

2017 North Dakota FIELD CROP PLANT DISEASE MANAGEMENT GUIDE

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DISCLAIMER

This plant disease management guide is based on the latest information available from the North Dakota Agricultural Experiment Station, U.S. Department of Agriculture, U.S. Environmental Protection Agency (EPA) and the agricultural chemical industry. The information conformed to federal and state regulations at the time of printing. The user should determine that the intended use is consistent with label directions. ***Designation that a product is labeled for control of a crop disease does not imply endorsement by the authors of use of that product or the degree of efficacy of that product for that use.***

Always follow the label directions. See individual fungicide labels for important information on:

- Safety recommendations and worker protection requirements
- Guidelines for ground, irrigation or aerial application
- Mixing procedures and tank mixes allowed
- Rotational and grazing restrictions
- Resistance management statements

LABEL PRECAUTIONS, RESTRICTIONS

Field re-entry, handling and loading precautions

Most fungicide labels state that workers either should not enter a sprayed field until the sprays have dried or should not enter for 24 hours unless they wear appropriate protective clothing. Information on use of protective clothing during mixing and loading also is given on the label. See the label for details.

Replant restrictions

Labels for all formulations of Ridomil have restrictions on what crops can be planted in less than a year following application of the product. These restrictions may vary somewhat depending on the formulation. Check these and all other labels **before** application to determine if replant restrictions will cause problems when determining what crop to plant next season.

Dosages

All dosages given in this guide are stated as the amount of formulated product (lb., oz., fl. oz., quarts) to use.

Restricted-use fungicides are fluids that are not available to the general public and are to be purchased and used by a certified pesticide applicator.

Fungicides containing triphenyltin hydroxide are restricted-use fungicides. These include products such as Super Tin, Agri Tin and Super Tin 4L. These are designated as RUP and Restricted-use Pesticide in the tables.

Disclaimer

The information given herein is for educational purposes only. North Dakota State University does not endorse commercial products or companies, even though reference may be made to trade names, trademarks or service names. **Omission of labeled products is possible if information about the product was not available at the time of printing or if it had questionable efficacy. Products not normally available in North Dakota are omitted from the guide. Seed treatment chemicals that are primarily insecticides with subminimal amounts of fungicide also are omitted.**

The plant pathology faculty at North Dakota State University assume no responsibility for property damage, personal injury or other loss due to the use of fungicides listed in this publication because they have no control over the use or misuse of these products.

FUNGICIDE FORMULATIONS

Most fungicides are solids that are not soluble in water. To use them, they must be made into a formulation (preparation). Some of the more common formulations are listed below. The common abbreviation for each formulation is given in parentheses following the name.

Wettable powders (WP)

Many fungicides are wettable powders consisting of solid fungicide and a wetting agent. When mixed with water, they form a suspension. Many of these suspensions settle out quickly, so an agitator is needed in the spray tank to keep the particles in suspension.

Water-soluble pouch (WSP)

Some fungicides are available in water-soluble pouch containers. These pouches dissolve in the mixing tank and release the fungicide. This reduces the exposure of mixer and loader personnel to dust from the fungicide.

Dusts (D)

Dusts are powders that are mixed with inert ingredients to form a product with a low percent of active material. These are used around the home garden, and a few formulations are used in commercial applications.

Granules (G)

The active ingredient is incorporated into small granules of inert material such as clay. Granules are incorporated into the soil.

Emulsifiable concentrates (EC)

A fungicide that is insoluble in water is dissolved in an organic solvent. An emulsifying agent is incorporated in the formulation so an emulsion is formed when the product is mixed with water. An emulsion is a suspension of very tiny drops of the solvent/fungicide in the water. It usually has a milky appearance (milk itself is an emulsion of fats in water).

Flowables (F)

Flowables are insoluble fungicides ground into a very fine product, usually by a wet-grinding process. These particles are nearly colloidal and are suspended in water to form a thick liquid. They remain suspended in water for relatively long periods of time but should be agitated before use. They are dust-free, easy to mix, remain in suspension longer than wettable powders and also may resist washing off the plant better than the wettable powders. Examples of flowables include Champ Flowable, Kocide 4.5 LF, Vitavax 200 and Dithane F-45. They need to be protected from freezing.

Dry flowable (DF)

See dispersible granules. (Next page)

Dispersible granules (DG)

Dispersible granules also are called dry flowable formulations. They are small granules that pour from a container like a liquid but do not stick to the sides of the container and do not need to be protected from freezing. They are virtually dust-free and disperse readily in water to form a suspension. Examples include Bravo Ultrex DG, Dithane DF, Rainshield NT, Manzate 75 DF and Penncozeb DF.

Fumigants

Fumigants are liquids that turn into a gas after application. They generally are used for soil fumigation.

MODE OF ACTION OF FUNGICIDES

The action of most fungicides takes place outside the host and is called "*protection*." A fungicide that acts outside the host is called a "protectant fungicide." Most older fungicides sprayed on leaves and fruit are of this type. "*Therapy*" is chemical action inside the host. For example, fungicides are locally systemic and move into the plant at the site of deposition. Several triazole fungicides have several days of therapeutic action against wheat leaf rust and also reduce the production of viable spores; that is, spores capable of growing.

Most protectant fungicides are relatively stable by themselves. Generally, they are relatively insoluble in water and resist removal or chemical change by water, yet must be toxic to fungi. Often a chemical change is brought about by the fungus, the host or the environment before toxicity occurs. Toxicity simply means the ability to damage the fungus cells.

Fungicides may act to produce a toxic reaction in the fungus in several different ways. (1) Some may inhibit (slow down or stop) cell wall formation. (2) Some affect the permeability of the cell wall, causing a leaking of nutrient materials from the cell. (3) Some fungicides may combine with essential metals in a way that they become unavailable for normal cell functions, including the functioning of essential enzymes. (4) Other fungicides may inhibit respiration or nuclear division, or may break dormancy of spores.

Some fungicides also may be toxic to plants if applied at rates too high or if applied under unfavorable environmental conditions. This is called *phytotoxicity*. Formulations of maneb + zinc are less phytotoxic to many vegetables than formulations that contain only maneb. Sometimes the method of formulation may make a fungicide less phytotoxic.

TOXICITY OF FUNGICIDES

Effects of chemicals on humans

Fungicides have various levels of toxicity to humans. Human exposure (skin, eye, internal) to fungicides can result in mild to severe reaction. Due to high levels of toxicity, some fungicides are restricted-use only.

Symptoms associated with chemical poisoning are listed below. All symptoms are not associated with every pesticide. Some of these symptoms are described below, but consulting a physician always is wise. Avoid diagnosing the effects on yourself or others.

- Eyes watering excessively
- Stomach cramps
- Dizziness
- Vomiting
- Excessive sweating
- Pupils of the eye reduced in size
- Rapid heart beat
- Muscle tremors or convulsions
- Extreme nervousness
- Mental confusion, lack of coordination
- Uncontrolled drooling or watering at the mouth
- Severe burns of the skin
- Loss of ability to use muscles
- Difficulty in breathing
- Unconsciousness

First aid

The following list should be considered:

- Stop exposure
- Call a physician
- Remove contaminated and restrictive clothing
- Drench contaminated area with water; flush repeatedly
- Provide fresh air but prevent chilling and overheating
- Avoid giving alcohol
- Provide milk for patient to drink
- Antidote - to be administered only by a physician

North Dakota Poison Control Center
Toll-free: (800) 732-2200

Toxicity ratings of pesticides

Pesticides generally are categorized according to acute **oral toxicity** (the toxicity when taken by mouth), but because users may absorb a significant quantity of the pesticide through their skin, **dermal toxicity** (toxicity when absorbed through the skin) is of equal or greater practical importance.

LD₅₀ values generally show relative toxicities among the chemicals and are not truly representative of effects on humans, especially since they usually are obtained on rats. Actual toxicities do not constitute the only hazards associated with exposure to the chemicals. For instance, a chemical with low toxicity may be hazardous due to concentration, high volatility, careless use or effects of long-term exposure.

LD₅₀ depends upon body weight. Thus, a given amount of chemical would have greater effect on a child than on an adult. LD₅₀ also is proportional to the percent of active ingredient. A material only 50 percent active requires twice as much to produce a toxic effect as 100 percent pure material.

The lower the LD₅₀ value, the greater the toxicity. A common standard for comparison is aspirin, which has an LD₅₀ of 1,200 mg/kg and is considered slightly toxic.

The following table illustrates the various toxicity classes:

Oral Toxicity		Dermal (Skin) Toxicity	
LD ₅₀ -mg/kg	Toxicity Class	LD ₅₀ -mg/kg	Toxicity Class
1-50	High	1-200	Severe
50-500	Moderate	200-2,000	Moderate
500-5,000	Low	2,000-20,000	Mild
Over 5,000	Very Low	Over 20,000	Very Mild

Information on the LD₅₀ of a specific fungicide and other toxicology information are available on the MSDS (Material Safety Data Sheet) for each product. These generally may be found at www.cdms.net/.

PROTECTING GROUNDWATER

Pesticides differ in their persistence and mobility in soil. Those that are highly persistent or highly mobile are more liable to contaminate groundwater than those that are not. Areas of the state where groundwater is most at risk are areas with coarse-textured soils, are low in organic matter and have a high water table. Most fungicides are relatively immobile, especially in clay soils with high organic matter, because they are adsorbed on clay particles or on the organic matter.

A few fungicides are somewhat mobile. Take care in the use of these fungicides, particularly the application of these products through a sprinkler irrigation system in high-risk areas. Risks may be reduced by minimizing the amount of water used for application through a sprinkler system, more use of ground or aerial application instead of application through the sprinkler system, and use of a different fungicide that is less mobile.

The persistence and mobility of fungicides commonly used in North Dakota may be found in NDSU Extension Service publication EB-49, "Persistence and Mobility of Pesticides in Soil and Water."

HANDLING CHEMICALS

Avoid splashing and spilling. Wear a mask especially when handling dusts or powders. Some chemicals, when combined, have increased toxicity (potentiation).

Rinse containers several times after using chemicals. Pour rinsate into the spray tank when using the same chemical. Dispose of containers as indicated in the next section. Keep a record of plant disease control chemicals used and methods of handling.

FUNGICIDE LABELS

Fungicides are named according to their chemical composition or the *chemical name*. An example of a chemical name is a coordination production of zinc ion and manganese ethylene bisdithiocarbamate; the chemical names are required on the label. Since chemical names often are long, *common names* frequently are used; for example, the common name for the above chemical is mancozeb. Manufacturers use *trade names* to identify their specific products. For example, there are various trade names for mancozeb, such as Dithane, Manzate and Penncozeb.

In addition to the names on labels, various other required label information includes precautions in handling, antidotes or telephone contacts to use in case of accidental poisoning, recommendations for use, materials contained in the package and their percentages, the manufacturer's or distributor's name and address, and the EPA registration number.

Some fungicides are made up in various formulations for different uses or methods of application, such as wettable powders, dusts, emulsifiable concentrates, granules, flowables, dispersible granules or solutions. The nature of the chemical sometimes restricts it to one or a few of these formulations.

SEED TREATMENT

Cereals

Fungicidal seed treatment helps protect the seed from rotting and the emerging seedlings from damping off and seedling blight. These are caused by soil-borne pathogens. When seeds germinate under favorable soil conditions, the danger of seed and seedling attack from soil-borne pathogens is lessened unless seed is of poor quality. Treatment of seed with a protectant fungicide may help protect against soil-borne pathogens and thus help stand establishment when seeds are germinating under unfavorable conditions, such as cold, wet weather. Many products are available for protection against seedling blight.

Treating seeds with a fungicide also helps protect them from diseases that are seed-borne. These include the covered smuts, bunt, scab, black point and black semi-loose smut of barley, and loose smuts of wheat, barley and oats. Loose smuts of wheat and barley are internally seed-borne. Loose smut of oats is seed-borne as spores under the hulls. These smuts cannot be controlled by conventional protectant seed treatment fungicides, but are

controlled by systemic seed treatment products. The embryo test can be used by the North Dakota State Seed Department to determine if loose smut is present in barley seed. This test cannot be used for the loose smuts of oats or wheat or black semiloose smut of barley. All current barley varieties are susceptible to loose smut. An embryo test is recommended for barley seed; if infection is 2 percent or greater, seed treatment of barley with an effective fungicide seed treatment is advised.

Common (*Bipolaris*, *Helminthosporium* or *Cochliobolus*) root rot of wheat and barley is a chronic problem in North Dakota, causing average yield losses of 5 to 11 percent, with much greater losses in some fields in certain years. Several seed treatment products are labeled for suppression of common root rot. Some seed treatments are also labeled for suppression of *Fusarium* root rot and take all root rot.

Chickpeas

Treating chickpea seed to protect against *Pythium* is essential for good emergence. A seed treatment to protect against seed-borne *Ascochyta* is important because this is a common and serious disease.

Dry beans and soybeans

Treating seed may reduce seedling blight during weather that is unfavorable for emergence. Do not use streptomycin with Rhizobium inoculant. If using captan seed treatments, in-furrow inoculant is preferable because inoculant does not survive well on captan-treated seed. Several products can be used to reduce the root rot potential, and many newer products have a broad spectrum of activity.

Flax

Treating flax seed with a fungicide helps protect against seed rot, damping off and seedling blight. Seed treatment is especially important in cases where the seed coats are broken, allowing entry of pathogens. Seed from fields heavily infected with Pasm (*Septoria linicola*) may be susceptible to seedling blight and should be seed treated.

Potatoes

Treatment of cut-seed pieces helps protect the cut surface against seed-piece decay. Most seed treatments are fungicides that will protect against fungi such as *Pythium*, *Rhizoctonia*, *Helminthosporium* and *Fusarium*. Fungicides do not protect against bacteria such as *Erwinia* or *Clavibacter*. However, control of fungi indirectly helps control *Erwinia* bacteria because seed decay is greater in seed infected with fungi. The addition of streptomycin to fungicide has limited value because it will control only bacteria contaminating cut surfaces and may inhibit wound healing. Seed treatment will reduce or help control new infections but will not cure existing decay, prevent lenticel infection or prevent infection of roots and stolons away from the seed piece due to soil or environmental inoculum. Seed treatment is no substitute for using good, sound, healthy seed. Seed should be stored at less than 40 F during the winter. In the spring, warm the seed to 50 to 60

F for 1 1/2 to two weeks before planting or until it just begins to sprout. Do not handle the seed until it is warm. Plant the cut seed in warm (50 to 58 F at planting depth), moist soil. If cut seed must be held, store in a well-ventilated area for suberization at 50 to 60 F with a relative humidity of 85 percent. Hold for one week, then lower the temperature to 50 to 60 F. Ideally, plant when seed and soil are the same temperature; the optimum is 50 F.

Safflower

Safflower rust is both seed-borne and soil-borne. The most devastating phase of the disease is a seedling blight, and root and foot rot. Typical rust pustules develop later on the leaves. Seed-borne safflower rust is controlled by seed treatment.

Sunflower

Soil-borne downy mildew infections were controlled with metalaxyl or mefenoxam seed treatment in the past. The downy mildew fungus, however, has developed insensitivity to metalaxyl and mefenoxam in much of North Dakota, South Dakota and Minnesota, so these fungicides are not effective. Several fungicides or fungicide-insecticide combinations have received state or federal labels for seed treatment of sunflower for seed rot and seedling blights.

APPLICATION OF SEED TREATMENT

Seed may be treated commercially or it may be treated on the farm. Commercial seed treatment may use a slurry treater or various automatic seed treaters. The various automatic seed treaters differ considerably, so they cannot be discussed here. Commercial seed treatment has become more common in recent years for many crops.

On-farm treatment may use various home-type or slurry mixers. Drill-box seed treatment is popular because no extra steps are required; the seed is treated in the drill-box at planting time. Good disease control depends on uniform fungicide coverage of the seed, but this is more difficult to accomplish in drill-box treatment because the means of mixing the seed and fungicide is inadequate. For effective drill-box treatment, fill the box with one-third the quantity of seed and fungicide and mix carefully with a paddle; repeat with the next third and then the final third. The paddle should not be used for any other purpose and should be stored in a safe place, out of reach of children and animals.

On-farm auger seed treatment methods are common. The fungicide is metered into the base of the auger used to fill the drill box. This method assures fairly good mixing and coverage.

All seed treatments have certain basic precautions. Use care in handling seed treatment products; many are irritating to the eyes, nose and skin. Treated seed usually is identified by the dye used in the chemical, and treated seed should not be fed to livestock or used for human food. Pesticide containers should be disposed of properly

in a landfill or buried in an area with no surface drainage to nearby waterways. If seed treatment cannot be done outdoors, it should be done in a well-ventilated room. Commercial seed treaters should have an adequate air exhaust system for treatment rooms. Workers exposed to seed treatment chemicals for long periods of time should have an approved chemical mask. The filter should be changed frequently. Recommended rates of application should be followed carefully because higher rates may injure the seed and lower rates may not give satisfactory disease control.

Forage legume seed should be treated well in advance of planting and inoculated with nitrogen-fixing *Rhizobia* at planting time. If dry beans have been treated with streptomycin for control of externally borne blight bacteria, inoculating with *Rhizobia* is not available.

FIELD CROP FOLIAR SPRAYS

Foliar fungicides are used to control fungal disease organisms that attack the above-ground portions of plants. Fungicides are used to protect the potential yield and quality of a crop. Many fungicides protect foliage from infection; therefore, these fungicides must be on the foliage before the fungus spores germinate.

Several foliar fungicides act differently from the protectants described above. For example, benzimidazole fungicides thiabendazole and thiophanate methyl are absorbed by the plant and translocated up the plant by the conducting tissues. They are called systemic fungicides. They only move up the plant; they do not move down. Thus, to control white mold on dry beans, complete coverage of stems, lower leaves and blossoms is required. Spraying only the upper leaves is not satisfactory because the fungicide will not move down to the location where it is needed. Strobilurin and triazole fungicides are locally systemic; they have some upward mobility and translaminar movement and some limited therapeutic action. Metalaxyl will move down from potato foliage into tubers in limited amounts to provide tuber protection against metalaxyl-sensitive strains of the late blight fungus and pink rot infection.

Spray control programs to prevent disease have been developed from data through years of research. Because each disease develops in a distinct manner, the decision to use a disease prevention program is based on weather conditions, disease development, potential yield of the crop and the dollars returned to management with use of the fungicides.

Many fungicides are registered for application through a sprinkler irrigation system, as well as by a spray. If a fungicide can be applied through a sprinkler system (fungigation), this is noted under application.

Most fungicide labels contain information on field re-entry, handling and loading precautions. Most labels state that workers either should not enter a sprayed field until the sprays have dried or should not enter for 24 hours

unless they wear appropriate protective clothing. Information on the use of protective clothing during mixing and loading also is given on the label. See the label for details.

Spraying

Spraying can be done with many different types of ground and air equipment. Getting good coverage is important: At least 5 gallons per acre (gal/A) should be used for aerial application and higher gallon amounts are required for ground equipment.

Droplet size for aerial application should be 200 to 400 microns (1/64 to 1/128 inch) in diameter. Generally, if nozzles are pointed back, appropriate nozzles are used and pressures do not exceed 30 or 35 pounds per square inch (psi), the correct droplet size will result. Application should be made with the boom 8 to 10 feet above the crop.

Some plant surfaces have a waxy or hairy coating, making good coverage difficult. The spray will collect in large, erect droplets, which then run off. Wheat and cabbage leaves are good examples. Frequently, using a wetting agent improves coverage. Usually this is a spreader-sticker. Certain fungicides may work better with certain spreader-stickers than others. This type of information usually can be found on the label or in supplemental brochures. Spreader-stickers may be incorporated into some flowable formulations, so adding a spreader-sticker to the spray tank is not necessary. However, the label must be checked on each product for this use.

RESISTANCE TO FUNGICIDES

Fungi may develop tolerance or resistance to certain fungicides. Several examples where this occurs in North Dakota are described below.

The sugar beet leafspot fungus (*Cercospora*) has developed resistance to the systemic benzimidazole fungicides (benomyl, thiabendazole and thiophanate methyl) in the Red River Valley and southern Minnesota. These fungicides should be not used at all in the southern Red River Valley and no more than once a season in a tank mix with an unrelated fungicide in the northern Red River Valley.

Resistance to the benzimidazole fungicides thiabendazole (TBZ or Mertect) and thiophanate methyl (Topsin M) has developed recently in the potato *Fusarium* dry rot pathogen *Fusarium sambucinum* and the potato silver scurf pathogen *Helminthosporium solani*. This resistance is common throughout the United States and Canada.

Resistance to iprodione has been reported from other parts of the country. Cross-resistance to the chemically related product vinclozolin is common when resistance to iprodione develops.

The A2 mating type of the late blight fungus, which is common in North Dakota and Minnesota, is resistant to metalaxyl and mefenoxam.

In North Dakota, reduced sensitivity to strobilurin fungicides have been observed in populations of the early blight fungus *Alternaria* sp. on potato and to the aschochyta blight pathogen (*Aschochyta rabiei*) on chickpeas (this does not cause aschochyta blight on lentils or field peas). Greater than 90% of the early blight fungus, *Alternaria solani*, are resistant to the QoI fungicides pyraclostrobin, fluoxastrobin, and azoxystrobin. Additionally, a very high proportion of the *Aschochyta rabiei* population affecting chickpea is resistant to pyraclostrobin. The *A. solani* population has also developed resistance to SDHI fungicides such as boscalid and penthiopyrad. Five mutations have been detected that convey resistance to this class of fungicide. Fluopyram, which is also a SDHI fungicide, is not affected by these mutations.

Tolerance of the leafspot fungus to triphenyltin hydroxide was widespread in southern Minnesota and the southern Red River Valley in 1999 and common in the Northern Red River Valley. However, tin-tolerant isolates do not survive as well as sensitive isolates when alternative fungicides are used. With appropriate FRAC (Fungicide Resistance Action Committee) rotations, tin-tolerant isolates have largely disappeared.

In contrast, benzimidazole-resistant strains survive well when alternative fungicides are used and persist for a long time. The best way to combat resistance is to prevent or delay it by alternating the different classes of fungicides and by avoiding constant use of fungicides known to trigger development of resistant fungi. Using tank mixes of unrelated fungicides also is reported to retard the development of resistance.

FUNGICIDE RESISTANCE MANAGEMENT STATEMENTS

The following statements are recommendations for commonly used fungicides. Information from the FRAC is available at www.frac.info/.

1. Methyl benzimidazole carbamates (MBC; Group 1) – High risk. Both mixtures and alternations with non-Group 1 fungicides are acceptable methods of preventing/managing resistance to Group 1 fungicides. For high-risk pathogens, mixtures are preferred to alternations.

2. Dicarboximides (Group 2) – Medium to high risk. Minimize the selection pressure by minimizing the number of applications. As a guide, do not apply more than two to three per crop per season. Maintain regular, prolonged times without exposure to Group 2 fungicides. When applying for *Botrytis* control, restrict applications to those times when *Botrytis* infection pressure is high. Where *Botrytis* resistance is well-established, use combinations

to stabilize *Botrytis* control, but their application must follow the same rules as for Group 2 fungicides alone.

3. Sterol biosynthesis inhibitors (SBI; Groups 3, 5, 17 and 18) – Low to medium risk. Repeated applications of SBI fungicides alone should not be used on the same crop in one season against a high-risk pathogen in areas of high disease pressure for that particular pathogen. For crop/pathogen situations where repeated spray applications are made during the season, alternation or mixtures with an effective noncross-resistant fungicide are recommended. Where alternation or the use of mixtures is not feasible because of a lack of effective or compatible noncross-resistant partner fungicides, then input of SBIs should be reserved for critical parts of the season or crop growth stage. If SBI performance should decline and sensitivity testing has confirmed the presence of less sensitive forms, SBIs should be used only in mixture or alternation with effective noncross-resistant partner fungicides. The introduction of the new classes of chemistry offers new opportunities for more effective resistance management. The use of different modes of action should be maximized for the most effective resistance management strategies. Users must adhere to the manufacturers' recommendations. In many cases, reports of "resistance" have, on investigation, been attributed to cutting recommended rates of use, or to poor or mistimed application. Fungicide input is only one aspect of crop management. Fungicide use does not replace the need for resistant crop varieties, good agronomic practice, plant hygiene/sanitation, etc.

4. Phenylamides (PA; Group 4) – High risk. The Group 4 fungicides should be used on a preventative and not curative or eradication basis. For foliar applications, Group 4 fungicides should be used in prepackaged mixtures with an unrelated effective partner and used in a sound management program. Where using residual partners, use between three-fourths and full recommended rates. The Group 4 fungicide dosage in the mixture depends on its intrinsic activity and is defined by the respective company. The Group 4 fungicides should not be used as soil treatments against airborne diseases. When solo formulations are made available for soil use, strategies that prevent any possibilities for foliar applications must be implemented. For seed treatment, mixtures rather than straight Group 4 fungicides should be used whenever possible. The number of Group 4 fungicide applications should be limited (two to four consecutive applications per crop and year). The application intervals should not exceed 14 days and may be shorter in cases of high disease pressure. If rates and application intervals are reduced, the total amount of the Group 4 fungicide used per season should not exceed that of the full rate, and the total exposure time should remain the same. The rate of the mixing partners should remain the same for both intervals. Group 4 fungicide sprays are recommended early season during the period of active vegetative growth of the crop. The grower should switch to non-Group 4 products not later than the normal standard application interval of the non-Group 4 product.

5. Quinone outside inhibitors (QoI; Group 11) – High risk. When using a Group 11 fungicide as a solo product, the number of applications should be no more than one-third of the total number of fungicide applications per season. In programs with tank mixes or pre-mixes of a Group 11 fungicide, applications should be no more than one-half of the total number of fungicide applications per season. In programs in which applications of Group 11 fungicides are made with both solo products and mixtures, the number of Group 11 fungicide-containing applications should be no more than half of the total number of fungicide applications per season.

6. Succinate dehydrogenase inhibitor (SDHI): (group 7) Medium to high risk. This group includes fungicides such as boscalid, benodanil, flutolanil, mepronil, fluopyram, florfuran, carboxin, oxycarboxin, thifluzamide, bixafen, fluxapyroxad, furametpyr, isopyrazam, penflufen, penthiopyrad, sedaxane and boscalid. Laboratory and field studies have confirmed target site mutations to SDHI. Limit use of SDHI and rotate with other chemistries of different modes of action.

Recent research has indicated that >90% of the *Alternaria solani* (cause of early blight of potato) are resistant to the SDHI fungicide, boscalid. Currently, there are five known mutations in the early blight pathogen which convey resistance to boscalid that have been identified in ND isolates. However, these mutations may or may not affect other SDHI fungicides, such as fluopyram, fluxapyroxad and penthiopyrad. When selecting SDHI fungicides for management of early blight of potato, consult comments in the 'Remarks' column for more information on resistance.

FUNGICIDE GROUPS

The soil application and foliar sprays tables in this guide have a numerical or letter designation (in parentheses) for each chemical component of the listed commercial Fungicides. This number or letter code indicates the Code is developed by the Resistance Action Committee = (FRAC). The purpose of FRAC is to prolong the effectiveness of fungicides liable to encounter resistance problems and to limit crop losses should resistance appear. If field resistance is known to one member of the fungicide group, cross-resistance to other chemicals within that group may be present. This Fungicide Guide is providing information on fungicide groups so that users are aware of potential resistance problems with continued use of chemicals in the same fungicide group. The intrinsic risk for resistance to develop to a given fungicide group varies among chemistries; for example, resistance development among the strobilurins, Group 11, is much more likely than resistance development among the mancozeb or maneb, Group Y. For more information about fungicide resistance and the FRAC fungicide list, see the following Web site:

www.frac.info

The following tables (pages 9-16) are derived directly from the FRAC code, and they describe modes of action, chemical group names, common names, and FRAC Code number.

