

LARGE PACKAGE HAY EQUIPMENT

New Concept in Hay Making

(Revision of Factsheet "Large Package Hay Equipment — New Concept in Hay Making," January 1976)

G.S. Moggach and J.K. Weeden Agricultural Engineers, Extension Branch

Big, round balers, big square balers and stackers are appealing to many Ontario farmers. Big round balers in particular are becoming quite popular in the major hay-producing counties with the stackers being accepted in Western Canada and the Western United States where precipitation is much lower.

It is quite obvious why farmers are interested in these machines because they offer a one-man mechanized low labor system (Figure 1). This is generally true of all machinery that replaces hand labor. Farming is no exception because labor is costly and sometimes not available because of the timeliness factor in most farming operations. The rate of increase and amount of increase in the cost of machinery is still less than for hand labor. This, of course, means we will continue to see an ever-increasing amount of mechanization on farms.



Figure 1. Large bales offer a one-man, mechanized, low labor system for haying

However every farm is a different situation and large package hay systems are best suited to the beef cow-calf enterprise where hay is the total roughage feed. This does not mean that such a system cannot be used in beef feedlot and dairy setups but economics is directing these farmers to store the majority of the roughage requirements as silage. Then the remainder of the hay in many cases is handled with a conventional small bale system which is already available on most farms. It is considered to be a sound economical approach for

many of these operations. The large package hay system is a completely new mechanized approach to harvesting, transporting, storing and feeding which definitely requires serious economic considerations before purchasing the equipment for this system.

OPERATING CHARACTERISTICS OF BIG BALERS

There are three basic types of large round balers as described below.

The most common type of round baler is the Expandable Chamber Round Pickup Baler (Figure 2). This type of baler picks up the windrow with a conventional tooth pickup and moves the hay into the bale chamber using rollers and belts. The hay is then compressed using belts and rollers or apron chains. As the hay is fed into the bale chamber, it expands producing a bale of relatively uniform density.

As the bale reaches the desired size, twine is fed into the chamber and wraps around the bale as it turns. After the bale has made approximately one revolution, forward travel is stopped, and twine continues to be fed in while the bale makes 6 to 10 more revolutions. After the wrapping is completed, the tailgate is raised, and the bale is ejected. The tailgate is then lowered, and a new bale is started.

