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Effect of biopriming sorghum (*Sorghum bicolour* L. Moench) with *Trichoderma* and *Psudomonas* on germination, vigour, and viability

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Abstract
To examine the impact of seed priming with bio fertilizers on germination rates, vigour, and viability of Sorghum seeds in RBD having four replications, as well as the impacts of bio fertilisers in three concentrations and priming durations on Sorghum seeds with bio priming treatments. T1 (control), T2 (seeds soaked in a 1% solution of *Trichoderma* for 14 hours), and T3 (seeds soaked in a 1% solution of *Trichoderma* for 18 hours) likewise T4 [seeds soaked in *Trichoderma* (1% solution for 24 hours), T5 [seeds soaked in *Psudomonas* (1% solution for 24 hours), T6 [seeds soaked in *Psudomonas* (1% solution for 24 hours), and T7 [seeds soaked in *Psudomonas* (1% solution for 24 hours)] on seed germination and vigour of Sorghum. The vigour index, seedling dry weight, germination rate, and seedling length of the Sorghum seeds were all significantly impacted by all treatments. The maximal vigour index was demonstrated by *Psudomonas* (1% solution for 14 hours). Sorghum that had been inoculated with these two cultures showed a significant aspect in root length, shoot length, fresh weight, and dry weight.

Keywords: Bio priming, sorghum, duration, seedling parameter

Introduction
The grass-family plant known as sorghum (*Sorghum bicolor*) and its starchy seeds are also known as great millet, Indian millet, milo, durra, or shallu. The plant probably originated in Africa, where it is a significant crop and comes in a wide range of types, including grain sorghums, which are produced for food, hay, and fodder, as well as sorghums, which are used for brooms and brushes. Sorghum is referred to as jowar, cholam, or jonna in India. Sorghum is particularly prized in hot, dry areas because of its endurance to heat and drought. Sorghum's feed quality is inferior to (maize). It has a high carbohydrate content, 10% protein, 3.4% fat, calcium, trace levels of iron, and vitamin B1 (niacin).
The gluten-free grain is often processed into a meal and used to make porridge, flatbreads, and cakes for humans. Processing can diminish the flavour's characteristic intensity. Starch, dextrose (a sugar), paste, and alcoholic beverages are further products made from the grain. The stalks are employed as building materials and as animal feed. Important sources of livestock feed include maize, sorghum, and barley. The brewing sector also uses barley and rice (Chopra and Prakash, 2002) [6]. Bio-priming is a novel method of seed treatment that integrates the biological (inoculating the seed with a beneficial organism) and physiological (hydrating the seed) aspects of disease prevention (Reddy, 2012) [17]. Recently, it has been employed as an alternative technique for eradicating numerous soil- and seed-borne diseases. A more contemporary method of seed priming is seed bio priming. Seed priming is a pre-sowing procedure that induces a physiological state that promotes more effective seed germination. According to Singh *et al*. (2004) [19], *Trichoderma harzianum* is the most popular bio-priming fungi because it has a wide range of antagonistic effects against plant pathogens, primarily fungi and nematodes, decomposes organic matter to increase humic acid in soil, solubilizes and mobilises phosphorus, and improves nitrogen use efficiency and nutrient availability.

Abiotic stress factors such osmosis; salinity, chilling, and high temperature were reduced by symbiotic fungi and tomato seeds treated with *T. harzianum* Rifai strain T-22 (Mansouri *et al*. 2010) [16]. The most numerous soil microorganisms, Bacteria play a critical role in nutrient cycling to maintain soil fertility. Through seed bio-priming, the application of PGPR to seed improves plant performance in stressful situations, which improves plant production both directly and indirectly (Dimkpa *et al*., 2009) [7].

By giving plants some common nutrients and phytohormones that have been impounded by bacterial siderophores, some PGPR may directly stimulate plant growth and improvement (Hayat *et al*., 2010; Rodriguez and Fraga, 1999) [12, 18]. Inoculating PGPR by seed bio priming exhibits synergistic effects, where one inoculant aids in the improved performance of another. Rhizosphere bacteria from different bacterial genera, including *Bacillus*, *Pseudomonas*, and *Rhizobium*, work together to support plant growth and development. Co-inoculation enhanced the absorption of nitrogen, phosphorus, and other mineral nutrients by seed crops when compared to solo inoculation (Figueiredo *et al*., 2011; Yadegari *et al*., 2010) [8, 24]. The study's goals were to determine the effects of bio priming using *Psudomonas* fluorescence and *Trichoderma herzianum.*

Method and Method

The study was conducted using 11 cm Petri dishes filled with two layers of filter paper (90 mm). The seeds were twice rinsed in deionized distilled water after being sterilised in sodium hypochlorite (1%) solution first. Then, the corresponding priming solutions were added to Petri plates containing double-layer filter paper. For 12 days, plates were housed in a seed germination chamber at 20 °C and 90% relative humidity. After 12 days, measurements were taken of the shoot length, root length, fresh weight, and dry weight. In the pot culture approach, the seed was rinsed with sterile distilled water after being sterilised with 70% ethanol. Dried seed was sown in a pot, and after three weeks, observations were made.