FRAC Code List© 2016

MOA	TARGET SITE AND CODE	GROUP NAME	CHEMICAL GROUP	COMMON NAME	COMMENTS	FRAC CODE
A: nucleic acids synthesis	A1: RNA polymerase I	PA – fungicides (PhenylAmides)	acylalanines	benalaxyl benalaxyl-M (=kiralaxyl) furalaxyl metalaxyl metalaxyl-M (=mefenoxam)	Resistance and cross resistance well known in various Oomycetes but mechanism unknown. High risk. See FRAC Phenylamide Guidelines for resistance management	4
			oxazolidinones	oxadixyl		
			butyrolactones	ofurace		
	A2: adenosin-deaminase	hydroxy- (2-amino-) pyrimidines	hydroxy- (2-amino-) pyrimidines	bupirimate dimethirimol ethirimol	Medium risk Resistance and cross resistance known in powdery mildews. Resistance management required.	8
	A3: DNA/RNA synthesis (proposed)	heteroaromatics	isoxazoles	hymexazole	Resistance not known.	32
			isothiazolones	octhilinone		
	A4: DNA topoisomerase type II (gyrase)	carboxylic acids	carboxylic acids	oxolinic acid	Bactericide. Resistance known. Risk in fungi unknown. Resistance management required.	31
B: Cytoskeleton and motor proteins	B1: β -tubulin assembly in mitosis	MBC - fungicides (Methyl Benzimidazole Carbamates)	benzimidazoles	benomyl carbendazim fuberidazole thiabendazole	Resistance common in many fungal species. Several target site mutations, mostly E198A/G/K, F200Y in β -tubulin gene. Positive cross resistance between the group members. Negative cross resistance to N-Phenylcarbamates. High risk. See FRAC Benzimidazole Guidelines for resistance management.	1
			thiophanates	thiophanate thiophanate-methyl		
	B2: β -tubulin assembly in mitosis	N-phenyl carbamates	N-phenyl carbamates	diethofencarb	Resistance known. Target site mutation E198K. Negative cross resistance to benzimidazoles. High risk. Resistance management required.	10
	B3: β -tubulin assembly in mitosis	benzamides	toluamides	zoxamide	Low to medium risk. Resistance management required.	22
		thiazole carboxamide	ethylamino-thiazole-carboxamide	ethaboxam		
	B4: cell division (proposed)	phenylureas	phenylureas	pencycuron	Resistance not known	20
	B5: delocalisation of spectrin-like proteins	benzamides	pyridinylmethyl-benzamides	fluopicolide	Resistance not known	43
B6: actin/myosin/fimbrin function e.g. in vesicle trafficking	cyanoacrylates	aminocyanoacrylates	phenamacril	Resistance known in Fusarium graminearum. Target site mutations in the gene coding for myosin-5 found in lab studies. Medium to high risk. Resistance management required	47	

MOA	TARGET SITE AND CODE	GROUP NAME	CHEMICAL GROUP	COMMON NAME	COMMENTS	FRAC CODE
C. respiration	C1: complex I NADH Oxido-reductase	pyrimidinamines	Pyrimidinamines	diflumetorim	Resistance not known.	39
		pyrazole-MET1	pyrazole-5-carboxamides	tolfenpyrad		
	C2: complex II: succinate-dehydrogenase	SDHI (Succinate dehydrogenase inhibitors)	phenyl-benzamides	benodanil flutolanil mepronil	Resistance known for several fungal species in field populations and lab mutants. Target site mutations in <i>sdh</i> gene, e.g. H/Y (or H/L) at 257, 267, 272 or P225L, dependent on fungal species. Resistance management required. Medium to high risk. See FRAC SDHI Guidelines for resistance management.	7
			phenyl-oxo-ethyl thiophene amide	isofetamid		
			pyridinyl-ethyl-benzamides	fluopyram		
			furan- carboxamides	fenfuram		
			oxathiin-carboxamides	carboxin oxycarboxin		
			thiazole-carboxamides	thifluzamide		
			pyrazole-4-carboxamides	benzovindiflupyr bixafen fluxapyroxad furametpyr isopyrazam penflufen penthioapyrad sedaxane		
			N-methoxy-(phenyl-ethyl)-pyrazole-carboxamides	pydiflumetofen		
	pyridine-carboxamides	boscalid				
	C3: complex III: cytochrome bc1 (ubiquinol oxidase) at Qo site (<i>cyt b gene</i>)	QoI-fungicides (Quinone outside Inhibitors)	methoxy-acrylates	azoxystrobin coumoxystrobin enoxastrobin flufenoxystrobin picoxystrobin pyraoxystrobin	Resistance known in various fungal species. Target site mutations in <i>cyt b</i> gene (G143A, F129L) and additional mechanisms. Cross resistance shown between all members of the QoI group. High risk. See FRAC QoI Guidelines for resistance management.	11
			methoxy-acetamide	mandestrobin		
			methoxy-carbamates	pyraclostrobin pyrametostrobin triclopyricarb		
			Oximino-acetates	kresoxim-methyl trifloxystrobin		
			oximino-acetamides	dimoxystrobin fenaminstrobin metominostrobin orysastrobin		
			oxazolidine-diones	famoxadone		
			dihydro-dioxazines	fluoxastrobin		
			Imidazolinones	fenamidone		
benzyl-carbamates	pyribencarb					
C4: complex III: cytochrome bc1(ubiquinone reductase) at Qi site	QiI - fungicides (Quinone inside Inhibitors)	cyano-imidazole	cyazofamid	Resistance risk unknown but assumed to be medium to high (mutations at target site known in model organisms). Resistance management required.	21	
		sulfamoyl-triazole	amisulbrom			

MOA	TARGET SITE AND CODE	GROUP NAME	CHEMICAL GROUP	COMMON NAME	COMMENTS	FRAC CODE
C: respiration (continued)	C5: uncouplers of oxidative phosphorylation		dinitrophenyl crotonates	binapacryl meptyldinocap dinocap	Resistance not known. Also acaricidal activity.	29
			2,6-dinitro-anilines	fluazinam	Low risk. However, resistance claimed in <i>Botrytis</i> in Japan.	
			(pyr.-hydrazones)	(ferimzone)	Reclassified to U 14 in 2012.	
	C6: inhibitors of oxidative phosphorylation, ATP synthase	organo tin compounds	tri-phenyl tin compounds	fentin acetate fentin chloride fentin hydroxide	Some resistance cases known. Low to medium risk.	30
	C7: ATP production (proposed)	thiophene-carboxamides	thiophene-carboxamides	silthiofam	Resistance reported. Risk low.	38
C8: complex III: cytochrome bc1 (ubiquinone reductase) at Qo site, stigmatellin binding sub-site	QoSI fungicides (Quinone outside Inhibitor, stigmatellin binding type)	triazolo-pyrimidylamine	ametotradin	Not cross resistant to QoI fungicides. Resistance risk assumed to be medium to high (single site inhibitor). Resistance management required.	45	
D: amino acids and protein synthesis	D1: methionine biosynthesis (proposed) (<i>cgs gene</i>)	AP - fungicides (Anilino-Pyrimidines)	anilino-pyrimidines	cyprodinil mepanipyrim pyrimethanil	Resistance known in <i>Botrytis</i> and <i>Venturia</i> , sporadically in <i>Oculimacula</i> . Medium risk. See FRAC Anilinopyrimidine Guidelines for resistance management.	9
	D2: protein synthesis	enopyranuronic acid antibiotic	enopyranuronic acid antibiotic	blasticidin-S	Low to medium risk. Resistance management required.	23
	D3: protein synthesis	hexopyranosyl antibiotic	hexopyranosyl antibiotic	kasugamycin	Resistance known in fungal and bacterial (<i>P. glumae</i>) pathogens. Medium risk. Resistance management required.	24
	D4: protein synthesis	glucopyranosyl antibiotic	glucopyranosyl antibiotic	streptomycin	Bactericide. Resistance known. High risk. Resistance management required.	25
	D5: protein synthesis	tetracycline antibiotic	tetracycline antibiotic	oxytetracycline	Bactericide. Resistance known. High risk. Resistance management required.	41
E: signal transduction	E1: signal transduction (mechanism unknown)	aza-naphthalenes	aryloxyquinoline	quinoxifen	Resistance to quinoxifen known. Medium risk. Resistance management required. Cross resistance found in <i>Erysiphe (Uncinula) necator</i> but not in <i>Blumeria graminis</i> .	13
			quinazolinone	proquinazid		
	E2: MAP/Histidine-Kinase in osmotic signal transduction (<i>os-2, HOG1</i>)	PP-fungicides (PhenylPyrroles)	phenylpyrroles	fenpiclonil fludioxonil	Resistance found sporadically, mechanism speculative. Low to medium risk. Resistance management required.	12

MOA	TARGET SITE AND CODE	GROUP NAME	CHEMICAL GROUP	COMMON NAME	COMMENTS	FRAC CODE
E: signal transduction (continued)	E3: MAP/Histidine-Kinase in osmotic signal transduction (<i>os-1, Daf1</i>)	dicarboximides	dicarboximides	chlozolinate dimethachlone iprodone procymidone vinclozolin	Resistance common in <i>Botrytis</i> and some other pathogens. Several mutations in OS-1, mostly I365S. Cross resistance common between the group members. Medium to high risk. See FRAC Dicarboximide Guidelines for resistance management.	
	F1:	formerly dicarboximides				
F: lipid synthesis and membrane integrity	F2: phospholipid biosynthesis, methyltrans-ferase	phospho-thiolates	phospho-thiolates	edifenphos iprobenfos (IBP) pyrazophos	Resistance known in specific fungi. Low to medium risk. Resistance management required if used for risky pathogens.	6
		dithiolanes	Dithiolanes	isoprothiolane		
	F3: lipid peroxidation (proposed)	AH-fungicides (Aromatic Hydrocarbons) (chlorophenyls, nitroanilines)	aromatic hydrocarbons	biphenyl chloroneb dicloran quintozene (PCNB) tecnazene (TCNB) tolclofos-methyl	Resistance known in some fungi. Low to medium risk. Cross resistance patterns complex due to different activity spectra.	14
		heteroaromatics	1,2,4-thiadiazoles	etridiazole		
	F4: cell membrane permeability, fatty acids (proposed)	carbamates	carbamates	iodocarb propamocarb prothiocarb	Low to medium risk. Resistance management required.	28
	F5:	formerly CAA-fungicides				
	F6: microbial disrupters of pathogen cell membranes	microbial (<i>Bacillus</i> sp.)	<i>Bacillus</i> sp. and the fungicidal lipopeptides produced	<i>Bacillus subtilis</i> syn. <i>B. amyloliquefaciens</i> strain QST 713	*synonyms for <i>Bacillus amyloliquefaciens</i> are <i>Bacillus subtilis</i> and <i>B. subtilis</i> var. <i>amyloliquefaciens</i> (previous taxonomic classification) Resistance not known. Induction of host plant defence described as additional mode of action for strain FZB24	44
<i>Bacillus amyloliquefaciens</i> strain FZB24						
<i>Bacillus amyloliquefaciens</i> strain MBI600						
<i>Bacillus amyloliquefaciens</i> strain D747						
F7: cell membrane disruption (proposed)	plant extract	terpene hydrocarbons and terpene alcohols	extract from <i>Melaleuca alternifolia</i> (tea tree)	Resistance not known	46	

MOA	TARGET SITE AND CODE	GROUP NAME	CHEMICAL GROUP	COMMON NAME	COMMENTS	FRAC CODE
G: sterol biosynthesis in membranes	G1: C14- demethylase in sterol biosynthesis (<i>erg11/cyp51</i>)	DMI-fungicides (DeMethylation Inhibitors) (SBI: Class I)	piperazines	triforine	There are big differences in the activity spectra of DMI fungicides. Resistance is known in various fungal species. Several resistance mechanisms are known incl. target site mutations in <i>cyp51</i> (<i>erg 11</i>) gene, e.g. V136A, Y137F, A379G, I381V; <i>cyp51</i> promotor; ABC transporters and others. Generally wise to accept that cross resistance is present between DMI fungicides active against the same fungus. DMI fungicides are Sterol Biosynthesis Inhibitors (SBIs), but show no cross resistance to other SBI classes. Medium risk. See FRAC SBI Guidelines for resistance management.	3
			pyridines	pyrifenoxy pyrisoxazole		
			pyrimidines	fenarimol nuarimol		
			imidazoles	imazalil oxpoconazole pefurazoate prochloraz triflumizole		
			triazoles	azaconazole bitertanol bromuconazole cyproconazole difenoconazole diniconazole epoxiconazole etaconazole fenbuconazole fluquinconazole flusilazole flutriafol hexaconazole imibenconazole ipconazole metconazole myclobutanil penconazole propiconazole simeconazole tebuconazole tetraconazole triadimefon triadimenol triticonazole prothioconazole		
	triazolinthiones					
	G2: Δ^{14} -reductase and $\Delta^8 \rightarrow \Delta^7$ -isomerase in sterol biosynthesis (<i>erg24, erg2</i>)	amines ("morpholines") (SBI: Class II)	morpholines	aldimorph dodemorph fenpropimorph tridemorph	Decreased sensitivity for powdery mildews. Cross resistance within the group generally found but not to other SBI classes. Low to medium risk. See FRAC SBI Guidelines for resistance management.	5
			piperidines	fenpropidin piperalin		
			spiroketal-amines	spiroxamine		
	G3: 3-keto reductase, C4- de-methylation (<i>erg27</i>)	(SBI: Class III)	hydroxyanilides	fenhexamid	Low to medium risk. Resistance management required.	17
			amino-pyrazolinone	fenpyrazamine		
	G4: squalene-epoxidase in sterol biosynthesis (<i>erg1</i>)	(SBI class IV)	thiocarbamates	pyributicarb	Resistance not known, fungicidal and herbicidal activity	18
			allylamines	naftifine terbinafine	Medical fungicides only	

MOA	TARGET SITE AND CODE	GROUP NAME	CHEMICAL GROUP	COMMON NAME	COMMENTS	FRAC CODE
H: cell wall biosynthesis	H3:	Formerly glucopyranosyl antibiotic (validamycin)				26
	H4: chitin synthase	polyoxins	peptidyl pyrimidine nucleoside	polyoxin	Resistance known. Medium risk. Resistance management required	19
	H5: cellulose synthase	CAA-fungicides (Carboxylic Acid Amides)	cinnamic acid amides	dimethomorph flumorph pyrimorph	Resistance known in <i>Plasmopara viticola</i> but not in <i>Phytophthora infestans</i> . Cross resistance between all members of the CAA group. Low to medium risk. See FRAC CAA Guidelines for resistance management	40
			valinamide carbamates	benthiavali carb iprovali carb valifenalate		
mandelic acid amides	mandipropamid					
I: melanin synthesis in cell wall	I1: reductase in melanin biosynthesis	MBI-R (Melanin Biosynthesis Inhibitors – Reductase)	isobenzofuranone	fthalide	Resistance not known	16.1
			pyrrolo-quinolinone	pyroquilon		
			triazolobenzothiazole	tricyclazole		
	I2: dehydratase in melanin biosynthesis	MBI-D (Melanin Biosynthesis Inhibitors – Dehydratase)	cyclopropane-carboxamide	carpropamid	Resistance known. Medium risk. Resistance management required	16.2
			carboxamide	diclocymet		
			propionamide	fenoxanil		
I3: polyketide synthase in melanin biosynthesis	MBI-P (Melanin Biosynthesis Inhibitors – Polyketide synthase)	trifluoroethyl-carbamate	tolprocarb	Resistance not known	16.3	
P: host plant defence induction	P1: salicylic acid pathway	benzothiazole BTH	benzo-thiadiazole BTH	acibenzolar-S-methyl	Resistance not known	P 1
	P2	benzothiazole	benzothiazole	probenazole (also antibacterial and antifungal activity)	Resistance not known	P 2
	P3	thiadiazole-carboxamide	thiadiazole-carboxamide	tiadinil isotianil	Resistance not known	P 3
	P4	natural compound	polysaccharides	laminarin	Resistance not known	P 4
	P5	plant extract	complex mixture, ethanol extract	extract from <i>Reynoutria sachalinensis</i> (giant knotweed)	Resistance not known	P 5

MOA	TARGET SITE AND CODE	GROUP NAME	CHEMICAL GROUP	COMMON NAME	COMMENTS	FRAC CODE
Unknown mode of action (U numbers not appearing in the list derive from reclassified fungicides)	unknown	cianoacetamide-oxime	cianoacetamide-oxime	cymoxanil	Resistance claims described. Low to medium risk. Resistance management required.	27
	unknown	phosphonates	ethyl phosphonates	fosetyl-Al	Few resistance cases reported in few pathogens. Low risk	33
				phosphorous acid and salts		
	unknown	phthalamic acids	phthalamic acids	teclofthalam (Bactericide)	Resistance not known	34
	unknown	benzotriazines	benzotriazines	triazoxide	Resistance not known	35
	unknown	benzene-sulfonamides	benzene-sulphonamides	flusulfamide	Resistance not known	36
	unknown	pyridazinones	pyridazinones	diclomezine	Resistance not known	37
	unknown	thiocarbamate	thiocarbamate	methasulfocarb	Resistance not known	42
	unknown	phenyl-acetamide	phenyl-acetamide	cyflufenamid	Resistance in <i>Sphaerotheca</i> . Resistance management required	U 6
	actin disruption (proposed)	aryl-phenyl-ketone	benzophenone	metrafenone	Less sensitive isolates detected in wheat powdery mildew. Medium risk. Resistance management required.	U 8
			benzoylpyridine	pyriofenone		
	cell membrane disruption (proposed)	guanidines	guanidines	dodine	Resistance known in <i>Venturia inaequalis</i> . Low to medium risk. Resistance management recommended.	U 12
	unknown	thiazolidine	cyano-methylene-thiazolidines	flutianil	Resistance not known	U 13
	unknown	pyrimidinone-hydrazones	pyrimidinone-hydrazones	ferimzone	Resistance not known Reclassified from C5 in 2012	U 14
	oxysterol binding protein (OSBP) inhibition (proposed)	piperidinyl-thiazole-isoxazolines	piperidinyl-thiazole-isoxazolines	oxathiapirolin	Resistance risk assumed to be medium to high (single site inhibitor). Resistance management required.	U 15
complex III: cytochrome bc1, unknown binding site (proposed)	4-quinolyl-acetate	4-quinolyl-acetates	tebufloquin	Not cross resistant to QoI. Resistance risk unknown but assumed to be medium. Resistance management required.	U 16	
Unknown	tetrazolyloxime	tetrazolyloximes	picarbutrazox	Resistance not known. Not cross resistant to PA, QoI, CAA	U 17	
Unknown (Inhibition of trehalase)	glucopyranosyl antibiotic	glucopyranosyl antibiotics	validamycin	Resistance not known. Induction of host plant defense by trehalose proposed	U 18	

MOA	TARGET SITE AND CODE	GROUP NAME	CHEMICAL GROUP	COMMON NAME	COMMENTS	FRAC CODE
not classified	unknown	diverse	diverse	mineral oils, organic oils, potassium bicarbonate, material of biological origin	Resistance not known	NC
Multi-site contact activity	multi-site contact activity	inorganic	inorganic	copper (different salts)	Generally considered as a low risk group without any signs of resistance developing to the fungicides	M 1
		inorganic	inorganic	sulphur		M 2
		dithiocarbamates and relatives	dithio-carbamates and relatives	ferbam mancozeb maneb metiram propineb thiram zinc thiazole zineb ziram		M 3
		phthalimides	phthalimides	captan captafol folpet		M 4
		chloronitriles (phthalonitriles)	chloronitriles (phthalonitriles)	chlorothalonil		M 5
		sulfamides	sulfamides	dichlofluanid tolylfluanid		M 6
		bis-guanidines	bis-guanidines	guazatine iminocadine		M 7
		triazines	triazines	anilazine		M 8
		quinones (anthraquinones)	quinones (anthra-quinones)	dithianon		M 9
		quinoxalines	quinoxalines	chinomethionat / quinomethionate		M 10
		maleimide	maleimide	fluoroimide		M 11
		polypeptide (from plant extract)	polypeptide (lectin)	extract from the cotyledons of lupine plantlets ("BLAD")	multiple effects on cell wall, ion membrane transporters; chelating effects	M12

Tables:

Alfalfa - Clover - Small-seeded Legumes Seed Treatment

Chemical	Application	Dosage ¹	Disease Control ²		Remarks
			Seedling Blight ³		
Mefenoxam (4) Apron XL, 33.3 %	Slurry	0.64 fl oz/cwt	X		For control of <i>Pythium</i> damping off and early season <i>Phytophthora</i> only.
Metalaxyl (4) Allegiance FL, 28.35% Dyna-Shield, 28.35% Sebring 318 FS, 28.35%	Slurry or mist	0.75 fl oz/cwt	X		For control of <i>Pythium</i> damping off and early season <i>Phytophthora</i> only.
Allegiance Dry Seed Protectant, 12.5%	Drill box	4 oz/cwt	X		
Belmont 2.7 FS, 28.98%	Slurry or mist	0.75-1.5 oz/cwt	X		
Thiram (M3) 42-S Thiram, 42% Signet 480 FS, 42%	Liquid or slurry	8 fl oz/cwt	X		For small-seeded legumes.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Alfalfa - Clover - Small-seeded Legumes Foliar Sprays

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³			Remarks
			Leaf Rust	White Mold	Spring Black Stem	
Bacillus subtilis strain QST 713 (44) Serenade ASO, 1.34%	Spray or fungigation	2-6 qt/A	X	X		Begin application when environmental conditions and plant stage are conducive to disease development.
Pyraclostrobin (11) Headline, 23.6% Headline SC, 23.3%	Spray or fungigation	6-9 fl oz/A	X		X	For use in alfalfa. PHI is 14 days.
Pyraclostrobin (11) + Fluxapyroxad (7) Priaxor 28.58%; 14.33%	Spray or fungigation	4-6.9 fl oz/A	X		X	Begin applications prior to onset of disease. Do not apply within 14 days of grazing or harvest. Do not use on rangeland. Do not apply more than 20.7 fl oz/A per year.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

Barley-Oat-Rye-Wheat Seed Treatment

Chemical (Fungicide Group)	Appl.	Dosage ¹	Disease Control ²				Remarks
			Covered Smut	Loose Smut	Seedling ³ Blight	Common Root Rot	
Azoxystrobin (11) Dynasty, 9.6%	Slurry	0.153-0.382 fl oz/cwt			X		For wheat and barley. Also controls dwarf bunt and common bunt. Use with Dividend Extreme.
Carboxin (7) Vitavax-34, 34%	Slurry or mist	2-3 fl oz/cwt	X	X	X		Do not graze or feed livestock on treated areas for 6 weeks after planting.
Carboxin (7) + Ipconazole (3) Rancona V 100 Pro 35.52%; 2.22%	Slurry or mist	0.9-1.5 fl oz/cwt	X	X	X	X	For control of seed-borne and soil-borne fungi.
Carboxin (7) + Thiram (M3) Vitaflo-280 15.59%; 13.25%	Slurry or mist	3.5-5 fl oz/cwt	X	X	X		Use high rate for control of loose smut. Do not graze or feed livestock on treated areas for 6 weeks after planting.
Clothianidin + Metalaxyl (4) + Metconazole (3) Nipsit SUITE Cereals OF 2.93% : 0.88% : 0.44%	Ready to apply	5-7.5 fl oz/cwt	X	X	X	X	For control of seed and soil-borne fungi and insects. Can be used with chemical, slurry, or mist-type seed treating equipment
Difenoconazole (3) + Mefenoxam (4) cont Dividend Extreme 7.73%: 1.87%	Slurry	1 fl oz/cwt common bunt, loose smut, <i>Fusarium</i> seed scab	X(bunt)	X	X		For spring wheat and barley. See label for winter wheat recommendations.
		2 fl oz/cwt as above, plus seed-borne <i>Septoria</i> , <i>Penicillium</i> and <i>Aspergillus</i> seed rots, <i>Pythium</i> damping off, early season common root rot (<i>Cochliobolus</i>) and <i>Rhizoctonia</i> root rot	X(bunt)	X	X	X	Registered on barley to suppress root rots and covered smut, and control seedling blight, at a rate of 2-4 fl oz/cwt.
		4 fl oz/cwt as above, plus flag smut, early season take-all root rot	X (bunt)	X	X	X	

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to fungal infections of the seed such as black point and scab.

Barley-Oat-Rye-Wheat Seed Treatment (continued)

Chemical (Fungicide Group)	Appl.	Dosage ¹	Disease Control ²				Remarks
			Covered Smut	Loose Smut	Seedling ³ Blight	Common Root Rot	
Ethaboxam (22) Intego Solo, 34.2%	Slurry or mist	0.20-0.26 fl oz/cwt			X		For control of <i>Pythium</i> .
Fludioxonil (12) Maxim 4FS, 40.3%	Slurry	0.08-0.16 fl oz/cwt			X		For control of seed-borne and soil-borne fungi that cause seed decay, damping off and seedling blight. Cereal forage may be grazed 30 days after planting.
Spirato 480 FS	Slurry	0.08-0.16 fl oz/cwt			X		
Dyna-Shield Fludioxonil	Slurry	0.08-0.16 fl oz/cwt			X		
Ipconazole (3) Rancona 3.8 FS, 40.7%	Mist or slurry	0.051-0.085 fl oz/cwt	X	X	X	X	Does not control <i>Pythium</i> .
Rancona Apex, 0.44%	Mist or slurry	5.0-8.73 fl oz/cwt	X	X	X	X	
Ipconazole (3) + Metalaxyl (4) Rancona Pinnacle, 0.434%:0.57%	Mist or slurry	5.0-8.33 fl oz/cwt	X	X	X	X	Contains metalaxyl for <i>Pythium</i> control.
Ipconazole (3) + Metalaxyl (4) + Imidicloprid Warden Cereals HR, 0.421%: 0.562%: 14.1%	Mist or Slurry	5.0 – 8.33 fl oz/cwt	X	X	X	X	For protection against seedling diseases and seed rot fungi, smuts, bunts, and some insects
Rancona Crest WR, 0.439%: 0.585%: 2.95%	Mist or slurry	5.0 – 8.33 fl oz/cwt	X	X	X	X	
Rancona Crest, 0.421%: 0.562%: 14.1%	Mist or slurry	5.0 – 8.33 fl oz/cwt	X	X	X	X	

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to fungal infections of the seed such as black point and scab.

Barley-Oat-Rye-Wheat Seed Treatment (continued)

Chemical (Fungicide Group)	Appl.	Dosage ¹	Disease Control ²				Remarks
			Covered Smut	Loose Smut	Seedling ³ Blight	Common Root Rot	
Mefenoxam (4) Apron XL, 33.3%	Mist or slurry	0.32-0.64 fl oz/cwt			X		For <i>Pythium</i> damping off control. See label for Dividend-Apron XL- LS combination.
Metalaxyl (4) Allegiance FL, 28.35% Sebring 318 FS, 28.35% Dyna-Shield, 28.35% Belmont 2.7 FS, 28.98%	Mist or slurry Slurry Slurry or mist	0.375-0.75 fl oz/cwt 0.75 fl oz/cwt 0.75 fl oz/cwt			X X X		For control of <i>Pythium</i> damping off only.
Metalaxyl (4) + Metconazole (3) Metlock CT, 4.51%: 2.25%	Mist or slurry	1.0-1.5 fl oz/cwt	X	X	X	X	For control of seed- borne and soil-borne diseases.
Metconazole (3) Metlock 40%	Mist or Slurry	0.045 – 0.09 fl oz/cwt	X	X	X	X	For control of seed- borne and soil-borne diseases.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to fungal infections of the seed such as black point and scab.

Barley-Oat-Rye-Wheat Seed Treatment (continued)

Chemical (Fungicide Group)	Appl.	Dosage ¹	Disease Control ²				Remarks
			Covered Smut	Loose Smut	Seedling ³ Blight	Common Root Rot	
PCNB (Terraclor) (14) PCNB Seed Coat, 24%	Slurry	2-4 oz/bu barley, oats 2 oz/bu wheat	X		X		Not registered for rye.
Pyraclostrobin (11) Stamina, 18.4%	Slurry or mist	0.4-0.8 fl oz/cwt			X		Registered for wheat, barley and rye.
Pyraclostrobin (11) + Triticonazole (3) +Metalaxyl (4) Stamina F ³ Cereals 1.59%:1.59%:0.93%	Liquid or Slurry	4.6 oz/cwt	X	X	X	X	For commercial and on- farm use. Registered for barley, oats, rye, triticale, and wheat.
Sedaxane (7) Vibrance 43.7%	Slurry	0.08-0.16 fl oz/cwt	X	X	X	X	For certain seed and seedling blight or damping off caused by certain seed and soil-borne pathogens, and certain smut diseases.
Thiram (M3) 42-S Thiram, 42% Signet 480 FS, 42% Thiram 480 DP, 42%		2 fl oz/bu			X		Not registered for oats.
Prothioconazole (3) + Penflufen (7) + Metalaxyl (4) EverGol Energy 7.18%: 3.59%: 5.74%	Slurry or mist	1 fl oz/cwt	X	X	X	X	Registered for barley, triticale, wheat, oats, rye and millet.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to fungal infections of the seed such as black point and scab.

Barley-Oat-Rye-Wheat Seed Treatment (continued)

Chemical (Fungicide Group)	Appl.	Dosage ¹	Disease Control ²				Remarks
			Covered Smut	Loose Smut	Seedling ³ Blight	Common Root Rot	
Tebuconazole (3) + Metalaxyl (4) Sativa M RTU, 0.48%:0.64% Sativa IM RTU 0.46%:0.615% Sativa IM Max 0.46%:0.615% Foothold 0.499%:0.668% Foothold Extra 0.455%:0.67%	Slurry or mist	3.4–5 fl oz/cwt	X	X	X	X	Not registered for rye. Do not graze barley, wheat or oat green forage for 31, 31 and 51 days, respectively.
	Slurry or mist	5-6.5 fl oz/cwt	X	X	X	X	Sativa IM Max also contains 11.4% imidacloprid for insect control.
	Slurry or mist	3.4-5.0 fl oz/cwt oz/cwt	X	X	X	X	Not registered for rye.
	Slurry or mist	5.0-6.5 fl oz/cwt	X	X	X	X	Not registered for rye. Foothold Extra also contains 11.4% imidacloprid for insect control.
Tebuconazole (3) + Metalaxyl (4) + Fludioxonil (12) Sativa IMF Max, 0.45%; 0.6%; 0.36%	Slurry or mist	3.4-5.0 fl oz/cwt	X	X	X	X	Not registered for oat and rye. Do not graze for 45 days. Sativa IMF Max also contains 11.2% imidacloprid for insect control
Sedaxane (7) + Difenconazole (3) +Mefenoxam (4) + Thiamethoxam Cruiser Maxx Vibrance Cereals 0.72%: 3.34%: 0.86%: 2.78%	Slurry	5 – 10 fl oz	X	X	X	X	For control of seed-borne and seed diseases of cereals and insects.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to fungal infections of the seed such as black point and scab

Barley-Oat-Rye-Wheat Seed Treatment (continued)

Chemical (Fungicide Group)	Appl.	Dosage ¹	Disease Control ²				Remarks
			Covered Smut	Loose Smut	Seedling ³ Blight	Common Root Rot	
Sedaxane (7) + Difenoconazole (3)+ Mefenoxam (4) Vibrance Extreme 1.22%; 5.86%; 1.46%	Slurry	2.8 – 5.6 fl oz/cwt	X	X	X	X	For control of seed-borne, soil borne, and early season diseases
Sedaxane (7) + Difenoconazole (3) + Mefenoxam (4) + Fludioxonil (12) + Thiamethoxam Warden Cereals WR11 1.44%; 3.45%; 0.86%; 0.72%; 5.75%	Slurry	5.0 fl oz/cwt	X	X	X	X	Ready to apply formulation for commercial or on-farm applications. For control of seed and soil-borne diseases of cereals. Insecticide thiamethoxam for wireworm control.
Prothioconazole (3) + Tebuconazole (3) + Metalaxyl (4) Raxil Pro MD, 1.47%; 0.29%; 0.59%	Slurry or mist	5-7.5 fl oz/cwt	X	X	X	X	Registered for use on wheat, barley, triticale, and oats.
Tebuconazole (3) + Metalaxyl (4) + Fludioxonil (12) + Imidacloprid Foothold Virock, 0.45%; 0.60%; 0.36%; 11.16%	Slurry	3.4-5 fl oz/cwt	X	X	X	X	Not registered for rye or oats.

¹Dosage = amount of formulated product to apply.

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³Seedling blights due to fungal infections of the seed such as black point and scab.

Barley-Oat-Rye-Wheat Seed Treatment (continued)

Chemical (Fungicide Group)	Appl.	Dosage ¹	Disease Control ²				Remarks
			Covered Smut	Loose Smut	Seedling ³ Blight	Common Root Rot	
Thiabendazole (1) Mertect 340-F, 42.3%	Slurry	1.3 fl oz/cwt for seed-borne common bunt, 2.6 fl oz/cwt for soil-borne common bunt 0.17 fl oz/cwt for Fusarium seed scab 1.95-3.9 fl oz/cwt for seedling diseases	X (bunt)		X		For spring wheat and winter wheat. Also, controls dwarf bunt in winter wheat.
Triticonazole (3) Charter, 2.4%	Concentrated product	3.1 fl oz/cwt	X	X	X	X	Apply with water in a 2:1 ratio of water: Charter. Registered for wheat and barley. Suppression of root rot.
Triticonazole (3) + Metalaxyl (4) Charter F2 1.32%:0.79%	RTA	5.4 fl oz/cwt	X	X	X	X	Registered for wheat and barley.
Triticonazole (3) + Thiram (M3) Charter PB 1:25%:12.5%	Ready to apply	5.5 fl oz/cwt	X	X	X	X	Charter PB can be used as a ready-to-apply product or in a slurry with water. Registered for wheat and barley only.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to fungal infections of the seed such as black point and scab.

