Hay Harvesting Costs in TEXAS

TEXAS AGRICULTURAL EXTENSION SERVICE
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INTRODUCTION

Making profitable decisions concerning machinery and equipment investments is a difficult task for most producers. Farmers often are caught in the dilemma of needing to substitute more machinery for labor while being careful not to over invest in expensive equipment. Owning too much equipment can increase costs and lead to a less profitable and less efficient operation.

Texas farmers and ranchers are confronted with several methods of harvesting forage. Generally, grazing is the cheapest harvest method. However, some mechanical hay harvesting and feeding is necessary on most Texas operations.[1]

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[1] Although this material was prepared specifically for the East Texas area, it is applicable to other areas of Texas and the Southeast.

The least-cost method of harvesting forage varies with individual farm situations and sizes. This publication provides cost estimates for the more common alternatives available under comparable management and production conditions. Like most farm management problems, no single answer fits all farm situations. This analysis should work for most good producers. With mechanically performed operations, producers with higher production levels will have lower per unit costs.

In general, the livestock producer is faced with the following alternatives regarding hay production and harvest.

- Buy all hay needed for livestock.
- Raise hay, but have it custom baled and hauled to the barn.
- Buy hay baling equipment and custom haul the hay to the barn or use a machine (commonly

Hay is an important crop in Texas. Harvesting costs constitute the major expense of hay production in many areas.

called a "Bale Wagon"[1]) to haul the hay to the barn.

- Buy a machine such as the "Stakhand"[1] to put loose hay in stacks.

- Buy a machine that "bales" the hay in large round rolls.

Although machinery is expensive, it is necessary to modern agriculture. If it is used effectively, it can reduce production costs. The decision to purchase machinery depends on how it affects the overall production system and costs. Machinery should be maintained properly if it is to be used efficiently; a good driver or operator is important for long, economical use of any equipment.

An important question frequently asked by farmers concerns the size of operation required to justify owning equipment. To answer this question, an understanding of fixed and variable costs is necessary.

Fixed Costs or Ownership Costs. These costs are important in determining the profitability of owning machinery since it is often a large part of total costs. Fixed costs which include depreciation, interest, taxes and insurance are termed "fixed" because they continue unchanged regardless of how much the machine is used. Repair and maintenance costs can be partly fixed and partly variable.[2] Items of maintenance such as tires, batteries, belts, etc., could be classed as fixed costs because they deteriorate with time and use. Other repair costs result from use and can be considered variable. However, in determining whether or not to own a machine, consider repairs and maintenance as part of the total fixed costs.

Variable Costs. Operating costs occur when machinery is used. They include labor, fuel, oil, grease, minor repairs, etc.

Total Costs. The estimated purchase and maintenance costs used in this publication were obtained from local machinery dealers. Information for production rates was supplied by producers for East Texas conditions and field size. These data were the basis for the following assumptions used in the calculations:

- Average production per cutting of 70 bales or 2.1 tons per acre.

- All new equipment is purchased for harvesting hay. All fixed costs associated with these items are charged to hay harvesting.

The actual per unit costs vary among individual farms depending on yield per acre, field size, equipment care and efficiency of the labor and machinery used.

[1]"Bale Wagon" and "Stakhand" are terms most frequently used in referring to these machines. No endorsement of these brands or criticism of other brands or manufacturers' trade names is intended by the Cooperative Extension Service.

[2]Variable costs and operating costs are synonymous and are used interchangeably throughout this publication.

Baling has been the traditional means of harvesting hay. Small producers often rely on the custom operator for baling.

BUYING HAY

Few producers like to rely solely on purchased hay for their livestock program. During dry or adverse grazing periods purchased hay may be so expensive that it removes the narrow profit margin in raising livestock.

CUSTOM BALING

Many Texas livestock producers raise their own hay and rely on custom operators to bale and haul it to the barn.

The usual charge of 40 cents per bale for baling and 20 cents for hauling varies depending on locality. Many producers have highly desirable arrangements with custom operators and find their use is more convenient and less expensive than owning baling equipment.

Other producers of the same size prefer to own a baler because of convenience and the assurance that they can bale their hay when it is ready rather than when they can schedule a custom operator. Harvesting timeliness is important for good quality hay high in protein.

If the cost of owning equipment is estimated near custom rates, the producer must base his decision on personal preference and convenience. In choosing a harvesting method also consider differences in forage waste and possible excess consumption by livestock. These factors differ for various hay packaging systems. This consumption-nutrition problem is not covered in great detail in this publication.

Labor shortages are forcing producers to mechanize hay hauling and handling.

OWNING HAY BALING EQUIPMENT

Two tractors usually are needed for baling. Most small livestock producers own one tractor even though they use custom balers. An additional tractor must be purchased if other hay harvesting equipment is purchased. This additional tractor may be used for other operations, but the equivalent of one full-time tractor should be charged to hay harvesting.

Fixed Costs. The following prices were used for calculating equipment costs. All machinery was assumed to have a 10-year life. These costs are shown in table 1.

Tractor. A diesel tractor (40-horsepower) with live power take-off will cost $6,500 and have a salvage value of $1,200. One probable overhaul will cost $450. Other major repairs, such as clutch, etc., also will be approximately $450. New tires, replaced once, will cost $310. These repair costs total $1,210 and will be incurred only once in the 10-year period. Other miscellaneous repairs will run about $125 annually, making average annual repairs $246.

