Crop Profile for Wheat (Spring) in South Dakota

Prepared: October, 1999

General Production Information

The type of spring wheat grown in South Dakota is classified as Hard Red Spring Wheat, *Triticum aestivum* L.

During 1998, South Dakota ranked fourth nationally in the production of other spring wheat with annual production of 59.2 million bushels. Leading production states are: North Dakota (211.2 million bushels), Montana (108.0 million bushels) and Minnesota (78.7 million bushels). The classification "Other Spring Wheat" is from the National Agricultural Statistics Service, and includes the class of Hard Red Spring Wheat grown in South Dakota.

Planted acreage of spring wheat in South Dakota was estimated at 1.95 million acres in 1998 with 1.85 million acres harvested. This acreage was down from the 1997 level of 2.35 million acres planted. The 1997 acreage was the largest planted acreage in the past five years.

In 1999, it is estimated that 1.7 million acres of spring wheat were planted in South Dakota. This represents slightly more than 11% of the 15,299,000 acres planted nationally.

Spring wheat is South Dakota's third largest crop in acreage planted, following corn (3.55 million acres) and soybeans (3.45 million acres). Soybeans surpassed spring wheat as the second largest acreage of a crop planted for the first time in 1997.

Spring wheat provides the third largest total cash receipts among the grain crops to South Dakota producers, providing $402,212,000 in gross cash receipts during 1998. This total followed corn ($782,307,000) and soybeans ($755,633,000) as the leading cash crops in the state during that production year.

Average production per acre was 32.0 bushels per acre during 1998, 28.0 bushels per acre in 1997, 37.0 in 1996 and 28.0 in 1995. Yield of other spring wheat averages slightly less than that of winter wheat in South Dakota and slightly greater than the yield of durum wheat.

Spring wheat production in South Dakota is concentrated in the north central, northeast and northwest regions of the state, with minor production in the central, east central, and west-central regions.

Production Regions

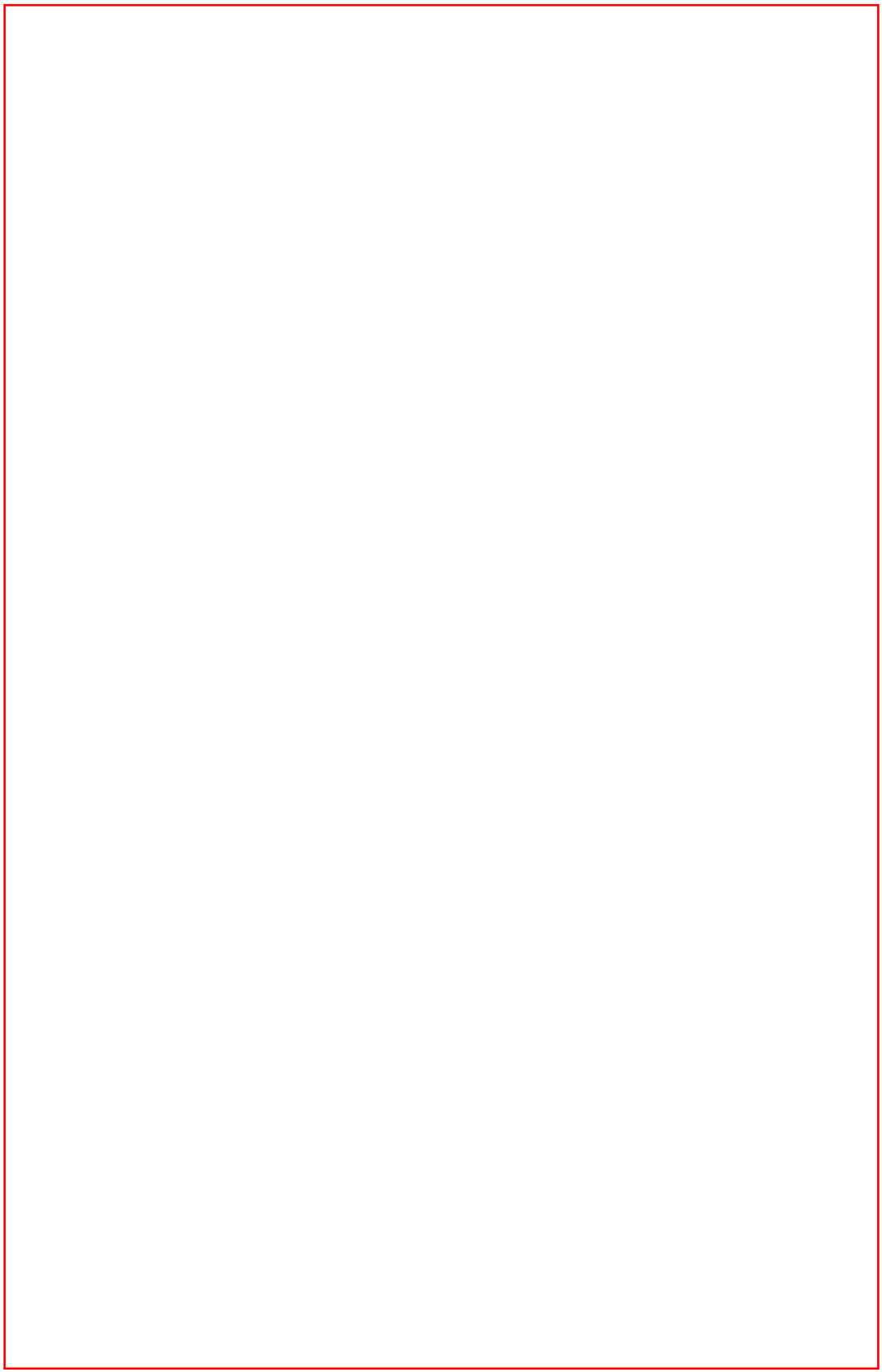
The Crop Profile/PMSP database, including this document, is supported by USDA NIFA.

