Importance Of Bio-Priming On Improving Seed Quality In Chilli (*CapsicumAnnuum*L.)

ABSTRACT

Chilli (*Capsicum annuum* L.) is an important spice crop of India and the quality of its seed is an important commercial trait. However, the quality of the seeds is lost if they are stored for the months between harvest and the subsequent sowing. The seeds of Rudra and Byadgi Dabbi varieties were subjected to bio-priming with the *Pseudomonas fluorescens, Bacillus* and *Trichoderma viride* on qualitative parameters with seven treatments. The experiment was carried out using CRBD. The culture of *Pseudomonas fluorescens, Bacillus and Trichoderma viride* at 2.5g and 5.0g concentration were used as pre-sowing bio-priming treatments. From the results it was found that the Bio-priming influenced significantly on the capability of the chilli seedlings with the improved germination percentage of 98.69% (2.5 g *P. fluorescens*, T_1), shoot length 6.53cm (5 g *P. fluorescens*, T_2), root length 7.18cm (5 g *T. viride*, T_6), seedling length 13.43 cm (5 g *P. fluorescens*, T_2) and seedling vigour index 1216.44 (5 g *P. fluorescens*, T_2) in Byadgi Dabbi cultivar and where as in Rudra cultivar recorded germination percentage of 99.75% (T_2), shoot length 4.13cm (5 g *T. viride*,T_6), root length 7.38cm (5 g *T. viride*, T_6), seedling length 11.56 cm (5 g *T. viride*,T_6) and seedling vigour index 1140.12 (5 g *T. viride*,T_6) when compared with control. Therefore, bio-priming with *Pseudomonas fluorescens, Bacillus* and *Trichoderma viride* are effective in enhancing the quality parameters of seed in chilli.

Key words: Bio-priming, *Pseudomonas fluorescens*, *Trichoderma viride*,*Bacillus*, Chilli

1 INTRODUCTION:

Chilli (*Capsicum annuum* L.) is key vegetable crop among Solanaceous vegetables which cultivated in sub-tropic and tropics areas where both ripe and unripe fruits are used for different medicinal and industrial purpose(Rai *et. al.*,2019). Imbalance use of fertilizers, improper plant protection, poor growth and sub-optimum plant population are the most important factors by which there is reduced in yield and lowering the quality parameters of chilli. Suboptimum plant population generally results from poor and erratic germination. In current years, a lot of studies have been done on invigoration of seeds to improve the

germination rate and uniformity of growth and reduce the emergence time of many vegetables and some field crops. Seed priming is now a widely used commercial process that accelerates the germination rate and improves seedling uniformity in many crops (Basra *et al.,* 2003).The seed is the most primary requirement of agriculture. Hence, it is crucial to maintain the quality of the seeds through nature-based solutions having multiple benefits. Among the pre-sowing techniques, seed priming as one of the most important developments to help rapid and uniform germination and emergence of seeds and to increase seed tolerance to adverse environmental conditions Harris *et al.,* (1999).

Among the seed priming techniques, bio-priming has emerged out to be the most simple, economical, and eco-friendly delivery system of beneficial microorganisms in the agroecosystem. Therefore, comprehension regarding the applicability of bio-priming in restoring soil health, improving plant nutrition, and maintaining crop/seed quality has a major role in achieving the UN-Sustainable Development Goals such as no poverty, zero hunger, good health and well-being, etc. (Sarakr*et al.*,2021).Bio-priming is a process of biological seed treatment that refers to combination of seed hydration (physiological aspect of disease control) and inoculation (biological aspect of disease control) of seed with beneficial organisms to protect seed. It is an ecological approach using either bacteria or selected fungal antagonists against the soil and seed-borne pathogens. Biological seed treatments may provide an alternative to chemical control of crop diseases. Some bacteria and fungi prevent diseases and enhance plant growth, in which Pseudomonas fluorescens, Bacillus and Trichoderma viride are most popular.

