A Self-Learning Resource From MSU Extension

MONTANA STATE UNIVERSITY EXTENSION

MontGuide

Small Grain Seed Treatment Guide

by Alan Dyer, Associate Professor, Plant Sciences and Plant Pathology; Jeffrey Johnston, Research Assistant; Cecil Tharp, Pesticide Safety Education Coordinator, Animal and Range Science; and Mary Burrows, MSU Extension Plant Pathologist

Lists methods for seed treatments to prevent various diseases and pest infestations.

MT199608AG Revised 8/12

SEED TREATMENTS PROMOTE SEEDLING establishment and help reduce yield and quality losses due to many pathogens and insects. The ability of seed treatments to control fungal diseases has made them a great success story of disease prevention. For instance, smuts and bunts historically caused tremendous yield and quality reductions in grain-growing regions worldwide. The use of effective seed treatments has reduced the severity of these pests to the point that their impacts are now minimal.

Fungicidal seed treatments control fungi residing on the seed surface or inside the seed and are also effective against pathogens that reside in the soil causing seedling diseases and root rots. Most seed treatments do not control bacterial pathogens and none control seedborne viruses. Insecticidal seed treatments have been used for years to prevent seed and seedling damage caused by soil inhabiting insects. Recently, the development of systemic insecticidal seed treatments with residual activity provides post-emergence protection against insects such as aphids. In addition to being one of the least expensive and safest methods of pest control, seed treatments are generally better targeted and more effective for a wider range of diseases and insect pests than in the past.

Guidelines for choosing a seed treatment

This publication compares the effectiveness of available seed treatments on diseases and insects that affect Montana's small grains. While seed treatments are important pest management tool, it is best to develop a long-term plan integrating a spectrum of pest management practices such as resistant varieties, crop rotations, residue and volunteer management, adequate soil fertility (based on water availability), and application of other pesticides. Careful consideration of all management options available for recurring pest problems is important.

The availability of new formulations, which complement the products used by producers for many years, has resulted in better seed treatments. Before selecting a product, producers should determine which diseases and/or insects have been recurring problems in their location. County Extension agents or the Schutter Diagnostic Laboratory disease clinic on the MSU campus can aid in identifying pest problems and provide information on the common pest problems in specific areas of the state (119 Plant Bioscience Building MSU, Bozeman, MT 59717-3150). Producers can then choose a product based on comparisons of product activity against organisms of concern (see table on page 6).

It is always important to start with good quality seed. Examine seed lots carefully before purchase or when using stored seed. If using stored seed, it is important to avoid seed from problem fields. This is particularly important for floral diseases like glume blotch as well as for Cephalosporium stripe, which has recently been shown to be seed transmissible. The Montana State Seed Laboratory (P.O. Box 173145, Room 40 Marsh Lab, Bozeman, MT 59717-3145 or http://plantsciences.montana.edu/seedlab/contact.html) can conduct standard purity and germination tests at a low cost. Seed lots with low test weights, low germination rates, or discolored kernels often produce less vigorous plants, even when this seed is treated. Seed treatment dosage and environmental conditions affect the ability of seed treatments to control target diseases and insects. Using recommended rates and minimizing environmental stresses through good management practices will maximize the benefits of

any seed treatment. Because some seed treatments are slightly phytotoxic, sow seed as soon as possible after it is treated. For the same reason, significantly exceeding recommended rates can result in poorer performance.

Disease Control

Diseases controlled by seed treatments are categorized into three primary groups: the smuts and bunts, the seed and seedling diseases, and the root rots. In the case of smuts and bunts, seed treatments provide very effective control against a potentially devastating group of diseases. Although seed treatments have effectively controlled smuts for the last 40 years, these diseases are still present in Montana and growers should take this risk seriously.

For seed and seedling diseases, seed treatments are an indispensable control tool whose effectiveness can be greatly enhanced through proper planting practices. Typically a seed treatment will protect seedlings for two to three weeks.

Historically, the root rots have been less affected by seed treatments than the other disease groups. However, some of the newer formulations are making significant strides in controlling these diseases. In some instances, these seed treatments may provide good root rot control by themselves, but one should not rely solely on them for disease control. Instead, seed treatments should still be integrated with plant resistance and cultural practices to provide effective management of root rots.

