COSTS OF TAME HAY AND NATIVE HAY HARVESTING SYSTEMS in North Dakota

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Introduction

North Dakota farmers harvest hay from more than 3 million acres to feed over 2 million cattle annually. Historically haying has been one of the most labor-intensive operations for farmers. With less labor available on today's farms, the farmer is in a difficult situation. He must select a system of hay harvesting that will provide enough hay for his livestock operation within the limited time and amount of labor and capital available.

Technology has added several new hay harvesting systems in recent years. These systems range from a labor intensive, low investment system to a capital intensive, one-man hay harvesting system. A system can be selected to match each farmer's available labor and capital and have the capacity necessary for timely completion of hay harvesting.

Rainfall Limits the Harvesting Season

Rainfall during the haying season limits the number of days available to complete the necessary haying operations. As rainfall is unpredictable, farmers may own, as a form of insurance, a hay harvesting system of greater capacity than would be necessary to complete the operation in a year with normal rainfall.

The state can be divided into four farming areas according to rainfall patterns. (Figure 1)

The available work hours for native and tame hay harvesting operations has been estimated for each area for three different drying conditions (Table 1). Operation 1 refers to mowing, raking, or swathing operations. It was assumed that Operation 1 is carried out during a nine-hour workday and a seven-day week under conditions of no precipitation.

Table 1. Available Work Hours for the Hay Harvesting Operations for Tame and Native Haying Seasons for Four Farming Areas in North Dakota.

Region	Native Hay		Tame Hay		
	Operation 1	Operation 2	Operation 1	Operation 2	Operation 3
		Above Normal Drying Conditions			
Red River Valley	180	131	227	163	189[a]
East Central	179	132	226	160	184
West Central	181	134	229	164	191
Western	186	141	229	165	191
		Normal Drying Conditions			
Red River Valley	169	125	213	153	186
East Central	168	125	212	150	183
West Central	170	128	215	155	187
Western	175	136	215	156	188
		Below Normal Drying Conditions			
Red River Valley	159	113	201	139	173
East Central	159	114	199	136	170
West Central	161	116	202	141	174
Western	167	123	203	149	175

[a] More hours are available for hay chopping because it can be done at 40 percent moisture content as compared to about 15 percent for other operations.