Trichoderma viride is a fungus used as bio-agent. It is used for seed and soil treatment for suppression of various diseases caused by fungal pathogens. The increased growth response induced by Trichoderma sp. has been reported for many crops such as beans (*Phaseolus vulgaris*) cucumber (*Cucumis sativus*), pepper (*Capsicum annum*), carnation (*Dianthus carophyllus*), maize (*Zea mays*), and wheat (*Tritichumaestivum*) (Lo and Lin, 2002). Trichoderma produce phytohormones, such as indol acetic acid (IAA) and ethylene, whose metabolic pathways have been, identified (Osiewacz, 2002) which produce cytokinin-like molecules, e.g.zeatyn and gibberellin GA3 or GA3-related have been recently detected (M. Ahsanur Rahman *et al.,* 2012). The controlled production of these compounds could improve bio-fertilization (Osiewacz, 2002). Pseudomonas fluorescens is an another bioagent used widely to control diseases and also known as plant growth rizobacteria due to production of plant growth-regulating substances (PGRs), phytohormones, mineralization of organic phosphorus, production of phytoalexin

flavonoids-like compounds, enhancement of mineral uptake, etc. (Mukerji *et al.*, 2006). Increased dry weight and plant height were recorded with Pseudomonas sp. MML2212 and Pseudomonas fluorescens on rice and green gram when compared with the control (Mathivanan*et al.*, 2005, Shanmugaiah*et al.*, 2005, 2007). Hence, research on response of different chilli genotypes towards bio-priming with Pseudomonas fluorescens and Trichoderma viride in respect to growth, yield, and quality attributes will have immense use to the farmers and seed industry.

2 MATERIAL AND METHODS

The present study was carried out at UHS, Bgalkote using byadgidabbi and rudra genotypes of chilli. Which are very popular in the area**.**The experiment was carried out using complete randomized design comparing with seven treatments like T_{1}- 2.5 g *P. fluorescens*, T_{2}-5 g *P. fluorescens*, T_{3}-2.5 g *Bacillus*, T_{4}-5 g *Bacillus*, T_{5}- 2.5 g *T. viride*, T_{6}- 5 g *T. viride*., T_{7}- Untreated control.

2.1 Seed treatment: Seeds of both Byadgi Dabbi and Rudra genotypes of chilliwere bio-primed with *P. fluorescens, Bacillus*and*T. viride* individually for twenty-four hours at different concentration and the seeds soaked in distilled water for the same duration were used as control. After the treatment, seeds were shade dried for 30 minutes and then those seeds were utilized for laboratory experiments.

2.2 Laboratory experiments: For in vitro experiment, 100 seeds with four replications for individual treatments and genotypes were placed in petriplates lines with two layers of Whatman filter paper soaked in sterilized distilled water and incubated at 25±10C. Germination percentage was recorded at(14DAS) as per ISTA. Paper Plate method used to measure root and shoot length of seedling and they were recorded after the 14DAS by random selection of five seedlings from each replication. The data was recorded and further analyzed stastically.

3 RESULTS AND DISCUSSION:

Seeds produced after pre-sowing bio-priming of seeds were subjected to laboratory testing for its quality assessment through different quality parameters like germination percentage, root length, shoot length, seedling length and vigorindex. It was found that there is significant effect of different treatment was found on the quality parameters' of seed in chilli.

3.1 Germination percentage

The resulted data revealed that highest germination percentage was observed in 2.5 g

