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A Bird's Eye View of Seed Treatment and Its Benefit

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Seed treatment refers to the application of physical, chemical, or biological agents to seeds before sowing, with the objective of protecting them from pathogens, insects, and adverse soil conditions, while also enhancing germination and seedling establishment. It is considered a cost-effective and eco-friendly method for safeguarding crops at their most vulnerable stage—the seedling phase.

The treatment may include fungicides, insecticides, bio-control agents, or nutrient coatings that shield seeds from seed-borne and soil-borne diseases, pests, and unfavorable environmental factors. In addition, modern seed treatments involve polymer coatings, growth stimulants, and nanotechnology-based agents to improve seed vigor, uniform emergence, and crop productivity.

Seed Treatment

It refers to the application of pesticides (fungicides, insecticides or a combination of both) to seeds before sowing and/or storage in order to protect the seeds and young seedlings from soil borne pathogens and/or storage pathogens and insects. Seeds are thoroughly mixed with required quantities of chemicals namely bavistin (carbendazim) @ 2-4 g/kg of seeds.

Seed Treaters

Methods of seed dressing

Dry or dust form

The chemicals in a required quantity is just uniformly mixed with the seed to protect it from pest and disease.

Eg- Bavistin @ 2g/kg of seed for fungi and activated clay @ 100g/kg of seed for insect control

Slurry form

The chemicals is applied to the seed with some water to make a uniform coat over the seed surface. Normally, 5ml of water is added to the chemical to form slurry and the seed surface is made to cover with uniform coating of slurry.

Liquid form

Seeds are soaked/dipped in the chemical solutions for a specified period and dried.

Mist form

This is followed in storage rooms to control pests, The chemicals are sprayed inside the room in the mist form.

Gaseous form

The chemical gases or fumes are used to Control the pest in seed lots and the storage godowns. It is also called as fumigation.

Equipment used for seed treatment

Seed treatment drum

Two types of seed treating drum is used.

- Disc type (seed pelleting machine)
- Cylinder/drum type.

In these treaters, the seeds with required quantity of-chemicals are placed inside the drum/disc and rotated by hand with uniform speed for uniform coating.

Slurry seed treater

This is an electrically operated automatic machine, which consists of a seed box with automatic scale, slurry tank, bucket conveyor to carry the slurry, mixing unit with stirrer/agitator and screen conveyor and an outlet. In the box, the seeds are weighed automatically and the seeds are dropped inside the mixing unit. Simultaneously, a required quantity of chemical slurry is carried out by the bucket conveyors from the slurry tank and poured inside the mixing unit. After thorough mixing, the treated seeds are sent out to the outlet by the screw conveyor.

Fumigation chamber

The chamber made up of metal or coal tar drum made in to a air tight manner is used for fumigating the seeds.

Types of Pre-Storage Treatments

The treatments given to the seeds prior to or during storage to protect the seed from deteriorative changes and from pest and diseases are called pre storage treatments. The types of pre storage seed treatments are

⇒ **HALOGENATION**

⇒ **ANTIOXIDENT TREATMENT**

⇒ **SEED PROTECTENTS**

⇒ **SEED FUMIGATION**

Halogenation

Dry dressing

It is application of halogens like chlorine, bromine and iodine to seeds before storage as dry dusting to stabilize the lipoprotein biomembrane.

procedure:

Calcium carbonate, fresh chalk, talc charcoal or activated clay are first exposed to vapours of halogens and alcohols @ 2-5 g /kg seed. An alternative method is to add the chemicals directly to the carrier (50-500 mg of chemical added to 2-5 g carrier for treating 1 kg seed) in a closed container, has proved to be a good carrier. After equilibrating the carrier- chemical mix, the seed is thoroughly dressed with same and kept for 24-72 h in the closed container and thereafter stored in the usual way. Bleaching powder (calcium oxychloride) may be directly mixed with the seed @ 1-4 g / kg seed.

Vapour treatment

Exposure of seeds to halogen vapour in a closed container for 16-72 h to very low concentrations of halogens. The concentration of chemicals and the time of exposure would depend on the material concerned.

