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In Vitro Study on Effects of Bio-inoculants Consortia on Seed Germination of Sorghum and Triticum

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Abstract : *Bio inoculants enhance the plant growth by various means such as mineralization, macronutrients fixation and plant growth hormone production, biocontrol activity, nutrient acquisition and many more. In current study we have isolated rhizospheric microorganisms from rhizospheric soil of Sorghum and Triticum, after putative identification two isolates from both crops were studied for efficiency on seed germination of Sorghum and Triticum in laboratory. Individual isolates and equivalent mixture of isolates were prepared both in case of Sorghum and Triticum respectively and tested for seed germination. Prominent results have been observed in microbial consortia than single bio inoculant and control during seed germination process of Sorghum and Triticum. Seed germination process has been studied by keeping control of same seeds without coating of bio inoculants. Effective seed germination was studied by considering various parameters of seed germination such as Vigor Index that is root and shoot growth ratio and number of seeds germinated among test seeds. Vigor indices of consortia coated seeds were high in comparison with control seeds and individual bio inoculant in both crops Sorghum and Triticum. This concludes that the microbial consortia were very effective in seed germination over control seeds and individual inoculant coated seeds. Further synergistic effects in microbial consortia have to be studied to get detailed mechanisms of bacteria in association rather individually.*

Key Words: Bio Inoculant, Seed Germination, Phytohormone, Microbial Consortia, Sorghum, Triticum

1. INTRODUCTION

In India many farmers just uses chemical fertilizers due to their easy availability and low costs. Research shows that the chemical fertilizers do more harm than the benefit in long term. Chemical fertilizers and their long lasting side effects on soil fertility makes them second choice of fertilizers as compared to bio fertilizers (Singh et al., 2026) Costly Chemical fertilizers and their side effects on soil fertility and human health have to take into consideration. Alternative to this is use of bio inoculants for better crop yield and preserving soil fertility (Krasilnikov, P. et. al., 2022) Sustainable agriculture is the solution to present agricultural crisis (D. V. Pathak, et. al., 2011)

Plant rhizosphere has diversity of microorganisms have pronounced positive effect on plant growth promotion via several plant growth promoting activities (V. Jeyanthi and S. Kanimozhi, 2018). Geochemical reactions catalyzed by rhizospheric microorganisms such as nitrogen fixation, phosphate solubilization, potassium solubilization are the major ones. Various other mineralization processes involves conversion of most chemically complex compounds into simpler forms which is suitable for plant growth (Pérez-García,et, al., 2023). Degradation of various complex organic compounds such as cellulose, lignin, chitin, gelatin and pectin helps plant in their growth promotion. Production of phytohormones is also important in plant growth promotion (Apaza-Calcina,J.D. et. al., 2025). Bio control activity is

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important phenomenon of these microorganisms. Due to bio control activity of inoculants plants get protection from many plant diseases and yield of them can be increased steadily (Vejan et al., 2016). Bio inoculants possess such beneficial activities which promotes plant growth.

Seed germination is very crucial stage in plant growth. Plant growth promoting bacteria speeds the seed germination process and yields more agricultural produce. Ending of seed dormancy and initiation of seedling from it is very essential process which lead to development of a healthy plant increases overall plant yield. Bioinoculants helps seeds to germinate properly and fastens the process of seed germination (K.Shaukat, et. al., 2006). Vigor Index is one of the important properties of seed germination to assess that the seed germination is effective. In this index product of percent seed germination and length of seedling is determined to estimate effective seed germination (Abdul Baki and Anderson, 1973).

II. METHODS AND MATERIALS

2.1 Isolation of Rhizospheric Bacteria

Rhizospheric soil was collected from roots of Sorghum and Triticum from local fields of Udgir town and nearby area. Isolation of bacteria was done by dissolving 1 gm soil into 100 ml sterile distilled water containing flasks. Mixing soil into water was done by using rotatory shaker at 100 RPM for 10 minutes. After this one loop-full suspension was streaked on sterile nutrient agar plates and incubated at room temperatures for 24 hours in incubator. Single and separate colony was selected and picked to streak again on nutrient agar slants to keep them as an isolate and stored into refrigerator at 4° C for further study. Putative identification was done by study of colony characteristics and Gram staining. From these isolates two isolates were selected from both crops that is Sorghum and Triticum respectively and studied for their effect on seed germination.

