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Cultural Practices That Influence Wheat Diseases

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The health of a wheat crop is determined well before the crop is planted. It is often the result of subtle factors in the management history of the field, including varieties, seed quality, seedbed, planting date, residue management and post harvest weed control. Wheat health management practices before the crop is planted must limit, as much as possible, the number of production hazards that must be dealt with after planting. Important diseases influenced by cultural practices include crown and root rot, wheat streak mosaic, soil-borne wheat mosaic, barley yellow dwarf, leaf rust, smut diseases, scab, Cephalosporium stripe and tan spot.

Varieties

The use of adapted, disease resistant varieties is a key management factor in efficient wheat production. Variety recommendations for tested varieties are developed using the concept of variety complementation. Variety complementation encourages the producer to select adapted varieties that differ in parentage, maturity and disease reaction. Because a perfect variety does not exist, complementation allows the producer to counterbalance the potential weaknesses in each variety. This compensation improves the opportunity for yield stability of the entire production system.

The four steps in selecting complementary varieties include:

1. Identifying your 'workhorse' varieties i.e. those that have a history of good performance on your acres.
2. Selecting varieties that differ in parentage from your workhorse varieties and other varieties grown. This list is published annually in a University of Nebraska Cooperative Extension publication, the *Nebraska Fall-Sown Small Grain Variety Tests,* which is available at all Extension offices.
3. Choosing varieties that bloom either earlier or later than your workhorse varieties to spread the risk from weather and disease and to stretch out harvest.
4. Selecting varieties that have specific characteristics needed for your production conditions or areas. For example, varieties that are leaf rust susceptible and wheat streak mosaic tolerant fit well in the Panhandle where leaf rust is not a serious problem, but wheat streak mosaic can be devastating. In eastern and central Nebraska leaf rust and soil-borne wheat mosaic often reduce yields, so leaf rust and soil-borne mosaic resistance is important.

A list of the agronomic characteristics and disease and Hessian fly reactions of many hard red winter wheat varieties grown in Nebraska is also found in the *Nebraska Fall-Sown Small Grain Variety Tests* or in the *Nebraska Certified Quality Seed Book* published by the Nebraska Crop Improvement Association, University of Nebraska. **When selecting varieties, think of disease resistance as insurance; it's nice to be covered should the need arise.**

Seed Quality

The phrase 'high quality seed wheat' means different things to different people. High quality seed wheat is not perfect, but it is a reasonably pure supply of an adapted variety. It is acceptably free of objectionable weed seed, seed-borne pathogens, other crop seed and debris. It is the farmer's responsibility to plant healthy, high quality seed.

Sources of seed wheat include:

1. Certified seed from a reputable dealer.
2. Non-certified seed from a reputable dealer.
3. A neighbor's grain bin or truck.
4. Your own grain bin from last year's crop.

Whether it's your own or your neighbor's bin run seed, it's important to know the germination, purity and viability of the seed and if it carries any disease-causing pathogens. Diseases often associated with poor quality bin run seed are loose smut, common bunt, black point and scab. Seeds infested with loose smut show no visible signs of infection. Infected seeds are normal in shape and color and are difficult to identify in the seed lot. Certification plays a key roll by detecting the disease symptoms in the field before harvest. In the United States, most breeder, foundation, registered or certified seed classes specify a zero or near-zero tolerance for loose smut. This is met by field inspection at heading and treatment of seed with Vitavax, Baytan or Dividend. Common bunt is more difficult to detect in the field and often goes unnoticed until harvest. Its spores are carried as an external contamination of seed. The disease is most effectively controlled by planting smut-free seed or by seed treatment.

Black point results from fungal infection of the grain after soft dough stage. A symptom is brown to dark brown discoloration around the embryo end of seeds. Any suspect seed should be closely examined and tested at a seed health testing laboratory. If black point is detected, the seed should not be used as seed wheat.

A single inspection of seed production fields at approximately the soft dough stage will provide an accurate assessment of scab development. In harvested grain, scab infested seed is shriveled and will appear pink on the embryo end. Scab infested grain should not be saved for seed.

