Dividend Extreme®

Dividend® XL RTA®

CRUISER® The power to perform™

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UNDERGROUND SECURITY™ Syngenta Seed Care™

syngenta

Syngenta Cereal Seed Treatments

Dividend Extreme®

Dividend® XL RTA®

CRUISER® The power to perform™

Superior Protection Against Insects and Diseases

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A Healthy Start for a Profitable Finish

Cereal growers can rest easy when their wheat or barley seed is treated with Cruiser® seed treatment insecticide and either Dividend Extreme® or Dividend® XL RTA® (Ready To Apply) seed treatment fungicides. With this insecticide-fungicide combination, seed is protected from insects and diseases from the beginning, ensuring that the crop gets off to a vigorous start.

Cruiser brings superior protection, especially during the early stages of the crop, against some of the most destructive insects including aphids, which can transmit barley yellow dwarf virus, and wireworms. With an excellent crop, worker and environmental safety profile, Cruiser provides convenient, seed-delivered insect protection.

Barley Yellow Dwarf Virus

The Dividend brands, including Dividend Extreme and Dividend XL RTA, raise the bar for seed treatment fungicides. Guarding against more than 16 seed-borne, soil-borne and fall foliar diseases including *Pythium, Rhizoctonia*, dwarf bunt and common root rot, the Dividend brands protect cereal crops from more diseases than any other product on the market. With Dividend brands, growers receive proven seed safety and seedling germination, systemic protection, healthy roots, stronger stands and more heads, which results in enhanced yield performance and improved return on investment.

Cruiser Protects Against:

- Bird cherry-oat aphid
- English grain aphid
- Grasshopper (reduces damage)
- Greenbug
- Russian wheat aphid
- Hessian fly
- Wireworm

Dividend Brands Protect Against:

- Barley stripe
- Common bunt
- Common root rot*
- Covered smut
- Dwarf bunt
- Flag smut
- *Fusarium* crown rot*
- *Fusarium* root rot*
- Leaf rust**
- Loose smut
- Powdery mildew**
- *Pythium* seedling damping off
- *Rhizoctonia* root rot*
- Seed rots
- Seed-borne *Fusarium* scab
- Seed-borne *Septoria*
- *Septoria* leaf blotch**
- Take-all*

*Early-season control

**Fall-season foliar disease control for the first six weeks after planting

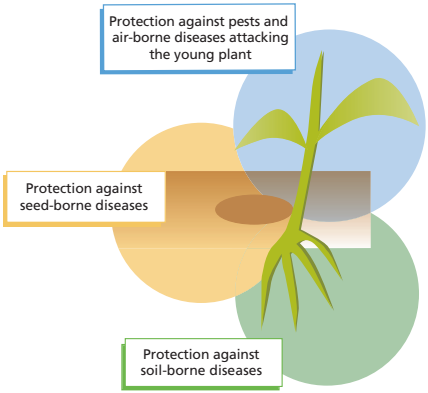
Application Flexibility

For growers who prefer the convenient, no-fuss approach, Cruiser and Dividend Extreme are the ultimate choice. Both products are applied by commercial seed treaters or seed companies — so growers get insect and disease protection without having to do anything extra, except ask for these treatments.

Cruiser provides a convenient replacement for soil and early foliar insecticide applications. The unique properties of thiamethoxam, the active ingredient in Cruiser, allow plants to absorb and effectively translocate the product to help achieve superior pest protection. **Cruiser has a flexible rate structure that can be tailored to the needs of each field — 0.19 - 0.25 oz/CWT for wireworm suppression and 0.75 - 1.33 oz/CWT for other insect pests.**

Dividend Extreme offers excellent seed safety, optimal flowability, less dust off and good adhesion to the seed, providing a more convenient product for both cereal growers and seed companies. **Dividend Extreme is commonly applied at 2 oz/CWT.**

Dividend XL RTA presents an option for growers who prefer to treat their seed themselves. It is formulated for direct application to the seed through an on-farm treater. With its improved cold-weather formulation, it offers optimum flowability, less dust off and good adhesion to the seed, just like its commercially applied counterpart, Dividend Extreme. **Dividend XL RTA is commonly applied at 5 oz/CWT.**



All three products offer the early-season, systemic, complete protection only available with seed treatment.

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The power to perform™

Barley Yellow Dwarf Virus Protection

Barley Yellow Dwarf Virus (BYDV) is a potentially devastating disease that has eluded producers for decades. This virus is spread by aphids, and even a small population of these tiny insects can wreak havoc in a field. Many researchers have identified fall attacks as most damaging and the source of a majority of the BYDV that is evident in the spring. Cruiser protects cereal crops from these sporadic fall aphid attacks and serves as the first line of defense against BYDV.

Visible Symptoms:

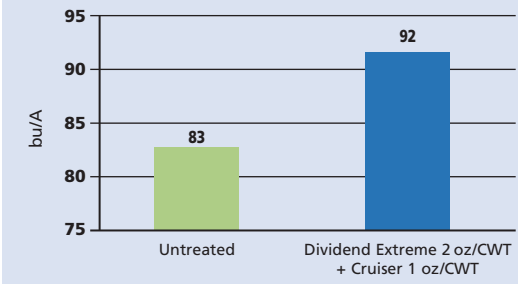
- Winterkill
- Plant stunting
- Yellow to red-purple leaf discoloration

Virus Impact:

- Underdeveloped root systems
- Decreased tillering
- Delayed maturity
- Nutritional disorders
- Reduced grain quality and yield

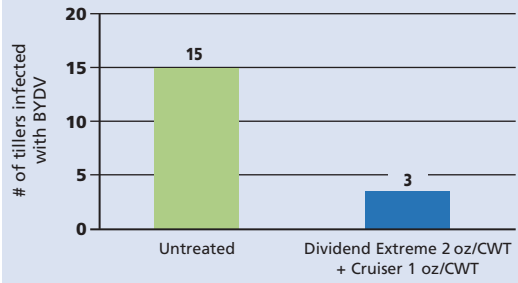
Aphid/BYDV Damage

Effect of BYDV on Yields



Source: E. Stromberg, Virginia Tech, 2003.

