

NORTH DAKOTA STATE UNIVERSITY



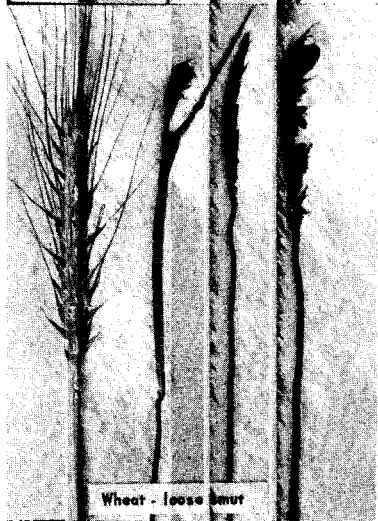
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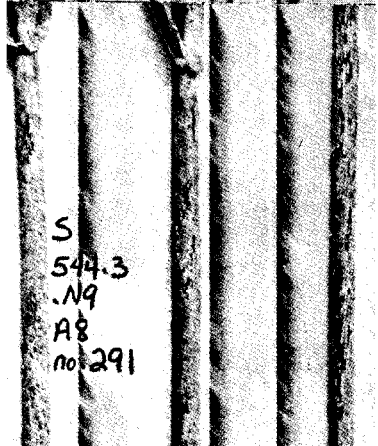
Botley spot blotch disease



Rye ergot



Wheat - loose smut



● SYMPTOMS

CROP DISEASES

● SUGGESTED CONTROLS

This circular will help the careful field observer identify crop diseases. It covers the nature and symptoms of diseases most common in North Dakota on small grains and flax.

Crop diseases do occur in all sections of the state. In general, rust on all crops and pasmo on flax occur most often in the eastern part of the state where rainfall and humidity are usually higher. Root rots, leaf and head blights are more prevalent in southeastern counties, while smuts can occur state wide.

Crop diseases play an important part in lowering crop yields. These losses often can be reduced by such approved disease control practices as (1) using varieties resistant to specific diseases, (2) treating seed, (3) rotating crops and (4) planting early.

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Wheat and Durum

Disease		Characteristics					
Common name	Scientific name	Seedling	Leaf	Stem	Head	Seed	
Stem rust	<u>Puccinia graminis tritici</u>		Elongated pustule on leaf sheath	Elongated pustule, producing red spores - black at harvest time	May appear on glumes and seed	Light test weight and yield - severe yield loss some seasons	
Leaf rust or orange rust	<u>Puccinia rubigo-vera tritici</u>		Circular orange colored pustules - later in season pustules are black and usually do not break through epidermis	May appear on stems	May appear on glumes	Some loss in test weight and yield	
Stinking smut or bunt	<u>Tilletia levis</u> <u>Tilletia tritici</u>				Head may be entirely or partially infected	Smut balls replace seeds	
Loose smut	<u>Ustilago tritici</u>	Fungus grows with the seedling and the resulting plant produces a smutty head			Replaces both grain and chaff with black smutty mass - smutty heads come out of boot earlier than healthy heads	Seed is infected at blossoming time and is invaded with the fungus but cannot be distinguished from healthy seed	
Scab or Fusarium blight	<u>Gibberella saubinetii</u> and <u>Fusarium spp.</u>	Fungus attacks roots, causing root rot, and leaves burn and become yellow - seedling dies or tries to re-root at soil line			All or any part of head may blight at maturity, salmon color of disease is evident	Carried within the seed - light shriveled seed frequently grayish or pinkish in color	
Helminthosporium blight and root rot	<u>Helminthosporium spp.</u>	Plants yellowed, roots blackened, plant dies or becomes stunted	Narrow dark brown lesions or spots	Lesions or spots on stem base	Empty spikelets individually or in group any place on head - may be blackened	Shriveled, blackened grain - also "black pointed" seeds - carried within the seed	
Black Chaff	<u>Xanthomonas translucens, var. undulosum</u>	Blighting caused from planting infected seed	Yellow translucent stripes or blotches	Water soaked, black stripes just below head and on culms	Water soaked black stripes and sunken dark spots on glumes - early infection causes dwarfed heads	Shriveled seed	
Basal glume rot	<u>Pseudomonas atrofaciens</u>				Dark brownish-black area at base of glume - usually only lower 1/3 of glume darkened	Germ end varies from faint brown to charcoal black	
Septoria blight	<u>Septoria tritici</u> and <u>S. nodorum</u>		Grayish-white spots on purplish-brown back ground (generally near nodes)		Brownish or purplish-brown spots on glumes	Shriveled seed	
Ergot	<u>Claviceps purpurea</u>	SEE DETAILED DESCRIPTION UNDER RYE					

