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Issue Article

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TREATMENTS FOR SEEDS TO PREVENT SEED-BORNE FUNGI IN VEGETABLE CROPS

***Abstract**: Managing plant diseases is crucial for crop production, particularly for high-quality seed. Infections can lower yield and quality, and seeds can spread pathogens. Treatment of seeds can be beneficial when applied to weaker seeds, damaged seed coats, or when germination is delayed due to unfavorable soil or weather conditions. Fungicide application was once the primary method of seed treatment, but innovative approaches are becoming more necessary, especially in organic farming. The outcome of a seed treatment depends on the severity of internal seed infection, the quantity of inoculum in a seed lot, the specificity of the treatment, and potential phytotoxicity. Other types of therapy may include seed disinfestation, disinfection, and/or protection. Fungicides can be narrow spectrum (effective against a small number of species) or broad spectrum (toxic to all or many types of fungi). Contact fungicides have little effect on interior fungal seed infections, while translaminar or cytotropic fungicides can enter the outermost layers of seeds. Systemic fungicides are often more effective against deep-level fungi and provide protection against early infection from airborne and soilborne illnesses. Physical therapies involve heating seeds, such as hot water, hot air, and electron treatments. Hot water treatment is a well-known method for sanitizing tainted cereal seeds, while aerated steam and electron seed treatments are being researched for their effectiveness in various host-pathogen systems.*

***Key words**: crops, seed-borne, treatments, fungi, egetable, phytotoxicity.*
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Introduction

For the majority of crops, managing plant diseases is crucial, and it is especially crucial for the creation of high-quality seed. Plant infections can lower the yield and quality of the seed harvested, and in the event of seedborne pathogens, they can also be kept in seed lots. Inadvertently serving as an effective vehicle for the spread of plant pathogens, seeds can do this. Although using treated seeds to improve seedling emergence is not a replacement for having access to and using healthy seeds, it can be useful when applied to weaker seeds and seeds with damaged seed coats. When germination is delayed due to unfavorable soil or weather circumstances, such as early planting in chilly or cold soil, planting in dry soil, or planting in an inadequate seedbed, similar benefits can also be attained. In fact, when seeds are grown for seed production or when high-quality seed with a low proportion of fungal infection is required, treatment of seeds can become a very essential method of eliminating or lowering seedborne diseases. Fungicide application was the primary method of seed treatment in the past, and it is still the most efficient method now. But innovative approaches without the usage of fungicides are becoming more and more necessary, especially in organic farming. Fungicide application was the primary method of seed treatment in the past, and it is still the most efficient method now. But innovative approaches that don't involve fungicides are becoming more and more necessary, particularly in organic farming. Producing seeds or other planting materials under organic farming conditions is a need for organic farming. The outcome of a seed treatment depends not only on the inherent efficiency of the compound used, but also on the severity of internal seed infection, the quantity of inoculum in a seed lot, the specificity of the treatment, and any potential phytotoxicity. Depending on exactly where the pathogen is located on or in the seed, other types of therapy may be applied, such as seed disinfestation, disinfection, and/or protection. The removal of spores and other types of disease organisms from the surface of seeds is known as seed disinfestation. Seed disinfection is the process of getting rid of a virus that has made its way into the seed's live cells, infected it, and taken up residence there. In the past, chemicals containing sulfur, copper, and mercury were used to create fungicides. The use of such inorganic compounds has decreased due to their toxicity for seeds and the emergence of other, more specialized molecules. The toxicity of mercury compounds to warm-blooded species and the buildup of mercury in the environment led to their ban because of this. Inorganic substances have been mostly superseded by the more recent systemic fungicides, and they are often very effective. Additionally, because systemic fungicides may be easily broken down by soil microorganisms, which prevents their buildup in the soil, they may be less dangerous to crops, animals, and the environment. Fungicides can be narrow spectrum (effective only against a small number of species) or broad spectrum (toxic to all or many types of fungi). Contact fungicides have little effect on interior fungal seed infections, such as loose smuts infection, because they only work against fungal spores on the surface of a seed. To combat shallow fungal infections, translaminar or cytotropic fungicides can enter the outermost layers of seeds. The systemic activity of other fungicides makes them useful against fungi that infect seeds at a deep level. These fungicides can also provide protection against early infection from airborne and soilborne illnesses. However, such chemicals are more potent at later stages of seedling development when foliar sprays are added to seed treatment. Physical therapies involve heating seeds; the most popular methods include hot water, hot air, and electron treatments. The host tissue is kept alive while the pathogen is inactivated or killed by the heat treatment. Among these physical treatments, hot water treatment is a well-known method that involves submerging plant Material in agitated water for a given amount of time and at a predetermined temperature. Hot water treatment has been employed regularly in the past to sanitize tainted cereal seeds, and this is currently garnering more attention. Two of the more recent physical seed treatments are aerated steam and electron seed treatments, and both are now the subject of extensive research. This is especially true given that both have shown to be quite successful in a number of host-pathogen systems.

