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UNIVERSITY OF MINNESOTA EXTENSION

Harvesting High-Quality Corn Silage

Proper harvest management is critical for high-quality corn silage, and it starts with harvest timing. This ensures that the harvested crop is at the optimum moisture for packing and fermentation. Silage that is too wet may not ferment properly and can lose nutrients through seepage. If silage is too dry when harvested, it has lower digestibility because of harder kernels and more lignified stover. In addition, dry silage does not pack as well, thus increasing the potential for air pockets and mold.

Optimum silage moisture at harvest ranges from 50-60% for upright oxygen-limiting silos, 60-65% for upright stave silos, 60-70% for bags, and 65-70% for bunkers. Due to variability among hybrids and growing conditions, it is necessary to measure silage moisture using a commercial forage moisture tester or microwave oven rather than simply estimating it from the kernel milkline. Instead, kernel milkline should be an indicator of when to collect the first silage samples for moisture testing.

A general guideline is to begin moisture testing when the milkline is 25% of the way down the kernel for horizontal silos, and 40% of the way down the kernel for vertical silos. Then, assume a constant drydown rate of about 0.6% per day, and measure moisture again prior to harvest.

Length of cut and crop processing are also important for obtaining high-quality corn silage. This is because breakage of cobs and kernels increases surface area; which improves digestibility, reduces cob sorting, and results in higher density silage that packs better.

Although crop processors are expensive, the higher-quality silage produced can increase milk production by 300 pounds per cow per year. The benefit of crop processors is greatest when there are harder kernels resulting from delayed harvest or drought. When using a crop processor, chopper cut length can be increased to reduce horsepower requirements while maintaining optimum particle size. For unprocessed corn, ideal chop length is 0.375" theoretical length of cut. For processed corn, recommended settings are a 0.75" theoretical length of cut with 0.08 to 0.12" roll clearance.

A 4 to 6" cutting height is generally recommended for corn silage, as it maximizes silage yield and milk per acre. However, drought-stressed corn can accumulate nitrate in the lower part of the stalk, thus increasing the potential for nitrate poisoning, particularly in older livestock on lower-energy rations. The potential for high-nitrate silage can be even worse if drought-stressed silage is harvested within 10 days of rainfall, since rainfall increases crop uptake of soil N.

Silage with high nitrate levels can be managed by dilution with other feeds or by increasing the cutting height to 12". Silage cut at this greater height has been shown to have 8% less silage yield and 2% less milk per acre. This same study found that a cutting height of 18" resulted in 15% less silage yield, 12% greater milk per ton, and 4% less milk per acre when compared to a 6" cutting height.

Increased silage quality with high cutting is due to a higher ratio of grain to stover. However, corn stalks are a good source of fiber and the lower tonnage with high-chop silage typically makes it difficult to justify in the absence of high nitrate levels.

When harvest begins, fill silos rapidly to reduce exposure of silage to oxygen and to reduce fungal growth. For bunker silos, pack silage as tightly as possible in progressive wedges in depths of 6" or less.

REFERENCES:

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Roth, 2003. www.ars.usda.gov/sp2UserFiles/Place/36553000/publications/4statePDFs/maximizingCorn.pdf

Schroeder, 2004. www.ag.ndsu.edu/pubs/ansci/dairy/as1253w.htm

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Upcoming Events

SE Forage Council & MFA Expo, Spring Valley
Dan Miller Farm
August 11, 6 to 8pm
Contact MFA Office
mfa@midwestforage.org

NCROC Beef Forage Day Grand Rapids
Thursday, August 13
10:30 to 3:00
Contact 218-327-4490

Irrigated Corn Silage Plot Tour, Ottertail City
Dan Dreyer Farm
Fri., August 28 @ 10:30am
Contact Doug Holen
holen009@umn.edu

NE Forage Council Field Day, Meadowlands
Jim Walzak Farm
Thurs., Sept. 3
Contact Russ Mathison
mathison@umn.edu

2010 MN Forage Days
Feb. 8-12, Featuring UW's Dr. Dan Undersander

Work Backwards to Adjust Feed-bunk Particle Size

When it's time to harvest haylage and corn silage, most operators will make sure the knives are set at the recommended theoretical cut for that forage**.** Theoretical cut setting affects particle size, but it's not the only factor.

