

Seed Treatment

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Definition

Seed treatment refers to the application of fungicide, insecticide or other non-chemical a combination of both, to seeds so as to disinfect and disinfest them from seed-born or soil-borne pathogenic organisms and storage insect. Seed treatment is also done to enhance seed quality and storability.

Objectives

- Protection from insect pests and diseases including the storage pests.
- Breaking of dormancy (physiological dormancy).
- Improving germination/or emergence.
- Controlling soil insects
- Supply of nutrients.
- Improving seedling vigour and promoting initial crop growth.
- To reduce yield loss of a crop.

Advantages of Seed Treatments

- It can efficiently control seed-borne pathogens.
- It can be controlled easily
- It can increase the duration of storage
- Relatively low dose of chemical is required
- It maintain the seed health

Types of Seed Treatment

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

B. Seed disinfestation. Seed disinfestation refers to the destruction of surface-borne organisms that have contaminated the seed surface but not infected the seed surface. Chemical dips, soaks, fungicides applied as dust, slurry or liquid have been found successful.

C. Seed protection. The purpose of seed protection is to protect the seed and young seedling from organisms in the soil which might otherwise cause decay of the seed before germination.

Agents for Seed Treatment

A. Chemical treatment

1. Fungicides

Fungicidal seed treatment may be divided into three categories, depending on the nature and purpose of the treatment.

Based on composition, seed treatment fungicides may be organic or inorganic, metallic or non-metallic and until recently, mercurial or non-mercurial.

2. Insecticides



Insecticides are often applied to seed to control or reduce insect damage to seed during storage and to a lesser degree to prevent damage from such insects as wire worms and seed corn maggots in the soil. Since some of the pesticides are selective in the control of pests, many times two or more compounds are combined in the treater tank, or an extra tank may be used, to give the spectrum of activity needed.

B. Non-chemical treatment

3. Bioagents

Seeds are treated with preidentified beneficial bioagents to protect the seed and supplement the nutrients. Use of bioagent for seed treatment is ecologically sound and biologically sustainable. It is an essential component of organic farming.

Seeds are mixed with adhering agents and specific biological strains in appropriate proportions followed by surface drying.

Fungi	<i>Trichoderma</i> spp., <i>Aspergillus flavus</i> , <i>Curvularia pallens</i> and <i>Chaetomium indicum</i>
Bacteria	<i>Pseudomonas</i> , <i>Bacillus</i> , <i>Clavibacter</i>
Botanicals	Leaf powder of <i>Azadirachta indica</i> , <i>Vitex negundo</i> , <i>Prosopis</i> , <i>Acacia</i> , <i>Pungam</i> , etc.
Nutrient supplementation	<i>Rhizobium</i> , <i>Azospirillum</i>

The success of protection by bioagents invariably depends on

- The potential of biological agent
- The number of propagules applied to the seed
- The application of technology
- The concurrent inhibition of other microbes in the application process

C. Seed treatment involving physical factors

4. Hot Water Treatment

The seeds are dipped for specific period of time in hot water to a particular temperature safe to embryo and deleterious to the associated pathogen. This method is useful for low volume high value seeds. Spores or bacteria that are attached to seeds can be killed by soaking the seeds in hot water. Use water of exactly 50°C and soak the seeds for 30 minutes.

- Hot Water Immersion Treatment
- Steam Treatments
- Forced Hot Air

5. Seed dip in water

Soaking of seeds in normal water 20°C for 41 hours reduces loose smut infection of wheat. Soaking in water at 25°C for 41 hours or 30°C for 28 hours eliminate the fungus from wheat seeds effectively.

6. Solar energy treatment

The seeds are soaked in water and exposed to sun for 6-8 hours which control loose smut of wheat. It activates the dormant mycelium and destroyed by heat.

7. Cold treatment

Seed treatment by cold plasma (80W) on the resistance of tomato to *Ralstonia solanacearum* (bacterial wilt).

8. Irradiation

Gamma, UV, X-ray and laser can be used to control seedborne pathogens. UV-C radiation to reduce seedborne anthracnose (*Colletotrichum acutatum*) from Andean lupin (*Lupinus mutabilis*).