Inspect and test bin run seed before planting because cures for smuts or seedling blights caused by scab or black point have not been developed. Repeated planting of bin run seed tends to increase seed-borne diseases.

Seedbed

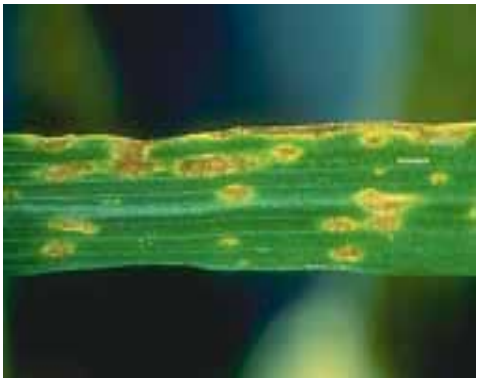
Root and crown rot of winter wheat is an interrelated disease complex caused by the interaction of infection of roots and crowns by fungi, harsh winter conditions, early planting and loose seedbeds. It is an insidious, persistent and inconspicuous disease complex that reduces wheat yields each year by causing stand loss, poor plant vigor, reduced yield and lower grain quality. In extreme cases, entire fields or large areas within fields are killed.

A healthy root system is critical to wheat's ability to tiller and produce large heads. Healthy roots are needed to support growth. When diseased, they fail to deliver the appropriate balance of nutrients, water and growth factors during the early stage of growth and development. This results in the failure of tiller buds to activate or causes the formation of small leaves and heads on the main stem and on tillers

Figure 1. *A loose seedbed can contribute to disease development.*

Diseases Influenced

1. Leaf rust



2. Tan spot

3. Septoria leaf blotch

7. Black point

8. Root and crown rot

9. Cephalosporium stripe

already initiated. Crown and root diseases cause a reduction in the number and size of heads and/or a loss of stands, plus make the crop less competitive with weeds.

A loose seedbed and prolonged moisture stress coupled with relatively high soil temperatures in the fall enhance early disease development on the roots, subcoronal internode and crown. The detrimental effects of a loose seedbed, soil moisture deficiency, lack of an insulating snow cover, ice and sustained low temperatures become apparent in the spring when affected wheat fields fail to green up uniformly.

Wheat planted into loose seedbeds often will show streaks of healthy green wheat in April that correspond to the tractor and drill tire tracks where the seedbed is firmer. The wheat between the equipment tracks, which is growing in a loose seedbed, often will show severe root and crown injury i.e. yellow, dying and dead plants with brown roots and crowns.

The first requirement is to change our thinking about what is a good seedbed for planting wheat. Seedbed preparation is a misconception. We may not need to prepare anything. A firm seedbed is best for planting wheat with moisture available at planting depth. Tillage operations can cost firmness as well as critical moisture. Many farmers are taking advantage of the good seedbed after summer crops. More than 30 percent of the wheat planted in southeast Nebraska is being no-tilled into grain sorghum, soybean, and corn stubble. This saves time, fuel, and moisture and provides the firm seedbed desired for establishment and winter survival of the wheat plant. If wheat is no-tilled into wheat stubble, then Cephalosporium stripe, tan spot and Septoria leaf and glume blotch

by Cultural Practices

4. Loose smut

5. Common bunt

6. Scab

10. Wheat streak mosaic

11. Soil-borne wheat mosiac

12. Barley yellow dwarf

diseases are a potential threat. The pathogens of these four diseases are associated with wheat residues so planting wheat into the residue of another crop is an important deterrent to their development.

When soil loosening tillage operations are necessary for weed control or lime incorporation, these trips should be limited and done when the soil is dry to reduce soil compaction. Weed control just prior to planting also may be important if winter annual weeds like pennycress, mustards, cheat or downy brome are present. Herbicides may be used in place of tillage.

In fallow, on all soils except sands, a tillage operation is recommended by late June even if one is not needed for weed control. The reason for this operation is that during a hot and dry July and August, the soil may get so hard that a drill cannot penetrate it in September or October.