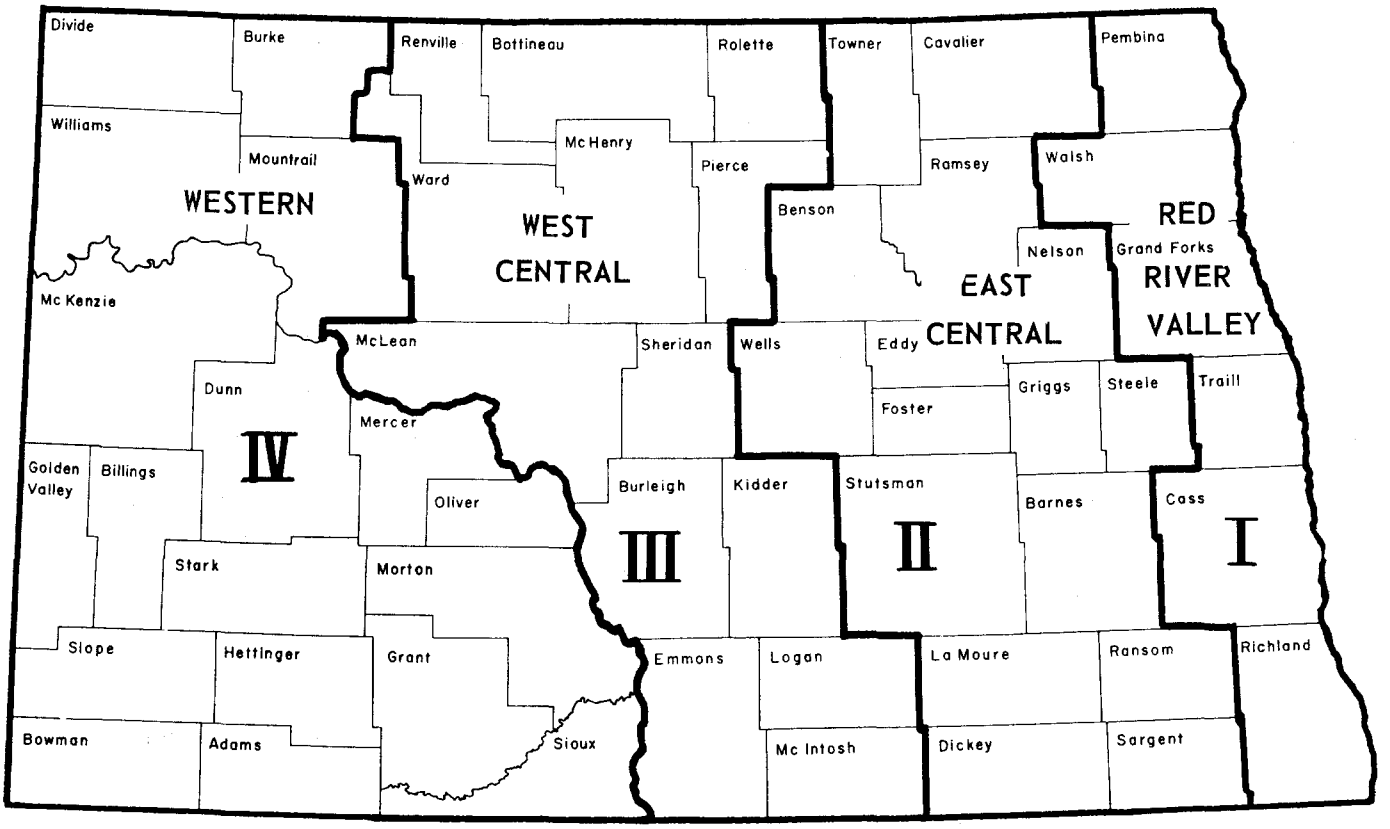

FIGURE 1. THE FOUR FARMING AREAS OF NORTH DAKOTA

Operation 2 includes baling and/or stacking operations, and Operation 3 refers to hay chopping. Because of dew, Operations 2 and 3 were assumed to be carried out during an eight-hour day and a seven-day week.

The work hours in Table 1 refer to the normal haying seasons. For tame hay this would be June 10 to July 1 (1st cutting) and July 25 to August 7 (2nd cutting, except for the Western Region which is August 1 to August 14). For native hay the season would be July 15 to August 15.

The total annual capacity for each hay harvesting machine is found by multiplying the capacity of the machine in tons per hour (Table 2) by the total annual hours available (Table 1). (Table 2 lists the machinery capacities and labor requirements for various hay harvesting machines.) For example, the medium baler, with a capacity of 6.4 tons per hour,

Table 2. Machinery Capacities and Labor Requirements for Hay Harvesting Machinery

Machinery	Capacity*	Labor Requirement
Swather, 14'	5.7 acres/hr.	.18 man hours/ton
Swather, 16'	8.0 acres/hr.	.13 man hours/ton
Mower, 9'	3.7 acres/hr.	.27 man hours/ton
Rake, 9'	5.2 acres/hr.	.19 man hours/ton
Baler, medium, PTO	6.4 tons/hr.	.16 man hours/ton
Baler, large, PTO	8.0 tons/hr.	.13 man hours/ton
Automatic bale wagon, medium, PTO	6.5 tons/hr.	.15 man hours/ton
Automatic bale wagon, large, PTO	8.0 tons/hr.	.13 man hours/ton
Big baler, medium	6.0 tons/hr.	.17 man hours/ton
Big baler, large	7.5 tons/hr.	.13 man hours/ton
Stacking wagon, 3 ton	6.5 tons/hr.	.15 man hours/ton
Stacking wagon, 6 ton	8.5 tons/hr.	.12 man hours/ton
Forage harvester, medium, PTO	9.0 tons/hr.	.11 man hours/ton
Forage harvester, large, PTO	11.0 tons/hr.	.09 man hours/ton
Hydraulic loader, stacker, & frame	4.0 tons/hr.	.25 man hours/ton
Three men hauling & stacking bales	2.7 tons/hr.	1.11 man hours/ton

* Capacities based on assumption of one ton per acre average yield.

could harvest a maximum of 1,024 tons of tame hay in East Central North Dakota (6.4 tons/hour x 160 hours = 1,024 tons). The capacity would range from 870 to 1,024 tons depending on drying conditions.

Annual capacities for several systems and for different drying conditions can be determined and compared using Tables 1 and 2. Once this is determined, and using the cost information that follows, a farmer or rancher can assemble a haying system to suit his situation, personal preferences, and capital available.

Cost Theory and Assumptions

In determining the costs for eleven hay harvesting systems, costs were divided according to fixed and variable costs. The assumptions made in determining these costs are as follows:

Fixed Costs:

- 13.5 percent of tractor costs were allocated to haying.
- 25 percent of swather costs were allocated to haying.
- Depreciation - straight line method used; 10 percent salvage value.
- Interest on investment - 8 percent of average investment.
- Insurance and shelter - 1 percent of original cost of machine.
- Machinery prices were November, 1973, prices in Cass County, North Dakota.