Effect of BYDV on Tillering



Source: E. Stromberg, Virginia Tech, 2003.

Systemic Protection for Wireworm Suppression

The increased popularity of reduced tillage programs has created an opening for wireworms to thrive. The shiny yellow larvae of click beetles, wireworms prefer cool, moist soils in fields with high organic matter. They feed on roots and seedlings and can reduce stands up to 80 percent. Yields start to go down after a field reaches 20 percent stand loss.

Because wireworms live underground, attacking roots, seeds and stems, foliar sprays provide no control, but seed treatment can help. Cruiser offers one of the most cost-effective and proven options for reducing wireworm damage. This gives plants a chance to develop root systems capable of taking up necessary nutrients and moisture, which allows them to better sustain any later attacks by wireworms. Although seed treatment insecticides are recognized as one of the best options for managing wireworm damage, they will only provide some level of suppression rather than complete control.

Damage Caused by Wireworms:

- Seed, root and stem feeding
- Reduction in plant stand
- Patches of dead plants

Conditions Favored by Wireworms:

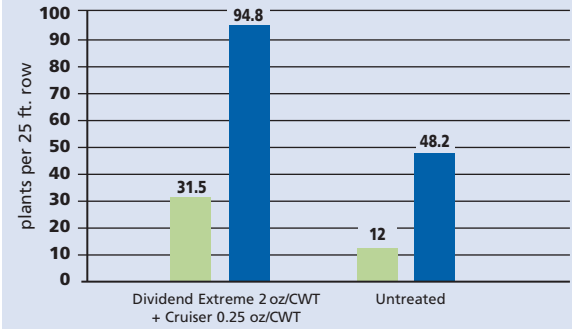
- Cool, moist soils
- Fields just put into production after being in pasture or sod
- Long-term legume or grassy cropped fields
- Reduced tillage fields for their high organic matter and ample supplies of plant roots and seeds

Location: Pacific Northwest, Source: McGregor Company

Location: Pacific Northwest, Source: McGregor Company

Plant Stand Under Heavy Wireworm Pressure

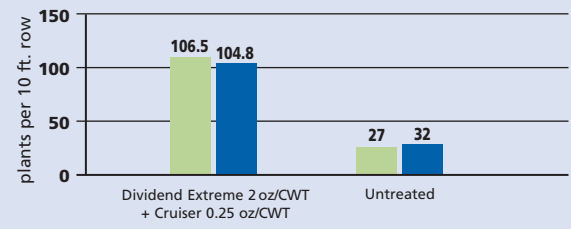
Washington, 2004



DAP = days after planting

Plant Stand Under Wireworm Pressure

Montana, 2004



DAP = days after planting

Defend Seeds Against *Fusarium* Seed Scab

Fusarium attacks the outside of the seed and the seed embryo. These infection points act as inoculum for a new round of infection in the next crop when conditions are favorable. However, the immediate threat is to the seed. If infected with *Fusarium*, the seed may die, germinate poorly or encounter seedling blight as it germinates.

Fusarium Seed Scab

Consequences of *Fusarium* Infections:

- Fewer seeds germinate
- Seedlings frequently die before becoming established
- Stands are spotty and uneven

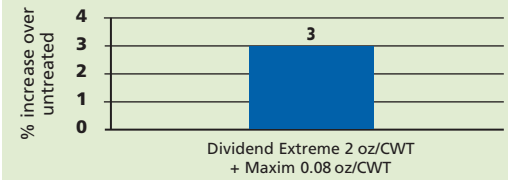
Dividend Extreme and Dividend XL RTA defend seeds against inoculum in the soil and reduce the chance of new infections. Combining these products with Maxim® 4FS seed treatment fungicide further enhances protection against seed scab. While seed treatment cannot protect wheat and barley plants from wind-borne inoculum that may affect the plant later in the season, the Dividend brands and Maxim 4FS have proven integral for managing seed scab, showing excellent activity against several *Fusarium* species including seed scab, root rot and crown rot. As a result, disease risk is lowered, germination and stand establishment are greatly improved and yield potential is protected.

Benefits of a Dividend Extreme and Maxim 4FS Program:

- Delivers excellent seed germination by protecting against seed scab and seedling blight
- Excellent seed safety and disease protection results in optimal seedling development and root growth
- Adding 0.08 oz/CWT of Maxim 4FS to 2-4 oz/CWT of Dividend Extreme boosts seed germination

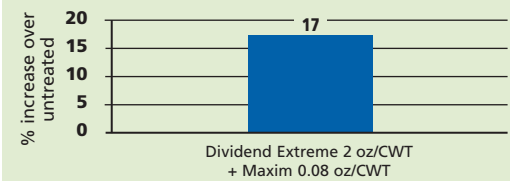
Seed-Borne Scab: Plant Stand

North Dakota, 2004



Seed-Borne Scab: Yield

Spring Wheat, 2004



Location: North Dakota

Seed-Borne Scab: Seed Germination

Untreated
Germination = 38%

Dividend Extreme
Germination = 78%

Dividend Extreme +
Maxim 4FS
Germination = 93%

Germs completed by Nebraska Crop Improvement Association.

