Large Hay Packages: Harvesting Through Feeding

Cooperative Extension South Dakota State University
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In a typical year, over 5 million tons of hay are produced in South Dakota. Over 2 million tons of this is alfalfa hay; a considerable part of the remainder is mixed prairie hay. Some hay is shipped and marketed, but a high percentage of it is used at or near where it is produced.

Until a few years ago, most hay was handled as small rectangular bales or large loose hay stacks. The new large hay packages offer the producer additional alternatives for hay handling. This Fact Sheet discusses some of the features and costs of these new systems as compared to the traditional handling systems. Included are some principles which apply to haying systems in general.

There are many variations of the new large hay packaging systems. Two have been selected for discussion because they are representative of the systems most commonly used in South Dakota, but this is not to imply that other systems not mentioned are inferior in any way.

The systems discussed involve the large round bales and the compressed stacks. Comparison data are also given for small rectangular bales and loose hay stacks. Some of the values presented in this report are estimates, but they are based upon the most reliable information which could be located.

With any haying system you want to minimize costs and at the same time maximize the amount of dry matter and nutritional quality in the hay. To accomplish this, you should consider your haying operation as an integrated system from harvesting to feeding. Don’t focus excessive attention on one or two aspects, while virtually ignoring others which may also greatly influence the attainment of your overall objective.

Cutting and windrowing

Since the handling system will not normally improve the nutritional quality of the hay, it is very important to start with high quality forage.

Numerous studies have shown the advantage of cutting the forage at the proper maturity level, thereby giving high tonnage of good quality material, with minimal injury to the forage plants.

Alfalfa should be cut at the first flower stage when it typically has 20% protein. If cut two weeks later, the protein content may be down to 13%.

Mixed prairie hay should be cut when the main grasses are just beginning to head, when it typically has 8% protein; late cutting can reduce protein content to below 4%. Retaining the maximum protein content in the hay may lessen the need for costly protein supplements in the feeding program.

Additional information concerning alfalfa and prairie hay can be found in the following Fact Sheets: FS 528, “Alfalfa Management on Dryland” and FS 581, “Prairie Hay at Its Best.”

The cutting and windrowing operations offer opportunities to reduce costs and retain quality. A machine which cuts, conditions, and windrows in one pass will save up to 70% of the time it would take to do these operations separately.

Curing time can be reduced 20 to 40% for conditioned hay compared to unconditioned hay.

For alfalfa and some other types of forage, it is important that the forage material be conditioned when it is in an unwilted state so that effective cracking of the stems will be achieved.

Alfalfa leaves contain 75% of the protein in the fresh cut hay. If alfalfa hay is raked, it should be done while the moisture content is above 40% to avoid severe leaf losses and consequent protein losses.

Package formers

Both the compression stackers and the large round balers pick up the hay from the cured windrow.

With the compression stacker, this hay is conveyed to a large round or rectangular container where it is continually or periodically compressed. In the periodic type units, three or four compressions have been found to be most efficient under average conditions with alfalfa hay. When the full stack has been produced, it is either ejected where it is finished or else transported to another location and then ejected.

With the commonly used round baler, the hay is picked up off the ground and fed into a baling chamber where a set of belts rolls it into a bale. When the bale has reached the desired size, twine is fed in and wrapped six to ten times around the bale, and then it is ejected.

If the hay yield is over 0.75 tons per acre, a 14-ft swather will produce a large enough windrow so that the package former will be able to process an adequate number of tons per hour. For low yielding prairie hay, research has indicated an overall advantage of cutting every other year during normal or dry periods and annually during periods of above...
average rainfall. This practice also helps provide windrows of adequate size.

With the round baler it is desirable to have a uniform windrow between 0.65 and 0.85 times as wide as the bale; for a bale 62 inches wide, the windrow should be between 40 and 53 inches wide.

If a windrow is too narrow, it will be necessary to weave sideways in the windrow in order to properly fill out the ends of the bale. If a windrow is too wide, some hay on the edges of the windrow will be missed.

A narrow windrow does not present any special problems for the compression stacker, but it is still desirable to use as wide a windrow as feasible to hasten drying. With some compression stackers, considerable operator skill is required to properly direct hay placement so that weather-resistant stacks will be formed. Poorly constructed stacks may be severely damaged by wind and rain. With both the large round bales and the compressed stacks, the importance of high density, well formed packages for minimizing storage losses cannot be overemphasized.

**Data on systems**

Information on hay handling systems is presented in Table 1. For each system, the cost per ton drops considerably in going from 100 to 300 tons per year; this drop is mostly a result of being able to spread the fixed cost of the equipment over a greater number of tons. For all tons per year included, the lowest cost-per-ton values are for large round bales. The tons-per-hour rates for the large round balers and the compression stackers are considerably higher than for the loose stackers and the small rectangular balers. The sweep and stack system requires the largest number of man hours per 100 tons. This labor requirement is a major factor which contributes to the relatively high cost per ton for the system.