Other factors that affect particle size include moisture content, crop stems, orientation of forage to the blade, knife sharpness, and setting of knives to the shear plate. Research indicates that fiber length affects forage quality, compaction for proper fermentation and prevention of spoilage during storage.

Particle size also affects rumination and buffering capacity which, if incorrect, can result in cows going off feed, low fat test, reduced milk production, DAs, laminitis, and liver abscesses. Table 1 shows the recommended particle size distribution for individual forages and TMRs using a Penn State separator with 2 sieves and a bottom pan.

Setting the knives at the recommended theoretical cut and analyzing particle size of single forages is only one step. Even if the theoretical cut during harvest is correct, the overall objective is to achieve the desired particle length distribution *at the feed bunk.*

This puts a large responsibility on the individual whose job is to mix and deliver the calculated ration on paper to the bunk. When it comes to mixing, errors can occur from the batch size being too large, trying to mix in too much hay, or mixing for too short or too long a period of time.

Table 1. Recommended particle size distribution (% as is).

Feed	Top	Middle	Bottom
TMR	7-10	45-55	40-50
Haylage	15-20	40-50	30-40
Processed Corn Silage	< 15	50-60	< 30
Unprocessed Corn Silage	< 5	50-60	< 30

Note: For a Penn State separator with 3 sieves and a bottom pan, the recommended particle size distribution for a TMR is: upper sieve 2-8%; middle sieve 30-50%; lower sieve 30-50%; bottom pan $\leq$ 20%.

It is important to check particle size % often during delivery to the bunk before the cows eat. Four samples should be taken and analyzed. Particle variation between them should be <10%. If the results are not according to recommendations, then adjustments need to be made.

Where do you start? Start at the bunk and work backwards to the harvesting process to determine where the problem lies. Test the feed refusal in the bunk and compare nutrient content to fresh delivered feed which will indicate feed uniformity. If not a problem, then check the mixer and mixing process.

If the correct amount of ingredients are being loaded and mixing times are appropriate, determine if there is a storage or moisture-content problem. With tower silos, determine if the unloader and/or blower are chewing up particle length and need adjusting.

Then check the settings on the forage harvester. Perhaps for the next crop harvested a slightly larger theoretical cut is needed. Forages should also be analyzed for particle size during harvest to determine if adjustments need to be made.

Adjusting equipment, analyzing procedures for storing forages, following TMR loading and mixing protocol are all important. Keep in mind that …*it's what the cow is actually consuming that is important for any decision regarding fiber length.* That's why I believe we should "Work Backwards to Adjust for Particle Size" to solve these problems on the dairy farm.

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Late-Season Perennial Forage Harvesting/Grazing

Balancing late summer and autumn forage supply needs and opportunities with winter injury potential requires good management of both harvested and grazed perennial forages.

Grass residual height. Pasture forage supply is often limited in late summer, so the temptation to graze pastures closely is strong. However, cool-season perennial grasses need a minimum residual height of 3-4" to have vigorous regrowth and good winter survival potentials. This minimum residual height is equally important with grass and grass/alfalfa stands harvested for hay or haylage.

Rest/recovery interval. In late summer and autumn, perennial legumes and grasses require ~30-45 days of rest between harvests/ grazings and/or before a killing frost to accumulate adequate reserves for winter survival and regrowth vigor. Stockpiling late summer and early autumn growth of perennial grasses for grazing in mid-late autumn provides this rest opportunity, as does allowing alfalfa to become well-flowered and shoot initiation of crown buds to begin.

Occasionally, hayfields and pastures harvested in mid/late-autumn are somewhat slower to recover the following spring than those left unharvested. However, the overall economic benefit of the quality forage gained in mid-autumn vs. slightly delayed forage development next spring should be considered. When perennial forage stands, particularly relatively younger stands, have been managed well (e.g. variety selection, fertility, rest intervals, residual heights), winter injury potential after mid-autumn harvest is usually minimal.

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Alfalfa Weevil: A Lesson on the Natural Environment

Alfalfa weevils have been a persistent pest problem of alfalfa in the west-central counties of Minnesota in recent seasons. In 2009, significant infestations were detected and treated during mid-June, reaching economically damaging levels after 1st cutting had been completed.