In order to improve plant establishment and boost germination and emergence uniformity, seed priming is a water-based technique that is applied to seeds. Bio-priming, which entails the application of bacteria that promote plant growth, is the phrase used to describe seed priming with living bacterial inoculums. By soaking seeds in a solution containing a bioagent for a predetermined amount of time and then re-drying them right before a radical develops, bio-priming involves the partial germination of seeds (Copeland and McDonald, 1995; Desai *et al*., 1997) [23].

Germination (%): According to ISTA, four replicates of 100 seeds each were used in the germination test, which was carried out in a walk-in germination chamber utilising the paper (between papers) medium (2010).

G% = Seeds germinated/Total seeds x 100

The vigour index of sorghum seedlings was calculated using formula suggested by

Abdul-Baki and Anderson (1973) [1]

Seed vigour index (SVI) = Germination (%) × Seedling dry weight (mg).

Vigour index mass: SVI-M = Germination% × seedling dry weight on the final count

Vigour index length: SVI-L = Germination% × seedling length (cm)

Significant differences in seed germination, vigour and seedling growth parameters were observed due to seed priming in sorghum. (Table 2)

Table 1: List of Treatments

Sr. No	Treatments	Details
1	TT1	Control
2	TT2	*Trichoderma* (1% solution 14 hours)
3	TT3	*Trichoderma* (1% solution 18 hours)
4	TT4	*Trichoderma* (1% solution 24 hours)
5	TT5	*Psudomonas* (1% solution 14 hours)
6	TT6	*Psudomonas* (1% solution 18 hours)
7	TT7	*Psudomonas* (1% solution 24 hours)

Result and Discussion

The objective of the current experiment was to compare the effects of various priming durations and procedures in order to identify the most effective priming treatments for sorghum. The experimental results are presented under the three sections of germination%, seedling dry weight, and length. The accelerated rate of cell division and stimulation of metabolic activity during the early phases of seed germination, according to Bose *et al*. (1992) [4], may be the reasons for the primed seeds' rapid germination. Studies in the same vein as Casenave *et al*. (2007) [5] and Bocian *et al*. (2008) [8] also reported a reduction in mean germination time (Sung, *et al*., 1995) [22].

Table 2: Effect of biopriming methods on germination of sorghum seed

Sr. No	Treatments	G%	VIM	VIL	SDW (g)	SL (cm)
1	T1	78	10.250	1544.40	1.269	19.80
2	T2	94	17.124	2605.44	1.588	30.15
3	T3	90	16.174	2260.80	1.673	25.12
4	T4	87	15.125	2108.01	1.593	24.23
5	T5	90	21.031	2478.60	2.916	27.54
6	T6	92	19.024	2834.10	2.189	28.32
7	T7	82	16.015	1949.96	1.986	23.78
	CD (5%)	2.30	4.97	38.20	0.06	0.42
	CV (%)	1.77	20.56	1.14	2.25	1.1
	SEM	0.77	1.67	12.86	0.02	0.14

The treatments primed with T2 [*Trichoderma* (1% Solution 14 hours)] bio fertiliser solution (94%) exhibit the highest seed germination percentage, while T1 [unsoaked (control)] (78%) shows the lowest. The increased production of hormones like gibberellins, which would have stimulated the action of particular enzymes that encouraged early germination, may be the cause of these observations. Additionally, improved auxin synthesis would have resulted in a notable boost in seedling vigour. Similar outcomes are in accordance with (Bharathi R *et al*, 2004) [2]. Every treatment emphasises the average germination time. Additionally, non-soaked seeds outperformed primed seeds by a large margin. According to Bose *et al.* (1992) [4] and stimulation of metabolic activity during the first stages of seed germination, the rapid germination of primed seeds may be caused by an increased rate of cell division. Similar studies revealed a decrease in mean germination time.

