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RESEARCH PAPER

Bio-efficacy of seed dressing fungicides and bio-agents on seed borne fungal infections and seed quality of greengram

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Abstract: A laboratory experiment was conducted during summer-2021 at Department of Seed Science and Technology, University of Agricultural Sciences, Dharwad. The experiment was laid out in completely randomized design consists of eight treatments including the seed treatment with different seed dressing fungicides and bio-agents in greengram with each replicated four times in paper towel method and recorded the the influence of treatments on seed quality attributes of greengram. Among the different treatments, the seed treatment with Mancozeb 50% WP+ Carbendazim 25% WS (Sprint) @ 2g/kg recorded significantly highest germination (84.67%), lower seed infection (12.00%) and showed 13.48 per cent increase in germination and 44.67 per cent decrease in infection over control. The seed treatment with *Trichoderma harzianum* @ 10 g /kg seeds (T_6) recorded the highest mean shoot length (24.3 cm) and mean root length (13.42 cm) followed by Mancozeb 50% WP+ carbendazim 25% WS (Sprint) @ 2g/kg seeds (23.1 cm) and 13.43 cm root length and these are found on par with each other. The seed treatment with Mancozeb 50% WP+ carbendazim 25% WS (Sprint) @ 2g/kg seeds (T_3) recorded significantly highest seedling vigour index (3098) and *Trichoderma harzianum* @ 10g /kg seeds (T_6) recorded 3025 and both are found on par with each other and are followed by seed treatment with carbendazim 50% WP @ 2g/kg seeds (2942), Thiophanate methyl + pyraclostrobin (Xelero) @ 2g/kg seeds (2678). Mancozeb 50% WP+ carbendazim 25% WS (Sprint) performed better in controlling seed borne infections and thus enhanced seed quality parameters of greengram. Among bioagents *Trichoderma harzianum* can be predominantly used for seed treatment of greengram against seed borne fungal infections.

Key words: Bioagents, Greengram, Seed dressing fungicides, Seed quality

Introduction

Greengram [*Vigna radiata* (L.)Wilezek] is a well-known pulse crop which is also known as greengram, golden gram, mung, or moong in some parts of the world (John,1991). It is considered to be the native of India and Central Asia. During 2020 -21 total production of greengram in India is about 2.64 million tonnes in an area of about 4.5 million hectares with an average productivity of 548 kg per hectare and accounts for about10-12 per cent of total pulse production in the country. (Anon., 2021). Greengram is a nutrient-dense food which contains 24.5% high-quality protein, 1.3% fats, 56.6% carbohydrates, and 3% dietary fibres. It is mineral-rich, with 140 mg calcium, 8.4 mg iron, and 280 mg phosphorous. In addition, it contains is of lavonoids having estrogens and antioxidant activities that can be used in prevention of diseases such as cancer (Brouns, 2002). Seed-borne diseases are recognized as important stumbling blocks in the production of greengram. Several workers reported *Alternaria spp, Aspergilus spp, Phoma medicaginis, Curvularia lunata, Macrophomia phaseolina, Rhizopus spp* are seed borne and seed transmissible (Raut and Ahire,1988; Patil *et al.,* 1990). Seed borne infections that are externally or internally connected with seeds can cause seed rot, seedling blight, and hence causes limited germination (upto 30-40%) and also causes reduction in seedling vigour. They also influence in the reduction of biomass of seedlings and also reduces chlorophyll A and B content (Saurabh and Singh, 2020). Seed treatment is the earliest method of plant protection, and it is now a popular way to administer fungal or bacterial bioprotectants. When compared to alternative field application systems, seed treatments provide a cost-effective and low-polluting delivery system for protective compounds.Bio protectants applied to seeds have the potential to colonized and protect roots, as well as boost plant growth. Biological control is one of the viable, eco-friendly propositions, which can substantially minimize the disease (Cook, 1985). To boost the quality and quantity of greengram output, farmers need healthy quality seeds with a high percentage of germination and purity. As a result, testing the seeds before sowing them in the field is essential and seed treatment with different seed dressing fungicides or bioagents before sowing is essential.