Wheat and Durum

How transmitted	Other crops affected	Recommended control			Remarks
		Seed treatment	Variety resistance	Other	
Red spores carried great distances by wind, may repeat infection every 8 - 14 days	Barley and wild grasses		Selkirk, Conley, Yuma, Langdon, Towner, Ramsey most resistant		Sporidia from the black spores go to barberry to complete life cycle - new races may form on common barberry, not Japanese barberry - infection blown in from south
Orange spores spread from plant to plant - may blow in			Lee, Selkirk, Yuma, Ramsey and Towner most resistant		Infection comes early in season
Smut balls break and spores cling to outside of healthy kernels		Use mercurial seed treatments	Mida, Rushmore, Selkirk, Conley and all durums most resistant		Smutty wheat not suited for milling unless scoured - spores can live 8 years or more
Spreads to healthy plants at blossom time and infects the new seed crop		Hot water treatment	Thatcher, Rushmore, Selkirk, Conley and all durums most resistant	Use uninfected seed	Select seed from a disease free field or plant a seed plot using hot water treated seed
Seed, air and soil borne	Rye, barley and corn	Use mercurial seed treatment to kill external spores and protect seed against soil borne fungus		Clean severely to remove badly infected seed	Durum more susceptible than hard wheat - hot water treatment will kill fungus within seed
Seed and soil borne	Barley and grasses	Use mercurial seed treatment to reduce seedling blight		Clean severely and discard shriveled seed	Roots blackened - plants may break off - nodes may become dark brown or black - hot water treatment will kill fungus within seed
Seed, air and vegetation	Barley, oats and rye	Use mercurial seed treatment		Clean severely and discard shriveled seed	Some varieties carry a "false black chaff" not caused by bacteria
Seed, air and vegetation		Use mercurial seed treatment		Clean seed severely and discard shriveled seed	Not very common in North Dakota
Air borne, infected straw and stubble		Use mercurial seed treatment		Clean seed severely and discard shriveled kernels	<u>S. tritici</u> attacks leaves mostly during cool weather while <u>S. nodorum</u> attacks heads mostly during warm weather.
(DURUM MORE SUSCEPTIBLE THAN HARD WHEAT)					

