Evaluating Hay and Pasture Stands for Winter Injury

Severe winter cold coupled with only light or no snow cover can result in poor hay and pasture stands in spring. Plants may be killed or weakened, leaving barren areas in the field or thinning of the stand, depending on the severity of winter injury.

Accurate assessment of perennial forage stands for winter injury is an important and economically sound management practice. The degree of injury will vary depending on a number of climatic and cultural factors.

Climatic Factors

Direct exposure of plants to extreme low temperatures. Continued exposure of legumes to temperatures of 0 to 15 degrees F can be lethal. Under these conditions, plant survival depends upon the genetic cold tolerance of the variety, the insulating properties of the soil, vegetative cover, and snow cover.

Heaving of plants from wet soils during alternate freezing and thawing. The heaved root and crown tissue is exposed to lethal air temperatures. The more branched rooted legumes are less susceptible to heaving. Sod-forming grasses are the least susceptible to heaving and help hold legumes in place. Selecting or providing soils with good surface drainage can reduce the occurrence of heaving.

Smothering of plants when covered by ice sheets. Smothering of alfalfa may cause injury within 1 to 3 weeks, and death within 2 to 6 weeks. Red clover and white clover have tolerance to smothering that is similar to alfalfa, while birdsfoot trefoil and ladino clover are more susceptible to injury. Grasses are more tolerant than legumes to smothering and can withstand injury for up to 10 to 14 weeks. Leaving 6 to 8 inches of vegetative stubble in the fall can help reduce the occurrence of ice sheet formation.

Mid-winter dehardening of plants from exposure to extended warm periods. Plants that deharden over winter during warm periods use some of their carbohydrate and nitrogen reserves during this premature regrowth attempt, leaving the plants with a reduced level of cold hardiness and less reserves available for continued survival during the remaining winter and for spring regrowth.

Summer drought may add to the seasonal stresses of harvest or grazing intensity, machinery or animal traffic, insect damage, and disease. Severe drought may cause the plant to go dormant, use its carbohydrate reserves for maintenance while dormant, and thus, enter into the fall in a weakened state unless it has sufficient time to replenish its carbohydrate reserves before winter.

Cultural Factors

The grower has little control over climatic factors that influence winter injury, but a number of cultural practices can be employed to reduce the severity of winter injury.

Injury is more likely to occur on species and varieties with low inherent cold hardiness. Red clover, birdsfoot trefoil, and orchardgrass are more frequently injured than alfalfa, tall fescue, smooth bromegrass, reed canarygrass, and Kentucky bluegrass. Winterhardy varieties are less frequently injured than moderately winterhardy varieties.

Disease resistance is very important in stand persistence and may partially contribute to winterhardiness. Plants weakened by disease are less resilient and more susceptible to winter injury.

Young stands are less susceptible to winter injury than old stands. Old plants are more likely to be infected with root and crown diseases, and stand loss is apt to be more serious because old stands generally have fewer plants per unit area than young stands.

IOWA STATE UNIVERSITY
Extension and Outreach

PM 1362 Revised November 2008

Table 1. Risk assessment of alfalfa harvest schedules in Iowa.*

	Risk		
Location	High	Medium	Low
Southern Iowa	5 cuts	4 summer cuts	2-3 summer + 1 late
Northern Iowa	4 summer cuts	3 summer + 1 late	3 summer

*Barnhart, 1985

Table 2. Age of stand and rating of winter survival.

Year	Good	Marginal*	Consider reseeding
	plants per square foot		
Yr. after seeding	+12	8 to 12	less than 8
2	+8	5 to 6	less than 5
3**	+6	4 to 5	less than 4
3**	+6	4 to 5	less than 4
4 and older**	+4	3 to 4	less than 3

*Alfalfa plants in thin stands often produce more individual stems per plant and compensate some in yield potential
**If 50 percent or more of the plants have crown or root rot, consider reseeding.

Injury is less severe where a grass is present. Grass reduces heaving of legumes and helps catch snow and provide insulation to crowns. Stand survival of grasses such as smooth bromegrass and reed canarygrass is excellent even under the most severe Iowa winters.

