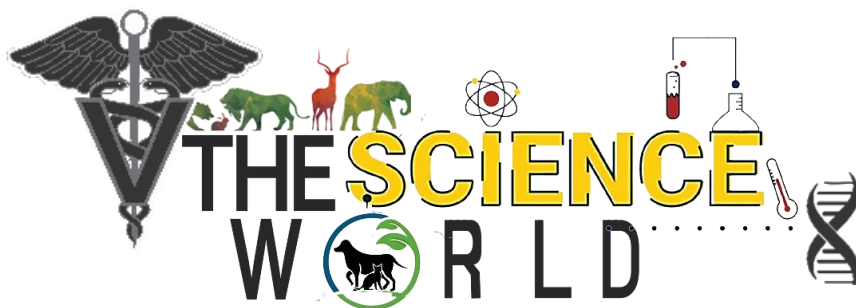




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Seed Treatment

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Abstract

Seed treatment is the application of physical, chemical or biological agents to seeds prior to sowing in order to suppress, control or repel pests and diseases. One of the advantages of seed treatment is that, it breaks and prevents seed dormancy. Seed dormancy and germination are strongly influenced by phytohormones, which are highly dependent on plant growth regulator levels. This paper reviewed the most common seed treatments used for crop field establishment. Seed treatment technology relies on pre sowing physiological, biological and chemical seed treatments. Under light environmental conditions, seed treated with (phytohormones, Gibberellic acid (GA), Benzyladenine (BA), and potassium nitrate (KN03) germination rate was higher than under dark conditions.

GA increased germination percentage by 53 and 42% under light and dark conditions respectively, when compared to nonprimed treatment. Similarly, seed primed with KN03 increased germination percentages by 44 and 33% under light and dark environmental conditions respectively. Trichoderma is effective in enhancing crop growth and physiological processes. Seed treated with hot water (physical seed treatment) provides effective control of seed-borne fungal infections and improves seed germination.

Introduction

To control plant diseases and pest infestations, seeds or vegetatively propagated materials may be treated with biological agents or chemicals. These substances, including pesticides like bactericides, fungicides and insecticides, primarily target true seeds from crops like cereals, pulses and oilseeds but can also be used on materials like bulbs and tubers.

Seed treatments are crucial for protecting crops from diseases caused by fungi, bacteria, viruses and pests, ensuring consistent plant establishment by mitigating seedborne and soilborne threats. This practice is akin to vaccinating children, as both are most effective early in development. By safeguarding germinating seeds, seed treatments can reduce seed rot and



seedling mortality, potentially improving plant establishment or yield by 5-15%. Furthermore, these therapeutic approaches have the potential to alleviate root rot problems in certain crops. Novel systemic chemicals could act as alternatives to traditional foliar fungicides and insecticides, especially in addressing early season foliar diseases and insect infestations.

Methods of Seed Treatments

Seed treatment refers to the application of physical, chemical or biological agents to seeds before sowing to protect them from seed-borne and soil-borne diseases, pests and to improve germination and seedling vigor. The main methods are:

1. Physical Seed Treatment

Physical seed treatment uses temperature, water, radiation, or mechanical methods to eliminate pathogens present on or inside seeds.

a) Hot Water Treatment

Seeds are soaked in hot water at a specific temperature for a fixed time. This helps kill pathogens without damaging the seed embryo.

Example: Rice seeds treated at 52-54 °C for 10 minutes to control bacterial and fungal diseases

Advantages: Effective against internal seed infections, no chemical residues, environmentally safe



b) Dry Heat Treatment

Seeds are exposed to dry heat in ovens or chambers for several hours. Used to control diseases transmitted internally through seeds.

Example: Vegetable seeds like tomato and cabbage are often treated using dry heat.

c) Solar Treatment

Seeds are soaked in water and then spread under sunlight for several hours. Sun heat helps reduce pathogen population.

Advantages: Low cost, easy for farmers to adopt



d) Scarification:

Scarification means breaking or weakening the hard seed coat to help germination.