Weevil infestations typically impact 1st-cut hay more than the regrowth, but this is not always the case. Are we seeing a change in biology of the weevil, or were these events predictable?

The Alfalfa Weevil's Life Cycle: Alfalfa weevil has only one generation per year. The adults (Figure 1A) emerge from the pupae in our fields by mid-summer. They overwinter as adults in plant debris, woodlots, ditch banks along field margins and other protected areas. Though they may lay eggs in the fall, the cold winter temperatures of the north should kill those eggs.

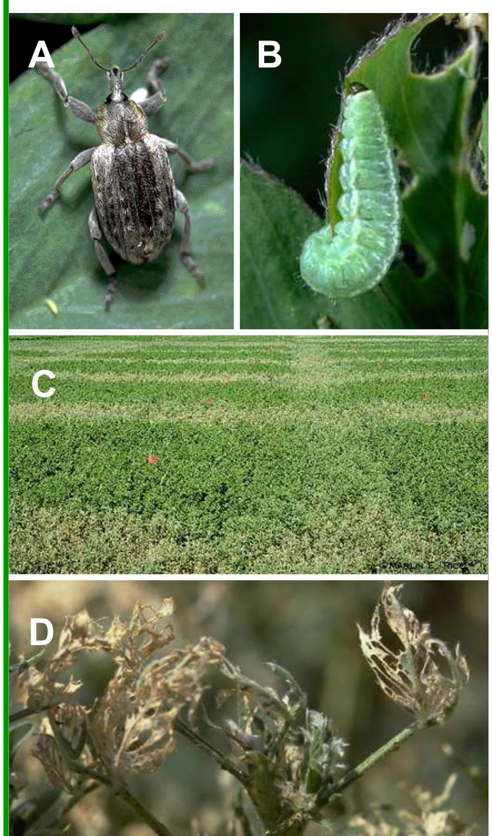

Figure 1. Alfalfa weevil adult **(A)**; larvae with its black head and white stripe **(B)**; feeding damage in untreated alleys **(C)**; and, close-up of leaf skeletonizing **(D)**.

Egg-laying in the spring is the source of new infestations. Egg-laying typically begins at 53˚F, a daily temperature average that typically occurs around early May. Eggs are laid in hollowed-out cavities chewed into stems by females.

As larvae hatch from eggs, they exit the cavity and move to leaf buds where they feed. The larvae (Figure 1B) grow through 4 instars, or stages. The time needed to go from egg to mature larva is 6 to 8 weeks, depending on temperatures.

Temperature Determines Development Rate: Insects are cold-blooded animals and therefore require an outside heat source to help drive physical development. The lower developmental threshold temperature for alfalfa weevil is 48˚F and was determined by controlled temperature studies in the lab. When temperatures are <48˚F, physical development of the insect is on hold. When temperatures are >48˚F, physical development/growth occurs.

The concept is referred to as Growing Degree Days (GDD) and has been used to model insect and plant growth. The faster GDDs are accumulated, the faster insects and plants develop.

Specific growth stage benchmarks are associated with experimentally determined accumulations of GDDs. Laboratory studies and field validations have determined GDD levels at which alfalfa weevils hatch, progress from one stage to the next, and when they pupate. These models were developed in the early 1970s for Midwestern populations.

Predicting Alfalfa Weevil Activity: The 2009 spring started and stayed cool. These conditions delayed egg laying, hatch, larval development, and consequently feeding and management decisions. This illustrated that crop stage and calendar dates are not always reliable indicators of insect activity.

Watch the weather and check current GDD accumulations for insight into what the populations are doing. Next year, weevil populations may or may not develop at 'normal' times during the growing season.

Nature's Control Tactics: *It can get too cold* for eggs and larvae. Eggs in stems die if the temperature drops to 10˚F. Larvae die at 21˚F. These temperatures are possible after egg laying and hatch have already begun.

In 2007, Illinois, Wisconsin and Iowa reported 100% larval mortality in when a late freeze occurred in the third week of April. Temperatures that dip below freezing may not kill all the larvae, but some mortality of small larvae can be expected, especially if the tender leaf buds where they are feeding are frozen.

