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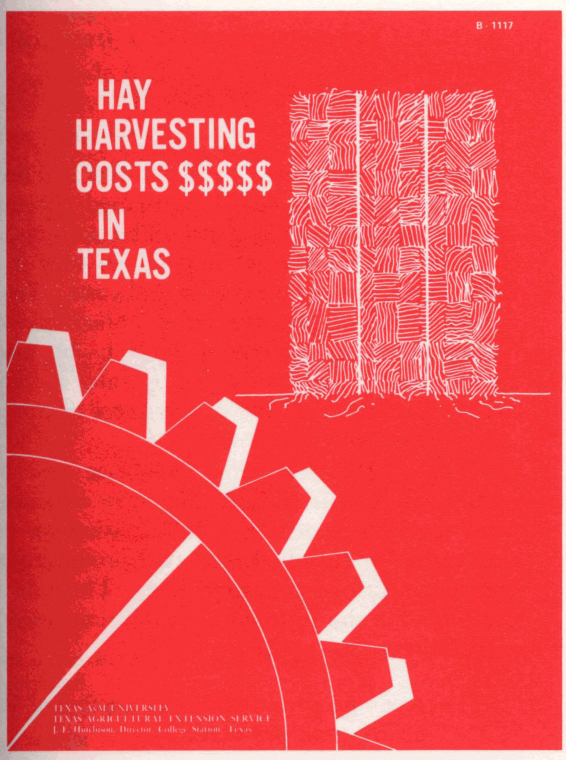
HAY HARVESTING COSTS $$$$$ IN TEXAS

TEXAS A&M UNIVERSITY
TEXAS AGRICULTURAL EXTENSION SERVICE
J. E. Hutchison, Director, College Station, Texas

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



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James T. Long and Wayne D. Taylor
Area Extension Economists-Management
Texas A&M University, Overton

INTRODUCTION

Making profitable decisions concerning investments in machinery and equipment is a difficult task for most producers. Farmers are caught in the dilemma of having to substitute more machinery for labor without over-investing in expensive equipment. Owning too much equipment can increase costs and lead to less profitable and less efficient operations.

Probably the most frequent question farmers ask concerns the size of operation required to justify owning equipment. In order to answer these questions, an understanding of the fixed and variable costs involved is important.

Fixed Costs or Ownership Costs. These costs are important in determining whether owning machinery is profitable. Fixed costs include depreciation, interest, taxes and insurance. These costs are termed "fixed" because they continue regardless of how much the machine is used. Repair and maintenance costs can be partly fixed and partly variable. Items of maintenance such as tires, batteries, belts, etc. could be classed as fixed costs because they deteriorate with time. Other repair costs are required because of use and can be considered variable. However, for the purpose of determining when to own, repair and maintenance can be considered part of the total fixed costs.

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

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

The least-cost method of harvesting forage varies with individual farm situations and sizes. The objective of this publication is to provide cost estimates of the more common alternatives available to various operations under comparable management and production conditions. As with most farm management problems, no single answer fits all farm situations. This analysis should fit the average *good* producer. As with most mechanically-performed operations, producers with higher production levels will generally have lower per unit costs.

In general, the livestock producer is faced with these alternatives in regard to hay production and harvest.

1. **Buy all hay needed for livestock**
2. **Raise hay, but have it custom baled and hauled to the barn**
3. **Buy hay baling equipment and:**
   - **A. Hand haul the hay to the barn**
   - **B. Use a machine (commonly called the "Bale Wagon"[2]) to haul the hay to the barn**
4. **Consider "loose-stacking" hay by:**
   - **A. Loose-stacking with a front-end loader**
   - **B. Using a machine such as the "Stakhand"[2]**

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 should depend on how it affects the overall production system and costs. Too much is bought for its prestige value. Machinery should be maintained properly if it is to be used efficiently; and a good driver or operator is important for long, economical use of any piece of equipment.

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

(1) **Average production per cutting of 70 bales or 2.1 tons per acre.**

(2) **All new equipment is purchased to use for harvesting hay. All fixed costs associated with these items are charged to hay harvesting.**

The actual per unit costs will vary among individual farms depending on yield per acre, field size, the care of the equipment by driver and owner and efficiency with which labor and machinery is utilized.

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

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

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 small "average" East Texas livestock producers raise their own hay and rely on custom operators to bale and haul it to the barn.

The usual charge is 25 cents per bale for baling and 10 to 15 cents for hauling. Many producers have highly desirable arrangements with custom operators and find their use more convenient 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 if the hay is to be of good quality and high in protein.

If the number of bales produced falls within a certain range, there is no economic advantage to either custom harvest or owning harvesting equipment. In this situation, a producer must base his decision on personal preference and convenience.