Mower. An 8-foot sickle mower costs about $1,100. It requires about $187.50 yearly for maintenance and repairs.

Rake. Cost for a PTO, 8-foot, 3-point mounted rake was estimated at $1,000 with an annual repair cost of $135.

Baler. Purchase price is estimated at $3,800 with annual maintenance of $275.

Operating Costs. Estimates from producers show that an average of 15 acres can be mowed in a 10-hour day. About 25 acres can be raked and approximately 17 acres per day can be baled. One and one-half gallons of diesel fuel at 38 cents per gallon are burned during each hour of operation for baling, cutting and raking. Change oil and filter every 300 hours at a cost of $8.40 per change. Hourly operational costs for diesel, oil and filter are approximately 60 cents. Labor cost was calculated at $2.50 per hour. Total operating cost, including labor and all equipment use, was $9.02 per acre or 12.9 cents per bale (as shown in table 2). Assuming an average yield of seventy 60-pound bales per cutting (2.1 tons), the operating cost will be $4.29 per ton.

Table 1. Estimated fixed costs of owning and operating hay baling equipment

Item	Cost	Annual depreciation[1]	Annual repairs	Interest[2]	Taxes and insurance[3]	Total annual fixed costs
Tractor	$ 6,500.00	$ 530.00	$246.00	$325.00	$ 81.25	$1,182.25
Mower	1,100.00	110.00	187.50	55.00	13.75	366.25
Rake	1,000.00	100.00	135.00	50.00	12.50	297.50
PTO Baler medium	3,800.00	380.00	275.00	190.00	47.50	892.50
Total	$12,400.00	$1,120.00	$843.50	$620.00	$155.00	$2,738.50

[1]Estimated useful life of 10 years on all equipment. Assumed salvage value of $1,200 on the tractor with zero salvage value on other equipment.
[2]New cost × 10 percent × ½.
[3]New cost × 1.25 percent.

Table 2. Operating cost per acre and per bale for various hay baling operations[1]

Operation	Times over	Labor hours per acre	Equipment hours per acre	Labor and operating costs		
				Per acre ($)	Per ton ($)	Per bale (¢)
Mowing	1.0	1.0	0.7	2.92	1.39	4.2
Raking	1.0	0.5	0.4	1.49	.71	2.1
Baling	1.0	1.0	0.6	2.86	1.36	4.1
Twine	---	---	---	1.75	.83	2.5
Total		2.5	1.7	9.02	4.29	12.9

[1]Average yield of 70 bales per acre per cutting. Assumes cost of 60 cents per hour for oil, filter and fuel and $2.50 per hour for labor.

Table 3. Estimated cost per ton and per bale of baling hay at various acreages when all machinery is owned[1]

Amount harvested annually			Average fixed costs		Average operating costs		Total cost for fixed and operating expense	
Acres[2]	Tons	Bales	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)
30	63	2,100	43.47	130.4	4.29	12.9	47.76	143.3
100	210	7,000	13.04	39.1	4.29	12.9	17.33	52.0
144[3]	303.2	10,105	9.03	27.1	4.29	12.9	13.32	40.0
150	315	10,500	8.69	26.1	4.29	12.9	12.98	39.0
300	630	21,000	4.35	13.0	4.29	12.9	8.64	25.9
600	1,260	42,000	2.17	6.5	4.29	12.9	6.46	19.4
1,000[4]	2,100[4]	70,000[4]	1.30	3.9	4.29	12.9	5.59	16.8

[1]Average yield of seventy 60-pound bales per acre per cutting. An additional 20 cents per bale, $14 per acre or $6.67 per ton will be required to haul and stack the hay, if custom hauling rates are used.

[2]Acres harvested one time over. One acre harvested three times would be the same as 3 acres harvested one time.

[3]This volume represents the break-even point for ownership of hay baler and associated equipment when the custom baling rate is 40 cents per bale.

[4]70,000 bales should be the maximum average annual capacity on one baler when weather and downtime are considered.

Total Baling Costs. With operating costs for labor, fuel, gas, etc. of $4.29 per ton and an average of 70 bales per acre for each cutting, the operating costs will be 12.9 cents per bale. At a cost of 20 cents per bale for custom hauling, direct, out-of-pocket costs will be 32.9 cents per bale.

Costs per bale and per acre for fixed expenses on tractor, baler, mower and rake depend on volume or amount harvested (see table 3). Depreciation, repairs, interest, insurance and taxes will run about $2,738.50 annually on machinery that costs $12,400 and has a 10-year life. If only 30 acres are harvested, the baling cost amounts to 143.3 cents per bale, excluding hauling. If 1,000 acres or 70,000 bales are harvested annually, this cost is reduced to 16.8 cents per bale. This amount is approximately the maximum that could be harvested. The economic break-even point between owning hay harvesting equipment and hiring a custom operator (at 40 cents per bale) is slightly more than 10,000 bales annually.

