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G88-874 Management Tips for Round Bale Hay Harvesting, Moving, and Storage

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Management Tips for Round Bale Hay Harvesting, Moving, and Storage

This NebGuide discusses management of hay harvesting with a large round baler. Specific management practices are necessary to maintain hay quality and minimize hay loss during harvest, transportation and storage of large round bales.

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Large round bale packaging systems allow one person to harvest, store and feed large quantities of hay for small as well as large acreages. Good management is required to maximize effectiveness. Losses in baling, transportation and storage of large round bales can far exceed the losses of rectangular bales unless the large round bale system is properly managed.

Who Considers A Large Round Bale System?

Hay producers select large round balers over small rectangular balers because of their high capacity, lower cost, and lower labor requirements. One person with properly sized equipment can usually bale, store and feed all hay for most operations.

When Is A Large Round Bale System A Poor Choice?

Major disadvantages of large round bales include poor saleability on the open hay market, poor long distance transportability, and potential losses from baling, transporting, storage and feeding. These disadvantages can be minimized with proper management.

The round shape and bale dimensions make it impossible to achieve a transport payload equivalent to small or

large rectangular bales. Long distance transport of round bales is generally impractical. In addition, there is less demand for large round bales on the open hay market than for rectangular bales. If you plan to sell or transport large round bales, consider a 4 ft. wide round bale that fits better on trucks than wider round bales.

Know your hay market and the desired package shape before selecting a haying system.

Dry matter and crude protein losses generally are greater with large round bale systems than with rectangular bale systems. This is particularly true when operating in dry, shatter prone alfalfa hay.

For example, in very dry alfalfa hay (less than 15 percent moisture content), yield losses for large round balers can exceed 25 percent, while a small rectangular baler in the same hay seldom has losses over five percent. Thus, timely field operations are more critical with large round bales than rectangular bales to minimize baler losses. Use equipment and management techniques which are specifically designed for large round bales since baling, transportation, storage and feeding losses of large round bales can be higher than with rectangular bales.

Selection of Large Round Balers

Several early round balers were "ground roll" types. These balers actually rolled up hay directly on the ground. Compared to balers with distinct bale chambers, ground roll balers tend to make a less dense bale with an irregular surface, and have a higher field loss. These bales do not weather as well and usually do not have a twine wrap.

Most current large round balers have a distinct bale chamber within the machine. This chamber is normally a fixed chamber or a variable chamber.

In a variable chamber, flat belts or chains with slats contain the bale from its initial formation until completion. It can make a relatively dense bale which has uniform density from center to outside.

In a fixed chamber baler, hay rolls within the chamber until it fills the chamber. These bales tend to have a soft core. The fixed chamber is normally confined by belts, chains, rollers or drums.

Data suggests that bale chamber losses are less for variable chamber balers with belts than for fixed chamber balers with rollers. However, rollers may require less maintenance than belts or chains.

Large round balers come in a wide range of sizes. The smallest balers produce a full-sized bale approximately 4 ft. wide by 4 ft. in diameter. The largest balers make bales nearly 8 ft. wide by 6 ft. in diameter. Bale weights vary from 500 lbs. to 2,500 lbs. in properly conditioned hay. Balers with a variable chamber produce uniform density bales in any diameter up to full size. Fixed chamber balers will not produce a maximum density bale until it reaches full size.

Modern large round balers are available with an assortment of options. Twine tie is available on almost all balers. An automatic twine wrap feature speeds wrapping. Some companies offer a system which automatically guides the baler across windrows to produce uniformly-shaped bales. Some balers eject the bale and close the tailgate without backing up the baler.

Recently, models have been introduced which contain two bale chambers. This arrangement allows a new bale to be started while a full bale is wrapped with twine and ejected, all without stopping forward travel. A bale counter, full bale warning light, and gate-closed indicator are useful options to help improve safety, the quality of the bale, and effectiveness of the balers.

Power required for large round balers varies with the size of baler, size of bale, density of bale formed, rate of bale forming, and contour of the field. As a rule of thumb, the smallest balers require 40 horsepower and the

largest balers require 100 horsepower.

Hay Preparation For Large Round Balers

The moisture content of hay entering the baler will greatly influence the amount of field loss and quality of hay after storage. This is generally more critical with a large round baler than with a rectangular baler. In particular, a large round baler will have excessive field loss when hay is too dry. NebGuide G84-738, *Management to Minimize Hay Waste*, reviews a number of factors involved in quality hay production. Following are management tips to reduce losses and improve quality for the large round bale systems:

- **Cutting** - Hay is usually cut with a sickle or drum type mower, a windrower, or swather. The cutting mechanism must be sharp and properly adjusted to cut the forage cleanly and to minimize shattering. Cut after the dew is gone and when the topsoil is dry to reduce soil compaction and to hasten hay drying. A long stubble keeps the windrow off the soil surface to aid drying and will improve subsequent pickup performance.

