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SHORT COMMUNICATION

INTEGRATED MANAGEMENT OF DRY ROOT ROT DISEASE IN CLUSTER BEAN (*CYAMOPSIS TETRAGONOLOBA* (L.) TAUB.

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SUMMARY

An experiment was conducted to know the effect of seed treatment with Bavistin (0.2%), soil application of mustard cake (2g/kg soil), biocontrol agents viz. VAM (600 sporocarps/kg soil) and *T. viride* (10 g/kg soil) in different combinations on two most popular cultivars of clusterbean viz. HG-365 and HG 2-20 to minimize the plant mortality effectively under screenhouse conditions. A minimum disease incidence of 16.8 and 10.2 per cent in cvs. HG-365 and HG 2-20 was achieved, respectively when bavistin treated clusterbean seeds were sown in *T. viride* and mustard cake impregnated soil. The disease incidence was 20 per cent in both the clusterbean cultivars when bavistin treated seeds were sown in VAM and mustard cake incorporated soils. In other words, seeds treated with bavistin and sown in *T. viride* and mustard cake incorporated soil gave a maximum of disease control of 74.8, 80.8 per cent as compared to control in clusterbean cvs. HG-365 and HG 2-20, respectively. Seeds treated with bavistin and sown in mustard cake impregnated soil provided 64.9, 49.9 per cent disease control whereas seeds treated with bavistin alone provided 50.0 and 37.5 per cent disease control in cvs. HG-365 and HG 2-20, respectively. Seeds treated with bavistin and sown in *T. viride* inoculated soils provided 55.02, 56.2 per cent whereas seeds treated with bavistin and sown in VAM inoculated soils provided 59.97, 43.9 per cent disease control in clusterbean cvs. HG-365 and HG 2-20, respectively.

Key Words : Cluster bean, *Rhizoctonia bataticola*, organic amendments, bavistin, damping off

Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub.) has gained great importance because of presence of gum (galactomannan) in its seed endosperm which represents 23-41 per cent of seed weight. The gum has diversified uses in many industries such as cosmetics, paper and textile industry, ore flotation, the manufacture of explosives, hydraulic fracturing of oil and gas formations etc (Arya *et al*. 2014). It also provides nutritious fodder and concentrates to the livestock and adds fertility to soil. India is the major producer of the guar gum in the world, enabling its exports to more than 65 countries. India is also the major exporter of guar gum to the world; it exports other forms of Guar products to a large number of countries (Satpal *et al*., 2018).

It suffers severely from the vagary of diseases caused by fungi and bacteria. Dry root rot caused by *Rhizoctonia bataticola* is the major disease responsible for its low productivity in Haryana and Rajasthan. Cluster bean is generally raised under moisture stress conditions and high temperature during the crop growth (Panchta *et al.*, 2016) which is conducive for the dry root rot disease development by *Rhizoctonia bataticola* (Taub.) Butler, [*Macrophomina phaseolina* (Tassi) Goid]. The fungus has been reported to affect over 500 plant species including cluster bean (Shahzad *et al*., 1988). It causes various types of symptoms simultaneously like dry root rot, collar rot, pre-emergence plant mortality, post-emergence plant mortality symptoms in the clusterbean crop and is mainly responsible for the poor crop stand in the field. Lodha (1998) reported a loss of 21.6 per cent plants of clusterbean when the crop was raised in *R. bataticola* infested soil. Moradia and Khandar (2011) reported a loss of 29.3 per cent plants due to dry root rot caused by *M. phaseolina* and yield loss of 435 kg/ha.

By virtue of its presence in soil or plant debris, polyphagous nature and vast distribution, it is very difficult to manage *R. bataticola* by a single control approach. Moreover, a scanty and incomplete information is available on dry root rot disease management in clusterbean by seed dressing with fungicides, soil incorporation of organic amendments, biocontrol agents and their integration for the maximum disease management.