P. fluorescens(T_1) with value of 98.69% for after 14 DAS of sowing followed by5 g *Bacillus*(T_4),5 g *T. viride* (T_6),2.5 g *T. viride*(T_5) whereas lowest was recorded in treatment 2.5 g Bacillus(T_3)of about 90.00% for germination percentage in Byadgi Dabbi variety. The Rudra variety recorded higher germination percentage in 5 g *P. fluorescens*(T_2) with value of 99.75% and all other treatments are on par with each other with lower germination percentage recorded in untreated control (T_7) of about 98.00% mentioned in table 1 and 2. Average influence of *Pseudomonas fluorescens* was found to be greater on this character in comparison to that of *Bacillus* and *Trichoderma viride* in both varieties. Response of Rudra variety towards pre-sowing bio-priming of seed germination on par with each other and influence of three the bio-inoculants was same almost same better than control.Whereas in Byadgi Dabbi significant differences observed for all the treatments.Influence of*Pseudomonas fluorescence* was more for both genotypes germination percentage was also increased by *Trichoderma viride* in all condition supporting results was found in Hanson, 2000; Mishra and Sinha, 2000, Mukhtar I 2008.

3.2 Root Length

Root length was recorded as maximum as 7.18cm and 6.93 cm in 5 g *T. viride*(T_6) and (T_2) in Byadgi Dabbi variety, when average was made over treatments, though5 *g T. viride*(T_6) and 5 g *P. fluorescens*(T_2) performed statistically at par for this character. Significantly shortest root length was recorded for untreated control(T_7) followed by 2.5 g *Bacillus*(T_3) and 5 g *Bacillus*(T_4) may be due to its unique genetic expression. The genotype Rudra recorded as maximum as 7.38cm and 7.25 cm in 5 g *T. viride*(T_6) and 2.5 g *P. fluorescens*(T_1) treatments whereas shortest root length was recorded for Untreated control(T_7) of about 4.80cm followed by 2.5 g *Bacillus*(T_3) with root length of about 4.90cm as mentioned in table no. 1 and 2. Significant positive influence of Trichoderma viride bioinoculant over control as well as *Pseudomonas fluorescence and Bacillus*was noted for expression for this character in both varieties.The interaction effects were significant in both varieties, maximum root length was produced when biopriming was made with *Trichoderma viride*(Rai *et al.,* 2019, Sarkar *et al.,* 2021). Similar result found by Lo, C.T. and Lin, C.Y. (2002) regarding screened Trichoderma strains root growth of bitter gourd, loofah and cucumber.

3.3 Shoot Length

The longest shoot length was produced in Byadgi Dabbi variety with treatment 5 g *P. fluorescens*(T_2)of about 6.53cm when overall performance of the all treatments were considered followed by 5 g *Bacillus*(T_4) with 5.15cm whereas shortest shoot length

wasrecorded in 5 g *T. viride*(T_6) with 2.30cm. In Rudra cultivar longest shoot length noticed with 4.13cm in (T_6) and shortest noticed of about 2.15cm in 5 g *P. fluorescens*(T_2). All the treatments were statistically significant with each other in both varieties. Average influence of*Bacillus, Trichoderma viride* and *Pseudomonas fluorescens* were found to be statistically significant with each other and positive over unprimed control. while greater influence of Trichoderma viride could be noted in noticed in Rudra variety whereasPseudomonas fluorescensnoticed in Byadgi Dabbi variety. The treatment Untreated control(T_7) in Rudra cultivar responded in similar way towards priming like*Trichoderma viride*, *Bacillus* and *Pseudomonas fluorescens*.

3.4 Seedling Length

Significantly longest seedlings were produced by5 g *P. fluorescens*(T_2) with 13.43cm followed by (T_2) with 10.26cm in Byadgi Dabbi, while shortest recorded for untreated control(T_7) with 8.23cm. In Rudra variety longest seedlings were produced by 5 g *T. viride*(T_6) with 11.50cm followed by 2.5 g *P. fluorescens*(T_1) with 10.28cm whereas shortest recorded for 2.5 g *T. viride*(T_5) with 8.63cm. Statistically similar performance was noted for Bacillus in both genotypes. The untreated control(T_7) produced seedlings of the smallest type irrespective of the varieties. Average influence untreated controlof Bacillus, *Trichoderma viride* and *Pseudomonas fluorescence* were found to be significant positive over unprimed control over the years, while greater influence of *Trichoderma viride*at higher concentration could be noted in Rudra variety whereas less influence recorded in same variety at lower concentration (Dubey *et al.,* 2007). Similar trend was recorded for all the individual varieties and it was of higher magnitude after bio-priming of seeds with Trichoderma viride, which may also be assessed through table on change over control due to priming (Rai *et al.,* 2019, Sarkar *et al.,* 2021).