Unsurpassed Dwarf Bunt Protection

Tilletia controversa Kuhn, also known as dwarf bunt, is a fungus or smut infecting wheat by dwarfing plants and destroying kernels. Higher elevations and long periods of snow cover in the Pacific Northwest create ideal conditions for dwarf bunt in winter wheat fields, as the disease requires 60 to 90 days of continuous snow cover, sustained low temperatures and diffused light. Due to the need for cool weather and snow cover during germination, spring cereals are not affected.

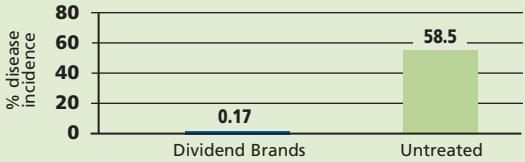
Impact of Dwarf Bunt:

- Reduced yield and test weight
- Plants develop heads with black bunt spores rather than healthy wheat kernels
- Smut balls from dwarf bunt stain kernels and produce a very distinct, unpleasant odor
- Restrictions prevent elevators from accepting and exporting grain with high bunt levels

Dividend Extreme is the only seed treatment available to protect against dwarf bunt. When growers use seed treated with Dividend Extreme, they know their wheat fields are protected from dwarf bunt and 15 other seed-borne, soil-borne and fall-foliar diseases right from the start. This protection helps maximize their grain marketing options.

Protection from Dwarf Bunt

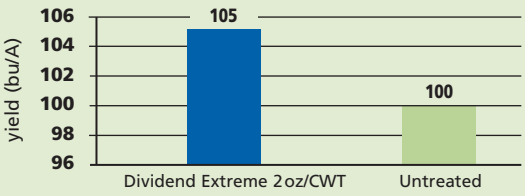
1988-1997



Average of 16 trials in ID, MT, OR, UT and WA.

Direct-Seeded Winter Wheat Yield

Washington State University, 2002



Spillman Agronomy Farms. Variety: Madsen.
Fifth consecutive year of direct seeding.

Excellent Protection Against *Pythium*

Pythium is one of the most prevalent disease pathogens attacking cereal crops. It is so common that it is often misdiagnosed as winter injury, poor soil fertility or toxicity from crop residue. *Pythium* feeds on the root system and results in spindly plants with shortened or distorted leaves, fewer tillers and smaller heads.

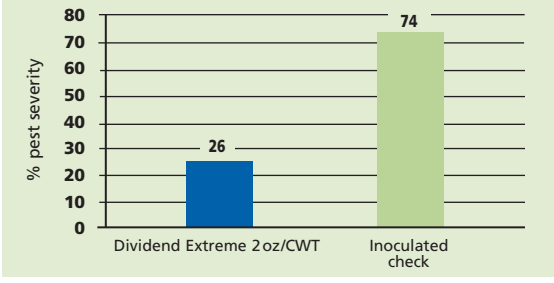
Pythium–infected seeds, untreated

Pythium–infected seeds, treated with Dividend Extreme

Impact of *Pythium:*

- Significant yield loss
- Delayed emergence
- Damping-off
- Restricts nutrient uptake due to disintegrated root tips
- Stunts plant growth
- Uneven plant development
- Thin plant stands

Pythium Protection with Seed Treatments



Research from Washington State University indicates that wheat seeds left unprotected are likely to become infected by *Pythium* within the first 24 to 48 hours after planting in moist soils. Dividend Extreme contains Apron XL® seed treatment fungicide at a labeled rate three times the norm for excellent, built-in protection against *Pythium.* Dividend Extreme protects seeds and young seedlings from day one, while aiding the development of a strong, uniform stand and enhancing yield potential.

Guard Against Common Root Rot

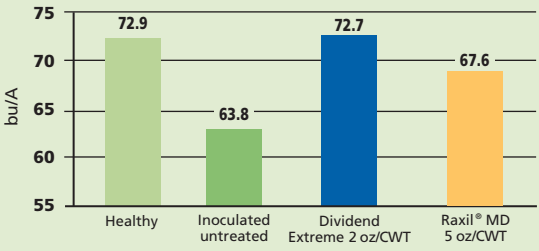
Lingering in cereal fields, easily misidentified and often undiagnosed, common root rot can cause severe damage. Also known as *Cochliobolus sativus*, common root rot survives as spores in the soil or among infected debris from previous crops.

Symptoms include subtle, elongated brown spots or lesions. With severe infections, the entire crown, sub-crown internode and root system may turn dark brown and die. Prematurity blight can occur when severe infections are aggravated by spells of hot weather following a period of cool weather. With prematurity blight, heads appear nearly white with either shriveled seeds or no seeds at all.

Dividend Extreme and Dividend XL RTA are adept at protecting the root system from common root rot. They act as a barrier between the disease in the soil and the developing root system — thereby lowering the disease risk and improving stand establishment.

Common Root Rot: Yield

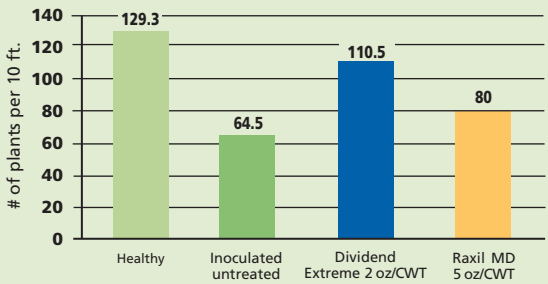
Spring Wheat, 2001



Under high disease pressure. Location: Montana.

Common Root Rot: Plant Stand

Spring Wheat, 2001



Under high disease pressure. Location: Montana.