- **Conditioning** - Conditioning speeds drying, especially of the stem, by opening the waxy layer surrounding the stem. This can be done either mechanically or chemically. Mechanical conditioners pass hay between two rolls to crush or crimp the stem. Avoid flail type conditioners because excessive shatter losses will occur.

  Correctly adjusted conditioners maintain adequate roll pressure uniformly along the entire roll length. Apply sufficient roll pressure to the hay to cause a noticeable breaking of the stem skin, but not so much pressure that leaves are broken off. Keep the rolls clean and free of wrapped material. Check to insure that the roll has not worn more in the center than near the ends. A constant diameter roll is necessary to maintain uniform pressure.

  Chemicals for conditioning are usually applied by spraying standing hay immediately prior to cutting. Both chemical conditioning and mechanical conditioning can be used together. Best results from conditioning occur under favorable drying conditions. Some chemicals used for conditioning also may improve the palatability of the forage.

- **Tedding** - Tedding fluffs, spreads or moves the windrow of hay. Some tedders simply shift the windrow several feet onto a dryer area while others spread out, invert and/or fluff the windrow. All these operations may improve drying, but high leaf loss can occur when the tedder is aggressive. In alfalfa production, a tedder is mainly used after windrows have been rained on.

- **Raking** - Raking forms a mowed swath into a windrow, or accumulates two or more windrows into one. When possible, eliminate raking by using a windrower. A windrower may reduce time of field operations and reduce in-field losses. Windrowed hay will dry slower than hay in a wide swath.

  More leaf loss can be caused by raking dry alfalfa than by any other harvest operation. Avoid raking when the forage moisture is less than 40 percent. If the rake is PTO driven, synchronize field speed and PTO speed to provide a gentle lifting and turning action. This will avoid aggressive handling of the forage and excessive leaf loss.

- **Windrow formation** - The ideal windrow width for round balers is between one-half and near full width of the baler pickup. This width range aids uniform bale formation within the chamber.

  Make windrows as large as possible within the capacity of the baler pickup to minimize baler losses. This reduces contact between hay and the baler pickup mechanism, and reduces the number of bale turns within the chamber. Large windrows may not be compatible with other equipment or with drying strategy, so some compromise usually is necessary.

Make windrows uniform in width and uniform in the amount of hay contained to yield bales of consistent density and shape. Minimize the number of windrow ends. Field loss occurs as the bale turns within the bale chamber. Do not create unnecessary bale chamber loss by running the baler when there is no hay feeding into the chamber.

Managing Techniques to Reduce Baler Losses

Field losses of one to five percent have been measured for small rectangular balers operating in typical conditions for alfalfa hay. Under these same conditions, field losses of three to 30 percent have been measured for large round balers. Minimize this potentially high loss when using large round balers by controlling losses due to: I) moisture content of the hay, 2) the baler pickup, and 3) the bale chamber.

Hay moisture content

Hay moisture content is the largest single factor contributing to leaf loss. *Figure 1* shows the importance of baling at higher moisture contents. Hay baled at a moisture content above 15 percent has much less leaf loss than hay baled below 15 percent moisture.

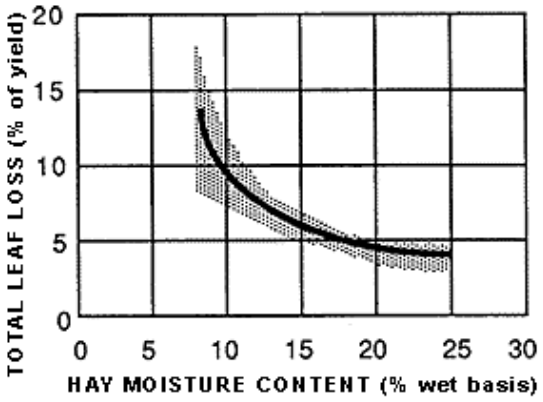

Figure 1. Leaf loss during baler operation. Accumulation of data for several large round balers over a range of hay moisture contents in fields of mixed alfalfa, crested wheatgrass and bromegrass. Data source: Prairie Agricultural Machinery Institute.

The upper moisture level depends on the type of hay, density and size of bale, drying conditions after baling, and other factors. The upper limit for moisture for large round alfalfa bales is typically 18 to 22 percent. Hay baled above 25 percent moisture will usually spoil unless chemical preservatives are added to the hay.

When the hay becomes too dry and brittle and losses become excessive, stop baling and resume in the evening or morning when the leaf moisture level increases. This dew-moistened hay can be baled at a slightly higher moisture level than when it was drying down because dew moisture in the hay is more easily released during curing than internal moisture.

Baler pickup

The baler pickup mechanism of large round balers may cause losses as high as 12 percent, although losses more typically range from one to three percent. Field speed, size of windrow, hay moisture content and mechanical condition of the pickup influence this loss.

Higher moisture content reduces pickup loss. Lower field speed in general, and synchronizing field speed to pickup rotational speed in particular, reduces pickup loss.

