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Bio-priming of Seeds: A Revolutionary Seed Treatment Methodology

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Introduction:

The latest advancement in seed treatment, known as "bio-priming," combines physiological (hydrating the seed) and biological (covering it with beneficial microorganisms) elements to prevent illness. By undergoing a number of structural, physiological, and biochemical changes within the plants, seed priming with advantageous microorganisms or biocontrol agents increases the availability of nutrients to the plants and induces systemic resistance against biotic and abiotic stresses in various ecological conditions. These microorganisms encompass a variety of bacterial and fungal agents that encourage plant development.

Benefits of bio-priming agents include:

- ✓ promoting germination of seeds and seedlings;
- ✓ facilitating nitrogen fixation;
- ✓ enhancing nutrient mobilisation;
- ✓ nutrient acquisition by solubilization;
- ✓ producing phytoharmones;
- ✓ enabling seed to germinate and emerge even in adverse climatic conditions;
- ✓ increasing vigour for rapid and strong plant development;
- ✓ protecting seeds against soil- and seed-borne pathogens;
- ✓ and choosing an environmentally friendly approach to disease management over chemical treatments.

Methodology

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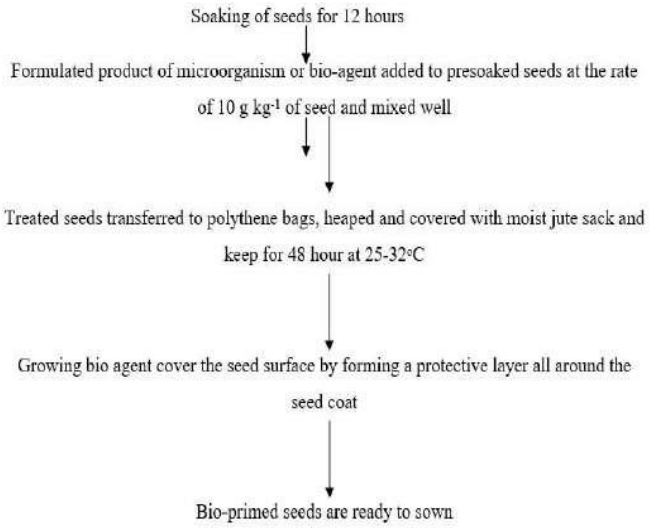

Microbial Seed Bio-Priming Agents

Azospirillum, Azotobacter, Rhizobium, Agrobacterium, Burkholderia, Acinetobacter, Enterobacter, Klebsiella, Pantoea, Pseudomonas, Serratia, Bacillus, Frankia, and Gliocladium spp. are the most often utilised plant growth-promoting bacteria in bio-priming. Trichoderma viride, T. harzianym, T. hamatum, Clonostachys rosea, Gliocladium roseum, and Chaetomium bostrycoides are the biocontrol agents.

Uptake, Growth, And Development Of Nutrients

The majority of microorganisms that encourage plant growth increase nutrient intake from soils, minimise the need for applying external fertiliser, and decrease nitrate and phosphate deposition in soils. It is well recognised that bacterial microbes play a crucial part in nitrogen cycling for preserving the fertility of the soil. These organisms enhance the soil's ability to absorb nutrients, and Numerous studies have demonstrated that seed-associated bio-priming microbes increased agricultural productivity by improving plant-microbe interactions. P and K remobilization, N2 fixation, iron sequestration, microbial phytoharmones, functional enzymes, vitamins, metabolites, nutrient uptake through hyphae, seed emergence promotion, active metabolite production, and vigorous seedling establishment are some of the most significant effects.

PGPM's Control Agents' Actions

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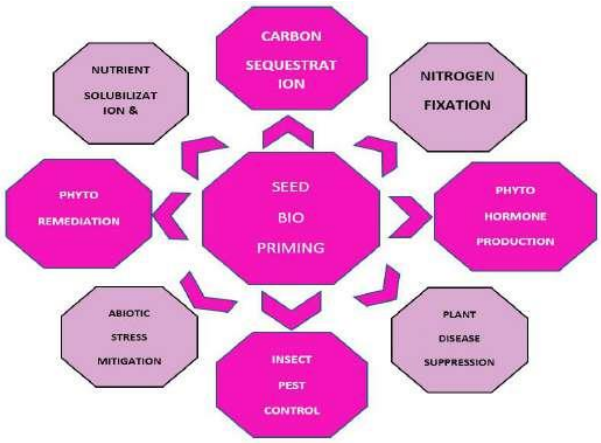

Reducing Abiotic Stress

Abiotic stressors including temperature, dryness, and salinity are experienced by the majority of crop plants and have an impact on seed quality and output. Lower yields can be the outcome of this abiotic stress since it can weaken seed germination, seedling vigour, and crop uniformity. It is becoming increasingly crucial to include microbial inoculants, which are highly effective and economical, in seed production procedures. The creation and incorporation of trait-specific microbial inoculants is becoming more crucial for reducing abiotic and biotic stressors through seed bio-priming.

Biological Stress Reduction

By using bio-control agents, bio-priming is a valuable strategy for building plant resistance. Through a series of interactions, a wide range of fungal bio-agents assist in reducing biotic stress in plants. Trichoderma harzianum, which has antibacterial effects against a wide range of plant diseases, is one of the most frequently used fungi for bio- priming. A symbiotic fungus called Vascular Arbuscular Mychorrhiza (V AM) has had notable benefits in combating abiotic problems, particularly dryness. Examples of biotic stress intervention techniques include destructive mycoparasitism, creating a physical barrier, chelating iron using siderophores, manufacturing cell well lytic enzymes, and using antagonistic compounds like cyanides and antibiotics.

Phytoremidiation

By changing the rhizosphere's environment, enhancing biomass production, and raising nutrient bioavailability, specific bacteria have been shown to be helpful in phytoremediation when paired with PGPMs for seed treatment. By using a number of biochemical mechanisms, including the release of several enzymes that carry out oxidative transformations, C-P cleavage events, and other biochemical events, microorganisms degrade harmful pesticide residues in soil. Bacillus, Pseudomonas, Flavobacterium, Moraxalla, Acinetobacter,

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Arthrobacter, Paracoccus, Aerobacter, Alkaligens, Burkholderia, and Sphingomonas are the main bacterial genera with bioremediation properties.

Bio-Priming of Seeds in Seed Production

Seed bio-priming offers significant advantages to the seed manufacturing business. In the same way that genetic traits are passed down through generations, seed bacteria and other promising bio-gents are now being employed to increase seed vigour. In many crops, the addition of these helpful microorganisms to the seed and soil interface is a crucial strategy for producing high-quality seeds. Therefore, the seed producing sectors will be the first to gain from seed bio-priming techniques.