2.2 Seed Germination Study

Seed germination experiment was conducted by Petri plate and sterile filter paper method. Maldandi (M-35-1) Sorghum and Lokwan 2189 Triticum seeds were purchased from local market of Udgir, of which primarily isolation of rhizospheric bacteria was done. Seeds were firstly surface disinfected by using standard technique. 0.1 % $HgCl_2$ solution was used to surface sterilize the seeds for 5 minutes (G.S. Nagananda. et. al., 2010). After seeds were five times rinsed by using sterile distilled water to remove traces of $HgCl_2$ solution completely. Seeds were soaked in sterile distilled water for about two hours to smoothen germination process. Bio inoculants were used separately and in consortia form also for both crop seeds. 1:1 ratio of both bacterial cultures mixed to prepare bio inoculant consortia in both case. Coating of seeds was done with isolated bio inoculants in careful manner by soaking seeds in activated bacterial cultures. Uniform coating of bacterial layer was ensured by keeping those seeds with bacterial cultures on rotatory shaker at 100 RPM for 30 minutes. Control seeds of both crops were treated same as above with sterile distilled water instead of bacterial culture. Total 15 seeds in every sterile Petri plate containing sterile filter paper moistened with distilled water were placed aseptically including control. Experiment was carried out in triplicates (Hamedalla, A.M. et. al., 2022).

Seeds coated with bio inoculants and control was incubated at room temperature for one week in growth chamber. Meanwhile filter paper has been moistened with sterile distilled water regularly to keep moisture constant throughout the germination process. Seeds were checked intermittently for their germination. After one week we have calculated Vigor Index to assess the seed germination process and effectiveness of bio inoculants (Shirin Mokari Firuzsalari. et. al., 2012)

Vigor Index is calculated by using following formula:

Vigor Index = Germination % × Total seedling length (Root+ Shoot) in cm

We got more Vigor index in case of microbial consortia as compared to individual bio inoculant and control. The result of seed germination experiment is indicated in following table.

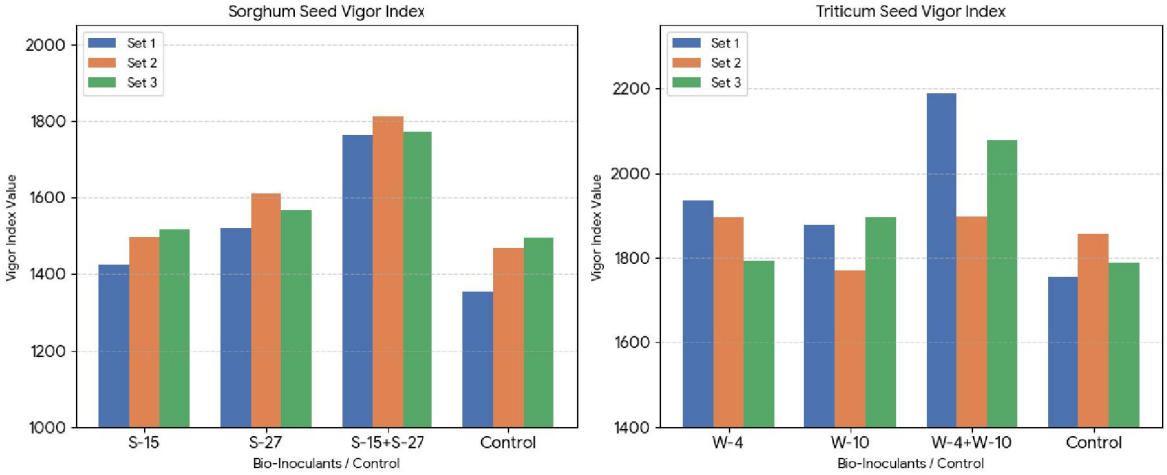
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Sr. No.	Bio inoculants							
	Sorghum				Triticum			
	S-15	S-27	S-15+S-27	Control	W-4	W-10	W-4+W-10	Control
Set-1	1425	1520	1764	1354	1936.2	1878	2189.5	1756.7
Set-2	1497	1611.5	1813.5	1467.5	1897	1768.5	1897.5	1855.5
Set-3	1517.2	1565.3	1772	1494.6	1793.5	1896.4	2078	1788.3

III. RESULTS AND DISCUSSION

Vigor indices of individual bio inoculants show less value in both crops whereas indices of consortia show greater value. Control sets of both crops also show lesser Vigor indices. According to above results the Vigor indices of bio inoculant consortia were greater in both Sorghum and Triticum.

Results show that these bio inoculant consortia can be used to germinate seeds effectively in both crops. Microbial synergistic effects in consortia are positive and these combinations hence can be used to promote growth of plants. The exact mechanisms of growth promotion in case of bio inoculants and consortia have to be studied in detail in further study to be more precise in application.



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