

Seed Treatment: Physical and Chemical Methods

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SUMMARY

Seed treatment refers to the application of certain agents physical, chemical or biological to the seed prior to sowing in order to suppress, control or repel pathogens, insects and other pests that attack seeds, seedlings or plants and it ranges from a basic dressing to coating and pelleting. Introduction and ban of arsenic (used from 1740 until 1808) is the key milestones in the history of modern seed treatment till then a continuous research and advancement in this technology is going on. The technological advancement prepared a roadmap for refining existing seed treatment technologies and future work on technologies like fluid drilling as a way to sow germinated seeds where gel can also serve as a delivery system for other materials, seed priming advances the early phase of germination without redicle emergence. Another advanced technology, solid matrix priming (SMP) has been evaluated as a means to advances the germination of seeds and serve as a carrier for useful material too. Physical and biological seed treatments alone an alternative to chemicals or in combination with a chemical treatment are being used worldwide because of their environmental safety and socioeconomic aspects. Biological seed treatments are expected to be one of the fastest growing seed treatment sectors in the near future, in part because they are easier to register at Environment Protection Agency (EPA). Lack of awareness to seed treatments at farmer's level is one of the limiting factors in disease management and hence, efforts should be made at farmer's level to adopt the technology. Keeping the all above facts in mind, selected seed treatment technologies with their improvement and significance will be discussed.

INTRODUCTION

Seed treatment is a biological, chemical mechanical or physical process designed to mitigate externally seed or soil borne microorganisms resulting in the emergence of healthy seedling and subsequently a healthy plant. Seed may be treated to promote good seedling establishment, to minimize yield loss or to maintain and improve quality and to avoid further spread of pathogen.

Types of Seed Treatment

There are two main types of seed treatment viz., 1. Physical, 2. Chemical

Physical Treatments

• Hot Water Treatment

After pre-soaking, the seed is held in water at definite temperature often a little above 50 °C and close to the maximal temperature of both pathogen and host for a definite period of time.

• Anaerobic Water Treatment

The seed is soaked in water and held under anaerobic conditions for definite time. For instance, barley was efficiently treated against loose smut by soaking in water in 24 °C for 6 hours and then drained and stored in air tight containers for 42 hours. With one, half of the container filled with grain.

• Dry Heat Treatment

This has been little used although different combinations of temperature have given promising results against certain pathogens. Dry air treatment of tomato seed at 70 °C for 3 to 4 days is partly effective against tobacco mosaic virus, treated seed lots must be tested before being accepted as virus free.

• Solar Heat Treatment (Solar Energy Method)

In countries with a hot climate, grain is pre soaked in water for 4 to 5 hours in the shade or in a room and then dried on ground in thin layers in sun for 1 hour usually at noon. The procedure has proved effective against loose smut of barley and wheat but has been used only to a limited extent in practice in India.

• Aerated Steam Treatment

The principle is to dry seed in moving vapour by pressure flow.

Chemical Treatments

• Steep treatment

The seed is soaked in a fungicidal liquid solution or suspension for a definite period of time and then dried.

• Sprinkle treatment

The seed is sprinkled with a fungicidal liquid solution or suspension, left damp with this for a definite period of time and then dried.

• Dust treatment

The seed is mixed with a dust fungicide in a mixing device until the seed is well coated; usually about 2 g of mercurials per kg seed is used.

• Slurry treatment

The seed is mixed with a dust fungicide in a special treater in which small calibrated amount of liquid (5-20 ml/kg seed) are added thus forming a soap like slurry to ensure coating without undue wetting.

• Wet treatment

The seed is mixed with a relatively small amount of concentrated liquid (about 100-300 ml/kg seed). There is no recovery of liquid after treatment but drying is necessary.

• Quick Wet (Short Wet) Treatment

The seed is mixed with a relatively small quantity of a concentrated usually volatile liquid fungicide (about 20-40 ml/kg seed), ensuring good coating. The treated seed usually requires no drying. If it is to be sown within a few days.

• Oil fungicide treatment

The seed is mixed with a slightly volatile mercurial germicide in an oily suspension in extremely small quantities (1-3 ml kg seed). No subsequent drying is needed.

• Fumigation

The seed is treated in an airtight container or chamber for a definite period of time by use of volatile material, a fungicide, nematicide or insecticide.