OWNING HAY BALING EQUIPMENT

At least two tractors are usually needed for baling. Most livestock producers who use custom balers will probably have to buy another tractor. This machine may be used for other operations, but the equivalent of one full-time tractor will be required for hay baling.

Fixed Costs. The following prices were used for calculating equipment costs. All machinery was assumed to have a 10-year life.

Tractor—A new price of $4,000 with a salvage value of $800. This is a diesel tractor (38 to 40 hp) with live power take-off. It will probably need to be overhauled once at a cost of $300. Other major repairs such as clutch, etc. will also be approximately $300. New tires, replaced once, will cost $175. Other miscellaneous repairs will be about $50 annually.

Mower—A 7-foot sickle mower costs about $600. It will require about $125 yearly for upkeep, maintenance and repairs.

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	$4,000.00	$320.00	$127.50	$160.00	$50.00	$ 657.50
Mower	600.00	60.00	125.00	24.00	7.50	216.50
Rake	600.00	60.00	100.00	24.00	7.50	191.50
PTO Baler mcd.	2,300.00	230.00	200.00	80.00	28.75	538.75
TOTAL	$7,500.00	$670.00	$552.50	$288.00	$93.75	$1,604.25

[1]Estimated useful life of 10 years on all equipment. Assumed salvage value of $800 on the tractor with zero salvage value on other equipment.

[2]New cost × 8 percent × ½.

[3]New cost × 1.25 percent.

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

Rake—Rake cost was estimated at $600. Annual upkeep is $100.

Baler—Purchase price is $2,300, with annual maintenance of $200.

Operating Costs. Estimates from operators 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 21 cents per gallon is burned during each hour of operation for baling, cutting and raking. Oil and filter should be changed every 300 hours and costs $6.50 per change. Hourly cost of operation for diesel, oil and filter would be approximately 34 cents. Labor cost was calculated at $1.50 per hour. Total operating cost, including labor and all equipment use, was 8.2 cents per bale and $5.73 per acre (as shown in Table 2). Assuming an average yield of seventy 60-pound bales per cutting (2.1 tons), the operating cost will be $2.73 per ton.

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 Cost		
				Per Acre ($)	Per Ton ($)	Per Bale (¢)
Mowing	1.0	1.0	0.7	1.74	.83	2.5
Raking	1.0	0.5	0.4	.89	.42	1.3
Baling	1.0	1.0	0.6	1.70	.81	2.4
Twine	....	....	....	1.40	.67	2.0
TOTAL		2.5	1.7	5.73	2.73	8.2

[1]Average yield of 70 bales per acre per cutting.

Total Baling Costs. Operating costs for labor, fuel, gas, etc. averaged $5.73 per acre for each cutting or $2.73 per ton. With an average of 70 bales per acre each cutting, the variable costs will be 8.2 cents per bale. At a cost of 10 cents per bale for custom hauling, direct, out-of-pocket costs will be 18.2 cents per bale.

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	25.46	76.4	2.73	8.2	28.19	84.6
50	105	3,500	15.28	45.8	2.73	8.2	18.01	54.0
75	158	5,250	10.15	30.6	2.73	8.2	12.88	38.8
100	210	7,000	7.64	22.9	2.73	8.2	10.37	31.1
125	263	8,750	6.10	18.3	2.73	8.2	8.83	26.5
136.4[3]	286.5[3]	9,549[3]	5.60	16.8	2.73	8.2	8.33	25.0
150	315	10,500	5.09	15.3	2.73	8.2	7.82	23.5
200	420	14,000	3.82	11.5	2.73	8.2	6.55	19.7
300	630	21,000	2.55	7.6	2.73	8.2	5.28	15.8
400	840	28,000	1.91	5.7	2.73	8.2	4.64	13.9
500	1,050	35,000	1.53	4.6	2.73	8.2	4.26	13.8
600	1,260	42,000	1.27	3.8	2.73	8.2	4.00	12.0
700	1,470	49,000	1.09	3.3	2.73	8.2	3.82	11.5
800	1,680	56,000	.95	2.9	2.73	8.2	3.68	11.1
900	1,890	63,000	.85	2.5	2.73	8.2	3.58	11.0
1,000[4]	2,100[4]	70,000[4]	.76	2.3	2.73	8.2	3.49	10.5

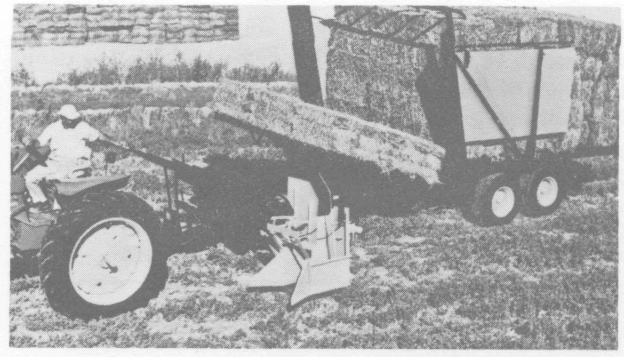
[1]Average yield of 70 bales per acre per cutting. An additional 10 cents per bale, $7 per acre or $3.30 per ton will be required to haul and stack the hay, if custom hauling rates are used.