Cultural Practices

Wheat is sown in South Dakota as a spring crop, primarily in late March, if possible and April. Production is severely inhibited if planting continues into May, with production generally declining up to one bushel per acre per day if planting takes place after May 10. Wheat is a flexible crop that fits well into various tillage and management schemes. Wheat may be direct seeded into tilled soil, under reduced tillage schemes and as a no-till crop. No single tillage practice is significantly better than others, and under proper conditions they all will work satisfactorily. No matter what tillage system is used, a good seed bed is required, with seed placed in moist soil as shallow as possible and the moist soil firmed around the seed. These conditions result in the most rapid germination. Seeding rate is targeted at 28 seeds/square foot. For average seed, this is 1.2-1.5 bushels per acre. A common production practice is to include wheat in a three-year rotation of corn, soybeans and wheat in the eastern part of the state. Wheat does not respond well to continuous cropping, as increased pressure from fusarium head blight (scab) and leaf spotting diseases as well as possible increased insect pressure make continuous production prohibitive. Fusarium head blight can also be a significant problem in fields planted into corn stubble, as the Fusarium fungus is present in the decaying corn residue. Therefore, the usual practice is to place the wheat crop following the soybeans in a three-year rotation or following fallow or a non small grain in other

production systems.

No-till production increases the amount of crop residue on the surface of the soil. This residue cover decreases water runoff and may increase soil organic matter over time. However, the residue may keep the soil from warming in the spring and may delay rapid germination of the wheat seed as a result. Additionally, no-till crop production reduces water loss caused by tillage. Normally, this reduced water loss would be advantageous to the crop in increased water supply. Recent extremely wet weather patterns, especially in the spring months, have caused no-till planting of spring wheat to be delayed as compared with that under conventional tillage. No-till has, however, been a very successful production practice in much of South Dakota.



Insect Pests

Several insect pests can occasionally become significant in South Dakota. Among the insects attacking wheat in the state are: aphids/greenbugs, grasshoppers, army cutworm and Hessian fly. Additionally, wheat stem sawfly, wheat stem maggot, pale western cutworm, true armyworm, wheat curl mite and orange wheat blossom midge are occasional pests. Fortunately, infestation of these pests to economic thresholds is not a common occurrence.

Aphids

The three main aphids that infest wheat in South Dakota are greenbug (*Schizaphis graminum*); birdcherry oat aphid (*Rhopalosiphum padi*) and English grain aphid (*Macrosiphum avenae*). Corn leaf aphids (*Rhopalosiphum maidis*) and Russian wheat aphids (*Diuraphis noxia)* are occasional pests, but are less frequently encountered. The greenbug is the most damaging species, and the most likely species to reach damaging populations. General feeding by aphids may cause damage to the wheat crop, but transmission of barley yellow dwarf virus poses the greatest threat, especially from the birdcherry oat aphid.

The greenbug aphid poses the most severe aphid threat to small grains grown in South Dakota. Greenbugs feed by inserting piercing-sucking mouthparts into plant tissue and removing plant sap. These insects also inject a toxin into the plant as they feed, causing further damage. Greenbugs do not overwinter in South Dakota, but may be brought into the state by strong southerly winds and weather fronts. Populations may be affected by natural enemies such as ladybird beetles; however, cool early spring temperatures will limit the growth and reproduction of these natural enemies and may allow aphid populations to increase dramatically.

Thresholds for treatment:

- Greenbug, English grain aphid, bird cherry-oat aphid:
  12-15 aphids per tiller during the seedling to boot stage
- Russian wheat aphid:
  15-20% tillers infested up to flowering, 20%+ from flowering to early milk stage

Pesticides Used:

Foliar Insecticides	Brand Names	Class	Rate	REI	PHI
chlorpyrifos	Lorsban 4E SG	Organophosphate	.25-.5 lb	24 hrs	28 d- grain; 14 d- forage
dimethoate	Dimethoate 4E	Organophosphate	.25-.375 lb	48 hrs	35 d- harvest; 14 d- grazing
disulfoton	Di-Syston 8E Di-Syston 15G	Organophosphate	.25-.75 lb 1 lb	72 hrs	30 days grain; no forage; 60 d- grain; 75 d- forage
malathion	various	Organophosphate	.94-1.25 lb	12 hrs	7 d
ethyl parathion	various	Organophosphate	.25 lb	72 hrs	15 d
methyl parathion	various	Organophosphate	.25-.75 lb	48 hrs	15 d

methyl parathion	Penncap-M	Organophosphate	.5-.75 lb	48 hrs	15 d
lambda cyhalothrin	Warrior T	Pyrethroid	.015-.025 lb	24 hrs	30 d- grain
In-Furrow Insecticides					
phorate	Thimet 15G or 20G, others	Organophosphate	.87 lb (@ 8 in wheat rows)	None (in-furrow only)	70 d- grain; 70 d- feed
carbofuran	Furadan 4F	Carbamate	.45 lb (@ 8 in wheat rows)	None (in-furrow only)	do not feed forage
Seed Treatment Insecticides					
Imidacloprid	Gaucho 480	Chloronicotonyl	.065-.08 lb	NA	NA

Grasshoppers

Grasshoppers are a potential pest of wheat production in South Dakota in any given year. The severity of a grasshopper infestation is dependent on the weather conditions during the growing season, as cool, wet conditions tend to reduce grasshopper infestations due to natural fungal infections in the pest. Dry, warm weather conditions and proximity to adequate hatching beds such as grass borders and fence rows, ditch banks and rangeland favor abundant grasshopper populations. No-till fields may create a favorable hatching bed as egg-laying areas remain relatively undisturbed. Although up to 24 species of grasshoppers are present in South Dakota in any given year, most damage to agricultural crops comes from three species, the two-striped grasshopper (*Melanoplus bivittatus*), the differential grasshopper (*Melanoplus differentialis*) and the red-legged grasshopper (*Melanoplus femurrubrum*). The most damaging species of grasshopper is the redlegged grasshopper, which hatches from the end of June through August in South Dakota.

Thresholds for treatment:
Treatment is suggested when populations reach eight or more per square yard in the field or 20 or more per square yard in the field margins.

Pesticides Used:

Foliar Insecticides	**Brand Names**	**Class**	**Rate**	**REI**	**PHI**
chlorpyrifos	Lorsban 4E SG	Organophosphate	.25-.5 lb	24 hrs	28 d- grain; 14 d- forage
dimethoate	Dimethoate 400	Organophosphate	.375 lb	48 hrs	35 d- harvest; 14 d- graze
carbofuran	Furadan 4F	Carbamate	.125-.25 lb	48 hrs	before heads emerge
malathion	various	Organophosphate	.94-1.25 lb	12 hrs	7 d
carbaryl	Sevin XLR Plus	Carbamate			21 d- harvest; 7 d- forage
lambda cyhalothrin	Warrior T	Pyrethroid	.015-.025 lb	24 hrs	30 d- grain
ethyl parathion	various	Organophosphate	.5 lb	72 hrs	15 d
methyl parathion	various	Organophosphate	.375-.5 lb	48 hrs	15 d
methyl parathion	Penncap-M	Organophosphate	.5-.75	48 hrs	15 d
In-Furrow Insecticides					
phorate	Thimet 15G or 20G, others	Organophosphate	.99 lb (@ 7 in wheat rows)	48 hrs (72 if < 25 in. rainfall)	70 d grain; 70 d feed

Army Cutworm and Pale Western Cutworm

These two cutworms are frequently present at some level primarily in western South Dakota in small grain fields, but are less common in spring wheat than winter wheat. Pale western cutworms (*Agrotis orthogonia*) are primarily subterranean feeders, while army cutworms (*Euxoa auxiliaris*) tend to be surface feeders. Pale western cutworms overwinter in South Dakota as eggs which hatch in the spring whereas the Army cutworm overwinters as a larvae. Army cutworms are generally less destructive than pale western cutworms because they tend to feed on leaf tissue rather than cutting stems. Monitoring for army cutworms must take place early in the season, as army cutworms can be active at 40 degrees Fahrenheit.

Threshold for treatment:

- Army cutworm:
  Two per square foot on wheat over 4 inches tall
- Pale western cutworm:
  1 or more per liner foot of row

Pesticides Used:

Foliar Insecticides	Brand Names	Class	Rate	REI	PHI
chlorpyrifos	Lorsban 4E SG	Organophosphate	.5 lb	24 hrs	28 d- grain; 14 d- forage
lambda cyhalothrin	Warrior T	Pyrethroid	.015-.025 lb	24 hrs	30 d- grain

True Armyworm

True armyworms (*Pseudaletia unipuncta*) feed on wheat about the time it is heading. The title "true armyworms" distinguishes them from the fall army cutworm and other cutworms. On wheat, the larvae primarily feed on the leaves, and may cause significant damage. They may also cut through the stem below the head during later stages. Heavy infestations can cause significant damage in a very short period of time. Armyworms feed mostly at night and hide in the soil during daylight, so pesticide application timing is critical and must be done in early morning or evening for best results. This pest is not an annual pest in the state, but may be present in any given year. Most infestations occur as adult moths are brought into the state from southern areas by wind currents.

