Importance of Bio-Priming on Improving Seed Quality in Chilli (*CapsicumAnnuum*L.)

ABSTRACT

India grows a lot of chilli (*Capsicum annuum L*.), and one of its most valuable commodities is its seed. 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 *Trichodermaviride* on qualitative parameters with seven treatments. The experiment was carried out using CRBD. The culture of *Pseudomonas fluorescens, Bacillus and Trichodermaviride* at 2.5g /l and 5.0g/lconcentration 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*, *Trichodermaviride,Bacillus*, Chilli

1 INTRODUCTION:

Among solanaceous vegetables, the chilli (*Capsicum annuum L.)* is a major crop grown in subtropical and tropical regions. Ripe and unripe fruits are utilized for a variety of industrial and therapeutic purposes (Rai et al., 2019). The main causes of the decreased production and inferior quality characteristics of chilli include imbalanced fertilizer usage, inadequate plant protection, poor development, and sub-optimal plant population (Alam et al., 2014).Poor and inconsistent germination usually leads to a suboptimal plant population. Invigorating seeds to increase germination rate, increase development uniformity, and shorten the time it takes for many vegetables and certain field crops to emerge has been the subject of several research in recent years. Nowadays, seed priming is a popular commercial technique that increases seedling uniformity and speeds up germination in a variety of crops (Basra et al., 2003).The most important ingredient for agriculture is seed. Therefore, it is essential to preserve the quality of the seeds using naturally occurring treatments that offer several advantages. One of the most significant advancements in pre-sowing procedures is seed priming, which promotes uniform and quick growth and growth of seeds while also enhancing their resistance to unfavorable climatic circumstances (Dhanya, B.A., 2014). According to Galhaut et al. (2014), bio-priming is the most straightforward, cost-effective, and environmentally friendly method of delivering beneficial microorganisms to the agroecosystem among seed priming strategies. Therefore, understanding how bio-priming can be applied to improve plant nutrition, restore soil health, and maintain crop/seed quality is crucial to achieving the UN Sustainable Development Goals, which include ending hunger, poverty, and promoting good health and well-being (Sarakret al., 2021). In order to preserve seed, a procedure known as "bio-priming" combines the physiological part of disease control—seed hydration—with the natural component of disease control—seed inoculation with helpful organisms. It is an ecological strategy that combats soil- and seed-borne infections by employing either bacteria or specific fungal antagonists. Certain bacteria and fungi, most notably Pseudomonas fluorescens, Bacillus, and Trichodermaviride, are known to inhibit illness and promote plant development.

A fungus called Trichodermaviride is employed as a bioagent. It is applied to seeds and soil to control a range of illnesses brought on by fungi. Many crops, including beans (Phaseolus vulgaris), cucumbers (Cucumissativus), peppers (Capsicum annum), carnations (Dianthus carophyllus), maize (Zea mays), and wheat (Tritichumaestivum), have been shown to have an enhanced growth response when exposed to Trichoderma sp. (Lo and Lin, 2002). Trichoderma create phytohormones that are linked to or produce cytokinin-like molecules, such as zeatyn and gibberellin GA3. These phytohormones, whose metabolic routes have been discovered (Osiewacz, 2002), include indol acetic acid (IAA) and ethylene (M. AhsanurRahman et al., 2012).Improved bio-fertilization may result from the regulated synthesis of these substances (Osiewacz, 2002). Another common bioagent for disease control is pseudomonas fluorescens, also referred to as plant growth rizobacteria because of its ability to produce phytohormones, phytogrowth-regulating substances (PGRs), mineralize organic phosphorus, produce phytoalexin-like compounds, enhance mineral absorption, and more (Mukerji et al., 2006). When compared to the control, Pseudomonas sp. MML2212 and Pseudomonas fluorescens were found to increase dry weight and plant height on rice and green gram (Mathivananet al., 2005, Shanmugaiah et al., 2005, 2007). In order to assess how several genotypes of chillies responded to bio-priming with Pseudomonas fluorescens and Trichodermaviride in terms of growth, yield, and quality features, the current study was started.

2 MATERIALS 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 research 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 ByadgiDabbi and Rudra genotypes of chilliwere bio-primed with *P. fluorescens, Bacillus*and*T. viride* individually for twenty-four hours at different concentration and As a control, the seeds were steeped in distilled water for the same amount of time. The seeds were used for lab tests after being shade-dried for 30 minutes following the treatment.