Material and methods

A lab experiment entitled "Bioefficacy of seed dressing fungicides and bio-agents on seed borne fungal infections and seed quality of greengram" was conducted during summer-2021 at Dept of Seed Science and Technology, University of Agricultural Sciences, Dharwad. This study was carried out to know the efficacy of different seed dressing fungicides and bio-agents in controlling seed borne fungal infections in the infected seed sample of the genotype DGGV 2. The experiment included 8 treatments and were allotted in completely randomized design (CRD) with 4 replications. Treatment details are listed *viz.*, T_1: Control, T_2: Seed dressed with 0.2% Carbendazim 50%WP, T_3: Seed dressed with 0.2% Mancozeb 50% WP+carbendazim 25% WS, T_4: Seed dressed with 0.2% Vitavax

power, T_5: Seed dressed with 0.2% Xelora 50 FS, T_6: Seed dressed with *Tricoderma harzianum* @10g/kg seeds, T_7: Seed dressed with *Pseudomonas fluroscens* @10g/kg seeds, T_8: Seed dressed with endophyte (*Bacillus subtilis*) @10g/kg seeds

Seeds were treated with fungicides and bio-agents by following dry seed treatment @ 0.2% concentration of fungicide was prepared and treated with seeds by sprinkling the water. The powder formulations of bio-agents *viz*., *Trichoderma harzianum, Pseudomonas fluorescens* and *Bacillus subtilis* were taken and were treated with seeds. Then the seeds were dried under shade. Four replications of 100 seeds per treatment were tested in moist rolled towel (paper towel method) as and then incubated in incubators at 25 ± 2^0C under 12 hr light and 12 h of darkness. The untreated sample served as control. The seed quality attributes were recorded after seven days of incubation.

Observations recorded

Seed germination (%)

Standard germination test was conducted in the laboratory as per ISTA (Anon., 2019) by adopting the rolled paper towel method at 25±1°C temperature and 90 ± 5 per cent relative humidity in seed germinator in 4 replicates of randomly drawn hundred seeds each. On seventh day of germination test, number of normal seedlings were counted in each replication and mean germination percentage for each treatment was expressed.

$$\text{Germination (\%)} = \frac{\text{Number of normal seedlings}}{\text{Total number of seeds}} \times 100$$

Seed infection (%)

From the between paper method, the number of seeds infested with mould growth was recorded and expressed in percentage.

Abnormal seedling (%)

Seedlings with abnormal root and shoot, whose structural part was missing was counted as abnormal seedling percentage.

Shoot length(cm)

From each treatment from all the replications on seventh day of germination test, ten normal seedlings were randomly selected and the shoot length measured from the base of primary leaf to collar region and mean shoot length was expressed in centimeter (cm) using metric scale.

Root length(cm)

The root length of each seedling was measured from collar region to the tip of primary root from the same ten normal seedlings used for shoot length measurement and the average root length was expressed in centimeter (cm).

Seedling vigour index

Ten normal seedlings were picked up randomly from each replication of the germination test on the final day. The mean values were used for computing the vigour indices adopting the method of Abdul-Baki and Anderson (1973) using the following formula-

Seedling vigourindex = Germination (%) x [(shoot length (cm)+ root length(cm)]

Statistical analysis

The data collected with respect to different parameters were analysed statistically. Statistical analysis was carried out by following the standard procedures (Panse and Sukhatme,1967). Data in percentage were transformed to angular values (Arc sine transformation) before analyzing.

Results and discussion

The effect of seed dressing fungicides and bio-agents in overcoming fungal infections and its influence on seed quality parameters of greengram genotype DGGV 2 are tabulated in table1.The seed treatment with Mancozeb 50% WP+ Carbendazim 25% WS (Sprint) @ 2g/kg seeds was found most effective among all the seed treatments and found highest

Table 1. Bio-efficacy of different seed dressing fungicides and bio-agents against seed borne fungal infections, germination% (paper towel method)