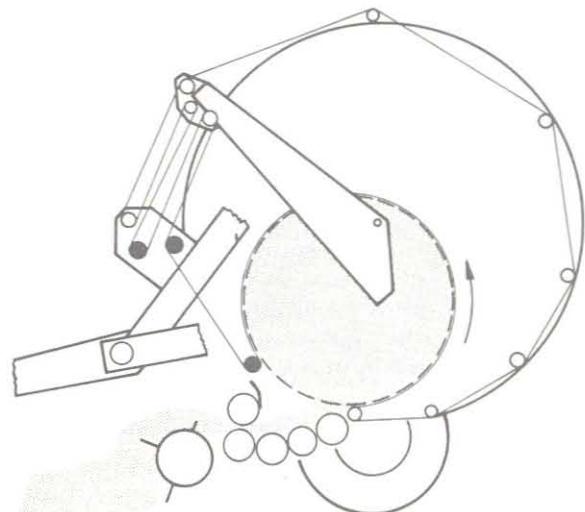


Figure 2. Schematic of an Expandable Chamber Round Pickup Baler

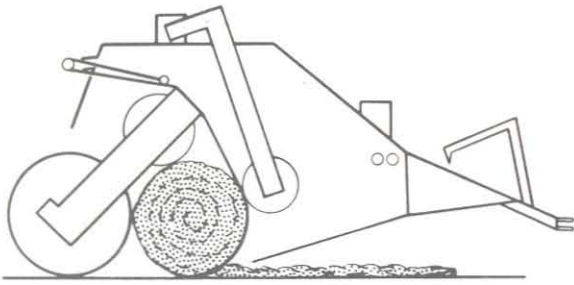


Figure 3. Schematic of a Ground Roll Baler

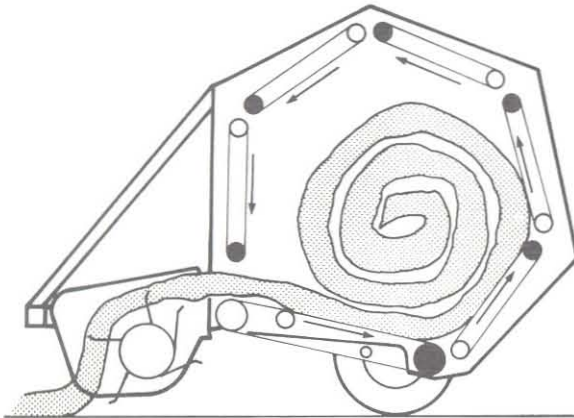


Figure 4. Schematic of a Fixed Volume Round Pickup Baler

Figure 3 illustrates the Ground Roll Baler. This type of baler rolls the hay along the ground to form the bale. Bales made using this type of baler are usually low in density and are not as stable as twine wrapped bales. This type of bale can experience significant losses during handling, transporting and storage.

The third type of round baler is based on a design developed in Europe and is referred to as the Fixed Volume Round Pickup Baler (Figure 4). The pickup lifts the hay into the bale chamber. The bale chamber, however, is of fixed volume and the bale does not take shape until the chamber is nearly full. Bales from this type of machine will have a lower density core than those produced by the expandable chamber balers. Although this type of machine has a capacity similar to the expandable chamber types, the power requirements appear to be higher.

There are two companies producing large square balers for the Canadian market. These machines produce a bale with a density similar to conventional square bales. The large bales, however, weigh from 700 to 900 kg (1500 to 2000 pounds) alfalfa hay. These bales require special handling equipment for moving and stacking. As with any large packages, front end loader attachments on small tractors require counterweights for stability.

Power requirements for large packaging machinery varies considerably from machine to machine. The desired packaging rate also affects the power requirements. The large round balers require from 35 to 70 horsepower (26 to 52 kW) with many requiring 50 horsepower (37 kW). The capacities of these balers

range from 4 to 11 tonnes (4 to 12 tons) per hour under good field conditions, and with an experienced operator. The big square balers have approximately the same power requirements and capacities as the big round balers.

Stackers appear to provide larger capacities than big round balers but power requirements can go as high as 90 horsepower (67 kW). Under good conditions, as much as 14 tonnes (16 tons) per hour can be harvested. Most stackers, however, are capable of harvesting 7 to 11 tonnes (8 to 12 tons) per hour.

Operating the Big Round Baler

Inexperienced operators starting with a new baler face many new problems not encountered with the conventional small square baler. Many of the problems arise when the operator tries to maximize capacity before he has developed the necessary skills.

Producing a uniformly cylindrical bale requires the baler to be operated alternately at both extreme sides of the windrow. Since the pickup is generally no wider than the bale chamber, precision tractor driving is a must to keep missed hay and plugging to a minimum. Where possible, a tractor with a wide wheel base should be used to avoid running on the edge of the windrow.

Starting a new bale can be difficult at times, particularly in grassy hay. If the bale doesn't start to roll in the chamber, it must be ejected and rebaled. Conditioned hay is easier to start since the stems are laid in different directions. Some self-propelled swathers, however, leave a high, narrow windrow which is not as desirable as the lower, wider windrows.

Properly tying the bale takes practice to ensure that there is adequate twine without being wasteful. Many operators have experienced problems with the twine cutters. The knives become plugged with bits of hay or twine.

A report from Western Canada indicates some problems with belt splices. This report also indicated that damp hay tended to wrap around compression rollers, forming belt rollers, platform rollers, or shafts. If this hay is not removed immediately, heat will build up resulting in fire. Therefore a fire extinguisher should be carried on the tractor.