Barley

Disease		Characteristics					
Common name	Scientific name	Seedling	Leaf	Stem	Head	Seed	
Covered smut	<u>Ustilago hordei</u>	(SEE DETAILED DESCRIPTION UNDER STINKING SMUT OF WHEAT.)					
Brown loose smut	<u>Ustilago nuda</u>	(SEE DETAILED DESCRIPTION UNDER WHEAT.)					
Black or intermediate smut	<u>Ustilago nigra</u>				Heads later than common loose smut - about same time as healthy grain		
Stem rust	<u>Puccinia graminis tritici</u> and <u>secalis</u>	(SEE DETAILED DESCRIPTION UNDER WHEAT.)					
Leaf rust	<u>Puccinia hordei</u>		Small, round yellowish brown spore masses on leaves				
Stripe	<u>Helminthosporium gramineum</u>	Seedling blight can occur	First symptoms are yellow striping of older leaves at tillering stage - later leaves turn olive brown and split	Spikes may fail to emerge - those that do are blighted, twisted and brown in color	Heads are blighted and empty	Seed becomes infected at flowering	
Spot blotch	<u>Helminthosporium sativum</u>	Seedling blight a dry rot type - infected seedling leaves dark green, erect with dark brown lesions near soil line and tillering excessive - crown rot develops at or below soil surface, leaf infection starts from base of leaf	Round to oblong dark brown lesions with definite margins - spots come together to form blotches - nodes may become black as stand matures	If severe only partial emergence of head - lodging	Lesions appear on floral bracts - sterile spikes	"Black point" occurs on embryo end - thin kernels	
Net blotch	<u>Helminthosporium teres</u>	Blotches evident even on first leaf blade near tip of leaf	Brown blotches scattered on leaves and at early stage show brown "netting"	Straw at harvest is dull brown and lacks strength	Small linear brown lesions	Light brown discoloration	
Septoria leaf blotch	<u>Septoria passerinii</u>		Straw colored blotches which when mature contain numerous very small black specks	Lodging		Shriveled kernels	
Bacterial blight	<u>Xanthomonas translucens</u>	First infection during seedling stage	Yellowish or brownish translucent blotches or strips - white exudate common on lesion - glossy color	Severe infections retard spike elongation and cause blighting	Lesions as on leaves		
Ergot	<u>Claviceps purpurea</u>	(SEE DETAILED DESCRIPTION UNDER RYE.)					
Scab	<u>Gibberella</u> and <u>Fusarium</u> sp.	Blighting either before or after emergence		Crown rot common in late stages	All or part of head with dead lusterless surface	Shrunken and light brown color - grayish starch with flour-like structure	
Stripe mosaic	Virus	Sometimes noticeable on seedling leaves	Yellow or light green short to long sometimes mottled areas - some strains cause brown areas			Thin kernels	

Barley

How transmitted	Other crops affected	Recommended Control			Remarks
		Seed treatment	Variety resistance	Other	
(COVERED SMUT OF BARLEY CANNOT AFFECT WHEAT OR STINKING SMUT OF WHEAT AFFECT BARLEY.)					
(LOOSE SMUT OF BARLEY CANNOT ATTACK WHEAT.)			Tregal resistant Kindred, OAC-21, Husky, Vantmore, moderately susceptible		
Seed - spores carried on outside		Use mercurial seed treatment			Spores spread direct to seed in field or threshing - symptoms range from that of loose to covered smut
	Wheat, rye		Kindred, Traill, Parkland, Vantmore, Husky, Vantage and some others are resistant		
Spores blow in from south and spread from plant to plant					Host plant is common Star-of-Bethlehem
Seed		Use mercurial treatments			Some infection carried underneath seed coat and not affected except by hot water treatment
Seed borne and crop residue	Wheat and grasses	Use mercurial seed treatment to reduce seedling blight -	Montcalm, Wis. 38 and Vantage are more susceptible than other varieties	Crop rotation	Seedling infection severe under warm dry conditions and leaf infections under warm moist conditions - hot water treatment will kill fungus within seed
Seed borne and crop residue		Use mercurial seed treatment to reduce seedling blight -		Crop rotation	Associated with cool temperatures generally not serious in N. Dak. - often abundant on volunteer barley in late fall - hot water treatment will kill fungus within seed
Seed borne and crop residue	Wheat, oats and rye and many grasses all take a different species of Septoria	Use mercurial seed treatment	Feebar only resistant variety	Crop rotation	At maturity leaf sheaths show brownish-gray blotches
Bacteria enter through stomata or insect punctures		Use mercurial seed treatment		Crop rotation	Favored by rainy, damp weather - spread by rain and insects
Seed and soil borne	Wheat, durum, rye corn	Use mercurial seed treatment to help seedling		Crop rotation - avoid barley, wheat or corn ground	Infected grain poisonous to hogs, dogs and humans - wet fall weather on lodged grain or in swath favors rapid spread
Through seed and by plant contact in the field	Has been reported on wheat			Use virus free seed	Several strains of virus

