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University of Nebraska Lincoln EXTENSION

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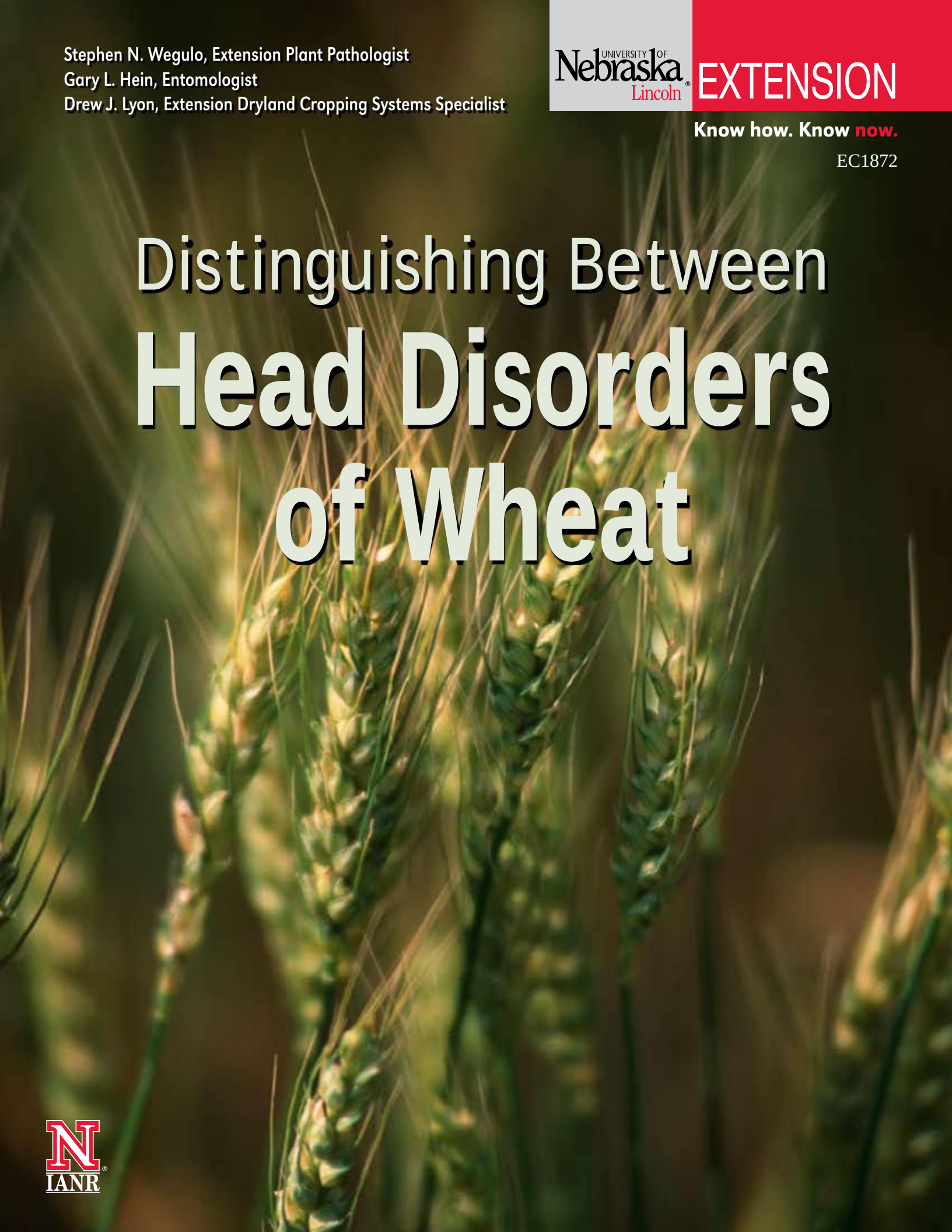
EC1872

Distinguishing Between Head Disorders of Wheat



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Several diseases, insects, and other disorders of wheat affect the head (spike). To manage these effectively, it is important to correctly identify the source of the problem. This Extension Circular provides information on how to distinguish between wheat head disorders.

Table 1. Summary of expressed symptoms of various disease, insect, and abiotic disorders that affect wheat heads.