Cruiser:

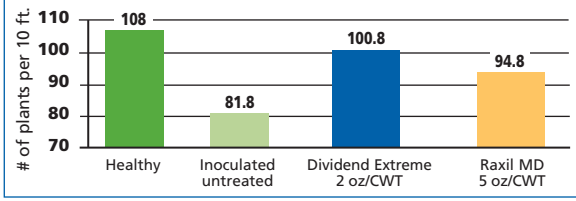
- Superior protection against wireworms and aphids
- Excellent performance against aphids reduces the transmission of BYDV
- Provides early-season protection against Hessian fly
- Helps produce healthier and more vigorous plants under certain conditions even in the absence of insects via the Thiamethoxam Vigor Effect to increase yield potential
- Consistent performance under a wide range of growing conditions
- Rate flexibility tailored to pest spectrum in each field
- Convenient, seed-delivered insect protection
- Excellent crop safety and not harmful to beneficial insects
- Fully compatible with the superior performance of Dividend Extreme seed treatment fungicide to protect against insects and more than 16 diseases at the same time

Dividend Brands:

- Protect against more than 16 early-season seed-borne and soil-borne diseases, including unsurpassed protection against dwarf bunt
- Contain Apron XL at a labeled rate three times the norm for excellent, built-in protection against *Pythium* damping off
- Offer excellent seed safety for optimal seedling development and root growth
- Potential for good return on investment vs. untreated and competitors
- Fully compatible with Cruiser seed treatment insecticide to protect wheat and barley seedlings from insects and diseases at the same time

Fusarium Crown Rot: Plant Stand

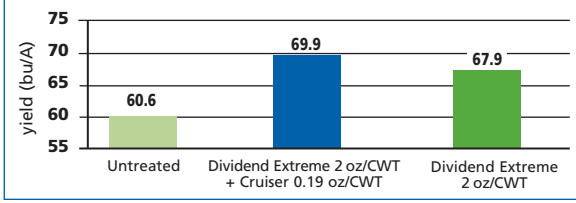
Spring Wheat, 2001



Location: Montana.

Impact of Seed Treatments on Spring Wheat

2004



Average of three trials. Location: Pacific Northwest. Variety: Alpowa.

Pest Identification

Aphids

Rhopalosiphum padi, Rhopalosiphum maidis, Sitobion avenae
Bird cherry-oat aphid, Corn leaf aphid, English grain aphid, Russian wheat aphid

Life Cycle: Most aphids overwinter as eggs on various plants. Life cycles may involve more than one host plant. In spring, females emerge from eggs and give birth to live young, which remain wingless or become winged for dispersal. A new generation is produced every three to four weeks. In fall, males are produced and mated females lay overwintering eggs. Most species of grain aphids migrate each year on southerly winds.

Description:

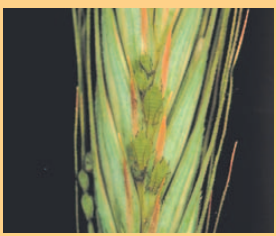
Adult: Adult aphids are about 0.1" long; roughly pear-shaped; may be winged or wingless; are slow moving and soft-bodied. Pair of tubular structures (cornicles) project like tail pipes from end of bodies. Adult aphids may fly or walk from host to host. **Bird cherry-oat aphid (BCOA)** is dark green to almost black with rounded body; red-brown area on back of abdomen; antennae nearly as long as body. **Corn leaf aphid (CLA)** is blue-green with a fuzzy appearance; body is flatter and longer than BCOA; cornicles are short and black. **English grain aphid (EGA)** is green to brown to pink with long black cornicles that reach past the end of the body; legs are long and black. **Russian wheat aphid** is small, lime-green with an elongated, spindle-shaped body; projection above the tail, which gives it a “double tail” appearance when viewed from the side; rather short antennae. Absence of prominent cornicles distinguishes it from other aphids.

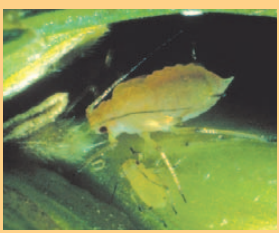
Damage: Damage caused by sucking plant juices; damaging roots, stems, leaves or fruit; causing abnormal growth, wilting or flower drop. In large

numbers, the EGA can shrivel developing grain kernels. Aphids can also transmit barley yellow dwarf virus (BYDV); and in this case, a single aphid can infect and stunt several plants. In turn, other aphids acquire the virus from infected plants then move to and infect healthy plants, quickly increasing disease level.


Aphid


Aphid, corn leaf


Aphid, English grain


Aphid, Russian wheat

Scouting/Control Measures: Cool, moist conditions favor aphid development. Fields should be inspected following a period of this type of weather. Make several counts throughout fields prior to heading. Counts should be at least 50 paces apart and observations should be made well into center of field. Carefully examine 20 stems in each of five areas of field. Examine at least 100 stems per field. Consult your extension service for threshold levels. Foliar treatments should be made before aphid feeding curls leaves. Lady beetles, syrphid fly larvae, green lacewing larvae (aphid lions) and parasitic wasps are natural predators of aphids.

Seed Treatment Product Recommendation:

CRUISER® The power to perform™

Distribution: Most species of aphids can be found throughout the United States.

Greenbug

Schizaphis graminum

Life Cycle: Some greenbugs overwinter as far north as Missouri; in northern regions, they migrate as winged females with prevailing southwesterly winds during March and April. Eggs generally hatch during late winter or early spring, producing wingless females. Within seven to 18 days of hatching, females begin giving birth to live young, and rate of reproduction is enormous.

