Cut Hay-Making Risks With This Seven-Step Plan

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MERCER — Far too many farmers and scientists see nothing but uncertainties when it comes to forage harvest. When should I cut? If I cut now, what will be the weather during drying? If I wait, will quality be higher than if the hay is rained on now? Would it be better to store as low moisture silage, or bale? When should I bale?

Those are some of the traditional questions. More recently some have been added to them. Should I use a drying agent, a preservative, or both? Which one should I use and how much?

We have devised a seven-step plan in Wisconsin that can turn these and other uncertainties into risks that can be ensured against and be managed. Generally, making low-moisture silage is the best way to manage these risks, especially with the first cutting, or cutting made in the fall.

With this hay making plan you may not always be able to make hay in a day, but you will better know what you are doing when you follow it. And, you should be able to harvest a high-energy and high-protein crop for feed and for sale.

Right day to cut?

The greatest uncertainty associated with hay and low-moisture silage production is the weather. The crop is ready for harvest of high-quality forage now. How much quality do I lose for each day I delay cutting? Is it better to cut a little early or a little late to avoid wet weather? Will the rain hold off until the crop is dry enough to bale or ensile?

It takes about 30 sunshine hours to field-cure non-conditioned hay in the Midwest. In spring this is about 4 days. It increases to about 3 days in the summer. Check your weather records to determine the uncertainty (chances) of receiving 3 or 4 days without rain. In Wisconsin this is about a 25% chance-pretty low betting odds.

Effective mechanical conditioning may remove up to 2 days from this drying time.

Dry matter losses in the field range from 16 to 50 percent, depending on when and how much rain occurs, the moisture content, and the type of bale.

Quality losses may be even greater. Wisconsin studies show that 1 inch of rain in the first 24 hours after cutting reduced carbohydrates (TNC) 20%, increased neutral detergent fiber (NDF) 20%, and dropped relative feed value (RFV) on early cut alfalfa 14%.

The same amount of rain on nearly dry hay reduced TNC 56%, increased NDF 45%, and lowered RFV of the same alfalfa by 30%.

Energy was leached out, leaving a higher concentration of fiber which resulted in lower digestibility and intake. These losses occur in the form of leaf loss, respiration, and leaching of nutrients from the plant.

Your conditions may not be the same as they are in Wisconsin. Your weather may be more predictable; or perhaps less predictable. You may be less likely to have grass or weeds mixed with your legumes. Even so, much of this plan will still be valuable to you.

The plan

The plan involves seven steps that integrate known technology into a system that elminiates as many days of field drying as possible. If we can eliminate 3 days of drying, the remaining day becomes only a "risk" which can be managed for. Here is the plan:

1. Cut early

Forages must be cut early (bud stage for alfalfa, as heads emerge from the boot for grass, etc.) to obtain optimum feed value, animal performance, and/or price. There is no substitue for this first step.

As the accompanying table shows, digestibility dropped about 0.4% per day and intake per percent body weight dropped about 0.04% per day, resulting in a loss of 1 lb. of milk per day, when alfalfa was left growing after the bud stage of maturity. In this study, bud-stage alfalfa was worth $156, $186, $207, and $331 per ton when fed to cows producing 80 to 100 lbs. of milk per day on 80:20, 63:37, 46:54 and 29:71 forage; grain rations, respectively, and where mid-bloom alfalfa was given a zero value.

Farmers often delay cutting after the crop is at the proper stage hoping for "better weather." However, a study in New York showed it was more advantageous to cut early and take a chance on the weather than to wait until the crop matured and lose most of the quality produced. Cows fed early cut, weathered hay produced 4 more pounds of milk per day than those fed late-cut, non-weathered hay.

Using newer technological advances in a hay making system can help farmers capture the higher feeding value available in early cut forage without experiencing the field and weathering losses from rain.

Hay auction prices range from $16 per ton for manture hay (low in quality according to Wisconsin Quality Tests) up to $185 per ton for high-quality hay. So whether you feed the hay or sell it, you are far better off to cut it as early as you can.

2. Condition the crop

Leaves dry rapidly; intact stems do not. Unless you do something to crack those stems open so the moisture inside can get out, you will have many of the leaves on the ground before the stems are dry enough to bale or ensile. The result will be a forage made up mainly of stems. However, crushed stems-even large ones-will dry almost as rapidly as small leaves.