Antioxidant treatment

Application of antioxidants such as vitamin A,C,E, hydroxytoluene (BHT) to seeds before storage as wet or treatments which delays the physiological ageing. The seeds are applied with antioxidants through soaking solutions at particular concentration.

Antioxidants such as vitamin A, C and E provides hydrogen atom for quenching the lipid radical thereby putting an end to free radical propagation and subsequent damage to cell membrane and ultra-cellular structures.

Seed protectants

The seed sanitation treatments refer to the application of pesticides (fungicides, insecticides or a combination of both) to seeds to disinfest and disinfect them from various seed borne and soil borne pathogenic organisms and storage insect pests to safe guard the seed and seedlings against the seed and soil borne pathogens. Seed borne pests and diseases may be carried

within seeds or on seeds or they may accompany the seed as free living organisms or in debris.

The seeds are simply dipped or soaked in the chemical solutions and the fungicides applied as dust, slurry or liquid in recommended concentrations.

Seed disinfection

This refers to the eradication of fungal spores that have become established within the seed coat or in more deep-seated tissues. The pathogen is internally seed borne in nature. For effective control, the fungicidal treatment must actually penetrate the seed in order to kill the fungus that is present.

Seed disinfestation

This refers to the destruction of surface borne organisms that have contaminated the seed surface, but have not infected the seed surface, the pathogen is externally seed borne in nature.

Seed fumigation

It is a process of exposing the seeds to fumigants (gaseous form of chemical) to control storage insects which cause seed deterioration during storage.

The seeds should be brought to equilibrium moisture contents at 60% RH, then they should be enclosed in air tight containers and fumigated at temperature of required durations. The seed moisture content should be around below and moisture >14% is detrimental to fumigation. After fumigation, seeds placed in cloth bags are aerated for 1 weeks under normal condition. Subsequent 2nd and 3rd fumigations are repeated after 6 months after first fumigation, respectively.

Examples of fumigants are ethylene oxide, aluminum phosphide, calcium cyanide, ethylene dichloride and carbon tetrachloride, ethylene dibromide, carbon di-sulphide or hydrogen phosphide. The dosage may be 2-3 g cu.m.

The toxic effects of the fumigants bring about the control of fungi or insects. The fumigant can penetrate into the seeds to control the deep-seated pathogens. Before going for fumigation, a thorough knowledge of seed moisture level and type of infestation, choice of fumigant, its doses and exposure time and necessity of number of fumigations is very essential.

Mid Storage Treatments

Seeds in storage accumulate damage to cell membranes during senescence. Mid storage seed treatments are capable of reducing the age induced damages and restoring the seed vigor to a certain extent besides, the seed viability and productivity of stored seeds are also improved.

Hydration — Dehydration (H-D)

It is the process of soaking the low and medium vigour seeds in water with or without added chemicals usually for short durations to raise the seed moisture content to 25 — 30% and drying back the seeds to safe limits for dry storage.

Types of H-D treatments

The wet treatments include soaking-drying, dipping-drying, spraying-drying, stepwise hydration-drying, moisture equilibration-drying, and moist sand conditioning-drying. The choice of the treatment depends upon the characteristics of seed and initial vigour status of seeds.

- Soaking-drying

Store seed is soaked in water or solution of chemicals sufficient to cover it and kept at room temperature for 2-6 h depending on the material with occasional stirring. The soaked seed is taken out and after surface drying in the shade for some time, dried back to the original moisture content.

Dilute solution of chemicals such as sodium or potassium and mono

Fungicidal and insecticidal formulations can also be incorporated in the soak water.

- Dipping — drying

seeds are dipped in water or solutions of the aforesaid chemicals for only 2-5 minutes and the wet seed is taken and kept covered for on the material, for absorption of surface water followed by drying back in S-D. The treatment is effective in most high and high-medium vigour seeds of rice, eat jute, summer and winter tables.