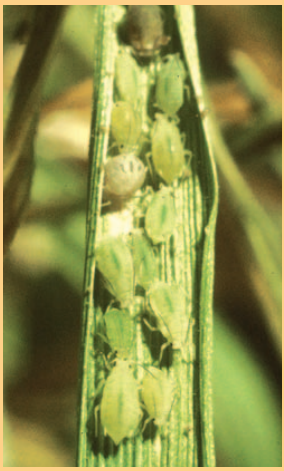


Photo by Brian D. Hudelson

Greenbug

Description:

Nymph: Similar to adult, but smaller in size.

Adult: Small, pale green aphids; winged or wingless females; about 1/16" long; very distinct darker green band down the middle of the back. Mostly black antennae are shorter than the body; relatively short cornicles (tailpipes) have black tips. Legs are green with joints and ends black. Colonies will occur on undersides of leaf blades, in crowns and occasionally on stems.

Damage: Damage may occur in fall or spring. Unlike other cereal aphids, greenbugs inject a toxin into the plant causing that tissue to die. Feeding injury first appears as a yellow ring around the puncture into which toxin has been injected and plant sap withdrawn. Injured leaf tissue turns red and then brown as the tissue dies. Infested fields usually show deadened, yellow or red areas in late winter or early spring. Greenbugs also transmit barley yellow dwarf virus.

Scouting/Control Measures: Wheat varieties differ in tolerance to greenbugs. Seed treatment insecticides offer early season protection in areas where risk of greenbug infestation is high. If 50-100 greenbugs are counted per linear row-foot, control may be needed. If these numbers are reached during early fall, treatment is generally advisable, unless an unusually high number of beneficial insects are present. Greenbugs generally decline naturally during December and January. Overwintering populations can increase rapidly during warm periods in February and March. Maintain close surveillance of fields if greenbugs are present. Greenbug in some areas have developed resistance to some insecticides. Contact local advisers concerning threshold levels and best control measures.

Seed Treatment Product Recommendation:

CRUISER® The power to perform™

Distribution: Throughout the United States, though most damaging in CO, KS, NE, OK and TX.

Hessian Fly

Mayetiola destructor

Life Cycle: Two generations annually. Fall generation maggot completes its growth and overwinters under leaf sheaths in a brown pupal form known as “flaxseed.” Small black flies emerge in March, mate and lay eggs for another generation, with egg and maggot activity in May or early June. Second generation larvae change into “flaxseed” pupae before grain harvest and remain in that stage on stubble throughout summer. Flies emerge in September and early October, lay eggs and larvae emerge to begin the fall/winter generation.

Description:

Egg: Red; laid in lines of 10 or 12 in grooves on upper side of leaves.

Larvae: Small, white, legless maggots.

Pupae: Also known as “flaxseed” stage because puparia resemble flaxseeds.

Adult: Very small black fly, smaller than the common mosquito (less than 1/8" long). Abdomen of female is dull red.

Damage: Maggots (larvae) are destructive stage. Maggots of fall generation work their way under leaf sheaths near crowns and feed by rasping the plant and sucking the exuding sap. Such feeding weakens and stunts plants and subjects them to abnormal winter kill. Larval feeding in late spring results in poorly filled heads and lodged straws.

Scouting/Control Measures: Scout wheat fields, especially in late October or November after first frost, looking for areas of poor stand and stunted plants. Also check plants in spring. Examine base of plants by pulling back sheaths of several leaves

and look for the "flaxseed" pupae. Use resistant varieties (although varieties are not resistant to all biotypes of the fly) and plant after the "Hessian fly-free date." Once an infestation of Hessian fly has developed, there is no effective rescue treatment. Parasitic wasps can sometimes reduce Hessian fly populations in spring. Some seed treatment insecticides can provide partial, early season control, but the key is to plant after the fly-free date. If you are not sure of that date, contact local advisers.

Seed Treatment Product Recommendation:

CRUISER® The power to perform™

Distribution: Throughout all wheat growing states; not found in arid wheat growing areas of the Plains States, but is found in irrigated areas.

Hessian Fly

Wireworm

Melanotus spp. or *Agroites spp.* or *Limonius spp.*

Life Cycle: Four stages of growth consisting of egg, larva, pupa and adult; most species require two or three years to complete development. Adults emerge in spring. Shortly after mating, female beetles lay up to 300 eggs in the soil, generally around the roots of grass plants. Larvae emerge from eggs. Depending on environmental conditions, some larvae require two to six years to reach full size of approximately 0.8"– 1.5", so numerous stages and sizes of larvae may be found at any one time. Pupal stage is also spent in the soil. Some species of wireworm can overwinter in any of the stages, but most do so in the larval and pupal stages.

Description:

Egg: Generally pearly white, round and difficult to see in the soil.

Larvae: Wireworm is the common name for the larval stage of several species of beetles.

Newly hatched wireworms are white with dark jaws. After feeding and molting several times, these larvae become hard, slender, jointed and shiny; and generally orange, brown or yellow. They can be 0.4" – 1.6" long; legs are present on the first three body segments behind the head.

Pupae: Generally white and soft-bodied.

Adult: Adults of some species are called "click" beetles because of their habit of snapping or clicking when placed on their backs. Adults are normally 0.06" – 1.5" long; tapered toward both ends; brown to nearly black with loose, flexible joint just ahead of wings.

Wireworm

Damage: Wireworms can attack the crop as soon as the seed is planted into the soil. Injury includes boring into the seed and young seedlings. Usually, seedlings are not completely severed as with cutworm, but suffer severe scaring which weakens the plant. Open wounds also provide paths for other plant diseases. Larvae feed on roots and underground shoots of small grains, especially those planted on land previously in sod.