2.2 Laboratory experiments:For the in vitro experiment, two layers of Whatman filter paper soaked in sterilized distilled water were put on petriplates lined with 100 seeds, with four replications for each genotype and treatment, and incubated at 25±10C. According to ISTA, the germination percentage was measured at (14 Days After Sowing-DAS). After 14 DAS, five seedlings at random from each replication were chosen to measure the length of the roots and shoots using the Paper Plate technique. The information was logged and subjected to a rigorous analysis.

3 RESULTS AND DISCUSSION:

Following pre-sowing bio-priming, the seeds were subjected to laboratory testing to evaluate their quality using several criteria such as vigor index, root length, and shoot length, seedling length, and germination %. The results revealed that there wassignificant effect of different treatment on the quality parameters' of chilli.

3.1 Germination percentage

The result revealed that the 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 and*T. viride*(T_5) respectively 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 were 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. It was discovered that Pseudomonas fluorescens had a higher average effect on this characteristic in both types compared to Bacillus and

Trichodermaviride. The Rudravariety responded similarly to the other varieties when pre-sowing bio-priming of seed germination, and the impact of the three bio-inoculants was nearly as good as that of the control.In contrast, substantial variations were seen in ByadgiDabbi across all treatments. In all conditions, Trichodermaviride also enhanced the germination %; data to corroborate this were reported by Hanson (2000), Mishra and Sinha (2000), and 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)carried out comparably statistically for this character. The untreated control group (T7) had the significantly shortest root length, with 2.5 g Bacillus (T3) and 5 g Bacillus (T4) following closely behind. The distinct genetic expression might be one of the factors.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(Table. 1 and Table2). Pseudomonas fluorescence, Bacillus, and Trichodermaviridebioinoculant all showed a significant beneficial effect over control when it came to the development of this trait in both kinds. Comparable outcomes with reference to the root growth of cucumber, loofah, and bitter gourd from screened Trichoderma strains were discovered by Lo, C.T., and Lin, C.Y. (2002).

3.3 Shoot Length

The longest shoot 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 was recorded 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 recorded of about 2.15cm in 5 g *P. fluorescens*(T_2). It was discovered that the average effects of Bacillus, Trichodermaviride, and Pseudomonas fluorescens were positive and statistically significant when compared to the unprimed control. While Pseudomonas fluorescens was seen in the ByadgiDabbi variety, a larger effect of Trichodermaviride was detected in the Rudra variety. The Rudra cultivar's untreated control (T7) reacted to priming similarly to Bacillus, Pseudomonas fluorescens, and Trichodermaviride.

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. Bacillus performed statistically similarly in both genotypes. Regardless of the cultivars, the untreated control (T7) generated seedlings of the most tiny kind. Over time, it was shown that the average untreated control of Bacillus, Trichodermaviride, and Pseudomonas fluorescence was significantly positive compared to the unprimed control. However, in the Rudra variety, Trichodermaviride was observed to have a bigger impact at higher concentrations. A table showing the change in control due to priming may also be used to evaluate the similar trend that was observed for each specific variety and was more pronounced following the bio-priming of seeds with Trichodermaviride (Rai et al., 2019, Sarkar et al., 2021).

3.5 Vigour Index

Similar to seedling length, the untreated control group (T7) exhibited the lowest magnitude of vigour index. This might be attributed to both the increased effect of its seed germination potential and the inherited potential of its seedling length. In both types, bio-priming had a significant impact on the increase in vigor index compared to control (Raiet al., 2019, Sarkar et al., 2021, Asaduzzaman et al., 2010, Mishra, D.S., and Sinha, A.P. 2000). In Rudra cultivar, Trichodermaviride (5 g T. viride, T6=1140.12) had a greater impact than Pseudomonas fluorescens (2.5 g P. fluorescens, T1=1022.37 and 5 g P. fluorescens, T2=803.09) for determining the average vigour index. 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 *Trichodermaviride*(5 g T. viride,T_6 =911.99) in Byadgidabbi variety(Table 1 and Table 2), Although both types' responses to bio-priming for the development of seeds with increased vigor above control were statistically equal, they followed a similar pattern. It was found that all of the bio-inoculants had very identical effects on both types. exception was noted for2.5 *g Bacillus*(T_3) in for which low superiority in influence with low concentration of *Trichodermaviride*.

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 Trichodermaviride*. The significant variation was found when compared with the control treatment, so from the study it concluded 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 ByadgiDabbichilli 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 Rudrachilli 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