Threshold for treatment:
5 per square foot

Pesticides Used:

Foliar Insecticides	Brand Names	Class	Rate	REI	PHI
carbaryl	Sevin XLR Plus	Carbamate	1-1.5 lb	12 hrs	21 d- grain; none- forage
lambda cyhalothrin	Warrior T	Pyrethroid	.015-.025 lb	24 hrs	30 d- grain
methomyl	Lannate	Organophosphate	.225- .45 lb	48 hrs	7d- grain; 10 d- forage
ethyl parathion	various	Organophosphate	.25 lb	72 hrs	15 d
methyl parathion	various	Organophosphate	1.25 lb	48 hrs	15 d
methyl parathion	Penncap-M	Organophosphate	.5-.75 lb	48 hrs	15 d

Hessian fly

Hessian flies (*Mayetiola destructor*) overwinter in South Dakota in their last larval stage in a puparium called the "flaxseed" stage. Adults emerge in April and lay eggs on wheat leaves. Larvae crawl below the leaf sheaths and begin feeding on plant sap. The plant is injured not from the feeding damage, but by a toxic salivary secretion from the fly larvae. Damage to plants is characterized by dark, bluish color to plants and thickened, stunted shoots.

Control:

1. Planting resistant varieties. Certain wheat varieties have solid stems, making them resistant to damage by this pest
2. Crop rotation to a non host crop
3. Parasitic wasps- although three species are known to attack Hessian fly larvae, these cannot be counted on for control

Economic benefits of pesticide control are difficult to predict and assess, although two products are labeled.

Foliar Insecticides	Brand Names	Class	Rate	REI	PHI
phorate	Thimet 20G	Organophosphate	.99 lb (@ 7 in. wheat rows)	48 hrs (72 if < 25 in. rain)	70 d- grain; 70 d- forage
disulfoton	Di-Syston 15G	Organophosphate	1.06 lb (@ 7 in. wheat rows)	48 hrs (72 if < 25 in. rain)	75 d- forage

Wheat Midge or Orange Wheat Blossom Midge

The orange wheat blossom midge *(Sitodiplosis mosellana)* is a relatively new insect to South Dakota wheat production. It is, however, a concern for wheat production in North Dakota and has been found in South Dakota fields in recent years. In 1996, wheat midge was detected in all areas east and north of the Missouri River in North Dakota. The adult midge is active from late June to early August. Peak activity is from early to mid July. Wheat is attractive for egg laying by midge from the time the head emerges from the boot through flowering. If insecticides are to be used to control this pest, the control must take place when the insect is in the adult stage to prevent egg-laying. The larval stage is difficult to control because it feeds inside the glumes of the wheat head, protecting it from insecticide application.

Thresholds for wheat (Adapted from North Dakota State University recommendations):
Examine wheat heads at dusk. The orange colored adult midge can be seen laying eggs on the wheat heads. In general, if one or more midges are observed for every four or five heads, treatment is warranted.

No treatment has been warranted in South Dakota to date.

Most commonly applied insecticides:
The most commonly applied insecticides in South Dakota, according to a Pesticide Impact Assessment Program Survey from the 1997 growing year, include: methyl parathion, Cygon 400 (dimethoate), Sevin XLR Plus (carbaryl) and chlorpyrifos (Lorsban 4E SG). All products were used infrequently, with each product reported as used on less than 0.6 percent of the total planted acreage statewide. Lambda cyhalothrin (Warrior T) was not commonly available at the time of the use survey, and has accounted for a greater proportion of applications in spring wheat since the use survey. Grasshoppers have also been a concern in years since the use survey, and account for increased insecticide application in recent years. It is estimated that the survey results are very conservative, and a larger percentage of total acreage is treated each season, but the total percentage is still quite small, with highest estimates of no more than 10-12% treated in any given year.

Diseases

Many diseases have a significant impact on spring wheat production in South Dakota. Losses vary from year to year, but some diseases, in epidemic years can be catastrophic. Most recently, epidemics of Fusarium head blight have reduced on-

farm income by millions of dollars. The most severe epidemic was in 1993, but the 1999 epidemic was also quite severe. Spring wheat losses to scab in SD were 5,800,000 bu in wheat alone, with an estimated loss in value of $17,800,000.

The following listed diseases have an estimate of loss due to disease development in wheat planted and harvested in 1998. The listing includes the common name of the disease followed by the scientific name of the pathogen and estimated percent loss due to each disease.

