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Original Research Article

Control of *Alternaria* Blight of Ashwagandha through Fungicides, Organic Manure and Biofertilzers

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Keywords

Ashwagandha, *Alternaria alternata*, management, fungicides, organic manure, biofertilizer

A B S T R A C T

An experiment was conducted under lab and field conditions during the year 2008-09 and 2009-10 for studying the management of *Alternaria* blight of Ashwagandha through fungicides, organic manure and biofertilizer. Maximum growth inhibition occurred in Carbendazim and Chlorothalonil after eight days (0.0 mm) at 500 ppm concentration *in vitro*. Minimum PDI of 5.0 and 5.4 was observed in Vitavax Power and Mancozeb *in vivo*. Maximum yield was recorded in Vitavax Power (7.48 q/ha) and Mancozeb (6.77 q/ha) followed by Chlorothalonil (5.75 q/ha). Evaluation of seven amendments of biofertilizes for management of disease under field conditions revealed that minimum PDI was observed in FYM and RDF + FYM. Maximum increase in yield was recorded in FYM followed by RDF + FYM.

Introduction

Withania or Ashwagandha [*Withania somnifera* (L.) Dunal] is an important medicinal plant of India belonging to Solanaceae. A native of Mediterranean region in North Africa, it is also found in Madhya Pradesh, Punjab, Himachal Pradesh, Western Uttar Pradesh and Himalayas.

It is cultivated in an area of about 4000 ha in India (Farooqui and Sreeramu, 2001). In Madhya Pradesh, it is cultivated in Neemuch, Chhindwara, Mandsaur, Seoni, Katni, Shahdol, Dewas, Dindori, Hoshangabad and Jabalpur districts. Roots are excellent for preparing medicines. Diseased leaves exhibited decrease in sugars (20%) and chlorophyll (26.5%) whereas; increase was noticed for proline (25%), free amino acids (3%) and proteins (74.3%).

The leaf blight of Ashwagandha caused by *A. alternata* revealed that a little information is available more particularly on disease prediction module in Madhya Pradesh leading to its management. Therefore, an attempt was being made for its management through fungicides, organic manure and biofertilzers.

Materials and Methods

In vitro–poisoned food technique was employed to test the efficacy of six recommended fungicides tested against *A. alternata* by using three concentrations (100, 250 and 500 ppm) of formulated products of Copper oxychloride 50 WP (Blue copper 50), Carboxin, Vitavax Power, Chlorothalonil, Carbendazim (Bavistin 50 WP BASF) and Mancozeb 75 WP

(Manzate). Observation on mean radial growth of pathogen was recorded on alternate days and percent inhibition over control was calculated as follows. *In Vivo* An experiment was conducted under field conditions following randomized block design with three replications having plot size 6 × 3 m^2 during the year 2008-09 and 2009-10. Seven fungicides along with recommended dose were tested against leaf blight. The solution / suspension of each fungicide was prepared and sprayed on 90 days old Ashwagandha plants.

The sprayer was washed and cleaned thoroughly with water to remove traces of chemical first applied. The plot sprayed with sterilized water served as control. The data was recorded at an interval of 15 days upto initiation of disease and was subjected to statistical analysis. During both the years, an experiment was conducted by using seven organic manure including biofertilizer to see the disease incidence due to Alternaria blight. Three replications were maintained with plot size of 6 × 3 m^2. Observations on percent disease incidence were recorded after initiation of disease at an interval of 15 days and finally yield was computed.

Results and Discussion

Efficacy of fungicides against *A. alternata* evaluated under *in vitro* condition presented in Table 1 indicated that all fungicides significantly decreased mycelial growth as compared to control. Higher concentration (500 ppm) of each fungicide was more effective in inhibition of growth as compared to lower concentration (100 ppm). Rate of growth among treatment ranged from 0.7 to 8.9 mm/day as compared to growth of control. Maximum growth inhibition occurred in Carbendazim and Chlorothalonil (0.0 mm) at 500 ppm concentration followed by Copper oxychloride (22.2 mm) and minimum was recorded in Carbendazim (79.9 mm) at 100 ppm concentration after eight days. The data presented in Table 1 indicated that days of incubation was proportional to mycelial growth. Hundred percent inhibition zone was observed in Carbendazim and Chlorothalonil followed by 75.1 percent in Copper oxychloride at 500 ppm concentration and minimum percent zone inhibition 10.4 percent in Carbendazim at 100ppm concentration. It is evident from the data that there was a significant increase in mycelial growth of *A. alternata* with increase in incubation period. Rate of growth among treatment ranged from 2.4 to 8.1 mm/day as compared to growth of control.