Scouting/Control Measure: Through crop rotation, tillage, soil applied insecticides and seed treatment insecticides, wireworms can usually be managed. Infestations are most severe on land not previously in row crops, especially following sod. Wireworms are difficult to control, partially because they usually live and do their damage several inches deep in the soil. There are no known thresholds to estimate economic damage to plants. Sometimes baits can be used to determine population levels. If wireworm infestations are high, talk to your local advisers for recommendations in your area.

Seed Treatment Product Recommendation:

CRUISER® The power to perform™

Distribution: Throughout the United States.

Barley Yellow Dwarf Virus

Luteovirus, BYDV

AKA: Red leaf (in oats)

Principle Crops Affected: Wheat, barley, oats, triticale

Symptoms: Barley yellow dwarf virus (BYDV) is evidenced by stunting and yellowing of wheat plants. Leaves may turn yellow along leaf margins or in blotchy patterns. Heads may be whole or partially sterile. Leaf yellowing begins at leaf tips and along midribs; infected leaves tend to be more erect. Flag leaves may have red-purple tips.

Barley Yellow Dwarf Virus

Disease Cycle: Although plants infected early in fall may be flat or weak and may winter-kill, symptoms are usually not seen until late spring, near jointing time. BYDV is complicated with many strains and is transmitted by more than 20 aphid species, some of which are windborne from more southern regions. The virus is very persistent in aphid vectors, but cold and dry conditions slow aphid activity and virus transmittal. It is not transmitted by seed nor soil.

Damage: Reduces tillering and sterility and fails to fill kernels, which lowers yields.

Scouting/Control Measures: Most important time for controlling aphids to prevent BYDV is during the first 30 days following emergence. Delay planting using the Hessian Fly Free Date. Plant varieties that are not highly sensitive to BYDV. Consult local advisers concerning threshold levels and best control measures. In some regions, as few as three aphids per row-foot during the first 30 days after emergence may justify using an insecticide.

Seed Treatment Product Recommendation:

CRUISER® The power to perform™

Distribution: Throughout the United States.

Common Bunt

Tilletia spp.

Common Bunt

AKA: Covered bunt

Principle Crops Affected: Wheat

Symptoms: Heads affected by this fungal disease have a blue cast when they emerge from the boot. Heads are smaller, with spreading glumes. Infected kernels are transformed into smut balls — masses of foul-smelling, dark brown powder, which are the spores of the fungus. Smutted heads generally stand more erect than healthy heads because of being lighter weight.

Disease Cycle: Most commonly found on fall-sown wheat. Infection occurs from smut spores on seed and from spores in soil close to the seed. Soil-borne spores can last for decades. Spores germinate in cool conditions, attacking seedlings before emergence.

Damage: Loss in yield is directly related to the percentage of diseased tillers. There can be loss in quality with down-grading smutty grain.

Scouting/Control Measures: Appropriate seed treatment fungicides will provide good control. Also rotate crops and plant resistant varieties. Contact local advisers if infection occurs.

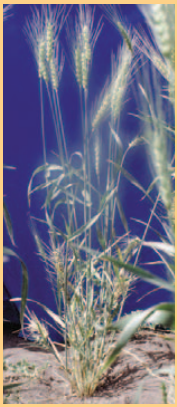
Seed Treatment Product Recommendation:

Dividend Extreme® Dividend XL RTA®

Distribution: Throughout the United States.

Dwarf bunt

Tilletia controvers



Dwarf Bunt

Principle Crops Affected: Winter wheat

Symptoms: Dwarf bunt looks like common bunt but affects only winter wheat, not spring wheat. Infected plants are shorter, with an increased number of tillers. Seed heads are full of greenish-brown "bunt balls" instead of kernels. Dwarf bunt has a strong, fishlike odor.

Disease cycle: Dwarf bunt can survive in soil for more than 10 years. At harvest, the bunt balls release black spores, which stay in the soil or on the seed. Spores on the seed are the most common source of inoculation. Spores germinate slowly at low temperatures under snow or frozen ground. Once a plant is infected, the fungus grows as the plant grows, filling the heads with bunt balls.

Damage: Yields are reduced because the bunt balls replace wheat kernels. As the spores are released, healthy grain can also be contaminated.

Scouting/Control Measures: Infected plants may be hard to find under a canopy of taller, healthy plants. Infection is most apparent later in the season as the bunt balls open to expose spores. Very early or very late fall planting and planting resistant varieties reduce yield losses caused by dwarf bunt, but these practices do not control the disease or prevent grain contamination. Fungicides and seed treatments that specify dwarf bunt control can be used.

Seed Treatment Product Recommendation:

Dividend Extreme® Dividend XL RTA®

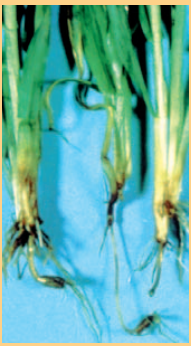
Distribution: Mainly Pacific Northwest in areas with winter snow cover.

Common Root Rot

Cochiobolus Satiuus
(Bipolaris sorokiniana)

Principle Crops Affected: Wheat, barley, oat

Symptoms: First symptoms are stunting and sometimes wilting of infected wheat seedlings. Later these plants turn yellow and die. Brown lesions develop on subcrown internodes and primary roots. Roots of diseased seedlings are rotted, red-brown and may be covered with a mass of white, gray or pink mold. If only part of the root system is involved, the plant does not tiller and sends up only a single stem with a small seed head. Dead plants often have a bleached appearance.


Common Root Rot

Disease Cycle: This disease can be especially important in areas where wheat is planted following corn. Infection results from spores that are soil-borne or seed-borne, or from crop residues of corn or other cereal crops. These fungi are common in soil. Favorable conditions for this disease include dry, cool soils and drought stress during seed filling.

