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Hay Harvesting —

Time, Labor, and Costs Vary With Harvesting Methods

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Table I.

Important Comparisons of the Hay-Harvesting Methods Upper Snake River Valley of Idaho, 1950 and 1951

Method and Equipment	Man Hours Used Per Ton	Tons Harvested Per Hour	Total Cost Per Ton
Derrick, Jackson Fork and Two Wagons	2.8	2.0	$3.62
Derrick, Slings, and Two Wagons	4.0	1.6	5.15
Derrick, Slings, Two Slips, and Tractors	2.8	1.6	4.46
Hydraulic Loader	.7	3.1	1.80
Three Man Square Baler, Derrick, Fork, and Wagons	2.2	2.5	5.31
Automatic Square Baler, Derrick, Fork, and Wagons	2.1	2.6	4.85
Derrick, Fork, and Wagons Automatic Round Baler,	2.1	2.6	4.84
Large Field Chopper, Tractors, Wagons, and Blower	1.2	2.6	4.51
Large Field Chopper, Trucks, and Blower	.8	3.5	3.47

Summary

No one hay-harvesting method is best for all farms. Pressure of other farm work, availability of labor and capital, and alternative uses of equipment are all important reasons for an operator's preference of one method over another.

A considerable variation in man hours exists among the methods used to harvest a ton of hay. In man hours, the hydraulic loader reached a low of .7; wagons-and-slings required 4 man-hours. In general, those methods in which the hay is handled loose and by hand — jackson fork, wagons-and-slings, and slips-and-slings — use more man hours per ton than do the mechanized methods — hydraulic loader, balers, and chopper.

The tons of hay harvested per hour varies a great deal among these methods. The average for all hand loading systems is 1.6 to 2.0 tons per hour as compared to 2.5 to 3.5 tons for the mechanized methods. If it is important to speed up the haying process, the mechanized methods are attractive.

The cost of harvesting a ton of hay ranges for $3.62 to $5.15 for all hand-loading systems. Of these costs, labor is the largest item of expense. It comprises a greater proportion of the total cost as the scale of operations increases. For the mechanized methods, the cost of harvesting a ton of hay ranges from $1.80 to $5.31. Of these costs, equipment is generally the largest item of expense. It comprises a smaller proportion of the total cost as these machines are used on a larger tonnage.

The low cost and high efficiency of the hydraulic loader are outstanding. The small amount of labor required to harvest a ton of hay, the large number of tons harvested per hour, and the comparatively low investment in equipment make it highly desirable. The hydraulic loader uses approximately one-fourth the labor required with the jackson fork or slips-and-slings methods but harvests twice as many tons per hour. In comparison to all balers, it uses approximately one-third the labor per ton while harvesting one-fourth more tons per hour. Compared to the chopper, it uses approximately three-fourths the labor per ton but harvests about the same tonnage per hour. However, the loader's ability to speed up harvesting can be a disadvantage. Heavy foliage losses result in the piling and storing operations unless the operator uses his best judgment.

Farm operators are usually more concerned with reducing the large amount of hard work and time involved in haying than they are in reducing costs with their present equipment. This is causing a shift from hand-loading systems to hydraulic loaders, balers, and choppers. The chopper saves the most labor; but, as is true with the automatic balers, the cost per ton is high unless it is used on a large tonnage. Like the chopper, the balers are labor saving but require more time and work per ton of stored hay. Mechanization reduces time and labor, it does not solve all haymaking problems.