[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 25 cents per bale.

[4]70,000 bales should be the maximum average annual capacity of one baler when weather and down-time are considered.

The costs per bale and per acre for fixed expenses of tractor, baler, mower and rake depend on the volume or amount harvested. Depreciation, repairs, interest, insurance and taxes will be about $1,604.25 annually on machinery that costs $7,500 and has a 10-year life. If only 30 acres are harvested, the costs of baling hay and putting it in the barn amounts to 84.6 cents per bale, excluding hauling. If 1,000 acres are cut annually, this cost is reduced to 10.5 cents per bale. These 1,000 acres would be about the maximum that could be harvested. The economic break-even point between owning hay harvesting equipment and using a custom operator is slightly more than 9,500 bales per year.



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

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.[3] It will pick up an average of 55 bales in 12 minutes and under average field conditions and distance to the barn, two to three trips can be made hourly. It is assumed that 150 bales could be handled per hour.

The hay is stacked in a neat, compact manner. Most newer hay barns will have excess overhead clearance. The Bale Wagon must have adequate width between stanchions in the barn. A farmer should 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 comes in contact with 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 capability to discharge hay 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 $4,535. The 40-horsepower tractor required to pull the Bale Wagon should require only one-half of the total tractor use. Thus, one-half of the fixed costs of the tractor was charged against the bale hauling operations.

Operating Costs. Experience of producers 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. One hundred and fifty bales per hour was used as an estimate of the number hauled. This rate allows

[3]The smaller, lower cost machine used in this report will require fewer units of production 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 will perform the job (after considering timeliness and risk) is more economical than a larger machine capable of performing the job more quickly. However, once the capacity of the smaller machine is exceeded, the larger machine should have lower per unit costs.

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	$4,535.00[1]	$453.50	$ 68.03	$181.40	$56.69	$ 759.62
Tractor	$2,000.00[2]	160.00	63.75	80.00	25.00	328.75
TOTAL	$6,535.00	$613.50	$131.78	$261.40	$81.69	$1,088.37

[1]Machine capacity 42 to 56 bales per load depending on bale size. Zero salvage value assumed.

[2]Forty-horsepower tractor assuming one-half of the use ($4,000 × ½ = $2,000) is for the hay hauling operation with $800 salvage value at the end of 10 years.

for 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.

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	.34	.08	.2
Labor	1.50	.33	1.0
TOTAL	1.84	.41	1.2

Total Cost of Hauling With the Bale Wagon. The operating cost of hauling hay with the mechanical Bale Wagon is estimated at $1.84 per hour or 41 cents per ton. The operating cost is 1.2 cents per bale if an average of 150 bales is hauled each hour.

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

Fixed costs vary with amount of hay hauled as shown in Table 6. At lower harvest levels, the costs of using a Bale Wagon are prohibitive. For example, 5,250 bales would cost 20.7 cents per bale in fixed (or ownership) costs plus 1.2 cents per bale in operating costs for a total of 21.9 cents each. Obviously, custom hauling would be much cheaper than owning hauling equipment at this volume.

Table 6. Estimated Ton and Bale Costs of Hauling Hay With a Mechanical Pull-Type Bale Wagon

Amount Harvested Annually			Average Fixed Costs		Average Operating Costs		Total Fixed and Operating Expense	
Acres[1]	Tons	Bales	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)
30	63	2,100	17.28	51.8	.41	1.2	17.69	53.0
50	105	3,500	10.37	31.1	.41	1.2	10.78	32.3
75	158	5,250	6.89	20.7	.41	1.2	7.30	21.9
100	210	7,000	5.18	15.5	.41	1.2	5.59	16.7
125	263	8,750	4.14	12.4	.41	1.2	4.55	13.6
150	315	10,500	3.46	10.4	.41	1.2	3.87	11.6
176.7[2]	371[2]	12,368[2]	2.93	8.8	.41	1.2	3.34	10.0
200	420	14,000	2.59	7.8	.41	1.2	3.00	9.0
300	630	21,000	1.73	5.2	.41	1.2	2.14	6.4
400	840	28,000	1.30	3.9	.41	1.2	1.71	5.1
500	1,050	35,000	1.04	3.1	.41	1.2	1.45	4.3
600	1,260	42,000	.86	2.6	.41	1.2	1.27	3.8
700	1,470	49,000	.74	2.2	.41	1.2	1.15	3.4
800	1,680	56,000	.65	1.9	.41	1.2	1.06	3.1
900	1,890	63,000	.58	1.7	.41	1.2	.99	2.9
1,000[3]	2,100[3]	70,000[3]	.52	1.6	.41	1.2	.93	2.8

[1]Average yield of 70 bales per cutting per acre. Acres shown represent a one time harvest. One acre harvested three times would be equal to 3 acres one time.