Seed Treatments	Germination (%)	Increase in germination over control(%)	Seed infection (%)	Decrease in seed infection over control (%)
T_1- Untreated (Control)	73.00(57.70)*	-	21.67(27.74)*	-
T_2- Carbendazim 50% WP @ 2g/kg seeds	81.67(64.65)	10.61	14.00(21.96)	35.39
T_3- Mancozeb 50% WP+ Carbendazim 25% WS (Sprint) @ 2g/kg seeds	84.67(66.95)	13.78	12.00(20.26)	44.67
T_4- Carboxin (37.5%)+ Thiram (37.5%) vitavax power) @ 2g/kg seeds	77.33(61.57)	5.59	17.67(24.85)	18.45
T_{5-} Thiophanate methyl + pyraclostrobin (Xelora) @ 2g/kg seeds	80.67(63.92)	9.50	15.6723.31	27.68
T_6- *Trichodermaharzianum*@ 10g/kg seeds	80.00(63.44)	8.75	15.67(23.29)	27.68
T_7- *Pseudomonas fluroscens*@ 10g/kg seeds	78.33(62.28)	6.80	17.00(24.34)	21.55
T_8- *Bacilussubtilis*@ 10g/kg seeds	75.00(60.35)	2.6	19.00(25.84)	12.32
S.Em(±)	0.41		0.49	
C.D (1%)	1.71		2.03	

* Values in paranthesis are arc sine transformed values

Table 1(cont..). Bio-efficacy of different seed dressing fungicides and bio-agents on shoot length, root length, seedling vigour index

Seed Treatments	Abnormal seedlings (%)	Shoot length (cm)	Root length (cm)	SVI
T_1- Untreated (control)	5.00(12.88)*	18.61	9.53	2054
T_2- Carbendazim 50% WP @ 2g/kg seeds	3.67(11.02)	23.32	12.71	2942
T_3- Mancozeb 50% WP+ Carbendazim 25% WS (Sprint) @ 2g/kg seeds	3.00(9.88)	23.1	13.43	3098
T_4- Carboxin (37.5%)+ Thiram (37.5 %) vitavax power) @ 2g/kg seeds	4.00(11.48)	19.29	9.87	2255
T_5- Thiophanate methyl + pyraclostrobin (Xelora) @ 2g/kg seeds	3.67(11.02)	21.4	11.73	2678
T_6- *Trichodermaharzianum*@ 10g/kg seeds	4.67(12.46)	24.3	13.42	3025
T_7- *Pseudomonas fluroscens*@ 10g/kg seeds	4.33(11.90)	20.72	10.39	2436
T_8- *Bacilussubtilis*@ 10g/kg seeds	5.00(12.88)	19.49	10.1	2190
S.Em(±)	0.80	0.31	0.25	29.95
C.D. (1%)	1.67	1.28	1.06	123

* Values in paranthesis are arc sine transformed values

germination (84.67%), found lower seed infection (12.00%). Among bio agents *Trichoderma harzianum* @ 10g /kg seeds found effective and showed 80% germination and showed 15.67% seed infection. The seed treatment with Mancozeb 50% WP+ Carbendazim 25% WS (Sprint) @ 2g/kg seeds recorded lower abnormal seedling (3.00 %) which is on par with the T_5 *i.e*., seed treatment with Thiophanate methyl + pyraclostrobin (Xelora) @ 2g/kg seeds (3.67%). Among bio agents T_7 (*Pseudomonas fluroscens* @ 10g /kg seeds) found effective and showed 4.33% abnormal seedling and other two bio agents are on par with each other.The seed treatment with *Trichoderma harzianum* @ 10g /kg seeds (T_6) recorded highest mean shoot length (24.3 cm) followed by Carbendazim 50% WP @ 2g/kg seeds (T_2) (23.32 cm), Mancozeb 50% WP+ Carbendazim 25% WS (Sprint) @ 2g/kg seeds (23.1 cm) and these are found on par with each other.The seed treatment with Mancozeb 50% WP+ Carbendazim 25% WS (Sprint) @ 2g/kg seeds (T_3) showed significantly highest mean root length (13.43 cm) and *Trichoderma harzianum* @ 10g /kg seeds (T_6) recorded 13.42 cm mean root length and both are found on par with each other.The seed treatment with Mancozeb 50% WP+ Carbendazim 25% WS (Sprint) @ 2g/kg seeds (T_3) recorded significantly highest seedling vigour index (3098) and *Trichoderma harzianum*@ 10g /kg seeds (T_6) recorded 3025 and both are found on par with each other and are followed by seed treatment with Carbendazim 50% WP @ 2g/kg seeds (2942), Thiophanate methyl + pyraclostrobin (Xelora) @ 2g/kg seeds (2678).