The interaction between fungicides and incubation period showed significantly minimum mycelial growth of *A.alternata* in Copper oxychloride (25.2 mm) followed by Chlorothalonil (26.1 mm) after eight days of incubation. Minimum mycelial growth of *A. alternata* was found in Carbendazim and Chlorothalonil (0.0 mm) significantly superior as compared to other treatments followed by Copper oxychloride (3.9 mm) at 500 ppm concentration. Maximum mycelial growth of *A. alternata* was found in Carbendazim (52.2 mm) at 100 ppm concentration. Patil *et al.,* (1992) reported that Ziram was most effective followed by Mancozeb and Copper oxychloride. Kamble *et al.,* (2000) also reported that Mancozeb was highly effective in inhibiting the mycelial growth of *A. alternata.* Spalding and King (1980) observed that Chlorothalonil was most effective for controlling the mycelial growth of *A. alternata.* The present finding is in close accordance with these finding however slight variation may be due to the difference in isolates and commercial product / concentration used.

Table.1 Radial growth of *Alternaria alternata* on PDA medium amended with five fungicides at three concentrations

Fungicides	Conc. (ppm)	Mycelial growth (mm) after days				Percentage inhibition over control
		2	4	6	8	
T_1 Copperoxychloride	100	11.2 (3.4)	19.3 (4.4)	24.2 (4.9)	29.3 (5.4)	67.1
	250	8.2 (2.9)	16.1 (4.0)	21.3 (4.6)	24.2 (4.9)	72.8
	500	6.8 (2.7)	14.2 (3.8)	19.6 (4.4)	22.2 (4.7)	75.1
T_2 Vitavex Power	100	21.8 (4.7)	36.4 (6.0)	50.1 (7.1)	68.6 (8.3)	23.0
	250	18.4 (4.3)	34.3 (5.8)	48.0 (6.9)	66.4 (8.1)	25.5
	500	15.7 (4.0)	30.6 (5.5)	42.3 (6.5)	63.4 (7.9)	28.9
T_3 Chlorothalonil	100	13.1 (3.6)	25.2 (5.0)	32.2 (5.7)	43.2 (6.61)	51.5
	250	9.1 (3.1)	17.8 (4.2)	24.8 (5.0)	35.1 (5.9)	60.6
	500	0.0 (0.7)	0.0 (0.7)	0.0 (0.7)	0.0 (0.7)	100.0
T_4 Carbendazim	100	24.6 (5.0)	45.6 (6.7)	58.9 (7.7)	79.9 (8.9)	10.4
	250	22.7 (4.8)	43.6 (6.6)	57.1 (7.5)	78.3 (8.8)	12.2
	500	0.0 (0.7)	0.0 (0.7)	0.0 (0.7)	0.0 (0.7)	100.0
T_5 Mancozeb	100	22.7 (4.8)	40.8 (6.4)	49.9 (7.1)	67.3 (8.2)	24.5
	250	20.9 (4.6)	38.2 (6.2)	47.3 (6.9)	64.7 (8.0)	27.4
	500	18.1 (4.3)	35.8 (6.0)	45.3 (6.7)	62.7 (7.9)	29.7
T_6 Control	100	26.4 (5.1)	47.6 (6.9)	66.2 (8.1)	89.2 (9.4)	
	SE M	CD				
T	0.247	0.691				
C	0.175	0.489				
D	0.202	0.564				
TxCxD	0.857	2.396				

Table.2 Efficacy of various fungicides against *Alternaria* blight of Ashwagandha caused by *Alternaria alternate*