Common bunt of wheat

Common bunt also is known as stinking smut because its presence on the head causes a pronounced odor of dead fish. This disease is the most common of the smuts and bunts observed in Montana wheat. The spores that carry the disease from one growing season to the next occur on the seed surface and sometimes in the soil. While common bunt no longer is a serious production problem, researchers confirmed in 1997 that two percent of Montana's wheat carried background levels of this pathogen. Without seed treatments, the disease again could become an economic problem. Late-planted winter wheat is most prone to infection. With the exception of imazalil, a number of protective and systemic materials provide good control.

Dwarf bunt

Dwarf bunt only affects winter sown cereals. Like common bunt, dwarf bunt reduces not only yield but also grain quality through the production of an unpleasant odor and taste in infected grain. Dwarf bunt can only develop where snow exists for prolonged periods on unfrozen ground. Depending upon temperature, the infection process requires anywhere from 35 to 105 days for completion. Dwarf bunt occurs in scattered areas of western and central Montana. Difenoconazole (the active ingredient in Dividend) provides essentially complete control of dwarf bunt when used at the highest recommended rate. This fungicide has expanded the number of winter wheat varieties that can be planted by Montana grain producers in affected areas.

Covered smut of barley

Covered smut differs visibly from loose smut in that a mass of black spores develop within a semi-persistent membrane in place of the kernels. Harvest of infected grain with healthy grain results in both yield and quality losses. Use of effective seed treatments can prevent yield losses due to covered smut. Covered smut can be soilborne, but it is more commonly seedborne. The fungal spores reside directly on the seed surface or under the hull of the barley kernel. Most surface-acting seed treatments result in elimination of spores on the seed surface.

Loose smut of wheat and loose smut of barley

Although loose smut of wheat and barley is caused by two different pathogens, these organisms act in a similar manner on both crops. Spikelets on infected plants normally become transformed into a dry mass of dark spores enclosed in a delicate membrane. This membrane ruptures easily and the spores blow away leaving only a barren head stalk (naked rachis) remaining. The windblown spores enter the flowers of developing heads. Both pathogens then invade the seed germ or embryo. The development of the fungus inside the new kernel makes protective fungicides ineffective for control. In contrast to loose smut of wheat, which is a fairly rare disease in Montana, barley is extremely susceptible to loose smut. Therefore, barley seed should be treated with an effective systemic fungicide. Interestingly, Dividend does not control loose smut in barley, but provides effective control in wheat, which historically is only a minor problem in Montana. If low levels of loose smut occur in grain to be saved for seed, that seed should be treated with an appropriate systemic fungicide.

Loose smut of oats

Unlike most loose smuts, this particular disease can be controlled by either a systemic or protective seed treatment. A few isolated oat fields experience loose smut each year in Montana. Seed treatment is recommended if seed from infected fields will be saved for future planting.

Dry seed decay

Dry seed decay is typically a threat when winter wheat is seeded into dry soils that have insufficient moisture to stimulate immediate seed germination. Dry seed decay may occur anywhere these conditions exist as the pathogen *Penicillium* is common to all areas of Montana. Symptoms include the growth of a blue or green mold *(Penicillium)* on the seed. Often, soil will cling to the affected seed due the fungal growth. Reduced germination potential and poor stands result. Unless prolonged dry soil conditions persist into the spring, dry seed decay will not be problem on spring wheat.

Fusarium seedling rot (and scabby seed)

Fusarium seedling rot is a widespread problem in Montana. Infections are not always lethal but may lead to later disease development. Non-lethal fall infections of winter wheat may have a pronounced effect on winter survival, even in years where snow cover is plentiful and have been linked to serious crown rot the following summer. Numerous species of *Fusarium* cause seedling rot, but seed treatments which control one are generally effective against the others.

In the past few years, Fusarium head scab or head blight has affected seed lots in some parts of the United States. If seed infected with Fusarium head scab is planted, seedling decay may occur resulting in poor stand. Cleaning seed and using an effective seed treatment are important for seed lots containing even low levels of scab. It is important to note that these seed treatments, while controlling seedling rot from scabby seed, do not provide effective control against Fusarium head blight.