When planting, place seed firmly into moist soil and cover with sufficient soil to prevent rapid drying. If the soil surface is dry at planting, use a hoe drill instead of a disc drill so placement of the seed is into firm moist soil. The openers must have proper tension to ensure that seed is planted deep enough, especially in the wheel tracks. Seed should be planted 1 to 1 1/2 inches in medium to fine textured soils, and 2 inches in coarse textured soils. Soil aggregates should be fine enough to provide good soil-seed contact, but not so fine that rain will puddle the silt and cause crusting, or wind will drift the soil. At least 20 percent residue cover should remain after planting for soil conservation and water infiltration. Some fields may require higher residue levels to protect the soil and meet conservation requirements.

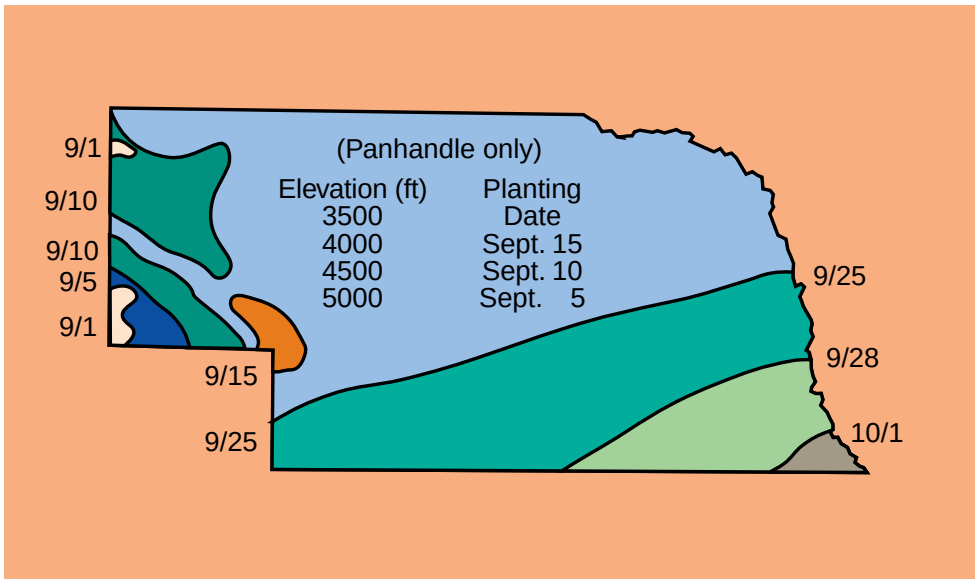


Figure 2. *Suggested seeding dates for winter wheat.*

Planting Time

In Nebraska, particularly western Nebraska, wheat farmers have always had to choose between the lesser of two evils when selecting a wheat planting date. Planting early gives good plant establishment that aids in the control of wind erosion. However, this can result in 1) a serious depletion of soil moisture reserves, which increases the threat of root and crown rot, and 2) a greater incidence of wheat streak mosaic and barley yellow dwarf because of heavy fall growth leading to mite or aphid buildup and fall infection by the virus. In the spring, crown and root rot abounds because of drought stress. Late planting conserves moisture, but if there is too little soil protection due to insufficient plant growth, crop residues and surface roughness, serious wind erosion and winter injury result.

The planting date of winter wheat varies from early September in the high plains of Kimball County in western Nebraska to early October in the rolling farmland of Richardson County in southeast Nebraska. Research to establish the optimum planting date has been conducted for many years taking into account several factors. In the Panhandle, the dates are based on elevation. With 4,000 feet as the base elevation and Sept. 10 as the base date, plant one day later for each 100 feet lower and one day earlier for each 100 feet higher in elevation. For the rest of the state, planting dates range from the third week of September to early October to avoid Hessian fly infestation. Other reasons for delayed planting include avoiding wheat streak mosaic, soil-borne wheat mosaic, Russian wheat aphid and too much fall growth. Research has shown that plants that develop several tillers because of early planting are more vulnerable to low temperatures than those seeded at the optimum date. **Plants in the three-leaf or four-leaf stage with good root systems going into dormancy are in the best position to survive a Nebraska winter.**

As the number of acres increases, more of the wheat must be planted both before and after the optimum date. Try to have half of the wheat planted by the optimum date. Plant the higher elevation sandy soil fields first.