Fusarium head blight	(*Gibberella zeae / Fusarium graminearum*)	10.00 %
Common root and crown rot	(*Cochliobolus sativus / Bipolaris sativus*)	5.00 %
Tan spot	(*Pyrenophora tritici-repentis*)	5.00 %
Leaf rust	(*Puccinia recondita f. sp. Tritici*)	3.00 %
Barley yellow dwarf	(*BYD luteovirus* - aphid transmitted)	2.00 %
Septoria leaf blotch complex	(*S. tritici, S. nodorum, S. avenae*)	2.00 %
Weather related	(environmental factors)	2.00 %
Wheat streak mosaic	(*WSM bromovirus* - mite transmitted)	2.00 %
Loose smut	(*Ustilago tritici*)	0.05 %
Bacterial black chaff	(*Xanthomonas campestris pv. Translucens*)	0.01 %
Covered smut/Common bunt	(*Tilletia caries, T. foetida*)	0.01 %
Take-All	*Gauemanomyces graminis var. tritici*	0.01 %
Powdery mildew	(*Erysiphe graminis f. sp. Tritici*)	0.00 %
Septoria glume blotch	(*Septoria nodorum*)	0.00 %
Stem rust	(*Puccinia graminis f. sp. Tritici*)	0.00 %
	Total loss during 1997-98	**31.08%**

Leaf rust
(*Puccinia recondita* on wheat and durum)

Leaf rust typically appears in the first three weeks of July. It is expressed as small, oval, orange-yellow pustules on wheat leaves. Leaf rust is a reemerging disease concern as a virulence shift in the rust population is affecting more currently grown cultivars than in recent years. Some of the more recently released cultivars with better tolerance of Fusarium head blight are more susceptible to the currently prevalent "T" races of leaf rust.

Leaf rust is managed primarily through the use of resistant spring wheat cultivars. Most widely grown spring wheat cultivars are resistant to moderately resistant to leaf rust. Foliar fungicides are available but require early disease detection and treatment before disease is severe.

Stem rust
(*Puccinia graminis* f. sp. *tritici* on wheat and durum)

Stem rust would be expected to appear in the first three weeks of July. It is expressed as brick-red pustules with ragged edges. The pustules may occur on any and all aboveground parts of the plant.

Stem rust is managed primarily through the use of resistant spring wheat cultivars. Spring wheat cultivars currently grown in South Dakota are resistant to stem rust. Foliar fungicides are available, but are not used for this target pest because of the continued success of host resistance.

Tan spot
(*Pyrenophora tritici-repentis* on wheat and durum) and

Septoria leaf disease complex
(*Septoria tritici, S. avenae, S. nodorum* on wheat)

Tan spot and the three Septoria diseases are all residue-borne. They will typically appear in the spring during cool, wet weather. Seedling infection may occur, but is typically less severe than on fall-seeded wheat. Seedling disease will usually occur in May and June with more serious flag leaf infections developing in midsummer. The disease is expressed as yellow, tan, or brown spots on lower leaves, usually small but enlarging with time. Tan spot lesions will develop a diamond shape as they mature while Septoria lesions are more random in shape.

These diseases are managed by rotation, tillage, and resistant cultivars. Most varieties are susceptible to tan spot and Septoria blotch. Foliar fungicides are effective and available, but require early disease detection and treatment. Hot, dry weather often stops or slows disease development while rainy or humid weather increases disease spread and severity.

Fusarium head blight or scab
(*Gibberella zeae* / *Fusarium graminearum* on wheat and durum)

Fusarium head blight or scab is residue-borne. Scab is typically most evident when the crop is in the soft dough stage. Most infection occurs at flowering. Disease is most severe in minimum tillage or zero tillage fields on corn or wheat residue. Infection requires a prolonged period of warm, wet weather at flowering, perhaps as long as 36 hours. Fusarium head blight is expressed as white spikelets or entire white heads. Pink to salmon colored masses of spores may develop at the base of infected spikelets during humid weather.

Fusarium head blight is managed by rotation, tillage, and planting less susceptible cultivars. No spring wheat cultivars are resistant to the disease. Spring tillage will decrease the risk of disease. Fungicides have been available on a Section 18 Emergency Exemption for application until flowering to suppress Fusarium head blight. Disease may be reduced by as much as 60% while yield is increased by up to 20% over untreated fields with the application of some fungicides.

Loose Smut
(*Ustilago tritici*)

Loose smut will appear soon after heading of the crop, starting about June 1 for early seeded wheat and continuing through the month of June. Symptoms and signs of the disease are dusty, brown to dark brown or black spore masses replacing the spikelets on the head rachis. After the spores have blown away there may remain only a naked rachis with a few remnants of the brown spores. Airborne spores lead to the infection of seed in the current growing season. The fungus survives in the embryo of the infected seed.

The disease can be managed by treating seed at planting with a systemic seed treatment fungicide. While barley seed can be tested for loose smut with an embryo test, the embryo test is unreliable for the detection of loose smut of wheat. Fields with a high incidence of loose smut should not be used as seed without treating with an effective seed treatment fungicide.

Covered smut and Common bunt
(*Tilletia caries, T. foetida*)

Covered smut and common bunt will appear about the same time as loose smut (above), early to mid-June. These smut diseases replace the seed with a stiff membrane filled with dark brown or black spore masses. Smutted kernels, sometimes called "bunt balls", are only slightly larger in diameter than healthy seed, but are light brown in color and more round; the smutted kernels, when ruptured, release masses of dark brown to black spores.