3.5 Vigour Index

Critical analysis on average performance of both varieties for this derived seedling parameter may lead to identify superior most varieties for expression of this important characters. Like seedling length, significantly lowest magnitude of vigour index was derived for untreated control(T_7) may be due to inherited potential of its seedling length as well as greater influence of its seed germination potential. Significant influence of bio-priming for enhancement in vigour index over control could be noticed in both varieties (Rai*et al.,* 2019, Sarkar *et al.,* 2021, Asaduzzaman *et al.,* 2010, Mishra, D.S., and Sinha, A.P. 2000). Superior influence of *Trichoderma viride*(5 g T. viride,T_6=1140.12) for determination of average vigour index was observed over *Pseudomonas fluorescens*(2.5 g *P. fluorescens*,

T_1=1022.37and 5 g *P. fluorescens*, T_2=803.09) in Rudra cultivar whereas its reverse trend positive superiority in influence of *Pseudomonas fluorescens*(5 g P. fluorescens,T_2=1216.44) could be noticed over that of *Trichoderma viride*(5 g T. viride,T_6 =911.99) in Byadgidabbi variety as mentioned in table 1 and 2, while it was statistically at on par response of both varieties towards bio-priming for production of seeds with enhanced vigour over control followed the similar trend. Significantly similar influence of all the bio-inoculants on both varieties was recorded, exception was noted for2.5 *g Bacillus*(T_3) in for which low superiority in influence with low concentration of *Trichoderma viride*.

CONCLUSION:

From the study it was found that there is enhancement in the seed quality parameters of chilli when there is bioprimng of*Pseudomonas fluorescens, Bacillud and Trichoderma viride.* The significant variation was found when compared with the control treatment, so from the study it concludes that to improve the crop quality there is need to have the biopriming of the mentioned microorganisms. Preferably *Pseudomonas fluorescens* to be used for the better results when compared with others.

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Table 1: Effect of seed bio-priming on seed quality of Byadgi Dabbi chilli genotypes

Treatments	Germination Percent (%)	Root Length (cm)	Shoot Length (cm)	Seedling Length (cm)	Vigour Index
T_1	98.69	5.38	4.33	9.71	957.99
T_2	90.75	6.93	6.53	13.43	1216.44
T_3	90.00	4.63	4.75	9.38	845.02
T_4	97.25	4.88	5.15	10.03	974.78

T_5	96.13	6.05	4.21	10.26	986.58
T_6	96.25	7.18	2.30	9.48	911.99
T_7	94.50	4.53	4.70	8.23	777.26
SEM	1.15	0.09	0.11	0.21	20.89
CD@5%	3.37	0.27	0.32	0.61	61.44
CV	2.42	3.26	4.88	4.13	4.38

Table 2: Effect of seed bio-priming on seed quality of Rudra chilli genotypes

Treatments	Germination Percent (%)	RootLength (cm)	Shoot Length (cm)	Seedling Length (cm)	Vigour Index
T_1	99.50	7.25	3.03	10.28	1022.37
T_2	99.75	5.90	2.15	8.05	803.09
T_3	99.38	4.90	2.53	7.43	738.01
T_4	99.44	6.03	3.23	9.25	919.94
T_5	98.50	5.20	3.43	8.63	849.54
T_6	99.15	7.38	4.13	11.50	1140.12
T_7	98.00	4.80	3.88	8.68	850.00
SEM	0.32	0.13	0.07	0.22	22.48
CD@5%	0.93	0.38	0.21	0.66	66.12
CV	0.64	4.34	4.54	4.90	4.98