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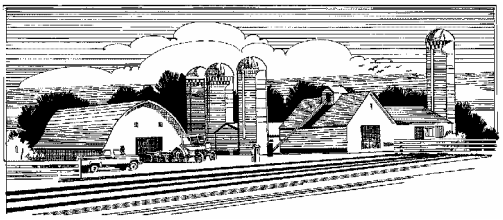

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Inside This Issue

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So, My Alfalfa is Dead – Now what?

Statewide, alfalfa fields took a beating this past winter. This newsletter will discuss some strategies for managing winter kill and injury.

The slightest depressions in fields are showing the most damage. This indicates that the damage was likely due to the significant icing that occurred from a January thaw.

In general, fields that are totally flat seem to have been hit the worst. Snow in these fields melted and then refroze without draining away in many case creating an ice layer two or more inches thick that remained for many weeks. Snow that melted in hillier fields drained to the low areas. These low areas were killed from the thick ice, but alfalfa on the slopes and hilltops generally seems to be OK.

When ice covers an area of a field, it seals off the root system from air. Roots are still alive and metabolizing during the winter and they therefore need to exchange gas with air to avoid toxic gas buildup. This is not possible when ice covers the field and eventually enough of the toxic gases and metabolites build up to kill root tissue.

Of the fields that I have scouted, the number of cuttings (assuming the forth cutting was taken post killing frost) didn't seem to have a great impact on stand survival.

When soil temperatures drop below 15 degrees for many weeks, significant crown damage occurs. Because the winter of 2002/2003 was very cold and open, soil temperatures were below this temperature for an extended period of time. If you took a late fall cutting that year, you were more likely to see injury because stubble traps snow, which insulates the soil and keeps temperatures in the 22-24 degree range.

Given that the number of cuttings last fall didn't seem to greatly impact stand survival, we can feel more confident that the majority of the damage to the stands was from icing and not excessively cold soil temperatures.

Stand and Feed Assessment

The first step in dealing with winter kill and injury is to assess two things: 1) how much feed do you have on hand, and 2) exactly what kind of shape is my alfalfa in?

Feed Inventory

We'll start with feed inventory assessment. Doing a feed inventory establishes your current stock of various feed ingredients on hand. The process involves determining the volume of each feed stored and then multiplying by the stored density to yield a weight of feed in storage.

For example, silage in a bunker silo has a dimension of 30' x 10' x 50'. Its volume is 15,000 cu ft. If the silage has a stored density of 40 lb /cu ft (as fed), the weight of feed in the bunker is:

15,000 cu ft x 40 lb /cu ft = 600,000 lb = 300 T as fed

The following materials can be found at the University of Wisconsin Team Forage Harvest and Storage web page:

http://www.uwex.edu/ces/crops/uwforage/storage.htm

Spreadsheets

- **Silage Pile Capacity Calculator**
- **Silage Pile Dimension Calculator**
- **Bunker Silo Density Calculator**
- **Bunker Silo Sizing Calculator -** includes a section for estimating daily forage feed needs for the whole dairy herd.
- **Cost of Forage Storage -** look in the help section for calculators for storage areas for bags, piles, bunkers, silage bales etc.

Publications

- **Silage Bag Capacity**
- **Choosing Forage Storage Facilities**
- **Density and Losses in Pressed Bag Silos**

Feed inventory management is slightly more complicated. With inventory management, you are predicting how long an ingredient will be available to feed and making adjustments accordingly. If the projected date to feed depletion occurs before a new crop comes in, you need to consider if you will reduce the rate of consumption to extend the feed ingredient, purchase more of that feed, substitute an existing feed ingredient into the ration or a combination of these choices.

How long will my feed last? The projected time to inventory depletion is calculated as:

Feed Inventory (tons) / **Consumption Rate** (tons/day)

For example:

100 tons / 2 tons fed/day = 50 days to depletion

Will feed need to be purchased? The projected feed to purchase (tons as fed) to meet feed needs at a given consumption rate is:

[Inventory (tons) – **Consumption Rate** (tons/day)] * **Time till harvest** (days)

100 tons – 2 tons/day * 70 days = -40 tons (as fed) to purchase *(negative value means purchase, positive value means excess)*

Alfalfa Stand Assessment

Having the ability to evaluate this injury early in spring is helpful in making crop rotation decisions. This section will discuss factors affecting winter injury and "how to" methods to evaluate it.