Hay Harvesting —

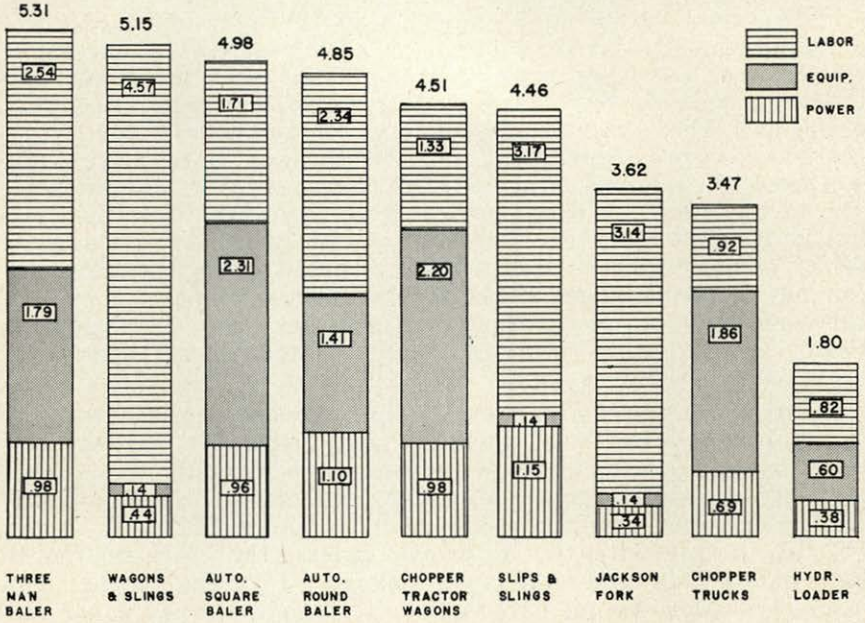
Time, Labor and Costs Vary With Harvesting Methods

by

Clyde B. Markeson*

The Problem—Hay harvesting is a major farm operation on most farms of the upper Snake river valley of Idaho and often it conflicts with other farm work demanding immediate attention. It must be completed in a relatively short period if high quality hay is to be obtained. Because little information is available as to the efficiency, operating costs, and investment of the newer as well as the older harvesting methods in the area, the information presented here was gathered from interviewing 115 farmers in the vicinity of Idaho Falls and Blackfoot in the summers of 1950 and 1951. This information makes it possible for farmers to compare the various methods and decide which is best adapted to their individual circumstances.

The term "harvesting" here means the time and costs incurred in handling the hay from windrow, pile, or shock to final storage. In comparing baling to other methods, loading, haul-



Cost of harvesting 1 ton of hay by specified harvesting methods.

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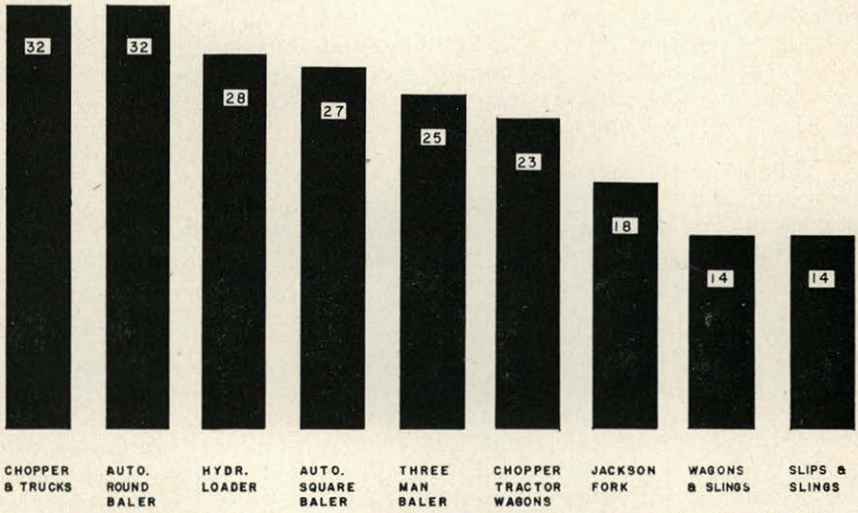
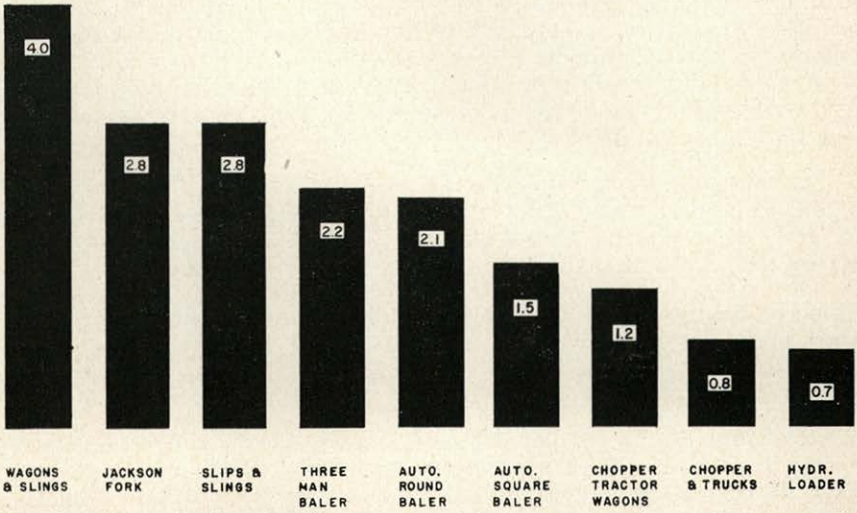
ing, and stacking time and their costs are included in the harvesting since baling and storing are done separately.