MECHANIZED BALE HANDLING

A machine commonly called a "Bale Wagon" performs the hauling operation. Various models and capacities are available. The Bale Wagon evaluated for this publication was designed for a 40-horsepower tractor.[1] It will pick up an average of 55 bales in 12 minutes. Under average field conditions and distances to the barn, two to three trips can be made hourly. It was assumed 150 bales could be handled hourly. Producer experience indicates that 1,000 to 2,000 bales can be picked up, transported (an average distance of 1 to 3 miles) to the barn and unloaded all in a 10-hour day.

The hay is stacked in a neat, compact manner. Most newer hay barns have excess overhead clearance. The barn needs adequate width between poles or roof supports to allow passage of the Bale Wagon. Do not build a new hay barn without considering its adaptability to this type of operation. In general, the structure should be 8 feet wide and have 16 feet of overhead clearance. The pole construction should be sturdy enough to withstand the stacking operation when the baled hay hits the sides.

The machine discussed in this report also can retrieve stacked hay and discharge it one bale at a time in a pasture feeding operation. This discharge capability can be adapted for putting hay on loading chains for storage in barn lofts or other facilities not suited to stacking. However, this removes the potential to retrieve stacks for feeding.

Fixed Costs. The pull-type wagon under consideration costs $6,660. The 40-horsepower tractor required to pull the Bale Wagon should require only one-half of the total tractor use (see table 4). Thus, one-half of the fixed costs of the tractor was charged against the bale hauling operations.

[1]The smaller, lower cost machine used in this report will require fewer production units to justify ownership than the larger, self-propelled type. Experience with all types of farm machinery indicates that smaller machines have lower per unit costs until their physical capacity is exceeded. Thus, a small machine that performs the job (after considering timeliness and risk) is more economical than a larger machine performing the job quicker. However, once the capacity of the smaller machine is exceeded, the larger machine should have lower per unit costs.

Large capital investments require more volume than the traditional method of hauling hay.

Table 4. Estimated fixed costs of owning and operating mechanical pull-type bale wagon

Item	Cost	Annual depreciation	Annual repairs	Interest	Taxes and insurance	Total annual fixed costs
Bale Wagon	$6,660.00[1]	$666.00	$107.25	$333.00	$ 83.25	$1,189.50
Tractor	3,250.00[2]	265.00	123.00	162.50	40.63	591.13
Total	$9,910.00	$931.00	$230.25	$495.50	$123.88	$1,780.63

[1]Machine capacity of 42 to 56 bales per load depending on bale size. Ten-year useful life with zero salvage value assumed.

[2]Forty-horsepower tractor assuming one-half of the use ($6,500 × ½ = $3,250) is for hay hauling operation with $1,200 salvage value at the end of 10 years.

Table 5. Estimated operating costs per hour, per ton and per bale for mechanical pull-type wagon.

Item	Amount		
	Per hour $	Per ton $	Per bale ¢
Fuel, oil and filter	.60	.13	.4
Labor	2.50	.56	1.7
Total	3.10	.69	2.1

Operating Costs. An estimated rate of 150 bales per hour was used to determine the number hauled. This rate includes servicing the machine, refueling, making minor adjustments, etc. The primary source of operating expenses with the Bale Wagon is the cost of the 40-horsepower tractor. These operating costs are shown in table 5.

Total Cost of Hauling with the Bale Wagon. The operating cost of hauling hay with the mechanical

Table 6. Estimated per ton and per bale costs of hauling hay with a mechanical pull-type bale wagon

Amount harvested annually			Average fixed costs		Average operating costs		Total cost for fixed and operating expense	
Acres[1]	Tons	Bales	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)
30	63	2,100	28.26	84.8	.69	2.1	28.95	86.9
100	210	7,000	8.48	25.4	.69	2.1	9.17	27.5
142[2]	298	9,948	5.97	17.9	.69	2.1	6.66	20.0
200	420	14,000	4.24	12.7	.69	2.1	4.93	14.8
400	840	28,000	2.12	6.4	.69	2.1	2.81	8.5
600	1,260	42,000	1.41	4.2	.69	2.1	2.10	6.3
1,000[3]	2,100[3]	70,000[3]	.85	2.5	.69	2.1	1.54	4.6

[1]Average yield of seventy 60-pound bales per cutting per acre. Acres represent a one time harvest. One acre harvested three times would be equal to 3 acres harvested one time.

[2]This volume represents the break-even point for ownership of pull-type wagon when the custom rate for hauling is 20 cents per bale.

[3]This volume represents the average maximum annual capacity for this type machine and the other conditions specified in this report.

Large hay packages are one method of reducing labor and investment requirements.

Bale Wagon was estimated at $3.10 per hour, 69 cents per ton or 2.1 cents per bale if an average of 150 bales is hauled hourly.

Fixed costs vary with the amount of hay hauled as shown in table 6. At lower harvest levels, the costs of using a Bale Wagon are prohibitive. For example, 7,000 bales would cost 25.4 cents per bale in fixed (or ownership) costs plus 2.1 cents per bale in operating costs for a total of 27.5 cents each. Obviously, custom hauling would be much cheaper than owning hauling equipment at this volume.

If the usual custom rate is 20 cents per bale, the break-even level of owning a Bale Wagon is 9,948 bales or 298 tons annually. Producers with this volume could economically justify owning a mechanical pull-type Bale Wagon. If the usual custom rate is 25 cents per bale, the break-even volume is only 7,776 bales while the break-even volume at a custom rate of 15 cents each is 13,803 bales or about 414 tons.