A correct speed match will gently lift the hay from the windrow and not push the hay or pull the hay from the windrow. Heavy windrows reduce pickup loss by reducing field speed and contact with pickup components. Do not make windrows so wide that hay is lost at the sides of the baler pickup. Check pickup components regularly for missing or bent tines and to ensure that the windrow is handled gently as it flows into the bale chamber.

Bale chamber

Bale chamber losses have been measured as high as 18 percent for large round balers. Bale chamber losses are normally two or three times higher in a large round baler than a rectangular baler. Windrow size, field speed, hay moisture content, bale rotating speed and wrapping of twine contribute to chamber losses.

To minimize bale chamber losses, the moisture content should be as high as possible that will permit safe storage, and the feed rate should be as high as possible to minimize the number of turns within the bale chamber. A high feed rate can be attained by using large windrows and high field speeds. Where windrows are small or field speeds must be low, use a lower PTO speed. This results in fewer revolutions to form a bale. PTO speed must be fast enough relative to field speed to maintain satisfactory pickup performance.

In one study of round balers, bale chamber losses were two percent of yield when the bale was formed in two minutes. When bale forming time was 13 minutes in the same hay, the bale chamber loss was II percent of yield. Since bale chamber losses typically exceed pickup losses, it usually is better to accept some pickup loss by driving faster to reduce the time required to form a bale. When wrapping twine, do not rotate the bale more times than necessary to secure the twine. The fines, primarily leaves, which fall from the bale chamber during twine wrapping are an indication of the bale chamber loss.

Large Round Bale Moving and Transportation

Losses between one and 10 percent of yield have been reported when large round bales were moved from field to storage site. Reduce these losses by spacing twine wraps six to 10 inches apart, by making a solid, dense bale with cylindrical form, and by using care in handling the bales.

Round bales can be readily handled by tractor-mounted equipment and special round bale wagons. Tractor front-end loaders can load and move large round bales, but use care to prevent accidents from tractor tipping or allowing the bale to fall or roll from the loader onto the operator. Single bales can be transported with a pickup. When transporting a large number of bales, single bale handling devices are inefficient. Tractor-powered and self-propelled large round bale loaders and transporters are available for large volume situations.

Long distance transportation of large round bales on public highways is covered by certain highway regulations. These regulations may include the maximum width, height and length of the load, the time of day it can be moved on the highway, and methods of securing the load. Current Nebraska law states that the securing device (chain, strap or rope) must be at least 1 1/2 times stronger than the weight of the load it secures. Consult the appropriate officials for the current regulations on the highways you will travel.

Large Round Bale Storage

Large round bales typically have a higher storage loss than rectangular bales, especially when stored outdoors. There are a number of storage techniques that minimize outdoor storage loss:

- **Make a dense bale** - A dense bale will sag less and have less surface area in contact with the ground. A dense surface layer will shed more precipitation and protect the inner part of the bale from weathering.

- **Use plastic twine** - Twine reduces bale sag, maintains bale shape, and provides a tight, smooth surface. Plastic twine will resist weathering, insects and rodents better than natural fiber twines. Twine should be wound tight and spaced six to 10 inches apart for best bale storage.

- **Store bales on a well drained location** - Bales soak up moisture if placed on a wet or poorly-drained site, causing a large layer of spoiled hay on the bottom of the bale. The storage site should drain away in all directions. A well drained, 4-6 in. coarse rock base will minimize bottom spoilage.

- **Store bales end-to-end**. The arrangement of large round bales in outdoor storage can significantly influence the amount of storage loss. Under most conditions, position bales end-to-end in long lines.

Orient the line northwest to southeast to allow prevailing winds to blow snow past the bales and minimize drifting and the resulting moisture soaking into the bales. Put the stem-down side of the bale to the north side of the line. The stem-down side tends to shed rain and snow better than the stem-up side. The stem-up side will then receive more sun to provide some melting and drying to lessen spoilage. If more than one line of bales is needed, space adjacent lines at least 10 ft. apart. This will minimize snow buildup between rows and allow the sun to reach the back row. Stacking large round bales usually increases losses. Stacking tends to trap moisture and limits drying action from exposure to the sun and wind.

Locate bale rows away from fences and tree lines to avoid contact with snow drifts. Keep livestock and other animals away from bales. Prevent weed growth around bales. Weeds shade the bales and can cause snow drifts.

- Indoor storage and bale covers If bales are to be marketed, stored for more than one season, or the location is in climates with high precipitation (such as the eastern two-thirds of Nebraska), indoor storage or bale covers should be considered. Remember that the outer four inch thick layer of a 6 ft. diameter round bale contains about 25 percent of the total bale volume. Studies have shown outdoor storage losses range between five and 35 percent depending on the amount of precipitation, storage site location, and original condition of the bale. Storage losses are usually reduced by approximately two-thirds with indoor storage and by one-half with good plastic covering outdoors. Beware of the side forces which stacked, large round bales can exert on the walls of storage structures.

Other References for Hay Harvesting Management:

NebGuide G84-738 Management to Minimize Hay Waste
NebGuide G76-303 Large Round Bale Safety

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