Load by Hand, Unload with Derrick

Hand loading in the field and stacking by derrick includes use of the Jackson fork, wagons-and-slings, and the slips-and-slings methods. Such methods are often used on farms having



Tons of hay harvested in a 9-hour day by specified harvesting methods.



Man hours required to handle one ton of hay from windrow, shock, or pile to storage by specified harvesting methods.

from 80 to 112 tons of hay and where family or exchange labor is available. Under these conditions, operators have a choice of using this plentiful supply of labor with little or no direct cash outlay or of purchasing or hiring a mechanized method with greater out-of-pocket costs. The advantages of these hand-loading systems are a low cash cost and a comparatively low investment. The major disadvantages are a large amount of hard hand work, a longer period of haying where the crop is large, and often the difficulty of stacking with a derrick in high winds.

Jackson Fork—A typical crew of six men and two wagons harvest an average of 18 tons of hay per 9-hour day using the Jackson fork. Hay shocked by hand is not loaded or stacked any faster than hay bunched with a dump rake. Each require nearly 2.8 man hours to load, haul and stack a ton of hay (Table 1).

The average harvesting cost is $3.62 per ton (Table 2). Labor cost represents about nine-tenths of this amount. Even though this is one of the least expensive harvesting methods, the hard work of loading and stacking is causing many operators to look for easier methods of putting up hay.

Wagons-and-Slings—Operators using wagons-and-slings involving six men and two wagons harvest an average of 14 tons of hay per 9-hour day. This is 4 tons less per day than is harvested with the Jackson fork system. There are several reasons for this. The man on the wagon must take time and care to place his slings on the wagon before it can be loaded. Loading activity must cease while the second set of slings is being placed and the loads are built higher. At the stack, loads often split and fall to the ground. This strewn hay must be removed before other wagons can pull up to be unloaded. When hooking the slings onto the cable, care must be taken to see that everything is done properly. It is not uncommon for chains to unhook and pull out from under the load. These factors are primarily responsible for the fact that this method uses an average of 1.2 more man hours per ton than either the jackson fork or slips-and-slings method.

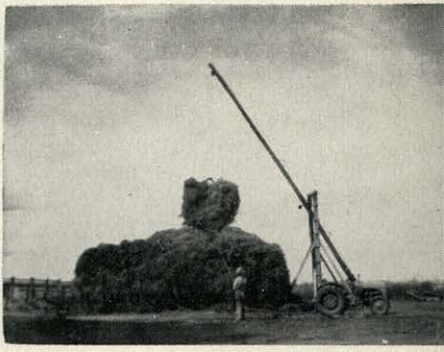
Of the hand loading systems, wagons-and-slings is the most expensive and the greatest time consumer. Of the total $5.15 cost per ton, labor absorbed about $4.57 (Table 2). The high cost per ton by this method is due to the high labor requirements.

Slips-and-Slings—This is a more mechanized way of using the sling principle and is an attempt to speed haying. Chains are placed on sleds which are in the majority of cases pulled with tractor power.

The tons harvested per day vary widely because of differences in length of haul. With an average size crew of six men and two slips, all operators harvest about 14 tons per 9-hour day. This is the same performance as the wagons-and-slings method, and 4 tons less per day than the jackson fork method. However, the hay

is generally hauled a greater distance with the slips than with the wagons.

Slips-and-slings are comparable to the jackson fork method in the use of labor. Each require about 2.8 man hours per ton (Table 1). As labor is the largest item of expense with both methods, this comparison is important. To a farmer making a choice between the two methods, labor hours should probably be of secondary consideration; investment in power and equipment should receive primary attention. There would be no advantage



Loading by hand and unloading by derrick is one of the most important ways of harvesting hay. This is usually practiced on farms having small hay enterprises.