Premature Turning/Bleaching — Entire Head	**Premature Turning/Bleaching — Partial Head**
Fusarium Head Blight (Scab) Take-all Frost Injury Wheat Stem Maggot Wheat Stem Sawfly Hessian Fly Russian Wheat Aphid	Scab Frost Injury Hail
Stems Broken Off/Lodged at Base	**Discoloration of Glumes/Awns**
Take-all Hessian Fly Wheat Stem Sawfly Frost Injury	Glume Blotch Black Chaff Melanism (Brown Necrosis) Frost Injury
Heads with Dark or Gray Fungal Growth/ Spores/Sclerotia/Discolored Grain	**Heads or Awns Curled/Deformed**
Loose Smut Common Bunt Ergot Sooty Mold Black Point	Frost Injury Hail During Late Boot Russian Wheat Aphid Wheat Curl Mite Synthetic Auxin Herbicide Injury (2,4-D, dicamba, picloram)

Biotic Disorders Caused by Plant Pathogens

Figure 1. A wheat head with a few spikelets bleached by Fusarium head blight (scab).

Figure 2. The top portion of a wheat head bleached by Fusarium head blight.

Figure 3. Pink to salmon spore mass of the Fusarium head blight fungus on a completely blighted head.

Figure 4. Right: A wheat head and stem (peduncle) infected by Fusarium head blight. Left: a healthy wheat head and stem.

Fusarium Head Blight (Scab)

Fusarium head blight is caused by the fungus *Fusarium graminearum* (sexual stage: *Gibberella zeae*). One or more spikelets or the entire head is prematurely whitened or bleached (*Figures 1 to 3*).

Partial bleaching of the wheat head is diagnostic of Fusarium head blight. During wet or humid conditions, pink to salmon spore masses may appear on bleached heads (*Figure 3*). Infection of the stem (peduncle) immediately below the head may occur, resulting in a brown to purple discoloration (*Figure 4*). Bleached spikelets are sterile or contain shriveled and/or chalky white or pink kernels. Bleached heads appear suddenly and usually are visible over a wide area in the field (*Figure 5*). Wheat plants are of normal height.

Key management strategies for Fusarium head blight include using crop rotation and avoiding planting wheat following corn or wheat, planting resistant/tolerant cultivars, and applying an appropriate fungicide at early flowering when conditions favor disease development.

For more information on Fusarium head blight, see Extension Circular EC1896, *Fusarium Head Blight of Wheat*.

Figure 5. Field symptoms of Fusarium head blight. Note the white heads scattered throughout the field.

Figure 6. Patches of a young wheat crop stunted by take-all.

Figure 7. Patches of white heads caused by take-all.

Take-All

Take-all is caused by the soil-borne fungus *Gaeumannomyces graminis*. In severe cases, young plants appear yellow and stunted, often in patches (*Figure 6*). In more mature fields, white heads occur in patches, often on plants that are stunted and which also have prematurely dead foliage (*Figure 7*).

The stem base of affected plants may darken and the roots are blackened and stunted, and in some instances the stem may break off at the base and lodge.

Take-all is managed mainly by cultural practices, including crop rotation out of cereal crops and grasses, a balanced fertilizer program, and seeding into a firm, well-drained soil.

Figure 8. Purple-brown discoloration on glumes of a wheat head caused by glume blotch. (Photo credit: Dr. Gregory Shaner, Purdue University)

Glume Blotch

Glume blotch is caused by the fungus *Stagonospora nodorum* (sexual stage: *Phaeosphaeria nodorum*). A purple-brown discoloration appears on glumes (*Figure 8*). Oval lesions form on mature leaves and coalesce, forming large areas of dead brown tissue.

Glume blotch symptoms on the wheat head can be easily confused with black chaff. During humid weather, the presence of cream to yellow ooze on the surface of the head or other infected plant parts distinguishes black chaff from glume blotch and other diseases. In the absence of humid weather, a laboratory test is necessary to distinguish between glume blotch and black chaff.

Glume blotch is managed by rotation out of cereal crops, cultivar resistance, and foliar fungicide application.

Figure 9. Discoloration of glumes on wheat heads caused by black chaff.

Black Chaff

Black chaff is caused by the bacterium *Xanthomonas campestris* pv. *transluscens*. Brown-black, water-soaked and necrotic streaks cause darkening on glumes (*Figure 9*). Streaking also can occur on leaves. A dark brown to purple discoloration may appear on the stem below the head and above the flag leaf.

During humid weather, a cream to yellow ooze appears on infected plant parts. Bands of healthy and necrotic tissue appear on awns.