Flax

Disease		Characteristics					
Common name	Scientific name	Seedling	Leaf	Stem	Head	Seed	
Wilt	<u>Fusarium lini</u>	Wilt - Roots are ashen-gray in color	Turn yellow at tips first then entirely	Branches affected first then whole plant			
Anthrachnose Canker	<u>Colletotrichum lini</u>	Lesions appear on seed leaves when 1-2 in. tall - occurs chiefly as a seedling blight		Lesions spread to stem, mostly at soil line		Shriveled seed is produced if plants do not die	
Heat Canker	High temperature at soil surface -- non-parasitic	Plants less than 4 inches most susceptible		Girdling of stem at soil line - stem may enlarge above injury			
Rust	<u>Melampsora lini</u>	Rounded bright orange pustules occur on leaves and stems early in season - elongated brown or purplish-black pustules occur on stems, later					
Pasmo	<u>Septoria linicola</u>		Greenish yellow to dark brown lesions appear first on leaves and later on stems				
Stem Break or Browning	<u>Polyspora lini</u>	Circular gray to brown lesions appear first on seed leaves		Lesions spread to stem and produce a canker at first node - stem becomes brittle and may break			
Rhizoctonia	<u>Rhizoctonia sp.</u>	Brown lesions form just below soil line		Later lesions may extend up to seed leaves			
Flax Dodder	<u>Cuscuta gronovii and coryli</u>	An annual, yellow or orange vine without leaves but has small white flowers in clusters - has no roots but draws nourishment from flax plant.					
Aster yellows	Virus		Turn yellowish green in color		Flower parts turn green forming a rosette like growth instead of a boll	Seed shriveled or does not form	
Grasshopper damage	FLAX BOLLS ARE CLIPPED OFF JUST BELOW THE BOLL AND CAN BE FOUND LYING ON GROUND.						
Cricket damage	PART OF FLAX BOLL EATEN AWAY.						

Flax

How transmitted	Other crops affected	Recommended Control			Remarks
		Seed treatment	Variety resistance	Other	
Soil and seed borne		Use mercurial seed treatment	All common varieties resistant		Plants are killed at any stage
Seed borne		Use mercurial seed treatment to kill spores on outside		Clean seed thoroughly to remove shriveled seed	Under damp conditions a salmon pink mold growth can often be seen on dying plants
				Seed early - most severe where hard crust forms after a rain	
Elongated black stem pustules contain spores which live over winter			All common varieties are resistant	Crop rotation	No alternate host as with wheat stem rust
Fungus lives over on crop residue and some spores carried on seed		Use mercurial seed treatment	All varieties somewhat susceptible - Marime most tolerant	Crop rotation	Continued wet weather late in growing season increases spread and damage
Seed-borne and crop residue		Use mercurial seed treatment to kill spores on outside of seed		Crop rotation	Brown spots on leaves and stems resemble pasmo but are smaller - affected stems often do not break completely but become semi-erect and ripen prematurely, producing little seed - spreads most rapidly during periods of high moisture
Soil borne	Many				Occurs in areas measuring a few feet across to an acre or more and may kill every plant
Dodder seed	Alfalfa and clovers	Use dodder free seed		Rotate away from alf. if known to have dodder	This is not true flax dodder - which is not known to exist in N. Dak.
By the six-spotted leaf hopper	Many native, garden and flower plants - also potatoes, where it is called purple top	Not transmitted by seed	All varieties susceptible		Infected leaf hoppers migrate in from south arriving here in early May
					8 hoppers per square yard warrant spraying

Oats

Disease		Characteristics				
Common name	Scientific name	Seedling	Leaf	Stem	Head	Seed
Loose smut	<u>Ustilago avenae</u>	Infection occurs in early stages of germination and seedling development			Grain replaced by black powdery mass which shatters - usually all spikelets affected	
Covered smut	<u>Ustilago kollerii</u>	Same			Less complete destruction of head and blacker mass than loose smut - does not shatter	
Stem rust	<u>Puccinia graminis avenae</u>	(SEE DETAILED DESCRIPTION UNDER WHEAT)				
Crown rust or leaf rust	<u>Puccinia coronata</u>		Elongated pustules orange-yellow color early in season - black spores develop later - long raised streaks which do not break through surface			
Halo blight	<u>Pseudomonas coronafaciens</u>		Spots with dead centers and pale yellow green, halo-like margins			
Blast	No causal organism				White empty spikelets especially near base of panicle	