Barley-Oat-Rye-Wheat Foliar Sprays

Chemical (Fungicide Group)	Applicati on ¹	Dosage ²	Disease Control ³					Remarks	
			Leaf ⁴ Spot	Leaf Rust	Stem Rust	Powdery Mildew	Fusarium Head Blight		
Bacillus pumilus strain QST 2808 (44) Sonata, 1.38%	Spray or fungigatio n	1-4 qt/A	X	X			X		Begin applications when environmental conditions and plant stage are conducive to disease development.
Copper (M1) Champ DP, 57.6%	Spray or fungigatio n	1-1.33 lb/A	X						Most not registered on rye, unless otherwise noted. Make first application at early heading and follow with second spray 10 days later. Kocide 3000 and ChampION++ can be applied as a foliar application for early season disease control and again at early heading and followed with another application 10 days later. Make a foliar application for early season disease control and again at early heading and followed with another application 10 days later. Labeled for rye. Labeled for rye.
Champ WG 77%		1.5-2 lb/A	X						
Champ Formula 2, Flowable, 37.5%		1-1.33 pt/A	X						
ChampION++ 46.1%		0.5-0.75 lb/A	X						
Cuprofix Ultra 40 Disperss 71.1%		1-1.25 lb/A	X						
Kocide 2000, DF 53.8%		1.25-1.5 lb/A	X						
Kocide 3000, DF 46.1%		0.5-0.75 lb	X						
Kocide 4.5 LF, 37.5%		1-1.33 pt/A	X						
MasterCop, 21.46%		0.5-1.5 pt/A	X						
Badge SC 32.17%		0.5-1.8 pt/ A	X						
Badge X2 45.31%	0.5-1.8 lb/A	X							

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Leaf spot includes fungal leaf diseases such as tan spot, Septoria blotch and spot blotch on wheat, and spot blotch and net blot on barley.

Barley-Oat-Rye-Wheat Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³					Remarks ⁵
			Leaf Spot ⁴	Leaf Rust	Stem Rust	Powdery Mildew	Fusarium Head Blight	
Mancozeb (M3) Dithane DF Rainshield NT, 75%	Spray or fungigation	2.1 lb/A	X	X				Do not make more than 3 applications of mancozeb. Do not apply mancozeb within 26 days of harvest. Do not graze livestock in treated areas prior to harvest. Addition of spreader/sticker will improve performance. 0.75 to 1-quart rate of Dithane F-45 or 1 lb rate Dithane DF Rainshield NT is for application at the tillering stage to barley and wheat in North Dakota, South Dakota and Minnesota; this is covered by a Section 2 (ee) label. Penncozeb labels state control of <i>Fusarium</i> head blight as well.
Dithane F-45, 37%	Spray or fungigation	1.6 qt/A	X	X				
Dithane M-45, 80%	Spray or fungigation	2 lb/A	X	X				
Dithane WSP, 80%	Spray or fungigation	2 lb/A	X	X				
Koverall, 75%	Spray or fungigation	2 lb/A	X	X				
Manzate Flowable, 37%	Spray or fungigation	1.6 qt/A	X	X				
Manzate ProStick, 75%	Spray or fungigation	2 lb/A	X	X				
Penncozeb, 80 WP, 80%	Spray or fungigation	1-2 lb/A	X	X				
Penncozeb 75 DF, 75%	Spray or fungigation	1-2 lb/A	X	X				
Roper DF Rainshield, 75%	Spray or fungigation	2.0-lb/A	X	X				
Mancozeb (M3) + Copper (M1) ManKocide, 15% + 46.1%	Spray or fungigation	2-2.5 lbs/A	X					Not registered for rye. Apply at early heading and follow with second spray 10 days later. Do not apply within 26 days of harvest. Use higher rates when conditions favor disease. Do not graze livestock in treated areas prior to harvest.
SDHI Penthiopyrad (7) Vertisan, 20.6%	Spray or fungigation	10-24 fl oz/A	X	X	X	X (suppres sion)		Apply prior to disease development. Optimal timing is to apply at Feekes 9 (flag leaf). Do not apply more than 48 fl oz/A per season. Do not apply after Feekes 10.51 (flowering).

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Leaf spot includes fungal leaf diseases such as tan spot, Septoria blotch and spot blotch on wheat, and spot blotch and net blot on barley.

⁵See fungicide resistance management statements on Pages 7-8.

Barley-Oat-Rye-Wheat Foliar Sprays (continued)

Chemical (Fungicide Group)	Applicatio n ¹	Dosage ²	Disease Control ³					Remarks ⁵
			Leaf Spot ⁴	Leaf Rust	Stem Rust	Powdery Mildew	Fusarium Head Blight	
Benzovindiflupyr (7) Trivapro A 10.27%	Spray or fungigation	4 fl oz/A	X	X	X	X		Combining Trivapro A and Trivapro B = Trivapro co-pack. Apply prior to disease development. Apply in spring for early disease control through Feekes 10.54. Do not apply more than 14 fl oz/A of Trivapro A per year.
Triazoles Cyproconazole (3) Alto, 8.9%	Spray or fungigation	1.5-5.5 fl oz/A	X	X	X	X		For wheat and Trtitalce only. Low rate for early season leaf spot suppression. For 3.0 or 5.5 fl. oz rate, apply between Feekes 8 and 10.51. PHI = 30 days.
Flutriafol (3) Topguard 11.8%	Spray or fungigation	10-14 fl oz/A	X	X	X	X		Registered for use on wheat (spring and winter) only. Do not exceed 2 applications or 28 fl oz/year. PHI = 30 days.
Metconazole (3) Caramba, 8.6%	Spray or fungigation	10-17 fl oz/A	X	X	X	X	X	Maximum of 2 applications per season. Apply 13.5-17 fl oz at early flowering for Fusarium head blight in wheat. Apply to barley for Fusarium head blight when plants are fully headed. Maximum rate per season 34 fl oz; 30-day preharvest interval.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Leaf spot includes fungal leaf diseases such as tan spot, Septoria blotch and spot blotch on wheat, and spot blotch and net blot on barley.

⁵See fungicide resistance management statements on Pages 7-8.

Barley-Oat-Rye-Wheat Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³					Remarks ⁵
			Leaf Spot	Leaf Rust	Stem Rust	Powdery Mildew	Fusarium Head Blight	
Propiconazole (3) Tilt 3.6EC, 41.8%	Spray or fungigation	2-4 fl oz/A	X	X	X	X	X	A 2-4 fl oz/A application for early season leaf disease control. May be applied to wheat until Feekes 10.5. Do not apply more than 8 fl oz per season. Do not apply after Feekes 10.54.
Fitness, 41.8%	Spray or fungigation	2.4 fl oz/A	X	X	X	X	X	
PropiMax EC, 41.8%	Spray or fungigation	2-4 fl oz/A	X	X	X	X	X	
Topaz 41.8%	Spray or fungigation	2-4 fl oz/A	X	X	X	X	X	
Bumper 41.8 EC 41.8%	Spray or fungigation	2-4 fl oz	X	X	X	X	X	
Bumper ES, 40.85%	Spray or fungigation	2-4 fl oz/A	X	X	X	X	X	
Propiconazole E-AG, 41.8%	Spray	2-4 fl oz/A	X	X	X	X	X	
Propicure, 41.8%	Spray or fungigation	2-4 fl oz/A	X	X	X	X	X	
Prothioconazole (3) Proline 480 SC, 41%	Spray	4.3-5.7 fl oz/A	X	X	X	X	X	Registered for use in wheat (including durum), barley, oat and rye. Apply for <i>Fusarium</i> head blight (scab) when the main stems of barley plants are fully headed or when 15% of the main-stem plants of wheat have started flowering. Do not make more than 2 applications of Proline per year. For maximum disease control, tank mix with the lowest rate of a nonionic surfactant and then apply in 15-20 gpa by ground or 5 gpa by air. Do not apply within 32 days of barley harvest or 30 days of wheat harvest.
Tebuconazole (3), 38.7% Monsoon, Muscle, Onset, Orius 3.6F, Tebucon, Tebucure, Tebustar, Tebuzol, and Toledo	Spray	4 fl oz/A		X	X		X	For wheat and barley for suppression of <i>Fusarium</i> head blight (scab) and rust control. Do not apply more than 4 fl oz per year. Do not apply within 30 days of harvest.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Leaf spot includes fungal leaf diseases such as tan spot, Septoria blotch and spot blotch on wheat, and spot blotch and net blot on barley.

⁵See fungicide resistance management statements on Pages 7-8.

Barley-Oat-Rye-Wheat Foliar Sprays (continued)

Chemical (Fungicide Group)	Applica- tion ¹	Dosage ²	Disease Control ³					Remarks
			Leaf Spot ⁴	Leaf Rust	Stem Rust	Powdery Mildew	Fusarium Head Blight	
Prothioconazole + Tebuconazole (3) Prosaro 421 SC, 19.0%:19.0%	Spray	6.5-8.2 fl oz/A	X	X	X	X	X	Registered for wheat (including durum) and barley. Prosaro has a 30-day PHI. Apply Prosaro for Fusarium head blight (scab) when the main stems of barley plants are fully headed or when 15% of the main stem plants of wheat have started flowering. Do not apply more than 8.2 oz of Prosaro per year.
Qols Azoxystrobin (11) Quadris, 22.9% Satori, 22.9% Equation, 22.9% Tetraban, 22.9%	Spray or fungigation	6.0-12.0 fl oz/A (12.0 fl oz/A, powdery mildew)	X	X	X	X		Resistance statement 5 ⁵ Wheat and barley. Registered for application up to Feekes 10.54. PHI = 45 days for wheat.
Pyraclostrobin (11) Headline EC, 23.6% Headline SC, 23.3%	Spray or fungigation	6-9 fl oz/A	X	X	X	X		Apply no later than 50% head emergence for barley and rye. A sec. 2 (ee) allows early application at 3 fl oz/A on wheat and barley. Registered for up to full head emergence (Feekes 10.5) for wheat. No more than 2 applications per season. Apply prior to disease onset.
Fluoxastrobin (11) Evito 480SC, 40.3%	Spray or fungigation	2.0-4 fl oz/A	X	X	X	X		Do not apply more than 11.4 fl oz/yr. Begin applications preventively and continue as needed on a 14- to 21-day interval. Apply from Feekes 5 up to late head emergence (Feekes 10.5).
Picoxystrobin (11) Approach, 22.5%	Spray or fungigation	3.0-6.0 fl oz/A	X	X	X	X		Early season application at 3-4 fl oz/A can be made for early season leaf disease control. Apply no later than Feekes 10.5. Do not apply more than 36 fl oz/A per season. PHI = 45 days for wheat, 7 days for forage, and 14 days for hay.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Leaf spot includes fungal leaf diseases such as tan spot, Septoria blotch and spot blotch on wheat, and spot blotch and net blot on barley.

⁵See fungicide resistance management statements on Pages 7-8.

Barley-Oat-Rye-Wheat Foliar Sprays (continued)

Chemical (Fungicide Group)	Applica- tion ¹	Dosage ²	Disease Control ³					Remarks ⁵
			Leaf Spot ⁴	Leaf Rust	Stem Rust	Powdery Mildew	Fusarium Head Blight	
QoI + SDHI Fluxapyroxad (7) + Pyraclostrobin (11) Priaxor 14.33%: 28.58%	Spray or fungigation	4-8 fl oz/A	X	X	X	X		Resistant statement 5 ⁵ & 6 ⁵ For barley and oats. Apply later than 50% head emergence (Feekes 10.3). For wheat, rye and triticale, apply no later than beginning of flowering
QoIs + Triazoles Trifloxystrobin (11) + Propiconazole (3) Stratego 11.4%:11.4%	Spray or fungigation	10 fl oz/A (wheat) 7 fl oz/A (barley, oat)	X	X	X	X		Resistance statement 5 ⁵ & 3 ⁵ . Stratego not registered for rye. Apply Stratego at 4-7 fl oz/A in barley and 4-10 fl oz/A in wheat for early season diseases. Do not apply Stratego after Feekes stage 8 (emergence of flag leaf ligule) in barley or 10.5 (full head emergence) in wheat. Do not exceed 2 applications of Stratego or 20 fl oz/season. PHI = 32 days in wheat, 40 days in barley.
Pyraclostrobin (11) + Metconazole (3) Twinline 12.0%:7.4%	Spray or fungigation	7-9 fl oz/A	X	X	X	X		Apply Twinline immediately after flag leaf emergence and before flowering. Apply prior to disease development to ensure maximum disease protection PHI = 30 days.
Picoxystrobin (11) + Cyproconazole (3) Aproach Prima, 17.94%: 7.17%	Spray or fungigation	3.4-6.8 fl oz/A	X	X	X	X		Apply at 3.4 fl oz/A for early season disease suppression. For optimal results, apply at Feekes 9 (flag leaf). Do not exceed 6.8 fl oz/A per season and no more than 2 sequential applications of a picoxystrobin containing product. PHI = 45 days for cereals, 21 days for forage or hay.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Leaf spot includes fungal leaf diseases such as tan spot, Septoria blotch and spot blotch on wheat, and spot blotch and net blot on barley.

⁵See fungicide resistance management statements on Pages 7-8.

Barley-Oat-Rye-Wheat Foliar Sprays (continued)

Chemical (Fungicide Group)	Applica- tion ¹	Dosage ²	Disease Control ³					Remarks ⁵
			Leaf Spot ⁴	Leaf Rust	Stem Rust	Powdery Mildew	Fusarium Head Blight	
Azoxystrobin (11) + Propiconazole (3) Quilt 7.0%: 11.7%	Spray or fungigation	7-14 fl oz/A	X	X	X	X		For wheat, barley and triticale. May be tank mixed with Axial and Discover herbicides. Quilt or Quilt Xcel also can be applied at 7 fl oz/A for early season disease control. Quilt is Registered for application up to Feekes 10.54. Quilt Xcel may be applied through full head emergence (Feekes 10.5) for wheat; 45 days PHI for barley and triticale and 7-day PHI for forage or hay. Trivapro A + Trivapro B = Trivapro co-pack. Apply in spring for early disease control through Feekes 10.54. Do not apply more than 28 fl oz/A of Trivapro B per year. Do not apply after Feekes 10.54
Quilt Xcel 13.5%:11.7%	Spray or fungigation	7-14 fl oz/A	X	X	X	X		
Trivapro B 13.5%, 11.7%	Spray or fungigation	10.5 fl oz/A	X	X	X	X		
Azoxystrobin (11) + Tebuconazole (3) Custodia, 11.0%; 18.35%	Spray or fungigation	6.4-8.6 fl oz/A	X	X	X	X		For wheat and barley. Apply prior to disease development up to late head emergence. Do not exceed 8.6 fl oz/A per season. PHI = 45 days for wheat and barley, 14 days for forage or hay.
Azoxystrobin (11) + Cyproconazole (3) Azure Xtra, 18.2%; 7.3%	Spray or fungigation	3.5-6.8 fl oz/A	X	X	X	X		For wheat and triticale. Apply product at 3.5 oz/A in the spring at approximately Feekes Stage 5. Apply at 5-6.8 oz/A between Feekes stage 8-10.51. Do not apply more than 6.8 fl oz/A per season. PHI = 30 days for wheat. PHI = 21 days for forage and hay.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Leaf spot includes fungal leaf diseases such as tan spot, Septoria blotch and spot blotch on wheat, and spot blotch and net blot on barley.

⁵See fungicide resistance management statements on Pages 7-8.

Barley-Oat-Rye-Wheat Foliar Sprays (continued)

Chemical (Fungicide Group)	Applica- tion ¹	Dosage ²	Disease Control ³					Remarks ⁵
			Leaf Spot ⁴	Leaf Rust	Stem Rust	Powdery Mildew	Fusarium Head Blight	
Fluoxastrobin (11) + Flutriafol (3) Fortix, 14.84%; 19.3% Preemptor, 14.84%; 19.3%	Spray	2-6 fl oz/A	X	X	X	X		For wheat only. Apply prior to disease development and up to Feekes 10.5. Do not exceed 12 fl oz/A per season. PHI = 40 days for grain, 15 days for hay and 7 days for forage. Do not tank mix with any bromoxynil product.
Pyraclostrobin (11) + Fluxapyroxad (7) + Propiconazole (3) Nexicor 18.76%; 2.81%; 11.73%	Spray or fungigation	7-13 fl oz/A	X	X	X	X		Do not apply more than 26 fl oz/A per year. Do not make more than two sequential applications. PHI = 7 days for forage and hay in barley, oat, rye, wheat, and triticale.
Sulfur (M) Sulfur DF, 80%	Spray	6-15lb/A				X		Do not apply when temperatures are high (above 90 F). For powdery mildew only.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Leaf spot includes fungal leaf diseases such as tan spot, Septoria blotch and spot blotch on wheat, and spot blotch and net blot on barley.

⁵See fungicide resistance management statements on Pages 7-8.

Canola (Rapeseed) Seed Treatment

Chemical	Application	Dosage ¹	Disease Control ²		Remarks
			Seed-borne Blackleg	Seedling Diseases ³	
Azoxystrobin (11) Dynasty, 9.6%	Slurry	0.10-3.75 fl oz/cwt	X	X	Resistance statement 5. Seed-borne blackleg, seedling <i>Rhizoctonia</i> damping off, <i>Alternaria</i> seedling blight. Add Apron XL LS for <i>Pythium</i> spp.
Carboxin (7) + Ipconazole (3) Rancona V RS 6.78%; 0.73%	Slurry or mist	12.3 fl oz/cwt	X	X	For commercial seed treater use. Do not graze or feed livestock on treated areas for six weeks after planting.
Clothianidin+ Penflufen (7)+ Trifloxystrobin (11) + Metalaxyl (4) Prosper EverGol 22.32%: 0.82%: 0.55%: 0.55%	Slurry or mist	21.5 fl oz/cwt	X	X	Registered for commercial use as a seed treatment in canola only. Contains both fungicide and insecticide.
Difenoconazole (3) + Metalaxyl M (4) + Fludioxonil (12) + Thiamethoxam Helix Xtra 1.25%; 0.38%; 0.13%; 20.7%	RTA slurry	23 fl oz/cwt	X	X	Commercial use only. Contains both insecticide and fungicide. Contains higher concentration of insecticide - to be used for high flea beetle pressure.
Ethaboxam (22) Intego Solo, 34.2%	Slurry or mist	0.2-0.3 fl oz/cwt		X	For control of <i>Pythium</i> .
Fludioxonil (12) Maxim 4FS, 40.3%	Slurry	0.08-0.16 fl oz/cwt	X	X	For seed-borne and soil-borne fungi.
Spirato 480 FS	Slurry	0.08-0.16 fl oz/cwt	X	X	
Dyna-Shield Fludioxonil, 40.3%	Slurry	0.08-0.16 fl oz/cwt	X	X	
Metalaxyl (4) Allegiance FL, 28.35% Sebring 318 FS, 28.35% Belmont 2.7 FS, 28.89%	Mist or slurry	0.25-0.5 fl. oz/cwt	X	X	For <i>Pythium</i> damping off only .

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Canola (Rapeseed) Seed Treatment (continued)

Chemical	Application	Dosage ¹	Disease Control ²		Remarks
			Seed-borne Blackleg	Seedling Diseases ³	
Pyraclostrobin (11) Stamina, 18.4%	Slurry or mist	1.5-3.1 fl oz/cwt		X	Control of <i>Rhizoctonia solani</i> and suppression of <i>Fusarium</i> sp. and <i>Pythium</i> sp.
Sedaxane (7) Vibrance 43.7%%	Slurry	0.08-0.16 fl oz/cwt or 2.5-5 gal/100 kg seed		X	For seed decay, seedling blight and damping off caused by <i>Rhizoctonia solani</i> .
Sedaxane (7) + Difenoconazole (3) + Mefenoxam (4) + Fludioxonil (12) + Thiamethoxam Helix Vibrance, 0.26%; 1.25%; 0.40%; 0.13%; 20.7%	Slurry	23 fl oz/cwt	X	X	For use in commercial seed treatment facilities with closed transfer systems. For seed decay, seedling blight and damping off caused by <i>Pythium</i> , <i>Fusarium</i> , and <i>Rhizoctonia</i>
Thiram (M3) Thiram 480 DP 42%	Mist or Slurry	6.4 fl oz/cwt	X	X	For use against seed decay, damping-off and seedling blights.
Fluxapyroxad (7) + Pyraclostrobin (11) + Metalaxyl (4) Obvius, 1.58%; 1.58%; 1.26%	RTA Slurry	9.2 fl oz/cwt	X	X	Control of <i>Rhizoctonia solani</i> , <i>Fusarium</i> sp. and <i>Pythium</i> .

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Canola (Rapeseed) Soil Application

Organism	Application	Dosage ¹	White mold ² (<i>Sclerotinia sclerotiorum</i>)	Remarks
<i>Coniothyrium minitans</i> Contans WG, 5.3%	Soil incorporation	1-2 lb/A	X	Fungus attacks sclerotia of the fungus in the soil.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³See fungicide resistance management statements on Pages 7-8.

Canola Foliar Sprays

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³			Remarks
			Alternaria Black Spot	Black- leg	Sclerotinia Stem Rot (white mold)	
Azoxystrobin (11) Quadris, 22.9% Satori, 22.9% Equation, 22.9% Tetraban, 22.9%	Spray or fungigation	6.0-15.5 fl oz/A	X	X	X	Resistance statement 5 ⁴ <i>Alternaria</i> Black Spot alone: 8.0 fl oz/A at pod stage (95% petal fall) Blackleg: 6.2 fl oz/A at 2- to 4-leaf stage <i>Alternaria</i> Black Spot or <i>Sclerotinia</i> Stem rot: 9.2-15.4 fl oz/A at 10-25% flowering (3-7 days after first flower).
Azoxystrobin (11) + Benzovindiflupyr (7) Elatus, 30.0%; 15.0%	Spray or fungigation	7.3 fl oz/A	X	X		Resistance statement 5 ⁴ For blackleg, apply during rosette stage between 2 nd true leaf and bolting. For alternaria, make an application at the end of flowering. Do not apply more than 7.3 fl oz/A per year. PHI = 30 days.
<i>Bacillus subtilis</i> strain QST 2808 (44) Serenade ASO, 1.34%	Spray or fungigation	2-6 qt/A			X	Begin applications when environmental conditions and plant stage are conducive to disease development. For disease suppression.
Boscalid (7) Endura, 70%	Spray or fungigation	5-6 oz/A			X	Apply at 20-50% flowering prior to the onset of disease. Apply a second application if conditions continue to be favorable for disease development.
Fluxapyroxad (7) + Pyraclostrobin (11) Priaxor 14.33% + 28.58%	Spray or fungigation	4-8 fl oz/A	X	X	X	Resistant statement 5 ⁵ & 6 ⁵ . For blackspot, apply at early pod development, for blackleg apply at 2 to 4 leaf stage, for <i>sclerotinia</i> apply at 20% to 50% bloom, and a second application may be made 14 days later if weather conditions are favorable for disease development. Do not make more than two consecutive applications of priaxor or more than 16 oz per season.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Canola Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³			Remarks
			Alternaria Black Spot	Black- leg	Sclerotinia Stem Rot (white mold)	
Metconazole (3) Quash WDG, 50%	Wettable Granule	2-4 oz/A			X	Apply at 20-50% bloom, 10-20 gpa by ground, 5 gpa by air. 35-day PHI. Do not make more than 1 application or apply more than 4 fl oz/A.
Prothioconazole (3) Proline 480 SC, 41%	Spray	4.3-5.7 fl oz/A		X	X	A 2(ee) allows for application of Proline at 4.3-5.7 oz/A at 2-4 leaf stage for blackleg management. Use higher rate if field has history of severe disease or if susceptible variety grown. Apply at 20-50% flowering for white mold. Do not make more than 2 applications per year. For maximum disease control, apply in 15-20 gpa by ground or 5 gpa by air. Do not apply within 36 days of harvest.
Penthiopyrad (7) Vertisan, 20.6%	Spray or fungigation	14-20 fl oz/A	X		X	Begin applications prior to disease development. For white mold, make initial application at 20-50% bloom. Do not exceed 41 fl oz/A per year. PHI = 21 days.
Picoxystrobin (11) Approach, 22.5%	Spray	6-12 fl oz/A	X	X	X	For white mold, apply at 20-50% bloom at 8-12 fl oz/A. Do not apply more than 24 fl oz/A per season. PHI = 28 days.
Pyraclostrobin (11) Headline EC, 23.6% Headline SC, 23.3%	Spray	6-12 fl oz/A	X	X	X	Resistance statement 5 ⁴ . For blackleg control, apply at 2- to 4-leaf stage. For black spot control, apply at early pod development. A second application 7-10 days later may be made if disease persists or weather is favorable for disease.
Pythium oligandrum DV 74 Polyversum (44) 1.0%	Spray or fungigation	1.5-3 fl oz			X	Research at NDSU showed efficacy against white mold when applied at 1.5 fl oz, 30 days before flowering and at 3 fl oz at flowering. Do not mix with chemical fungicides.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8

Canola Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³			Remarks
			Alternaria Black Spot	Black- leg	Sclerotinia Stem Rot (white mold)	
Thiophanate Methyl (1) Topsin M WSB, T-Methyl 70 W WSB, 70% Cercobin	Spray or fungigation	1-2 lb/A			X	Resistance statement ¹⁴ Apply 1-2 lb once at 20-50% flowering, or apply 1 lb twice with the first application at 20-30% flowering and the second application at 40-50% flowering. Do not apply more than 2 lbs product/acre/season.
Thiophanate Methyl, WDG 85%	Spray or fungigation	0.8-1.6 lb/A			X	Apply 0.8-1.6 lb once at 20-50% flowering, or apply 0.8 lb twice, with the first application at 20-30% flowering and the second application at 40-50% flowering. Do not apply more than 1.6 lbs product/acre/season.
T-Methyl E-AG 4.5F	Spray or fungigation	20-40 fl oz/A			X	See label for specific application timings. Do not apply more than 40 fl oz of T-Methyl E-AG per acre per season.
Fluopyram (7) + Prothioconazole (3) Propulse 17.4%; 17.4%	Spray or fungigation	13.6 fl oz/A	X		X	For optimum disease control apply at early flowering. Do not apply more than 27.2 fl oz/A per year. Do not apply ProPulse within 36 days of harvest.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Chickpea (Garbanzo Bean) Seed Treatment

Chemical	Application	Dosage ¹	Control ² of Seedling Diseases ³	Remarks
Azoxystrobin (11) Dynasty 9.6%	Slurry	0.153-0.765 fl oz/cwt	X	For seed-borne and soil-borne fungi.
Carboxin (7) + Thiram (M3) Vitaflo-280 15.59%; 13.25%	Ready to use slurry			
Fludioxonil (12) Maxim 4FS, 40.3% Spirato 480 FS Dyna-Shield Fludioxonil	Slurry Slurry Slurry	0.08-0.16 fl oz/cwt 0.08-0.16 fl oz/cwt 0.08-0.16 fl oz/cwt	X X X	For seed-borne and soil-borne fungi.
Fludioxonil (12) + Mefenoxam (4) Apron Maxx RFC 2.31%:3.46%	Slurry	1.5 fl oz/cwt	X	

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Chickpea (Garbanzo Bean) Seed Treatment (continued)

Chemical	Application	Dosage ¹	Control ² of Seedling Diseases ³	Remarks
Ipconazole (3) Rancona 3.8 FS, 40.7%	Slurry or mist	0.085 fl oz/cwt	X	Does not provide control of <i>Pythium</i>
Ipconazole (3) + Metalaxyl (4) Rancona Summit, 0.902%: 1.44% Rancona CTS, 2.42%; 1.94%	Slurry or mist	4.0 fl oz/cwt	X	For seed-borne and soil-borne fungi.
Mefenoxam (4) Apron XL, 33.3%	Slurry or mist	0.32-0.64 fl oz/cwt	X	For <i>Pythium</i> damping off.
Mefenoxam (4) + Fludioxonil (12) + Thiamethoxam Cruiser Maxx, 1.7%:1.12%:22.61%	Slurry or mist	3 fl oz/cwt	X	For seed-borne and soil-borne fungi and insect.
Metalaxyl (4) Allegiance, 28.35% Allegiance, FL 28.35% Sebring 318 FS, 28.35% Dyna-Shield, 28.35% Belmont 2.7 FS, 28.98%	Slurry or mist Slurry or mist Slurry Slurry or mist	0.75-1.0 fl oz/cwt 0.25-0.5 fl oz/cwt 0.75 fl oz/cwt 0.75 fl oz/cwt	X X X X	For <i>Pythium</i> damping off.
Prothioconazole (3) + Penflufen (7) + Metalaxyl (4) EverGol Energy 7.18% : 3.59% : 5.74	Slurry or mist	1 fl oz/cwt	X	For seed-borne and soil-borne fungi and seed rot and damping off caused by <i>Rhizoctonia</i> .
Pyraclostrobin (11) Stamina 18.4%	Slurry or mist	0.4-1.5 fl oz/cwt	X	For seed-borne and soil-borne fungi and for control of seed and seedling disease caused by <i>Rhizoctonia solani</i> .
Sedaxane (7) Vibrance, 43.7%	Slurry	0.08-0.16 fl oz/cwt or 2.5-5 gai/100 kg of seed	X	For seed decay, seedling blights, and damping off caused by <i>Rhizoctonia</i>
Sedaxane (7) + Mefenoxam (4) + Fludioxonil (12) Vibrance Maxx, 4.69%; 3.52%; 2.35%	Slurry	1.54 fl oz/cwt	X	For seed-borne and soil-borne diseases caused by <i>Rhizoctonia</i> , <i>Pythium</i> and <i>Fusarium</i> .
Toclofos-methyl (14) Rizolex, 42%	Slurry or mist	0.3 fl oz/cwt	X	For seed-borne and soil-borne diseases. Controls <i>Rhizoctonia</i> and <i>Fusarium</i> species.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Chickpea (Garbanzo Bean) Seed Treatment (continued)

Chemical	Application	Dosage ¹	Control ² of Seedling Diseases ³	Remarks
Thiabendazole (1) Mertect 340-F, 42.3%	Slurry	2.04 fl oz/cwt	X	For seed-borne <i>Ascochyta</i> .
Trifloxystrobin (11) Trilex, 22%	Slurry	0.32 fl oz/cwt	X	For seed-borne and soil-borne fungi.
Trifloxystrobin (11) + Metalaxyl (4) Trilex 2000, 7.12%:5.69%	RTU or slurry or mist	1.0 fl oz/cwt	X	For seed-borne and soil-borne fungi.
Fluxapyroxad (7) + Pyraclostrobin (11) + Metalaxyl (4) Obvius, 1.58%; 1.58%; 1.26%	RTA Slurry	4.6 fl oz/cwt	X	Control of <i>Rhizoctonia</i> sp., <i>Fusarium</i> sp., <i>Pythium</i> sp., <i>Botrytis</i> sp., <i>Colletotricum</i> sp., and <i>Ascochyta</i> sp. (seed borne).

