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# Bio-Physical Seed Treatment: A Cost-Effective Method in Disease Management

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## Abstract

The seed is an essential unit in commercial crop production. Seed plays a significant role in associating micro-organisms that establish hazardous for new plants created from it. Seed associated pathogens usually harmful for plant health as well as agriculture seed production. Bio-Physical seed treatments alone a substitute to chemical or in combination with a chemical treatment are being used worldwide because of their environmental safety and socio-economic aspects. The seed-borne and early season diseases and insects create devastating consequences if not managed timely. So seed treatment is an economical way to overcome seed-borne diseases, seed treatment gives effective protection from seed associated pathogen until one month from the time of seed treatment, especially during seed germination. Hence Bio-Physical seed treatment and methods using natural crop protection agents/microbial inoculants could be an alternative to chemical seed treatment methods in crop production.

## Introduction

Ninety percent of the world's food crops are grown from seed. Seed treatments play a vital role by protecting the seed and seedlings against disease and insect pressure from the moment they are planted. Seed treatment means the application of certain agent's physical, chemical, or biological to the seed before sowing 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.

In case of chemical control via soil/ foliar application has its limitation such as high cost, selectivity, the effect on target organisms, development of pest resistance, a resurgence of pests, pollution of food and feed, health hazards, toxicity towards plants and animals, environmental pollution, etc. A number of plant diseases have been initiating from seed associated pathogenic Inoculums.

There are several pathogens including *Phytophthora*, *Pythium*, *Rhizoctonia* and *Fusarium* and also insects that can damage or even kill the seed or seedlings before they even have a chance to develop, which can negatively influence the crop's progress throughout the growing season and have a major impact on the yield results at harvest time. Most crops benefit from seed treatment. However, the seed treatment is probably the cheapest and often the safest method of direct plant disease control. Seed treatment active ingredients are regulated by the U.S. Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

## Why Need Seed Treatment

Most of the chemicals (fungicides or insecticides) are applied to control the disease that is usually unsafe to the environment as well as humans also. So the

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 socio-economic aspects. Biological seed treatments are expected to be one of the fastest-growing seed treatment sectors shortly, in part because they are easier to register at the 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.

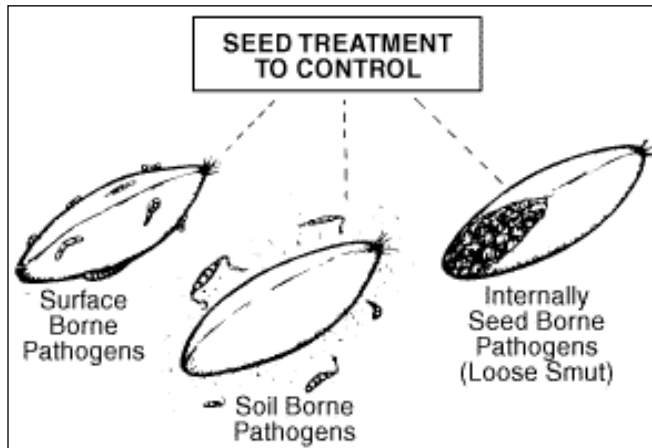


Figure 1: Seed treatment to control

## Seed Associated Diseases and Insect Pests

When we plant a seed in the ground microorganisms (fungi, bacteria, viruses, etc.) and soil insects tend to exploit it as a food source. Some of these microbes/insects can injure the seed or plant by causing disease and economic damage to plant health. The important seed-borne pathogen is various fungi, bacteria, viruses, nematodes, etc. They may be associated internally or externally with the seed or as concomitant contamination as sclerotia, galls, fungal cells, bacterial ooze, infected plant parts, soil particles, etc. mixed with the seed. Seed-borne pathogens usually caused a dangerous for plant health because pathogens infects at initial stage of development especially during seed germination. The most common organisms usually associated with plant diseases are *Pythium* species, *Fusarium*, *Diplodia*, *Penicillium*, *Helminthosporium*, *Ustilago*, *Tilletia*, *Rhizoctonia*, *nematodes*, various seed-borne viruses.

## Methods of Seed Treatment

Seed treatment like baby care begins with the mother, the treatment with which we are mainly concerned in this article are those applied to the seeds themselves at the stage almost immediately before sowing for control of

plant diseases transmitted through seeds. The different seed treatments are as follows:

### A. Physical Seed Treatment

Considering the side effects of chemicals on the ecosystem and organism, some alternative methods were evolved and are being used presently for treating seeds. In the case of agrochemicals, they are less suitable to be used as it degrades the land, environment, and therefore the human and animal food. Thus, it is important to investigate the use of sustainable methods, such as physical methods in this century.

Hot water treatment is a very age-old practice to control many seed-borne diseases by using various ranges of temperatures for particular disease, enough to kill the organism but not quite hot enough to kill the seed and it is still being used as a very effective alternative to chemicals.

Thermal seed treatment has been practically applied, where the seeds are heated by irradiation from the sun. In most of the fungal viral infections in seeds, the thermal seed treatment shown good potential to overcome them.