[2]This volume represents the break-even point for ownership of pull-type wagon when the custom rate for hauling is 10 cents per bale.

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

If the usual custom rate is 10 cents per bale, the break-even level of annual harvest is 12,368 bales or 371 tons. Producers with at least this much volume could economically justify owning a mechanical pull-type Bale Wagon. If the usual custom rate is 12 cents per bale, the break-even volume is 10,078 bales while the break-even volume at a custom rate of 15 cents each is 7,887 bales or about 239 tons.

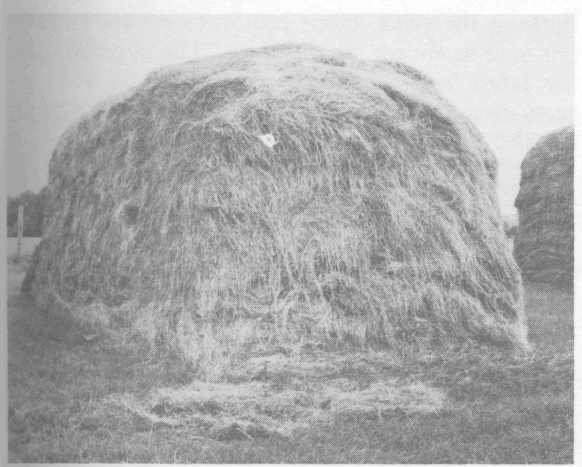
LOOSE HAY STACKING

Loose stacking of hay is receiving attention as a means of 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 have shown that more than half the costs of a good quality bale of hay is involved in the harvesting and hauling when hay is handled by a custom operator. The labor shortage has also created problems in feeding baled hay in the winter. Consequently, loose hay stacking is being considered as a means of reducing costs.

Economics is not the only consideration in comparing loose stacking to baling. In addition, some economic considerations will vary from farm to farm. Therefore, the feasibility of loose hay stacking must be studied for each farm situation. Non-economic factors to consider are the following:

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

- For all practical purposes, hay in a stack is not a marketable product. Many producers earn additional income by selling excess baled hay. This income loss should be compared with the savings gained from using stacked hay.



Loose stacking is one method of reducing labor and investment requirements.

- Demonstrations throughout East Texas have shown the value of rotational grazing. This 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 stacking than baling, especially if the livestock are wintered in the same pastures. Highly productive pastures grazed in rotation require shredding and dragging to insure maximum quality. Stacking hay in these pastures could contribute to the overall quality as well as reduce the winter feeding costs significantly.

- It is difficult to control animal intake when hay is stacked. If the hay is of very 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. 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. This could mean that the cows receiving baled hay were either underfed or fed hay of lower quality; or perhaps the cows on loose stacked hay were overfed. 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.

- When hay is fed from stacks, more attention must be paid to calving dates, pasture management, etc. to maximize overall benefits. In order 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 stacked hay have estimated the weathering loss at 2 to 5 percent and the loss due to waste and spoilage from 2 to 10 percent. Spoilage is a direct result of how the stacks are formed. Properly formed stacks should not lose quality or spoil any more than baled hay.

- Injury or death may result if large stacks collapse on cattle while feeding. Proper stack formation, location and the amount available to cattle may reduce shoving and fighting that can cause stacks to collapse.

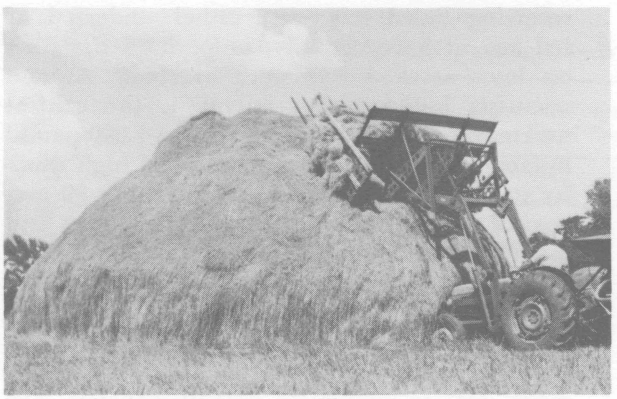
Tractor-Mounted (Front-End Loader) Hay Stacking Equipment

Fixed Costs. Stacking hay with a tractor-mounted front-end loader has been common several years. Similar equipment mounted on trucks has been used very satisfactorily. Investment requirements for stacking hay with tractor-mounted equipment are shown in Table 7. Enclosures are required to shape the stacks. Metal enclosures are available through equipment dealers or panels can be constructed with lumber and net wire. The investment shown in Table 7 assumes that inexpensive, home-constructed panels are used in forming the stacks. The initial investment includes the cost of a 40-horsepower tractor with a front-end stacking attachment, mower and rake for a total of $7,000. The annual fixed cost is $1,376.