Management of Crop Residue and Post Harvest Weed Control

Wheat residue is the overwintering site for the pathogens that cause tan spot, Septoria leaf and glume blotches and Cephalosporium stripe. Weathered residue that is present in a wheat-fallow-wheat system provides less carryover of the tan spot and Septoria pathogens than does current year residue. Planting wheat into another crop's residue will break this carryover cycle. Cephalosporium stripe can be controlled by a two-year rotation cropping system.

Crop residue is the most cost-effective way to reduce soil erosion from wind and water. The approximate amounts of crop residue for conservation compliance are listed in Table I. Check with your local Natural Resources Conservation Service for your field requirements.

Soil is most subject to wind erosion during the high wind months of March, April, and May. Water erosion also is important during these months and higher amounts of residue are required. Therefore, crop residue management plans should include maintaining crop residue during this period when soil is most susceptible to erosion.

Fallow practices provide good weed control, conserve moisture, and provide for a firm seedbed. These along with good stands of adapted winter wheat varieties planted and fertilized according to recommended practices, plus weed control in the growing crop, usually result in a large amount of quality residue. Spreading the long straw and chaff at harvest aids in residue management.

You may consider using herbicides to control weeds in wheat residue during the fallow period.

Use one of two options.

The first option, if there are few weeds after harvest, is to delay the herbicide application until late August and use Roundup or Cyclone plus atrazine. The rate of atrazine depends on date of application, soil type, pH, organic matter, and the succeeding crop. For the atrazine rates refer to the discussion on split treatments. If the August herbicide treatment is used, the first tillage operation the next year can usually be delayed until late May or early June if the field is to be fallowed and then planted to wheat in the fall.

Cyclone plus atrazine offers good control of barnyard grass that is small or mature. If sprayed during the tillering to boot stage, Cyclone plus atrazine provides poor control of barnyard grass. However, once barnyard grass has headed, Cyclone plus atrazine provides good control. Spraying after the grass has headed allows seed production. In addition, the longer the weeds grow, the more soil water and nutrients are used.

Consider the following when using nonselective herbicides for difficult-to-control weeds. With Cyclone, be sure to use a minimum of 2 pints of X-77 or equivalent surfactant per 100 gallons of solution. A surfactant also needs to be added to Roundup. The label rates are 2 qt/100 gallons of spray solution (0.5% v/v.). Landmaster BW and Fallow Master have surfactant included. With Roundup, Fallow Master, and Landmaster BW, add ammonium sulfate (spray grade) at 17 lb per 100 gal of spray solution. The ammonium sulfate is the first item put into the spray tank after the water. Ammonium sulfate is especially helpful when stress conditions are present and weeds may not be easily identified. Improve control by increasing the rate of Roundup, Landmaster BW, or Fallow Master. A spray volume of 5 to 10 gallons per acre should be used with Roundup, Fallow Master, and Landmaster BW. Fallow Master will provide better control of kochia and Russian thistle than either Roundup or Landmaster BW. Do not use Roundup, Fallow Master or Landmaster BW on days with rain or when temperatures reach 95°. Always check the product label before applying.

In years when large amounts of summer annual grass weeds are present at harvest, option two with split treatments is especially effective. The split application avoids possible antagonism of atrazine plus Roundup, Landmaster BW or Fallow Master mixtures. With the split treatment, an application of Roundup, Fallow Master, or Landmaster BW is made in July or early August. In September apply atrazine alone or in a tank mix with Cyclone or crop oil concentrate to control volunteer winter wheat, downy brome, and/or jointed goatgrass. If control of volunteer wheat and other annual grasses was not 100 percent with the first application, a second application should be made before planting wheat in adjacent fields to reduce the possibility of wheat streak mosaic. Volunteer wheat and annual grass weeds are primary oversummering hosts for wheat streak mosaic virus and its wheat curl mite vector.