The storage losses given are for all packages stored outside. Losses are less for compressed stacks and large round bales, indicating that these packages normally can be stored for reasonably long periods without excessive losses. Higher moisture contents can be used with the stacks as compared to the bales, thereby permitting a shorter drying period before packaging.

Higher moisture contents can be used in the lower density type of packages. Moisture contents higher than indicated have been tolerated under certain conditions, but risk of heating and spoilage is too great.

**Transporting**

The manufacturers supply equipment for loading and transporting the complete compressed stacks, but take care in loading and unloading the stacks to prevent damage. Sometimes the same equipment that was used in building the stack can also be used for loading and transporting it.

A wide variety of equipment exists for loading and/or transporting the large round bales. Selection of this equipment depends upon such factors as number of tons per year handled, hauling distance, and amount of time available for moving the bales. If the bales are moved during a period of the year when

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Large round bales give you the lowest cost per ton of any hay handling system. You can also harvest more tons per hour than with a loose stacker or small baler.

The compression stacker works at a high tons-per-hour rate. Storage losses are relatively low, and you can harvest at fairly high moisture content.

Loose hay requires the most man hours of all systems. This gives it a relatively high cost per ton, compared to other systems.
Table 1. Data on hay handling systems.

<table>
<thead>
<tr>
<th>System</th>
<th>Cost per ton</th>
<th>Effective rate of package (ton/hrs)</th>
<th>Labor required (man-hrs per 100 tons)</th>
<th>Storage loss (year)</th>
<th>Recommended moisture content for packaging (lb/cu ft)</th>
<th>Typical package density (lbs/cu ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100 ton/yr</td>
<td>300 ton/yr</td>
<td>1000 ton/yr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large round bale, 1250# average weight</td>
<td>$18.00</td>
<td>$9.25</td>
<td>$6.25</td>
<td>8</td>
<td>34</td>
<td>7%</td>
</tr>
<tr>
<td>Compressed stacks, 4 tons average weight</td>
<td>28.50</td>
<td>13.50</td>
<td>8.25</td>
<td>8</td>
<td>40</td>
<td>7%</td>
</tr>
<tr>
<td>Small rectangular bale with mechanical handling, 70# average weight</td>
<td>21.75</td>
<td>12.50</td>
<td>9.25</td>
<td>5</td>
<td>56</td>
<td>12%</td>
</tr>
<tr>
<td>Sweep and stack, 6 tons average weight</td>
<td>24.00</td>
<td>13.50</td>
<td>10.00</td>
<td>5</td>
<td>72</td>
<td>12%</td>
</tr>
</tbody>
</table>

Notes:
1. Cost per ton and man-hours per 100 tons for all systems are from cutting in the field through storage in the yard.
2. Inflation will result in increasing costs, but it will still be reasonable to make relative cost comparisons for a few years.
3. Storage losses given are for all packages stored outside. If the small rectangular bales are stored under cover, the typical storage loss will be 4% per year.

Time is readily available, a low rate of tons per hour transported can often be tolerated.

Storage
Large round bales need to be stored in a well drained location, but should not be stacked and should be spaced 18 inches apart to allow for good air circulation between bales. If not separated, moisture is retained and spoilage occurs at contact points. Likewise, compressed stacks need to be stored in a well drained location and be spaced at least 36 inches from one another.
Storage losses are less if the hay packages can be stored on sandy or gravelly soil rather than on heavier textured soil. For large round bales which a person plans to store for more than one year, it may be worthwhile to use non-rotting plastic twine. The plastic twine should be removed before feeding the hay to the livestock.

Feeding
Feeding the hay offers another opportunity for savings.
If cows are given free access to several weeks’ supply of hay, the amount lost is usually more than the amount consumed. If cows are given free access to anything more than a one-day supply of hay, losses increase.
The following values are based on the amount of hay that was manually removed from the ground after the cows completely finished eating; some of the lost hay may not have been recovered by this technique.
For free access to hay on hard ground, a one-day supply resulted in 11% of the hay being lost, a 2-day supply gave a 25% loss, and a 6-day supply gave a 34% loss. With soft ground or snow, considerably greater losses can be expected. A rack or electric fence can be used for controlling access to the hay.
Various suggestions in this regard are contained in the “Beef Housing and Equipment Handbook” which is published by the Midwest Plan Service.

If cows are fed a limited amount of hay per day from a small rack, check regularly to see that aggressive cows do not overeat, while timid cows are not getting enough.

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A variety of new loading and transporting equipment has been developed for small bales, taking away some of the need for part-time summer labor.
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