Table 7. Estimated Fixed Costs of Owning and Operating Tractor-Mounted (Front-End Loader Type) Hay Stacking Equipment

Item	Cost	Annual Depreciation	Annual Repairs	Interest[1]	Taxes and Insurance[2]	Total Annual Fixed Costs
Tractor	$4,000.00[3]	$320.00	$127.50	$160.00	$50.00	$ 657.50
Stacker	1,800.00[4]	180.00	36.00	72.00	22.50	310.50
Mower	600.00	60.00	125.00	24.00	7.50	216.50
Rake	600.00	60.00	100.00	24.00	7.50	191.50
TOTAL	$7,000.00	$620.00	$388.50	$280.00	$87.50	$1,376.00

[1]New cost × 8 percent × ½.
[2]New cost × 1.25 percent.
[3]Assumes 40-horsepower tractor, $4,000 new cost, $800 salvage value. Zero salvage value assumed for other equipment.
[4]Includes front-end stacker mounted on tractor and forming for framing stacks.



After the hay is cut and windrowed, the hydraulically operated front-end stacker is used to push and lift the hay to the stack.

Operating Costs. After the hay is cut and windrowed, the hydraulically operated front-end stacker is used to push and lift the hay to the stack. The load is then dumped into the enclosures. Labor and machine requirements for the cutting and raking operation are identical to this phase of harvesting with baling equipment. The only variation in the operation would be windrowing. Most producers who use front-end stacking equipment will windrow the hay toward the location of the stack as much as possible or stack at a location to minimize machine time. Experienced producers can easily stack 1 acre of hay per hour. For best results, one man should be inside the enclosure to spread the hay evenly and insure proper stack formation. With the additional help of a person shaping the stack, labor requirements are 3.5 hours per acre as shown in Table 8. The operating costs for labor and machinery operation are $5.97 per acre, or approximately $2.84 per ton and 8.5 cents for the amount equivalent to a bale.

Table 8. Estimated Operating Cost Per Acre, Per Ton and Per Bale Equivalent of Stacking Loose Hay With Tractor-Mounted (Front-End Loader) Stacker

Operation	Times Over	Labor Hours	Equipment Hours	Cost		
				Acre $	Ton $	Bale ¢
Mowing	1	1.0	0.7	1.74	.83	2.5
Raking	1	0.5	0.4	.89	.42	1.2
Stacking	1	2.0	1.0	3.34	1.59	4.8
TOTAL		3.5	2.1	5.97	2.84	8.5

Total Cost. The total costs of owning and operating the tractor-mounted (front-end loader) stacking equipment are shown in Table 9. With the usual custom rate of 35 cents per bale for baling and hauling, the break-even level of harvest is 155.8 tons or 5,192 bales annually. If the usual custom rate for baling and hauling is 40 cents per bale, the break-even level would be approximately 131 tons or 4,368 bales.

Table 9. Estimated Cost Per Ton and Per Bale Equivalent of Harvesting Hay With a Tractor-Mounted (Front-End Loader) Hay Stacker[1]

Amount Harvested Annually			Average Fixed Costs		Average Operating Costs		Total Fixed and Operating Expense	
Acres[2]	Tons	Bales	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)
30	63	2,100	21.84	65.5	2.84	8.5	24.68	74.0
50	105	3,500	13.10	39.3	2.84	8.5	15.94	47.8
74.2[3]	155.8[3]	5,192[3]	8.83	26.5	2.84	8.5	11.67	35.0
75	158	5,250	8.71	26.2	2.84	8.5	11.55	34.7
100	210	7,000	6.55	19.7	2.84	8.5	9.39	28.2
125	263	8,750	5.23	15.7	2.84	8.5	8.07	24.2
150	315	10,500	4.37	13.1	2.84	8.5	7.21	21.6
200	420	14,000	3.28	9.8	2.84	8.5	6.12	18.3
300	630	21,000	2.18	6.6	2.84	8.5	5.02	15.1
400	840	28,000	1.64	4.9	2.84	8.5	4.48	13.4
500	1,050	35,000	1.31	3.9	2.84	8.5	4.15	12.4
600[4]	1,260[4]	42,000[4]	1.09	3.3	2.84	8.5	3.93	11.8

[1]Average yield of 2.1 tons or 70 bales per acre.

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

[3]This volume represents the break-even point of owning and using the specific complement of machinery when custom baling and hauling is 35 cents per bale or $11.67 per ton.