The key factors in controlling wheat streak mosaic and the new High Plains wheat virus disease are control of volunteer wheat and grass weeds in stubble fields and appropriate planting date. The atrazine rate needed varies with soil and rainfall patterns and crop rotation. In southwest Nebraska, use at least 1 lb/A of atrazine, but in the Panhandle, 0.5 lb/A is often the maximum acceptable rate if winter wheat will be planted the next year. For fields to be planted to corn or grain sorghum, the atrazine rate for

Table I. Crop residue required for conservation compliance in a winter wheat-fallow rotation.

	Erosion Type	
Soils that require residue	*Water*	*Wind*
	5% or greater slope 9% or greater slope in Panhandle	Fine sand Loamy fine sand Fine sandy loam
Percent residue cover required March, April, May	50%	45%
Percent residue cover required June through after planting	30%	15%

most soil will be 2 lb/A if atrazine is used in a summer treatment. Be careful not to exceed the label rate for atrazine with the two combined treatments. For winter wheat-fallow the atrazine rate is limited to 1 lb/A applied at least 12 months prior to wheat seeding. After harvest it is essential that you watch closely and spray at the proper time to control weeds. Most labels state that weeds must be treated before they are 6 inches tall. If weeds are under severe drought stress, wait for rain and spray about a week later.

Delaying tillage until late May or early June allows the farmer to use tillage implements that maintain crop residue. Sweeps, chisel plows, and rodweeders must be used in dry soil to kill weeds. These implements cannot be used effectively in cool moist weather.

In winter wheat-fallow another option is available. Most years sweep blades can be used immediately after harvest. If winter annual grasses such as jointed goatgrass, downy brome or rye are a problem, tillage immediately after harvest may plant these weeds when a winter wheat-fallow rotation is used. The weather must be dry and hot to successfully use a sweep blade, since weeds must wilt within 30 minutes for good control. Usually, if you do not blade immediately after harvest, it is impossible to get a blade into the ground later unless moisture is received. Two bladings usually are necessary in the fall for good weed control, since the first usually plants weed seeds.

There are many benefits from maintaining crop residue in addition to soil conservation. These include higher moisture retention by trapping snow, slowing water movement, increasing water infiltration, lowering soil temperature and improving habitat for wildlife. Due to these benefits, it is better to reduce or control diseases such as tan spot and wheat streak mosaic through methods that do not destroy crop residue. Table II outlines control methods for these diseases.

Table II. How cultural practices influence wheat diseases.

Cultural practice	*Wheat diseases influenced*	*Best management practices*	*Other control options*
Varieties	Rusts	Resistant varieties	Foliar fungicide
	Soil-borne wheat mosaic	Resistant varieties	Proper planting date
Seed quality	Loose smut	Certified seed	Seed treatment fungicide
	Common bunt	Certified seed	Seed treatment fungicide
	Scab	Certified seed	Seed treatment fungicide
	Black point	Certified seed	Seed treatment fungicide
Seedbed	Root and crown rot	Firm/mellow seedbed and proper planting date	Seed treatment fungicide
Planting time	Root and crown rot	Firm/mellow seedbed and proper planting date	Seed fungicide treatment
	Wheat streak mosaic	Proper planting date and good post-harvest weed control	Tolerant varieties
	Soil-borne wheat mosaic	Resistant varieties	Proper planting date
	Barley yellow dwarf	Proper planting date	Tolerant varieties
	High Plains virus	Proper planting date and post-harvest weed control	None
	Cephalosporium stripe	2-year rotation and tolerant varieties	Proper planting date
Residue management and post-harvest weed control	Wheat streak mosaic	Proper planting date and post-harvest weed control	Tolerant varieties
	Tan spot and Septoria diseases	Foliar fungicide and rotation	Stubble mulching
	Cephalosporium stripe	2-year rotation and tolerant varieties	Proper planting date