### How to Treat Seed with Hot Water

Hot water seed treatments aid in general control of seed-borne pathogens on crucifers, carrot, celery, eggplant, lettuce, onion, parsnip, pepper, spinach, and tomato. It will aid in controlling fungi such as *Alternaria*, *Fusarium*, and *Verticillium* as well as bacteria including *Xanthomonas* and *Pseudomonas*. Hot water treatment is recognized to be as effective as fungicides for controlling loose smut of wheat.

- Wrap seed in a permeable cloth (e.g., cheesecloth)
- Pre-warm seed in the water at 100 °F for 10 minutes.
- Soak seed in hot water maintained at 122 °F for the prescribed treatment time (example: 20 minutes for many *Brassica* crops).
- Cool seed in running water for 5 minutes.
- Dry seed.

#### Precautions

- Don't exceed the recommended high temperature while treating seed to preserve seed viability; don't go at a cooler temperature because pathogens won't be killed.
- Hot water treatment done at the proper temperature kills much of the pathogen population on seeds and seed lots with good germination rates before treatment should retain good germination rates after treatment.
- Studies done during 2015 at Oregon State University showed that hot water-treated seed maintained germination as good as or better than the non-treated seed for at least one year after treatment.



Figure 2: Hot-water treatments can eliminate disease-causing organisms from seed

## B. Biological Seed Treatment

The efficient use of microorganisms to combat plant diseases by their application in seed treatment requires the development of biological control systems that are effective, reliable, and economical. Through the biological treatment, growers can raise healthy crops and increase the crop yield by treating seeds with recommended bio-agents results in minimizing the use of pesticides.

Treatment of seeds with beneficial micro-organisms including fungi and bacteria (species of *Trichoderma*, *Pseudomonas*, *Bacillus*, *Rhizobium*, etc.) ameliorates a wide variety of biotic, abiotic, and physiological stresses to seed and seedlings. Inoculations of seeds with such biological agents in combination with priming (Bio-priming) potentially are able to promote rapid and more uniform seed germination and plants growth.

### How to Treat Seed with Biological Control Agents

- Small quantities of seed can be treated with appropriately-labeled biological agent dusts in a manner Mix *Pseudomonas fluorescens* and *Trichoderma viride* (5 grams each per 100 gm of seed) with one liter of cooled rice gruel. Spread all around the seeds required for one hectare of planting on a clean floor. Sprinkle the bio-agents over the seeds and mix well.
- Many of the biological agents are applied to soil or growing media rather than seed.

#### Precautions

- Most biological control agents are sensitive to environmental conditions during storage and must be handled with care.
- If the seeds you buy were treated by the seed dealer or someone else, do not treat seeds again.
- Avoid storage at hot temperatures.
- Follow the manufacturer's label directions for handling biological agents and treated seeds.

- Don't permit children, pets, or livestock to have access to the treated seed.
- Don't feed treated seed to livestock.

## Benefits of Seed Treatment

### Grower Benefits

- Seed treatments contribute to earlier and faster planting, higher plant populations, and higher crop yields.
- Farmers achieve maximum protection of crops by planting genetically modified (GM) seed that has been treated with crop protection products.
- Following planting, seed treatments offer effective control against the early season, below-ground and above-ground pests and diseases, and reduce the need for additional rescue treatments or replanting of a failed crop.
- Seed treatment protects the seed itself, which has high intrinsic value and increases the value of the harvested crop through improved yield.

### Healthier Crops

Seed treatment offers an effective method of protecting the seed from pathogens, insects and other pests and contributes to the healthy, uniform stand establishment of a variety of crops produced in the U.S. Insecticide and fungicide seed treatments contribute to more uniform seedling emergence, healthier plants and significantly reduced insect and disease damage.

### Positive Environmental Impacts

- Seed treatment precisely places the crop protection product on the surface of a small seed, effectively reducing the need to apply products over the entire field.
- Due to its precise application directly to the seed, which is then planted below the soil surface, seed treatment reduces potential off-target exposure to plants and animals.

### Precision Application

- When applied as a seed treatment, crop protection products increase precision and effectiveness by placing the product exactly where it is needed to protect the germinating seed.
- The precise application of a crop protection product via seed treatment reduces soil surface exposure by up to 90 percent compared to in-furrow applications and up to 99 percent compared to a surface application.
- Polymer seed coatings bind crop protection products directly to the seed, largely eliminating dust exposure to people who handle and plant the seed, as well as to non-target organisms.

## Conclusion

Seed treatments with Bio-Physical agents, increase precision and effectiveness of crop protection products by reducing the application rate of pesticides applied

to the land area, and hence, it is a leading technology in precision agriculture in the present days. After knowing about seed treatment we can say that it will become practical, inexpensive, and an easy method of micronutrient delivery (seed enhancement) by advanced technologies of seed priming or seed coating especially by small landholders in developing countries.

Lack of awareness of 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. Future development and commercial use of seed treatment

technologies are dependent on important factors such as economic, social, environmental safety, and practical utility for that particular crop.

## References

- Agrios, G.N., 2005. Plant Pathology. Fifth Edition, Elsevier Academic Press, California, London-U.K. Publisher: Dana Dreibelbis, 922.
- Harman, G.E., 1991. Seed treatments for biological control of plant disease. *Crop Protection*, 10, 166-171.