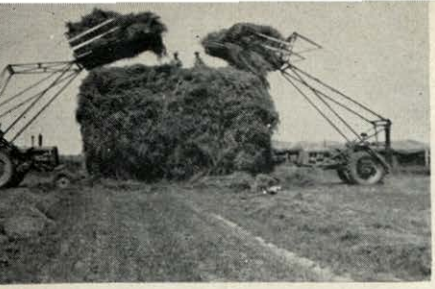
for an operator already using slips to shift to the wagons-and-slings method unless he felt the quality of hay to be better or unless adequate cheap labor is available.

Labor is the largest item of expense in harvesting with slips-and-slings. It absorbed $3.17 of the $4.46 harvesting cost per ton (Table 2). Again the high cost per ton is due to the large labor requirements.

For all hand-loading methods, roughly three-fourths of the harvesting cost per ton is for labor. If much of this labor is supplied by the family or is provided by neighbors as exchange labor, the out-of-pocket cost per ton is less than calculated here. Labor-cost reductions can be made on most farms by studying the present labor-equipment arrangement and making any necessary adjustments.

The Mechanized Methods

The hydraulic loader, the three-man and automatic square balers, the automatic round baler, and the large field chopper are the main mechanized methods of harvesting hay in the valley. Most farms having medium and large hay tonnages of 140 to more than 300 tons of hay use one of these methods. They are most economical on farms where they are used on a large tonnage or when an operator can use the equipment on his farm and do custom work on the side. This makes it possible to spread the compara-



The hydraulic loader harvests a larger tonnage per hour at a smaller cost per ton than any other method in general use. However, care must be used to prevent excessive leaf loss with this equipment.

tively high equipment costs over a larger tonnage which in turn reduces the per ton cost.

Hydraulic Loader—It is common to pile the hay before starting the actual harvest with the hydraulic loader. On such pre-piled hay a three man crew harvests 3.1 tons per hour (Table 1), or about 28 tons per 9-hour day. If the hay is picked up from the windrow, a two-man crew stores an average of 2 tons per hour or 18 tons per day.

Most farmers like the loader's performance. Many have found that its relatively small cost and many uses make it a wise investment. Others who cannot afford to purchase one alone have cooperated with a neighbor in procuring one. Its use for operating manure loaders, picking up and stacking loose pea and grain straw, hauling feed and bedding during the winter months, lifting heavy implements, and as a scaffold in painting buildings spreads out the investment and lowers the cost per ton of the hay harvested.

The most frequqently mentioned criticisms of this machine are the cost of replacing expensive teeth broken in the piling and loading operations, excessive loss of hay foliage, the danger of twisting the tractor over when the loader is high in the air, and the difficulty in pulling the hay out of the stack at feeding time. Care and skill in handling the hay and equipment would solve most of these problems. Most users agree that the performance of the loader and the quality of the hay are in proportion to the quality of judgment exercised by the operators.

Cost of harvesting with this method is $1.80 per ton for a three man crew stacking 3.1 tons per hour (Table 2). Unlike the other mechanized methods, equipment expense represents a smaller proportion of the harvesting cost per ton than does labor. A smaller investment in equipment or the harvesting of a larger tonnage per hour are largely responsible for this. Equipment accounts for nearly one-third of the total cost; labor represents slightly more than one-half.

Baling—The three-man square baler processes nearly 25 tons of hay per 9-hour day. The maximum speed of this baler is gauged very closely to the speed at which the bales can be hand tied. Each

The automatic round baler processes a larger tonnage per hour than the square baler. Cost per ton is also lower.

Table II.