LARGE HAY PACKAGE SYSTEMS

Large hay package systems are being considered for reducing the overall cost of the haying operation. Producers report that costs of getting hay in the barn plus the labor and expense of feeding the hay in the winter are becoming an economic burden. Records show that more than half the cost of a good quality conventional bale of hay is harvesting and hauling when hay is handled by a custom operator. The labor shortage also has created problems in feeding baled hay in the winter. Consequently, large hay packages are an alternative to reduce costs.

Harvesting costs are not the only consideration in comparing large packages to conventional bales. Other economic considerations exist which vary from farm to farm. Therefore, the feasibility of large packages must be studied for each farm situation. Other factors to consider include the following:

- Hay stacks are less mobile, and it is advantageous if the hay is produced and stored where the cattle will be fed in the winter. Feeding baled hay is a major problem on some farms. On other farms the feeding is not critical and the time is used by the producer to observe his livestock. Where feeding takes place in varied and isolated pastures, the optimum location of packages and hay barns must be considered.

- Hay in a stack is not marketed easily. Many producers earn additional income by selling excess baled hay. This income loss should be compared with the savings gained from using stacked hay. Large round rolls are being marketed in some areas of Texas, however.

- Large package harvesting equipment allows the producer to utilize a higher percentage of the total forage produced when the excess is harvested and stored for winter feeding. Harvesting excess forage may be more feasible with large packages than baling, especially if the livestock are wintered in the same pastures.

- It is difficult to control animal intake when hay is fed free choice in stacks or rolls. If the hay is of high quality, it is possible for a 1,000-pound dry cow to consume twice as much hay (and

protein) as is required for maintenance. Animal scientists indicate that energy is the critical nutrient for cow productivity. If a 1,000-pound nursing cow consumes 30 pounds of high quality, stacked hay, she would receive about 90 percent of the energy required for production and maintenance, but an excess of protein. Some producers have observed that cows which were fed stacked hay free choice were in better condition after the winter feeding period than cows fed baled hay.

- When hay is fed from large packages, more attention must be given to calving dates, pasture management, etc. to maximize overall benefits. With high consumption rates, a lactating cow will turn feed into calf gain rather than excess body weight. To make more accurate decisions, more information is needed on management, performance and economics of cows fed stacked and baled hay.

- Producers experienced in using large hay packages have estimated the weathering and spoilage loss at 2 to 10 percent. These packages are conserved without shelter, whereas baled hay must be moved to the barn before rainfall. Spoilage is a direct result of how the packages are formed. Properly formed stacks and tight rolls should not lose quality or spoil much more than baled hay.

- The economic advantages of large hay packages can be lost if *excess* labor and expenses are involved in the use of panels or hay racks to avoid waste. Observations show that waste and spoilage are reduced best if sufficient cattle are used to consume the hay package in 2 to 4 days.

LOOSE HAY STACKING WITH MECHANICAL STACKER

There are several new machines for stacking loose hay. One machine, called the Stakhand, is more prevalent in Texas. This equipment is available in several sizes. The most popular machine can form a stack of 2 to 3 tons of hay and costs $12,000.

Fixed Costs. The investment requirements for stacking hay with this smaller machine are shown in table 7. The total investment of $31,000 includes a tractor of recommended horsepower (60-horsepower) and a pull-type cutter windrower. The cutter will increase the operation's efficiency and minimize the investment in the haying operation. This machine was not considered in the baling operation because in high rainfall areas, dealers and farmers reported difficulty in properly drying hay for baling. Two rakes pulled in tandem, were included based on efficiency and larger windrows. As seen in table 7, the annual fixed or ownership costs of this equipment total $6,204.51.

Operating Costs. Operating costs for the Stakhand and other types of haying operations were determined in a similar manner. Hourly costs (see table 8) for labor were $2.50. Fuel and oil cost 60 cents per hour for the cutting and raking operations and 71

Table 7. Estimated cost of owning and operating mechanical loose hay stacking equipment

Item	Cost	Annual depreciation[1]	Annual repairs[2]	Interest[3]	Taxes and insurance[4]	Total annual fixed cost
Stakhand[5]	$12,000.00	$1,200.00	$ 360.00	$600.00	$150.00	$2,310.00
Tractor	9,750.00	835.00	369.00	487.50	121.88	1,813.38
Cutter	4,000.00	400.00	215.00	200.00	50.00	865.00
Tractor[6]	3,250.00	265.00	123.00	162.50	40.63	591.13
Rakes (2)	2,000.00	200.00	300.00	100.00	25.00	625.00
Total	$31,000.00	$2,900.00	$1,367.00	$1,550.00	$387.51	$6,204.51

[1]Assumes 10-year useful life on all equipment with $1,400 salvage value on tractor and zero value on other equipment.

[2]New cost × .03 for Stakhand. Other figures are based on experience.

[3]New cost × 10 percent × ½.

[4]New cost × 1.25 percent.

[5]Two to 3-ton capacity machine.

[6]Forty-horsepower tractor assuming one-half of the use ($6,500 × ½ = $3,250) is for the hay hauling operation with $1,200 salvage value at the end of 10 years.