[4]This volume should be the average maximum annual capacity of this machine for the conditions specified in this publication.

Loose Hay Stacking With Mechanical Stacker

There are several new machines for stacking loose hay. One machine, called the Stakhand, is more prevalent in East Texas. This equipment is available in two sizes. The larger can form a stack of 5 to 6 tons of hay and the smaller machine can form a stack of 2 to 3 tons of hay. The larger machine costs about $13,000 and the smaller one is about $7,500.

Fixed Costs. The investment requirements for stacking hay with the smaller machine are shown in Table 10. The total investment of $18,900 includes a tractor of recommended horsepower (60 DBHP) and a self-propelled cutter-windrower. The self-propelled cutter will increase the efficiency of the operation as well as minimize the investment

Table 10. Estimated Fixed Cost of Owning and Operating Mechanical Loose-Stacking Hay Equipment

Item	Cost	Years Useful Life	Annual Depreciation[1]	Annual Repairs[2]	Interest[3]	Taxes and Insurance[4]	Total Annual Fixed Cost
Stakhand[5]	$ 7,500.00	10	$ 750.00	$225.00	$300.00	$ 93.75	$1,368.75
Tractor	6,000.00	10	510.00	135.00	240.00	75.00	960.00
Cutter (SP)	4,200.00	10	420.00	210.00	168.00	52.50	850.50
Rakes (2)	1,200.00	10	120.00	200.00	48.00	15.00	383.00
TOTAL	$18,900.00		$1,800.00	$770.00	$756.00	$236.25	$3,562.25

[1]Assumes $900 salvage value on tractor with zero salvage value on other equipment.

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

[3]New cost × 8 percent × ½.

[4]New cost × 1.25 percent.

[5]Two to 3-ton capacity machine.

Investment in mechanized stacking can reduce harvesting and feeding labor.

in the haying operation. This machine was not considered in the baling operation because dealers and farmers reported difficulty in properly drying grass hay for baling. Tandem rakes were included based on the need for efficiency and larger windrows. As seen in Table 10, the annual fixed or ownership costs of this equipment total $3,562.25.

Operating Costs. Operating costs for the small Stakhand were determined in a similar manner as for the other types of haying operations. Cost per hour (see Table 11) for labor was $1.50 with fuel and oil costs at 34 cents for the cutting and raking operation and 40 cents per hour for the larger tractor required to pull the Stakhand. The Stakhand and the self-propelled cutter have a capacity of about 17 acres per day.

Total Cost. The annual fixed and operating costs of mechanical stacking are shown in Table 12. The break-even volume is 11,796 bales or 353.9 tons annually when the custom baling and hauling rate is 35 cents per bale.

Custom mechanical hay stacking is just beginning. Preliminary reports indicate that the custom rate will be around $30 per stack or approximately $10.71 per ton assuming there are 2.8 tons of hay per stack. Under these conditions, a total of 391 tons or approximately 13,032 bales would be the break-even level of annual harvest.

Table 11. 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	1.40	.67	2.0
Raking	1	0.3	0.2	.52	.25	0.7
Stacking	1	0.8	0.6	1.44	.69	2.1
TOTAL		1.9	1.4	3.36	1.61	4.8

Table 12. 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 Fixed and Operating Expense	
Acres[2]	Tons	Bales	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)
30	63	2,100	56.54	169.6	1.61	4.8	58.15	171.4
50	105	3,500	33.93	101.8	1.61	4.8	35.54	106.6
75	158	5,250	22.55	67.9	1.61	4.8	24.16	72.7
100	210	7,000	16.96	50.9	1.61	4.8	18.57	55.7
125	263	8,750	13.54	40.7	1.61	4.8	15.15	45.5
150	315	10,500	11.31	33.9	1.61	4.8	12.92	38.7
168.5[3]	353.9[3]	11,796[3]	10.07	30.2	1.61	4.8	11.68	35.0
200	420	14,000	8.48	25.4	1.61	4.8	10.09	30.2
300	630	21,000	5.65	17.0	1.61	4.8	7.26	21.8
400	840	28,000	4.24	12.7	1.61	4.8	5.85	17.5
500	1,050	35,000	3.39	10.2	1.61	4.8	5.00	15.0
600	1,200	42,000	2.83	8.5	1.61	4.8	4.44	13.3
700	1,470	49,000	2.42	7.3	1.61	4.8	4.03	12.1
800	1,680	56,000	2.12	6.4	1.61	4.8	3.73	11.2
900	1,890	63,000	1.88	5.7	1.61	4.8	3.49	10.5
1,000[4]	2,100[4]	70,000[4]	1.70	5.1	1.61	4.8	3.31	9.9

[1]Average yield of 2.1 tons or 70 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 and hauling is 35 cents per bale.