- **Spraying — drying**

Seeds are spread in a thin layer and then, an amount of water (approximately 1/5 to 1/4 of the seed weight) is sprayed on to it in two equal installments (turning over the seed layer after the first spray) and then, kept covered by a polythene sheet for 2-4 h before drying back. This treatment is similar to D-D in its efficacy and suitability.

- **Moisture equilibration — drying**

Here, the seeds are placed in thin layers on trays kept on a raised platform in a closed moisture saturated chamber lined internally with moist blotters giving nearly 100% RH at room temperature. After 24-48 h, depending on the material and ambient temperature, the seed is dried back in the usual way. For soaking injury prone seeds this treatment, which gives a slow and progressive rise in moisture content, is very effective. It is however, difficult to practice on a large scale. And is not advocated for low vigour non leguminous seeds because of possible aging effect of the treatment especially when given for prolonged periods.

- **Moist sand conditioning — drying**

This treatment is similar to the moisture equilibration treatment, but easier to practice. For slow and progressive moisture uptake, the seed is thoroughly mixed with pre moistened sand, using 3 times the amount of air-dry sand than seed. Moisture content of sand is adjusted to 5-10% by adding the required amount of water or solution of chemicals to previously washed and dried fine grain building grade sand. The addition of water should be so adjusted as to get the required hydration effect without initiating the germination process. After mixing the dry seed with the pre moistened sand, the mixture is kept at room temperature for 16 -36 hr on the material and sand moisture content. The seed absorbs moisture from sand and after incubation, the hydrated seed is separated from sand by sieving and dried back to the original weight.

The hydration — dehydration treatments

- Should be given only to stored seeds.
- Is effective in low and medium vigour non- leguminous seeds.
- The moisture equilibration and moist sand conditioning treatments in which moisture is taken up by the seed in a slow and progressive manner, are recommended for relatively high-vigour seeds and seeds of pulses and leguminous vegetable crops.
- Direct soaking of leguminous seeds should be avoided.
- Would not make a seed germinable, which has already lost viability.