Wet soil seedling rot

The soil borne fungus *Pythium* can cause pre- or post-emergence damping off of wheat and barley seedlings. Symptoms include poor stands and/or patches of young plants that are pale green in color and stunted. Roots of young plants will have soft and wet tan-brown areas at or near their tips. Older plants are minimally affected by Pythium disease. Wet soil seedling rot is favored by poorly draining soils, as well as by no-till and irrigation production. The disease is most commonly seen in winter and durum wheat. In problematic locations, systemic seed treatments that incorporate metalaxyl or mefanoxam active ingredients protect against the seed and seedling stages of the disease. Since the activity of these products is limited to *Pythium* and related fungi, it should always be used in combination with materials active against other pathogens.

Bare Patch

The pathogen *Rhizoctonia* can cause seedling blight as well as root rot disease in small grains. Symptoms occur most prominently in the early season. Variously sized patches of plants become severely stunted, and the seminal and crown roots of infected plants have distinct sunken, brown lesions and "spear-tipped" roots. The disease sometimes occurs in minimum and no-till systems that allow the pathogen to survive on intact residue and on volunteer plants. In Montana, *Rhizoctonia* also has been a problem in conventionally tilled fields where large amounts of either volunteer wheat or cheatgrass were sprayed with glyphosate and subsequently seeded to small grains within one to seven days. In these situations, delaying planting for two weeks after spraying improves disease control and yield. The evaluation of systemic seed treatments suggests that they can suppress *Rhizoctonia* development. However, correct volunteer management and delayed seeding intervals remain the preferred control method for this disease.

Common root rot

This disease starts in at the subcrown internode of plants grown under stress, especially moisture stress. A recent survey showed the causal agent *Bipolaris sorokiniana* to be widely distributed within Montana, significantly affecting yield in 15 percent of infested fields. Evaluation of seed treatment trials indicate that some fungicides are effective in reducing root rot severity, but a corresponding yield increase does not always result. This disease is commonly associated with Fusarium crown rot. Planting depths in excess of 2.5 inches have been associated with increased severity for common root rot and Fusarium crown rot.

Fusarium crown rot

This disease attacks the crown system of plants grown under moisture stress similar to common root rot. The loss of crown roots and the associated crown tissue can result in yield losses up to 20 percent. Evaluations of seed treatment trials indicate that some fungicides are effective in reducing root rot severity, but a corresponding yield increase does not always result. Conditions which encourage abundant early season growth, such as high moisture or heavy nitrogen fertilization, followed by a hot dry period will deplete the available soil moisture and promote Fusarium crown rot development. This disease is commonly associated with common root rot. Excess planting depths should be avoided.

Take-all

Take-all is a devastating disease that has defied chemical control for over 100 years. Symptoms include patches of bleached plants with unfilled heads. Plants pull easily from the soil and the root system is poor with shiny, coal black roots and crowns. This fungal disease is indigenous to native prairie grassland soils at low levels. In Montana, take-all is most common in irrigated wheat fields. However, the disease also may occur in dryland fields in years of heavy rainfall in the spring and early summer. When combined with moisture, the following conditions also are favorable to disease development: high soil alkalinity, low fertility (especially nitrogen and phosphorous), soil compaction, cool weather, early seeded winter wheat, and continuous wheat for two to five years. Difenoconazole applied at the maximum rate has shown variable results in Montana. No other available seed treatment provides demonstrated control of take all.

Barley stripe

Barley stripe has occurred sporadically in Montana since the 1980s. An internally seedborne fungus causes this disease, and it should not be confused with the viral disease, barley stripe mosaic. Symptoms include yellow striping of the leaves that progresses to necrotic brown streaking. Irrigation or high moisture conditions are necessary for seed infection to occur. Without this moisture, barley stripe seldom is a problem. Seed treatments containing imazalil provide excellent control of barley stripe. However, unless the disease is known to occur in a crop to be used for seed, seed treatments are usually unnecessary.

Net blotch of barley

This foliar disease of barley is known to be seedborne. Tests at Montana State University revealed that up to 36 percent of seed in certain lots were infested with net blotch. The use of imazalil was effective in suppressing this seedborne inoculum. However, in fields with heavy barley stubble, infection of new plants from spores splashed from infested crop residues is common.

