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CORN

BEST MANAGEMENT PRACTICES

CHAPTER 49

Managing Corn Diseases with Seed Treatments

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Corn seed treatments vary in type, packaging, and purpose (Fig. 49.1). Because some fungicide seed treatments are highly poisonous, producers or applicators should follow label instructions. Most of the corn seed comes pretreated by seed companies with fungicides and/or insecticides. For a list of updated fungicides used for seed treatments that are registered for South Dakota, consult the current updated South Dakota Corn protection guide available online at the South Dakota iGrow.org website. The purpose of this chapter is to provide guidance on corn seed treatments. Tips for effective seed treatments are provided in Table 49.1.

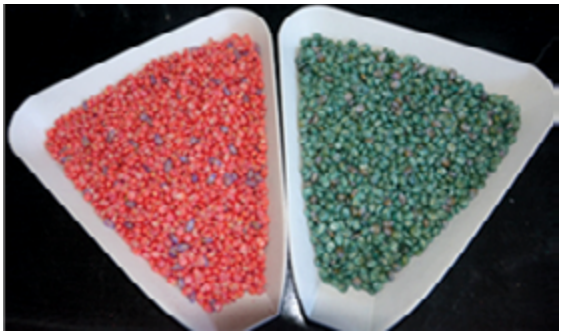

Figure 49.1 Treated corn seed with different color coats.

Table 49.1 Tips for using seed treatments:

1. Match your seed treatment to your problem.
2. Use high-quality seed.
3. Use proper handling techniques and labeled rates.
4. If treating the seed yourself, calibrate your equipment and use dedicated seed treatment equipment when available.
   a. Grain auger mounted treatment equipment may provide adequate coverage.
5. Treated seed should not be allowed to contaminate equipment used to transport or store, food or feed grains.
   a. Do Not Use Treated Seed for Food or Feed!!
6. Use caution when considering planter-applied (planter-box) seed treatments.

History of Seed Treatments

Seed treatments were the first form of crop protection in modern agriculture. Egyptians and Romans treated seeds with sap from onions. In Europe before the 1800s, manure, chorine salts, copper, and hot water were used as seed treatments. Today, fungicides, insecticides, nematicides, and fertilizer are used as seed treatments for various agricultural crops and are useful tools in promoting stand establishment and seedling vigor (Munkvold et al., 2014). Seed treatments may also help preserve yield potential and prevent quality losses in grain by preventing development of seed- and soil-borne diseases (Rodriguez-Brljevich et al., 2009). The development of effective seed treatments can be noted as one of the most significant

advancements in plant disease management. In general, fungicidal seed treatments are used for three primary reasons:

- To manage soil-borne pathogens that can cause seed rots, seedling blights in many crops, root rots, smuts, or downy mildew.
- To manage diseases caused by seed-borne pathogens residing on the seed surface.
- To manage diseases caused by seed-borne fungi surviving inside the seed.

Developing Your Seed Treatment Strategy

Disease management in agricultural crops requires a multifaceted approach as part of an integrated pest management (IPM) program. Weather conditions cannot be precisely predicted at the time of planting, therefore seed treatments can be cheap insurance when conditions are conducive for seed and seedling diseases. When making a decision about seed treatments, consider:

1. Do you expect an economic return?
    a. Estimate the yield response relative to cost.
2. What is the history of seedling diseases in your field? For example, if a field is known to have high incidence of damping-off, then fungicide seed treatment is warranted. Likewise, if a field has a history of corn nematodes, a nematicide seed treatment then would be warranted.
3. What are the prevailing or expected climatic conditions at the time of planting?
    a. Wet and cool soils are favorable conditions for most seedling pathogens, including Pythium spp.
    b. Cool soil conditions also reduce seedling growth rate, providing a longer interaction time between the pathogen and the seed.
4. Is the crop for seed production?
    a. Grain for seed attracts higher prices, therefore, it may be beneficial to consider seed treatment in addition to other factors below.
    b. Fungicide seed treatments also can increase the likelihood of the seed being produced and offered for sale as disease-free.
5. Is corn following corn?
    a. Survival of seedling pathogens is typically higher in nonrotated fields.
6. Is corn being planted in a till or no-till/minimum-till field?
    a. No-till fields may have an increased risk of seedling diseases.
7. When will you plant?
    a. Planting early in the spring when the soil temperatures are low may increase the risk of seed/seedling infection.
8. What is the disease rating for the cultivar to be planted?
    a. Seed companies provide disease ratings for cultivars.
    b. For hybrids susceptible to seedling diseases, a seed treatment may be beneficial.
9. What is the germination rate for the seed lot?
    a. For seed with a low germination percentage, seed treatment may protect young seedlings with marginal vigor and improve plant stands compared with nontreated seed.
10. What is the desired plant population per acre?
    a. With increasing costs of seed, growers may opt for lower plant populations per acre, therefore to avoid further loss of plants; a fungicide seed treatment may be justified.
11. What is the expected price per bushel?
    a. Higher prices per bushel would indicate that fewer additional bushels are needed to offset seed treatment costs.
12. Is the seed for replanting?
    a. If replanting because of stand establishment problems (especially in wet spots) is considered, using fungicide treated seeds may increase chances of survival of replanted seed.
13. Fungicide seed treatments are not effective against bacterial pathogens or in managing viral diseases.
    a. Most seed treatment products do not control all types of fungal pathogens.
14. Residue and volunteer plant management for reduction of residue-borne and overwintering diseases.

15. High quality, disease-free seed to prevent the spread of seed-borne diseases and promote healthy stand establishment.
16. Proper hybrid selection for host resistance and adaptation to the growing region.
17. Proper plant health management (fertility program, planting population, etc.).
    a. Healthy plants have a higher tolerance to the development of plant diseases.
18. Judicious use of plant protectant products such as herbicides, insecticides, and fungicides to reduce losses, promote healthy plants, prevent quality losses in seed, and for resistance management.

Determining the Appropriate Chemical Treatment

Field history is a key component in the decision-making process when selecting appropriate seed treatments. The cropping sequence and the history of major disease or insect pests within the field can be important factors in seed treatment decisions. Proper identification of disease agents is also important. Agronomy or Plant Pathology Extension Field Specialists at the Regional Extension Centers or the Plant Disease Diagnostic Clinic at SDSU can assist producers in identifying plant health problems throughout the growing season. Other web resources that can help with corn disease identification are outlined in the reference section of this chapter.

Effectiveness of control will vary with seed treatment product, rate, environmental conditions, and pests present. Seed treatments may provide some level of control for early season diseases as well as control of seedling blights and seed- or soil-borne diseases. They should not be viewed as season-long protection.

Newly opened land, such as CRP being returned to crop production, may present a special consideration (due to heavy pathogen inoculum) and most certainly will be a situation where seed treatments should be considered. Diseases such as root rots and seedling blights can often be more severe when crops are planted into these high-residue situations. Also, insect pressure on newly cultivated lands may differ from a typical cropping situation.

In-furrow Seed Treatment vs. On-seed Treatments vs. Biotechnology Traits

In-furrow fungicide application treats the soil, whereas on-seed treatment targets pathogens on the seed and those in the soil that will come in contact with the seed/root early in the season. In-furrow treatments usually require high active-ingredient rates compared to on-seed treatments. Both methods are effective in managing seed and soil-borne diseases. However, in-furrow fungicide treatments may require high application rates and also nontarget effects may be high with in-furrow treatments. As of 2015, biotechnology traits for disease management have not been incorporated in commercial corn hybrids. Disease-resistance genes in corn have been bred using the traditional/conventional approach. Therefore, plant disease management relies heavily on host resistance, cultural practices, and fungicides.