Biological control:

A number of natural enemies (parasitic wasps) were introduced during the 1980s to establish a level of alfalfa weevil biological control, and resulted in five parasitoid species becoming widely established in the Midwest. However, these small wasps are sensitive to insecticide use. When alfalfa growers rely too aggressively on insecticides to manage weevil or other alfalfa pests, the "good bug - bad bug" balance can be disrupted.

Conserving these beneficial parasitic wasps is achieved by holding off the insecticide when not needed, such as using early cutting to mange weevil. Protect them by using insecticides only when application is justified to prevent economic loss.

SCOUT! SCOUT! SCOUT!

The best defense is a good offense. Know what the crop and the insects are doing before you make decisions.

A trusty sweep net is the best tool for finding alfalfa weevil early. Use GDDs to determine when to start scouting. GDDs will help you avoid starting to scout too late and/or quit scouting too early.

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Avoid Moldy Hay for Horses

At moisture levels >15%, mold can grow on hay that isn't treated with preservative (i.e. propionic acid). Mold growth produces heat and can result in large amounts of dry matter and total digestible nutrient (TDN) losses. In some cases, heating can be great enough to cause spontaneous combustion and fire.

Drying stored hay can be enhanced by improving ventilation, creating air spaces between bales, avoiding placing other wet products in the same area, reducing the size of a stack, alternating the direction of rows in a stack, and allowing ample space above a stack of bales (moisture tends to move up and out the top of a bale stack).

Molds commonly found in hay include *Alternaria*, *Aspergillus*, *Cladosporum, Fusarium*, *Mucor*, *Penicillium*, and *Rhizopus*. These molds can produce spores that cause respiratory problems and colic in horses, and under some conditions mycotoxins.

Horses are particularly sensitive to mold spores. Inhaling these spores (and dust) can result in a respiratory disease called Recurrent Airway Obstruction (RAO), commonly referred to as heaves. Some horses are very sensitive to certain mold spores, while others seem to be unaffected. Among sensitive horses, symptoms vary. To decrease exposure and symptoms, sensitive horses should spend more time outdoors, including feeding if possible.

Other ways to reduce exposure are: 1) use rubber mats instead of other potentially dusty bedding; 2) don't feed dusty and moldy hay and grains—hay baled for horses should be less than 15% moisture; 3) keep horses out of the barn while cleaning and riding; 4) feed horses outdoors if possible; 5) soak dusty hay in water before feeding sensitive horses; 6) if possible, store hay in a well-ventilated, separate building away from horse boarding and riding; and 7) if the horse is housed indoors, ensure that there is good ventilation through the barn.

In summary:

Most molds are naturally occurring in hay and are usually harmless if consumed in small quantities.

Molds consumed by sensitive horses or in large quantities can lead to respiratory problems and possibly colic.

If a forage-mold analysis confirms a moderate to high level of mold, or if the hay is visually (or detected by smell) moldy and/or dusty, do not feed it to horses.

High moisture at baling is the leading cause of moldy hay. Hay baled for horses should be <15% moisture.

Improving ventilation, creating air spaces between bales, avoiding placing other wet products in the same area, reducing the size of stacks, alternating the direction of rows in a stack, and allowing ample space above a stack will encourage drying and reduce mold growth.

To confirm mold species, counts, and mycotoxins, test moldy forage at a commercial forage testing lab.

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Renovation/Summer Seeding Management

When moisture and soil fertility are adequate, August is a good time to seed perennial grasses, alfalfa, and alfalfa/grass mixtures. In tilled seedbeds, perennial forages should be seeded by early August in northern MN, and by mid-August in southern MN. Cold-tolerant grasses like smooth bromegrass and timothy can be seeded as late as ~Sept. 1. No-till seedings can be done a bit later than seedings into tilled seedbeds.

Late-summer/autumn is also a good period to begin pasture renovation. Perennial broadleaf weeds can be controlled with herbicides, and lime and fertilizer applied based on soil tests, to provide a favorable environment for no-till establishment of legumes and high-yielding grasses next spring. These pastures can also be intentionally overgrazed this autumn (observe herbicide grazing restrictions) and/or fed on this winter to make them less competitive with seedlings introduced next spring via frost seeding (March) or no-till drilling (April).

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