Bavistin used as seed treatment (2g/kg seed), mustard cake used as soil amendment (2g/kg soil), *T. viride* used as soil amendment (10g/kg soil) and VAM used as soil amendment (600 sporocarps/kg soil) were integrated in pots to know their efficacy on the dry root rot disease of clusterbean cvs. HG-365 and HG 2-20 under screen house conditions. The experiment was laid in Completely Randomized Design (CRD) with three replications for each treatment. The treatments were: T_1 = Bavistin alone (Seed treatment), T_2 = Mustard cake alone (Soil application), T_3 = *T. viride* (Tv) alone (Soil application), T_4 = VAM alone (Soil application), T_5 = Bavistin (S.T.) + Mustard cake (Soil application), T_6 = Bavistin (S.T.) + Tv (Soil application), T_7 = Bavistin (S.T.) + VAM (Soil application), T_8 = Bavistin (S.T.) + Mustard cake (Soil application) + VAM (Soil application), T_9 = Bavistin (S.T.) + Mustard cake (Soil application) + Tv (Soil application),T_{10} = Control (With pathogen) and T_{11}= Control (No pathogen). The organic amendments and bioagents were added in soil one week before sowing, pathogen was applied in the soil two days before sowing at the rate of 1000 mg/kg soil, whereas, seed treatment (S.T.) with fungicide given at the time of sowing. Observations on pre-emergence (PEM) and post-emergence (POEM) plant mortality were taken up to 30 days after sowing.

A minimum disease incidence of 16.8 per cent in HG-365 was achieved when bavistin treated seeds (2g/kg seed) were sown in soils incorporated with *T. viride* (10g/kg soil) and mustard cake (2g/kg soil), whereas, it was 20.0 per cent when bavistin treated seeds (2g/kg seed) were sown in soils incorporated with VAM (600 sporocarps/kg soil) and mustard cake (2g/kg soil). In other words, seeds treated with bavistin and sown in *T. viride* and mustard cake incorporated soil gave a maximum of disease control of 74.8 per cent as compared to control in clusterbean cv. HG 365 (Table-1).

All the treatments were found to be statistically significant in reducing pre and post-emergence mortality as compared to control. Clusterbean seeds treated with bavistin alone provided 50.0 per cent disease control, whereas, seeds treated with bavistin and sown in mustard cake impregnated soil provided 64.9 per cent disease control, and seeds treated with bavistin and sown in VAM impregnated soil provided 59.9 per cent disease control.

Integrated root rot disease management in clusterbean cv. HG 2-20 under screen house conditions

A minimum disease incidence of 10.2 per cent in HG 2-20 was achieved when bavistin treated seeds (2g/kg seed) were sown in soils incorporated with *T. viride* (10g/kg soil) and mustard cake (2g/kg soil), whereas, it was 20.2 per cent when bavistin treated seeds (2g/kg seed) were sown in soils incorporated with VAM (600 sporocarps/kg soil) and mustard cake (2g/kg soil). In other words, seeds treated with bavistin and sown in *T. viride* and mustard cake incorporated soil gave a maximum of disease control of 80.8 per cent as compared to control in clusterbean cv. HG 2-20 (Table-10).

All the treatments were found to be statistically significant in reducing pre and post-emergence mortality as compared to control. Pre-emergence and post-emergence plant mortality was not significantly affected if bavistin treated seeds were sown in VAM or *T. viride* treated soils. Clusterbean seeds treated with bavistin alone provided 37.5 per cent disease control, whereas, seeds treated with bavistin and sown in *T. viride* impregnated soil provided 56.2 per cent disease control. It was observed that seeds treated with bavistin and sown in VAM impregnated soil provided 43.9 per cent disease control.

TABLE 1

Integrated dry root rot disease management of cluster bean cv. HG-365 under screen house conditions

Dose (g/kg soil)	PEM[1] (%)	POEM[2] (%)	Total mortality (%)	Disease control (%)
Bavistin (2 g/kg soil)	13.3 (21.3)	20.0 (26.5)	33.3	50.0
Mustard cake (2 g/kg soil)	10.2 (18.4)	26.7 (31.0)	36.9	44.8
Tv (10 g/kg soil)	13.3 (21.3)	30.0 (33.2)	43.3	34.8
VAM (600 sporocarps/kg soil)	13.3 (21.3)	26.6 (31.0)	39.9	40.1
Mustard cake (2 g/kg soil) + Bavistin (2g/kg soil)	6.7 (14.8)	16.7 (24.0)	23.4	64.9
Bavistin (2 g/kg soil)+Tv (10g/kg soil)	10 (18.4)	20 (26.0)	30.0	55.0
Bavistin (2 g/kg soil)+VAM (600 sporocarps/kg soil)	10 (18.4)	16.7 (24.0)	26.7	59.9
Bavistin (2 g/kg soil)+VAM (600 sporocarps/kg soil)+Mustard cake (2 g/kg soil)	3.3 (9.9)	16.7 (24.0)	20.0	70.0
Bavistin (2 g/kg soil)+Tv (10 g/kg soil)+Mustard cake (2 g/kg soil)	3.5 (9.9)	13.3 (21.3)	16.8	74.8
Check (Pathogen inoculated)	23.4 (28.7)	43.3 (41.1)	66.7	0.00
Check (No pathogen)	0.5 (4.05)	0.5 (4.05)	-	-
C. D. (P=0.05)	(4.48)	(3.22)	-	-

Figures in parentheses are angular transformed values, 1PEM = Pre-emergence mortality, 2POEM = Post-emergence mortality.