The most effective management strategy for black chaff is planting certified, pathogen-free seed. Other management strategies include controlling volunteer wheat and grassy weeds in and surrounding crop fields, and managing irrigation such that the foliage dries between irrigations. For more information on black chaff, see NebGuide G1672, *Black Chaff of Wheat*.

Figure 10. Loose smut on a wheat head.

Loose Smut

Loose smut is caused by the fungus *Ustilago tritici*. Heads of infected plants emerge earlier, are darker in color and slightly taller than heads of healthy plants.

Spikelets of infected heads are replaced by masses of olive-black spores (*Figure 10*). These spores may be blown off leaving an empty rachis.

Loose smut is managed by using certified, pathogen-free seed; treating seed with a systemic fungicide before planting; and planting resistant cultivars. For more information on loose smut, see NebGuide G1978, *Loose Smut and Common Bunt of Wheat*.

Figure 11. Bunt balls containing spores of the common bunt (stinking smut) fungus.

Common Bunt (Stinking Smut)

Common bunt is caused by the fungi *Tilletia tritici* and *T. laevis*. Infected plants may appear stunted but are not readily distinguished until head emergence.

Bunted heads are slender and retain their green color longer than healthy heads. Glumes and awns spread apart exposing bunt balls ("kernels" full of black spore masses). The bunt balls (*Figure 11*) resemble kernels but are more rounded, and they remain on the head and give off a strong odor.

Management strategies for common bunt are similar to those of loose smut: planting certified, pathogen-free seed; treating seed with a fungicide before planting; and choosing resistant cultivars. For more information on common bunt, see NebGuide G1978, *Loose Smut and Common Bunt of Wheat*.

Figure 12. Black point. Note the brown to black discoloration of the embryo end of the wheat grain (arrow).

Black Point

Black point, also known as kernel smudge, is characterized by a brown to black discoloration of the embryo region of the grain (*Figure 12*). It is caused mainly by fungi in the genera *Alternaria* and *Bipolaris*.

Black point is managed by storing affected grain under cool, dry, and well-ventilated conditions; avoiding the use of affected grain as seed; or, if affected grain is used as seed, treating it with a systemic fungicide to improve germination and reduce seedling infection. For more information on black point, see Extension Circular EC1874, *Fungal Diseases Affecting Grain and Seed Quality in Wheat*.

Figure 13. Ergots (sclerotia) of the ergot fungus.

Ergot

Ergot is caused by the fungus *Claviceps purpurea*.

Horn-shaped, purple-black ergots or sclerotia (hard, compact masses of fungal tissue that act as survival structures) (*Figure 13*), replace individual grains on the head.

Ergot is managed by planting sclerotia-free seed, mowing grasses surrounding wheat fields before heading, and rotating out of cereal crops and grasses. For more information on ergot, see Extension Circular EC1874, *Fungal Diseases Affecting Grain and Seed Quality in Wheat*.

Figure 14. Sooty mold on a wheat head.

Sooty Mold

Sooty mold is caused by weakly pathogenic fungi belonging to several genera including *Alternaria* and *Cladosporium*.

A superficial gray-black fungal growth appears on the surface of the head (*Figure 14*).

Control of sooty mold in the field is not justified and may not be economical. Grain from fields affected by sooty mold should be stored under dry, cool, and well-ventilated conditions to avoid development of storage molds and should be treated with a systemic fungicide if it is to be used as seed.

Biotic Disorders Caused by Insects and Mites

Figure 15. Loose white heads caused by stem maggot damage.

Wheat Stem Maggot

Wheat stem maggot (*Meromyza americana* Fitch) feeding in the stem above the top node causes the head to prematurely die and become bleached. Damaged heads are usually isolated and more conspicuous than heads bleached by diseases. Only the head and stem below the head are dry and whitened with the rest of the plant remaining normal green (*Figure 15*). If the head is pulled upward, it will separate from the lower stem just above the first node showing a ragged edge where the stem had been chewed off. In Nebraska, damage from the wheat stem maggot can be dramatic but rarely is significant, and no management procedures have been developed for this insect.

Figure 16. Lodging of wheat tillers caused by wheat stem sawfly damage.

Figure 17. Wheat stems broken off near ground level just above the crown as a result of wheat stem sawfly damage.