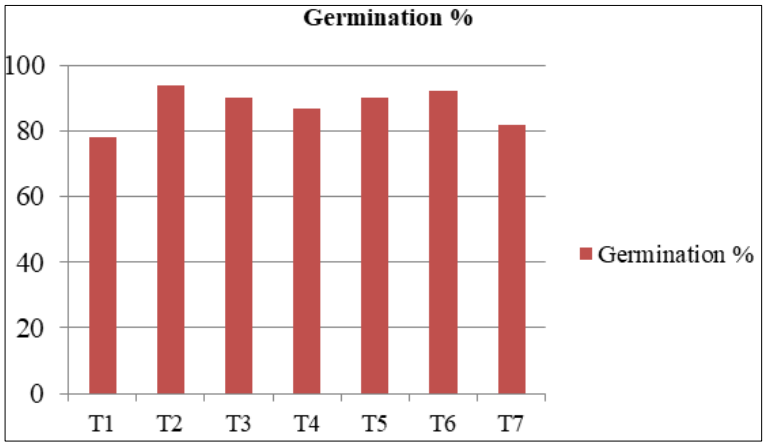

Fig 1: Speed of germination as Impact by different priming treatments on sorghum seed

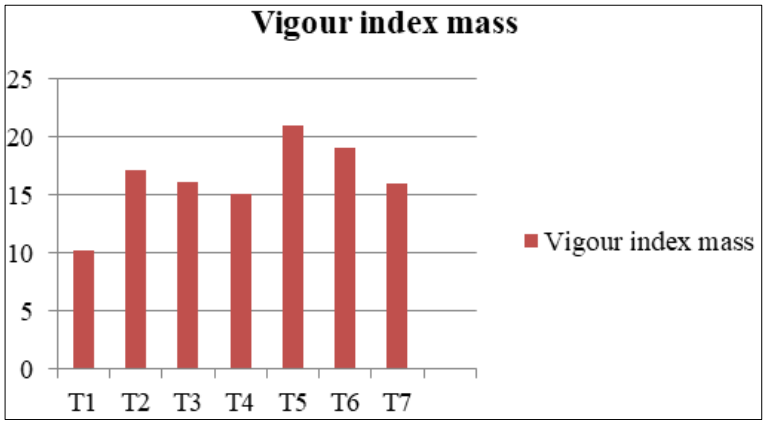

Fig 2: Seed vigour index mass as impact by different priming treatments

The T5 treatments primed with a 1% solution of *Pseudomonas* yield the best results in terms of seed vigour index mass (21.031). While T1 unsoaked (control) had the lowest seed vigour index mass (10.250). Due to an increasing supply of nourishment, the treatment that is biofertilized rises. The results of this experiment demonstrate that, depending on the type of bacteria used, *Psudomonas* improved the seed vigour index mass.

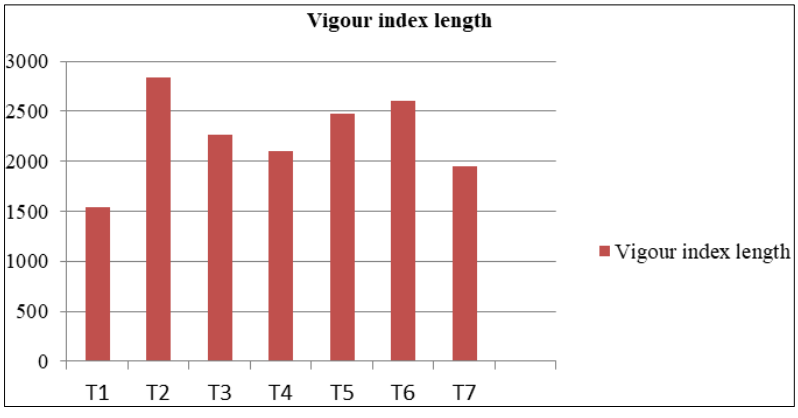

Fig 3: Seed vigour index length as impact by different priming treatments on sorghum seeds

The seeds which has soaked with bio fertilize solution of T6 *Psudomonas* (1% Solution 18 hours)] (2834.10) shows the excelsior seed vigour index length. While lowest seed vigour index length was observed with T1 unsoaked (control) (1544.40). The probable reason for recording the highest vigour index length might be due to photosynthetic capacity of maize treated with bio fertilizers increases due to increased supply of nutrition. Starch metabolism has been considered to play a vital role in early seedling vigour.