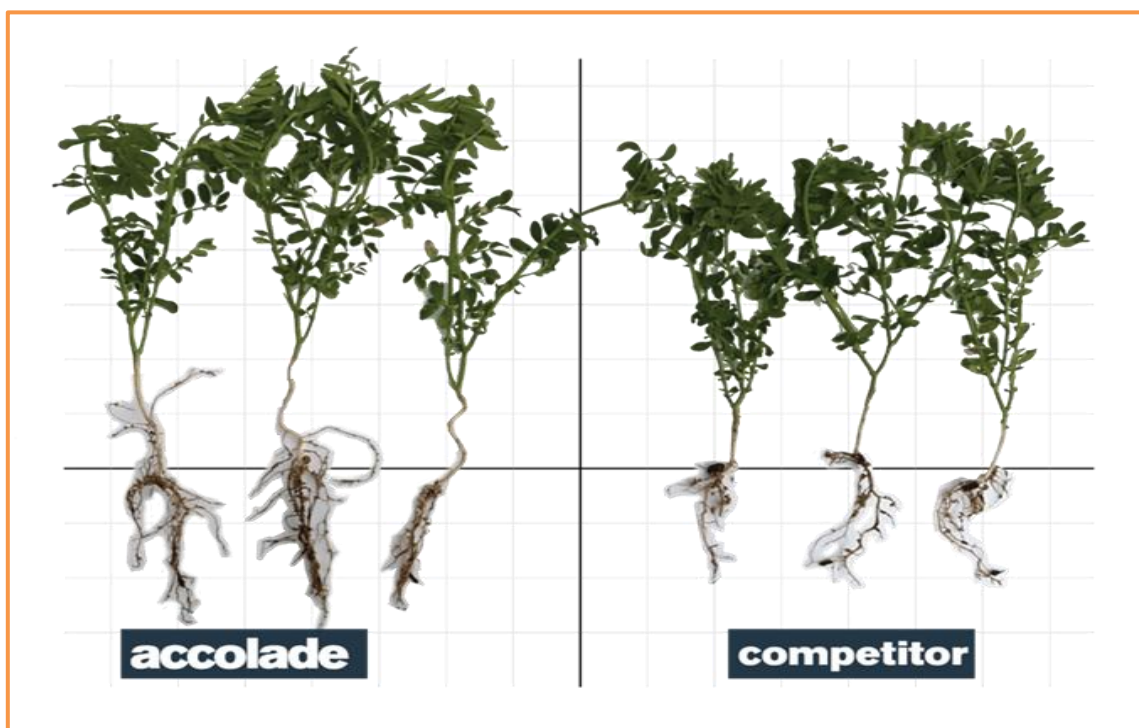
Common Methods of Seed Treatment

Seed treatment encompasses a range of methods, each tailored to address specific needs and challenges. Whether it's to provide a protective layer, enhance performance, or ensure healthy germination, these methods play a pivotal role in modern agriculture. Learn more about them below:

- **Seed Coating:** Seed coating is the process of enveloping seeds with a thin layer of materials like polymers, fertilizers, or growth promoters. The coating serves multiple purposes. It can enhance seed visibility, making it easier for farmers to observe sowing patterns.
- **Seed Dressing:** Dressing seeds involves applying fungicides, insecticides, or other protective agents to their surface. The application techniques can vary, but they often involve tumbling seeds with the dressing agent until they're uniformly covered. Seed dressing protects seeds from pests and diseases during the early stages of growth.
- **Seed Pelleting:** Pelleting involves encasing seeds in a thicker, uniform coating to create pellets of a standard size and shape. The pellet shape aids in precision planting, ensuring

seeds are spaced evenly. Pelleting can lead to better crop stands and easier weed management.

- **Seed Priming:** As discussed earlier, seed priming is a pre-sowing strategy that prepares seeds for germination. When these primed seeds are then planted, they exhibit faster and more uniform emergence, helping crops establish themselves more effectively in the field.
- **Seed Disinfection:** Seeds can be carriers of pathogens, either on their surface or within them. Disinfecting seeds involves treating them with chemical or non-chemical agents to kill or inhibit these pathogens. This method is crucial for disease prevention, ensuring that seeds are free from harmful microbes that can jeopardize the entire crop.