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Chickpea Foliar Sprays

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control Ascochyta ³	Remarks
Bacillus subtilis strain QST 713 (44) Serenade ASO, 1.34%	Spray or fungigation	2-6 qt/A		Begin applications when environmental conditions and plant stage are conducive to disease development.
Boscalid (7) Endura, 70%	Spray or fungigation	6 oz/A	X	Labeled for control of <i>Botrytis</i> gray mold, <i>Sclerotinia</i> white mold and rust. Apply at the beginning of flowering, prior to the onset of disease. Make a second application at full blossom if conditions continue to be favorable for disease development.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Chickpea Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control Ascochyta ³	Remarks
Chlorothalonil (M5) Bravo Ultrex, or Equus DF 82.5% Bravo WeatherstickZN, 51% Bravo Weatherstick, 54% Echo 720, 54.0% Chlorothalonil 720, 54% Praiz, 54.0% Vabro, 54.0%	Spray or fungigation	1.25-1.8 lb/A	X	State label allows application to begin at onset of disease, with maybe 2-4 weeks before flowering. Repeat at 7- to 10- day intervals. Do not make more than 4 applications per growing season. Do not apply within 14 days of harvest. Begin application during early bloom and repeat at 7- to 10- day intervals. Do not apply more than 11.1 lbs/A per season.
	Spray or fungigation	1.38-2 pt/A	X	
	Spray or fungigation	1.38-2 pt/A	X	
	Spray or fungigation	1.38-2 pt/A	X	
	Spray or fungigation	1.38-2 pt/A	X	
	Spray or fungigation	1.38-2 pt/A	X	
	Spray or fungigation	1.38-2 pt/A	X	
	Spray or fungigation	1.38-2 pt/A	X	
Cyprodinil (9) + Fludioxonil (12) Switch 62.5WG, 37.5%; 25.0%	Spray	11-14 fl oz/A		For suppression of white mold Begin applications prior to or at the onset of disease. Make first application at 10-20% bloom. Do not apply more than 56 fl oz/A per season. PHI = 7 days.
Difenoconazole (3) + Benzovindiflupyr (7) Aprovia Top, 11.25%; 7.50%	Spray or fungigation	10.5-11 fl oz/A	X	Begin applications prior to disease onset when conditions are conducive for disease. Do not make more than two sequential applications before alternating to a fungicide from a different group. Do not apply more than 22 fl oz/A per year. PHI = 14 days.
Fluopyram (7) + Prothioconazole (3) ProPulse 17.4%:17.4%	Spray	8.0-13.6 fl oz/A	X	Apply at early flower or at the first sign of disease, whichever occurs first. Do not make more than two sequential applications before rotating with a fungicide from a different group. Continue applications as needed on a 10-14-day interval. Do not apply within 7 days of cutting or swathing the crop for harvest or within 14 days of harvest.
Fluxapyroxad (7) + Pyraclostrobin (11) Priaxor 14.33%:28.58%	Spray or fungigation	4-8 fl oz/A	X	Resistance statement 5 ⁴ . For optimal disease control, begin applications prior to disease development. NDSU has documented that <i>Ascochyta rabiei</i> is resistant QoI fungicides (FRAC 11) in ND and neighboring states, and that chemistry may not control <i>Ascochyta</i> blight.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Chickpea Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control Ascochyta ³	Remarks
Prothioconazole (3) Proline 480 SC, 41%	Spray	5.0-5.7 fl oz/A	X	Apply at early flower or at the first sign or disease, whichever occurs first. Use the higher rate when conditions are favorable for severe disease pressure and/or when growing more disease-susceptible varieties. Do not make more than three applications per year. Repeat applications as needed on a 10- to 14-day interval. Do not apply within 7 days of cutting or swathing the crop for harvest.
Penthiopyrad (7) Vertisan, 20.6%	Spray or fungigation	14-20 fl oz/A	X	Begin applications prior to disease development. For white mold, make initial application at beginning bloom and follow with a second application at full bloom. Do not exceed 41 fl oz/A per year. PHI = 21 days.
QoIs Azoxystrobin (11) Quadris, 22.9% Satori, 22.9% Equation, 22.9% Tetraban, 22.9%	Spray or fungigation	6.2-15.4 fl oz/A	X	Resistance Statement 5 ⁴ NDSU has documented that <i>Ascochyta rabiei</i> , the pathogen that causes Ascochyta Blight on chickpeas, is resistant to QoI fungicides in ND and neighboring states. As a result, QoI fungicide applications (Including Headline, Quadris, and mixes with them) may not manage the disease.
Azoxystrobin (11) + Chlorothalonil (M5) Quadris Opti, 4.6%: 46%	Spray	1.6-2.4 pt/A	X	Quadris Opti should not be tank mixed with COC, MS0 or silicon adjuvants.
Azoxystrobin (11) + Difenconazole (3) Quadris Top 18.2%:11.4%	Spray or fungigation	8-14 fl oz/A	X	Maximum of 56 fl oz/A season. 14-day PHI. Quadris Top should be used with an adjuvant such as a non-ionic based surfactant or crop oil concentrate or blend.
Azoxystrobin (11) + Propiconazole (3) Quilt, 7.0%:11.7%	Spray or fungigation	14 fl oz/A	X	Maximum of 42 fl oz/A season. 14-day PHI.
Pyraclostrobin (11) Headline EC, 23.6% Headline SC, 23.3%	Spray or fungigation	6-9 fl oz/A	X	Maximum of 18 fl oz/A per season. 21-day PHI
Picoxystrobin (11) Approach, 22.5%	Spray or fungigation	6-12 fl oz/A	X	Labeled for white mold when applied at beginning of bloom at 8-12 fl oz/A. Do not apply more than 24 fl oz/A per season. PHI = 14 days.
Trifloxystrobin (11) + Prothioconazole (3) Stratego YLD 32.3%; 10.8%	Spray or fungigation	4.0-4.8 fl oz/A	X	Apply at early flower or at the first symptoms of the disease, whichever occurs first. Do not exceed 0.28 lb of prothioconazole or 0.24 lb of trifloxystrobin per acre per year. Do not apply within 30 days of harvest. Do not apply within 7 days of cutting or swathing the crop for forage.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Corn (Field) and Sorghum Seed Treatment

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Azoxystrobin (11) Dynasty, 9.6%	Slurry	0.0688 fl oz/80,000 kernel count unit	X	Also controls seed-borne head smut. Use only in combination with labeled rates of Maxim and Apron XL products.
Captan (M4) The following captan products are registered for seed treatment of corn and sorghum: Captan - Diazinon Seed Treater, 36.67% Methoxychlor, 70.9% Kernel Guard, 14.67% (corn only) Nu-Gro Captan 4000, 38.7% Sorghum Guard, 32.75%	See individual labels for rates of application, formulations, method of application and registered use	See individual labels for amounts of formulated product to apply	X	Captan - Diazinon Seed Treater contains 25% diazinon insecticide. Kernel Guard contains 15% diazinon and 25% lindane. Sorghum Guard contains 16.6% lindane insecticide.
Carboxin (7) Kernel Guard Supreme, 14%	Drill box	1.5 oz/42 lb	X	Kernel Guard contains 10.42% permethrin.
Ethaboxam (22) Intego Solo, 34.2%	Slurry or mist	0.2-0.3 fl oz/cwt	X	For control of <i>Pythium</i> . Also registered for sweet corn, sorghum and grain (milo).
Fludioxonil (12) Maxim 4FS, 40.3%	Slurry	0.036-0.072 fl oz/80,000 kernel count	X	For control of seed-borne and soil-borne fungi which causes seed decay, damping off and seedling blight, and seed-borne head smut.
Spirato 480FS 40.3%	Slurry	0.08 fl oz/cwt for sweet corn	X	
Dyna-Shield Fludioxonil, 40.3%	Slurry	0.036-0.072 fl oz/80,000 kernel count	X	
Fludioxonil (12) +Mefenoxam (4) Maxim XL, 21% : 8.4%	Water-based slurry	.071 fl oz/80,000 kernel count unit of seed	X	Controls seedling blights and fungi causing seed decay and damping off. For field corn.
Fludioxonil (12) +Mefenoxam (4) + Azoxystrobin (11) + Thiabendazole (1) Maxim Quattro 3.32%:2.65%:1.33%:26.5%	Water-based slurry	0.46 fl oz/80,000 kernel count	X	Also controls seed-borne smut.
Ipconazole (3) Vortex, 40.7%	Water-based Slurry	0.044 fl oz/cwt	X	For protection against soil-borne and seed-borne diseases.

¹Dosages for corn apply to field corn. Dosages for sweet corn vary with some products, and others are not registered for sweet corn, so consult the label for sweet corn information. Dosages are amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Corn (Field) and Sorghum Seed Treatment (continued)

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Mancozeb (M3) Dithane DF Rainshield NT, 75%	Slurry	1.6-3.2 oz/bu field corn 1.6-2.7 oz/bu sorghum	X	Dithane DF, F-45 and M-45 registered for seed treatment of field corn and sorghum but not for seed treatment of sweet corn. Grain Guard and Grain Guard Plus registered for sorghum only. Grain Guard Plus contains 18.75% lindane insecticide.
Dithane F-45, 37%	Drill box or slurry	2.4-4.8 fl oz/bu field corn, 2.4-4.0 fl oz/bu sorghum	X	
Dithane ST, 37%	Slurry or mist	2.4-4.8 fl oz/bu field corn 2.4-4.0 fl oz/bu sorghum	X	
Dithane M-45, 80% or Dithane WSP, 80%	Drill box or slurry	1.5-3.0 oz/bu field corn 1.5-2.5 oz/bu sorghum	X	
Grain Guard, 50%	Drill box	3 oz/bu	X	
Grain Guard Plus, 50%	Drill box	3 oz/bu	X	
Manzate ProStick, 75%	Slurry	1.5-3 oz/bu corn 1.5-2.5 oz/bu sorghum	X	
Manzate Flowable, 37%	Slurry	2.4-4.8 oz/bu corn 2.4-4.0 oz/bu sorghum	X	
Penncozeb 80 WP, 80%	Drill box or slurry	1.5-3.0 oz/bu field corn 1.5-2.5 oz/bu sorghum	X	Treated seed should be labeled "must not be used for food, feed or oil purposes."
Penncozeb 75 DF, 75%	Drill box or slurry	1.6-3.2 oz/bu field corn 1.6-2.7 oz/bu sorghum	X	
Mefenoxam (4) Apron XL, 33.3%	Liquid or slurry	0.32-0.64 fl oz/cwt	X	For control of <i>Pythium</i> damping off only.
Metalaxyl (4) Allegiance FL, 28.35% or Sebring 318 FS, 28.35%	Mist or slurry	0.375-0.75 fl oz/cwt sorghum	X	For control of <i>Pythium</i> damping off only.
Dyna-Shield, 28.35%	Slurry	0.75 fl oz/cwt corn	X	
Metalaxyl (4) + PCNB (14) + Carboxin (7) Prevail, 3.12%:15%:15%	Drill box	3 oz/bu	X	Not registered for sorghum. Controls early season <i>Pythium</i> and <i>Rhizoctonia</i> .
Metconazole (3) Metlock 40%	Liquid or slurry	0.045-0.09 fl oz/cwt	X	Disease protection for <i>Rhizoctonia</i> damping-off, <i>Fusarium</i> seed/seeding dieback seed decay fungi and head smut.
Metalaxyl (4) + Metconazole (3) Metlock CT, 4.51%: 2.25%	Liquid or slurry	1.0-1.5 fl oz/cwt	X	Disease protection for <i>Rhizoctonia</i> damping-off, <i>Fusarium</i> seed/seeding dieback seed decay fungi and head smut.

¹Dosages for corn apply to field corn. Dosages for sweet corn vary with some products, and others are not registered for sweet corn, so consult the label for sweet corn information. Dosages are amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Corn (Field) and Sorghum Seed Treatment (continued)

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Pyraclostrobin (11) Stamina, 18.4%	Slurry or mist	0.4-0.8 fl oz/cwt	X	Controls seed and seedling disease caused by <i>Rhizoctonia solani</i> , seed-borne fungi causing seed decay and seedling blight.
Pyraclostrobin (11) + Bacillus subtilis MBI 600 Xanthion, 23.6%; 5.0%	In-furrow Spray	3.6-7.2 flo oz/1000 ft of row	X	Product must be mixed in a 5:1 ratio of pyraclostrobin to <i>Bacillus subtilis</i> . Also for suppression of <i>Rhizoctonia solani</i> , <i>Fusarium</i> sp. and <i>Pythium</i> sp.
Bacillus subtilis strain QST 713 (44) Serenade ASO, 1.34%	In-furrow	2-6 fl qt/A	X	For control of <i>Pythium</i> and <i>Rhizoctonia</i> . Apply as directed spry in the seed furrow and to the covering soil at planting. A 2 (ee) allows application of Serenade ASO at 1 fl qt/A.
Sedaxane (7) Vibrance, 43.7%%	Slurry	2.5-5 gai/100 kg of seed corn 2.5-5 gai/100 kg of seed sorghum	X	For seed decay, seedling blights, and damping off caused by <i>Rhizoctonia</i>
Thiamethoxam + Fludioxonil (12)+ Mefenoxam (4) + Azoxyastrobin (11) Cruiser Extreme 25.0% : 1.25% : 1.0% : 0.50%	Water-based slurry		X	For protection against damage from certain insects, soil-borne and seed-borne diseases.
Thiram (M3) 42-S Thiram, 42% Signet 480 FS, 42%	Liquid or slurry	1.5 fl oz/bu field corn 5.0 fl oz/cwt sweet corn 2 fl oz/bu sorghum	X	
Tolclofos-methyl (14) Rizolex, 42%	Slurry or mist	0.3 fl oz/cwt	X	For seed-borne and soil-borne diseases. Controls <i>Rhizoctonia solani</i> .
Trifloxystrobin (11) + Metalaxyl (4) Trilex 2000 7.12%; 5.69%	Slurry or mist	0.5 fl oz/cwt	X	Provides seed and seedling protection against seed-borne fungi.

¹Dosages for corn apply to field corn. Dosages for sweet corn vary with some products, and others are not registered for sweet corn, so consult the label for sweet corn information. Dosages are amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Corn Nematicide Seed Treatment

Chemical	Application	Control	Remarks
Abamectrin + Thiamethoxam Avicta Duo Corn, 12.4%:28.1% Avicta Duo 250 Corn, 11.3%: 14.2%	Commercially applied	Root nematodes (by abamectrin) and various insects (by thiamethoxam)	Crop Protection LLC has an <i>Avicta Complete Corn</i> commercial brand that recommends the combination of multiple separate seed treatment products.
Abamectrin + Thiamethoxam + Thiabendazole (1) + Fludioxonil (12) + Mefenoxam (4) + Azoxystrobin (11) Avicta Complete Corn 250, 10.3%: 11.7%: 2.34%: 0.30%: 0.23%: 0.12% Avicta Complete Corn 500, 10.20%: 23.10%: 2.31%: 0.30%: 0.23%: 0.12%	Commercially applied	Root nematodes (by abamectrin), various insects (by thiamethoxam), and various diseases (by thiabendazole, fludioxonil, mefenoxam, and azoxystrobin)	Syngenta Crop Protection LLC has a commercially treated blend of nematicide, insecticide, and fungicide seed treatment products.
Clothiandin + <i>Bacillus firmus</i> Poncho Votivo, 40.3% and 8.1%	Commercially applied	Provides early season protection of the corn plant against root nematodes and broad control of insect pests.	The <i>Bacillus firmus</i> bacterium creates a living barrier that prevents nematodes from reaching the roots.

Corn Soil Application

Chemical (Fungicide Group)	Application	Dosage ¹	Remarks
Azoxystrobin (11) Quadris, 22.9%	In-furrow spray	0.4-0.8 fl oz/1000 ft. row	For soilborne and seedling diseases. Do not apply more than 123 fl oz of production/A per season.
<i>Bacillus subtilis</i>, strain MBI 600 (44) Xanthion, 5.0%	In-furrow spray	0.02-0.04 fl oz/1,000 ft. row	Can be used in combination with Headline. For soilborne diseases such as Rhizoctonia and Fusarium.
<i>Bacillus amyloliquefaciens</i> strain D747 (44) + Bifenthrin Ethos XB, 5.0%; 15.67%	In-furrow	4-17 fl oz/A	Restricted use pesticide. Suppression of seedling blights caused by <i>Pythium</i> , <i>Rhizoctonia</i> and <i>Fusarium</i> .
Pyraclostrobin (11) Headline, 23.6%	In-furrow spray	0.1-0.8 fl oz/1,000 ft. row	For suppression of Rhizoctonia. Do not apply more than 12 fl oz/A of Headline.
Fluoxastrobin (11) Evito 480 SC, 40.3%	In-furrow spray	0.11-0.16 fl oz/1,000 ft. row	For protection against soilborne diseases. Do not exceed a maximum of 22.8 ounces/acre of fluoxastrobin per year.
Pyraclostrobin (11) + Bifenthrin Manticor, 7.2%; 14.4%	In-furrow spray	0.49-1.09 fl oz/1,000 ft row	For suppression of Rhizoctonia and corn insects. Do not apply more than 0.3 lbs of bifenthrin per year.

¹Dosage = amount of formulated product to apply.

³See fungicide resistance management statements on Pages 7-8.

Corn (Field) Foliar Sprays

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks
			Rust	Leaf Spots ⁴	
<i>Bacillus subtilis</i> strain QST 713 (44) Serenade ASO, 1.34%	Spray or fungigation	2-6 qt/A	X	X	Begin applications when environmental conditions and plant stage are conducive to disease development.
<i>Bacillus pumilus</i> strain QST 2808 Sonata, 1.38%	Spray or fungigation	1-4 qt/A	X	X	Begin applications when environmental conditions and plant stage are conducive to disease development.
Chlorothalonil (M5) Equus 720 SST, 54.0 % Equus DF, 82.5%	Spray or fungigation Spray or fungigation	0.75-2.0 pts/A 0.7-1.8 lbs/A	X X	X X	Begin applicatiосn when conditions favors disease development. Maximum use rate per season is 12.0 pts/A for Equus 720 SST and 10.9 lbs/A for Equus DF. PHI = 14 days
Copper (M1) MasterCop, 21.46%	Spray or fungigation	0.5-1.5 pt/A			Apply when disease first appears and every 7 to 10 days as needed. Manium use rate per season is 6.0 pts/A.
Flutriafol (3) Topguard 11.8%	Spray	7-14 fl oz/A	X	X	Resistance statement 3 ⁵ . For control of several fungal diseases. Do not apply more than 2 applications or 28 fl oz/season. PHI=80 days.
Fluxapyroxad (7) + Pyraclostrobin (11) Priaxor 14.33%: 28.58%	Spray or fungigation	4-8 fl oz/A	X	X	Resistance Statements 5 and 6 ⁵ . Apply at V5-V8 growth stages for early season disease control. Do not harvest for forage within 7 days of last application. PHI=21 days
Mancozeb (M3) Koverall, 75% Manzate ProStick, 75% Penncozeb 75DF Manzate Flowable, 37% Roper DF Rainshield, 75%	Sprays or fungigation Sprays or fungigation Sprays or fungigation Sprays or fungigation	1.5 lb/A 1.5 lb/A 1-1.15 lb/A 1.2 qt/A 1.5 lb/A	X X X X	X X X X	Do not feed treated forage to livestock. Do not apply more than 15 lb product per season. Do not apply within 40 days of harvest.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Leaf spots include fungal leaf diseases such as northern corn leaf blight

⁵See fungicide resistance management statements on Pages 7-8.

Corn (Field) Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks
			Rust	Leaf Spots ⁴	
Penthiopyrad (7) Vertisan, 20.6%	Spray or fungigation	10-24 fl oz/A	X	X	Apply prior to disease development. Controls multiple diseases of corn. Do not apply more than 48 fl oz/A per year. PHI = 7 days.
Triazoles Propiconazole (3) Tilt, Propimax, or Bumper 41.8 EC, Propiconazole E-AG, 41.8% Fitness, 41.8% Topaz 41.8% Bumper ES, 40.85% Propicure, 41.8%	Spray or fungigation Spray or fungigation	2-4 fl oz/A	X	X	Resistance statement 3 ⁵ . Do not apply to field corn and field corn grown for seed after silking. Do not apply more than 16 oz/A per season. Do not apply to sweet corn within 14 days of harvest or field corn within 30 days of harvest. See label for restrictions on use for forage.
Prothioconazole (3) Proline 480 SC, 41.0%	Spray or fungigation	5.7 fl oz/A	X	X	Apply when symptoms first appear. Do not use adjuvants in sprays made between V8 (8 leaf collar) and VT (tasseling). Do not apply more than 22.8 fl oz/A per season. PHI = 14 days.
Tebuconazole (3) Orius 3.6F, 38.7% Tebuzol 3.6F, Monsoon, Onset 3.6L, Tebucure	Spray or fungigation	4-6 fl oz/A	X	X	See individual labels for spray schedule recommendations and preharvest intervals.
Qols Azoxystrobin (11) Quadris, 22.9% Satori, 22.9% Equation, 22.9% Tetraban, 22.9%	Spray or fungigation	6.0-9.0 fl oz/A rust 6.0-15.5 fl oz/A leaf spots	X	X	Resistance statement 5 ⁵ for all. Do not apply more than 2 sequential applications and do not apply more than 123 fl oz per acre per season. For field, pop and sweet corn.
Fluoxastrobin (11) Evito 480SC, 40.3%	Spray or fungigation	2.0-5.7 fl oz/A	X	X	Apply maximum of 2 applications (with final application no later than the R4 early growth stage). Do not apply more than 11.4 fl oz/year Apply prior to disease onset. Apply at V5-V8 growth stages for ear season disease control. Additionally, applications can be made at VT-R2 growth stages. PHI = 7 days. Do not exceed 72 fl oz/A per season; maximum of 2 sequential applications.
Pyraclostrobin (11) Headline EC, 23.6% Headline SC, 23.3%	Spray or fungigation	6-12 fl oz/A	X	X	For early season disease control/suppression make a single 3-4 fl oz/A application between V4-V7. Apply no more than 36 fl oz/A per season and no more than 2 sequential applications. PHI = 7 days.
Picoxystrobin (11) Approach, 22.5%	Spray or fungigation	6-12 fl oz/A	X	X	

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Leaf spots include fungal leaf diseases such as northern corn leaf blight

⁵See fungicide resistance management statements on Pages 7-8.

Corn (Field) Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks
			Rust	Leaf Spots ⁴	
Qols + Triazole Azoxystrobin (11) + Propiconazole (3) Quilt 7.0%; 11.7% Quilt Xcel 13.5%; 11.7% Trivapro B 1.5%; 11.7%	Spray or fungigation Spray or fungigation Spray or fungigation	7-14 fl oz/A 10.5-14 fl oz/A 10.5 fl oz/A	X X X	X X X	Resistance statement 3 ⁵ . Applications prior to tasseling may impose stress on the plant that could inhibit proper kernel development, especially under stress conditions. Field corn and sweet corn. Alternate applications of Quilt or Quilt Xcel with Tilt or another non-Group 11 fungicide. For best disease control, make applications after R1. PHI = 30 days. Combining Trivapro A and Trivapro B = Trivapro co-pack. Apply prior to disease onset when conditions are conducive for disease. Do not apply more than 28 fl oz/A of Trivapro B per year. PHI = 30 days for Trivapro B.
Azoxystrobin (11) + Tebuconazole (3) Custodia, 11.0%; 18.35%	Spray or fungigation	9-12.9 fl oz/A	X	X	Resistance statement 3 ^b . Apply in protective spray schedule. Repeat applications at 7 to 14 day intervals. Do not use adjuvants or crop oil after the V8 stage prior to VT. Do not exceed 51.7 fl oz/A per season. PHI = 21 days for forage and 36 days for grain or fodder.
Azoxystrobin (11) + Tetraconazole (3) Affiance, 9.35%; 7.48%	Spray or fungigation	10.0-17.0 fl oz/A	X	X	Resistance statement 3 ^b . Apply prior to disease onset and as part of an integrated pest management program. Do not apply more than 17.0 fl oz/A per year. Do not make more than two applications per year. Applications can be made between V4-R3. Harvest PHI = 7 days. Silage PHI = 21 days.
Pyraclostrobin (11) + Metconazole (3) Headline AMP 13.64%;5.14%	Spray	10-14.4 fl oz/A	X	X	Resistance statement 3 ⁵ and 5 ⁵ . For optimal disease control, begin applications prior to disease development. Apply at VT-R2 growth stages for optimal disease control. Do not exceed 57.6 fl oz/A/season. 20-day PHI.
Trifloxystrobin (11) + Prothioconazole (3) Stratego YLD, 32.3%;10.8%	Spray or fungigation	4.0-5.0 fl oz/A	X	X	A 2(ee) allows application of Stratego YLD at 2.0-5.0 oz/A at the V4 to V6 growth stages. Additionally, Stratego YLD can be applied from VT to R2 stages. Do not apply more than 10 fl oz/A/year. 14-day PHI.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Leaf spots include fungal leaf diseases such as northern corn leaf blight

⁵See fungicide resistance management statements on Pages 7-8.

Corn (Field) Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks
			Rust	Leaf Spots ⁴	
Picoxystrobin (11) + Cyproconazole (3) Approach Prima, 17.94%: 7.17%	Spray or fungigation	3.4-6.8 fl oz/A	X	X	Apply preventatively for disease control. Apply at 3.4 fl oz/A for early season disease control. Do not apply more than 6.8 fl oz/A per season and no more than two sequential applications of a picoxystrobin containing product. PHI = 30 days for grain corn, and 21 days for silage.
Fluoxastrobin (11) + Flutriafol (3) Fortix, 14.84%; 19.3% Preemptor, 14.84%; 19.3%	Spray or fungigation	4-6 fl oz/A	X	X	Apply preventatively from V5-VT. Do not use crop oil or MSO. Do not use surfactant after V8 and before VT. Do not apply more than 12 fl oz/A per year. PHI = 30 days
Fluoxastrobin (11) + Tetraconazole (3) Zolera FX. 17.76%; 17.76%	Spray or fungigation	4.4-6.8 fl oz/A	X	X	For best results apply beginning at VT. Do not use surfactant after V8 and before VT. Do not apply more than 6.8 fl oz/A per year. PHI = 30 days.
SDHI Benzovindiflupyr (7) Trivapro A 10.27%	Spray or fungigation	4 fl oz/A	X	X	Combining Trivapro A and Trivapro B = Trivapro co-pack. Apply prior to disease onset when conditions are conducive for disease. Do not apply more than 14 fl oz/A of Trivapro A per year.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Leaf spots include fungal leaf diseases such as northern corn leaf blight.

⁵See fungicide resistance management statements on Pages 7-8.

Crambe Seed Treatment

Chemical	Application	Dosage ¹	Control ² of Seedling Blight ³	Remarks
Fludioxonil (12) Maxim 4FS, 40.3% Dyna-Shield Fludioxonil, 40.3%	Slurry Slurry	0.08-0.16 fl oz/cwt 0.08-0.16 fl oz/cwt	X X	For <i>Rhizoctonia</i> and <i>Fusarium</i> .
Mefenoxam (4) Apron XL, 33.3 %	Slurry	0.32 fl oz/cwt	X	For suppression of <i>Pythium</i> .
Pyraclostrobin (11) Stamina, 18.4%	Slurry or mist	1.5-3.1 fl oz/cwt	X	For suppression of <i>Rhizoctonia solani</i> , <i>Fusarium</i> sp. and <i>Pythium</i> sp.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Dry Edible Bean Seed Treatment

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Azoxystrobin (11) Dynasty, 9.6%	Slurry	0.153-0.765 fl oz/cwt	X	For seed-borne and soil-borne fungi.
Carboxin (7) Vitavax-34, 34%	Slurry or mist	3-4 fl oz/cwt	X	For <i>Rhizoctonia</i> seed rots, damping off and seedling blight.
Carboxin (7) + Thiram (M3) Vitaflo-280 15.59%; 13.25%	Slurry or mist	4 fl oz/cwt	X	For seed-borne and soil-borne diseases including <i>Rhizoctonia</i> , <i>Fusarium</i> and <i>Pythium</i> .
Captan (M4) Captan 400, 38.4%	See label for rates of application, formulations and registered use	See label for amounts of formulated product to apply	X	
Chloroneb (14) Chloroneb 65W, 65%	Slurry	4 oz/cwt	X	May be used as a supplemental seed treatment for improved suppression of <i>Rhizoctonia</i> and <i>Pythium</i> .
Fludioxonil (12) Maxim 4FS, 40.3% Spirato 480 FS, 40.3% Dyna-Shield Fludioxonil, 40.3%	Slurry Slurry Slurry	0.08-0.16 fl oz/cwt	X X X	For seed-borne and soil-borne fungi. Registered for control of <i>Rhizoctonia</i> and <i>Fusarium</i> .
Fludioxonil (12) + Mefenoxam (4) Apron Maxx RFC 2.31%:3.46%	Slurry	1.5 fl oz/cwt	X	For <i>Fusarium</i> and <i>Rhizoctonia</i> control.
Ipconazole (3) Rancona 3.8 FS, 40.7%	Slurry or mist	0.085 fl oz/cwt	X	Does not provide control of <i>Pythium</i>
Ipconazole (3) + Metalaxyl (4) Rancona Summit, 0.902%: 1.443%	Slurry or mist	4.0 fl oz/cwt	X	
Mefenoxam (4) Apron XL, 33.3%	Slurry or mist	0.32-0.64 fl oz/cwt	X	For <i>Pythium</i> control. For both commercial and on-farm use.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Dry Edible Bean Seed Treatment (continued)

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Metalaxyl (4) Allegiance FL, 28.35% Sebring 318 FS, 28.35% Allegiance Dry Seed Protectant, 12.5% Dyna-Shield, 28.35% Belmont 2.7 FS, 28.98%	Mist or slurry Drill box Slurry Slurry or mist	0.75 fl oz/cwt 4 oz/cwt 0.75 fl oz/cwt 0.75 fl oz/cwt	X X X X	Metalaxyl is only for <i>Pythium</i> damping control. For use only with commercial seed treatment equipment. Apron Dry Seed Protectant is for drill box application to seed not previously treated with Apron; thorough mixing of fungicide and seed is essential for good control.
Mefenoxam (4) + Fludioxonil (12) + Thiamethoxam CruiserMaxx 1.7%:1.12%:22.6%	Slurry or mix	3 fl oz/cwt	X	For seed-borne and soil-borne fungi and insects. Contains thiamethoxam for insect control.
Mefenoxam (4) + Fludioxonil (12) + Sedaxane (7) + Thiamethoxam CruiserMaxx Vibrance, 3.13%; 1.04%; 1.04%; 20.8%	Slurry or mix	3.22 fl oz/cwt	X	For seed-borne and soil-borne fungi and insects. Contains thiamethoxam for insect control.
Metalaxyl (4) + PCNB (14) + Carboxin (7) Prevail, 3.12%:15%:15%	Drill box	6-8 oz/cwt	X	Controls early season <i>Pythium</i> and <i>Rhizoctonia</i> .
Prothioconazole (3) + Penflufen (7) + Metalaxyl (4) EverGol Energy 7.18% : 3.59% : 5.74%	Slurry or mist	1 fl oz/cwt	X	For seed-borne and soil-borne fungi and seed rot and damping off caused by <i>Rhizoctonia</i> .
Pyraclostrobin (11) Stamina, 18.4%	Slurry or mist	0.4-1.5 fl oz/cwt	X	For seed-borne and soil-borne fungi.
Sedaxane (7) Vibrance, 43.7%	Slurry	0.08-0.16 fl oz/cwt or 2.5-5 gai/100 kg of seed	X	For seed decay, seedling blights, and damping off caused by <i>Rhizoctonia</i>
Sedaxane (7) + Mefenoxam (4) + Fludioxonil (12) Vibrance Maxx, 4.69%; 3.52%; 2.35%	Slurry	1.54 fl oz/cwt	X	For seed-borne and soil-borne diseases caused by <i>Rhizoctonia</i> , <i>Pythium</i> and <i>Fusarium</i> .
Thiabendazole (1) Mertect 340-F, 42.3%	Slurry	0.30-0.67 fl oz/cwt	X	For seedling diseases caused by <i>Fusarium</i> spp.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Dry Edible Bean Seed Treatment (continued)

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Thiram (M3) 42-S Thiram, 42% Signet 480 FS, 42%	Liquid or slurry	2 fl oz/cwt	X	
Thiram 50WP Dyed, 50%	Drill box or slurry	2 oz/cwt	X	
Toclofos-methyl (14) Rizolex, 42%	Slurry or mist	0.3 fl oz/cwt	X	For seed-borne and soil-borne diseases. Controls <i>Rhizoctonia</i> and <i>Fusarium</i> species.
Fluxapyroxad (7) + Pyraclostrobin (11) + Metalaxyl (4) Obvius, 1.58%; 1.58%; 1.26%	RTA Slurry	4.6 fl oz/cwt	X	Control of <i>Rhizoctonia</i> sp., <i>Fusarium</i> sp., <i>Pythium</i> sp., <i>Botrytis</i> sp. and <i>Colletotricum</i> sp. (seed borne).