• Pelleting

Application of a sticker prior to mixing the seed with a dust, which may contain pesticide, fertilizers or other suitable materials. The seed is coated first with methocel, a cellulose acetate sticker in a dilute solution and is then agitated with the dust in such a way that each seed becomes a pellet containing an outer zone of protectant. Sometimes, seed is treated with a fungicide before pelleting such as sugar beet seed, which is usually steeped in methyl mercuric phosphate before the process.

Seed Treatment Equipments

The basic principle in any chemical seed treatment is mixing seed and chemical in order to obtain adequate coating and for some treatments, adequate penetration.

• The Shovel Method

Seeds are spread on a clean, dry surface, four to six inches in depth. The proper amount of treatment is diluted with water and sprinkled evenly over the seed. Mixing is accomplished with a shovel or scope turning the seed at least twenty times.

• Stationary Upright Gravity Treater

It is simplest form, homemade treater for small quantities of seed consist of a cylinder, usually a metal oil drum, containing a hopper with a funnel shaped auger through which a regulated flow of grain falls in apex of a screen come to allow dust to pass through a chute into bags. This gravity feed type is not so efficient in production and even mixing as the rotational drum.

• Hand Rotated Treater

This is a revolving drum or barrel and is provided with baffles inside to increase agitation. The container may be placed diagonal position by which further agitation in rotating is obtained. The rotary treater should be turned slowly for about 50 revolutions for the seed to tumble from one end of the container to the other, so as to give

even distribution of the agent. It is suitable for small seed lots of small grain. For large seeded legumes and similar kind of seed sensitive to damage, this procedure might be unsatisfactory.

- **Dust Treater**

The seed is mixed with the dust in different types of chambers in rotating drums or by gravity through chutes provided with baffles. Accurate metering of dust is not possible, hence excessive coverage of seed at the discharge end of the treater. Large scale application of dust treatment to seed has serious disadvantages—dustiness around the treater and consequently danger to operators at continual operations. Most dust in use cause irritation to skin or to the mucous membrane of the respiratory tract.

- **Slurry Treater**

To overcome difficulties faced in dust use, wettable powders were developed for slurry application. The dust is applied as heavy suspension in water to the surface of the seed. The machine is provided with seed and slurry mixing devices which mix the seed and fungicide in calibrated amounts from small buckets drawn on an endless chain. Slurry machines are adapted to all types of seed and rates of treating up to 20 qtl. per hour. Bagging can be done directly because a drying process is unnecessary.

- **Liquid Treater**

These have been designed for direct (undiluted) application of liquid preparations such as mercury preparations in concentrated formulations. e.g. Panogen and ceresin liquid in an ethylene glycol or similar carrier. The machine is provided with an adjustable hopper to control seed flow, calibration devices for metering seed and fungicide and an inclined drum with baffles at the discharge end to control the time the seed is retained in the rotating drum mixing chamber. The capacity of this type is 20 qtl. per hour.

- **Mist Treater**

This type is a further development of the slurry liquid treaters in an attempt to obtain complete coverage of the seed by less volatile preparations. The best known band of these machines is the Mist-o—provided with rapidly spinning discs that break the fungicide solution into small drop lets the dispersal of which ensures complete and uniform coverage when the machine is properly adjusted and used.

- **Spray Treater**

In this treater, the fungicide suspension is introduced through spray nozzles into the mixing chamber with the seed. This treater was originally developed for treatment of sugar beet seed. Capacity is near 20 q per hour for small grains.

- **Hot Water Treaters**

The seed is treated in 20 kg to 80 kgs loosely woven jute bags, tied at the top and presoaked for a period of 5 hours in water at 21 °C. The bags are then attached to an endless belt that slowly passes through a tank of water at 52 °C. It is held in tank for 11 minutes, a false bottom in the tank which moves in the opposite direction to the carrier belt, force the water through the loose barley so that it is all equally and evenly heated. The seed is cooled quickly by immersing the bags in cold water for a few minutes, then placing it on a draining rack for a short time before moving in to the dryer. The dryer consists of a rectangular through measuring 51 x 5 x 5 x 5 cm, with wire covered opening in the top over which the bags of seed are spread. Warm air, controlled to 35 °C is forced into the through and thus up through the seed. The capacity of the hot water unit is 1200 kg/hour and of the dryer about 360 kg/ha.

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