Damage: Main loss is due to a reduced number of heads per plant by kernel weight. The number of kernels per head are also reduced.

Scouting/Control Measures: Thoroughly plow or burn infected stubble, straw, corn stalks, grass weeds, etc. Rotate crops, and do not follow corn with wheat. Remove light and shriveled seeds from seed wheat. Plant resistant or tolerant varieties that are treated with appropriate seed treatment fungicides. Delay sowing until soil temperatures are 60°F or less. If this disease has been observed, contact local advisers for best control options.

Seed Treatment Product Recommendation:

Dividend® Extreme® Dividend® XL RTA®

Distribution: Throughout the United States.

Flag Smut

Urocystis agropyri (U. tritici)

Principle Crops Affected: Wheat

Symptoms: Flag smut is recognized best at heading, distinguished by the characteristic dusty black appearance of diseased heads. Leaves may also appear twisted, giving the appearance of hormone-type herbicide injury. Typically, at or near heading, the infected heads emerge one to three days earlier than those of healthy plants. The chaff and grain in an affected head are completely transformed into a black powder or sori, which are dispersed by wind, rain or insects during the flowering period of healthy plant heads.

Infections that occur near heading cause sheaths and leaves to form long, gray-black streaks, typically between leaf veins. Leaves will curl, and may become shredded as tissue between veins breaks down.

Disease Cycle: Maximum infection of plants occurs during flowering. The black spores form a smutted head, infecting prior to emergence. In conditions of moisture and temperatures between 50° and 70°F, the spores germinate and grow in the flower, invading the seed. After infecting the seed, flag smut will become dormant until an infected seed is sown and begins to sprout. The smut becomes active and grows, keeping pace with the wheat plant's development.

Infection is favored by dry soil conditions, typically 10 to 15 percent moisture levels. Flag smut may be seed- or soil-borne, with soil resting stage lasting up to four years. Thus, crop rotations are only somewhat effective.

Damage: The fungus affects the leaves and stems of wheat. Most infected plants will not produce seeds. The greatest economical loss is from loss of grain production. Fields with heavy flag smut produce high levels of spores that can cause spread of smut for future crops. Seed held back from fields containing flag smut are at risk for developing early season symptoms, including stand losses and yield reductions.

Scouting/Control Measures: Use a variety resistant to flag smut and a fungicide seed treatment. Crop rotation may be beneficial.

Seed Treatment Product Recommendation:

Dividend® Extreme® Dividend® XL RTA®

Distribution: Most winter wheat areas and cool, fall-sown spring wheat areas.

Loose Smut

Ustilago tritici

Principle Crops Affected: Wheat

Symptoms: Easily recognized by characteristic dusty black appearance of diseased heads. Generally, glumes and grain are completely transformed to black powder spore masses which shatter off, leaving a bare, blackened spike at harvest. Infected plants are difficult to detect prior to heading.

Loose Smut

Disease Cycle: Seed-borne fungal mycelium establishes itself in the embryo of the seed at flowering. As seed matures, mycelium becomes dormant. When infected seed germinates the following spring, mycelium begins to grow and penetrates the growing point.

Damage: Loss in yield is directly related to the percentage of diseased tillers. Also can be loss in quality with downgrading of smutty grain.

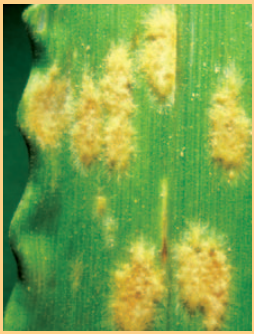
Scouting/Control Measures: Plant clean, certified seed from smut-free fields. Plant resistant varieties. Use appropriate systemic seed treatment fungicides. Rotate crops. Discuss control options with local advisers.

Seed Treatment Product Recommendation:

Dividend Extreme® Dividend XL RTA®

Distribution: Throughout the United States.

Powdery Mildew
Erysiphe graminis



Powdery Mildew

Principle Crops Affected:
All small grains

Symptoms: Powdery mildew prefers plants in parts of the field where growth is dense and air is moist. Small, irregular or circular gray-white spots appear on upper leaf surfaces and enlarge as the fungus grows. Spots take on a floury appearance due to production of spores. Lower leaf surface beneath diseased spots turns yellow; older parts of spots turn brown. Gray-white spots also found on spikelets. Small, black, fruiting bodies form in mature lesions. Under very favorable conditions, powdery mildew spots can also develop on stems and heads.

Disease Cycle: Powdery white spots appear on leaves when plants are flowering; under rain-free conditions, spread rapidly to cover all leaves, stem, tendrils and pods. As foliage ages, pinhead-sized round structures speckle the mildewed surface. Rapid spread is due to prolific production of wind-blown spores that can infect without rain or dew. Airborne spores land on plant surfaces, germinate and penetrate epidermal cells. In southern areas, it may overwinter on living leaves of various plant species. Spread is favored by cool weather below 86°F.

Damage: Severe infestations cause infected leaves to wither and die early. Plants affected by powdery mildew produce fewer tillers and grains per head. The disease will seriously reduce yield if the flag and second leaf are affected.

Scouting/Control Measures: In many areas, this disease is present every year. Resistant varieties have been developed for areas where powdery mildew is most serious. Crop rotation also helps. Because of superficial-type infection, foliar fungicides are generally very effective. If powdery mildew develops, discuss control options with local advisers.

Seed Treatment Product Recommendation:

Dividend® Extreme® Dividend® XL RTA®

Distribution: Throughout the United States.