Investment in mechanized stacking can reduce harvesting and feeding labor.

cents per hour for the larger tractor required to pull the Stakhand. The Stakhand and cutter have a capacity of about 17 acres per day.

Operating costs are $5.66 per acre, $2.69 per ton, 8.1 cents per bale or $6.73 for a 2.5-ton stack.

Table 8. Estimated operating cost per acre, per ton and per bale equivalent of harvesting hay with mechanical hay stacker

Operation	Times over	Labor hours	Equipment hours	Cost		
				Acre $	Ton $	Bale ¢
Cutting	1	0.8	0.6	2.36	1.12	3.4
Raking	1	0.3	0.2	.87	.41	1.2
Stacking	1	0.8	0.6	2.43	1.16	3.5
Total		1.9	1.4	5.66	2.69	8.1

Table 9. Estimated cost per ton and per bale equivalent of harvesting hay with a mechanical stacker[1]

Amount harvested annually			Average fixed costs		Average operating costs		Total cost for fixed and operating expense	
Acres[2]	Tons	Bales	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)
30	63	2,100	98.48	295.5	2.69	8.1	101.17	303.6
100	210	7,000	29.55	88.6	2.69	8.1	32.24	96.7
150	315	10,500	19.70	59.1	2.69	8.1	22.39	67.2
278[3]	584	19,460	10.63	31.9	2.69	8.1	13.32	40.0
300	630	21,000	9.85	29.5	2.69	8.1	12.54	37.6
600	1,200	42,000	5.17	14.8	2.69	8.1	7.86	22.9
1,000[4]	2,100[4]	70,000[4]	2.95	8.9	2.69	8.1	5.64	17.0

[1]Average yield of 2.1 tons or seventy 60-pound bales per acre.

[2]Acres harvested one time over. One acre harvested three times would be equal to 3 acres harvested one time.

[3]This volume represents the break-even point of owning all stacking equipment when custom baling is 40 cents per bale. If custom baling and hauling is 60 cents, the break-even point is 11,955 bales.

[4]This volume should be the maximum average capacity of one machine when weather and downtime are considered.

Total Cost. The annual fixed and operating costs of mechanical stacking are shown in table 9. The break-even volume is 19,460 bales or 584 tons annually when the custom baling rate is 40 cents per conventional bale. At an annual rate of 2,100 tons, the cost is reduced to 17 cents per conventional bale.

THE LARGE ROUND BALER

A relatively new hay harvesting machine is the large round baler which forms a cylinder or roll of hay of various sizes. The most common size baler will put up a roll or bale weighing approximately 1,200 pounds. Cost of this machine with a mover is $6,150 (see table 10). A pull-type cutter and rakes are recommended for this type of operation.

Fixed Costs. The investment required for a large round baler is $21,900 with $4,629.95 annual fixed costs. This investment is shown in table 10 along with depreciation on tractor, baler, bale mover, cutter and two rakes plus repairs, interest, taxes and insurance. The pull-type cutter increases the efficiency and timeliness of the round baling and the loose stacking methods and is generally recommended.

Table 10. Investment and annual ownership costs of large round baler

Item	Cost	Annual depreciation[1]	Repairs	Interest[2]	Taxes and insurance[3]	Total annual fixed costs
Tractor	$ 9,750.00	$ 835.00	$ 369.00	$ 487.50	$121.88	$1,813.38
Baler and mover	6,150.00	615.00	327.20	307.50	76.87	1,326.57
Cutter	4,000.00	400.00	215.00	200.00	50.00	865.00
Rakes (2)	2,000.00	200.00	300.00	100.00	25.00	625.00
Total	$21,900.00	$2,050.00	$1,211.20	$1,095.00	$273.75	$4,629.95

[1]Assumes 10-year useful life on all equipment with $1,400 salvage value for tractor and zero salvage for other equipment.
[2]New cost × 10 percent × ½.
[3]New cost × 1.25 percent.

The large round bale or roll is becoming increasingly important as a hay harvesting method in Texas.

Table 11. Estimated operating cost per acre and per ton harvesting hay with large round baler

Operation	Times over	Labor hours	Equipment hours	Operating cost[1] Acre $	Ton $	Bale ¢
Cutting	1	0.8	0.6	2.36	1.12	3.4
Raking	1	0.3	0.2	.87	.41	1.2
Baling and moving	1	0.8	0.6	2.43	1.16	3.5
Twine	---	---	---	.77	.37	1.1
Total		1.9	1.4	6.43	3.06	9.2

[1]3.5 round bales, 2.1 tons or seventy 60-pound conventional bales per acre.

Table 12. Estimated cost per ton of harvesting hay with large round baler

Amount harvested annually			Average fixed costs		Average operating costs		Average total costs	
Acres	Tons	Bales	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)
30	63	2,100	73.49	220.5	3.06	9.2	76.55	229.7
100	210	7,000	22.05	66.1	3.06	9.2	25.11	75.3
150	315	10,500	14.70	44.1	3.06	9.2	17.76	53.3
215[2]	451	15,032	10.26	30.8	3.06	9.2	13.32	40.0
300	630	21,000	7.35	22.0	3.06	9.2	10.41	31.2
600	1,260	42,000	3.67	11.0	3.06	9.2	6.73	20.2
1,000[3]	2,100[4]	70,000[4]	2.20	6.6	3.06	9.2	5.26	15.8

[1]Average yield of 2.1 tons or seventy 60-pound bales.