Economic Considerations

Economic research studies indicates the following when we consider the complete system of **harvesting, transporting, storing, and feeding**.

Stacker Systems Very little, if any, economic advantage over the conventional small bale system unless more than 500 tons are harvested.

Big Round and Big Square Baler Systems Start to show an economic advantage over conventional small bale systems in the 200 ton range. Therefore, farmers **who do not** harvest this amount should seriously consider these alternatives:

- (a) Use a conventional small bale system.
- (b) Hire a custom operator.
- (c) Justify the big package system by increasing the size of livestock enterprise.
- (d) Do custom work in addition to their own so the total tonnage exceeds 200.

Storage and Feeding Recommendations

1. Research information, done at Purdue University, indicated by Figures 5, 6 and 7 is very important in selecting a feeding arrangement that will keep feeding losses to a minimum.

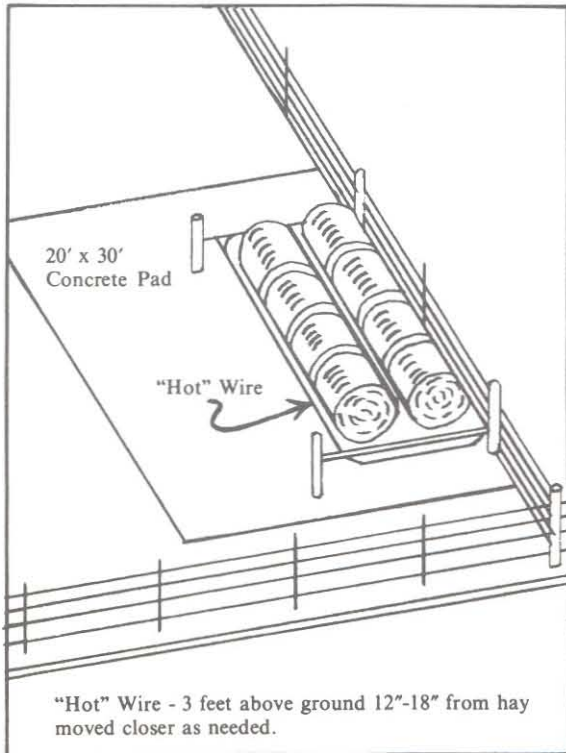


Figure 5. Vermeer bales positioning for **limit** feeding. — Less than 1% hay not eaten

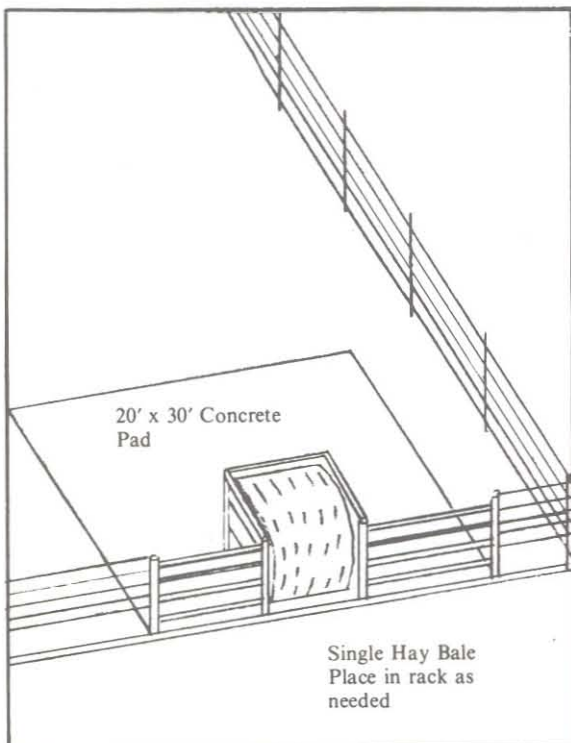


Figure 6. Vermeer and/or Hawkbit bale positioned for **self** feeding. — Vermeer Bales — 4.40% hay not eaten — Hawkbit Bales — 4.34% hay not eaten