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Dry Edible Bean Soil Application

Chemical (Fungicide Group)	Application	Dosage ¹	Control ² of Rhizoctonia	Remarks
Azoxystrobin (11) + Metalaxyl (4) Uniform 28.2%:10.9%	In-furrow	0.34 fl oz/1,000 linear feet of row	X	Apply in a 7-inch band. One application per season.
Bacillus subtilis strain QST 713 (44) Serenade ASO, 1.34%	In-furrow	2-6 fl qt/A	X	Apply as directed spray in the seed furrow and to covering soil at planting.
Bacillus amyloliquefaciens strain D747 (44) + Bifenthrin Ethos XB, 5.0%; 15.67%	In-furrow	4-17 fl oz/A	X	Restricted use pesticide. Suppression of seedling blights.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³See fungicide resistance management statements on Pages 7-8.

Dry Edible Bean Soil Application (continued)

Chemical (Fungicide Group)	Application	Dosage ¹	Control ² of Rhizoctonia	Remarks
PCNB (14) Terraclor FL, 40%	In-furrow spray	2.2-3.3 fl oz/1,000 linear feet of row	X	Spray planting furrow and covering soil at planting. Do not apply to seed. Use lower rates on lighter soils.
Terraclor 75 WP, 75%	In-furrow spray	1.4-2.2 oz/1,000 linear feet of row	X	Apply as a directed spray in the seed furrow and to covering soil at planting.
Terraclor EC, 23.8%	In-furrow spray	4.4-6.6 fl oz/1,000 linear feet of row	X	Spray planting furrow and covering soil at planting. Do not apply directly to seed. Use lower rates on lighter soils.
PCNB 2 Spray, 24%	In-furrow spray	8.8 fl oz/1,000 linear feet of row	X	
Terraclor 10G, 10%	In-furrow granules	0.75-1 lb/1,000 linear feet of row	X	Apply in planting furrow and covering soil at planting.
PCNB (14) + Metalaxyl (4) Ridomil Gold PC GR 10%: 0.5%	In-furrow granules	0.75 lb/1,000 linear feet of row	X	Resistance statement 4 ³ . Adjust application equipment so granules are mixed with soil surrounding seed. See label for planting restrictions within 12 months of application.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³See fungicide resistance management statements on Pages 7-8.

Dry Edible Bean Foliar Sprays

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³				Remarks
			Anthraco- nose	Rust	Halo Blight	White Mold	
Bacillus subtilis strain QST 713 (44) Serenade ASO, 1.34%	Spray or fungigation	2-6 qt/A		X		X	Begin applications when environmental conditions and plant stage are conducive to disease development.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Dry Edible Bean Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³				Remarks
			Anthraco-nose	Rust	Halo Blight	White Mold	
<i>Bacillus subtilis</i> strain QST 713 (44) Serenade ASO, 1.34%	Spray or fungigation	2-6 qt/A		X		X	Begin applications when environmental conditions and plant stage are conducive to disease development.
Boscalid (7) Endura, 70%	Spray or fungigation	8-11 oz/A				X	Apply at the beginning of flowering, prior to disease onset. Use higher rate for extended protection. Make a second application at full bloom if conditions continue to be favorable for disease development. Do not apply within 21 days of harvest.
Chlorothalonil (M5) Bravo WeatherStik Echo, Echo 720, Chlorothalonil 720, Equus 720 SST, 54%	Spray or fungigation	1 3/8-2 pt/A	X	X			Do not apply chlorothalonil within 14 days of harvest. See publication PP-576, "Dry Edible Bean Diseases." Carefully monitor fields for disease. Bravo Zn, Bravo ZN, Echo Zn and Terranil Zn also contain zinc.
Bravo Ultrex DG, or Equus DF, 82.5%	Spray or fungigation	1.25-1.8 lb/A	X	X			
Echo Zn, Bravo ZN or Terranil Zn, 38.5%	Spray or fungigation	2-3 pt/A	X	X			
Echo 90 DF, 90%	Spray or fungigation	1.13-1.63 lb/A	X	X			
Praiz, 54%	Spray or fungigation	1 3/8-2 pt/A	X	X			
Vabro, 54%	Spray or fungigation	1 3/8-2 pt/A	X	X			

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Dry Edible Bean Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³				Remarks
			Anthracnose	Rust	Halo Blight	White Mold	
Copper (M1) Basicop WP, 53%	Spray	2-4 lbs/A			X		
Champ DP, 57.6%	Spray or fungigation	0.66-2 lb/A			X		
Champ Formula 2 Flowable, 37.5%	Spray or fungigation	0.66-2 pt/A			X		
Champion++ 46.1%	Spray or fungigation	0.5-1.25 lb/A			X		
Cuprofix Ultra 40 Disprss 71.1%	Spray or fungigation	0.75-2 lbs/A			X		
Kocide 2000, 53.8%	Spray or fungigation	0.75-2.25 lb/A			X		
Kocide 3000, 46.1%	Spray or fungigation	0.5-1.25 lb/A			X		
Kocide 4.5 LF, 37.5%	Spray or fungigation	0.66-2 pt/A			X		
MasterCop, 21.46%	Spray or fungigation	0.5-1.0 pt/A			X		
Badge X2, 45.31%	Spray or fungigation	0.5-1.25 lbs/A			X		
Badge SC, 32.17%	Spray or fungigation	1-2 lbs/A			X		
Difenoconazole (3) + Benzovindiflupyr (7) Aprovia Top, 11.25%; 7.50%	Spray or fungigation	10.5-11 fl oz/A	X	X			Begin applications prior to disease onset when conditions are conducive for disease. Do not make more than two sequential applications before alternating to a fungicide from a different group. Do not apply more than 22 fl oz/A per year. PHI = 14 days.
Fludioxonil (12) Cannonball WP, 50%	Spray or fungigation	7 fl oz/A				X	Begin applications at onset of disease. Make first application at 10-20% bloom. Do not apply more than 28 oz/A of Cannonball per season 7 day PHI.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Dry Edible Bean Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³				Remarks
			Anthracnose	Rust	Halo Blight	White Mold	
Fluopyram (7) + Prothioconazole (3) ProPulse 17.4%:17.4%	Spray or fungigation	8.0-13.6 fl oz/A				X	Apply at early flower or at the first sign of disease, whichever occurs first. Do not make more than two sequential applications before rotating with a fungicide from a different group. Continue applications as needed on a 10-14-day interval. Do not apply within 7 days of cutting or swathing the crop for harvest or within 14 days of harvest.
Cyprodinil (9)+ Fludioxonil (12) Switch 62.5 WG 37.5%:25.0%	Spray	11-14 oz/A				X	Make first application at 10-20% bloom. A 2 (ee) label allows Switch to be applied in tank mix with Thiophonate-methyl for improved white mold control.
Fluazinam (29) Omega 500F, 40%	Spray or fungigation	0.5-0.85 pt/A				X	Make first application at 10-30% bloom. Second application may be made 7-10 days later if needed. Do not exceed 1.75 pts/acre/season. PHI 30 days.
Fluxapyroxad (7) + Pyraclostrobin (11) Priaxor 14.336%:28.58%	Spray or fungigation	4-8 oz/A	X	X		X	Resistance statement 5 and 6 ⁴ . Do not apply more than 2 applications per season. PWI=21 days White mold suppression only.
Iprodione (2) Rovral 4F, 41.6% Nevado 4F, 41.6% Meteor, 41.6%	Ground spray or fungigation	1.5-2.0 pt/A				X	Resistance statement 2 ⁴ . Apply at first bloom (10% of plants with 1 open blossom) and again at peak bloom, if needed. Do not apply after full bloom. Use 50-100 psi and 3 nozzles, 1 over the row and 1 on each side. If pH of spray water exceeds 7.0, buffer it to pH 5.0-7.0.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Dry Edible Bean Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³				Remarks
			Anthracnose	Rust	Halo Blight	White Mold	
Penthiopyrad (7) Vertisan, 20.6%	Spray or fungigation	14-20 fl oz/A	X	X		X	Begin applications prior to disease development. For white mold, make initial application at beginning bloom and follow with a second application at full bloom. Do not exceed 41 fl oz/A per year. PHI = 21 days.
Prothioconazole (3) Proline 480 SC, 41%	Spray	5.7 fl oz/A		X		X	Apply Proline prior to disease onset or at 15-25% flowering when conditions are favorable for disease development. Do not make more than 3 applications per year. Repeat applications as needed on a 5- to 14-day interval. For maximum disease control, apply in 20 or more gpa by ground. Do not apply within 7 days of cutting or swathing for harvest.
Tebuconazole (3), 38.7% Orius 3.6F Tebuzol 3.6F, Monsoon, Onset 3.6F, Tebucure	Spray or fungigation	4-6 fl oz/A		X			See labels for information on spray scheduling, preharvest intervals and re-entry intervals. Do not apply more than 12 fl oz per year.
Qols Azoxystrobin (11) Quadris, 22.9% Satori, 22.9% Equation, 22.9% Tetraban, 22.9% Azoxystrobin (11) + Chlorothalonil (M5) Quadris Opti, 4.6%:46% Azoxystrobin (11) + Propiconazole (3) Quilt, 7.0%, 11.7%	Spray or fungigation Spray Spray or fungigation	6.0 fl oz/A for rust 6.0-15.5 fl oz/A for other leaf diseases 1.6-2.4 pt/A 14 fl oz/A	X X X	X X X			Resistance statement 5 ⁴ Apply preventatively for best results. Additional applications may be required on a 7- to 14-day interval. PHI: 14 days. Maximum of 42 fl oz/A per season. 14-day PHI

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Dry Edible Bean Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³				Remarks
			Anthraco-nose	Rust	Halo Blight	White Mold	
Picoxystrobin (11) Approach, 22.5%	Spray or fungigation	6-12 fl oz/A	X	X		X	For white mold, make preventative application at beginning bloom and at 8-12 fl oz/A. Do not apply more than 24 fl oz/A per season and no more than 2 sequential applications. 14-day PHI.
Pyraclostrobin (11) Headline EC, 23.6% Headline SC, 23.3%	Spray or fungigation	6-9 fl oz/A	X	X			Apply prior to onset of disease. Maximum of 2 applications per season. 21- day PHI.
Sulfur (M) Microthiol Disperss, 80%	Spray	7 lb/A		X			
Thiophanate-methyl (1) Topsin M WSB, or T-methyl 70W WSB or T-Methyl WSB E-AG Cercobin	Spray or fungigation	1.5-2 lb/A- 1 application or 1-1.5 lb/A - 2 applications	X			X	Resistance statement 1 ⁴ . Apply 1.5-2 lb once when 70-100% of the plants have at least 1 open blossom. Or apply 1-1.5 lb twice, with the first application when 10-30% of the plants have at least 1 open blossom and the second application 4-7 days later. Complete coverage of all parts of plant is essential for control of white mold. Do not apply more than 4 lbs product/acre/season. Do not apply thiophanate-methyl within 14 days of harvest.
Topsin or T-Methyl E-AG or Incognito, 46.2% or Topsin 4.5 FL, 45%	Spray or fungigation	30-40 fl oz/A 1 application or 20-30 fl oz/A if 2 applications	X			X	
Thiophanate Methyl 85 WDG, 85%Incognito 85 WDG, 85%	Spray or fungigation	0.8-1.6 lb/A	X			X	

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Flax Seed Treatment

Chemical	Application	Dosage ¹	Control ² of Seedling Blight ³	Remarks
Captan (M4) Captan 400, 37.4%	Slurry	2-3.75 fl oz/cwt	X	
Fludioxonil (12) Maxim 4FS, 40.3% Spirato 480 FS, 40.3% Dyna-Shield Fludioxonil	Slurry	0.08-0.16 fl oz/cwt	X	
	Slurry	0.08-0.16 fl oz/cwt	X	
	Slurry	0.08-0.16 fl oz/cwt	X	
Mancozeb (M3) Dithane DF Rainshield NT, 75% Dithane F-45, 37% Dithane WSP or Penncozeb 80 WP, 80% Penncozeb 75 DF, 75% Manzate 75 ProStick, 75% Manzate Flowable, 37%	Slurry	2.1-4.3 oz/bu	X	
	Drill box or slurry	3.2-6.4 fl oz/bu	X	
	Drill box or slurry	2-4 oz/bu	X	
	Drill box or slurry	2.1-4.3 oz/bu	X	
	Slurry	2-4 oz/bu	X	
	Slurry	3.2-6.4 fl oz/bu	X	
Thiram (M3) 42-S Thiram, 42% Signet 480 FS, 42% Thiram 480 DP, 42%	Liquid or slurry	3 fl oz/bu	X	
Fluxapyroxad (7) + Pyraclostrobin (11) + Metalaxyl (4) Obvius, 1.58%; 1.58%; 1.26%	RTA Slurry	4.6 fl oz/cwt	X	

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Flax Foliar Sprays

Chemical (Fungicide Group)	Application ¹	Dosage ²	Pasmo (<i>Septoria linicola</i>) Control ³	Remarks
Azoxystrobin (11) Quadris 22.9% Satori, 22.9% Equation, 22.9% Tetraban, 22.9%	Spray or fungigation	6-15.5 fl oz	X	Resistance statement ⁵ . Controls downy mildew and <i>Alternaria</i> leaf spot. Make Quadris applications preventatively for best results. Additional applications may be required under favorable environmental conditions. Do not apply more than 27 fl oz/A/season. PHI: 30 days.mid-flowering 14-7 days after flower initiation.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Leaf spot includes fungal leaf diseases such as tan spot, Septoria blotch and spot blotch on wheat, and spot blotch and net blot on barley.

⁵See fungicide resistance management statements on Pages 7-8.

Flax Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Pasmo (<i>Septoria linicola</i>) Control ³	Remarks
Fluxopyroxad (7) + Pyraclostrobin (11) Priaxor 14.33%:28.58%	Spray or fungigation	4-8 fl oz/A	X	Resistance statement 5 and 6 ⁵ For optimal disease control, apply prior to disease development and continue 7 to 14 days later if conditions are conducive. Do not apply more than 2 applications and 16 fl oz/A per season. PHI=21 days.
Pyraclostrobin (11) Headline EC, 23.6% Headline SC, 23.3%	Spray or fungigation	6-12 fl oz/A	X	For optimal disease control, apply Headline before disease onset. Resistance statement 5 ⁵ . Apply at early to mid-flowering (4-7 days after flower initiation). Make second application if disease persists. Do not apply more than 24 fl oz/season. 21- day PHI.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Leaf spot includes fungal leaf diseases such as tan spot, Septoria blotch and spot blotch on wheat, and spot blotch and net blot on barley.

⁵See fungicide resistance management statements on Pages 7-8.

Grasses (Forage) Seed Treatment

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Fludioxonil (12) Maxim 4 FS, 40.3%	Slurry	0.08-0.16 fl oz/cwt	X	For seed-borne and soil-borne fungi.
Spirato 480 FS, 40.3%	Slurry	0.08-0.16 fl oz/cwt	X	
Mefenoxam (4) Apron XL LS, 32.3%	Slurry or mist	0.32-0.64 fl oz/cwt	X	Apron XL LS controls only <i>Pythium</i> . For both commercial and on-farm use.
Metalaxyl (4) Allegiance FI 28.35% Sebring 318 FS, 28.35%				Acquire and Allegiance controls only <i>Pythium</i> .
Allegiance Dry Seed Protectant, 12.5%	Drill box	3-4 oz/cwt	X	Allegiance Dry Seed Protectant is for drill box application to seed not previously treated with Apron; thorough mixing of fungicide and seed is essential for good control.
Dyna-Shield, 28.35%	Slurry	0.75 fl oz/cwt	X	
Belmont – 2.7 FS 28.98%	Slurry or mist			

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Grasses (Forage) Seed Treatment (continued)

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Thiram (M3) 42-S Thiram, 42%	Liquid or slurry	8 fl oz/cwt	X	
Thiram 50WP Dyed, 50%	Drill box or slurry	8 oz/cwt	X	
Signet 480 FS, 42%	Liquid or slurry	8 fl oz/cwt	X	

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Lentils Seed Treatment

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Azoxystrobin (11) Dynasty 9.6%, Protege 9.6%	Slurry	0.153-0.765 fl oz/cwt	X	For seed-borne and soil-borne fungi. Not for <i>Pythium</i> if used alone.
Fludioxonil (12) Maxim 4FS, 40.3% Spirato 480 FS, 40.3% Dyna-Shield Fludioxonil, 40.3%	Slurry	0.08-0.16 fl oz/cwt	X	For seed-borne and soil-borne fungi.
Ipconazole (3) Rancona 3.8 FS, 40.7%	Slurry or mist	0.085 fl oz/cwt	X	Does not provide control of <i>Pythium</i>
Ipconazole (3) + Metalaxyl (4) Rancona Summit, 0.902%: 1.443% Rancona CTS, 2.42%; 1.94%	Slurry or mist	4.0 fl oz/cwt	X	
Mefenoxam (4) Apron XL, 33.3%	Slurry or mist	0.32-0.64 fl oz/cwt	X	Use 0.32-0.64 fl oz/cwt for <i>Pythium</i> damping off. For early season <i>Phytophthora</i> , use 0.64 fl oz/cwt.
Mefenoxam (4) + Fludioxonil (12) Apron Maxx RTA 1.1%:0.73%	Slurry	5 fl oz/cwt	X	For protection against damping-off and seed rots.
Apron Maxx RFC 3.46%:2.31%	Slurry	1.5 fl oz/cwt	X	

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Lentils Seed Treatment (continued)

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Mefenoxam (4) + Fludioxonil (12) + Thiamethoxam Cruiser Maxx 1.7%:1.12%:22.61%	Slurry or mist	3 fl oz/cwt	X	
Metalaxyl (4) Allegiance FL, 28.35% Sebring 318 FS	Slurry or mist	0.75 fl oz/cwt	X	Metalaxyl controls only <i>Pythium</i> .
Allegiance Dry Seed Protectant, 12.5%	Drill box	4 oz/cwt	X	
Dyna-Shield, 28.35%	Slurry	0.75 fl oz/cwt	X	
Belmont 2.7 FS, 28.98%	Slurry or mist	0.75 fl oz/cwt	X	
Prothioconazole (3) + Penflufen (7) + Metalaxyl (4) EverGol Energy 7.18%:3.59%:5.74%	Slurry or mist	1.0 fl oz/cwt	X	For seed-borne and soil borne fungi and seed rot and damping off caused by <i>Rhizoctonia</i>
Pyraclostrobin (11) Stamina, 18.4%	Slurry or mist	0.4-1.5 fl oz/cwt	X	For seed-borne and soil-borne fungi.
Fluxapyroxad (7) + Pyraclostrobin (11) + Metalaxyl (4) Obvius, 1.58%; 1.58%; 1.26%	RTA Slurry	4.6 fl oz/cwt	X	Control of <i>Rhizoctonia</i> sp., <i>Fusarium</i> sp., <i>Pythium</i> sp., <i>Botrytis</i> sp., <i>Colletotricum</i> sp., and <i>Ascochyta</i> sp. (seed borne).
Sedaxane (7) Vibrance, 43.7%	Slurry	0.08-0.16 fl oz/cwt or 2.5-5 gal/100 kg of seed	X	For seed decay, seedling blights, and damping off caused by <i>Rhizoctonia</i>
Sedaxane (7) + Mefenoxam (4) + Fludioxonil (12) Vibrance Maxx, 4.69%; 3.52%; 2.35%	Slurry	1.54 fl oz/cwt	X	For seed-borne and soil-borne diseases caused by <i>Rhizoctonia</i> , <i>Pythium</i> and <i>Fusarium</i> .
Toclofos-methyl (14) Rizolex, 42%	Slurry or mist	0.3 fl oz/cwt	X	For seed-borne and soil-borne diseases. Controls <i>Rhizoctonia</i> and <i>Fusarium</i> species.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Lentils Seed Treatment (continued)

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Thiabendazole (1) Mertect 340-F, 42.3%	Slurry	1.05 fl oz/cwt	X	For seed-borne control of <i>Ascochyta rabiei</i> .
Thiram (M3) Thiram 480 DP, 42%	Slurry	8 fl oz/cwt	X	For seed-borne and soil-borne diseases.
Trifloxystrobin (11) Trilex, 22%	Slurry	0.32 fl oz/cwt	X	For seed-borne and soil-borne fungi.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Lentils Foliar Sprays

Chemical (Fungicide Group)	Application ⁿ¹	Dosage ²	Ascochyta Control ³	Anthraco-nose Control ³	Remarks
Bacillus subtilis strain QST 713 (44) Serenade ASO, 1.34%	Spray or fungigation	2-6 qt/A			Begin applications when environmental conditions and plant stage are conducive to disease development.
Boscalid (7) Endura, 70%	Spray or fungigation	8-11oz/A	X		Resistance Statement 6 ⁴ Also controls white mold. Begin applications prior to disease development and repeat on a 7- to 14-day interval. Do not make more than 2 applications per season (22 oz/A/season).
Chlorothalonil (M5) Equus 720 SST, 54.0%	Spray or fungigation	1.0-1.5 pts/A	X	X	Begin applications prior to disease development. Repeat applications at 7-10 day intervals. Do not apply more than 8.0 pts/A/year. PHI = 14 days.
Penthiopyrad (7) Vertisan, 20.6%	Spray or fungigation	14-20 fl oz/A	X	X	Begin applications prior to disease development. For white mold, make initial application at beginning bloom and follow with a second application at full bloom. Do not exceed 41 fl oz/A per year. PHI = 21 days.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Lentils

Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Ascochyta Control ³	Anthracnose Control ³	Remarks
Difenoconazole (3) + Benzovindiflupyr (7) Aprovia Top, 11.25%; 7.50%	Spray or fungigation	10.5-11 fl oz/A	X	X	Begin applications prior to disease onset when conditions are conducive for disease. Do not make more than two sequential applications before alternating to a fungicide from a different group. Do not apply more than 22 fl oz/A per year. PHI = 14 days.
Fluopyram (7) + Prothioconazole (3) ProPulse 17.4%:17.4%	Spray or fungigation	8.0-10.3 fl oz/A	X		Apply at early flower or at the first sign of disease, whichever occurs first. Do not make more than two sequential applications before rotating with a fungicide from a different group. Continue applications as needed on a 10-14-day interval. Do not apply within 7 days of cutting or swathing the crop for harvest or within 14 days of harvest.
Fluxapyroxad (7) + Pyraclostrobin (11) Priaxor 14.33%:28.58%	Spray or fungigation	4-8 fl oz/A	X	X	Resistance statement 5 and 6 ⁴ Begin applications prior to disease development and continue on a 7-14-day interval if conditions are conducive to disease development. Maximum applications per season=2 PHI=21 days
Prothioconazole (3) Proline 480 SC, 41%	Spray	5.0-5.7 fl oz/A	X		Resistance Statement 3 ⁴ Apply at early flowering or at the first sign of disease. Use the higher rate when conditions are favorable for severe disease pressure and/or when growing more susceptible varieties. Do not make more than 3 applications per year. Repeat applications as needed on a 10- to 14-day interval. Do not apply within 7 days of cutting or swathing the crop for harvest.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Lentils Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Ascochyta Control ³	Anthracnose Control ³	Remarks
Qols					Resistance Statement 5 ⁴ .
Azoxystrobin (11) Quadris, 22.9% Satori, 22.9% Tetraban, 22.9%	Spray or fungigation	6.0-15.5 oz/A	X	X	Begin applications prior to disease development and continue on a 7- to 14-day interval. Do not apply more than 2.88 qt/A/season for Quadris.
Pyraclostrobin (11) Headline EC, 23.6% Headline SC, 23.3%	Spray or fungigation	6-9 fl oz/A	X	X	Begin applications prior to disease development and repeat on a 7- to 14- day interval if conditions are conducive for disease development.
Picoxystrobin (11) Approach, 22.5%	Spray or fungigation	6-12 fl oz/A	X	X	Begin applications prior to disease development and continue on a 7-14-day interval when disease pressure is high. Apply no more than 24 fl oz/A per season. 14-day PHI.
Trifloxystrobin (11) + Prothioconazole (3) Stratego YLD 32.3%; 10.8%	Spray or fungigation	4.0-4.8 fl oz/A	X	X	Apply at early flower or at the first symptom of the disease, whichever occurs first. Do not exceed 0.28 lb prothioconazole or 0.24 lb of trifloxystrobin per acre per year. Do not apply within 30 days of harvest. Do not apply within 7 days of cutting or swathing the crop for forage.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Pea (Field) Seed Treatment

Chemical	Application	Dosage ¹	Control ² of Seedling Blight ³	Remarks
Azoxystrobin (11) Dynasty 9.6%	Slurry	0.153-0.765 fl oz/A	X	
Captan (M4) Captan 75%	See label for directions	1 oz/bu	X	Does not control seed-borne <i>Ascochyta</i> .
Fludioxonil (12) Maxim 4FS, 40.3% Spirato 480FS, 40.3% Dyna-Shield Fludioxonil, 40.3%	Slurry Slurry Slurry	0.08-0.16 fl oz/cwt 0.08-0.16 fl oz/cwt 0.08-0.16 fl oz/cwt	X X X	For seed-borne and soil-borne fungi.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Pea (Field) Seed Treatment (continued)

Chemical	Application	Dosage ¹	Control ² of Seedling Blight ³	Remarks
Ipconazole (3) Rancona 3.8 FS, 40.7%	Slurry or mist	0.085 fl oz/cwt	X	Does not provide control of <i>Pythium</i>
Ipconazole (3) + Metalaxyl (4) Rancona Summit, 0.902%: 1.443% Rancona CTS, 2.42%; 1.94%	Slurry or mist	4.0 fl oz/cwt	X	For seed rot, damping of and seedling blight.
Mefenoxam (4) Apron XL, 33.3%	Slurry or mist	0.32-0.64 fl oz/cwt	X	Use 0.32-0.64 fl oz/cwt for <i>Pythium</i> damping off. For early season <i>Phytophthora</i> , use 0.64 fl oz/cwt.
Mefenoxam (4) + Fludioxonil (12) Apron Maxx RTA 1.1%:0.73% Apron Maxx RFC 2.31%:3.46% Maxim XL 8.4%:21%	Slurry Slurry Slurry	5 fl oz/cwt 1.5 fl oz/cwt 0.167-0.334 fl oz/cwt	X X X	For control of seed rots due to <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , <i>Rhizoctonia</i> .
Mefenoxam (4) + Fludioxonil (12) + Thiamethoxam Cruiser Maxx 1.7%:1.12%:22.61%	Slurry or mist	1.5 fl oz/cwt	X	For seed-borne and soil-borne fungi and insects. Contains thiamethoxam for insect control.
Metalaxyl (4) Allegiance FI, 28.35% Sebring 318 FS, 28.35%	Mist or slurry	0.75 fl oz/cwt	X	For <i>Pythium</i> damping off. See labels for higher rates for systemic downy mildew.
Allegiance Dry Seed Protectant 12.5%	Drill box	4 fl oz/cwt	X	Apron Dry Seed Protectant for drill box application to seed not previously treated with Apron. Thorough mixing of fungicide and seed is essential for good control.
Dyna-Shield, 28.35%	Slurry	0.75 fl oz/cwt	X	
Belmont 2.7 FS, 28.98%	Slurry or mist	0.75 fl oz/cwt	X	
Prothioconazole + Penflufen + Metalaxyl EverGol Energy 7.18%:3.59%:5.74%	Slurry or mist	1.0 fl oz/cwt	X	For seed-borne and soil-born fungi and seed rot and damping off caused by <i>Rhizoctonia</i> .