Pythium

Principle Crops Affected: Wheat, many others

Symptoms: *Pythium* is one of the most common soil pathogens found in nature. *Pythium* infects the seed at or before germination, attacking the young seedling before or after emergence. Disease symptoms may include any of the following: seed decay; decay of the seedling before emergence; seedling root rot characterized by a soft, watery rot; root tips that are brown and dead in appearance; brown tissue on the outer portion of the root that easily pulls off and/or root cells containing fungus spores. Plants that do emerge are pale, stunted, become yellow and die within a few days. Surviving plants are less vigorous and competitive during early season growth development.

Early season symptoms are commonly called damping-off. Compacted soils and water-soaked conditions cause anaerobic conditions that are favorable for the development of *Pythium*. Low soil oxygen levels cause plants to exudates oxygen forming sugars that *Pythium* thrive on and cause rapid increase in soil levels.

Cool conditions slow down plant development, increasing the exposure and time needed for infections to develop.

Disease Cycle: The fungus can be found in soil, sand, pond and stream water and their sediments, as well as dead roots of previous crops. *Pythium* is a particular problem in poorly drained soils. The fungus prefers wet and especially cool conditions for releasing spores. *Pythium* can develop most easily in seedlings, as plants become more resistant as they age. The plant's root tips are attacked and killed first, causing root loss and poor growth. Several species of *Pythium* are known to infect wheat seed and seedlings.

Damage: *Pythium* root rot is difficult to control once rot has begun and rapid death of crops occur when infected. Economical impact can occur from stand loss, poor vigor, delayed emergence and poor plant development.

Scouting/Control: Most soils contain some level of *Pythium*, ensuring the potential for infections in fields if environmental conditions become favorable. Plant good quality seed, free from cracks and splits, in well-drained soils. Use seed treatment fungicides to prevent infection during the most susceptible early season development period.

Seed Treatment Product Recommendation:

Dividend Extreme®

Dividend® XL RTA®

Distribution: Throughout the United States.

Pythium damping off

Rhizoctonia Root Rot

Rhizoctonia solani

Principle Crops Affected: Wheat, barley, many others

Related Species: *Rhizoctonia* stem rot

Symptoms: This fungus can cause pre-emergence or post-emergence damping-off of seedlings and wilting. It can cause brown or red-brown lesions on larger seedlings and young plant stems down to the soil line and on the tap root. Infected stems often break in the lesioned area. Roots may die from a firm, dry, brown or red-brown decay.

Disease Cycle: The fungal structures overwinter in the soil and in crop residue. Stress conditions favor infection. Warm and dry soil prior to planting, followed by warm and wet conditions after planting, favor this disease. This fungus can survive indefinitely.

Scouting/Control Measures: Use systemic fungicide seed treatments, avoid seedling stresses, such as planting too deeply and compacting soil. Promote good soil conditions that favor rapid seedling development.

Seed Treatment Product Recommendation:

Dividend® Extreme® Dividend® XL RTA®

Distribution: Throughout the United States.

Septoria Leaf Blotch

Septoria tritici or *Mycosphaerella graminicola*

Principle Crops Affected: Wheat, barley

Symptoms: Small yellow to brown flecks occur on leaves. These expand to irregular yellow to brown lesions, sometimes with gray to brown centers and yellow edges. Small black dots or spores appear in diseased areas and distinguish this leaf disease from others.

Disease Cycle: Fungal pathogens overwinter on crop residue. Disease is primarily dispersed short distances by rain splash. Wet, warm weather favors the disease, which can also be seed-borne.

Septoria leaf blotch

Damage: Shriveled seed and reduced seed set which lowers yield.

Scouting/Control Measures: Allow a one- or preferably two-year break between wheat and/or barley. Use varieties with some resistance. Burying residue may reduce disease incidence. Foliar-applied fungicides will reduce losses, but crops should be monitored closely around flag leaf emergence and sprayed when only small spots are present on upper leaves. Seed treatment fungicides will reduce seed transmission but will not protect plants from spores spreading from crop residue, which is typically where the disease originates.

Seed Treatment Product Recommendation:

Dividend® Extreme® Dividend® XL RTA®

Distribution: Throughout the United States.

Take-all

Gaeumannomyces graminis

Principle Crops Affected: Barley, wheat

Symptoms: Diseased plants usually occur in localized areas up to several feet in diameter. Affected plants are severely stunted, lose their green color and rapidly become bleached. A black, scruffy mold appears on lower stems and roots. Roots, crowns and stem bases have brown to black dry rot. A dark brown or black mat of coarse fungus hyphae may be found under lower leaf sheaths. Infected plants die prematurely with unfilled white heads.

Disease Cycle: Severity of this disease, especially crown and basal rots, varies greatly from year to year in the same field. Lives in the soil on diseased straw and root residues. Runner hyphae grow from the residue to roots of wheat plants. When certain forage grasses are grown in rotation (especially bromegrass and wheatgrass), this fungus builds up in the soil. Nitrate fertilizers favor the build-up of this disease, as does cool and moist soil in fall and spring.

Take-all

Damage: Planting wheat after grasses where fungus has built up can result in severe crop loss.

Scouting/Control Measures: Remove affected crop residues, grassy weeds and volunteer grains. Do not plant wheat after bromegrass, wheatgrass or barley. If this fungus builds up in the soil, rotate to crops other than cereals and forage grasses for at least three years. Maintain balanced soil fertility levels and use ammonium forms of N for spring top-dress.

Avoid early planting. Appropriate seed treatment fungicides may be beneficial. If this disease becomes a problem, contact local advisers regarding best control measures.

Seed Treatment Product Recommendation:

Dividend Extreme® Dividend XL RTA®

Distribution: Throughout the United States.