Hay Harvesting Costs per Ton Upper Snake River Valley of Idaho, 1950 and 1951

Method	Cost Per Ton*			Total Cost Per Ton	Tons Harvested Annually	Typical Number Of Men In Crew
	Labor	Power	Equipment			
Jackson fork	$3.14	$ .34	$ .14	$3.62	86	6.0
Wagons and Slings	4.57	.44	.14	5.15	80	6.0
Slips and Slings	3.17	1.15	.14	4.46	112	6.0
Hydraulic Loader	.82	.38	.60	1.80	139	3.0
Three Man Baler						
Bale	124	.43	1.65	3.32		3.0
Haul and Stack	1.30	.55	.14	1.99	190	4.0
Total	2.54	.98	1.79	5.31		7.0
Automatic Square Baler						
Bale	.41	.41	2.17	2.99		1.0
Haul and Stack	1.30	.55	.14	1.99	272	4.0
Total	1.71	.96	2.31	4.98		5.0
Automatic Round Baler						
Bale	.32	.34	1.27	1.93		1.0
Haul and Stack	2.02	.76	.14	2.92	134	4.0
Total	2.34	1.10	1.41	4.85		5.0
Large Field Chopper and Tractors						
Chop	.58	.38	1.44	2.40		2.0
Haul and Stack	.75	.60	.76	2.11	325	2.0
Total	1.33	.98	2.20	4.51		4.0
Large Field Chopper and Trucks						
Chop	.47	.35	1.44	2.26		2.0
Haul and Stack	.45	.34	.42	1.21	**	2.0
Total	.92	.69	1.86	3.47		4.0

* Labor is computed at $1.15 per hour, tractor power at $1.20 per hour, horse power at $.17 per horse hour, and truck use at $1.20 per tour. Tractor and truck costs include depreciation, interest, taxes, housing, repairs, oil, grease, and fuel. Equipment costs are derived from Circular No. 868, United States Department of Agriculture, Bureau of Agricultural Economics, June, 1951.

**Tonnage harvested per year is not given. However, it is safe to assume that those chopping and hauling with a truck harvested a larger annual tonnage than those using a tractor for these operations.

bale is bound by two wires, the number of wires per ton depending upon the weight of the bales and the number of wires which break or are lost. Generally 50 wires are required per ton for bales weighing from 80 to 85 pounds.

The automatic square baler processes approximately 27 tons of hay per 9-hour day. Each bale is wrapped and tied with twine by an automatic tying mechanism. One 20 pound ball of twine will tie about 240 bales each weighing 65 pounds.

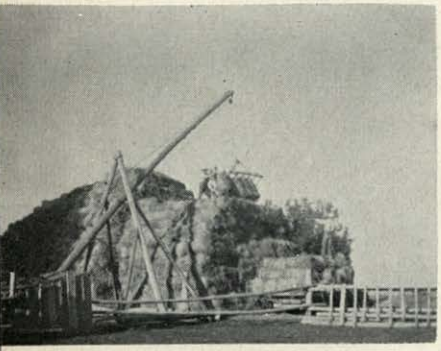
The automatic round baler operates on the rotary principle from the power takeoff. Forward travel is stopped only long enough to permit the bale to be wrapped with twine and discharged from the machine. Approximately 32 tons of hay are processed per 9-hour day with this baler.

Of all balers, the automatic round baler uses less labor, power, and equipment per ton and bales the most hay per hour. It bales .8 ton more per hour than all three-man balers and uses .08 less man

hours per ton. In comparison to the automatic square baler, it bales .6 ton more per hour.

Average baling cost is $3.32 per ton with the three-man baler, $2.99 with the automatic square baler, and $1.93 with the automatic round baler (Table 2). Equipment costs are about one-half of the total cost for the three-man baler, approximately seven-tenths of the harvesting cost per ton for the automatic square baler, and two-thirds of the cost per ton for the automatic round baler.

Each baler has its advantages and limitations. If the hay is to be shipped, baled hay is easier to handle than is loose hay. Wire-tied square bales are preferred over twine-tied square or round



Storing a ton of round bales takes more time than for the square bales. Costs rise with the additional time and labor.

bales for this purpose. The round baler is within financial reach of many operators who cannot afford to purchase either the three-man or automatic square baler. Twine-tied bales are preferred over wire-tied bales when the hay is to be fed on the place. Farmers have found from experience that wire in and around the feeding lot and on the farm causes broken machinery and loss of cattle.

Storing Baled Hay—As the harvesting is not complete until the hay is stored, it is necessary to include the loading, hauling, and stacking of bales if the requirements and costs of harvesting with the baler method are to be compared to the other methods.

With an average size crew of four men and two wagons, about 20 tons of square bales are stored per 9-hour day while 14 tons of round bales can be stored in the same period. Because of their shape, extra time and precaution must be taken in handling round bales to prevent rolling.