Additionally, the desire from consumers for food free of pesticides and the rising cost of pesticides, particularly in less developed parts of the world, have prompted researchers to look for alternatives to these chemical substances.

Table 1. Primary species of fungal pathogens transmitted through seeds in several vegetable crops (Valeria Mancini)

Vegetable host crops		Seed-transmissible fungal pathogen species
Apiaceae Daucus carota L.	Apiaceae Daucus carota L.	Alternaria dauci (Kuhn) ̈ Groves & Skolko Alternaria radicina Meier Drechsler & Eddy
Brassicaceae Brassica spp.	Brassicaceae Brassica spp.	Alternaria brassicicola (Schwein.) Wiltshire Leptosphaeria maculans (Desmaz.) Ces. & De Not.
Solanaceae Lycopersicon esculentum Mill.	Solanaceae Lycopersicon esculentum Mill.	Fusarium oxysporum Schlechtend.:Fr. f. sp. lycopersici (Sacc.) W.C. Snyder & H.N. Hans. Alternaria solani Sorauer
Fabaceae Pisum sativum L.	Fabaceae Pisum sativum L.	Ascochyta pisi Lib. Ascochyta pinodes L.K. Jones Ascochyta pinodella L.K. Jones
	Cicer arietinum L.	Ascochyta rabiei (Passerini) Labrousse
	Lens culinaris Medik.	Ascochyta lentis Bond. & Vassil.
	Vicia faba L.	Ascochyta fabae Speg.

Additionally, there are some disorders for which there aren't any, very few, or ineffective chemical treatments. The need for alternatives to synthetic fungicides is rising as a result of all of these issues. Therefore, the use of biological control is being investigated as an addition to or as a replacement for the use of synthetic chemicals in agriculture. The use of biocontrol agents and plant extracts in seed treatments provide an appealing alternative to the use of synthetic fungicides.

These microbes can be used to treat seeds and, in certain situations, they may even be utilized to prime seeds. Osmotic stress is applied to the seeds during seed priming, a hydration procedure, before the seeds are dried back. The emergence of directly seeded crops is therefore improved, particularly under wet or cold conditions, and speedy and uniform emergence is supplied. It permits controlled imbibition and induction of the pregerminative metabolism, although radicle emergence is inhibited.

The seeds can be hydrated, incubated, and dried using this process, which also allows for the application of BCAs. The main mechanisms of growth promotion used by gram-positive Bacillus species, which are also PGPR, include production of growth-stimulating phytohormones, solubilization and mobilization of phosphate, siderophore production, antibiosis, inhibition of plant ethylene synthesis, and induction of systemic pathogen resistance in plants. Bacillus amyloliquefaciens (Priest et al., 1987), Bacillus subtilis (Cohn, 1872), Bacillus pasteurii (now Sporosarcina pasteurii Bergey 2004), Bacillus cereus Frankland & Frankland, 1887, Bacillus pumilus, Bacillus mycoides, and Bacillus sphaericus are among the species that can significantly lower the incidence or severity of many diseases. 64,65 Streptomycetes are another group of such gram-positive bacteria that are active in the rhizosphere and efficient in the biocontrol of plant diseases through a variety of mechanisms, such as antibiosis, rupture of the fungal cell wall, competition, and hyperparasitism.

The primary seed-transmissible fungal diseases of certain significant vegetable crops will be defined and discussed in the next sections, along with fungicide, physical, and biopesticide treatments (Table1).

The primary seedborne diseases that impact various significant vegetable crops have been discussed in this review along with seed treatments that are successful in reducing or eliminating their presence. In addition to lowering the quantity and caliber of the seed harvested, seed lots can be preserved seedborne diseases, greatly accelerating the spread of plant illnesses. Alternative, eco-friendly seed treatments can offer additional support in addition to the conventional fungal seed treatment. Some of these have been used in the past, such as hot water therapies, while others, like as treatments using BCAs, have only recently been used.

Fungicide treatments, which consistently demonstrate an efficiency larger than 80% relative to the control and are therefore more dependable than alternative treatments, may generally diminish, if not eradicate, seedborne pathogens in all of the vegetable/pathogen systems under consideration. The best seed protection is provided by physical treatments, which are particularly effective against A. dauci, A. radicina, A. brassicicola, and L. maculans. Despite this, alternative treatments have occasionally shown to be just as effective as chemical treatments.

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