Covered smut is a seedling infecting smut that is effectively treated with any seed treatment fungicide, protectant or systemic.

Take-All
(*Gauemanomyces graminis* var. *tritici*)

Take-all is typically a greater concern on winter wheat than spring wheat. It is a residue-borne disease that may increase in severity in no-till or when spring and winter wheats are cropped in successive years. Symptoms of take-all, like

common root rot will appear starting about the last week of June and continuing through crop maturity. Stunted tillers, stunted plants, white heads, and prematurely ripe areas of the field are all indicators of possible take-all. Affected plants will develop a scurfy to glossy black discoloration at the base of the stem. Plants may pull easily from the ground because of severely rotted roots and crowns.

Take-all is managed with crop rotation and tillage to incorporate residues. Seed treatment fungicides effective against common root rot are also effective against take-all, but may require application at the highest labeled rate.

Common Root Rot
(*Cochliobolus sativus* / *Bipolaris sativus*)

Common root rot becomes most obvious on spring wheat from heading to maturity, about July 15 to August 15. Affected plants may appear stunted or with stunted tillers. White heads that spread down on white stems or prematurely ripe plants may also indicate root rot. Affected plants may pull from the ground easily because the roots and crowns are severely rotted. Plants that die prematurely may occur in irregularly shaped clusters or as single plants in a field.

Common root rot may be managed with crop rotation. Avoid successive cereal crops. Destroy the green bridge of volunteer winter wheat or grassy weeds. Slow release forms of nitrogen may also increase the incidence of common root rot.

Wheat streak mosaic
(Wheat streak mosaic virus - WSMV)

Typically spring wheat will express wheat streak mosaic early in the season from mid-May through June. Affected plants will develop yellow to white streaks on older leaves and light green streaks in young leaves.

The most important point in managing wheat streak mosaic is destroying volunteer winter wheat. A green bridge, living plants that can support the wheat curl mite that spreads the virus, are critical to the proliferation of the virus. Some cultivars may have better resistance to WSMV.

Barley yellow dwarf
(Barley yellow dwarf virus - BYDV)

Yellow dwarf will typically express on spring wheat in South Dakota as the crop is approaching the boot stage, from about June 1 to July 7. Affected plants will have yellow leaf tips. Depending on the spring wheat cultivar, leaf tips may develop a reddish tinge, but yellow is most common. If infection occurs early, such as may occur with late seeded wheat, stunting may occur. BYDV is spread by grain aphids. The bird cherry-oat aphid is considered the most important vector of BYDV in South Dakota. Aphid management is usually not effective in limiting BYDV spread.

Yellow dwarf is best managed by planting early to avoid infection at the time when the crop is most susceptible to severe loss. With earlier planting, the crop will be at a later stage of development when and if aphids appear and infection occurs.

Bacterial black chaff
(*Xanthomonas campestris* pv. *translucens*)

Bacterial black chaff of wheat will usually appear following flowering, about mid-June to mid-July. Large, dark brown to black spots may appear on the glumes or black bands may appear on the awns. The spots on the glumes may form streaks that run vertically. The black chaff bacterium may also infect leaves, causing large, dark, greasy spots. When black chaff infection occurs late, little damage results. Earlier infection can cause black point on the grain and the viability of the seed may be reduced.

The black chaff bacterium survives on a crop residue and may infect most small grains, so management of black chaff is through rotation to non cereal crops. The disease may be more severe in rainy years with high humidity or under overhead irrigation. Avoiding late irrigation may reduce the severity of the disease.

Powdery mildew

(*Erysiphe graminis* f. sp. *tritici*)

Powdery mildew is more of a problem on winter wheat than spring wheat; however, in cool, wetter years, powdery mildew may be more severe. It is not a serious wheat disease in South Dakota. The disease may develop any time after row closure through about the soft dough stage, about June 1 to July 30. The disease appears as fluffy white growth on lower leaves. When walking through a field of wheat with powdery mildew, dust clouds may blow up from the spores of the fungus being brushed off the leaf surface.

The disease is best managed by avoiding heavy nitrogen fertilization, planting resistant varieties, or using foliar fungicides. Fungicides are not typically used for powdery mildew in South Dakota.

Fungicides Used:

Systemic fungicide seed treatments are generally used to control loose smut in wheat production. Protectant fungicide seed treatments may also be used to control common bunt or stinking smut. Seed treatment products containing imazalil or difenconizole are also effective against common root rot. Products that were recommended and commonly used during 1997 included: carboxin with PCNB (Vitavax-PCNB), carboxin with thiram (Vitavax-Thiram), carboxin with imazalil (Vitavax Extra), or difenconizole (Dividend XL RTA). Approximately 5% of the wheat acreage had a seed treatment applied. Cost of seed treatment ranged from $0.63 to $1.20 per cwt.