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Pea (Field) Seed Treatment (Continued)

Chemical	Application	Dosage ¹	Control ² of Seedling Blight ³	Remarks
Fluxapyroxad (7) + Pyraclostrobin (11) + Metalaxyl (4) Obvius, 1.58%; 1.58%; 1.26%	RTA Slurry	4.6 fl oz/cwt	X	Control of <i>Rhizoctonia</i> sp., <i>Fusarium</i> sp., <i>Pythium</i> sp., <i>Botrytis</i> sp., <i>Colletotricum</i> sp., and <i>Ascochyta</i> sp. (seed borne).
Pyraclostrobin (11) Stamina, 18.4%	Slurry or mist	0.4-1.5 fl oz/cwt	X	For seed-borne and soil-borne fungi.
Sedaxane (7) Vibrance, 43.7%	Slurry	0.08-0.16 fl oz/cwt or 2.5-5 gal/100 kg of seed	X	For seed decay, seedling blights, and damping off caused by <i>Rhizoctonia</i>
Sedaxane (7) + Mefenoxam (4) + Fludioxonil (12) Vibrance Maxx, 4.69%; 3.52%; 2.35%	Slurry	1.54 fl oz/cwt	X	For seed-borne and soil-borne diseases caused by <i>Rhizoctonia</i> , <i>Pythium</i> and <i>Fusarium</i> .
Thiabendazole (1) Mertect 340-F, 42.3%	Slurry	1.05 fl oz/cwt	X	For seed-borne control of <i>Ascochyta rabiei</i> .
Thiram (M3) Thiram 480 DP, 42%	Slurry or mist	3 fl oz/cwt	X	For seed-borne and soil-borne diseases.
Trifloxystrobin (11) + Metalaxyl (4) Trilex 2000, 7.12%:5.69%	Slurry or mist	1.0 fl oz/cwt	X	For seed-borne and soil-borne fungi.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Pea (Field) Foliar Sprays

Chemical (Fungicide Group)	Application ¹	Dosage ²	Control ³ of Powdery Mildew	Control ³ of Ascochyta Blight	Remarks
<i>Bacillus subtilis</i> strain QST 713 (44) Serenade ASO, 1.34%	Spray or fungigation	2-6 qt/A			Begin applications when environmental conditions and plant stage are conducive to disease development.
Difenoconazole (3) + Benzovindiflupyr (7) Aprovia Top, 11.25%; 7.50%	Spray or fungigation	10.5-11 fl oz/A	X	X	Begin applications prior to disease onset when conditions are conducive for disease. Do not make more than two sequential applications before alternating to a fungicide from a different group. Do not apply more than 22 fl oz/A per year. PHI = 14 days.
Fluxapyroxad (7) + Pyraclostrobin (11) Priaxor 14.33%:28.58%	Spray or fungigation	4-8 fl oz/A	X	X	Resistance statement 5 and 6 ⁴ Begin application prior to disease development and continue on a 7-14-day interval if conditions are conducive to disease development. Maximum applications per season=2 PHI=21 Pea hay may be fed no sooner than 14 days after last application.
Penthiopyrad (7) Vertisan, 20.6%	Spray or fungigation	14-20 fl oz/A	X	X	Begin applications prior to disease development. For white mold, make initial application at beginning bloom and follow with a second application at full bloom. Do not exceed 41 fl oz/A per year. PHI = 21 days.
Prothioconazole (3) Proline 480 SC, 41%	Spray	5.7 fl oz/A		X	Apply at early flowering or at the first sign of disease. Use higher rate when conditions are favorable for severe disease pressure and/or when growing more susceptible varieties. Do not make more than 3 applications per year. Repeat applications as needed on a 5- to 14-day interval. Do not apply within 7 days of cutting or swathing the crop for harvest.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statement on Pages 7-8.

Pea (Field) Foliar Sprays (Continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Control ³ of Powdery Mildew	Control ³ of Ascochyta Blight	Remarks
Qols Azoxystrobin (11) Quadris, 22.9% Satori, 22.9% Equation, 22.9% Tetraban, 22.9%	Spray or fungigation	6.0-15.5 fl oz/A	X	X	Resistance statement 5 ⁴ . Products also control many other fungal leaf diseases. Make applications preventatively for best results. Additional applications may be required under favorable environmental conditions. PHI: 14 days for Quadris, 21 days for Headline, 14 days for Aproach
Pyraclostrobin (11) Headline EC, 23.6% Headline SC, 23.3%	Spray or fungigation	6-9 fl oz/A	X	X	
Picoxystrobin (11) Aproach, 22.5%	Spray or fungigation	6-12 fl oz/A	X	X	
Trifloxystrobin (11) + Prothioconazole (3) Stratego YLD 32.3%; 10.8%	Spray or fungigation	4.0-4.8 fl oz/A		X	
Sulfur (M) Kumulus DF, 80%	Spray or fungigation	3-5 lb/A	X		Sulfur has been used in Wisconsin and the Prairie Provinces of Canada. Its economic return has not been determined for North Dakota.
Liquid Sulfur Six, 52%	Spray or fungigation	3-4 pt/A	X		
Micro Sulf, 80%	Spray or fungigation	3-5 lb/A	X		
Microthiol Disperss, 80%	Spray or fungigation	7 lb/A	X		

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statement on Pages 7-8.

Potato Seed Treatment

Chemical	Application	Dosage ¹	Disease Control ²		Remarks
			Fungi ³	Bacteria ⁴	
Azoxystrobin (11) Dynasty, 9.6%	Water-based slurry	0.10-3.75 fl oz/cwt	X		For suppression of black scurf and stem canker and seed-borne black dot, and for protection against silver scurf.
Fenamidone (11) Reason, 44.4%	Diluted spray slurry	0.15 fl oz/cwt	X		For protection against seed-borne late blight. Do not apply in more than 2.5 fl oz of total slurry per 100 lbs of seed.
Fludioxonil (12) Maxim 0.5%	Dust	8.0 oz/cwt	X		Maxim and Maxim MZ are formulated as dusts to be applied to cut or single-drop seed before planting. Maxim products effectively suppress <i>Fusarium</i> dry rot seed decay, stem cankers and tuber black scurf caused by seed-borne <i>Rhizoctonia solani</i> and seed-borne <i>Helminthosporium solani</i> , the causal agent of silver scurf disease. Half rates are recommended for processing (fries).
Maxim 4FS	Liquid	0.04-0.08 fl oz/cwt	X		
Spirato 480FS 40.3%	Slurry	0.08 fl oz	X		
Dyna-Shield Fludioxonil, 40.3%	Slurry	0.08-0.16 fl oz/cwt	X		
Fludioxonil (12) + mancozeb (M3) Maxim MZ, 0.5%:9.6%	Dust	0.5 lb/cwt	X		
Fludioxonil (12) + Thiamethoxam Cruiser Maxx Potato 7.0%:28%	Liquid	0.19-0.27 fl oz/cwt rate depends on seeding rate	X		To aid in control of certain insects and <i>Fusarium</i> dry rot and other fungal diseases.
Fludioxonil (12) + Difenoconazole (3) + Sedaxane (7) + Thiamethoxam CruiserMaxx Vibrance Potato, 3.34%; 6.69%; 6.69%; 13.4%	Slurry or mix	0.5 fl oz/cwt	X		To aid in control of <i>Rhizoctonia</i> , <i>Fusarium</i> , <i>Helminthosporium</i> and certain insects.

¹ Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³*Fusarium*, *Rhizoctonia solani* and *Helminthosporium solani*. These fungi cause dry rot, *Rhizoctonia* stem canker and silver scurf.

⁴Includes *Erwinia*, cause of soft rot decay, and *Clavibacter*, cause of ring rot.

Potato Seed Treatment (continued)

Chemical	Application	Dosage ¹	Disease Control ²		Remarks
			Fungi ³	Bacteria ⁴	
Mancozeb (M4) Koverall, 75%	Slurry	1.25lb/50 gal water	X		For suppression of <i>Fusarium</i> dry rot, <i>Rhizoctonia</i> , seed-borne common scab and silver scurf. Only Mancozeb will reduce the spread of <i>Phytophthora infestans</i> , the cause of late blight, during seed-cutting operations. Dip seed pieces into mixture
Manzate Flowable, 37%	Slurry	1 qt/50 gal water	X		
Manzate Pros tick, 75%	Dust	1.25 lbs/50 gal water	X		
PSP 6%	Dust	1 lb/cwt	X		
PST Plus Bark 6%	Dust	1 lb/cwt	X		
Penncozeb 75%	Slurry	1 ¼ lbs/50 gal water	X		
Penncozeb 80 WP, 80%	Slurry	1.25 lb/50 gal water	X		
Roper DF Rainshield, 75%	Slurry		X		
Mancozeb (M4) + Flutolanil (7) Moncoat MZ, 6.0%: 1.5%	Dust	0.75-1lb/cwt	X		For suppression of <i>Rhizoctonia</i> and <i>Fusarium</i> dry rot seed decay. MZ added to suppress <i>Fusarium</i> dry rot seed decay.
Penflufen (7) + Prothioconazole (3) Emesto Silver 9.35%:1.68%	Diluted Spray Slurry	0.31 fl oz-cwt	X		For suppression of <i>Rhizoctonia solani</i> , black scurf, stem and stolon canker caused by seed-borne and soil-borne <i>Rhizoctonia</i> , silver scurf caused by <i>Helminthosporium solani</i> and seed piece rot caused by <i>Fusarium</i> . For added <i>Fusarium</i> protection apply a MZ product designed for potatoes. Do not apply more than 2.5 fl oz of total slurry per 100 lbs of seed.
Sedaxane (7) Vibrance, 43.7%	Slurry	0.05-0.08 fl oz/cwt	X		For suppression of black scurf, stem and stolon canker, and seed-borne silver scurf.
Thiophanate methyl (1) ST-Methyl 540 FS, 46.2%	Slurry	0.5-0.7 fl oz/cwt	X		For aiding the control of dry rot, black scurf and stem canker, and silver scurf

¹ Dosage = amount of formulated product to apply.

² X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³ *Fusarium*, *Rhizoctonia solani* and *Helminthosporium solani*. These fungi cause dry rot, *Rhizoctonia* stem canker and silver scurf.

⁴ Includes *Erwinia*, cause of soft rot decay, and *Clavibacter*, cause of ring rot.

Potato Soil Application

Chemical (Fungicide Group)	Application	Dosage ¹	Control of Rhizoctonia ²	Pythium Leak	Pink Rot	Remarks
<i>Bacillus subtilis</i> Strain QST 713 (44) Serenade ASO 1.34%	In-furrow at planting	2-6 fl qt/A	X			Apply as directed spray in the seed furrow and to the covering soil at planting for management of <i>Rhizoctonia</i>
Azoxystrobin (11) Quadris, 22.9% Satori, 22.9% Equation, 22.9% Tetraban, 22.9%	In-furrow spray	0.4-0.6 fl oz/1,000 ft. of row (5.8-8.7 fl oz/A with 36" rows)	X			Resistance statement 5 ³ . For control of black scurf (<i>Rhizoctonia solani</i>) and Silver scurf (<i>Helminthosporium solani</i>). Also controls black dot caused by <i>Colletotrichum coccodes</i> . Apply as in-furrow spray in 5-15 gal of water at planting.
Pyraclostrobin (11) Headline EC, 23.6% Headline SC, 22.3%	In-furrow spray	0.4-0.8 fl oz/1,000 ft. of row	X			Maximum application rate is 0.73 fl oz/1,000 feet of row.
Fluoxastrobin (11) Evito, 40.3%	In-furrow spray	0.16-0.24 fl oz/1,000 ft of row	X			For control of black scurf, silver scurf and black dot. Do not use more than 22.8 fl oz/acre per year.
Cyazofamid (21) Ranman 34.5%	In-furrow lay by	0.42 fl. oz/1,000ft row 2.75 fl oz/A in minimum of 20 gallons of finished spray solution			X	For additional control of Pink Rot.
Azoxystrobin(11)+ Mefenoxam (4) Quadris Ridomil Gold SL	In-furrow spray	0.82 fl oz/1,000 ft. of row	X	X	X	Maximum application rate of 1.5lb of azoxystrobin and 0.5 lb of mefenoxam products per acre per season.
Azoxystrobin (11) + Benzovindiflupyr (7) Elatus, 30.0%; 15.0%	In-furrow spray	0.34-0.5 oz/1,000 ft. of row	X			Also manages black dot and silver scurf. Do not apply more than 9.5 fl oz/A per year. PHI = 14 days.
Fluazinam (29) Omega 500F, 40%	In-furrow spray	1.5-3.0 pts/A				For suppression of Powdery Scab. Apply in- furrow over the seed piece immediately prior to covering over the seed piece with soil using at least 5 to 10 gpa. Use 1.5 pint per acre rate on fields with a history of low levels of powdery scab or with low numbers of spore balls present in the soil. Apply 3 pints per acre rate to fields with a history of moderate to heavy disease pressure or with moderate to high numbers of spore balls present in the soil. 24 c labels for use in Minnesota and North Dakota.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³See fungicide resistance management statement on Pages 7-8.

Potato Soil Application (Continued)

Chemical (Fungicide Group)	Application	Dosage ¹	Control of Rhizoctonia ²	Pythium Leak	Pink Rot	Remarks
Flutolanil (7) Moncut, 70%	In-furrow	0.79-1.18 oz/1,000 ft. row of a 36 in row	X			
Fluxapyroxad (7)+ Pyraclostrobin (11) Priaxor 14.33%: 28.58%	In-furrow spray	0.48-0.6 fl oz/1,000 ft. row.	X			Resistance statement 5 and 6 ³ For 34-inch rows or less, use a maximum of 0.48 fl oz product per 1000 row feet
Penthiopyrad (7) Vertisan, 20.6%	In-furrow	0.7-1.6 fl oz/1,000 ft row	X			Maximum rate per acre per application is 24 fl oz.
Mefenoxam (4) Ridomil Gold EC or SL, 48%	6-8 inch band, in furrow or impregnated on dry fertilizer	0.42 fl oz /100 ft. of row		X	X	Resistance statement 4 ³ . For postharvest control of pythium leak and pink rot caused by <i>Phytophthora</i> <i>erythroseptica</i> .
Ultra Flourish, 25.1%		0.84 fl oz /100 ft. of row		X	X	
Platinum Ridomil Gold, 9%		2.2 fl oz /1,000 ft. row		X	X	Platinum Ridomil Gold contains 4.5% thiamethoxam for control of various potato insects.
Phosphites (33) Sodium (mono - and - dibasic) Potassium, and Ammonium Phosphites (33), Several products		check label			X	Apply in a band at planting directly over the seed pieces. For Pythium leak control, apply in combination with mefenoxam fungicide. Soil applications have not been shown to be efficacious with this fungicide. Foliar applications are recommended.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³See fungicide resistance management statement on Pages 7-8.

Potato Foliar Sprays

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks ⁴
			Late Blight	Early Blight	
SDHI Boscalid (7) Endura, 70%	Spray or fungigation	2.5-4.5 oz/a (EB) 5.5-10 oz/A (white mold)		X	Resistance statement 6 ⁵ . Recent NDSU Research has indicated that >90% of the <i>A. solani</i> is resistant to boscalid. 10-day PHI. Also controls <i>Sclerotinia</i> white mold and Botrytis. For white mold control, apply prior to infection generally just prior to row closure. For early blight control, apply prior to disease onset. Do not exceed 20 oz/A per season.
Penthiopyrad (7) Vertisan, 20.6%	Spray or fungigation	10-24 fl oz/A (early blight) 14-24 fl oz/A (white mold) 14-24 fl oz/A (black dot)		X	Resistance statement 6 ⁵ . Recent NDSU research demonstrated that >70% of <i>Alternaria solani</i> isolates are resistant to another FRAC 7 product, Boscalid, and over 50% of those isolates are also resistant to Penthiopyrad. Begin applications prior to disease development. Repeat applications every 7-14 days. For white mold, make initial application at full bloom. Do not exceed 72 fl oz/A per season and make no more than 2 sequential applications. PHI = 7 days
<i>Bacillus subtilis</i> strain QST 713 (44) Serenade ASO, 1.34%	Spray or fungigation	2-6 qt/A	X	X	Include in a multiple spray program for management of early blight.
Chlorothalonil (M5) Bravo WeatherStik, Equus 720, Echo 720, Praiz, Vabro or Chloronil 720, 54%	Spray or fungigation	0.75 pt/ A 1 st application. 1.0-1.5 pt/A subsequent applications	X	X	Do not apply more than 11.25 lb ai of chlorothalonil per acre per season (23 pt of 40.4%, 16 pt of 54%, 14.5 lb of 82.5%, 13 lb of 90%). Do not apply within 7 days of harvest. A 24 (C) state label has been granted to Echo 720, Echo ZN to allow up to 16 lb ai per acre per season for late blight control. Do not apply more than 16 lb ai of Bravo Zn, Bravo Weatherstik or Bravo ZN per season (30.5 pt Bravo Zn, 21.5 pt of Bravo Weatherstik or Bravo Weatherstik Zn). Bravo Ultrex has a maximum 10-day interval between applications for potato late blight control.
Bravo Ultrex DG, 82.5%	Spray or fungigation	0.7-1.4 lb/A	X	X	
Bravo Zn, Echo Zn or Terranil Zn, 38.5%	Spray or fungigation	1.0-2.13 pt/A	X	X	
Equus DF, 82.5%	Spray or fungigation	0.7 lb/A first application. 0.9-1.36 lb/A subsequent applications	X	X	
Echo 90 DF, 90%	Spray or fungigation	0.63-1.25 lb/A	X	X	
Orondis Opti B 54.0%	Spray or fungigation	0.75 pt/A 1 st application. 1.5 pt/A subsequent applications.	X	X	

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Check the NDSU blight hotline, (888) 482-7286, for information on infection potential of early blight and late blight. Whenever late blight is severe, vine killing is extremely important and should be done at least 2 weeks before harvest to prevent tuber infections. Hilling of soil around the vines should be done just before killing them. ⁵See fungicide resistance management statement on Pages 7-8.

Potato Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks ⁴
			Late Blight	Early Blight	
Chlorothalonil (M5) + Zoxamide (22) Zing! 40%, 6.8%	Spray or fungigation	32-34 fl oz/A	X	X	Apply on preventative schedule. Do not make more than 2 sequential applications before alternating with a fungicide that has a different mode of action. Do not make more than 8 applications or apply more than 1.52lb zoxamide and 8.8lb chlorothalonil per acre per season. Do not apply within 7 days of harvest.
SDHI + QoI Fluxapyroxad (7) + Pyraclostrobin (11) Priaxor 14.33%:28.58%	Spray or fungigation	4 to 8 fl oz/A	X	X	Resistance Statements 5 and 6 ⁵ Recent NDSU research demonstrated that >90% of <i>Alternaria solani</i> isolates are resistant to another FRAC 7 product, Boscalid, and greater than 50% of those isolates are also resistant to Fluxapyroxad. Also, >90% of <i>A. solani</i> isolates are resistant to pyraclostrobin Also for control of Black dot, Brown Spot and blackpit, and suppression of Botrytis gray mold. For suppression of late blight only Do not apply more than 3 applications or 24 fl oz/A per season. PHI=7 days.
Copper (M1) Basicop WP, 53% Champ DP, 57.6% Champ WG, 77% Champ Formula 2 Flowable, 37.5% Champlon++ 46.1% Cuprofix Ultra 40 Disperss 71.1% Kocide 2000, 53.8% Kocide 3000, 46.1% Kocide 4.5 LF, 37.5% MasterCop, 21.46% Badge X2, 45.31% Badge SC, 32.17%	Spray Spray or fungigation Spray or fungigation Spray or fungigation Spray or fungigation Spray or fungigation Spray or fungigation Spray or fungigation Spray or fungigation Spray or fungigation	3-6 lbs/A 0.66-2.66 lb/A 1-1 ½ lbs/A 0.66-2.66 pt/A 0.5-1.75 lb/A 0.75-3.0 lb/A 1.25-6lb/A 0.5-1.75 lb 0.66-2.66 pt/A 0.5-1.5 pt/A 0.5-1.75 lbs/A 1-4 pt/A	X X X X X X X X X X X X	X X X X X X X X X X X X	Do <u>not</u> apply Basicop through irrigation system. Coppers are not effective under high disease pressure. Control will be improved by tank mixing with other compatible registered fungicides.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Check the NDSU blight hotline, (888) 482-7286, for information on infection potential of early blight and late blight. Whenever late blight is severe, vine killing is extremely important and should be done at least 2 weeks before harvest to prevent tuber infections. Hilling of soil around the vines should be done just before killing them.

⁵See fungicide resistance management statement on Pages 7-8.

Potato Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks ⁴
			Late Blight	Early Blight	
Copper Sulfate (M1) Blue Viking Star Glow Powder or Triangle Brand Copper Sulfate Instant Powder	Spray	10 lb/A			For application with Diquat desiccant to enhance vine desiccation and suppress late blight.
Cymoxanil (27) Curzate 60 DF, 60%	Spray or fungigation	3 1/3 oz/A	X		Must be tank-mixed with a protectant fungicide. Do not apply within 14 days of harvest.
Dimethomorph (40) Forum, 43.5%	Spray or fungigation	6 oz/A	X		Do not exceed 30 oz/A per season. Do not apply Forum alone; must be tank-mixed with fungicides other than mefenoxam or metalaxyl registered for late blight control. 4-day PHI.
Fluopyram (7) + Pyrimethanil (9) Luna Tranquility 11.3%:33.8%	Spray or fungigation	11.2 fl oz/A		X	Resistance statement 6 ⁵ . None of the currently known SDHI mutations of the pathogen causing early blight (<i>Alternaria solani</i>) that affect boscalid appear to affect fluopyram. Also effective against white mold, botrytis, brown spot, and black dot. Apply Luna Tranquility mid-season on a 7 to 14-day interval. For resistance management of early blight and improved late blight management mix Luna Tranquility with an EBDC or chlorothalonil. Do not apply more than 2 sequential applications or any Group 7 or 9 containing fungicide before rotating with a fungicide from a different group. PHI=7 days.
Fluazinam (29) Omega 500F, 40%	Spray or fungigation	5.5 fl oz/A for late blight 5.5-8 fl oz/A for white mold 1.5-3.0 pints/A in-furrow for powdery scab	X		Begin applications when conditions favor disease development. Repeat applications at 7-10 days. Do not apply more than 3.5 pts per acre per season. Do not apply within 14 days of harvest. Provides some tuber protection against late blight when used at the end of the season.
Iprodione (2) Rovral 4F, 41.6% Nevado 4F, 41.6% Meteor, 41.6%	Ground spray or fungigation	1-2 pt/A, early blight		X	Resistance statement 2 ⁵ . Rovral Nevado 4F also are labeled for control of white mold. Do not apply within 14 day of harvest. If pH of spray water is above 7.0, buffer it to pH 5.0-7.0.

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²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Check the NDSU blight hotline, (888) 482-7286, for information on infection potential of early blight and late blight. Whenever late blight is severe, vine killing is extremely important and should be done at least 2 weeks before harvest to prevent tuber infections. Hilling of soil around the vines should be done just before killing them.

⁵See fungicide resistance management statement on Pages 7-8.

Potato Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks ⁴
			Late Blight	Early Blight	
Mancozeb (M3) Dithane DF Rainshield NT, 75%	Spray or fungigation	0.5-2 lb/A	X	X	Do not apply within 14 days of harvest. Vine kill should occur 14 days before harvest. Do not apply more than 11.2 lb ai/A per season of total EBDC (mancozeb, maneb or metiram). We recommend that this product be used with an Integrated Pest Management Program.
Dithane F-45, 37%	Spray or fungigation	0.8-1.6 qt/A	X	X	
Dithane M-45, 80%	Spray or fungigation	1-2 lb/A	X	X	
Koverall, 75%	Spray or fungigation	1-2 lb/A	X	X	
Manex II, 37%	Spray or fungigation	0.8-1.6 qt/A	X	X	
Manzate ProStick, 75%	Spray or fungigation	1-2 lb/A	X	X	
Manzate Flowable, 37%	Spray or fungigation	1-2 lb/A	X	X	
Penncozeb, 80%	Spray or fungigation	1-2 lb/A	X	X	
Penncozeb DF, 75%	Spray or fungigation	1-2 lb/A	X	X	
Roper DF Rainshield, 75%	Spray or fungigation	1-2 lb/A	X	X	
Mancozeb (M3) + Copper (M1) Mankocide, 15.0%:46.1%	Spray or fungigation	1.5-5.0 lbs/A	X	X	Do not use within 3 days of harvest.
Mancozeb (M3) + Zoxamide (22) Gavel, 66.7%:8.3%	Spray or fungigation	1.5-2 lb/A	X	X	Do not apply within 14 days of harvest. Do not make more than 6 applications or apply more than 12 lbs (8 lbs active mancozeb + 1 lb active zoxamide) per acre per season. Provides some tuber protection against late blight when used at the end of the season.
Mancozeb (M3) + Chlorothalonil (M5) Elixir, 62.5%; 12.5%	Spray or fungigation	1.2-2.0 lbs/A	X	X	Do not apply with 14 days of harvest. Do not apply more than 18.0 lbs/A per season. Recommended that this product be used in an Integrated Management Program.
Mandipropamid (40) + Difenoconazole (3) Revus Top, 21.9%:21.9%	Spray or fungigation	5.5-7.0 fl oz/A	X	X	Begin applications before disease development and continue on 7- to 10-day intervals. Also controls black dot and brown spot. Do not make more than 2 applications before switching to a different mode of action. Do not apply within 14 days of harvest or apply more than 28 fl oz/season.

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²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Check the NDSU blight hotline, (888) 482-7286, for information on infection potential of early blight and late blight. Whenever late blight is severe, vine killing is extremely important and should be done at least 2 weeks before harvest to prevent tuber infections. Hilling of soil around the vines should be done just before killing them.

⁵Mefenoxam provides average control of new mating types of the late blight fungus; it provides excellent control for mefenoxam-sensitive strains of the A1 mating type. Most late blight strains present since 1998 are resistant to mefenoxam.

⁶See fungicide resistance management statement on Pages 7-8.

Potato Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks ⁴
			Late Blight	Early Blight	
Mefenoxam (4) + Chlorothalonil (M5) Ridomil Gold/Bravo WP, 4.5%:72% Ridomil Gold/Bravo Liquid	Spray or fungigation Spray or fungigation	2 lb/A 1 container/ 10 acres	X ⁵	X	Resistance statement 4 ⁶ . Do not apply Ridomil Gold/Bravo, Ridomil Gold/Bravo Liquid or Ridomil Gold/Copper within 14 days of harvest. For late blight control, begin applications when conditions are favorable for late blight, but before infection, and continue at 14-day intervals until threat of disease is over. To minimize the potential for resistance, do not make more than 3 applications. The full rate of a protectant fungicide should be applied between Ridomil applications, regardless of the Ridomil formulation used. See label for rotation restrictions: waiting period to plant after application of Ridomil (all formulations) is 0 days for dry beans, soybeans, potatoes and sugarbeets; 40 days for wheat, barley, and oats; 9 months for corn; and 12 months for all other crops. A minimum of two applications at 2 lb/A (flowering and 14 days later) for all Ridomil formulations will control A1 late blight tuber rot, <i>Pythium</i> leak and <i>Phytophthora erythroseptica</i> pink rot. For aerial applications a minimum of 5 gal/A spray volume is recommended.
Mefenoxam (4) + Copper Hydroxide (M1) Ridomil Gold/Copper WP, 5%:60%	Spray or fungigation	2.0 lb/A + 0.8 lb ai/A of maneb, mancozeb, metiram or chlorothalonil	X ⁵	X	
Mefenoxam (4) + Mancozeb (M3) Ridomil Gold MZ, 4%:64%	Spray or fungigation	2.5 lb/A	X ⁵	X	Resistance statement 4 ⁶ . Do not apply Ridomil Gold MZ within 14 days of harvest. For late blight control, begin applications when conditions are favorable for late blight, but before infection, and continue at 14-day intervals until threat of disease is over. To minimize the potential for resistance, do not make more than 3 applications. The full rate of a protectant fungicide should be applied between Ridomil applications, regardless of the Ridomil formulation used. See label for rotation restrictions: waiting period to plant after Ridomil application (all formulations) is 0 days for dry beans, soybeans, potatoes and sugar beets; 40 days for wheat, barley and oats; 9 months for corn and sweet corn; and 12 months for all other crops. Two applications (flowering and 14 days later) at 2.5 lb rate will control A1 late blight tuber rot, <i>Pythium</i> leak and <i>Phytophthora erythroseptica</i> pink rot. For aerial applications, minimum of 5 gal/A spray is recommended.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Check the NDSU blight hotline, (888) 482-7286, for information on infection potential of early blight and late blight. Whenever late blight is severe, vine killing is extremely important and should be done at least 2 weeks before harvest to prevent tuber infections. Hilling of soil around the vines should be done just before killing them.

⁵See fungicide resistance management statements on Pages 7-8.

Potato Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Late Blight Control ³	Early Blight Control ³	Remarks ⁴
Metconazole (3) Quash 50%	Spray or fungigation	2.5-4.0 fl oz/A		X	Also effective on black dot, brown spot, and white mold. Use in a tank mix with Chlorothalonil or Mancozeb. Do not apply more than 2 applications per season. PHI=1 day
Metiram (M3) Polyram 80 DF, 80%	Spray or fungigation	1.5-2 lb/A	X	X	Do not apply within 14 days of harvest. Vine kill should occur 14 days before harvest. Do not exceed 14 lbs/A per season. We recommend that this product be used with an Integrated Pest Management Program. See label for further restrictions.
Potassium Phosphite (33) + Chlorothalonil (M5) Catamaran	Spray or fungigation	4.0-5.5 pt/A	X	X	Also for pink rot. See label for application instructions. Do not apply more than 17 pts/A/season. Do not apply within 6 weeks of harvest.
Propamocarb (28) Previcur, 66.5%	Spray or fungigation	0.7 pt/A low disease risk 0.9 pt/A medium disease risk 1.2 pt/A high disease risk	X		Do not apply more than 6 pts of Previcur/acre/season. Do not apply within 14 days of harvest. Use in a tank mix with 0.9 lb ai/acre of chlorothalonil (1.2 pt/acre of Bravo Weatherstik or equivalent) or 1 lb ai mancozeb (1.25 lb/acre of Dithane M-45 or equivalent).
Pyrimethanil (9) Scala, 54.6%	Spray or fungigation	7 fl oz/A		X	Also effective against Botrytis. Use only in tank mix with protectant such as mancozeb and chlorothalonil. Do not apply more than 35 fl oz/A per season. Do not make more than 2 consecutive applications of Scala. PHI= 7 days.
Mandipropamid (40) Orondis Ultra B 23.3%	Spray or fungigation	8 fl oz/A	X		Begin applications prior to disease development. Make no more than 2 sequential applications of a group 40 fungicide. Do not apply more than 32 fl oz/A per season. PHI = 14 days.

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⁴Check the NDSU blight hotline, (888) 482-7286, for information on infection potential of early blight and late blight. Whenever late blight is severe, vine killing is extremely important and should be done at least 2 weeks before harvest to prevent tuber infections. Hilling of soil around the vines should be done just before killing them.

⁵See fungicide resistance management statements on Pages 7-8.

*Designates restricted-use pesticide.

Potato Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks ⁴
			Late Blight	Early Blight	
Sodium (mono - and dibasic -), Potassium, and Ammonium Phosphites (33) Several products	Spray or fungigation	check label	X		Provides better control when alternated with other fungicides. Also provides suppression of storage rot diseases such as pink rot.
Thiophanate methyl (1) Topsin M WSB, or T-Methyl E-AG 70 WSB, 70%	Spray or fungigation	1-1.5 lbs/A			Resistance statement 1 ⁵ . Topsin M, Topsin 4.5 FI acre, Incognito 4.5F, Incognito 85 WDG, and Thiophanate methyl WDG are labeled for white mold control in potatoes.
Topsin 4.5 FL, 45% or T-Methyl E-AG 4.5F, Cercobin, 41.3%	Spray or fungigation	20-30 fl oz/A			
Thiophanate Methyl 85 WDG, 85% Incognito 85 WDG, 85%	Spray or fungigation	0.8-1.2 lb/A			
Incognito 4.5F, 46.2%	Spray or fungigation	20-30 fl oz/A			
Oxathiapiprolin (U15) Orondis Opti A 10.2%	Spray or fungigation	1.6-4.8 fl oz/A	X		Use higher rates when disease is present, for longer application intervals or for susceptible varieties. Do not exceed 27.2 fl oz/A per year. PHI = 5 days.
Orondis Ultra A 10.2%	Spray or fungigation	1.6-4.8 fl oz/A	X		

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⁴Check the NDSU blight hotline, (888) 482-7286, for information on infection potential of early blight and late blight. Whenever late blight is severe, vine killing is extremely important and should be done at least 2 weeks before harvest to prevent tuber infections. Hilling of soil around the vines should be done just before killing them.