The per ton cost of storing square bales is $1.99 compared to $2.92 for round bales (Table 2). As storing does not readily lend

The large field chopper is a high cost machine. Its cost per ton, however, is not high on large hay enterprises.

itself to mechanization, labor is the most important cost item, about seven-tenths of the total cost for storing each type of bale. Since most farmers use a derrick in stacking baled hay, equipment costs are negligible.

It is worth noting that when the baling and storing costs per ton for both types of bales are averaged together the low cost of round baling is offset by the high cost of storing the round bales. The net result is that harvesting costs per ton of baled hay are fairly uniform regardless of bale shape.

Chopping—Operators using a tractor to pull the chopper and wagons harvest an average of 23 tons per day while those using a truck for these operations harvest nearly 32 tons. In general, when tractors are used for both operations, it takes longer to unload a ton of hay than it does to chop it. This means that there are times when the chopper has to wait for a wagon to return from the stacking area. On the other hand when trucks are used, hay can be unloaded faster than it can be chopped. The reason for this is that the trucks are generally equipped with some kind of power take-off device which speeds the unloading process.

The combined chopping and storing operations require 1.2 man-hours to harvest a ton of hay with tractors and .8 man-hour with trucks (Table 1).

There is little difference in the chopping cost per ton between these two methods. The cost is $2.40 per ton for those operators using tractors and $2.60 per ton for those using trucks (Table 2). Equipment costs represent about 60 percent of these amounts. In the storing operation the cost per ton with trucks is about 57 per cent of the cost of using tractors and wagons. With both, labor, power, and equipment are each about one-third of the cost.

Operators said that the small number of man hours required per ton, the small amount of hard work involved, the small amount of waste in feeding chopped hay, and speed in the haying operation are the reasons they prefer this method of harvesting.

The disadvantages most frequently mentioned are the high initial investment for the chopper and supplementary equipment and the high cash operating expenses. In addition, one must contend with the dust and chaff which become quite disagreeable in high winds.

Investment in Hay-Harvesting Equipment

For farmers who intend to shift from a hand loading method to one which is more highly mechanized, initial investment will receive serious thought. Here are the approximate initial investments for the more important mechanized methods. The figures for each machine includes all makes. Hydraulic loaders, $450 to $905; automatic round balers, $1200 to $1300; three-man square balers, $1500 to $1725; automatic square balers, $2300 to $2700;

and a large field chopper, $2800 to $3200. If these costs are to be charged off in about 10 years, the annual depreciation charge is quite high. This points out that it is necessary to harvest many tons per year if equipment costs are to be reduced to a reasonable cost per ton.

Recommended Methods for Various Size Hay Enterprises

If less than 90 tons of hay are to be harvested annually (up to 25 or 30 acres of alfalfa) a Jackson fork or the wagons-and-slings method would seem the best. Assuming quality of hay equal for both methods, the fork is preferred over slings. Unless a custom baler or chopper can be hired to process the hay and put it into storage for less than $4.00 per ton, it is likely that an operator can perform the job more cheaply himself.

Within a range of 90 to 150 tons (30 to 45 acres) tractor and slips, a hydraulic loader, or an automatic round baler are worth consideration. Of these methods, the loader is most economical in time requirements and costs. For those who can only afford to purchase a tractor or who already have one and cannot afford to purchase a loader or round baler, slips and slings are the only alternative. Even if the harvesting cost per ton with tractor and slips is $.84 higher than with the Jackson fork method, tractors and slips can be justified because of the greater acreages of other crops upon which the tractor can be used. From the viewpoint of ease in feeding and in hauling hay long distances, a round baler will be preferred over a loader. However, for an operator who does his own feeding and who also has plenty of time to do it, the loader should receive preference over the round baler.

The farmer who handles from 150 to 275 tons per year (50 to 76 acres) will do well to consider the square baler. As it costs approximately $1000 to eliminate the two extra men required with a three-man baler, an automatic baler must be used upon a greater tonnage of either hay or straw if the cost per ton is to be reduced to the level of the three-man baler.

Above 275 tons (75 to 90 acres), the balers cannot compete with the large field chopper. Square balers, besides requiring more labor per ton, have the ever present cost of wire and twine. This cost is, of course, in direct proportion to the tonnage processed. There is no such direct variable cost with a chopper. This size hay enterprise makes it possible to spread the high annual cost of the chopper over many tons of hay thereby reducing fixed costs —depreciation, interest—to a reasonable cost per ton.