Insects

Wireworms.

These soil-inhabiting insects cause sporadic and sometimes severe stand reduction in wheat, barley and other crops, especially following seeding into sod or old pastures. Damage varies from feeding injury shortly after plant germination to stem boring shortly after plant emergence. Damaging wireworm populations are difficult to predict in Montana since there are several species with life cycles varying from one to seven years. However, the use of bait stations for monitoring wireworm populations has been somewhat effective for estimating field infestation levels. Soil activity typically begins with soil temperatures in the mid-50s, although dryland-infesting wireworms are thought to be active at lower temperatures. Damage is more severe when spring weather is cool and wet.

Most producers routinely treat their seed with imidacloprid, thiamethoxam, or clothianidin to minimize potential stand loss, especially in locations with a previous history of wireworm feeding injury. In the past, low rate (Cruiser 5FS: .19-.25 oz/cwt; Gaucho 600: .13-.26 oz/cwt), have been thought to be effective, but new research suggests higher rates are needed for protection of crops from wireworm damage. Growers need to use the higher rates of products containing imidacloprid, thiamethoxam, or clothianidin (Cruiser 5FS: .75-1.33 oz/cwt; Gaucho 600: 1.2-2.4 oz/cwt; Nipsit: 7.5 oz/cwt). These higher rates are expressed as rates used for grasshopper control for Cruiser 5FS, Gaucho 600 and some generics.

Aphids

Russian wheat aphids (RWA) have caused significant crop losses to Montana small grains. Other aphids, including the bird cherry oat aphid, English grain aphid, and greenbug do occur in Montana and are common vectors of barley yellow dwarf. This viral disease has caused sporadic but serious losses in both winter and spring grains. Generally, barley yellow dwarf is most serious in early-seeded winter wheat.

Typically, damaging populations of these aphids do not overwinter but migrate from southern states during the summer when weather patterns are favorable. Treatments such as Gaucho, Cruiser 5FS, Di-Syston and Thimet have been registered for use against the above aphids and are most effective against early season infestations and provide protection for several weeks. The higher registered rate can be used if extreme aphid pressure is expected early in the growing season. Because aphids migrate into Montana during the growing season, regular monitoring to detect their presence and estimate populations is recommended. When RWA populations reach or exceed the economic threshold, a foliar treatment may be applied (refer to *High Plains Integrated Pest Management Guide for Colorado, Western Nebraska, Montana and Wyoming Bulletin 564A,* http://www.highplainsipm.org/). Recently, Lorsban has been delisted by the EPA from barley. This has left many producers with no treatment options for RWA on barley. Recent studies by MSU suggest a foliar application of Warrior 1E (a. i. lambda cyhalothrin) at the 3.84 oz/acre rate to be highly effective against an early RWA infestation.

Cautions

Since seed treatments are poisonous, it is important to follow label directions when applying these chemicals and when handling treated seed. Some products are toxic and others are irritating to the skin and respiratory system. Regardless of the product, use of protective clothing, gloves, an approved chemical respirator, and goggles are recommended.

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.

Generally, commercial facilities use liquid concentrate or flowable formulations, while drill box treatment involves use of powder or dust formulations. Either method requires uniform coverage of the seed at the correct rate for good disease control. Lower rates may not give adequate control whereas higher rates may cause seed injury.

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.

Fungicide seed treatments and the diseases they control in Montana

E - *effective control* V - *moderate control* N - *no effect* Empty - *no data*

Chemistry	Pythium	Rhizoctonia Bare Patch	Fusarium Crown Rot	Common Root Rot	Dry Seed Decay	Dwarf Bunt of Winter Wheat	Common Bunt of Wheat	Covered Smut of Barley	Loose Smut of Barley
Acquire	E	N	N	N	N	N	N	N	N
Charter F2	E	V	V	V	V	N	E	E	E
Cruiser Maxx	V	E	V	V	V	E	E	E	N
Cruiser Maxx Vibrance Cereals	E	E	E	V	E	E	E	E	E
Dividend Extreme	E	V	V	V	E	E	E		N
Incentive RTA	E*	V*	V*	V*	E*	E*	E*		N*
NipsIt Suite Cereals	E	E	V*	V*					E
Proceed Concen-	E	E	V	E	E	N	E		E
Rancona 3.8 FS	N	V	V	V	E	N	E	E	E
Rancona Crest	E	E	V	V	E	N	E	E	E
Rancona Pinnacle	E	V	V	V	E	N	E	E	E
Raxil MD	E	V	V	V	E	N	E	E	E
Raxil XT	E	V	V	V	E	N	E	E	E
Stamina	N	E	V	V	V	N	V	E	
Stamina F3 HL	E	E	V	E	E	N	E	E	E
Stamina F3 Cereals	E	E	V	E	E	N	E	E	E
Vibrance		E	E	V					E
Vibrance Extreme	E	E	E	V	E	E	E	E	E