D. Special treatments



9. Seed hardening treatment

Seeds can be hardened for stress tolerance. The treatments are imposed to the seeds mainly to tolerate initial drought and cold. Cold tolerance treatment is given to germinated seeds, such treatments are given only to temperate crop and tree seeds.

The most important factors to be considered while seed hardening are seed:solution ratio (1:1), the duration of soaking and method of drying.

The effectiveness of the treatment depends upon the conduct of seed hardening process. The solution amount never be higher than the amount of the seeds. All solution added should be imbibed by the seeds. There should not be any leftover solution as it causes leaching effect. Once the seeds imbibe water, the germination process takes place.

At the end of soaking period the seeds should be dried back to its original moisture content. These seeds when sown the germination will be completed earlier whereas in non-hardened seeds the process germination takes a longer period.

10. Seed fortification

Main aim is to supply nutrients to seeds. The main objective is to achieve the high vigor to overcome unfavorable soil reactions. e.g. seed fortification with selenium (Se), silicon (Si), iron (Fe), zinc (Zn) etc.

Methods of Seed Treatment

- **Seed Dressing:** The most common method of seed treatment. The seed is dressed with either a dry formulation or wet treated with a slurry or liquid formulation. Dressings are applied both on-farm and industrially.
- **Slurry Treatment:** Slurry is prepared by mixing the chemicals with water. The required quantity of the chemical is automatically mixed with the specified quantity of the seeds before bagging. Dipping of seeds/seedlings in slurry, e.g., rice seedlings are dipped in phosphate slurry.
- **Dust Treatment:** Treatment of seed with powder form of fungicides.
- **Wet Treatment:** Treatment of seed with liquids/liquid solutions.
- **Seed Coating:** A special binder is used with a formulation to enhance adherence to the seed. coatings require advanced treatment technology.
- **Pelleting:** Pelleting is a technique used as a protectant against soil organisms, soil pests and as a repellent against birds and rodents.
- **Seed dipping:** It involves the dipping of the seed or propagules in a chemical solution for a specified period prior to sowing. For example- seed dipping Dithan M45 control late blight of potato.
- **Osmotic priming:** Aqueous solution of polyethylene glycol (PEG) provides an osmotic environment. Immersion of seed in PEG solution followed by drying and storage does not impair germination and the method is called osmotic priming. Immersing rice seed in 20% PEG containing 0.1% carboxin reduce seedborne infection of *Drechslera oryzae*.

Ideal Chemical Seed Treatment

The ideal seed treatment should be highly effective against various pests and must satisfy the following requirements:

- be harmless to the seed;
- be stable for relatively long periods of time before planting;
- give an even coating to seed, adhere well, without giving an unattractive appearance;
- be relatively inexpensive; and
- be registered for the intended use.

Labeling treated seed

There are seed laws for labeling treated seed. Information required to be shown on the label:

1. A word or statement in type no smaller than 8 points indicating that the seed has been treated.
2. The commonly accepted, coined, chemical or abbreviated chemical (generic) and name of the applied substance and rate of application.
3. A caution statement if the substance used in such treatment in the amount remaining with seed is harmful to humans or other vertebrate animals.
4. Seed treated with a “restricted use” toxic substance shall be labeled to show a statement such as “poison treated” in red. In addition, the label shall show a representation of a skull and crossbones.
5. Seed treated with a “general use” or low toxicity substance, if the amount remaining with the seed is harmful to humans or other vertebrate animals, shall be labeled to show a caution statement in type no smaller than 8 points, such as “Do Not Use for Food, Feed, or Oil.”

In addition, the label may contain additional information; such as, (a) purpose of treatment, (b) antidotes, (c) safety precautions, and d) procedure to follow in case of an accident.