Methods includes; Rubbing seeds with sandpaper, mechanical cracking.

Examples

Legume crops and hard-seeded plants



2. Chemical Seed Treatment

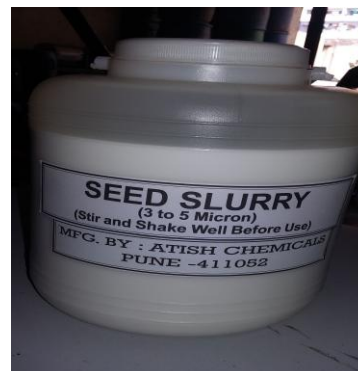
a) Dry Seed dressing:

Seeds are mixed with powdered chemicals and shaken or mixed thoroughly.

Common chemicals used, Thiram, Captan, Carbendazim

Advantages

Simple and quick, requires little equipment



b) Slurry treatment

Fungicides are mixed with a small quantity of water to form a slurry. The slurry is applied to seeds for uniform coating.

Advantages: Better coverage of seeds, seeds are soaked in chemical solutions for a specific time before sowing. Controls seed-borne pathogens, enhances germination.

3. Biological Methods of Seed Treatment

Biological seed treatment uses beneficial microorganisms to protect seeds and improve plant growth.

Common bio agents

Rhizobium, Trichoderma viride, Pseudomonas fluorescens

Advantages: Eco-friendly, improves soil fertility and plant growth, controls soil-borne pathogens.



4) Advanced methods of seed treatment:

a) Seed priming:

Seed priming is a controlled hydration process in which seeds are partially hydrated to start metabolic activity but not allow radicle emergence.

Types of seed priming:

Hydro priming:

Seeds are soaked in water for a specific time and then dried before sowing. Improves germination and seedling vigor.



Osmo priming:

Seeds are soaked in osmotic solutions like Polyethylene glycol, Potassium nitrate.

Halo priming:

Seeds are soaked in salt solutions such as Sodium chloride.

Biopriming:

Seeds are treated with beneficial microbes like *Trichoderma harzianum* or *Pseudomonas fluorescens*.

b) polymer seed coating:

Polymer coating involves applying a thin polymer layer around seeds along with fungicides, insecticides, or nutrients. common polymer: Polyvinyl alcohol.

Advantages: Uniform chemical distribution, Reduced chemical loss, better seed flow in sowing machines.

c) Seed pelleting:

In advanced pelleting, seeds are coated with nutrients, pesticides and growth regulators using binders and fillers.

Advantages:

Improves precision planting, suitable for small seeds like carrot and lettuce, enhances seedling growth.

d) Nano seed treatment:

This is a modern technique where nanoparticles are used to coat or treat seeds to improve nutrient uptake and disease resistance.

Advantages:

Enhanced seed germination, improved nutrient efficiency, increased resistance to pathogens.

e) plasma seed treatment:

Seeds are exposed to cold plasma energy to improve seed germination and disinfection.

Advantages:

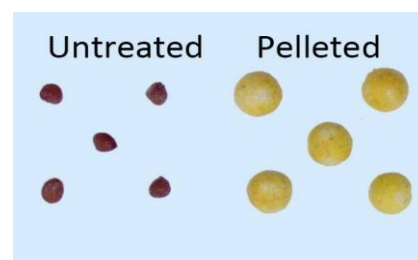
Kills seed-borne pathogens, improves seed surface properties, enhances water absorption

f) Seed fortification:

Seed fortification involves soaking seeds in nutrient solutions to improve nutrient content and seedling.

Advantages:

Improves nutrient availability, enhances early plant growth



g) Seed encapsulation:

This technique encloses seeds in gel or polymer capsules containing nutrients, pesticides, and beneficial microbes.

Advantages:

Protects seeds from harsh soil conditions, provides a controlled nutrient supply, improves seed handling and sowing.

Conclusion:

Advanced seed treatment methods such as seed priming, polymer coating, nano treatment, plasma treatment, seed fortification and encapsulation improve germination, protect seeds from pathogens, enhance nutrient uptake and increase crop productivity.

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