Even if leaves remain on the stems, their quality will be higher if they dry quickly. At 80% moisture when cut, respiration will cause a 2% loss of feed value per hour. However, at 30% moisture this loss is zero.

Conversely, mechanical loss of leaves and fine stems range from 0.5% of the dry matter per treatment or operation at 80% moisture, and will increase to 2.5% of the dry matter per treatment at 20% moisture. Thus, the farmer needs to have the forage dry rapidly with little mechanical movement.

As well as cutting the crop early in its growth cycle, cut it early in the day and crimp it so it will have ideal conditions in which to dry. A crop that is cut in late afternoon or evening will do little or no drying through the night, but lots of respiring. Your losses can be high.

The conditioner works best when the roll speed is 2 to 3 times faster than the ground speed. Set the tension so that the stems are being cracked. Meshing or fluted rolls should not touch. See the operator's manual for proper adjustment of your machine. Have you checked your conditioner lately?

3. Use a drying agent, too

Using a dessicant, or drying agent, as it is sometimes called, along with mechanical conditioning can reduce the moisture content an additional 2 or 3 percentage points to as much as 10 percentage points during a 24-hour drying period. This dessicant or chemical conditioner is applied to the entire stem and leaves as the crop is being mowed.

Several chemicals can be used for chemical conditioning. These include potassium and sodium carbonate (both alkaline salts) and sodium silicate. These are all naturally occurring salts.

Some other products containing methyl esters of fats, vegetable oils, and animal fats to enhance the rate of drying are under study for possible use as dessicants. Recent research in Michigan has shown that these products work no better than potassium or sodium carbonate alone.

Since the crop is standing when dessicants are applied and won't be cut until a few milli-seconds later, some dessicant materials may be labeled by the EPA as pesticides because of claims made by the companies. Check with your state regulatory authority for their interpretation of this point.

Dessicants are most effective when applied as a spray at the mower-conditioner. Some researchers have suggested placing the spray nozzles behind the reel and ahead of the conditioning rollers. It is difficult for the operator to monitor the nozzles when they are there, so application may not be as uniform.

A roller conditioner works better than a flail-type conditioner for this purpose. The rollers seem to help spread the materials evenly across the surface of the cut material.

The application rate should be at least 30 gallons per acre for good coverage, which means you need to haul a lot of water to the mower and through the field.

Recommended amounts of chemical include 5 lbs. of potassium carbonate in 30 gallons of water to 7 lbs. of either potassium carbonate or sodium carbonate per acre in 30 gallons of water. We suggest 7 lbs. The cost of potassium carbonate ranges from about 25¢ to 45¢ per lb. Thus, the recommended application would cost between $2 and $4.50 per acre, which would work out to about $1 or $1.25 per ton of forage harvested.

When relative humidity was 80%, we found no practice will speed the drying process. But when humidity was 20%, all treatments were equal in enhancing the drying of the forage. They have been more effective in second and third cuttings than at the first.

Chemical conditioners vary in performance mainly because of environmental conditions. Sunlight, humidity, and wind are the keys. If laundry won't dry on a clothesline on a particular day, hay will not dry in the field that day; it is as simple as that.

Any cut hay will rewet to some extent from dew through the night. Studies have shown that crimped hay and chemically treated hay seems to rewet faster during the night. It will dry out faster again the next morning after the sun comes up, however.

4. Windrow design

Crimping and chemical dessicants will permit water to leave plant stems rapidly. Heavy windrows, just like clothes piled in a basket, inhibit this moisture from dissipating into the air. In a Wisconsin study, two windrows, one twice as wide and thick as the other, had moisture concentrations of 67% and 25% respectively, 7 hrs. after cutting.

To continue the analogy of clothes drying for a moment; clothes will not dry when they are piled in the laundry basket; they need to be spread out on the line. In the same way, a narrow, thick windrow will not allow hay to dry nearly as rapidly as will a wide, thin one that exposes more of the forage to sunlight and drying winds. Make your windrow just as wide and thin as your baler or chopper can handle.

To avoid leaf loss, do not turn or ted hay after the moisture percentage falls below 40 to 50%.

5. Know the moisture

Don't guess the moisture percentage; measure it so that you can know for certain. Several electronic devices are available, but we believe you can best use the oil bath method or a more desirable microwave oven method. Specifics on these methods are available from county extension offices or the ag bulletin office in Wisconsin and many other states.

