84 q/ha) by 22.42% and reducing the blight incidence by 50.00% over untreated control, followed by seed primed with *T. viride* + *P. fluorescens* @ 5 gm each /kg seed. (Table 3). While critically analyzing it was observed that bio- primed seeds exhibited faster rate of germination, more uniform emergence, reduced dormancy and greater tolerance to diseases and thus finally enhanced the yield. Thus, potential of these seed priming treatments needs to be exploited commercially for better performance of sunflower seed.

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