Injury occurs more frequently where fall cutting or overgrazing is practiced. Fall cutting or grazing may not allow for accumulation of adequate carbohydrate reserves for the winter or leave stubble to catch snow.

High frequency of harvest or intense fall grazing increases the risk of winter injury and reduces stand persistence. Table 1 provides a risk assessment of alfalfa harvest schedules on stand persistence in Iowa.

Injury is less severe where a good annual soil fertility program is followed. The only exception would be fall applied nitrogen on grasses that would encourage strong vegetative growth when the plant should be going dormant.

Stand Evaluation

Winter-injured plants often are slow to recover in spring, so a quick decision to destroy a winter injured stand is not recommended. When evaluating winter injury, consider both the number of plants per square foot and the age of the stand. Crown and root diseases also have a major effect on stand reduction of legumes, so plants should be checked for dead, dying, or diseased tissue.

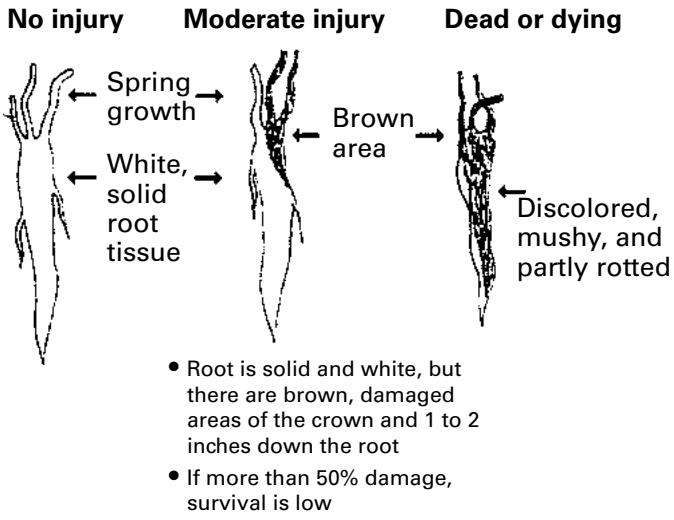
Alfalfa

Wait until the spring regrowth is about 3 to 4 inches high. Select random stand count sites. Check a 1-square-foot site for every 5 to 10 acres. Dig up all of the plants in the 1-square-foot area. Pick at the crown and buds with a knife to determine if the tissue is still alive. Also split the taproots to determine if they are firm and creamy-white, or yellowish-brown and decaying. Do not confuse brown decaying tissue with taproot bark tissue. Count only the healthy plants. More than 50 percent of the taproot should be disease free. Figure 1 can be used as a guide for rating injury. Table 2 can be used to help rate the stand.

Pastures

Evaluate other legumes similar to alfalfa. The ability of red clover, white clover, and birdsfoot trefoil to reseed may compensate for some stand loss. Sod-forming grasses may spread and fill in for thin stands; bunch type grasses will not. For a legume in a legume-grass mix, consider the "marginal" values given in table 2 as "good." Table 3 rates winterhardiness of grasses and legumes.

Figure 1. Guide for measuring injury from disease.



Management Options for Winter-Injured Stands

Management alternatives to consider depend on severity of winter injury, age of stand, and grower needs.

Alfalfa

1. If the stand is "marginal," it may be best to leave it and obtain what forage will be produced. Delaying first harvest until one-half to full bloom will let the stand regain productive vigor, then a normal cutting schedule could be resumed. Cutting after Sept. 1 is not recommended if the stand is to be kept another year.

2. If the legume in a legume-grass mix has decreased by more than 50 percent, but the grass stand is good, applying nitrogen fertilizer to stimulate grass production over that of the legume may be beneficial.

3. Options after first harvest include keeping the stand or destroying the damaged stand and planting an alternative crop. However, under dry soil conditions, any alternative crop following alfalfa is questionable because the alfalfa stand will have depleted the subsoil moisture.

4. For unacceptable or damaged alfalfa stands, reseeding alfalfa into an injured stand may be desired. Successful reseeding of alfalfa will depend largely on age of stand and cause of plant injury such as disease or lethal winter climate.