Wheat Stem Sawfly

Wheat stem sawfly (*Cephus cinctus* Norton) damage can result in premature drying of the heads, but this impact is much less dramatic than with the wheat stem maggot. The most obvious damage occurs from tillers lodging at the base of the plant as harvest approaches (*Figure 16*). Pulling upward on the affected stems can result in a break of the stem near ground level just above the crown (*Figure 17*). Splitting infested stems will reveal the stems filled with a sawdust-like material. Wheat stem sawfly will reduce physiological yield and result in significant lodging losses at harvest. Sawfly presence is greater in no-till situations, and management of the insect primarily relies on cultural practices, such as crop rotation and avoiding planting narrow strips of wheat-fallow, to reduce the potential for sawfly population buildup.

Hessian Fly

Hessian fly (*Mayetiola destructor* (Say)) damage during the spring can result in prematurely discolored heads and also lodging near the base of the plant. Hessian flies undergo two generations (fall and spring) each year. Feeding damage from the spring generation weakens the stems at the site of feeding, under the leaf sheath of the lower nodes on the plant. Hessian fly damage is rare in western Nebraska, but the damage potential increases the further east you go. Management of Hessian fly relies on planting resistant cultivars, avoiding early planting, and preventing volunteer wheat from hosting the fall generation. For more information on Hessian Fly, see NebGuide G1923, *Hessian Fly on Wheat*.

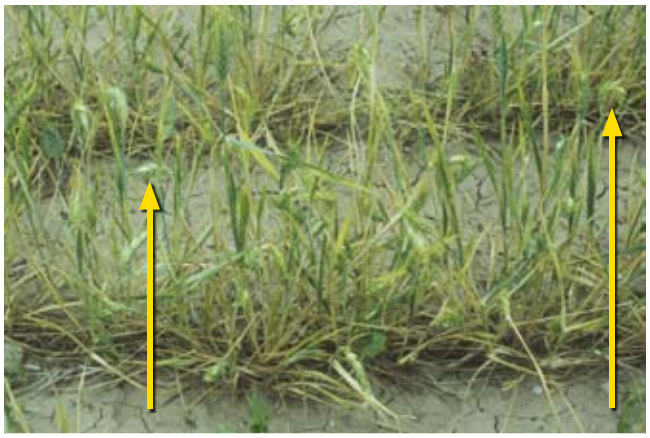

Figure 18. Leaf curling and curving of wheat heads caused by the Russian wheat aphid (arrows).

Figure 19. Close-up of a curved wheat head resulting from Russian wheat aphid injury.

Russian Wheat Aphid

Heavy Russian wheat aphid (*Diuraphis noxia* Mord.) populations can cause the flag leaf to roll tightly. Awns will become trapped in these curled leaves, and as the head emerges, the awns remain trapped. As a result, the head will not emerge correctly and will become curved (*Figures 18 and 19*). Flowering on the inside of these curved heads will be severely disrupted, and poor seed development will result. These heads can turn and dry up prematurely. Scouting prior to flag leaf emergence will identify severe infestations that can be treated to protect the flag leaf. For more information on Russian wheat aphid, see NebGuide G1284, *Cereal Aphids.*

Wheat Curl Mite

Wheat curl mite (*Aceria tosichella* Keifer) feeding on wheat can also result in tightly curled leaves, trapping awns and resulting in curled or distorted heads. Typically this is of little consequence because mite infestations this serious will most likely have previously resulted in wheat streak mosaic or Triticum mosaic virus infections that would be much more serious than the trapped heads. Controlling volunteer wheat and avoiding early planting are important tactics to manage the wheat curl mite and its associated viruses. For more information on the wheat curl mite, see Extension Circular EC1871, *Managing Wheat Streak Mosaic*.

Figure 20. Wheathead armyworm. (Photo credit: Dr. Phil Sloderbeck, Kansas State University)

Figure 21. Wheat grain damaged by the wheathead armyworm. (Photo credit: Dr. Phil Sloderbeck, Kansas State University)

Wheathead armyworm

Wheathead armyworms (*Faronta diffusa* (Walker)) (*Figure 20*) feed on the kernels of the developing head, resulting in partially damaged seeds (*Figure 21*). These insects are commonly found throughout the Great Plains region but seldom cause significant damage to wheat. Damage will result from direct loss of seeds, but quality losses also will result from insect damaged kernels (IDK) being present in the marketed grain. Few management options are available since little is known about the insect's behavior on wheat. Damage is generally most serious near field margins, and damaged wheat near the margins can be blended with wheat further into the field where its incidence will likely be reduced.

Figure 22. Wheat heads clipped and fallen to the ground as a result of grasshopper feeding.