It is estimated that 25,000 - 30,000 acres of wheat were sprayed with a foliar fungicide during 1997. Propiconazole (Tilt) fungicide was most commonly used during 1997 on this acreage. In 1998 an additional 18,000 acres was treated with tebuconizole (Folicur), a product that was available on a Section 18 for Fusarium head blight suppression in 1998 and 1999. Growers are recommended only to spray foliar fungicides, if the wheat crop meets the criteria to possibly benefit from these sprays. Most importantly is the yield potential of about 40 bu/A at current market prices. Complete criteria for producers to evaluate the profitability of fungicide use are listed in a spreadsheet-based foliar fungicide decision guide for wheat production that is available to growers from their county extension educator or by downloading from the Internet.

Fungicides:

Foliar Fungicides	Brand Names	Class	Rate	REI	PHI
Azoxystrobin	Quadris	Strobilurin	0.10-0.175 lb	12 hrs	45 d
Benomyl	Benlate, Benlate SP	Benzimidazole	0.125-0.25 lb	24 hrs	21 d
Mancozeb	Dithane (DF, M-45, F-45 or WSP), Penncozeb, Manzate 200	EBDC	1.2-1.6 lb	24 hrs	26 d
Propiconazole	Tilt 3.6 EC	Triazole	0.1125	24 hrs	40 d

Fungicide Notes:

Azoxystrobin- Azoxystrobin is highly effective against rusts and the leaf spot complex. It may also be used to suppress Fusarium head blight.

Benomyl- Benomyl is effective against powdery mildew. It is used more frequently for suppression of Fusarium head blight.

Mancozeb- Up to 4.8 lbs. active ingredient per acre may be applied each season, but rarely is more than one application made.

Propiconazole- This fungicide is locally systemic and is effective against rusts and the residue-borne leaf spot diseases. It is typically applied once to the fully emerged flag leaf. Some producers are using a reduced rate application at the five leaf stage to reduce tan spot and Septoria diseases early in the season.

Weeds

Many different weed species attack wheat fields in South Dakota. Annual and perennial weeds are yearly concerns for growers in the state. Primary among the annual weeds causing greatest concern are the grasses green foxtail *(Setaria viridis)*, yellow foxtail *(Setaria lutescens)* and wild oat *(Avena fatua)* and the broadleaves kochia (*Kochia scoparia*), wild buckwheat *(Avena fatua)* and the broadleaves kochia (*Kochia scoparia*), wild buckwheat *(Polygonum convolvulus*), Russian thistle *(Salsola kali)*, and wild mustard *(Brassica kaber)*. Perennial broadleaves of concern include field bindweed *(Convolvulus arvensis)* and Canada thistle *(Cirsium arvense)*. Many other species are present in producers fields, but these represent the primary focus of pesticide applications.

Pesticide resistance has become a concern in recent years. Kochia resistant to herbicides that act on the plant enzyme ALS, including the sulfonylureas, has become prominent in much of South Dakota. Although not currently documented in South Dakota, green foxtail resistance to dinitroaniline herbicides has been noted in neighboring states, and a small area of North Dakota has reported wild oat populations resistant to ACC-ase inhibitor herbicides, such as diclofop (Hoelon).

Using good cultural practices is a very important step in weed management. Always plant seed from weed free seed stocks, prevent weed growth and development, especially seed production and properly clean harvesting and tillage equipment to prevent spread of weed seed and plant parts. Selective herbicides are also very useful and a wide selection is available to assist producers.

Field history data and planning are important in spring wheat management. However, unpredictable weather and extremes frequently result in unanticipated weed problems. These situations include:

Delayed Planting. Wet spring conditions that delay planting two weeks or more affects both crop and weeds. The crop may tiller less, be less competitive and yield expectations are reduced. Foxtail competition effects are increased. The application window for broadleaves is reduced; risk of crop injury is increased at advanced crop stages.

Delayed harvest. Straight-cut harvest (no use of windrows) has become the standard. Preharvest treatments are more important when rain/wet fields delay harvest. Foxtail and kochia are primary preharvest targets. Treatment for perennial weeds preharvest combines perennial weed control with usual postharvest burndown in no-till systems.

Preplant burndown. Planting is normally completed before weed emergence in no-till systems; seedbed tillage destroys the initial weed flush in conventional systems. Delayed seeding in no-till has increased the need for burndown. Currently wild oat can be controlled; wild buckwheat and kochia are not adequately controlled. Failure to provide early control results in improper weed/crop staging for postemerge herbicides. Failure to control emerged weeds at planting results in a reduced yield.

Herbicides Used:

Most commonly applied herbicides-

The most commonly applied herbicides in South Dakota, according to a Pesticide Impact Assessment Program Survey from the 1997 growing year, include: a tank mix of 2,4-D amine (.413 lb a.i./a) plus Banvel SGF (dicamba) (.062 lb a.i/a), 17.82% of planted acreage; a tank mix of Harmony Extra (thifensulfuron + tribenuron) (0.019 lb a.i/a) plus 2,4-D or other phenoxy herbicide (0.2-0.5 lb a.i./a), 10.25% of planted acreage; 2,4-D amine (0.44 lb a.i./a), 9.66% of planted acreage, and Bronate (bromoxynil + MCPA amine) (0.292 +0.292 lb a.i./a), 8.51% of planted acreage. The dramatic increase in ALS-resistant kochia in the state in the growing seasons since the pesticide use survey has increased the use of alternative products such as Starane (fluroxypyr).