Treatment	Does %	PDI (%)		Mean (%)	Yield Kg/plot		Mean Kg/plot	Yield Q/ha		Mean Q/ha
		2008-09	2009-10		2008-09	2009-10		2008-09	2009-10	
Carboxin	0.10	10.6	10.4	10.5	0.542	0.500	0.538	5.420	5.340	5.380
Copper oxychloride	0.25	9.4	9.3	9.3	0.559	0.450	0.558	5.597	5.570	5.584
Thiram	0.20	12.6	13.4	13.0	0.525	0.519	0.522	5.197	5.253	5.225
Chlorothalonil	0.20	7.8	7.2	7.5	0.576	0.573	0.575	5.733	5.767	5.750
Carbendazim	0.10	8.2	7.9	8.0	0.556	0.555	0.556	5.557	5.560	5.559
Vitavax Power	0.10	5.1	5.0	5.0	0.750	0.746	0.748	7.467	7.497	7.482
Mancozeb	0.25	5.6	5.4	5.5	0.680	0.675	0.677	6.750	6.797	6.774
Control		30.4	32.6	31.5	0.480	0.400	0.404	4.000	4.083	4.042
SEm		0.11	0.17					0.16	0.14	
CD5%		0.3431	0.5238					0.4855	0.4156	

Table.3 Efficacy of various biofertilizers against Alternaria blight of Ashwagandha caused by *Alternaria alternate*

Treatment	Does (%)	PDI (%)		Mean (%)	Yield Kg/plot		Mean Kg/plot	Yield Q/ha		Mean Q/ha
		2008-09	09-10		2008-09	09-10		2008-09	09-10	
T_1=FYM	10t/ha	5.8	5.2	5.5	0.781	0.791	0.786	7.810	7.913	7.862
T_2=FYM+ *Azotobactor* + PSB	5t/ha 2kg/ha	7.6	7.0	7.3	0.662	0.666	0.664	6.623	6.667	6.645
T_3=RDF + Vermicompost	50% 5t/ha	8.2	7.8	8.0	0.637	0.643	0.640	6.377	6.433	6.405
T_4=Vermicompost	5t/ha	13.4	12.2	12.8	0.6230	0.623	0.623	6.230	6.233	6.232
T_5=Vermicompost + *Azotobactor* + PSB	2.5t/ha 2kg/ha	8.8	8.6	8.7	0.651	0.654	0.653	6.510	6.543	6.527
T_6=RDF	100%	16.4	15.3	15.8	0.569	0.573	0.571	5.697	5.737	5.717
T_7=RDF+ FYM	50% 5t/ha	6.8	6.8	6.8	0.721	0.725	0.723	7.217	7.250	7.234
T_8=Control		34.1	32.2	33.1	0.423	0.430	0.4265	4.233	4.307	4.270
SEm±		0.10	0.08					0.09	0.12	
CD		0.2969	0.2520					0.2814	0.3582	