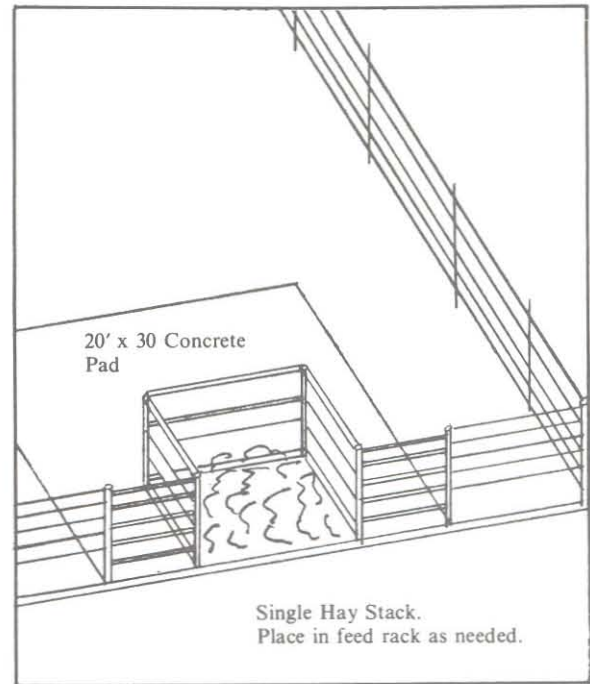


Figure 7. Feed rack for Hesston Stack for **self** feeding. Hesston Stack — 2.34% hay not eaten



Figure 8. For large bales, a well designed hay feeder placed on a concrete pad will keep feeding losses to a minimum

2. The photograph of a big bale feeder certainly indicates the importance of proper design and management (Figure 8).
3. Storage of big bales in a building is generally not economical because of the inefficient use of space due to the limitations in piling them.
4. Big bales should be stored on 6 to 8 inches of crushed stone because Purdue University research indicates a 57% reduction in loss when stored in this manner.
5. Space the rows of bales at least 2 feet apart to reduce the amount of snow piling between them and the resulting spoilage when it thaws.
6. The properly designed hay feeder should be positioned on a concrete pad (minimum size 24 feet square).
7. Slant bar feeders or a movable hot wire are very acceptable feeding methods providing a space requirement of 2 feet per cow is allowed.

8. All feeders, regardless of type should be equipped with a floor which is raised one foot above grade.

General Recommendations

1. The hay should not be baled until the moisture content is down to 20%.
2. Weathering losses range from 5 to 100% but these losses can be kept well below 20% provided the bales are stored on a well-drained area with the bale rows at least 2 feet apart.
3. The first consideration in this new system is how the hay will be fed and limit feeding on a paved area in a well-designed feeder is a must.
4. Remember the large package hay system is completely mechanical, which means that hand labor is and has to be eliminated in every phase of the system.

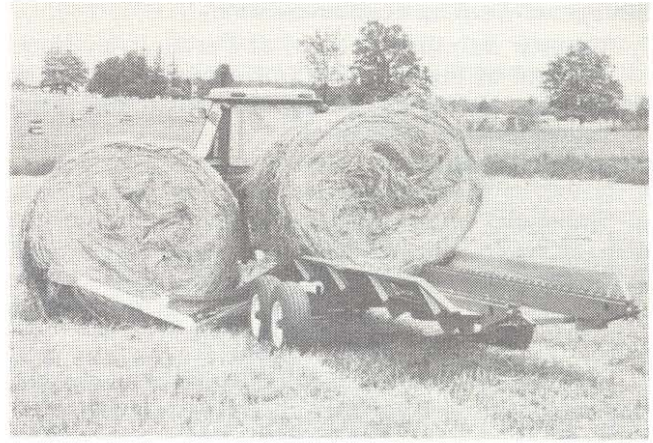


Figure 9. A bale carrier can load and transport 4 or 5 large bales