Classification of Fungicidal Seed Treatments

Fungicidal seed treatments can be classified based on movement of the seed treatment product in relation to the seed. Fungicides used as protectants (contacts) are effective only on the seed surface, providing protection against seed surface-borne pathogens and providing some level of control of soil-borne pathogens. These products generally have a relatively short residual. Protectant fungicides such as captan, maneb, thiram, or fludioxonil help control most types of soil-borne pathogens, with the exception of root-rotting organisms. Systemic seed treatment fungicides are absorbed into the emerging seedling and inhibit or kill the fungus inside host plant tissues. Systemic fungicides used for seed treatment include the following: azoxystrobin, carboxin, mefenoxam, metalaxyl, thiabendazole, trifloxystrobin, and various triazole fungicides, including difenoconazole, ipconazole, tebuconazole, and triticonazole.

Mefenoxam and metalaxyl are primarily used to target the water mold fungi Pythium. Biological agents as seed treatments are also available and may provide some level of protectant activity. Not all fungicides have activity against the same range of organisms. Refer to the specific crop-pest combinations listed in the text for product-use recommendations on the label. Always read and follow label directions. Consult the South Dakota Corn protection guide at the South Dakota igrow.org website for information for specific products

(http://igrow.org/agronomy/other-crops/2015-pest-management-guides/).

4. Manage Plant Residues

Managing residue is critical for optimizing seed germination. Over the past 30 years, residue management problems have increased because corn yield, and consequently, corn residue have doubled. When returned to the soil, corn residue has helped South Dakota farmers increase soil organic matter (Soil OM) content of most fields. Soil OM in corn fields of eastern SD has increased an average of 24% from 1985 to 2010 (Clay et al., 2012). However, the higher amounts of crop residues have complicated seedbed preparation, slowed soil warming, and contributed to a corn "yield drag" (i.e. lower corn yields than expected) (Gentry et al., 2013). Techniques to reduce residue problems include:

a. Chopping the corn residue with a stalk chopper or chopping combine header. Combine corn headers often are integrated with stalk choppers that have enhanced capacity to chop residue. Chopping residue helps improve stand uniformity and yields (Gentry, 2013), and
b. Adopting tillage techniques that minimize contact between the seed and the surface residue, (for example strip tillage in the planting zone);
c. Harvesting and baling residue after grain harvest. This technique has been widely adopted in the recent past. However, problems with soil erosion, soil organic matter reduction, and nutrient deficiencies should be considered when deciding if, and how much, residue is harvested. Bailing residue may also the positive benefit of helping the soil warm up.

Proper Applications and Precautions

Fungicides and seed treatment products vary in formulation type, packaging, and use requirements. Products may be dry or liquid and in concentrate or ready-to-use formulations. While many seed treatments may be applied on-farm, several products are limited to use only by commercial applicators using closed application systems. Caution should be used when handling or working with seed treatment products. Fungicide seed treatments can be highly poisonous and many are irritants, therefore proper handling precautions must be taken when handling seed treatment chemicals, and producers or applicators must strictly adhere to all label directions regarding safe handling, mixing, storage, and disposal. Using personal protection, including an approved chemical respirator, goggles, and pesticide-resistant gloves, is recommended even if not specifically required by the fungicide label. Follow label rates, as overapplication may result in unintentional injury to the seed, and underapplication may reduce the effectiveness of products.

Properly calibrate all application equipment to assure uniform coverage. Uniform coverage of the seed is critical to optimize effectiveness of the seed treatment. Several seed treatment methods are available, though not all are appropriate for every situation. Commercial application or application through dedicated seed treatment equipment will likely provide the most uniform coverage. Grain auger mounted treatment equipment is available, and may provide adequate coverage in an on-farm situation; however, an auger that has been used to treat seed may be unusable for moving grain intended for food or feed. Likewise, treated seed should not be allowed to contaminate equipment used to transport or store food or feed grains. Use caution when considering planter-applied (planter-box) seed treatments. Good disease control depends on uniform fungicide coverage of the seed, and this is more difficult to accomplish in planter-applied situations. Always read and follow label directions. Understand the product-specific guidelines for proper application: how and when to apply, feeding or grazing restrictions, as well as important safety precautions. Always dispose of pesticide containers properly.

For more details on handling seed treatments, refer to the American Seed Trade Association guide on seed treatment stewardship www.seed-treatment-guide.com.

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