You won't be able to apply the proper rates of preservatives & spoilage will occur if you don't know the moisture percentage. Check several places in the windrow because dandelions and other weeds will cause a variation in moisture.

6. Bale at higher moisture

Use of chemical preservatives such as propionic acid allow you to bale at higher moisture percentages than you can without them. This, too, lets you get the hay out of the field more quickly. Research in Michigan, Minnesota, Pennsylvania, and Wisconsin has come up with the following guidelines for preservative use:

- High-moisture alfalfa hay(25 to 30% moisture) treated with an adequate amount of organic acid preservatives and baled properly, had quality comparable to that of heat-dried hay.

- When preservatives were used, harvested yeilds averaged 140 to 300 more pounds per acre because the hay had experienced less field loss due to leaf shatter and reduced exposure to adverse weather.

- Chemically treated hay had less temperature rise in storage than untreated hay baled at the same moisture. Thus, heat damage was reduced. When 25% moisture hay was stored without preservatives there was usually mold growth.

- Hay in small bales continues to dry in storage until it reaches an equilibrium moisture of about 11%. There is, of course, shrinkage during this moisture loss, so it is not recommended that you bale if the moisture is greater than 30%.

- Treating and baling at 25 to 30% moisture allows the operator to start baling earlier in the morning and to continue later into the day. Baling with perservatives can begin 12 to 24 hours earlier than baling without preservatives.

- Some growers consider big-bale silage to be a short-term alternative if rain threatens. Large round bales can be baled at 40% moisture and either stacked and covered or stuffed into individual plastic bags. Although other articles published in this magazine have outlined advantages for this practice, there are also disadvantages. For one, these bales tend to flatten out and fall apart. You need nearly twice as much twine to maintain a firm package. Silage bales also are difficult to move. Bag quality is a major drawback. Some have small holes even when new, and some will split at the seams or tear quite easily. Sunlight (ultraviolet radiation) can cause deterioration of some types of plastic. All of the above can lead to spoilage. Scientists in Kentucky have found that fermentation is poor. Thus, preservatives are probably needed. If rain is approaching, though, you could apply acid at the 2% rate (40 lbs. per ton) and store 40% moisture hay in large plastic bags if you are mindful of the above precautions.

7. Mow drying

Some growers are including mow drying to help assure high-quality hay. Adding mow or barn drying to the haying system- using unheated air - appears to be an important component for certain areas, such as northern U.S., where seasons are short, rain is frequent, and temperatures are relatively low. The addition of heat from a solar collector or other sources may further reduce drying time.

In some areas where it was possible to make only two hay cuttings per season, the operators are making three cuts and storing as low-moisture silage instead of hay. The same three cuts could be accomplished by baling at high moisture contents, using a preservative, and barn drying.

Mow drying has a number of advantages:

- Bale at 30 to 35% moisture to reduce leaf shatter.

- Cut preservative rates in half if they are applied properly.

- Permit proper curing of hay that varied in moisture when baled.

- Solar drying can permit greater flexibility in the system.

-Both large round and small square bales can be dried if the equipment is properly designed.

If you go this round, don't put more forage in your dryer than you can dry in 4 to 6 days.

The costs of mow or barn dryers can vary. One Wisconsin farmer put a dryer in his mow for a total investment of $4,000. This averaged out to $3.50 per ton of hay. Another spent $26,000 giving him a fixed cost of $15 per ton.

Design the dryer to deliver no less than 500 cubic feet of air per minute per ton of stored hay. The cost of electricity for the fan averages $3 to $3.50 per ton.

Economics

The costs and return from this system are outlined in an accompanying table. As you can see, using the cost assumptions that we did, the system will not pay for itself when there is no rain and is barely economical when there is

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Alfalfa quality and relation to animal performance.

Stage of quality	CP	Composition-% ADF	NDF	DDM %	DMI %Bwa/lbs/dy.b	4% FMC
Pre-bloom	21.1	30.2	40.5	62.7	2.08	87.1
First flower	18.9	33.0	42.0	61.6	1.97	77.2
Mid-bloom	14.7	38.0	52.5	54.8	1.48	66.2

a/with 20% Concentrate
b/with 54% Concentrate

Kawas and Jorgensen
UW-Dairy Science