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RESEARCH ARTICLE

EFFECT OF INTEGRATED DISEASE MANAGEMENT (IDM) MODULES ON GROWTH PARAMETERS AND INCIDENCE OF WHITE MOLD OF FRENCH BEAN CAUSED BY SCLEROTINIA SCLEROTIORUM.

C.Lalfakawma[1], B.C. Das[2]and M.C Talukdar[3]

[1]Department of Plant Pathology, College of Agriculture, Assam Agricultural University,Jorhat-785013,India.
[2]Regional Agricultural Research Station (RARS),Titabor-785630, Jorhat, Assam,India
[3]Department of Soil Science, College of Agriculture, Assam Agricultural University,Jorhat-785013,India.

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Corresponding Author

C.Lalfakawma,

Abstract

A study was conducted to evaluate the effect of Integrated Disease Management (IDM) modules on the incidence of white mold of French bean caused by *Sclerotiniasclerotiorum* during 2013 to 2014 in the experimental Farm of department of Horticulture, Assam Agricultural University, Jorhat. The results on integration of Carbendazim with bio-agent in different treatment combinations revealed that all the treatments significantly reduced white mold incidence. Maximum white mold incidence of French bean was observed in soil inoculated with *S. sclerotiorum* alone in absence of FYM and *Trichodermaharzianum.* Maximum reduction of white mold incidence was observed when seeds were treated with Carbendazim @ 0.2% and it was integrated with soil application of *T. harzianum* @ 2% (w/w) of soil and Carbendazim spray @ 0.1% at 15 and 30 days after germination in FYM amended soil

Introduction:-

French bean is susceptible to a wide range of disease causing pathogens. However, white mold caused by *S.sclerotiorum* has the principal significance, causing serious and unpredictable loss as high as 100 per cent (Purdy, 1979; Tu, 1989). It affects plant in all stage i.e. seedling, matured, harvested stages of crops.The disease have been found to be one of the most destructive in French bean as reported by several workers (Steadman, 1983 and Bag, 2000). *S. sclerotiorum* is a potential pathogen in Assam having a wide host range was first reported by Chowdhury (1946), Roy (1973) and Saikia (1986) recorded the occurrence of *S. sclerotiorum* on 30 hosts under 19 genera from North East India. In the North Eastern part of the country, more particularly, in the surroundings of Jorhat and Golaghat districts, the disease is of common occurrence in epidemic form and has been posing a serious threat to the cultivation of many crops including French bean during the last several years. Keeping in view the importance of developing a suitable management strategies, Field evaluation was carried out for management of *Sclerotinia*rot of French bean with an Integrated approach which involving co-ordinated use of multiple tactics for optimizing the control of soil-borne inoculum of the pathogen.

Materials and methods:-

The experiment was conducted in the Experimental Farm of Department of Horticulture, AAU, Jorhat. The plot size ($2m^2$) was laid out in Randomized Block Design (RBD) with three replication of each treatment. The soil of all the plot except uninoculated control,were inoculated with 15 days old *S. Sclerotiorum* grown on 4% MSM @ 2 % (w/w) before one week of sowing seeds.15 days old best bio-agent grown in wheat-bran wasused for soil application @ 2%(w/w).To get this concentration, 8.96 kg of substrate was added to a plot area of 2 squaremeter **Table 1:**Effect of

IDM modules on per cent disease incidence against white mold of French bean caused by *S. sclerotiorum* under field condition.