* Has not been field tested; performance based on listed ingredients and or company claims.

Seed Treatments by Manufacturer and Their % Active Ingredients*

Agrisolutions	
Nitroshield	Imidacloprid (48.7)
BASF Ag Products	
Acquire	Metalaxyl (28.35)
Charter F2	Triticonazole + Metalaxyl (1.32 + 0.79)
Stamina	Pyraclostrobin (20.4)
Stamina F3 HL	Pyraclostrobin + Triticonazole + Metalaxyl (7.57 +7.57 + 4.54)
Stamina F3 Cereals	Pyraclostrobin + Triticonazole + Metalaxyl (1.59+ 1.59 + 0.93)
Bayer CropScience	
Gaucho 600 F	Imidacloprid (48.7)
Gaucho 480 F	Imidacloprid (40.7)
Gaucho XT	Imidacloprid + Metalaxyl + Tebuconzole (12.7+ 0.82 + 0.62)
Proceed Concentrate	Tebuconazole + Metalaxyl + Prothioconazole (1.38 + 2.75 + 6.88)
Raxil MD	Tebuconazole + Metalaxyl (0.48 + 0.64)
Raxil MD-W	Tebuconazole + Metalaxyl + Imidacloprid (0.46+ 0.61 +1.5)
Raxil MD-ExtraW	Tebuconazole + Metalaxyl + Imazalil + Imidacloprid (0.41+0.56 +0.96 +1.3)
Raxil XT	Tebuconazole + Metalaxyl (15 + 20)
Chemtura Corporation	
Attendant 480	Imidacloprid (48)
Enhance AW	Imidacloprid + Caboxin + Captan (20 + 20 + 19.55)
Rancona 3.8 FS	Ipconazole (40.7)
Rancona Crest	Ipconazole + Metalaxyl + Imidacloprid (0.42 + 0.56 + 14.1)
Rancona Crest WR	Ipconazole + Metalaxyl + Imidacloprid (0.42 + 0.585 + 2.95)
Rancona Pinnacle	Ipconazole + Metalaxyl
Syngenta Crop Protection, Inc.	
Cruiser 5FS	Thiamethoxam (47.6)
Cruiser Maxx Cereals	Difenoconazole + Mefenoxam + Thiamethoxam (3.36 + 0.56 + 2.80)
Cruiser Maxx Vibrance Cereals	Sedaxane + Difenoconazole + Mefenoxam + Thiamethoxam (0.72 + 3.34 + 0.86 + 2.78)
Dividend Extreme	Difenoconazole + Mefenoxam (7.73 +1.93)
Vibrance	Sedaxane (45.45)
Vibrance Extreme	Sedaxane + Difenconazole + Mefanoxam (1.22 + 5.86 + 1.46)
Valent	
NipsIt Suite Cereals	Clothianidin + Metalaxyl + Metconazole (2.94 + 0.88 + 0.44)
Winfield Solutions LLC	
Incentive RTA	Difenoconazole + Mefenoxam (3.21 + 0.27)

* Discrimination or endorsement is not intended with the listing of commercial products by Montana State University. Due to labels and registrations which are constantly changing, applicators must always read and follow the product label. MSU Extension cannot assume liability for the suggested use of chemicals herein.

To order additional publications, please contact your county or reservation MSU Extension office, visit our online catalog at **www.msuextension.org/store** or e-mail **orderpubs@montana.edu**

MONTANA STATE UNIVERSITY | EXTENSION

File under: Agriculture and Natural Resources
(Plant Diseases)
Revised August 2012 812SA