How do I diagnose winter injury?

- **Slow Green Up.** One of the most evident results of winter injury is that stands are slow to green up. If other fields in the area are starting to grow and yours are still brown, it is time to check those stands for injury or death.

- **Asymmetrical Growth**. Buds for spring growth are formed during the previous fall. If parts of an alfalfa root are killed and others are not, only the living portion of the crown will give rise to new shoots resulting in a crown with shoots on only one side or asymmetrical growth.

- **Uneven Growth**. During winter, some buds on a plant crown may be killed and others may not. The uninjured buds will start growth early while the killed buds must be replaced by new buds formed in spring. This will result in shoots of different height on the same plant, with the shoots from buds formed in spring several inches shorter than the shoots arising from fall buds.

- **Root Damage.** The best way to diagnose winter injury is by digging up plants (4 to 6 inches deep) and examining roots. Healthy roots should be firm and white in color with little evidence of root rot. Winter killed roots will have a gray, water-soaked appearance early, just after soils thaw. Once water leaves the root, the tissue will become brown, dehydrated and stringy. If the root is soft and water can be easily squeezed from it, or is brown, dry and stringy, it is most likely winter killed. Also, if 50% or more of the root is blackened from root rot, the plant will most likely die during spring green up or later in the year. See UW Extension Publication A3620 for more details on evaluating root health.

Winter injured stands required different management than healthy stands if they are to stay in production. If winter injury is evident consider the following:

- **Determine yield potential.** Potential yield of an alfalfa stand may be estimated by determining the number of stems in a square foot area. Once stem number is determined use the following formula to calculate yield potential of that stand:

  Yield (tons/acre) = (Stems/ft2 x 0.1) + 0.38

  For example, an alfalfa stand with 50 stems/ft2 would have a yield potential of 5.38. Remember, this is potential yield. Soil factors, nutrient deficiency, insects, diseases and many other things may affect the actual yield.

- **Use the following guidelines to aid in making a decision about keeping a winter injured stand:**

Using Stem Density to Evaluate Alfalfa Stands	
Density (stems/ft2)	**Action**
Over 55	Stem density not limiting yield
40-55	Stem density limiting yield potential
Under 40	Stem density severely limiting yield Consider replacing

Stand and Feed Assessment, continued

Ok, I have winter injury, how should I manage the stand to minimize stress?

- **Allow alfalfa plants to mature longer before cutting.** Allowing plants to mature to early, mid or even full bloom will help the plants restore needed carbohydrates for subsequent production. How long and during which cutting depends on the extent of winter injury. For severely injured stands, allow plants to go to nearly full bloom in first cut and to early flower in subsequent cuttings. This will give these stands the best chance at survival. Stands with less injury could be harvested somewhat earlier depending on the extent of the injury. Stands with only mild injury could be allowed to go to 10 to 25% bloom at sometime during the season. It may be best to choose second or third cutting with these stands as first crop is usually the highest yielding.
- **Increase cutting height.** This is particularly important when allowing plants to flower before cutting. At this time, new shoots may be developing at the base of the plants. It is important to not remove these shoots as it will further weaken the plant to have to produce new ones.
- **Fertilize**. It is particularly important that winter injured stands have adequate fertility. Soil test and apply needed fertilizer prior to first cutting if possible.
- **Control Weeds.** Herbicide applications to control weed competition will help the stand by eliminating weeds that compete for moisture, light and nutrients.
- **No Late Fall Cutting.** Do not cut winter injured stands after Sept 1 to allow for the buildup of food reserves prior to winter unless the intent is to plow down the stand.

Overseeding Options

What Forage Species Can Be Used to Thicken a Thin Alfalfa Stand? Most producers would probably prefer to overseed additional alfalfa into a thin stand. However, overseeding alfalfa stands over one year old with additional alfalfa seed is not recommended due to the likelihood of autotoxicity issues (more info below).

Several other forage species have been utilized for thickening existing alfalfa stands, including **cereal grains** (oats, beardless barley, wheat, triticale); **annual and perennial ryegrasses; sorghum-sudangrass; orchardgrass; and red, berseem and ladino clovers**.

Choice of species to overseed into alfalfa depends on the desired forage quality, yield, and length of stand extension needed.