Treatments	Disease incidence (%)		
	30DAG	60 DAG	90DAG
FYM	12.96(21.10)[b]	31.74(34.29)[b]	41.48(40.09)[b]
Seed treatment with Carbendazim @ 2g/kg	0.37(3.49)[f]	4.44(12.16)[f]	10.37(18.79)[e]
Seed treatment with T. harzianum @ 15g/kg	4.81(12.67)[c]	12.22(20.46)[c]	18.89(25.76)[c]
Soil application with T. harzianum @ 20g/kg	3.34(10.53)[d]	10.37(18.79)[d]	16.29z23.80)[d]
Seed treatment with Carbendazim @ 2g/kg + soil application with T. harzianum @ 20g/kg	0.00(0.00)[h]	2.59(9.26)[g]	7.03(15.38)[g]
Seed treatment with T. harzianum @15g/kg + soil application with T. harzianum @ 20g/kg	2.22(8.57)[e]	6.40(14.65)[e]	11.11(19.47)[e]
Seed treatment with T. harzianum @ 15g/kg + soil application with T. harzianum @ 20g/kg + Carbendazim spray @ 1g/lt at 15 and 30 DAG	0.74(4.93)[g]	4.05(11.61)[f]	8.90(17.36)[f]
Seed treatment with Carbendazim @ 2g/kg + soil application with T. harzianum @ 20g/kg + spray Carbendazim @ 1g/lt at 15 and 30 DAG.	0.00(0.00)[h]	1.82(7.75)[h]	5.92(14.08)[h]
S. sclerotiorum alone (Inoculated control)	28.11(32.02)[a]	65.74(54.17)[a]	83.37(65.93)[a]
Uninoculated control (Absolute control)	0.00(0.00)[h]	1.00(5.74)	3.70(11.09)[i]
S.Ed(±)	**0.38**	**0.43**	**0.50**
CD (P = 0.05)	**0.82**	**0.92**	**1.05**

Figure in the parenthesis are angular transformed value
DAG = Days after germination,Values are mean of three replications
Means followed by same letter shown in superscript(s) are not significantly different.

(approx. 880 kg of soil). The amendment requirement was calculated on the basis of 2 million kg of soil/ha. All the plots except inoculated control and absolute control were allotted organic amendment @ 2kg/plot. French bean seeds (var. Contender) were sown @ 30 seeds/ plot with a spacing of 45 cm x 35 cm. The treatments were: (T_1) FYM + *S. Sclerotiorum*,(T_2) Seed treatment with Carbendazim @ 2g/kg, (T_3) Seed treatment with *T. harzianum* @ 15g/kg, (T4) Soil application with *T.harzianum*@ 20g/kg ,(T5) Seed treatment with Carbendazim @ 2g/kg + soil application with *T. Harzianum*@ 20g/kg , (T6) Seed treatment with *T.harzianum* @15g/kg + soil application with *T. harzianum*@ 20g/kg, (T_7) Seed treatment with *T.harzianum* @ 15g/kg + soil application with T. harzianum @ 20g/kg + Carbendazim spray@ 1g/lt of water at 15 and 30 DAG,(T_8) Seed treatment with Carbendazim @ 2g/kg + soil application with *T.harzianum* @ 20g/kg + spray carbendazim @ 0.1% at 15 and 30 DAG,(T_9) *S. sclerotiorum* alone (Inoculated control), (T_{10}) Uninoculated control (Absolute control). Data on per cent disease incidence , germination percentage and growth parameters were recorded at 15 days after sowing and the subsequent records were made till harvest.

Results and discussion:-

The results on integration of Carbendazim with bio-agent in different treatment combinations revealed that all the treatments significantly reduced white mold incidence (Table.1). However, maximum white mold incidence of French bean was observed in soil inoculated with *S. sclerotiorum* alone in absence of FYM and *T. harzianum*. The reduction of white mold incidence in amended soil in the present investigation might be due to incorporation of FYM which operate several mechanisms by suppression of soil borne plant pathogens. The beneficial effect of the amendment in suppressing white mold incidence of French bean may attributed to provide food base to *T. harzianum* for rapid multiplication, thus augmenting its activity and/or increasing C:N ratio during decomposition resulting higher CO_2 in rhizosphere which is injurious to pathogenic phase of *S. sclerotiorum*. The present findings are in agreement with that ofPapavizas and Davey (1962) who reported that increasing C:N ratio during decomposition of organic amendment resulted increasing C:N ratio and CO_2 in rhizosphere soil which is injurious on pathogenic phase of *R. solani.* Maximum reduction of white mold incidence was observed when seeds were treated with Carbendazim @ 0.2% and it was integrated with soil application of *T. harzianum* @ 2% (w/w) of soil and Carbendazim spray @ 0.1% at 15 and 30 days after germination in FYM amended soil.This indicated that the

possibility of combining some appropriate chemicals with bio-agents which augments the synergistic effect resulting from interaction between *T. harzianum* and sublethal doses of Carbendazim. Dutta and Das (1999) reported lethal dose of Carbendazim was found to be compatibility of *T. harzianum* in management of stem rot of soybean. Elad et al. (1980) also reported that a synergistic effect developed from the interaction between *T. harzianum* and sublethal doses of Pentachloronitrobenzene (PCNB) when applied against *S. rolfsii* in Peanuts and this synergism is apparently due to partial suppression of soil microflora, enabling a more effective activity of the bio-control agent.