⁵See fungicide resistance management statements on Pages 7-8.

***Designates restricted-use pesticide**

Potato Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks ^{4,5}
			Late Blight	Early Blight	
QoIs					
Azoxystrobin (11) Quadris, 22.9% Satori, 22.9% Equation, 22.9% Tetraban, 22.9%	Spray or fungigation	6.0-15.5 fl oz/A	X	X	Resistance statement 5 ⁵ For all Early blight: 6.2 fl oz/A on a 7-day interval or 12.4 fl oz/A on a 14-day interval. Late blight: 6.2 fl oz/A on a 7-day interval as a preventive, 12.4-15.4 fl oz/A on a 5-day interval when late blight is present. Do not make more than 6 applications per acre per year. Do not apply within 14 days of harvest. Also labeled for black dot control. See label for application instructions.
Azoxystrobin (11) + Chlorothalonil (M5) Quadris Opti, 4.6%: 46%	Spray	1.6 pt/A	X	X	Also controls blackdot, brown spot, powdery mildew and Septoria leafspot. Apply on a 7- to 14-day interval; do not make more than 2 sequential applications before rotating to an alternate MOA. Quadris top should be used with an adjuvant such as a non-ionic based surfactant or crop oil concentrate or blend. Do not exceed 55.3 oz/A/season. PHI = 14
Azoxystrobin (11) + Difenconazole (3) Quadris Top 18.2%:11.4%	Spray or fungigation	8-14 oz/A	X	X	Use 6 oz/A for early blight and 8 oz/A for late blight. Do not make more than 1 application of Tanos before alternating with a fungicide that has a different mode of action. Maximum of 72 oz/A/season.
Famoxadone (11) + Cymoxanil (27) Tanos, 25%: 25%	Spray or fungigation	6-8 oz/A	X	X	Use 6 oz/A for early blight and 8 oz/A for late blight. Do not make more than 1 application of Tanos before alternating with a fungicide that has a different mode of action. Maximum of 72 oz/A/season.
Fenamidone (11) Reason, 44.4%	Spray or fungigation	5.5-8.2 fl oz/A	X	X	Resistance statement 5 ⁵ . A 2 (ee) allows application of Reason at 4 fl oz/A tank mixed with mancozeb, chlorothalonil for control of early and late blight. Reason can be applied early in the season for management of black dot. Tank mix with a different mode of action for resistance management. Applications should be on a 5- to 10-day interval and alternated with a fungicide with a different mode of action. Do not apply more than 24.6 oz/A of Reason per season. PHI = 14 days.
Fluoxastrobin (11) Evito, 40.3%	Spray or fungigation	3.8 fl oz/a			Do not apply within 7 days of harvest. Do not make more than 6 applications per season.

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²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Check the NDSU blight hotline, (888) 482-7286, for information on infection potential of early blight and late blight. Whenever late blight is severe, vine killing is extremely important and should be done at least 2 weeks before harvest to prevent tuber infections. Hilling of soil around the vines should be done just before killing them.

⁵See fungicide resistance management statements on Pages 7-8.

***Designates restricted-use pesticide**

Potato Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks ^{4,5}
			Late Blight	Early Blight	
QoIs (Continued)					
Pyraclostrobin (11) Headline EC, 23.6%	Spray or fungigation	6-9 fl oz/A early Blight	X	X	Use 6-9 fl oz/A for early blight and 6-12 fl oz/A for late blight. *Do not apply within 3 days of harvest. Do not make more than 6 applications per season. Also controls black dot. Apply prior to disease onset.
Headline SC, 23.3%		6-12 fl oz/A late Blight	X	X	
Pyraclostrobin (11) + Metiram (M3) Cabrio Plus, 5.0%:55%	Spray or fungigation	2.0-2.9 lbs/A for black dot & early blight; 2.9 lbs/A for late blight	X	X	PHI=14 days.
Trifloxystrobin (11) Gem 500 SC 42.6%	Spray	2.9-3.8oz/A early blight 3.8 oz/A late blight	X	X	For early blight, begin application preventively and continue as needed on a 7- to 10-day interval. For late blight, begin applications preventively. Alternate Gem with a protectant fungicide registered for late blight on a 7- to 10-day schedule. Do not apply more than 23 oz. GEM 500SC per season. Do not apply within 7 days of harvest. Do not make more than 6 total applications per acre per season.
Cyazofamid (21) Ranman, 34.5%	Spray or fungigation	0.42 fl oz/1,000 linear ft. row or 1.4-2.75 fl oz/A as broadcast spray	X		Also for pink rot and <i>Pythium</i> leak control. Do not apply more than 27.5 fl oz per season. Alternate sprays of Ranman with a fungicide from a different chemistry class.
Triphenyltin Hydroxide (TPTH)* RUP (30) Super Tin 80WP AgPak, 80% or Agri Tin, 80%	Spray or fungigation	2.5-3.75 oz/A	X	X	RESTRICTED-USE PESTICIDE. Do not apply within 7 days of harvest. Do not exceed 11.25 oz/A TPTH per season. May use 1.87 oz/A TPTH when used in combination with another fungicide. Ground application must be with closed cab. Do not enter treated area within 48 hours of treatment without proper PPE specified on label.
or Super Tin* 4L, or Agri Tin* 4L, 40%	Spray or fungigation	4-6 fl oz/A	X	X	Super Tin 4L label says "do not exceed 18 fl oz/a/season."

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³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Check the NDSU blight hotline, (888) 482-7286, for information on infection potential of early blight and late blight. Whenever late blight is severe, vine killing is extremely important and should be done at least 2 weeks before harvest to prevent tuber infections. Hilling of soil around the vines should be done just before killing them.

⁵See fungicide resistance management statements on Pages 7-8.

*Designates restricted-use pesticide

Safflower Seed Treatment

Chemical	Application	Dosage ¹	Control ² of Seed-borne Rust	Remarks
Carboxin (7) Vitavax 34, 34%	Slurry	2 fl oz/cwt	X	
Fludioxonil (12) Maxim 4FS, 40.3%	Slurry	0.08-0.16 fl oz/cwt		
Spirato 480FS, 40.3%	Slurry	0.08-0.16 fl oz/cwt		
Dyna-Shield Fludioxonil, 40.3%	Slurry	0.08-0.16 fl oz/cwt		
Mancozeb (M3) Dithane DF Rainshield NT, 75%	Slurry	2.1 oz/cwt	X	
Dithane F-45, 37%	Drill box or slurry	3.2 fl oz/cwt	X	
Dithane WSP, 80%	Drill box or slurry	2 oz/cwt	X	
Manzate ProStick, 75%	Slurry	2 oz/cwt	X	
Penncozeb 80 WP, 80%	Drill box or slurry	2 oz/cwt		
Penncozeb 75 DF, 75%	Drill box or slurry	2.1 oz/cwt	X	
Thiram (M3) 42-S Thiram, 42%	Liquid or slurry	2 fl oz/bu	X	
Thiram 50WP Dyed, 50%	Drill box or slurry	4 oz/cwt	X	
Signet 480FS, 44%	Liquid or slurry	2 fl oz/bu	X	

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

Safflower Foliar Sprays

Chemical (Fungicide Group)	Application ¹	Dosage ²	Alternaria Leaf Spot Control	Remarks
Azoxystrobin (11) Quadris, 22.9%	Spray or fungigation	6.0-15.5 fl oz/A	X	Resistance statement 5 ⁴ . Also controls downy mildew. Make Quadris applications preventatively for best results. Additional applications may be required under favorable environmental conditions. Do not apply more than 27 fl oz of product/season. PHI= 30 days.
Pyraclostrobin (11) Headline EC, 23.6%	Spray or fungigation	6-12 fl oz/A	X	Also controls <i>Septoria</i> spp. Apply prior to disease development for optimum control
Fluxopyrad (7)+ Pyraclostrobin Priaxor 14.33%: 28.58%	Spray or fungigation	4-8 fl oz/A	X	Also controls <i>Septoria</i> spp. For suppression of <i>Sclerotinia</i> . Apply prior to disease development. Maximum of 2 applications per season. PHI= 21 days.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

Soybean Seed Treatment

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Azoxystrobin (11) Dynasty, 9.6%	Slurry	0.153-0.459 fl oz/cwt	X	For seed-borne and soil-borne fungi causing decay, damping off and seedling blight.
Captan (M4) Captan 4000, 38.4% Hi-Moly/Captan-D, 48.9% Hi-Moly Captan, 18.44%	See individual labels for rates of application, formulations and registered use	See individual labels for rates of application, formulations and registered use	X	Hi-Moly contains molybdenum.
Carboxin (7) Vitavax-34, 34%	Slurry	3-4 fl oz/cwt	X	Vitavax 34 may be used on seed previously treated with captan or thiram. Germate Plus contains 15% diazinon and 25% lindane insecticide. Kernel Guard Supreme contains 10.42% permethrin.
Germate Plus, 14%	Drill box	1.5 oz/42 lb (2 oz/bu)	X	
Kernel Guard Supreme, 14%	Drill box	1.5 oz/42 lb	X	
Carboxin (7) + Captan (M4) Enhance, 20%:19%	Drill box	3 oz/bu	X	
Carboxin (7) + Thiram (M3) Vitaflo-280 15.59%; 13.25%	Ready to use slurry or mist	4 fl oz/cwt	X	For seed rot, seedling blight and damping off.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Soybean (continued) Seed Treatment

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Chloroneb (14) Chloroneb 65W, 65%	Slurry	4 oz/cwt	X	May be used as a supplemental seed treatment for improved suppression of <i>Rhizoctonia</i> and <i>Pythium</i> .
Clothianidin + Ipconazole (3) + Metalaxyl (4) + Ethaboxam (22) Intego Suite System, (Inovate Pro) - 24.03%; 1.203%; 0.965%; (Intego Solo) - 34.2%	Slurry or mist	2.81 fl oz/cwt + 0. fl oz/cwt	X	Registered for control of seed rots, <i>Pythium</i> , <i>Fusarium</i> and <i>Rhizoctonia</i> .
Ethaboxam (22) Intego Solo, 34.2%	Slurry or mist	0.3-0.6 fl oz/cwt	X	For control of <i>Pythium</i> and early season <i>Phytophthora</i> .
Fludioxonil (12) Maxim 4FS, 40.3% Spirato 480FS, 40.3% Dyna-Shield Fludioxonil, 40.3%	Slurry Slurry Slurry	0.08-0.16 fl oz/cwt or .0038-.0076 mg ai seed	X	For seed-borne and soil-borne fungi. Registered for control of <i>Rhizoctonia</i> and <i>Fusarium</i> .
Fluopyram (7) ILeVO, 48.4%	Slurry	0.075-0.25 mg ai/seed or 0.6-1.97 fl oz/140,000 seeds		Protects the root system against the SDS fungus. Combining Poncho/VOTiVO and ILeVO provides protection from nematodes and insects.
Ipconazole (3) Rancona 3.8 FS, 40.7%	Slurry or mist	0.085 fl oz/cwt	X	Does not provide control of <i>Pythium</i>
Ipconazole (3) + Metalaxyl (4) Rancona Summit 0.902%:1.443% Rancona Xtra 1.029%:1.647%	Slurry or mist Slurry or mist	4.0 fl oz slurry/cwt 3.5-15 fl oz slurry/cwt	X X	For seed and seedling diseases.
Mefenoxam (4) Apron XL, 33.3%	Slurry or mist	0.16-0.64 fl oz/cwt	X	For <i>Pythium</i> and early season <i>Phytophthora</i> control only. For both commercial and on-farm use.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Soybean (continued) Seed Treatment

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Mefenoxam (4) + Fludioxonil (12) + Thiamethoxam Cruiser Maxx, 1.7%:1.12%:22.61% Crusier Maxx Advanced 3.21%: 1.07%: 21.5% Crusier Maxx Plus 3.21%: 1.07%: 21.50% CruiserMaxx EZ 3.46%: 1.15%: 23.10%	Slurry or mist Water based slurry Water based slurry Water based slurry	3 fl oz/cwt 3.2 fl oz/cwt or 1.49 fl oz/140,000 seeds 3.2 fl oz/cwt or 1.49 fl 3.5 fl oz/100 lb seed or 0.0057-0.0113 mg ai seed	X X X X	For seed-borne and soil-borne fungi and insects. For protection against certain early season insects, soil-borne and seed-borne diseases. For protection against certain early season insects, soil-borne and seed-borne diseases. For protection against insects, seed-borne diseases, and seedling diseases.
Mefenoxam (4) + Fludioxonil (12) + Sedaxane (7) + Thiamethoxam CruiserMaxx Vibrance, 3.13%; 1.04%; 1.04%; 20.8%	Slurry or mix	3.22 fl oz/cwt or 1.5 fl oz/140,000 seeds	X	For seed-borne and soil-borne fungi and insects. Contains thiamethoxam for insect control.
Mefenoxam (4) + Fludioxonil (12) Apron Maxx RTA, 1.1%:0.73% Apron Maxx RFC, 3.46%: 2.31% Maxim XL, 8.4%: 21% Warden RTA 2.2%:0.72%	Slurry or mist (on-farm application) Slurry Slurry or mist Slurry or mist	5 fl oz/cwt 1.5 fl oz/cwt 0.167-0.334 fl oz/cwt 5 fl oz/cwt	X X X X	See labels for inoculant remarks.
Mefenoxam (4) + Fludioxonil (12) + Thiabendazole (1) + Thiamethoxam Equity, 1.70%; 1.12%; 2.13%: 22.61%	Water based slurry	3.0 fl oz/cwt	X	For protection against insects and early season diseases <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , <i>Rhizoctonia</i> and <i>Phomopsis</i> .
Mefenoxam (4) + Fludioxonil (12) + Thiabendazole (1) + Sedaxane (7) + Thiamethoxam Equity, 3.35%; 1.12%; 2.24%: 1.12%: 22.40%	Water based slurry	2.96 fl oz/cwt	X	For protection against insects and early season diseases <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , <i>Rhizoctonia</i> and <i>Phomopsis</i> .

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Soybean (continued) Seed Treatment

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Metalaxyl (4) Allegiance FL, 28.35% Dyna-Shield, 28.35% Sebring 18FS 30.14% Belmont 2.7 FS, 28.98%	Mist or slurry Slurry Mist or slurry Slurry or mist	“ “ “ 0.75-1.50 fl oz,cwt	see remarks	Metalaxyl is for <i>Pythium</i> damping off and early season <i>Phytophthora</i> control only. For use only with commercial seed treatment equipment.
Metalaxyl (4) + Ipconazole (3) + Clothianidin Inovate Seed Protectant 1.64%:1.03%:47.8%	Slurry or mist	4.78 fl oz/cwt	X	For seed-borne and soil-borne fungi and insects. Products need to be mixed together.
Metalaxyl (4) + Thiophanate-Methyl (1) + Fludioxonil (12) + Imidacloprid Dyna-Shield Conquest 5.05%: 3.28%: 0.81%; 20.17%	Slurry or mist	4.0 fl oz/cwt	X	For protection against damping-off, seed, and seedling diseases due to <i>Pythium</i> , <i>Phytophthora</i> , <i>Fusarium</i> , and <i>Rhizoctonia</i> and early-season insects. For use only in commercial seed treatment facilities.
Penflufen (7) + Prothioconazole (3) + Metalaxyl (4) EverGol Energy SB, 3.59%, 7.18%, 5.74%	Slurry or mist	1 fl oz/cwt	X	For seed rot and damping off caused by <i>Rhizoctonia</i> , <i>Fusarium</i> , and <i>Pythium</i> . Also, for seed decay caused by <i>Phomopsis</i> .
Sedaxane (7) Vibrance 43.7%	Slurry	0.08-.16 fl/oz cwt or 2.5-5 gai/100 kg seed	X	Seed decay, seedling blight and damping off caused by <i>Rhizoctonia solani</i>
Sedaxane (7) + Fludioxonil (12) + Mefenoxam (4) + Thiamethoxam Warden CX, 1%; 1%; 5.99%; 20.0%	Slurry	3.38 fl oz/cwt	X	For suppression of <i>Rhizoctonia</i> sp., <i>Pythium</i> sp., <i>Phytophthora</i> , and <i>Fusarium</i> sp. Thiamethoxam is for broad spectrum insect control.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Soybean (continued) Seed Treatment

Chemical	Application	Dosage ¹	Control ² of Seedling Blights ³	Remarks
Tolclofos-methyl (14) Rizolex, 42%	Slurry or mist	0.3 fl oz/cwt	X	For seed-borne and soil-borne diseases. Controls <i>Rhizoctonia solani</i> and <i>Fusarium</i> species
Trifloxystrobin (11) Trilex, 22%	Slurry	0.32 fl oz/cwt	X	For seed-borne and soil-borne fungi.
Trifloxystrobin (11) + Metalaxyl (4) Trilex 2000, 7.12%:5.96%	RTU or slurry or mist	1.0 fl oz/cwt	X	For seed-borne and soil-borne fungi.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³Seedling blights due to various fungal infections of seed.

Note: Some seed treatments may affect Rhizobia inoculants; read inoculant label for specific information.

Soybean Soil Application

Chemical (Fungicide Group)	Application	Dosage ¹	Control ² of Pythium, Phytophthora	Remarks
Azoxystrobin (11) + Metalaxyl (4) Uniform 28.2%:10.9%	In-furrow	0.34 fl oz/1,000 linear feet of row	X	Apply in a 7-inch band. One application per season.
Pyraclostrobin (11) + Fluxapyroxad (7) Priaxor 28.58%; 14.33%	In-furrow spray	0.2-0.6 fl oz/1,000 ft. row	X	Do not mix with liquid fertilizer. Also suppresses <i>Rhizoctonia</i> and <i>Fusarium</i> . Maximum of 1 application per season.
Bacillus subtilis QST 713 (44) Serenade ASO, 1.34%	In-furrow spray	2-6 fl qt/A	X	Apply as a directed spray in the seed furrow and to cover soil at planting.
Bacillus amyloliquefaciens strain D747 (44) + Bifenthrin Ethos XB, 5.0%; 15.67%	In-furrow	4-17 fl oz/A		Restricted use pesticide. Suppression of seedling blights.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³See fungicide resistance management statements on Pages 7-8.

Soybean Soil Application (continued)

Chemical (Fungicide Group)	Application	Dosage ¹	Control ² of Pythium, Phytophthora	Remarks
Mefenoxam (4) Ridomil Gold EC, 48% Ridomil Gold GR, 2.5%	In-furrow spray In-furrow, 7" band or T-band	0.08-0.28 fl oz/1,000 ft. of row 1.5-6 oz/1,000 ft. of row	X X	Resistance statement 4 ³ . Do not apply directly to seed but to soil that will be mixed in covering the seed. Use lower rates for early to midseason control; full rates for full- season control. See label for planting restrictions within 12 months of application.
Pyraclostrobin (11) Headline EC, 23.6%	In-furrow spray	0.4-0.8 fl oz/1,000 ft. row		For suppression of Rhizoctonia. For 22" rows, use maximum of 0.5 fl oz/1,000 ft. of row. For 30" rows, use maximum of 0.7 fl oz/1,000 ft. of row.
Azoxystrobin (11) Equation, 22.98% Tetraban, 22.9%	In-furrow spray	0.4-0.8 fl oz/1,000 ft. row		For suppression of Rhizoctonia.
Fluoxastrobin (11) Evito, 40.3%	In-furrow spray	0.11-0.16 fl oz/1,000 ft row		For suppression of Rhizoctonia.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³See fungicide resistance management statements on Pages 7-8.

Soybean Nematicide Seed Treatment

Chemical	Application	Dosage ¹	Control	Remarks
Abamectrin Avicta 500FS, 46.3%	Commercially applied		Nematodes	Syngenta Crop Protection LLC has a commercially treated blend of nematicide, insecticide, and fungicide seed treatment products.
Abamectrin + Thiamethoxam + Mefenoxam (4) + Fludioxonil (12) Avicta Complete Beans 500, 22.20%: 11.10%: 1.67%: 0.55%	Commercially applied		Nematodes (by abamectrin), various insects (by thiamethoxam), and various diseases (by mefenoxam and fludioxonil)	Syngenta Crop Protection LLC has a commercially treated blend of nematicide, insecticide, and fungicide seed treatment products.
Pasteuria nishizawae – Pn1 Clariva pn, 15.0%	Slurry	0.9-33.8 fl oz/100 lbs seed	Soybean cyst nematode	
Clothianidin + Bacillus firmus Poncho Votivo, 40.3%: 8.1%	Commercially applied		Provides early season protection of the soybean plant against root nematodes and broad control of insect pests.	The <i>Bacillus firmus</i> bacterium creates a living barrier that prevents nematodes from racing the roots.

Soybean Foliar Sprays

Chemical (Fungicide Group)	Application ¹	Dosage ²	White Mold Control ³	Remarks
Bacillus subtilis strain QST 713 (44) Serenade ASO, 1.34%	Spray or fungigation	2-6 qt/A	X	For suppression.
Bacillus pumulis QST 2808 (44) Sonata, 1.38%	Spray or fungigation	0.5-4 qt/A	X	Use 0.5 to 4 qt/A in tank mix with labeled rates of strobilurins fungicides when conditions are conducive to disease development. Use 1 to 4 qt/A stand-alone.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Soybean Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	White Mold Control ³	Remarks
SDHI Boscalid (7) Endura, 70%	Spray or fungigation	5.5-11 oz/A	X	For optimal white mold control, apply at early flowering. If environment remains favorable for disease development, make a second application 7-14 days after initial application. PHI=21 days
Penthiopyrad (7) Vertisan, 20.6%	Spray or fungigation	10-30 fl oz/A	X	Begin applications prior to disease development. Vertisan controls several diseases. For white mold, make initial application at beginning of bloom and a second application at full bloom. Apply no more than 61 fl oz/A per year with no more than 2 sequential applications. PHI = 14 days.
Benzovindiflupyr (7) Trivapro A, 10.27%	Spray or fungigation	4 fl oz/A		Combining Trivapro A and Trivapro B = Trivapro co-pack. Begin applications prior to disease onset when conditions are favorable for disease development. Do not apply more than 14 fl oz/A of Trivapro A per year.
Fluopyram (7) + Prothioconazole (3) ProPulse 17.4%:17.4%	Spray or fungigation	10.2 fl oz/A	X	For optimum disease control apply at early flowering. Do not apply more than 30.9 fl oz/A per year. Do not apply within 21 days of harvest.
Qols Azoxystrobin (11) Quadris, 22.9% Satori, 22.9% Equation, 22.9% Tetaban, 22.9%	Spray	6.0-15.5 fl oz/A		Resistance statement 5 ⁴ . Both products control pod and stem blight, soybean rust and brown spot.
Fluoxystrobin (11) Evito 480SC, 40.3%	Spray or fungigation	2.0-5.7fl oz/a		For control of Asian soybean rust and many fungal leaf spots. Begin applications preventively and continue as needed on 14- to 21-day interval. Do not apply more than 11.4 fl oz per year.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8

Soybean Foliar Sprays (continued)

Chemical (Fungicide Group)	pplication ¹	Dosage ²	White Mold Control ³	Remarks
Pyraclostrobin (11) Headline EC, 23.6% Headline SC, 23.3%	Spray or fungigation	6-12 fl oz/A		Apply prior to onset of disease. PHI = 21 days. Controls pod and stem blight and several fungal leaf spot pathogens.
Picoxystrobin (11) Approach, 22.5%	Spray or fungigation	6-12 fl oz/A	X	Apply prior to disease development. Approach is labeled for suppression of downy mildew. For white mold, make initial application at beginning bloom and a second application at full bloom. Apply no more than 36 fl oz/A season. PHI = 14 days.
Qols + Triazoles Azoxystrobin (11) + Propiconazole (3) Quilt, 7%:11.6% Quilt Xcel, 13.5%:11.7% Trivapro B 13.5%; 11.7%	Spray or fungigation Spray or fungigation Spray or fungigation	14-20.5 fl oz/A 10.5-21 fl oz/A 10.5 fl oz/A		Resistance statement 5 ⁴ and 3 ⁴ . Quilt controls several diseases in soybeans including soybean rust. Do not apply more than 42 fl oz/A. PHI: 21 days for seed; 0 for forage or hay. Quilt Xcel controls several diseases in soybeans. Do not apply more than 42 oz/a/year. Do not apply after R6 stage soybeans. Combining Trivapro A and Trivapro B = Trivapro co-pack. Begin applications prior to disease onset when conditions are favorable for disease development. Do not apply more than 42 fl oz/A of Trivapro B per year. Apply up to growth stage R6 for Trivapro B.
Azoxystrobin (11) + Cyproconazole (3) Azure Xtra, 18.2%:7.3%		5.0-6.8 fl oz/A		Azure Xtra controls several diseases in soybeans, including soybean rust. Azure Xtra is extremely phytotoxic to certain apple varieties, so don't spray when drift may reach apples. Do not apply more than 13.6 fl oz/A. Do not apply within 30 days of harvest.
Azoxystrobin (11) + Tebuconazole (3) Custodia, 11.0%; 18.35%	Spray or fungigation	8.6 fl oz/A		Apply as a preventative spray prior to disease development. Do not apply more than 25.9 fl oz/A per season. PHI = 21 days.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Soybean Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	White Mold Control ³	Remarks
Azoxystrobin (11) + Tetraconazole (3) Affiance, 9.35%; 7.48%	Spray or fungigation	10.0-14.0 fl oz/A		Apply prior to disease development when conditions favor disease development. Do not make more than three applications per year or apply more than 28.7 fl oz/A per year. PHI = 14 days.
Picoxystrobin (11) + Cyproconazole (3) Approach Prima, 17.94%: 7.17%	Spray or fungigation	5-6.8 fl oz/A		Begin applications prior to disease development for several diseases. Use no more than 13.6 fl oz/A per season and no more than 2 sequential applications of a picoxystrobin containing product. PHI = 30 days.
Fluoxastrobin (11) + Flutriafol (3) Fortix, 14.8%; 19.3% Preemptor, 14.84%; 19.3%	Spray or fungigation	4-6 fl oz/A		For fungal leaf spots and Asian soybean rust. Apply from R1 to R3. Do not make more than 2 applications per season. Do not apply more than 12 fl oz/A per season. PHI = 21 days for grain and 30 days for seed.
Fluoxastrobin (11) + Tetraconazole (3) Zolera FX, 17.76%; 17.76%	Spray or fungigation	4.4-6.8 fl oz/A		For fungal leaf spots and suppression of white mold. Do not apply more than 6.8 fl oz/A per season. Apply at or prior to R1 for white mold suppression. PHI = 3 days for forage, 30 days for seed.
Chlorothalonil (M5) Bravo Ultrex, Equus DF, 82.5%	Spray or fungigation	See label		Chlorothalonil products control pod and stem blight and stem canker, and suppress soybean rust.
Bravo WeatherStik, Echo 720	Spray or fungigation	See label		Do not feed soybean hay or thrashings from chlorothalonil-treated fields to livestock.
Equus 720 SST, Praize, Vabro, or Chlorothalonil 720, 54%	Spray or fungigation	See label		
Echo 90 DF, 90%	Spray or fungigation	See label		
Echo Zn, 38.5%	Spray or fungigation	See label		

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Soybean Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	White Mold Control ³	Remarks
Copper Sulfate (M1) Cuprofix Ultra 40, 71.1%	Spray or fungigation	0.75-1.25 lb/A bacterial diseases 1.25-2.0 lbs/A fungal leaf spots		
Cyproconazole (3) Alto 100 SL, 8.9%	Spray or fungigation	4.0-5.5 fl oz/A		For control of soybean rust and other leaf diseases. See label for specific rate recommendations. Do not apply more than 11 fl oz/season. Do not apply with 30 days of harvest.
Flutriafol (3) Topguard 11.8%	Spray or fungigation	7-14 fl oz/A	X Suppression Only	For control of foliar fungal diseases.
Fluxapyroxad (7) + Pyraclostrobin (11) Priaxor 14.33%:28.58%	Spray or fungigation	4-8 fl oz/A	X Suppression Only	Resistance statement 5 and 6 ⁴ For control of several Soybean diseases. Do not apply more than 2 applications and 16 fl oz/A PWI=21 days
Propiconazole (3) Tilt 3.6 EC, or Propiconazole E-AG, 41.80% Bumper 41.8 EC and Topaz 41.8% Bumper ES, 40.85% Propicure, 41.8%	Spray Spray Spray Spray	4-6 fl oz/A 4-6 fl oz/A 4-6 fl oz/A 4-6 fl oz/A		Resistance statement 3 ⁴ . Propiconazole controls several diseases of soybeans, including soybean rust. Do not apply more than 12 fl oz/A. Apply up to R6.
Prothioconazole (3) Proline 480 SC, 41%	Spray	3.0-5.0 fl oz/A	X	For white mold management, apply Proline at 4.3 fl oz/A prior to disease onset or at the R1 (bloom initiation) stage. A subsequent application may be used 7-14 days later. Also for control of soybean rust and powdery mildew. Do not apply more than 12.9 fl oz/year. 21-day PHI.
Tebuconazole 38.7% (3) Orius 3.6F Tebuzol 3.6F Monsoon Onset 3.6L Tebucure	Spray	3-4 fl oz/A		For control of soybean rust and powdery mildew. Do not apply more than 12 fl oz/A per season. These products have a 21-day PHI.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Soybean Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	White Mold Control ³	Remarks
Tetraconazole (3) Domark 20.5%	Spray	4.0-5.0 fl oz/A	X	Do not make more than 2 applications per year. Do not graze or feed forage or hay to livestock. Do not apply after soybean growth stage R5.
Thiophanate Methyl (1) Topsin M WSB 70WE, T-methyl WSB 70W, 70%	Spray or fungigation	0.751 lb/A	X	Resistance Statement 1 ⁴
Topsin M 70WP, or T-Methyl E-AG 70 WSP, 70%	Spray or fungigation	0.75-1 lb/A	X	Thiophanate-methyl also controls pod and stem blight but is not labeled for control of soybean rust.
Topsin 4.5 FL, 45% or T-Methyl E-AG 4.5 FL	Spray or fungigation	10-20 fl oz/A	X	One application at early bloom (R1-R2) followed by a second application 7-14 days later if conditions favorable for continued disease pressure. 21-day PHI. 5 gal/A minimum by air.
Topsin XTR, 37.5%, Incognito 4.5F, 46.2%, Cercobin, 41.3%	Spray or fungigation	20.0 fl oz/A	X	
Thiophanate Methyl 85 WDG, 85% Incognito 85 WDG, 85%	Spray or fungigation	0.4-0.8 lb/A pod and stem blight 0.6-0.8 lb/A white mold	X	
Thiophanate Methyl (1) + Propiconazole (3) Protocol 23.7%:7.1%	Spray	2.0 pt/A	X	Resistance Statement 1 and 3 ⁴ For management of white mold, soybean rust and other diseases Do not apply more than 4 pt/A per season