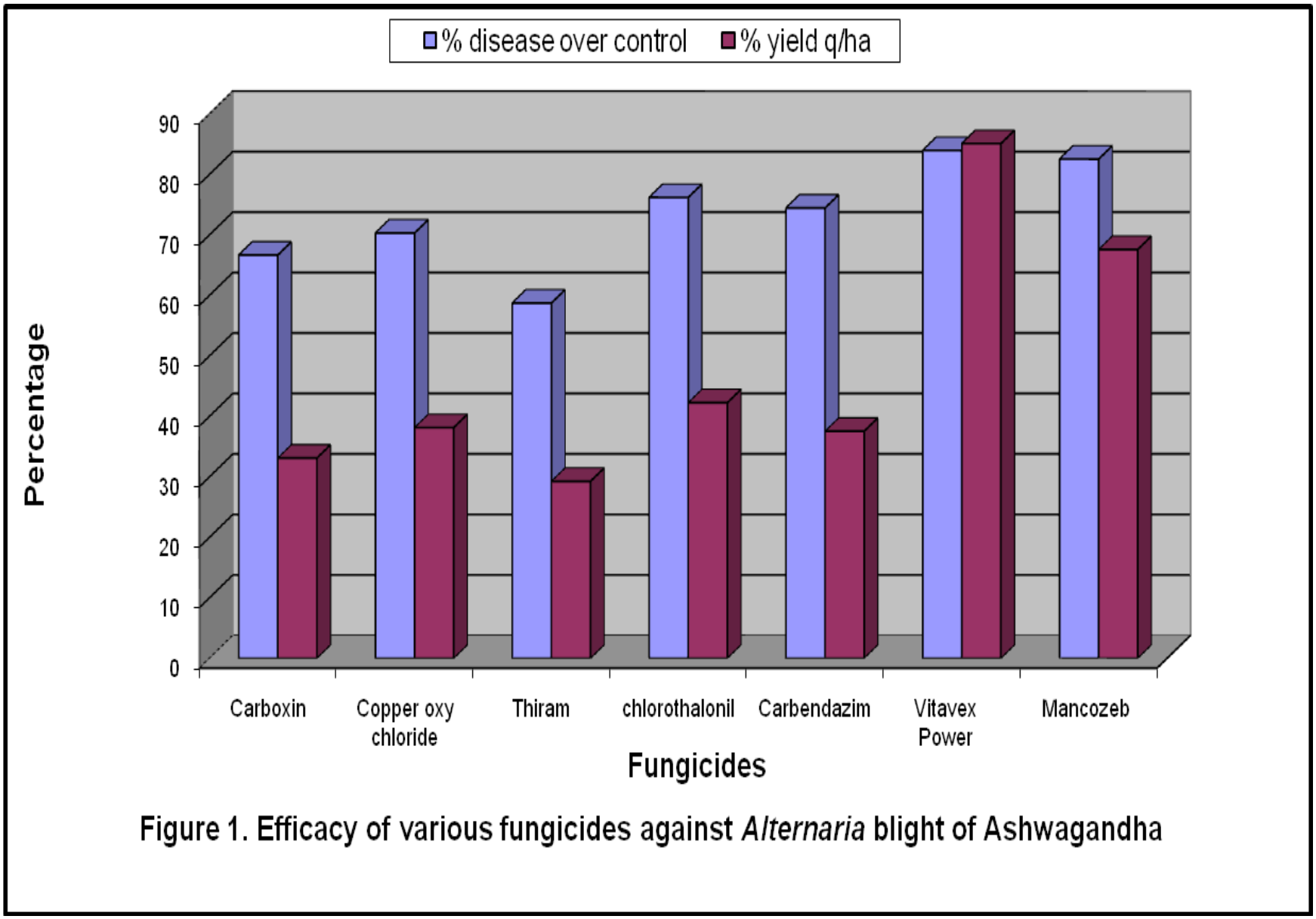

Figure 1. Efficacy of various fungicides against *Alternaria* blight of Ashwagandha