Rye

Ergot	<u>Claviceps purpurea</u>				Empty florets occur in addition to those replaced by ergot	Large black bodies replace seed usually 2-5 per head
Stem rust	<u>Puccinia graminis secalis</u>	(SEE DESCRIPTION OF STEM RUST UNDER WHEAT.)				
Leaf rust or brown rust	<u>Puccinia rubiag vera secalis</u>	(SEE DESCRIPTION OF LEAF RUST ON WHEAT.)				
Stem smut	<u>Urocystis occulta</u>	Infection occurs from seed-borne spores	Long narrow gray to black stripes on stems and leaves. Plants tend to break			Shriveled
Fusarium blight or scab	<u>Gibberella sanhinetii</u> and <u>Fusarium sp.</u>	(SEE DESCRIPTION UNDER WHEAT.)				
Helminthosporium blight	<u>Helminthosporium sp.</u>	(SEE DESCRIPTION UNDER WHEAT.)				

Oats

How transmitted	Other crops affected	Recommended control			Remarks
		Seed treatment	Variety resistance	Other	
Spores cling to seed	Grasses and wild oats	Use mercurial seed treatment - volatile mercury treatments best	Andrew, Marion, Ransom, Rodney, Garry and others resistant		
Spores cling to seed	Same	Use mercurial seed treatment - volatile mercury treatments best	Most varieties satisfactory		
(OAT STEM RUST DOES NOT ATTACK OTHER CROPS EXCEPT SOME GRASSES.) Ransom, Garry and Rodney most resistant					
Black spores attack buckthorn bush early in spring and spread to oats - orange spores can blow in from south	Wild oats and grasses		Most varieties commonly grown are moderately susceptible		
Seed - develops in seedling and spreads to other plants by wind and rain or crop residue	Rye - occasionally barley and wheat	Use mercurial seed treatment		Rotation	Bacteria enter through stomata or insect punctures
					Caused by environmental factors such as rain, fertility, etc. - occurs from tillering to pollinating stage

Rye

Ergot bodies on ground germinate, infecting heads at blossoming time. "Honey dew" containing spores is produced, and carried to other heads by insects and wind	Wheat, durum grasses - barley and oats only slightly	Clean seed thoroughly to remove ergot bodies		Crop rotation - ergot body usually lives only one year. Mow roadside grasses	Ergotized grain, pasture or hay poisonous to livestock
(DOES ATTACK BARLEY AND WILD GRASSES.)					Rarely serious on rye in North Dakota.
(DOES NOT ATTACK WHEAT.)					Not common in North Dakota. Infection must blow in from the south
Seed borne		Use mercurial seed treatment			Not common
					Usually less severe than on wheat

Corn

Disease		Characteristics					
Common Name	Scientific Name	Seedling	Leaf	Stem	Ear of corn or pod of soybean	Seed	
Smut	<u>Ustilago zeae</u>	Attacks plants at later stage	Leaves, stalk, ear and tassel may be affected and replaced by spore masses of varying sizes				
Seedling blight	<u>Gibberella spp.</u>	Roots pinkish and frequently killed	Plants are dwarfed, stalks weak, tassel slow to open or not produced, ears of poor quality			Rough, shrunken, dull and moldy	
Stalk rot							
Kernel rot							
	<u>Fusarium spp.</u>	Much the same as <u>Gibberella</u> above, pale salmon color with tendency to reddish in later stages					
Ear rot	<u>Diplodia spp.</u>	Characterized by a grayish dry rot on ear and kernels - not easily recognized in other parts of plant					
Leaf blight	<u>Helminthosporium turcicum</u>		Large linear water soaked lesions turning olive to black to straw color		Ear or tassel infection rare		
Rust	<u>Puccinia sorghi</u>		First stage elongated blisters - later brown rusty spots				

