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New Developments in Cereal and Soybean Seed Treatment Fungicides

Chemical seed treatment for disease control has become standard practice for many crops and, if effective, is relatively easy and inexpensive. Nearly 100% of commercial corn and sorghum seed is treated by seedsmen to protect against seed decay and seedling blights, but small grain seed is not as universally treated.

Few new chemicals have been approved for use on small grains in the United States in recent years, but several new combinations and formulations have been released and more are being tested (Table 1). The new systemics control many of the same diseases as the old standards do, and some are persistent enough to provide some protection against foliar diseases and root rots. This expansion of control activity assures continued use of chemical seed treatment.

The following is a summary of recent research on seed treatments published in Volume 37 of *Fungicide and Nematicide Tests*. Many of the fungicides mentioned are not labeled for use, and some have limited approval. Disease severity and necessity for controls vary with locality, soil, and climatic conditions, so local authorities should be consulted for specific recommendations.

Barley. Captan, maneb, and thiram continue to be the most common fungicides used for barley seed rot and seedling blight control. Covered smut and semiloose smut are relatively easy to control, but some spores lodge under the glumes, making it difficult for surface-acting fungicides to be as effective as the systemics. True or brown loose smut infects the embryo and is not controlled by surface fungicides. Carboxin (Vitavax) is the only fungicide approved in the United States that will control true or brown loose smut, caused by *Ustilago nuda*. Methfuroxam (Furavax, Trivax), fenfuram (Panoram), and triadimenol (Baytan) all show promise without much phytotoxicity and may receive wider use soon.

Barley stripe is becoming more important with the loss of mercury seed treatments. Carboxin gives better control than the surface-acting fungicides.

Oats. Oat seed treatments are used primarily for control of loose and covered smuts. Because spores survive under the hull of the oat kernel and are hard to reach with surface-acting fungicides, systemic fungicides containing carboxin have been the most effective. Metalaxyl (sold under the name of Apron for seed treatment) and triadimenol look very effective and may be registered soon in the United States for oat smut control. In one test, Apron also controlled downy mildew.

Wheat. Wheat seed treatment fungicides are used to control seed rots, seedling blights, bunt, and loose smut. Most wheat seed is not sold through dealers but is grown by farmers and exchanged with neighbors, so seed treatment must be initiated by the farmers who plant it. Seedling diseases seldom cause as serious losses with wheat as with some other crops. Most popular varieties have moderate resistance to bunt and loose smuts, so many farmers in a bind for time or money have opted not to treat seed, even though such treatment has proved beneficial over the long haul. Consequently, the percentage of wheat seed treated has declined in recent years.

Seed rots and seedling blights are most effectively controlled by the old standards—maneb, captan, and thiram. Pentachloronitrobenzene (PCNB, sold as Terra-Coat) and hexachlorobenzene (HCB, usually combined with maneb) both give excellent control of bunt. Loose smut of wheat infects the embryo, so surface-acting fungicides are ineffective. Carboxin has become the standard treatment for loose smut. It also gives some control of bunt and seedling diseases but is usually combined with other fungicides for broader spectrum activity.

The minimum effective rates of many fungicides for adequate disease control in wheat have been fairly well established. The rates given in Table 2 are general guidelines for moderate disease pressure. Rates vary some with weather, disease pressure, and host susceptibility, but rates lower than those listed will not give satisfactory control in severe situations. The effectiveness of new formulations and rates can be predicted by calculating the rate of active ingredients per bushel and comparing the rate with those in

Table 2. Minimum rates of common wheat seed treatment fungicides for adequate control of moderate disease

	Rate of active ingredient (oz/bu)		
Chemical	Stand increase	Bunt	Loose smut
Captan	0.5	1.5	...[a]
Carboxin	0.5	1.0	0.3
HCB	...	0.2	...
Maneb	0.5	1.0	...
PCNB	...	0.4	...
Thiram	1.0	1.0	...

[a] Insufficiently tested, not effective, or not labeled.

Table 1. Seed treatment fungicides for cereals and soybeans

Fungicide				
Common name	Trade name	Systemic?	Crops	Diseases controlled
Old standards				
Captan	Many	No	Corn, small grains, sorghum, soybeans	Seed decay, seedling blights
Carboxin	Vitavax	Yes	Small grains	Bunt, loose smut
			Soybeans	Seed decay, seedling blights
Hexachlorobenzene (HCB)	Many	No	Small grains	Bunt
Mancozeb and maneb	Many	No	Corn	Seed decay, seedling blights
			Small grains	Bunt, seed decay, seedling blights
			Sorghum	Seed decay, seedling blights
Pentachloronitro-benzene (PCNB)	Terraclor, Terra-Coat	No	Small grains	Bunt, seed decay, seedling blights
			Soybeans	Seed decay, seedling blights
Thiram	Several	No	Small grains, soybeans	Bunt, seed decay, seedling blights
New or experimental				
CGA-64251	Vangard	Yes	Oats	Smuts
			Wheat	Bunt
Metalaxyl	Apron	Yes	Small grains	Downy mildew, dwarf bunt, oat smuts
	Ridomil	Yes	Soybeans	Phytophthora root rot
Thiabendazole	Mertect LSP	Yes	Oats	Smuts
			Sorghum	Smuts
			Wheat	Common and dwarf bunt
Triadimenol	Baytan	Yes	Small grains	Bunt, loose smut, seed decay, seedling blights, take-all

Table 2. In formulations with two or more fungicides effective against a given disease, the amounts are added for comparison.

Triadimenol is the most promising experimental wheat seed treatment fungicide being tested. The chemical controls seedling diseases, bunt, and loose smut and, in limited testing, also shows promise in reducing take-all root rot—which, if reliable and consistent, could open up a whole new area of activity for seed treatment chemicals. Combinations of some experimental systemics applied as seed treatments apparently persist in high enough concentration in maturing plants to give some protection against powdery mildew.

Apron, CGA-64251 (Vangard), triadimenol, and thiabendazole (Mertect LSP) give some control of both soilborne and seedborne dwarf bunt. Methfuroxam, triadimefon (Bayleton), triadimenol, and CGA-64251 all control flag smut.

Benomyl (Benlate) controls loose smut and is especially effective against *Fusarium* seedling blights but has not been labeled for seed treatments.

With this array of promising new chemicals, there will be some major shifts in wheat seed treatment chemical usage in the next few years.

Corn. Captan controls corn seed decay and seedling blights and has been the standard seed treatment fungicide for many years; there has been very little activity in testing new fungicides for this crop. Most corn seed is routinely treated by seed dealers and handlers before sale.

Sorghum. Captan has also been the standard sorghum seed treatment fungicide. Most commercial sorghum seed is treated before sale to control seedling diseases and covered kernel smut. Some of the experimental systemics are effective against these complexes but do not appear to be much better than captan.

Soybeans. Seed treatment has not been used as widely in soybeans as in other crops. Physical damage to seed from handling during treatment sometimes reduces germination, and fungicides may also reduce effectiveness of nitrogen-fixing bacteria. Seed treatments may increase stands but seldom increase yields. Captan and thiram have been used most often, and Vitavax 200 has been labeled recently. Metalaxyl (Ridomil) looks promising in reducing Phytophthora root rot in experimental plots.

Dr. Willis is editor of the seed treatment section of Fungicide and Nematicide Tests, *William C. Nesmith, Editor, published annually by the New Fungicide and Nematicide Data Committee of The American Phytopathological Society. Copies of current and past volumes may be obtained from Richard E. Stuckey, Business Manager F & N Tests, Plant Pathology Department, University of Kentucky, Lexington 40546.*