What can I expect for forage quality and yields? According to WI research conducted at the UW Lancaster Agriculture Research Station (Tables 1 & 2), orchardgrass, diploid/tetraploid Italian ryegrasses, or oats followed by sorghum-sudangrass all produce yields and forage quality comparable to that of a thinned alfalfa stand (less than 3 -5 plants/ft2). Sudangrass alone produces somewhat lower yields and quality, but can be an emergency choice for land that could not be planted to corn silage soon enough after alfalfa winterkill was observed or after removal of an early first crop.

Overseeding Options, continued

Table 1. Overseeding to increase yield of thinned alfalfa stands, UW Lancaster, 1997 – 1999.

Treatment	Yield	CP	ADF	NDF	RFV
	T/a, d.m.	----------%----------			
Orchardgrass	3.98	20.8	32.9	45.5	129
Italian ryegrass, diploid	3.92	20.4	33.0	45.5	129
Italian ryegrass, tetraploid	3.86	21.2	32.5	44.3	133
Oats to sorghum-sudan	3.83	19.9	33.2	46.9	125
Sorghum-sudan alone	1.95	17.4	34.4	56.8	102
LSD (.05)	0.29	0.8	1.3	1.7	6

In this study, all forages were cut 3 times by Sept. 1st in each year, except sorghum-sudangrass, which was cut twice in 1997 and 3 times in 1998/1999. Cuttings were timed to optimize forage quality and quantity. As shown in Table 2, there were significant differences only between yields for orchardgrass and sorghum alone, but no differences among forages for crude protein or relative feed value when compared to alfalfa.

Research from other states also suggests that overseeding other forages into alfalfa has potential to extend stand life one or more growing seasons, and can be considered as an alternative when economics or conservation planning require maintenance of the current thin alfalfa stand.

Table 2. Overseeding vs. alfalfa alone, UW Lancaster, 1999.

Treatment	Yield	CP	RFV
	T/a, d.m.	%	
Orchardgrass	4.78	20.5	122
Italian ryegrass, tetraploid	4.64	20.0	124
Italian ryegrass, diploid	4.64	19.5	117
Check: alfalfa alone	**4.30**	**19.5**	**119**
Oats to sorghum-sudan	4.28	18.8	119
Sorghum-sudan alone	2.14	18.5	106
LSD (.05)	0.42	1.2	9

Overseeding Options, continued

What establishment practices are recommended for overseeding alfalfa?
Research suggests that the benefits of overseeding on yield are not seen unless the alfalfa stand is less than 5 plants/ft2 or 40 stems/ft2 (1). Older alfalfa stands that carry a heavy weed load of species such as dandelion or quackgrass may be better candidates for rotation to another crop rather than for overseeding to extend the stand life.

Ideally, cool season grasses, legumes, and cereals should be overseeded in April as soon as the soil is dry enough to plant into and the extent of winter injury damage is evident. Warm season annuals such as sudangrass should be planted later, when the soil has warmed to approximately 60°F.

While a no-till drill is desirable, seeding with a conventional drill or broadcasting seed will also work. Tillage is usually unnecessary if seeding is done early enough and the soil is moist.

Suggested seeding rates and seed depth are provided in Table 3. When using broadcast seeding methods, use the higher seeding rate to ensure adequate seed.

Table 3. Seeding & fertility information for overseeding other forage species into a thin alfalfa stand.

Forage	Seeding Rate*, lbs./acre	Seeding Depth, inches	Fertility Requirements
Orchardgrass	5 – 10	.25 - .75	40 – 60 lbs. N
Italian ryegrasses	5 – 10	.25 - .75	40 – 60 lbs. N
Red Clover	6 – 10	.25 - .75	Inoculate
Oats	50 – 75	1.0 – 2.0	40 – 60 lbs. N
Sorghum-sudangrass	20 – 30	1.0 – 2.0	50 – 75lbs. N

***** Actual seeding rate used depends on seeding method—broadcast seeding should use higher rates.

Legumes added to a thin alfalfa stand should be inoculated prior to seeding to ensure adequate nodulation and nitrogen fixation. Cereals and grasses may need additional nitrogen at rates suggested in Table 3 to support yield and forage quality. If manure has been applied to the alfalfa stand during the previous fall or winter, additional nitrogen may not be necessary.