Soybeans

Damping off and root rot	<u>Pythium spp.</u>	Seedling decay before or after emergence		Brown lesions on roots and stems at ground level		Decay of seed in soil	
Stem canker				Brown to black canker above ground level - Entire plant may wilt before leaves mature			
Bacterial blight	<u>Pseudomonas spp.</u>		Water soaked spots becoming brown	Brown spots in severe cases			
Brown spot	<u>Septoria glycines</u>		Reddish brown spots mostly on lower leaves				
Mosaic	Virus		Mottled green and yellow crinkled distorted leaves	Stunting and yellowing of entire plant		No seed produced on severely infected plants	

Corn

How Transmitted	Other Crops Affected	Recommended Control			Remarks
		Seed Treatment	Variety Resistance	Other	
Spores carried from season to season in old stalks and manure			Some hybrids more resistant than others	Rotation - avoid manured fields if smutty corn fed	Spores germinate when moisture is favorable and produce a second kind of spore which is carried to young tender parts of corn plant
Fungus lives over winter in stalks & stubble, new spores attack crop	Wheat, barley & other crops	Yes - but do not use infected seed	Hybrids vary	Rotation	Seed treatment does not kill fungus carried internally in seed - barley should not follow diseased corn
	Wheat, oats, barley	As above	Hybrids vary	Rotation	
Seed and crop residue		As above	Hybrids vary	Rotation	Infection takes place at silking - easily recognized on ears in field or crib
Crop residue	Sudangrass sorghums		Hybrids vary	Rotation	
Spores blow in from South			Hybrids vary		The alternate host is <u>Oxalis</u> spp.

Soybeans

Soil borne	Many	Yes		Crop rotation	Usually occurs in part of row or patches 3 to 30 ft. wide
Soil - seed and plant residue			Varieties differ		Symptoms appear late as crop approaches maturity
Seed borne and crop residue				Rotation - avoid cultivation when plants are wet - bacteria spread by machinery	Favored by warm temperature and high humidity
Leaf residue				Rotation - avoid cultivation when wet - fungus spread by machinery	Develops during wet humid weather - plants seldom infected after midseason
Seed - insects - mechanical					Caused by several viruses - some show symptoms identical to 2,4-D injury

SEED TREATMENT

Seed is treated to destroy organisms carried on the surface of the seeds. Smut, seed rotting diseases, and some of the root rots and blights, are controlled by seed treatment. The treated seeds are also protected from soil-borne organisms while germinating and while the plants are small. Plants from treated seed emerge more quickly and the stand is thicker and more uniform.

Treat all seeds at least 24 hours before sowing. Seeds sown sooner than 24 hours after treatment do not have full benefit of the treatment. Oats and barley seem to require a storage period of two weeks or longer after treatment for best results.

Good, sound, high-quality seed that is dry can be treated several months ahead of planting. Seed with high moisture or damaged seed including weathered, broken or sprouted seeds should not be treated until a few days before sowing.

Seed treatment is recommended for small grain and flax. It costs very little per acre and offers protection under a variety of conditions.

1. When seed is damaged. When seed is light in test weight or is damaged by disease, weather, harvesting, poor storage or high moisture seed treatment will be especially beneficial. Treating such seed helps it to fight off diseases and to produce a good stand.

2. When soil is cold and wet. Some seed rotting organisms can thrive when conditions are too wet and cold for seed to germinate and grow. Seed treatment can protect the seed and seedling against these organisms until the soil becomes warm and dry enough for good growth.

3. When soil is dry. The longer seed lies unsprouted in the soil the greater the chance for it to become infected with disease.

4. Under favorable conditions. Even sound, healthy seed with favorable growing conditions benefits from seed treatment. Plants from treated seed emerge faster, are healthy and more vigorous. Seed treating thus gets your crop off to a better start.

Bulletins available from your County Extension Agent or the Agricultural Information Department, NDAC, Fargo.

Bulletin 402 Seed Treatments

Bulletin 330 The Black Point Disease of Wheat

Circular A269 Blackpoint Disease

Reprint No. 316 Ergot Production