[2]This volume represents the break-even volume when the custom rate is $13.32 per ton. With the custom rate of $19.99 per ton (60 cents per bale for custom baling and hauling), the break-even point is 11,955 bales.

[3]This volume should be the maximum average capacity of one machine when weather and downtime are considered.

Operating Costs. Since the loose stacker and large round baler have identical capacities and require the same cutting operations, the operating costs per acre are the same except the large roll requires twine. Twine costs 22 cents per roll or 77 cents per acre. Operating costs are $6.43 per acre, $3.06 per ton or 9.2 cents per conventional bale equivalent (see table 11). Operating costs for a 1,200-pound roll are $1.84.

Total Cost. With the annual fixed and operating costs shown in tables 10 and 11, the break-even volume for the large roll is 451 tons or 15,032 conventional bales as shown in table 12. At an annual rate of 2,100 tons, costs per conventional bale are reduced to 15.8 cents.

COMPARING HAY HARVESTING ALTERNATIVES

The estimated total investment, annual fixed costs and operating costs per ton of the various methods of harvesting hay are shown in table 13. These figures are the total amounts as presented in the previous discussion and are combined in the case of the baler-Bale Wagon system.

Costs per unit (ton and bale) for the various harvesting methods are shown in table 14.

The break-even point for owning all necessary conventional baling equipment is 303.2 tons or 10,105 bales when the custom rate for baling and hauling is 60 cents per bale. The 292-ton harvest level is the break-even point for owning a Bale Wagon. Consequently, a combination of baler and Bale Wagon is more economical than baling and custom hauling when more than 10,043 bales are harvested annually.

Owning a mechanical stacker can be justified when harvesting exceeds 584 tons or 19,460 bales annually and the custom rate for baling and hauling is 60 cents per bale. For less than 840 tons, the combination of baler and Bale Wagon offers the cheaper

Table 13. Estimated total investment, annual fixed costs and operating cost per ton of various hay harvesting methods

Method	Initial investment	Annual ownership or fixed costs	Operating cost per ton
Baler with custom hauling	$12,400	$2,738.50	$10.96[1]
Baler and Bale Wagon	21,710	4,519.13	4.98
Round baler	21,900	4,629.95	3.06
Mechanical stacker	31,000	6,204.51	2.69

[1]Assumes 20 cents per bale for custom hauling.

means of harvest than the mechanical loose stacker. This assumes no additional cost for moving the stack. More than 840 tons of hay stacked with the mechanical stacker cost less than the baler and Bale Wagon method. With higher harvest levels, the operating costs of the baler and the Bale Wagon compared to the mechanical stacker become critical. The operating cost per ton with the baler and Bale Wagon is $4.98 compared to $2.69 per ton with the mechanical stacker.

The round baler provides the small producer an opportunity to own his equipment and reduce the harvesting costs if his only available option is the conventional baler and custom hauling. Assuming that his field layout is such that he has no moving costs comparable to the conventional baler requirements, a small producer can afford to purchase a round baler when harvesting more than 263 tons annually. If his field layout is such that he has moving costs comparable to conventional bales, then he must bale 451 tons annually which is a greater volume than required for the purchase of a conventional baler and Bale Wagon. If he has the services of a custom round baler available at $12 for a 1,200-pound roll, he must have a volume of 455.7 rolls or 273.4 tons to justify purchase. With a custom rate of $9 per roll,

Table 14. Estimated total cost per ton and per bale of owning various hay harvesting equipment[1]

Amount harvested annually		Baler (custom haul)		Baler and Bale Wagon		Mechanical (pull-type) stacker		Round baler	
Tons	Bales	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)
63	2,100	54.42	163.3	76.71	230.2	101.17	303.6	76.55	229.7
210	7,000	24.00	72.0	26.50	79.6	32.24	96.7	25.11	75.3
263	8,750	21.37	64.2	22.16	66.6	26.28	79.0	20.66	62.1
292[2]	9,738	20.33	61.0	20.46	61.4	23.94	71.8	18.92	56.7
300	9,999	20.08	60.3	20.04	60.2	23.37	70.2	18.49	55.5
301[3]	10,043	20.05	60.2	19.98	60.0	23.28	69.9	18.43	55.3
303[4]	10,105	19.99	60.0	19.88	59.7	23.15	69.5	18.33	55.0
315	10,500	19.65	59.0	19.33	58.0	22.39	67.2	17.76	53.3
420	14,000	17.48	52.5	15.74	47.3	17.46	52.4	14.08	42.3
451[5]	15,032	17.03	51.1	15.00	45.1	16.45	49.4	13.33	40.0
500	16,650	16.44	49.3	14.02	42.1	15.10	45.4	12.32	37.0
584[6]	19,460	15.65	47.0	12.72	38.2	13.31	40.0	10.99	33.0
630	21,000	15.31	45.9	12.15	36.5	12.54	37.6	10.41	31.2
840	28,000	14.22	42.7	10.36	31.1	10.08	30.3	8.57	25.7
1,050	35,000	13.57	40.7	9.28	27.9	8.60	25.8	7.47	22.4
1,260	42,000	13.13	39.4	8.57	25.8	7.61	22.9	6.73	20.2
1,470	49,000	12.82	38.5	8.05	24.2	6.91	20.8	6.21	18.6
1,680	56,000	12.59	37.8	7.67	23.1	6.38	19.2	5.82	17.4
1,890	63,000	12.41	37.2	7.37	22.2	5.97	17.9	5.51	16.5
2,100	70,000	12.26	36.8	7.13	21.5	5.64	17.0	5.26	15.8

[1]Assumes average of 33.3 bales per ton and an average yield of 2.1 tons per acre. Quantities are assumed to be conventional bale equivalents for round baler and stacker.