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

HAY HARVESTING ALTERNATIVES COMPARED

The estimated total investment and annual fixed costs 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.

Table 13. Estimated Total Investment and Annual Fixed Costs of Various Methods of Hay Harvesting

Method	Initial Investment	Annual Ownership or Fixed Costs
Tractor mounted (front-end loader) stacker	$ 7,000.00	$1,376.00
Baler with custom hauling	7,500.00	1,604.25
Baler and Bale Wagon	14,035.00	2,692.62
Mechanical stacker	18,900.00	3,562.25

As seen in Table 13, the tractor-mounted stacker requires the least investment, followed by baler ownership with custom hauling, baler and Bale Wagon and the mechanical stacker.

The cost per unit (ton and bale) of the various harvesting methods is shown in Table 14. Assuming a custom rate of 35 cents per bale for harvesting, a producer could justify ownership of a tractor-mounted stacker with a little more than 155.8 tons or 5,192 bales annually. This way of harvesting hay is less expensive than either baling or stacking with a mechanical stacker.

The break-even harvest level for owning all necessary baling equipment is 286.5 tons or 9,549 bales when the custom rate of baling and hauling is 35 cents per bale. The 371-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 12,368 bales are harvested annually.

Owning a mechanical stacker can be justified for harvests greater than 353.9 tons or 11,796 bales annually when the custom rate for baling and hauling is 35 cents per bale. However, the combination of baler and Bale Wagon offers the cheaper means of harvest between baling and stacking up to a level of 568.4 tons. Beyond this, stacking hay with the mechanical stacker costs less than the baler and Bale Wagon method. With higher levels of harvests, the combined operating costs of the baler and the Bale Wagon and the mechanical stacker become more critical. The operating cost per ton with the baler and Bale Wagon is $3.14 compared to $1.61 per ton with the mechancal stacker.

Table 14. Estimated Total Cost Per Ton and Per Bale of Owning Various Hay Harvesting Equipment[1]

Amount Harvested Annually		Tractor Mounted (Front-End Loader) Stacker		Baling[2]		Mechanical (Pull-Type) Stacker	
Tons	Bales	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)	Ton ($)	Bale (¢)
63	2,100	24.68	74.0	31.49	94.6	58.15	171.4
105	3,500	15.94	47.8	21.31	64.0	35.54	106.6
155.8	5,192	11.67	35.0	16.33	49.0	24.47	73.4
158	5,250	11.55	34.7	16.18	48.8	24.16	72.7
210	7,000	9.39	28.2	13.67	41.1	18.57	55.7
263	8,750	8.07	24.2	12.13	36.5	15.15	45.5
286.5	9,549	7.64	22.9	11.63	35.0	14.04	42.1
315	10,500	7.21	21.6	11.12	33.5	12.92	38.7
353.9	11,796	6.73	20.2	10.56	31.8	11.68	35.0
371	12,368	6.55	19.6	10.35	31.2	11.21	33.6
420	14,000	6.12	18.3	9.55	28.7	10.09	30.2
568.4	18,945	5.26	15.8	7.87	23.6	9.87	23.6
630	21,000	5.02	15.1	7.42	22.2	7.26	21.8
840	28,000	4.48	13.4	6.35	19.0	5.85	17.5
1,050	35,000	4.15	12.4	5.71	18.1	5.15	15.0
1,260	42,000	3.93	11.8	5.27	15.8	4.44	13.3
1,470	49,000	.....	.....	4.97	14.9	4.03	12.1
1,680	56,000	.....	.....	4.74	14.2	3.73	11.2
1,890	63,000	.....	.....	4.57	13.9	3.49	10.5
2,100	70,000	.....	.....	4.42	13.3	3.31	9.9

[1]Assumes average of 33.3 bales per ton and an average yield of 70 bales or 2.1 tons per acre.

[2]Includes cost of 10 cents per bale for hauling hay to the barn until sufficient volume (12,368 bales) is reached so that the Bale Wagon becomes more economical than custom hauling.