Grasshoppers/Armyworms

Grasshoppers and armyworms are general feeders that may be numerous during the later stage of wheat development. True armyworms (*Pseudaletia unipuncta* (Haworth) are more likely to be present prior to heading but may remain after heading. Grasshoppers are more likely to increase in presence as they move from adjacent grass areas into maturing wheat. Both insects can feed on wheat heads and consume green seeds and glumes. Also, after the heads have turned, they will feed on the remaining green stem just below the head, resulting in heads that are clipped and which fall to the ground (*Figure 22*). Significant infestations of either of these insects are uncommon but can be identified with scouting during this period and treatments considered if populations are extreme. For more information on grasshoppers, see NebGuide G1627, *A Guide to Grasshopper Control in Cropland*.

Abiotic Disorders

Melanism (Brown Necrosis)

Some wheat cultivars produce melanoid pigments which appear as brown-black streaks or blotches on glumes. This disorder, also known as pseudo black chaff or brown necrosis, is genetic.

The symptoms resemble those of glume blotch and black chaff (*Figures 8* and *9*). A laboratory test is required to distinguish melanism from glume blotch or black chaff.

Figure 23. Wheat heads partially whitened by frost injury.

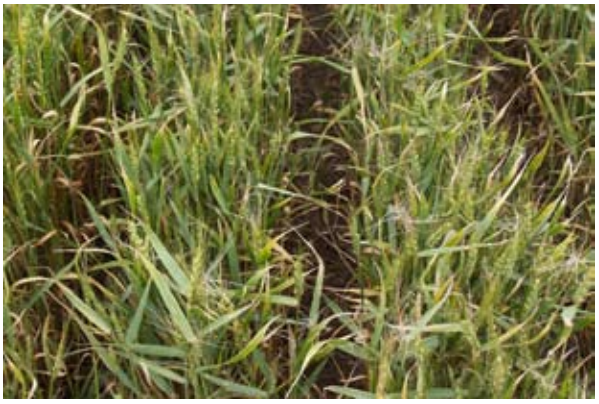

Figure 24. Distorted awns on wheat heads caused by frost injury.

Frost Injury

Freezing temperatures after jointing when the developing head is above the ground and less protected can damage wheat heads. The low temperature reached and the duration of freezing temperatures will correlate with the severity of damage symptoms seen, but this is also modified by several environmental factors (e.g., canopy cover, soil moisture). Entire heads or portions of heads may turn white indicating the extent of damage to the florets in the entire head (*Figure 23*). Damaged heads and the peduncles are not easily detached from the stem when pulled. Frosts that occur during flowering can cause floret sterility and abortion. Damaged tillers may have curled or distorted awns (*Figure 24*). Frost damage is frequently worse in low spots in fields where cold air settles. For more information on frost injury, see Extension Circular EC132, *Freeze Injury to Nebraska Wheat*.

Figure 25. Severe hail injury to a wheat crop at the full heading growth stage. (Photo Credit: Dr. Robert Harveson)

Figure 26. Missing florets on a wheat head damaged by hail (arrow). (Photo Credit: Dr. Robert Harveson)

Hail Injury

Severe hail damage (*Figures 25 and 26*) is certainly not difficult to identify, but damage resulting from lighter hails that do not result in broken stems or heads can sometimes go unnoticed except for these subtle symptoms.

Isolated hail occurring during the boot stage can damage or break over the leaf sheath that is just above the emerging head, resulting in awns becoming trapped in the kinked leaf sheath. As the head grows out, the awns remain stuck in the bent leaf sheath and the heads become curled or otherwise distorted. This condition can be identified by the presence of wounds on the stem, a strong kink in the leaf sheath of the flag leaf, and bent or curled awns. Hail occurring during later stages of head development can result in patches of dead or missing florets and seeds in the head (*Figure 26*). The loss of these seeds can be verified by inspecting the ground below the plants or inspecting the florets for the presence/absence of seeds.

Figure 27. Awns on a wheat head trapped in a flag leaf damaged by 2,4-D herbicide.

Synthetic Auxin Herbicide Injury

Synthetic auxin (Group 4) herbicides such as 2,4-D and dicamba (Banvel®, Clarity®) applied to wheat either before it has reached the four-tiller stage or after jointing can result in twisted flag leaves. Awns from emerging heads can become trapped in the damaged flag leaves (*Figure 27*). This entrapment results in curled or distorted heads and prevents normal head development.

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