[2]When hauling costs are 20 cents per bale, the automatic Bale Wagon becomes economical to own at 9,738 bales or more.

[3]Break-even volume for baler and Bale Wagon.

[4]Break-even volume for conventional baler and custom hauling.

[5]Break-even volume for owning round baler versus custom hiring conventional baler at 40 cents per bale.

[6]Break-even volume for owning a mechanical stacker.

646.6 rolls, 388 tons or 12,932 conventional bales are required to justify purchase.

In summary, all of the possible comparisons cannot be calculated readily in advance. A producer must look at his options in terms of custom hay harvesting services available and use the data in the tables of this publication to make a decision. Because of the lack of standardized costs associated with buying used equipment, this publication was limited to the purchase of new equipment only. Obviously, producers with mechanical aptitude and the opportunity to obtain good used equipment may be able to economically justify owning equipment at lower volumes of hay harvesting than indicated for new equipment.

INVESTMENT DECISIONS CONCERNING MACHINERY

Although it is almost impossible to calculate all the possible combinations of machine ownership in this publication, the "break-even" formula, along with the information previously presented can help in making decisions for individual farm situations. The "break-even" formula is a quick and easy method of evaluating machinery investment decisions. A computer analysis of machinery investment decisions is more precise and considers the effect of changes in the present value of the future cash flow after taxes and loan payments. These analyses are available and more information on this method can be obtained from the county Extension agents or area economists-management.

Armed with the fixed and variable costs of the machinery in question, the producer can apply the following formula in determining the break-even point between owning a machine and hiring a custom operator.

$$\text{"Break-even point"} = \frac{\text{Annual fixed costs}}{\text{Custom rate } \textit{minus} \text{ operating costs per unit}}$$

Example: Assume that Mr. Brown has his hay conventionally baled and hauled to the barn for 60 cents per bale. His total annual fixed costs for a baler and Bale Wagon are $4,519.13 ($2,738.50 plus $1,780.63) (see tables 1 and 4). The operating costs for baling and hauling with the Bale Wagon are 15 cents (tables 2 and 5 — 12.9 cents plus 2.1 cents). His break-even volume is:

$$\frac{\$4,519.13}{\text{60 cents minus 15 cents}} = 10{,}043 \text{ bales}$$

Example: Assume that Mr. Brown has a custom operator bale his hay with a round baler at $10.50 per bale. Assume also that each round bale weighs 1,200 pounds — the equivalent of 20 conventional bales. The annual fixed costs of owning round baling equipment are $4,629.95 (table 10). The operating costs per round bale are $1.84 (table 11 — 20 conventional bales per roll × 9.2 cents per bale). Then, Mr. Brown's break-even volume is:

$$\frac{\$4,629.95}{\$10.50 \text{ minus } \$1.84} = \begin{array}{l}\text{534.6 round bales (the equivalent of 10,692 conventional bales or about 321 tons)}\end{array}$$