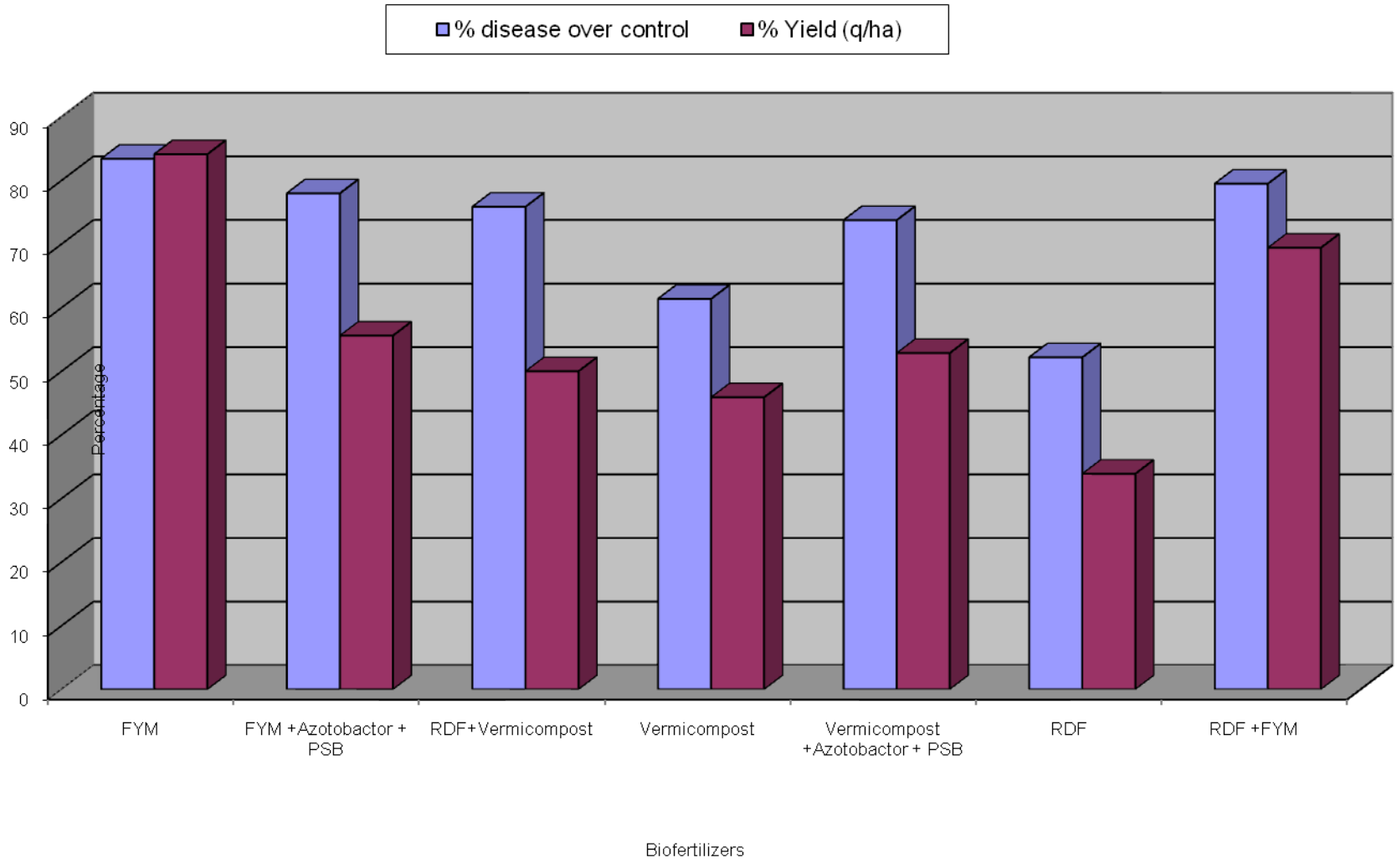

Figure 2. Efficacy of various biofertilzer against Alternaria blight of Ashwagandha caused by Alternaria alternata

The data presented in Table 2 under field conditions clearly indicated that during both the years percent disease incidence was 30.4 and 32.6 respectively. The mean PDI of all treatments (fungicides) was significantly reduced as compared to control. Maximum PDI among treatment was recorded in Thiram (13.0%) and Carboxin (10.5%) whereas, minimum PDI was observed in Vitavax Power (5.0%) and Mancozeb (5.4%). Maximum increase in yield (Kg/ha) was recorded in Vitavax Power (7.48 q/ha) followed by Mancozeb (6.77 q/ha). Vitavax power is found effective in checking *Alternaria* blight of Ashwagandha, whereas, spray of Mancozeb was found most effective (Kathal and Gupta, 2017).

Table 3 clearly indicated that during both the years, percent disease incidence was 34.1 and 32.2 respectively. The mean PDI of all treatments (biofertilizer) was significantly reduced as compared to control. The maximum PDI, among treatment of 15.85 percent and 12.8 percent was recorded in recommended doses of fertilizer and Vermicompost respectively. Minimum PDI of 5.5 and 6.8 was observed in FYM and RDF + FYM. Maximum increase in yield was recorded in FYM and RDF + FYM. After the application of biofertilizer, maximum yield (7.86 q/ha) and % disease incidence over control was observed for FYM (5.5%) followed by RDF+ FYM and least yield and % disease over control by RDF followed by Vermicompost. Evaluation of seven amendments of biofertilizers for management of disease under field conditions revealed that maximum yield (q/ha) and minimum % disease incidence was recorded in FYM (7.862 and 5.5) followed by RDF+ FYM (7.234 and 6.8) whereas low yield coupled with low percent disease incidence was recorded in RDF (5.717 and 15.8). Effect of organic manures and biofertilizers in control of diseases caused by *A.alternata* have been reported in different (Jayathilake *et al.,* 2002; Mughrabi, 2006).

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