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Overseeding Options, continued

What harvest practices are recommended?
Forage from overseeded fields should be harvested at the appropriate stage for desired tonnage and quality and may be put up as greenchop, haylage, baleage or dry hay, depending on harvest conditions. Early harvest of cereals and annual grasses (prior to boot stage) will maximize quality and encourage a second cutting. Perennial grasses are usually harvested slightly later as they will need a longer initial establishment period.

Red clover can be harvested at the same times that one would harvest alfalfa to obtain highest quality. Warm season annual grasses such as sudangrass should be cut at 24 – 30 inches tall and harvested on a 30 – 40 day schedule for dairy quality forage to be fed to lactating animals. For higher tonnage or silage, harvest at a later maturity (36 inches tall for heifers or 48 inches tall for dry cows or beef cattle). Leave at least 6 –8 inches of stubble for regrowth.

New Planting Options for Forage

If alfalfa stands are too thin to overseed and you need forage, you will want to consider a new planting. There is need for forage both quickly (close to when first cutting would be taken) and for total season yield. We suggest the following for forage quickly:

1) Oats or triticale mixed with peas. This will provide the greatest tonnage in the shortest time (about July 1). We recommend 2 bu/a with 50% peas or less (down to 25%). The main function of the peas is to increase palatability and forage quality. This mixture will dry more slowly than the small grain by itself but this is not significant for haylage. 30 to 40 lb N/a should be applied at seeding.

2) Italian ryegrass seeded at 15 to 20 lb/acre. This can be seeded over just killed spots with standard drill and harvested for haylage along with whatever alfalfa is remaining. It can also be seeded over the entire field after remaining alfalfa is killed. It will yield less than (1) by July 1 (about 50% less) but will provide 3 to 4 cuts for the season and will give more overall yield for the season (unless this summer is dry). It will make good hay or haylage. Italian ryegrass dries more slowly than other grasses but can still be made into hay if desired. Nitrogen (30 to 40 lbs) must be applied at seeding because legume credits from alfalfa will not be available till mid summer.

3) Another option for quick forage is to plant sudan grass or sorghum-sudan hybrids. Sudangrasses are warm weather crops that perform best when the growing season is characterized by greater than normal temperatures. Cool conditions greatly curtail growth and productivity. These species are diverse, but generally fall into the following categories: sudangrass, or a Sorghum-sudangrass hybrid.

Sudangrasses should be seeded after the soil temperature reaches 60 to 65 degrees F. These species can be established either by conventional or reduced tillage methods. Soil pH should be between 6 and 7.5 with 6.5 being considered optimum. Seed at ¾ to 1¼" in heavy soils and up to 2" in sands. Seed sorghum at a rate of 12 to 15 lbs/a. Seed sudangrass and sorghum-sudangrass hybrids at 20 to 30 lbs/a.

If the growing season ends up being "normal" or above normal in terms of temperature, you can expect the following yields. Sudangrass: 3-5 t/a (total season yield). If planted in early June, first cutting would be in mid-July. Sorghum-sudangrass: 4-6 t/a and if planted in early June the first cutting would be in mid July.

For total season forage: Corn silage will provide the highest yield of quality forage for the season. All the alternate crops we tested yielded much less and or lower quality forage.

Seeding Back to Alfalfa

Reseeding has met with varied success due primarily to compounds produced by older alfalfa plants, which inhibit the growth of young seedlings. This process is known as autotoxicity. In this section, we will discuss what causes autotoxicity, factors that affect it, and ways to reduce the effect.

What is autotoxicity? Plants produce a wide range of chemicals aimed at defending them from attack by insects and diseases. Among these chemicals are some that inhibit the growth of other plant species. The production of chemical compounds by a plant that are toxic to members of the same species is known as **autotoxicity** Alfalfa is a plant species that exhibits autotoxicity.

What factors affect autotoxicity? Once a stand of alfalfa is killed, whether by plowing, spraying or even winterkill, the autotoxic compounds are released into the soil environment. How long they remain and what affect they have on a new alfalfa seeding is a function of soil type, temperature, and amount to rainfall

These compounds are microbially degraded and so conditions that favor microbial growth (warm, moist versus cool, dry soils) reduce the persistence of the toxins.

Tillage affects the level of toxin in the soil. More aggressive tillage will better mix and dilute the toxins. Wisconsin research showed the effects of autotoxicity to be greater in no-till fields than those moldboard plowed. Alfalfa that was planted in spring after fall killing an old alfalfa stand showed yield reductions of 30% when seeded conventionally and 40% when no-tilled.