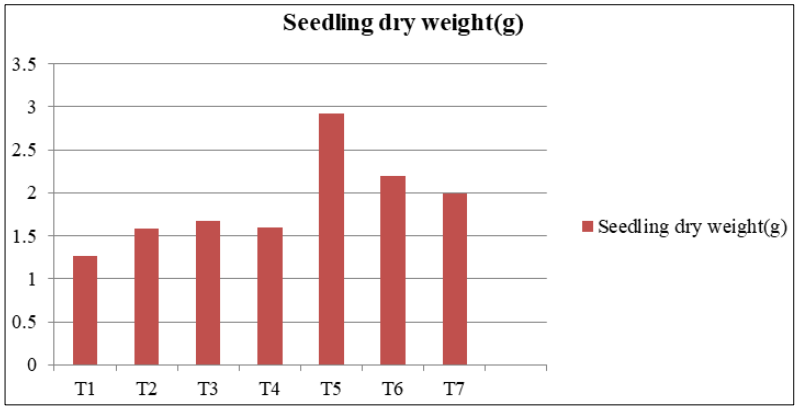

Fig 4: Dry weight of seedling (g) as impact by different priming treatments on sorghum seeds.

T5 *Psudomonas* bio agent solution (1% solution for 14 hours) primed treatments the most common outcome in seedling dry weight is 2.916gm. The lowest seedling dry weight was 1.269gm for T1 unsoaked (control). This result could be attributed to an increase in the synthesis of the hormone gibberellin, which stimulates the activity of -amylase and other germination-specific enzymes such as protease and nuclease involved in starch hydrolysis and assimilation (Gholami *et al*., 2009) [10].

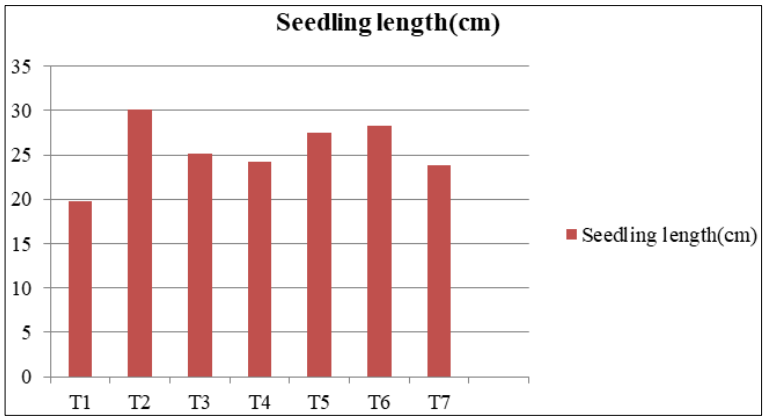

Fig 5: Root length (cm) as impact by different priming treatments on sorghum seed

Soaked seeds with T2 bio fertiliser solutions [*Trichoderma* (1% Solution 14 hours)] (30.15 cm) produce the best seedling length. T1 [unsoaked (control)] had the shortest seedling length (19.80). *Trichoderma* application enhanced either germination and emergence% and index in this study, which suggests that seeds germinated better, seedlings emerged stronger. This could be owing to increased production of growth stimulators, which has been observed in plant-*Trichoderma* interactions. This outcome is comparable to (Gravel, 2006) [11] Someshwar and Sitansu (2010) [20] utilised bacterial inoculum of *P.fluorescens* for seed biopriming and discovered that it significantly improved than many of the fungal biopriming agents, namely *T. vir ide* AN-10 and *T. harzianum* AN-13, in stimulating the germination of seeds of chilli, tomato, and brinjal while being equatable to *T. harzianum* WB-1 in inducing germination of the crop seeds. The maximum seed germination was attained when crop seeds were primed with *T. harzianum* AN-5 and WB-1 mycelial inoculum. In order to increase plant growth and yield as well as to defend against M. phaseolina, Minaxi and Saxena (2010a) [15] suggested bacterizing moong bean seeds with *P. fluorescens* BAM-4.Seed germination, shoot length, shoot fresh and dry weight, root length, root fresh and dry weight, leaf area, and Rhizosphere colonisation all exhibited a substantial improvement.

Conclusion

The outcomes of the current study indicate that the 14-hour treatment produced the best benefits, whilst the unprimed seed control showed the least primed effects.