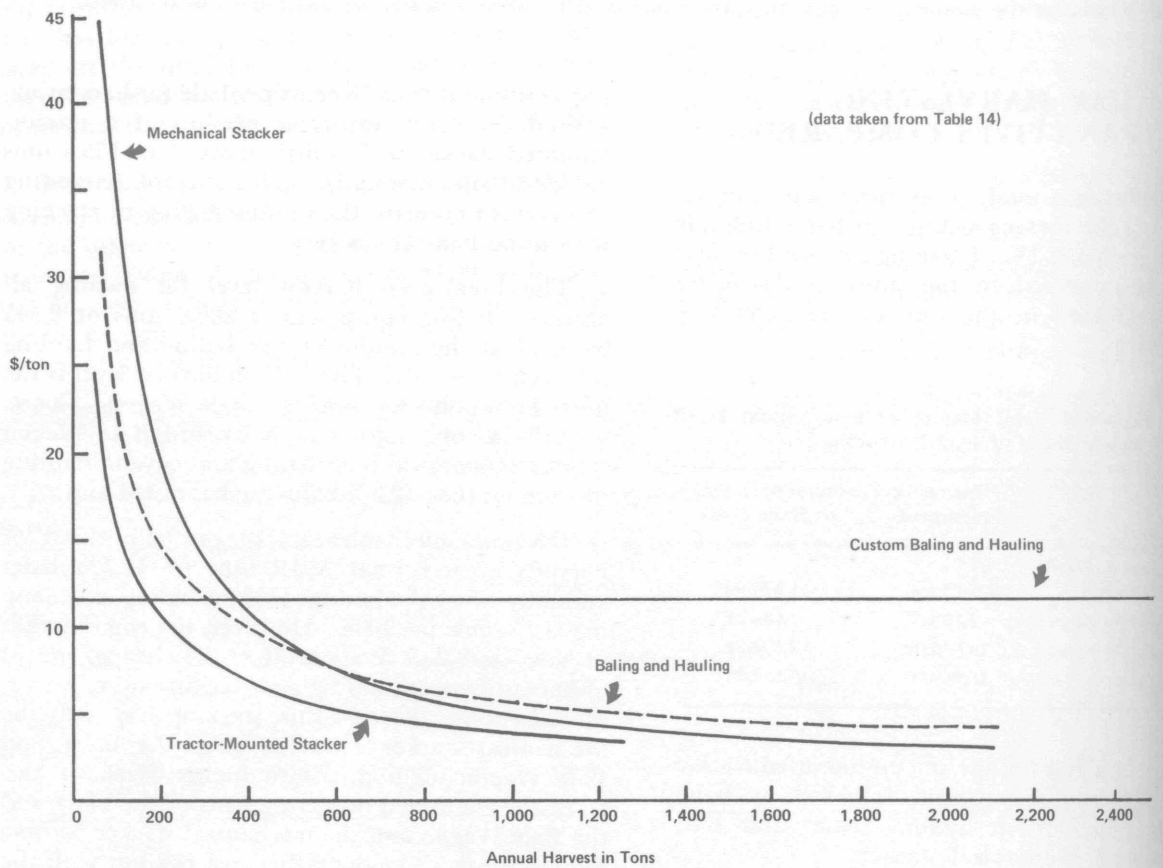


FIG. 1. AVERAGE COST PER TON OF VARIOUS METHODS OF HARVESTING HAY

HOW TO MAKE WISE DECISIONS CONCERNING INVESTMENTS IN MACHINERY

Although it is almost impossible to calculate all possible combinations of machine ownership in this publication, the "break-even" formula, along with information presented, can help in making decisions for individual farm situations.

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

"Break-even point" =

$$\frac{\textit{Total annual fixed costs}}{\textit{Custom rate } \textbf{minus} \textit{ operating cost per unit}}$$

Situation: *Mr. Brown has his hay custom baled for 25 cents per bale and harvests about 7,000 bales each year. He already owns the right size and number of tractors. What is the break-even point between owning a baler, rake and mower and having the hay custom baled?*

Arithmetic: *As seen in Table 1, the* ***annual fixed costs*** *of a mower, rake and baler totals $946.75. In Table 2, the operating costs are 8.2 cents per bale, including labor. The break-even point is calculated below.*

$$\frac{\$946.75 \text{ (annual fixed costs)}}{\$.25 \text{ (custom rate)} - \$.082 \text{ (variable costs)}} =$$

$$\frac{\$946.75}{\$.168} = 5{,}635 \text{ bales (break-even point)}$$

Decision: *By investing $3,500 in the mower, rake and baler, Mr. Brown saves approximately $229.25 each year or realizes a return of 6.5 percent on his investment. Unless a greater return on his $3,500 investment could be realized by investing in another phase of his operation, Mr. Brown should buy the hay harvesting equipment.*

More accurate break-even points can be calculated if actual figures are used or if the costs are tailored to the individual situation.

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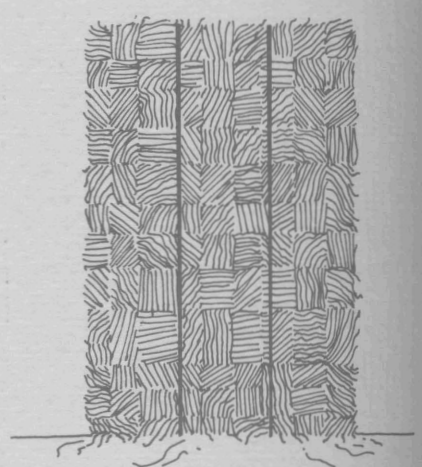

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