The age of the existing alfalfa stand will affect autotoxicity. Younger plants (those one year old or less) contain less toxin than older plants. This means that failed seedings or even new seedings that winterkill can be seeded back to alfalfa with little yield reduction.

How can autotoxicity be reduced? The best way to avoid autotoxicity is to rotate to some other crop such as corn for at least a year before seeding the same field back to alfalfa. This gives the toxins time to be degraded, leached, or otherwise removed from the soil environment. If alfalfa must follow alfalfa, the best choice is to kill the old alfalfa in the year prior to seeding. The degree of toxicity is directly related to the amount of time between killing the old stand and establishing the new stand.

If alfalfa must be planted in the same year an old stand is killed, a late-summer seeding represents the best option. Planting a crop such as oats, sorghum or other early harvested crop may help in that some of the toxin may be removed through plant uptake. If alfalfa must be planted in spring following a spring killing of an old alfalfa stand, wait at least three weeks before reseeding. In all of the scenarios discussed above except rotating out of alfalfa for at least one year, some yield reduction will likely be experienced. In the case of a spring-kill followed by spring replant, serious yield reductions are possible.

Can I thicken an old alfalfa stand by interseeding alfalfa? As stands age and become thin, producers often wonder if they can be thickened by interseeding alfalfa into them. This practice has met with very little success. In part, this is due to the very competitive environment the new seedling is placed in and in part due to autotoxic chemicals secreted by the existing plants. Researchers at the University of Missouri found that new seedlings planted within 8 to 16 inches of an old alfalfa plant had significant yield reductions (2).

Seeding Back to Alfalfa, continued

Seedlings within 8 inches of an old plant did not survive (Fig.2). This means that an existing stand density as low as 0.8 plants/ft2 would be enough for the autotoxic zone to cover an entire acre. Given this, along with the potential for weed competition, interseeding alfalfa to thicken alfalfa stands is not likely to be successful and is not recommended. An exception would be large dead areas, such as from ice sheeting, or failed new seedings where only young plants (less than one year old) are present.

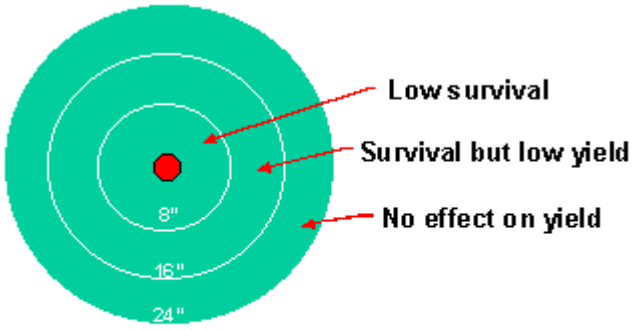

Figure 2. Zone of influence of an old alfalfa plant on new alfalfa seedlings. Source: John Jennings, U of MO

What about winterkilled stands? Plants that are healthy in fall and then winterkill will not release the toxins from the roots until they thaw. Even if thawing takes place during a winter warm up, little leaching or microbial degradation of these compounds will take place until spring. This means that the autotoxic effect of a winterkilled stand would be similar to that of a stand killed in early spring. There will be significant yield reductions if these stands are spring seeded back to alfalfa unless they are less than two years old. These stands should be rotated out of alfalfa, or late summer seeded following oats or some other annual crop.

References

Volume 5 Focus on Forage Factsheets:

Making a Feed Inventory - March, 2003. Brian Holmes; Extension Agricultural Engineer, University of Wisconsin

Seeding Alfalfa Fields Back Into Alfalfa - March, 2003. Dennis Cosgrove and Dan Undersander; Extension Forage Agronomists, University of Wisconsin

Evaluating and Managing Alfalfa Stands for Winter Survival - April, 2003 . Dennis Cosgrove and Dan Undersander, Extension Forage Agronomists, University of Wisconsin

Seeding into an Existing Alfalfa Stand - April, 2003. Rhonda Gildersleeve, Dan Undersander, and Tim Wood; Agricultural Agent, UW Extension-Iowa County, Extension Forage Agronomist, University of Wisconsin, Superintendent, Lancaster Ag Research Station