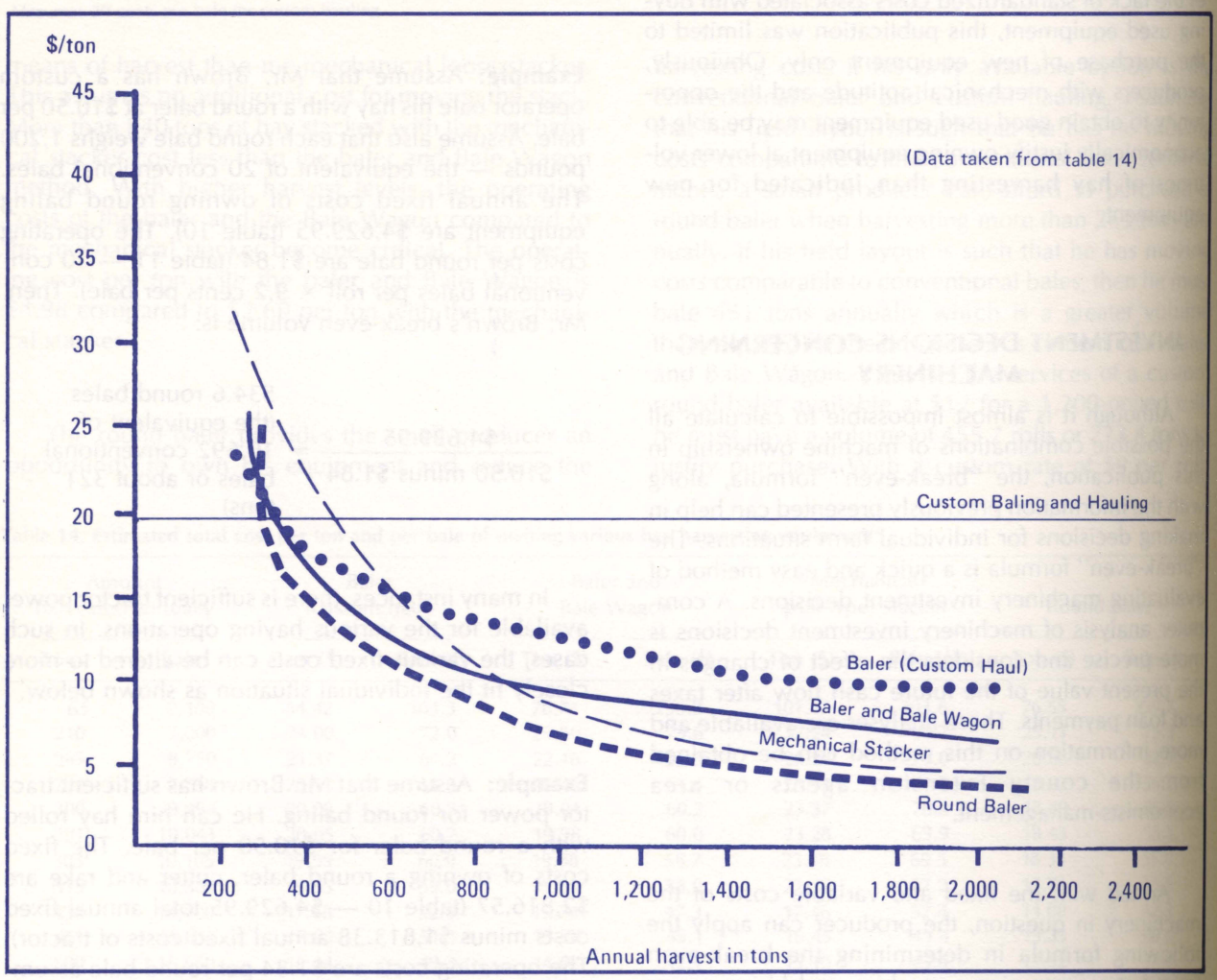
In many instances, there is sufficient tractor power available for the various haying operations. In such cases, the various fixed costs can be altered to more closely fit the individual situation as shown below.

Example: Assume that Mr. Brown has sufficient tractor power for round baling. He can hire hay rolled with a round baler for $10.50 per bale. The fixed costs of owning a round baler, cutter and rake are $2,816.57 (table 10 — $4,629.95 total annual fixed costs minus $1,813.38 annual fixed costs of tractor). The operating costs are $1.84 per round bale assuming 20 conventional bales per round bale (table 11). The break-even volume in this situation is:

$$\frac{\$2,816.57}{\$10.50 \text{ minus } \$1.84} = \begin{array}{l}\text{325 round bales (the equivalent of 6,505 conventional bales or 195 tons)}\end{array}$$

Use of the break-even formula is the first step in making wise decisions concerning machinery investment. The formula will indicate the volume necessary for a profitable investment.

However, the break-even formula doesn't indicate whether the investment is feasible, i.e., will there be enough cash flow to make the necessary loan payments, etc. Consider other uses of investment capital also. In some instances, money used for machinery purchases will yield a greater return if it is used in another phase of the farming operation.



Average cost per ton of various methods of harvesting hay

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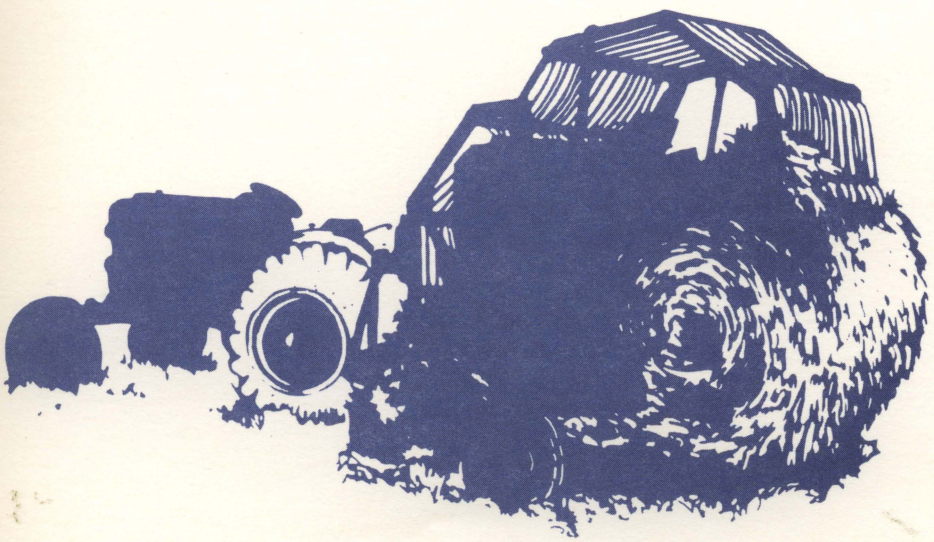

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