The results revealed that seed treatment with Mancozeb 50% WP+ Carbendazim 25% WS (Sprint) @ 2g/kg seeds performed better over the control and other treatments due to combinational antagonistic effect of both systemic and contact fungicide in comby product Mancozeb + Carbendazim which suppressed the development of fungi and it provides both Mn and Zn for the growth of seedling (Deshmukh *et al*., 2020). Seed treatment with *Trichoderma harzianum* also performed better among the treatments due to antagonistic and mycoparasitism effect and also it provides growth promoting substances which influences better seed germination and seedling growth. This is in accordance with findings of Pradeep *et al.*(2000), who noticed that seed treatment with *Trichoderma viride* and *Pseudomonas fluorescens* reduced *Aspergillus niger, Aspergillus flavus, and Fusarium monilifor me* colonies while dramatically increasing seed germination and seedling vigour index in pigeon pea. Gveroska and Ziberoski *et al.* (2012) reported that volatile compounds and inhibitory enzymes like chitinase are released by *Trichoderma harzianum*, which diffuse through seed pores and cause deformations of chitin and also causes deformations of hyphae of *Alternaria alternata* and thus reduces its infection. Seed germination and seedling growth was maximum in dry seed treatment with Carbendazim + Mancozeb reported by Deshmukh *et al*. (2020).

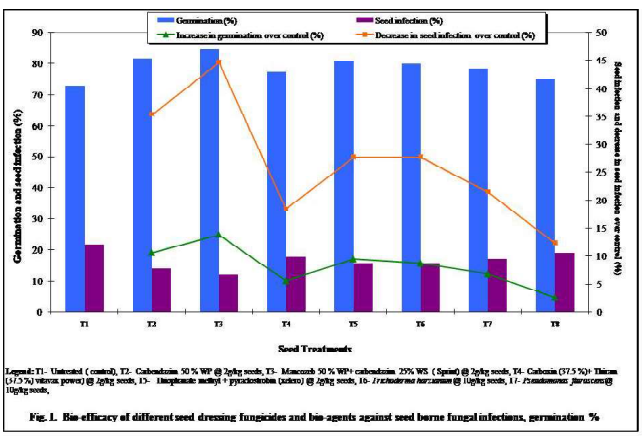

Fig. 1. Bio-efficacy of different seed dressing fungicides and bio-agents against seed borne fungal infections, germination %

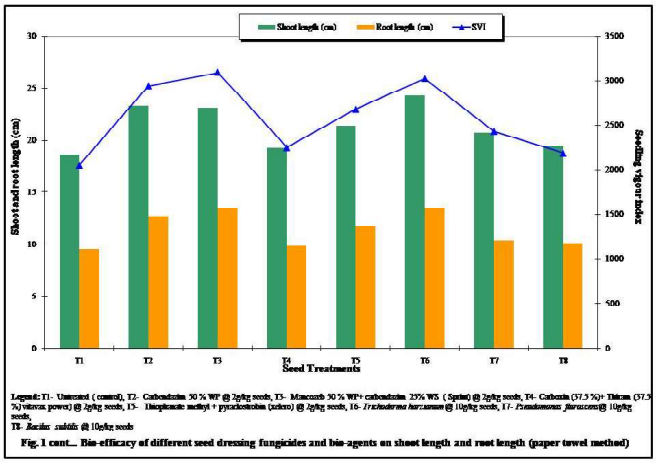

Fig. 1 cont... Bio-efficacy of different seed dressing fungicides and bio-agents on shoot length and root length (paper towel method)

Conclusion

Eight seed borne fungi *viz., Fusarium oxysporum, Macrophomina phaseolina, Aspergillus flavus*, *Aspergillus niger, Rhizopusspp, Colletotrichum spp, Alternaria alternata and Cercospora canacens* were found associated with seeds of greengram.The seed borne mycoflora *viz., Aspergillus flavus* and *Aspergillus niger* were found more damaging and reduces seed quality parameters in laboratory conditions. The seed treatment with Mancozeb 50% WP+Carbendazim 25% WS (Sprint) exhibited lowest seed mycoflora, enhanced seed germination and seedling vigour index in naturally infected seed. Among bioagents *Trichoderma harzianum* performed better compared to other two bioagents. Hence both can be recommended for seed treatment of greengram.

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