Schedule for Seed Treatment

Crop	Name of chemical	Rate (g per ton of seed)
Rice	Ceresan wet 2.15%	600
Wheat	Agrosan GN 1% Dust or Thiram 75% WDP	2500 or 1000
Oats	Agrosan GN 1% Dust	2500
Sorghum	Thiram 75% WDP	850
Blackgram	Thiram 75% WDP dust	2500
Grasspea	Agrosan GN 1% Dust	2500
Lentil	Agrosan GN 1% Dust	2500
Pigeonpea	Thiram 75% WDP	750
Soybean	Captan 75% dust and Thiram 75% dust	3000 and 1:1
Mustard	Agrosan GN 1% dust	2500
Groundnut	Captan 75% dust and Thiram 75% WDP	2150 or 125
Sesame	Agrosan GN 1% dust	2500
Sunflower	Thiram 75% dust	2500
Cotton	Captan 75% dust	2500
Jute	Captan 75% WDP	800
Sunhemp	Thiram 75% WDP	750
Sugar beet	Thiram 75% dust	2500

Limitations of seed treatments

- **Accidental poisoning.** Treated seed looks like food to some animals. Hungry livestock that find carelessly handled treated seed will probably eat it. Birds, like pheasants or quail, may consume spilled treated seed. Even young children may find and eat improperly stored treated seed.

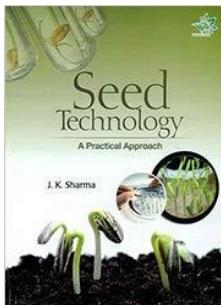
- **Limited dose capacity.** The amount of pesticide that can be applied is limited by how much will actually stick to the seed.
- **Limited duration of protection.** The duration of protection is often short due to the relatively small amount of chemical applied to the seed, dilution of the chemical as the plant grows, and breakdown of the chemical.
- **Limited shelf life of treated seed.** Producing excess treated seed is undesirable because the shelf life of treated seed may be limited. Surplus treated seed cannot be sold for grain.
- **Phytotoxicity:** A few seed treatments are partly phytotoxic and when applied at high rates it may result in lower germination and/or stunting may occur if application rates are not carefully controlled. Cracked, sprouted, and scuffed seeds may be particularly susceptible to toxic effects. A few seed treatments may reduce the length of the sprout and, therefore, affect the choice of planting depth.
- **Worker exposure.** In the course of treating and handling large volumes of seed, workers may be exposed to seed treatment chemicals as aerosols. Some, such as thiram, are irritating when inhaled.

Precautions in seed treatment

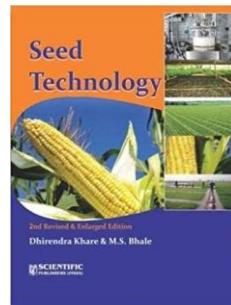
- Use appropriate recommended chemicals for crop, pathogens and diseases. Use precise doses. Lower rates may not give adequate control, whereas higher rates may cause seed injury. Therefore, care must also be taken to treat seed at the correct dosage rate; applying too much or too little material can be as damaging as never treating at all.
- Most products used in the treatment of seeds are harmful to humans, but they can also be harmful to seeds. Extreme care is required to ensure that treated seed is never used as human or animal food.
- Regardless of the product, use of protective clothing, gloves, an approved chemical respirator and goggles are recommended.
- To minimize this possibility, treated seed should be clearly labeled as being dangerous, if consumed. The temptation to use unsold treated seed for human or animal feed can be avoided if care is taken to treat only the quantity for which sales are assured.
- Combinations of some fungicidal and insecticidal seed treatments can be toxic to the seed. It is important to read the label carefully before mixing insecticides with fungicides.
- Treated seed should never be used as food. In addition, equipment such as augers and trucks used to deliver grain to elevators should not be contaminated by treated grain.
- Seed with very high moisture content is very susceptible to injury when treated with some of the concentrated liquid products.
- Never use chemical of expiry date for seed treatment.
- First treat the seed with fungicide, thereafter insecticide and finally with *Rhizobium*. This sequence be followed whenever recommendation is made.

Suggested reading:





Seed Technology: A Practical Approach
By J.K. Sharma
Westville Publishing House (2012)



Seed Technology
By D Khare and M.S. Bhale
Scientific Publishers India (2014)