Annual grasses:

Foliar Herbicides	Brand Names	Class	Rate	REI	PHI
diclofop	Hoelon	Aryloxyphenoxy-propionate	.75-1 lb	24 hrs	77 d- harvest; no grazing

fenoxaprop-p-ethyl	Tiller/Puma/ Cheyenne	Aryloxyphenoxy-propionate	.029-.082 lb	24 hrs	60 d- harvest
propanil	Stampede[2]	Aniline	1-1.1 lb	24 hrs	no grazing/green chop
tralkoxydim	Achieve	Cyclohexanedione	.18-.24 lb	12 hrs	30 d- graze; 45 d- mature straw; 60 d- harvest
trifluralin	Treflan	Dinitroaniline	.5-.75 lb	12 hrs	preplant incorporated only

Annual broadleaves:

Foliar Herbicides	Brand Names	Class	Rate	REI	PHI
2,4-D	Various	Phenoxy	.25-.5 lb	48 hrs	14 d- grazing; no straw for feed
bromoxynil	Buctril, Bronate	Nitrile	.25-.5 lb	12 hrs	45 d- graze; 30 d- crop rotation
carfentrazone-ethyl	Aim	Triazolinine	.008-.016 lb	12 hrs	none
chlorsulfuron +metsulfuron[2]	Finesse	Sulfonylurea	.009-.014 lb	4 hrs	10-16 mo rotation crops
clopyralid	Stinger, Curtail	Pyridine/carboxylic acid	.09-.12 lb	12 h-Stinger 48 h-Curtail	7 d- graze
fluroxypyr	Starane	Carboxylic acid	.12-.25 lb	12 hrs	7 d- graze; 14 d- hay; 70 d- grain
MCPA	Various	Phenoxy	.25-.516	48 hrs	before boot stage
metsulfuron	Ally	Sulfonylurea	.004 lb	4 hrs	rotational restrictions
picloram	Tordon 22k	Carboxylic acid	.015-.02 lb	12 hrs	14 d- graze/forage; 50 d- harvest
prosulfuron	Peak	Sulfonylurea	.009-.018 lb	12 hrs	30 d- graze; 40 d- forage; 60 d- grain
thifensulfuron + tribenuron	Harmony Extra	Sulfonylurea	.014-.028 lb	12 hrs	45 d- harvest
triasulfuron	Amber	Sulfonylurea	.013-.026 lb	4 hrs	none
tribenuron	Express	Sulfonylurea	.008-.016 lb	12 hrs	45 d- harvest

Perennial broadleaves/postharvest:

Foliar Herbicides	Brand Names	Class	Rate	REI	PHI
2,4-D	Various	Phenoxy	1- 2 lb	48 hrs	14 d- grazing; no straw for feed
clopyralid/2,4-D	Curtail	Carboxylic acid	.19 + 1 lb	48 hrs	no hay; do not apply after boot stage
dicamba	Banvel, Clarity	Benzoic acid	.06-.12 lb	24 hrs	37 d- hay
glyphosate	Roundup, Glyfos	EPSP Inhibitor	.75- 3 lb	12 hrs	35 d- when used as spot treatment
picloram/2,4-D	Tordon 22k	Carboxylic acid	.12-.25 + .5-1 lb	48 hrs	14 d- graze/forage; 50 d- harvest

ALS-Resistant Kochia Management:

Foliar Herbicides	Brand Names	Class	Rate	REI	PHI
bromoxynil	Buctril, Bronate	Nitrile	.25-.5 lb	12 hrs	45 d- graze; 30 d- crop rotation
carfentrazone-ethyl	Aim	Triazolinine	.008-.016 lb	12 hrs	none
dicamba	Banvel, Clarity	Benzoic acid	.06-.12	24 hrs	37 d- hay
fluroxypyr	Starane	Carboxylic acid	.12-.25 lb	12 hrs	apply through flag leaf emergence

Wild oats:

Foliar Herbicides	Brand Names	Class	Rate	REI	PHI
diclofop	Hoelon	Aryloxyphenoxy propionate	.75-1 lb	24 hrs	77 d- harvest; no grazing
difenzoquat	Avenge	Bipyridylium	.66-1 lb	48 hrs	apply before flag leaf
imazametha-benz	Assert	Imidazolinone	.31-.38 lb	48 hrs	apply before jointing
tralkoxydim	Achieve	Cyclohexanedione	.18-.24 lb	12 hrs	30 d- graze; 45 d- mature straw; 60 d- harvest
triallate	Far-go	Thiocarbamate	1-1.25 lb	12 hrs	Fall/Spring preplant use only
fenoxaprop-p-ethyl	Tiller/Puma/ Cheyenne	Aryloxyphenoxy-propionate	.029-.082 lb	24 hrs	60 d- harvest

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