TABLE 2
Integrated dry root rot disease management of clusterbean cv. HG 2-20 under screen house conditions

Dose (g/kg soil)	PEM[1] (%)	POEM[2] (%)	Total mortality (%)	Disease control (%)
Bavistin (2 g/kg soil)	13.3 (21.3)	20.0 (26.0)	33.3	37.5
Mustard cake (2 g/kg soil)	13.3 (21.3)	26.7 (31.0)	40.0	24.9
Tv (10 g/kg soil)	16.7 (24.0)	30.0 (33.2)	46.7	12.4
VAM (600 sporocarps/kg soil)	16.7 (24.0)	33.3 (35.0)	50.0	6.2
Mustard cake (2 g/kg soil)+Bavistin (2 g/kg soil)	10.0 (18.4)	16.7 (24.0)	26.7	49.9
Bavistin (2 g/kg soil)+Tv (10 g/kg soil)	10.0 (18.4)	13.3 (21.3)	23.3	56.2
Bavistin (2 g/kg soil)+VAM (600 sporocarps/kg soil)	13.3 (21.3)	16.7 (24.0)	29.9	43.9
Bavistin (2 g/kg soil)+VAM (600 sporocarps/kg soil)+Mustard cake (2 g/kg soil)	3.5 (9.9)	16.7 (24.0)	20.2	62.1
Bavistin (2 g/kg soil)+Tv (10 g/kg soil)+Mustard cake (2 g/kg soil)	3.5 (9.9)	6.7 (14.8)	10.2	80.8
Check (Pathogen inoculated)	20.0 (26.6)	33.3 (35.2)	53.3	0.00
Check (No pathogen)	0.5 (4.05)	0.5 (4.05)	-	-
C. D. (P=0.05)	4.00	3.44	-	-

Figures in parenthesis are angular transformed values, 1PEM = Pre-emergence mortality, 2POEM = Post-emergence mortality.

The integration of the best selected seed dressing fungicide, soil application of biocontrol agents and organic amendment was done to effectively control the dry root rot disease in clusterbean. An experiment was conducted to know the effect of seed treatment with Bavistin (0.2%), soil application of mustard cake (2g/kg soil), biocontrol agents viz. VAM (600 sporocarps/kg soil) and *T. viride* (10 g/kg soil) in different combinations on two most popular cultivars of clusterbean (cvs. HG-365 and HG 2-20) to minimize the plant mortality effectively under screenhouse conditions. A minimum disease incidence of 16.8 and 10.2 per cent in cvs. HG-365 and HG 2-20 was achieved, respectively when bavistin treated clusterbean seeds were sown in *T. viride* and mustard cake impregnated soil. The disease incidence was 20 per cent in both the clusterbean cultivars when bavistin treated seeds were sown in VAM and mustard cake incorporated soils. In other words, seeds treated with bavistin and sown in *T. viride* and mustard cake incorporated soil gave a maximum of disease control of 74.8, 80.8 per cent as compared to control in clusterbean cvs. HG-365 and HG 2-20, respectively. Seeds treated with bavistin and sown in mustard cake impregnated soil provided 64.9, 49.9 per cent disease control whereas seeds treated with bavistin alone provided 50.0 and 37.5 per cent disease control in cvs. HG-365 and HG 2-20, respectively. Seeds treated with bavistin and sown in *T. viride* inoculated soils provided 55.02, 56.2 per cent whereas seeds treated with bavistin and sown in VAM inoculated soils provided 59.97, 43.9 per cent disease control in clusterbean cvs. HG-365 and HG 2-20, respectively. In a similar type of study Vyas (1994) also suggested the integrated use of *T. viride* and bavistin for the control of dry root rot of soybean. Mathivanan *et al*., (1997) advocated the integrated use of bavistin and *T. viride* for the control of root diseases in cotton. These observations directly corroborate with our findings. The present findings suggest that seed treatment with fungicide and soil incorporation of biocontrol agents and/or soil amendments with organic amendments act synergistically and this might be the reason for low pre and post-emergence plant mortality in clusterbean cvs. HG-365 and HG 2-20.

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