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References

1. Abdul-Baki AA, Anderson JD. Vigour deterioration in soybean by multiple criteria. Crop science. 1973;13:630-633.

2. Bharathi R, Vivekananthan R, Harish S, Ramanathan A, Samiyappan R. Rhizobacteria-based bio-formulations for the management of fruit rot infection in chillies. Crop Protection journal. 2004;23:835-843.
3. Bocian S, Houbowicz R. Effect of different ways of priming tomato (*Lycopersicon esculentum* MILL.) seeds on their quality. Pol. Journal of Natural Science. 2008;23(4):729-739.
4. Bose B, Mishra T. Response of wheat seed to pre sowing seed treatments with Mg (NO_3). Annals Agriculture Research. 1992;13:132-136.
5. Casenave EC, Toselli ME. Hydro priming as a pre-treatment for cotton germination under thermal and water stress conditions. Seed Science Technology. 2007;35:88-98.
6. Chopra VL, Prakash S. eds., Evolution and Adaptation of Cereal Crops. Science Publishers Inc, NH, USA; c2002. p. 1-295.
7. Dimkpa C, Weinand, T, Asch F. Plant-rhizobacteria interactions alleviate abiotic stress conditions. Plant Cell Environment. 2009;32:1682-1694.
8. Figueiredo MVB, Seldin L, de Araujo FF, Mariano RDLR. Plant growth promoting rhizobacteria: fundamentals and applications. In: Plant growth and health promoting bacteria; c2011. p. 21-43.
9. Tsapikounis FA, Ipsilandis CG, Greveniotis V. Specific environment of aromatic plants cultivations and native microorganisms affect the effectiveness of the mycoparasites of the genus Trichoderma. Int J Hortic Food Sci. 2020;2(1):31-40.
10. Gholami Shahsavani S, Nezarat S. The Effect of Plant Growth Promoting Rhizobacteria (PGPR) on Germination, Seedling Growth and Yield of Maize, World Academy of Science, Engineering and Technology. 2009;49:19-24.
11. Gravel V, Antoun H, Tweddell R. Growth stimulation and fruit yield improvement of greenhouse tomato plants by inoculation with Pseudomonas putida or *Trichoderma* atro *viride* possible role of indole acetic acid (IAA); c2006.
12. Hayat R, Ali S, Amara U, Khalid R, Ahmed I. Soil beneficial bacteria and their role in plant growth promotion: a review. Annals of Microbiology. 2010;60:579-598.
13. ISTA. International rules for seed testing. Seed testing. Seed science and technology. 2010;13:299-335.
14. McDonald MB. Seed priming. In: Black, M., Bewley, J.D. (Eds). Seed Technology and its Biological Basis. Sheffield, Sheffield Academic Press; c2000. p. 287-325.
15. Saxena J. Disease suppression and crop improvement in moong beans (*Vigna radiata*) through *Pseudomonas* and *Burkholderia* strains isolated from semi-arid region of Rajasthan, India. Biocontrol. 2010a;55:799-810.
16. Mansouri F, Bjorkman T, Harman GE. Seed treatment with *Trichoderma harzianum* alleviates biotic, abiotic and physiological stress in germinating seed and seedling. Phytopathology. 2010;100:1213-1221.
17. Reddy PP. Bio-priming of seeds. In: Recent advances in crop protection. Springer, New Delhi; c2012.
18. Rodríguez H, Fraga R. Phosphate solubilizing bacteria and their role in plant growth promotion. Biotechnology Advances. 1999;17:319-339.
19. Singh US, Zaidi NW, Joshi D, Jones D, Khan T, Bajpai A. *Trichoderma*: a microbe with multifaceted activity. Annual Review of Plant Pathology. 2004;3:33-75.
20. Someshwar B, Sitansu P. Biopriming of seeds for improving germination behavior of chilli, tomato and brinjal. Journal of Mycology and Plant Pathology. 2010;40:375-379.
21. Okpalanma EF, Ukpong ES, Chude CO, Abah RC. Determination of malting conditions, proximate and biochemical properties of sorghum/millet grains and malts. International Journal of Food Science and Nutrition. 2021;6(2):51-8.
22. Sung P, Robberson DL. DNA strand exchange mediated by a RAD51-ss DNA nucleoprotein filament with polarity opposite to that of RecA. Cell. 1995 Aug 11;82(3):453-61.
23. Desai JD, Banat IM. Microbial production of surfactants and their commercial potential. Microbiology and Molecular biology reviews. 1997 Mar;61(1):47-64.
24. Yadegari M, Rahmani HA, Noor mohammadi G, Ayneband A. Plant growth promoting rhizobacteria increase growth, yield and nitrogen fixation in *Phaseolus vulgaris*. Journal of Plant Nutrition. 2010;33:1733-1743.