Increased growth response of French bean as measured in terms of plant height, dry weight of shoot and root and yield was observed in application of Carbendazim and *T. harzianum* either alone or in combination in organic amended soil over control (Table.2). However, maximum growth response was recorded when seeds were treated with Carbendazim @ 0.2% and it was integrated with soil application of *T. harzianum* @ 2% (w/w) of soil and Carbendazim spray @ 0.1% at 15 and 30 days after germination in FYM

Table. 2: Effect of IDM modules on growth parameters of French bean.

Treatments	**Growth parameters**			
	Height of the plant (cm)	**Dry shoot weight (g)**	**Dry root weight (g)**	**Yield(g/plot)**
FYM	26.17^{e}	3.45^{e}	1.18^{f}	1487.5^{f}
Seed treatment with Carbendazim @ 2g/kg	28.23^{cd}	4.18^{cd}	1.51^{d}	1772.7^{c}
Seed treatment with *T. harzianum* @ 15g/kg	26.51^{e}	3.88^{e}	1.32^{e}	1628.4^{e}
Soil application with *T. harzianum* @ 20g/kg	27.64^{cde}	3.94^{cd}	1.33^{de}	1704.8^{d}
Seed treatment with Carbendazim @ 2g/kg + soil application with *T. harzianum* @ 20g/kg	30.14^{ab}	5.00^{ab}	1.83^{ab}	1867.43^{ab}
Seed treatment with *T. harzianum* @15g/kg + soil application with *T. harzianum* @ 20g/kg	28.72^{bc}	4.06^{c}	1.50^{cd}	1766.6^{c}
Seed treatment with *T. harzianum* @ 15g/kg + soil application with *T. harzianum* @ 20g/kg + Carbendazim spray @ 1g/lt at 15 and 30 DAG	29.33^{bc}	4.25^{c}	1.65^{c}	1834.2^{ab}
Seed treatment with Carbendazim @ 2g/kg + soil application with *T. harzianum* @ 20g/kg + spray Carbendazim @ 1g/lt at 15 and 30 DAG.	31.00^{a}	5.37^{a}	1.96^{a}	1892.32^{a}
S. sclerotiorum alone (Inoculated control)	21.26^{f}	2.25^{f}	0.92^{g}	754.75^{g}
Uninoculated control (Absolute control)	26.87^{de}	3.47^{e}	1.23^{ef}	1764.46^{c}
S.Ed(±)	**0.78**	**0.27**	**0.08**	**30.62**
CD (P = 0.05)	**1.65**	**0.80**	**0.17**	**64.34**

Values are mean of three replications
Means within the columns separated by Duncan's multiple range test P=0.05

Means followed by same letter shown in superscript(s) are not significantly differentamended soil.The increased growth response might be due to direct effect of the antagonist on plants through the secretion of growth regulating metabolites or increased nutrient uptake (Chet and Baker, 1981). They also suggested that addition of organic matter into the soil cause better vigour and/or altered root physiology of plant which help the plant to resist against infection.

Thus, it may be concluded from the present study that seeds treated with Carbendazim @ 0.2 per cent along with soil application of *T. harzianum* @ 2 per cent and Carbendazim spray @ 0.1 per cent was highly effective against *S. Sclerotiorum* and increased growth response. Singh and Tripathi (1997) reported that myceliogenic phase of *S. sclerotiorum*is more effective than carpogenic phase and therefore, seed treatment with Carbendazim was found tobe more effective than spray. They further reported that, Carbendazim was an ideal fungicide for seed treatment to control *S. sclerotiorum*, however among various fungicides, Carbendazim has been found to ideal for seed treatment as well as spray in management of *Sclerotinia*rot of Sunflower

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