Table 3. Winterhardiness (WH) and drought (DR) tolerance ratings.*

	Rating	
	WH	**DR**
Grasses		
Smooth bromegrass	E	G
Reed canarygrass	E	G
Switchgrass	E	E
Big bluestem	E	E
Kentucky bluegrass	E	P
Timothy	G	F
Orchardgrass	F	F
Tall fescue	F	G
Legumes		
Alfalfa	G	G
Crownvetch	G	G
Birdsfoot trefoil	G	F
Sweet clover	G	F
Red clover	F	P
White clover	F	P
Alsike clover	F	P
Lespedeza	P	G

*E=excellent, G=good, F=fair, P=poor

• **For stands 2 years old or older**, autotoxicity of alfalfa may cause renovation problems. Autotoxicity is not well understood but it seems to be caused by water soluable toxins from decomposition of old alfalfa tissue (roots and top-growth). Younger stands (within 12 to 15 months of the original planting) probably have not developed a high enough level of autotoxicity in the soil to interfere with reseeding.

• **Older stands with less than 25 percent of the plants remaining** (1 plant or less per square foot) may be interseeded with red clover if the stand will be maintained for hay harvest for only 1 to 2 more years. Otherwise, this stand would not be considered an economical 'keeper.'

• **Older stands with 25 to 50 percent of the plants remaining** in the stand are not recommended for interseeding with alfalfa because of autotoxicity. However, interseeding red clover or a grass into a uniformly thin stand of alfalfa may be beneficial. It usually is recommended to destroy these stands and rotate to a different crop.

- **If reestablishment of a stand** is desired, it may be more beneficial to rotate the injured stand to an alternative crop for a year or more to avoid possible autotoxicity problems and take advantage of the nitrogen contribution from the legume and the weed, insect, and disease control offered by a rotation.

- **Alfalfa stands thinned mainly by disease** should be rotated to an alternative crop for a year or more, or seeded to a grass-based forage mixture to decrease the level of disease organisms in the soil. Consider using disease resistant varieties for reestablishment into these fields when reseeding alfalfa in a later year.

- **"Patching-up" an area of an injured stand**. "Patched-in" areas often are mismanaged during the seeding year. The grower must be patient and use management practices that will help the new seedlings become established and not manage the area like the surrounding established stand. These younger plants often are more susceptible to potato leafhopper damage compared with the older plants.

5. If forage needs are great or will be in the upcoming year, and present alfalfa stands are 3 years old or older with suspected winter injury, it may be wise to seed a new stand in another field as soon as conditions permit to ensure an adequate forage supply. The existing stands then could be managed according to severity of injury.

Pastures

1. If the injured stand is to be grazed in spring, graze conservatively to let the stand recover.

2. Check on rental opportunities of other pasture. If extensive pasture renovation is required, it may be economical to rent pasture until renovation is completed.

3. Fertilization and weed control of the existing injured stand may be sufficient in improving the pasture to meet grower needs. See PM-869, *Fertilizing Pasture*.

4. A more productive forage component may be added to a thinned pasture or injured area. Legumes can be frost seeded or interseeded into a pasture. Grasses can be interseeded into a pasture, but frost seeding usually is not recommended. See PM-856, *Improving Pasture by Frost Seeding*, and PM-1097, *Interseeding and No-till Pasture Renovation*.

5. For more severely damaged pastures, consider no-till renovation on erodible land or complete renovation of the stand where erosion potential is minimal. See PM-1097, *Interseeding and No-till Pasture Renovation*, and PM-1008, *Steps to Establish and Maintain Legume-Grass Pastures*.

Summary

Choosing the best economic alternative after winter injury can be very difficult. The decision to renovate, delay harvest of first cutting, and/or add nitrogen fertilizer to older, thin stands is influenced by yield, cost, alternative hay prices, forage supplies, and forage demand. A decision on alternatives, particularly those requiring borrowing money, ought to be considered in light of the financial status of the farm. Growers must make choices on their own, but choices dealing with winter injury have long-term consequences. The best decisions are derived from accurately assessing stand and winter injury.

Revised by Stephen K. Barnhart, extension agronomist. Originally prepared by Brian J. Lang, extension field crops specialist.

File: Agronomy 3