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Sugar Beet Seed Treatment

Chemical	Application	Dosage ¹	Disease Control ²				Remarks
			Aphanomyces	Pythium	Phoma	Rhizoctonia	
Chloroneb (14) Chloroneb 65W, 65%	Liquid or slurry	6 fl oz/cwt		X		X	For control of <i>Pythium</i> and <i>Rhizoctonia</i> . For use as a supplement to another fungicide.
Fludioxonil (12) Maxim 4 FS, 40.3%	Slurry	0.08-0.16 fl oz/cwt			X	X	For control of seed-borne and soil-borne fungi.
Spirato 480FS 40.3%	Slurry	0.08-0.16 fl oz/cwt				X	Provides Suppression of <i>R. solani</i>
Hymexazol (32) Tachigaren, 70%	Pelleted seed	20-90 g/unit of 100,000 seed	X	X			For control of <i>Pythium</i> and <i>Aphanomyces</i> . Use of rates greater than 45 g may result in phytotoxicity. In fields with known heavy disease pressure, use of Tachigaren and a tolerant variety is suggested.
Mefenoxam (4) Apron XL, 33.3%	Slurry or mist	0.32-0.64 fl oz/cwt		X			For control of <i>Pythium</i> . May be combined with other fungicides if products are known to be compatible. For use only with commercial seed treatment equipment.
Metalaxyl (4) Allegiance FL, 28.35%	Mist or slurry	0.75 fl oz/cwt		X			For control of <i>Pythium</i> . May be combined with other fungicides if products are known to be compatible.
Dyna-Shield 28.35%	Slurry	0.75 fl oz/cwt		X			
Sebring 318FS 30.14%		0.75 fl oz/cwt		X			
Belmont 2.7 FS, 28.98%	Slurry or mist	0.75 fl oz/cwt		X			

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

Sugar Beet Seed Treatment (continued)

Chemical	Application	Dosage ¹	Disease Control ²				Remarks
			Aphanomyces	Pythium	Phoma	Rhizoctonia	
Penthiopyrad (7) Kabina ST	Commercially applied	0.53-1.06 fl oz/unit of 100,000 seeds				X	For control of <i>Rhizoctonia solani</i> .
Metconazole (3) Metlock, 40%	Mist or slurry	0.008-0.016 fl oz/10,000 seed				X	Provides Suppression of <i>R. solani</i>
Thiram (M3) 42-S Thiram, 42% Signet 480 FS, 42% Thiram 480 DP, 42%	Liquid or slurry	8 fl oz/cwt		X		X	
Tolclofos-methyl (14) Rizolex, 42%	Slurry or mist	1.5 fl oz/cwt				X	For seed-borne and soil-borne diseases. Controls <i>Rhizoctonia solani</i> .
Pyraclostrobin (11) Stamina, 18.4%	Slurry or mist	1.7-2.5 fl oz/100,000 seeds				X	Provides protection from seedling diseases caused by <i>Fusarium</i> spp. And <i>Rhizontonia</i> spp.
Fluxapyroxad (7) Systiva 28.7%	Commercial seed treatment use only.	0.52 fl oz/100,000 seeds				X	For use on <i>Rhizoctonia</i> in sugarbeets.
Sedaxane (7) Vibrance, 43.7%	Slurry	0.07-0.13 fl oz/100,000 seeds				X	For use on seed decay, seedling blight and damping-off caused by <i>Rhizoctonia</i>

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

Sugar Beet Soil Application

Chemical (Fungicide Group)	Application	Dosage ¹	Control ² of Pythium	Control ² of Rhizoctonia	Remarks
Bacillus subtilis strain QST 713 (44) Serenade ASO, 1.34%	In-furrow at planting	2-6 fl qt/A	X		Apply as directed spray in the seed furrow and to the covering soil at planting for management of <i>Rhizoctonia</i> .
QoIs Azoxystrobin (11) Quadris, 22.9% Satori, 22.9% Equation, 22.9% Tetran, 22.9% AZteroid FC, 18.4%	Band 7" or less	0.4-0.7 fl oz/1,000 ft. of row 0.5-1.0 fl oz/1,000 ft of row for AZteroid FC	X	X	Resistance statement 5 ³ . Apply Quadris in a band (7" or less) over cotyledonary 4- to 8-leaf sugar beets before average daily temperatures at 4" soil depth reaches 65°F, using 5-15 gpa. Rate is already determined as a BAND spray, not broadcast. AZteroid FC may be tank mixed with starter fertilizer, but may increase phytotoxicity.
Pyraclostrobin (11) Headline EC, 23.6% Headline SC, 23.3%	In-furrow spray	0.4 -0.8 fl oz/1,000 ft. of row		X	For suppression of <i>Rhizoctonia</i> . For 22" row, use maximum of 0.5 fl oz/1,000 ft. of row. For 30" row, use maximum of 0.7 ² fl ² oz/1,000 ft. of row.
Trifloxystrobin (11) Gem 500 SC, 42.6%	In-furrow spray	2.9-3.6 oz/A in band		X	Resistance statement 5 ³ . For suppression of <i>Rhizoctonia</i> .
Mefenoxam (4) Ridomil Gold EC, 48%	7" band preplant incorporated	0.21-0.43 fl oz/1,000 ft. of row	X		Resistance statement 4 ³ .
Ridomil Gold GR, 2.5%	7" band preplant incorporated	4.3-8.6 oz/1,000 ft. of row	X		See label for planting restrictions within 12 months of application.
Ultra Flourish, 25.1%	7" band preplant incorporated	0.43-0.86 fl oz/1,000 ft. of row	X		
Penthiopyrad (7) Vertisan, 20.6%	In-furrow spray	0.7-1.6 fl oz/1,000 ft of row		X	Maximum rate per acre per application is 30 fl oz.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³See fungicide resistance management statements on Pages 7-8.

Sugar Beet Soil Application (continued)

Chemical (Fungicide Group)	Application	Dosage ¹	Control ² of Pythium	Control ² of Rhizoctonia	Remarks
Pyraclostrobin (11) + Fluxapyroxad (7) Priaxor 28.58%; 14.33%	Band 7" or less	0.2-0.4 fl oz/1,000 ft. row	X	X	Apply 6.7 fl oz/A in 22" row spacing. Maximum of 1 soil directed application per season.
Azoxystrobin (11) + Mefenoxam (4) Uniform, 28.2%; 10.9%	In-furrow spray	0.34 fl oz/1000 ft. row	X	X	Apply as a spray at a minimum of 5 gal of water or liquid fertilizer per acre.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³See fungicide resistance management statements on Pages 7-8.

Sugar Beet Nematicide Seed Treatment

Chemical	Application	Dosage ¹	Control	Remarks
<i>Pasteuria nishizawae</i> – Pn1 Clariva pn, 15.0%	Slurry	0.034-1.35 fl oz per 100,000 seeds	Sugar beet cyst nematode	

Sugar Beet Foliar Sprays

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks
			Cercospor a Leaf Spot ⁴	Powdery Mildew	
<i>Bacillus pumilus</i> strain 2808 (44) Sonata, 1.38%	Spray or fungigation	2-4 qt/A	X	X	Begin applications when environmental conditions and plant stage are conducive to disease development.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Begin when disease is first observed in field. Higher rates are used when disease is severe on susceptible varieties. Use 5-10 gal water with airplane or 20-40 gal water and at least 100 psi with ground equipment. Repeat tin or copper at 10-14 days. Repeat maneb or mancozeb at 7- 10 days.

⁵See fungicide resistance management statement on Pages 7-8.

Sugar Beet Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks
			Cercospora Leaf Spot ⁴	Powdery Mildew	
Copper (M1) Basicop WP, 53%	Spray	4 lb/A	X		Does not provide adequate control of <i>Cercospora</i> leafspot.
Champ DP, 57.6%	Spray or fungigation	1.33-3.33 lb/A	X		
Champ WG, 77%	Spray or fungigation	2-5 lb/A	X		
Champ Formula 2 Flowable, 35.5%	Spray or fungigation	1.33-3.33 pt/A	X		
Champion++ 46.1%	Spray or fungigation	0.75-2.0 lb/A	X		
Cuprofix Ultra 40 Disperss, 71.1%	Spray or fungigation	1.25-3.0 lb/A	X		
Kocide 2000, 53.8%	Spray or fungigation	1.5-3.75 lb/A	X		
Kocide 3000, 46.1%	Spray or fungigation	0.75-2.0 lb	X		
Kocide 4.5 LF, 37.5%	Spray or fungigation	1.33-2.66 pt/A	X		
MasterCop, 21.46%	Spray or fungigation	0.5-1.5 pt/A	X		
Badge SC, 32.17%	Spray or fungigation	1-4 fl oz/A	X		
Badge X2	Spray or fungigation	1-4 lbs/A	X		
Difenoconazole (3) + Propiconazole (3) 22.8%:22.8% Inspire XT, 23.2%	Spray or fungigation	7 fl oz/A	X	X	Resistance statement 3 ⁵ . Do not apply within 21 days of harvest. Do not apply more than 21 fl oz/A/season. Do not apply more than 0.34 lb /ai /A of propiconazole products, and no more than 0.46 lb /ai /A of difenoconazole products per season. REI = 12 hours.
Fenbuconazole (3) Enable 2F, 23.5%	Spray	8 fl oz/A	X	X	Preharvest interval of 14 days. Resistance statement 3 ⁵ . REI = 12 hours.
Flutriafol (3) Topguard 11.8%	Spray	10-14 fl oz/A	X	X	Resistance statement 3 ⁵ Do not exceed 28 fl oz or 2 applications per season. PHI= 21 days. REI = 12 hours.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Begin when disease is first observed in field. Higher rates are used when disease is severe on susceptible varieties. Use 5-10 gal water with airplane or 20-40 gal water and at least 100 psi with ground equipment. Repeat tin or copper at 10-14 days. Repeat maneb or mancozeb at 7- 10 days.

⁵See fungicide resistance management statement on Pages 7-8.

Sugar Beet Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks ⁵
			Cercospora Leaf Spot ⁴	Powdery Mildew	
Fluopyram (7) + Prothioconazole (3) ProPulse 17.4%:17.4%	Spray or fungigation	13.6 fl oz/A	X	X	For optimum disease control apply at first symptom of disease. Do not apply more than 34.2 fl oz/A per year. Do not apply ProPulse within 7 days of harvest. REI = 12 hours.
Fluxapyroxad (7) + Pyraclostrobin (11) Priaxor 14.33%:28.58%	Spray or fungigation	6 to 8 fl oz/A	X	X	Resistance statements 5 and 6 ⁵ For control of <i>Rhizoctonia</i> stem canker and crown rot use 8 fl oz. Do not exceed 3 applications or 24 fl oz/A per season PHI=7 days. REI = 12 hours.
Mancozeb (M3) Dithane DF Rainshield NT, 75%	Spray or fungigation	1.5-2 lb/A	X		Do not apply mancozeb within 14 days of harvest. Do not exceed 11.2 lb ai/A per season of total EBDC (mancozeb and/or maneb), i.e., do not exceed 14 lb/A of formulated WP or DF or 11.2 qt/A of formulated flowable product per season. Do not feed treated sugarbeets to livestock.
Dithane F-45, 37%	Spray or fungigation	1.2-1.6 qt/A	X		
Dithane M-45, 80%	Spray or fungigation	1.5-2 lb/A	X		
Koverall, 75%	Spray or fungigation	1.5-2 lb/A	X		
Manex II, 37%	Spray or fungigation	1.2-1.6 qt/A	X		
Manzate Flowable,37%	Spray or fungigation	0.4-1.6 qts/A	X		
Manzate ProStick, 75%	Spray or fungigation	1.5-2 lb/A	X		
Penncozeb, 80%	Spray or fungigation	1.5-2 lb/A	X		
Penncozeb DF, 75%	Spray or fungigation	1.5-2 lb/A	X		
Roper DF Rainshield, 75%	Spray or fungigation	1-2 lb/A	X		
Mancozeb (M3) + Copper (M1) ManKocide 15%: 46.1%	Spray or fungigation	2.5-6.5 lbs/A	X		Do not exceed 36.8 lbs product/acre/season. Do not apply within 14 days of harvest.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Begin when disease is first observed in field. Higher rates are used when disease is severe on susceptible varieties. Use 5-10 gal. water with airplane or 20-40 gal. water and at least 100 psi with ground equipment. Repeat tin or copper at 10-14 days. Repeat maneb or mancozeb at 7- 10 days.

⁵See **current "Sugar Beet Production Guide"** for management strategies.

⁶See fungicide resistance management statements on Pages 7-8.

Sugar Beet Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks
			Leaf Spot ⁴	Powdery Mildew	
Metconazole (3) Caramba, 8.6%	Spray or fungigation	9-14 fl oz/A		X	For optimal powdery mildew control, begin application prior to disease development. 14-day PHI. Maximum of 34 fl oz/season. REI = 12 hours.
Propiconazole (3) Tilt 3.6 E.C. 41.8% or Propiconazole E-AG 41.8% Bumper 41.8 EC, 41.8% Topaz 41.8% Bumper ES, 40.85%, Propicure 41.8%	Spray or fungigation	4 fl oz/A	X	X	Resistance statement 3 ⁶ . Begin application at first sign of disease. Do not exceed 12 fl oz/year. PHI = 21 days. REI = 12 hours.
Prothioconazole (3) Proline 480 SC, 41.0%	Spray	5.0-5.7 fl oz/A	X	X	Resistance statement 3 ⁶ . Proline at 5.7 fl oz/A in a 7" or less band at the 4-leaf stage also manages Rhizoctonia stem and crown canker. Do not apply more than 17.1 fl oz of Proline per year. Do not apply within 7 days of harvest. REI = 12 hours.
QoIs Azoxystrobin (11) Quadris, 22.9% Satori, 22.9% Tetraban, 22.9%	Spray or fungigation	6.2-15.4 fl oz/A	X	X	Resistance statement 5 ⁶ . 123 fl oz Quadris/Acre/season maximum. May be applied the day of harvest. REI = 4 hours. Band application at 4-leaf stage for management of Rhizoctonia stem and crown canker.
Pyraclostrobin (11) Headline EC, 23.6% Headline SC, 23.3%	Spray or fungigation	9-12 fl oz/A	X	X	48 fl oz Headline/Acre/season maximum. Has a 7-day PHI. REI = 12 hours.
Trifloxystrobin (11) Gem 500 SC, 42.6%	Spray only	2.9-3.6oz/A	X	X	10.0 oz Gem/Acre/season maximum. Has a 21-day PHI. REI = 12 hours.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Begin when disease is first observed in field. Higher rates are used when disease is severe on susceptible varieties. Use 5-10 gal. water with airplane or 20-40 gal. water and at least 100 psi with ground equipment. Repeat tin or copper at 10-14 days. Repeat maneb or mancozeb at 7-10 days.

⁵Because benzimidazole (Topsin M)-resistant strains of *Cercospora beticola* have developed in many sugar beet-growing areas, Topsin M should be used only once per season and only in combination with a nonbenzimidazole fungicide.

⁶See **current "Sugar Beet Production Guide"** for management strategies.

⁷See fungicide resistance management statements on Pages 7-8.

***Designates restricted-use pesticide.**

Sugar Beet Foliar Sprays (continued)

Chemical (Fungicide Group)	Application ¹	Dosage ²	Disease Control ³		Remarks
			Leaf Spot ⁴	Powdery Mildew	
Sulfur (M) Super Six, 52% Microthiol Disperss 80% Micro Sulf, 80%	Spray or fungigation Spray or fungigation Spray or fungigation	8 pt/A 5-10 lb/A 5-10 lb/A		X X X	Apply sulfur fungicide if mildew appears prior to mid-September. One application gives protection for 4 weeks. Degree of control depends on amount of sulfur used (if less than 5 lb ai is used, only partial control may result).
Tetraconazole (3) Minerva, 11.6%	Spray or fungigation	13 fl oz/A	X	X	Preharvest interval of 14 days. Do not apply more than 13 fl oz/A per season. Resistance statement 3 ⁷ . REI = 12 hours.
Penthiopyrad (7) Vertisan, 20.6%	Spray or fungigation	14-30 fl oz/A	X	X	Maximum of 61 fl oz/acre per season. PHI = 7 days. REI = 12 hours.
Thiophanate Methyl (1) + Propiconazole (3) Protocol 23.7% : 7.1%	Spray or fungigation	1.25-1.33 pt/A	X ⁶	X ⁶	Resistance statement 1 and 3 ⁶ . For management of leaf spot and powdery mildew. Do not make more than 1 application for <i>Cercospora</i> leaf spot. PHI = 21 days. REI = 1 day.
Tetraconazole (3) + Triphenyltin Hydroxide – TPTH (30) Minerva DUO, 7.66%; 21.08%	Spray	16 fl oz/A	X ⁶	X ⁶	RESTRICTED-USE PESTICIDE. Do not make more than one application per growing season. Apply when conditions are favorable for disease development. Apply no more 0.75 lbs/A of TPTH per season. PHI = 21 days.
Triphenyltin Hydroxide (TPTH) RUP* (30) Super Tin 80WP AgPak, 80% or Agri Tin, 80% Super Tin 4L or Agri Tin 4L, 40%	Spray Spray	2.5-5.0 oz/A 4.0-8.0 fl oz/A	X ⁶ X ⁶		RESTRICTED-USE PESTICIDE. Do not exceed 15 oz/A of Super Tin 80WP per season. Do not feed treated tops to livestock. Do not enter treated areas within 48 hours of treatment without protective clothing specified on label. Ground application must be with closed cabs. A Sec 24 (c) state label allows treatment up to 7 days before harvest. Do not exceed 24 fl oz/A/season for Super Tin 4L.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴Begin when disease is first observed in field. Higher rates are used when disease is severe on susceptible varieties. Use 5-10 gal water with airplane or 20-40 gal water and at least 100 psi with ground equipment. Repeat tin or copper at 10-14 days. Repeat maneb or mancozeb at 7-10 days.

⁵See current "Sugar Beet Production Guide" for management strategies.

⁶See fungicide resistance management statements on Pages 7-8.

Sunflower Seed Treatment

Chemical	Application	Dosage ¹	Disease Control ²		Remarks
			Seedling Blights ³	Downy Mildew	
Azoxystrobin (11) Dynasty, 9.6%	Slurry	3.75-15 fl oz/cwt 0.025-0.1 mg/seed		X	Provides suppression against downy mildew.
Acibenzolar-S-Methyl (21) Bion 500 FS, 42.0%	Slurry	0.012-0.029 mg ai/seed		X	Seed weight based on 4,500 seeds/lb. For suppression of downy mildew.
Captan (M4) Captan 400, 37.4%	Slurry	2-4 fl oz/cwt	X		
Fludioxonil (12) Maxim 4FS, 40.3%	Slurry	0.08-0.16 fl oz/cwt	X		For seed-borne and soil-borne fungi.
Spirato 480 FS, 40.3%	Slurry	0.08-0.16 fl oz/cwt	X		
Dyna-Shield Fludioxonil, 40.3 %	Slurry	0.08-0.16 fl oz/cwt	X		
Fludioxonil (12) + Mefenoxam (4) Maxim XL, 21%: 8.4%	Slurry	0.167-0.334 fl oz/cwt	X		
Mefenoxam (4) Apron XL, 33.3%	Slurry	1.28 fl oz/cwt			
Metalaxyl (4) Allegiance FL, 28.35% Sebring 318 FS, 28.35%	Mist or slurry	1.5-3.0 fl oz/cwt			In North Dakota, the pathogen causing downy mildew has been resistant to metalaxyl for over a decade. The resistance is thought to be widespread and stable.
Dyna-Shield, 28.35%	Slurry	1.5-3 fl oz/cwt			
Belmont 2.7 FS, 28.98%	Slurry or mist	1.5-3.0 fl oz/cwt			
Pyraclostrobin (11) Stamina, 18.4%	Slurry	0.8-2.3 fl oz/cwt	X		For seed-borne and soil-borne fungi.
Ethaboxam (22) Intego Solo, 34.2%	Slurry	0.075-0.1 mg ai/seed	X	X	For suppression of downy mildew and <i>Pythium</i> .
Thiram (M3) 42-S Thiram, 42% Signet 480 FS, 42%	Liquid or slurry	2 fl oz/bu	X		

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

³An increase in stand has been noted only once in moderately severe tests to date; under very severe conditions, some increase in stand might be expected.

Sunflower Foliar Sprays

Chemical (Fungicide Group)	Application ¹	Dosage ²	Rust Control ³	Remarks
Azoxystrobin (11) Quadris, 22.9% Satori, 22.9% Equation, 22.9% Tetraban, 22.9%	Spray or fungigation	6-15.5 fl oz/A	X	Resistance statement 5 ⁴ . Apply prior to disease development. Also labeled for control of Alternaria leaf spot.
Boscalid (7) Endura 70%	Spray or fungigation	8-11 oz/A		For suppression of sclerotinia head rot.
Penthiopyrad (7) Vertisan, 20.6%	Spray or fungigation	10-30 fl oz/A	X	For suppression of sclerotinia head rot. Apply prior to disease development. Do not apply more than 61 fl oz/A per season. PHI = 14 days.
Fluopyram (7) + Tebuconazole (3) Luna Experience 17.6%; 17.6%	Spray of fungigation	9.0-12.8 fl oz/A	X	For suppression of sclerotinia head rot. For optimum disease control apply prior to disease development. Do not apply more than 34 fl oz/A per year. Do not apply within 50 days of harvest.
Fluxapyroxad (7) + Pyraclostrobin (11) Priaxor 14.33% : 28.58%	Spray or fungigation	4-8 fl oz	X	Resistant statements 5 & 6 ⁴ . For control of several fungal diseases including <i>Alternaria</i> , <i>Septoria</i> , rust and powdery mildew. For suppression of sclerotinia head rot.
Pyraclostrobin (11) Headline EC, 23.6% Headline SC, 23.3%	Spray or fungigation	6-12 fl oz/A	X	Resistance statement 5 ⁴ . Apply prior to disease development. Also labeled for control of Alternaria leaf spot, powdery mildew, septoria leaf spot and white rust. Maximum of 2 applications per season. PHI = 21 days.
Tebuconazole (3) 38.7% Orius 3.6F Tebuzol 3.6F Monsoon Onset 3.6L Tebucure	Spray	4-6 fl oz/A	X	For maximum disease control, labels recommend using lowest rate of nonionic surfactant. Apply at earliest sign of infection. Do not apply more than 16 fl oz per season or within 50 days of harvest. See labels for further information or spray scheduling.

¹Spray = ground or aerial; Fungigation = application through sprinkler irrigation system.

²Dosage = amount of formulated product to apply.

³X = product labeled for crop and disease; Blank = product not labeled for specific disease.

⁴See fungicide resistance management statements on Pages 7-8.

Soil-Applied Biological Fungicides

Organism	Application	Dosage ¹	Sclerotinia Sclerotiorum (white mold) Control ²	Remarks
Coniothyrium minitans Contans WG, 5.3%	Soil incorporation	1-2 lb/A depending on crop	X	Fungus attacks sclerotia of the fungus.

¹Dosage = amount of formulated product to apply.

²X = product labeled for crop and disease; Blank = product not labeled for specific disease.

DISTRIBUTOR LIST

<u>Product</u>	<u>Company</u>	<u>Product</u>	<u>Company</u>
Abound	Syngenta/Crop Protection LLC	Kocide Products	DuPont
Acquire	BASF	Koverall	Cheminova
Affiance	Gowan USA LLC	Kumulus Sulfur	Micro flo Co.
Agri Tin	DuPont	Liquid sulfur six	Helena Chemical Co.
Agri-Mycin 17	Merck	Luna Experience	Bayer
Agrox products	Wilbur Ellis	Luna Tranquility	Bayer
Allegiance	Bayer CropScience	Manex	DuPont
Alto	Syngenta/Crop Protection LLC.	Mankocide	DuPont
Aproach	DuPont	Manzate Flowable	United Phosphorus Inc.
Aproach Prima	DuPont	Manzate ProStick, 4L	Dupont
Apron seed treatment products	Syngenta/Crop Protection LLC.	Manzate ProStick	United Phosphorus Inc
Avicta Systems	Syngenta/Crop Protection LLC.	MasterCop	ADAMA
Azure Xtra	NuFarm	Maxim Products	Syngenta/Crop Protection LLC
Badge SC, Badge X2	Gowan USA LLC	Mertect 340-F.Mertect DG	Merck
Basicop	Nufarm	Meteor	United Phosphorus Inc.
Big 6 Grain Protector	Seed MateBlue Viking Star Glow	Metlock	Valent
Bravo products	Syngenta/Crop Protection LLC.	Microthiol Disperss	United Phosphorus Inc.
Bumper	ADAMA	Micro Sulf	Nufarm
Cabrio Plus	BASF	Moncoat MZ	Gowan
Cannonball NP	BASF	Moncut	Gowan
Captan seed treatment products	Wilbur Ellis	Monsoon	Loveland Products
Caramba	BASF	Nevado 4F	ADAMA
Catamaran	Luxembourg-Pamol	NipsIt products	Valent
Cercobin	Cheminova	NuFlow M	Wilbur Ellis
Champ products	NuFarm	Nu-Grow Captan Carboxin	Wilbur Ellis
Charter, Charter PB	BASF	Nusan 30	Wilbur Ellis
Charter F2		Omega	Syngenta/ISK BioSciences
Chloroneb 65W	Wilbur Ellis	Onset	Winfield Solutions
Chlorothalonil 720	Arysta	Orius	ADMA.
Clariva pn	Syngenta/Crop Protection LLC.	PCNB Seed coat	Wilbur Ellis
Contans	Prophyta (Advan)	Penncozeb products	United Phosphorous Inc.
Cruiser Maxx Products	Syngenta/Crop Protection LLC.	Phostrol	NuFarm
Cuprofix Ultra 40 Disperss	United Phosphorus Inc.	Polyram 80DG	Loveland Products
Curzate 60 DF	DuPont	Polyversum	Biopreparaty Co.
Custodia	ADAMA	Potato Seed piece fung. Dust	Wilbur Ellis
Dithane products	DOW	Praiz	Winfield Solutions, LLC
Dividend seed treatment products	Syngenta/Crop Protection LLC.	Presidio	Valent
Dyna-Shield-Metalaxyl	Loveland Products	Prevail	Trace
Dynasty	Syngenta/Crop Protection LLC.	Previcur	Bayer
Echo 720 and Echo Zn	Sipcam Agro USA	Priaxor	BASF
Elixir	United Phosphorus Inc.	Proline	Bayer
Emesto Silver	Bayer	Propiconazole E-AG	NuFarm
Eminent	Gowan USA LLC	Propicure	Winfield Solutions, LLC
Enable	DOW	Propimax EC	Dow
Endura	BASF	ProPulse	Bayer
Equation	Cheminova	Prosaro	Bayer
Equity	Loveland Products	Prosper EverGol	Bayer
Equus	ADAMA	Protector-L	Trace
EverGol Energy	Bayer	Protocol	Loveland Products
Evito	Arysta LifeScience	PST 6% Plus Bark	Simplot
Fitness	Loveland Products	Quadris TOP MP	Syngenta/Crop Protection LLC.
Foothold, Foothold Extra	Loveland Products	Quadris, Quadris Opti	Syngenta/Crop Protection LLC.
Fortix	Arysta LifeScience	Quash	Valent
Forum	BASF	Quilt, Quilt Xcel	Syngenta Crop Protection LLC.
Gavel	DOW	Rancona products	Arysta LifeScience
Gem 500 SC	Bayer	Raxil PRO MD	Bayer
Grain Guard	Trace	Ranman	Summit Agro USA/ISK
Grain Guard plus	Trace	Bicosciences	
Granol N-M	Wilbur Ellis	Reason	Bayer
Granol plus	Wilbur Ellis	Revus Top	Syngenta/Crop Protection LLC.
Headline, Headline AMP,	BASF	Ridomil formulations	Syngenta/Crop Protection LLC.
Headline SC	BASF	Roper DF Rainshield	Loveland Products
HiMoly-Captan D	Trace	Sativa	NuFarm
ILeVO	Bayer	Satori	Loveland Products
Incognito	ADAMA	Scala	Bayer
Inspire XT	Syngenta/Crop Protection LLC.	Sebring	NuFarm
Incentive	Winfield Solutions LLC	Serenade ASO	Bayer
Intego	Valent	Signet	NuFarm
Inovate Seed Protectant	Valent	Sonata	Bayer
Kernal Guard	Trace	Sorghum Guard	Trace
		Spirato 480 FS	NuFarm
		Stamina	BASF
		Switch 62.5WG	Syngenta/Crop Protection LLC.
		Stratego, Stratego YLD	Bayer

Product
 Sulfur 6
 Sulfur DF
 Super Six
 SuperTin 80WP, 4L
 Tachigaren 70WP
 Tanos
 T-Methyl
 Tebucure
 TebuStar
 Tetraban
 Tebuzol
 Terraclor
 Thiophanate Methyl 85 WDG
 Tilt
 T-Methyl E-AG
 Topaz

Company
 Wilbur Ellis
 Simplot
 United Phosphorous Inc.
 Sumitomo
 DuPont
 Micro Flo Co.
 Winfield Solutions, LLC
 Albaugh
 Winfield Solutions, LLC
 United Phosphorous Inc.
 Arysta LifeScience
 Mana Inc
 Syngenta/Crop Protection LLC.
 NuFarm
 Winfield Solutions LLC

Product
 TopGuard
 Topsin products
 Triangle Brand Copper Sulfate
 Trilex 2000
 Trinox
 Twinline
 Ultra Flourish
 Uniform
 Vibrance
 Vabro
 Vertisan
 Vortex
 Warden products
 Zolera FX

Company
 Cheminova
 United Phosphorous Inc.
 Phelps Dodge
 Bayer
 Carlson Co.
 BASF
 NuFarm
 Syngenta/Crop Protection LLC.
 Syngenta/Crop Protection LLC
 Winfield Solutions, LLC
 DuPont
 Bayer
 Winfield Solutions LLC
 Arysta LifeScience

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Pesticide certification information for the back of the weed, insect, or fungicide guide:

The printing cost for this publication was paid for in part by fees paid by certified North Dakota Pesticide Applicators and Dealers.

For information regarding pesticide certification, contact the **North Dakota State University Extension Pesticide Program**

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For pesticide enforcement, compliance assistance, registration, and other regulatory issues, contact the **Agriculture Chemical Division at the North Dakota Department of Agriculture**

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