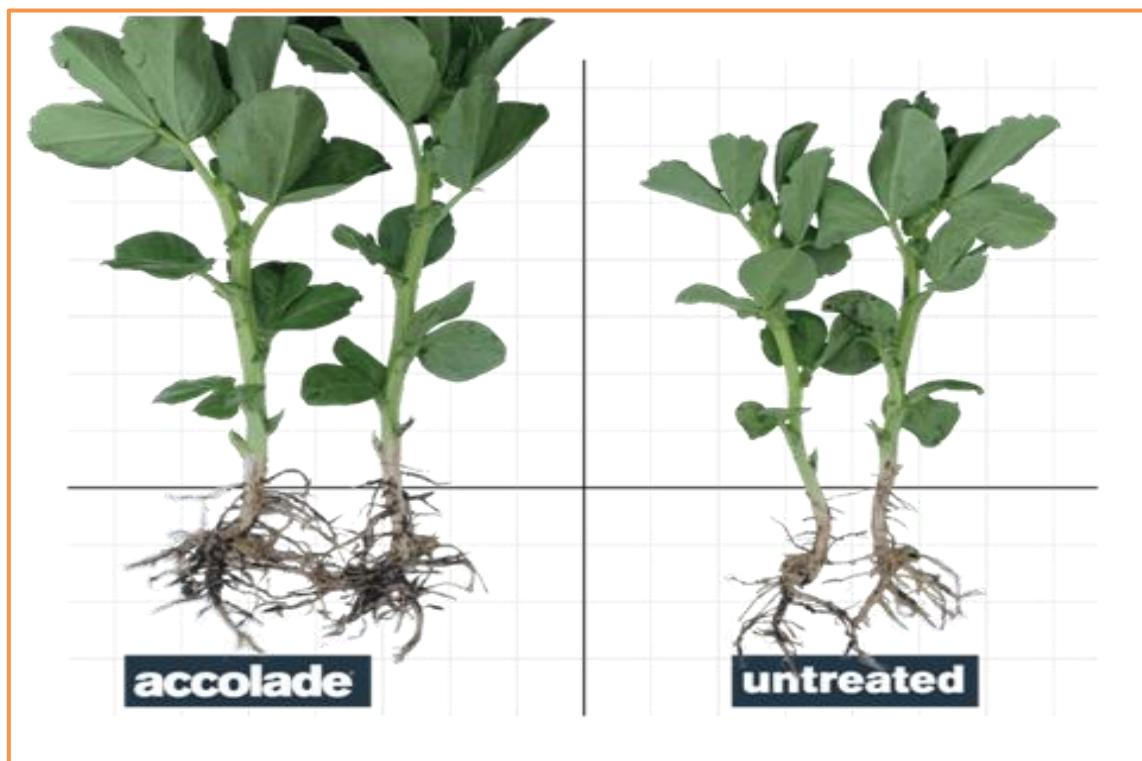


Types of Seed Treatments

Seed treatments encompass a broad spectrum of agents, each designed to address specific challenges that seeds may encounter. These treatments include:

- Fungicides:** Fungicides protect seeds against a wide range of fungal diseases that can inhibit germination or harm young plants. These chemicals work by either killing the fungi or preventing their growth. Depending on the fungicide, their modes of action may include damaging fungal cell walls, inhibiting fungal enzyme activity, or disrupting critical life cycle stages of the fungi.
- Insecticides:** Seed-applied insecticides shield young plants from various pests, such as aphids, cutworms, and beetles. These treatments repel, kill, or inhibit pest growth, ensuring a pest-free environment during critical early growth stages.
- Biopesticides:** These are derived from natural sources, such as plants, microbes, or other biological entities. Biopesticides offer a more environmentally friendly approach to pest and disease management. They often target specific pests, reducing the chances of resistance, and have minimal impact on non-target organisms and the environment.
- Nematicides:** Nematodes can severely affect root health, leading to reduced nutrient uptake and stunted growth. Nematicides combat these microscopic worms, ensuring a healthy root system, and in turn, robust plant growth.
- Plant Growth Regulators:** These substances influence plant growth and development. By regulating processes like cell division, elongation, and differentiation, they can enhance seed germination, root development, and overall crop yield.

- F. **Micronutrients:** Granular micronutrients, though required in tiny amounts, are vital for plant health. They play crucial roles in enzymatic reactions, chlorophyll production, and overall plant metabolism. Seed treatments that supply this essential trace elements can ensure robust, healthy plant growth from the outset.



What are the Benefits of Seed Treatment?

Improved Disease Resistance with Fungicides

- One of the primary threats to seeds, especially in the early stages of growth, is fungal diseases. Fungal diseases can interfere with seed germination, stunt seedling growth, and significantly reduce crop yield. Treating seeds with fungicides gives them a protective shield against these fungal pathogens.
- Fungicidal seed treatments can target a specific fungal threat or offer broad-spectrum protection against numerous fungi. This ensures a healthy start for the seedling and can also mean the difference between crop success and failure.

Protection Against Pests and Insects

- Seeds and young plants are vulnerable to a variety of pests and insects. These pests can destroy them before they even have a chance to germinate. Using insecticides and innovative biopesticides (derived from natural materials such as animals, plants, bacteria, and certain minerals) can protect seeds from these threats.
- Biopesticides, in particular, offer an environmentally friendly solution, reducing the need for synthetic chemicals while still providing robust protection against pests.

Increased Tolerance to Environmental Stresses with Seed Priming Techniques

- Our world faces many environmental challenges, ranging from droughts to salinity and temperature fluctuations. Such stresses can severely impact the germination and growth of seeds. Seed priming is a technique that exposes seeds to specific treatments and prepares them to face these stressors head-on.
- Priming can include hydration techniques or exposure to certain beneficial compounds. Primed seeds often show improved germination rates, faster growth, and an increased ability to tolerate adverse environmental conditions. The result is a more resilient plant that can thrive even when faced with environmental challenges.



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