Variable Costs:

- Repairs - estimates based on percent of new price; varies with machine.
- Fuel cost - based on Nebraska tractor test average; gasoline priced at $.40 per gallon, diesel fuel at $.37 per gallon.
- Lubrication cost - 15 percent of fuel cost.
- Labor - $2.00 per hour for all hired labor and the labor of the farmer and his family.
- Twine - $.60 per ton for standard size bales, $.15 per ton for big bales.

Costs of Haying Systems

Costs of harvesting hay were calculated for small, medium and large capacity haying systems. Equipment listed is for harvesting tame hay. For harvesting native hay, the swather would be replaced with a mower and a rake.

Small Capacity Systems

- Medium baler and manual stacking of bales. Necessary machinery includes a swather (self-propelled), medium-size power take-off baler, 12-foot flatbed wagon, and 60-75 horsepower tractor.
- Medium baler with a bale accumulator (eight-bale type). Machines needed are a self-propelled swather, medium-sized PTO baler, eight-bale type accumulator, 12-foot flatbed wagon, 60-75 horsepower tractor, and 40-55 horsepower tractor with loader-fork.
- Loader loose hay stacking with a stack frame. This system uses a self-propelled swather, medium-size stack frame, 60-75 horsepower tractor with push-off loader.

Medium Capacity Systems

- Medium baler with small automatic bale wagon. Equipment includes a 14-foot self-propelled swather, medium-size PTO baler, pull type automatic bale wagon, one 60-75 and one 40-55 horsepower tractor.
- Small big baler (1,500 pound bale). Machinery required: 14-foot self-propelled swather, PTO 1500-pound big baler, bale carrier capable of carrying one bale at a time, and 60-75 horsepower tractor.
- Small loose hay stacking wagon (3 ton capacity). Equipment includes 60-75 horsepower tractor, 14-foot self-propelled swather, and 3-ton stacking wagon.
- Small hay chopping system. Necessary machinery: 14-foot self-propelled swather, three tractors (80-95, 60-75, and 40-55 horsepower), PTO medium-sized forage harvester with hay head and two medium-size forage wagons.

Large Capacity Systems

- Large baler and large automatic bale wagon. Equipment needed: 16-foot self-propelled swather, large PTO baler, large pull-type automatic bale wagon, two tractors (60-75 and 80-95 horsepower).
- Large big baler (2,500 pound bale). This system uses a PTO 2500-pound big baler, 16-foot self-propelled swather, one 80-95 horsepower tractor, and a bale carrier (1 bale at a time).
- Large loose hay stacking wagon (6 ton capacity). Equipment includes a 6-ton stacking wagon, 80-95 horsepower tractor, and 16-foot self-propelled swather.
- Large hay chopping system. Machines needed are: 16-foot self-propelled swather, large size

Table 3. Labor Requirements and Labor Cost for Cutting, Harvesting, and Transporting Hay to Storage

	Type of System	No. Men Required	Man Hrs. Per Ton	Per Ton: Total Man Hrs.	Per Ton: Total Labor Cost @ $2/Hr.
1.	Medium baler with manually stacking bales	3	1.223	3.67	$7.34
2.	Medium baler and bale accumulator	2	.325	.65	1.30
3.	Loader loose hay stacking with frame	1	.43	.43	.86
4.	Medium baler with small automatic bale wagon	2	.245	.49	.98
5.	Small big baler	1	.57	.57	1.14
6.	Small loose hay stacking wagon	1	.33	.33	.66
7.	Small hay chopping	3	.17	.51	1.02
8.	Large baler with large automatic bale wagon	2	.195	.39	.78
9.	Large big baler	1	.39	.39	.78
10.	Large loose hay stacking wagon	1	.25	.25	.50
11.	Large hay chopping	3	.133	.40	.80

PTO forage harvester with hay head, two large forage wagons, three tractors (40-55, 60-75, 95-120 horsepower).

Total labor requirements costs vary with the different systems. The number of men, the number of man hours per ton, total man hours and total labor costs for cutting, harvesting, and transporting hay to storage for each system are listed in Table 3.

SMALL CAPACITY SYSTEMS

Table 4. Costs for Baling and Manually Stacking Bales

Tons	Total Annual Costs: Total Fixed Costs	Total Annual Costs: Total Variable Costs	Total Annual Costs: Total Costs	Costs Per Ton: Ave. F.C.	Costs Per Ton: Ave. V. C.	Costs Per Ton: Ave. T.C.
			Tame Hay			
50	$799	$ 433[a]	$ 1,232	$15.98	$8.67[a]	$24.65
250	799	2,167	2,966	3.20	8.67	11.87
500	799	4,335	5,134	1.60	8.67	10.27
750	799	6,502	7,301	1.06	8.67	9.74
1,000	799	8,670	9,469	.80	8.67	9.47
			Native Hay			
50	$838	$ 492	$ 1,330	$16.75	$9.84	$26.59
250	838	2,460	3,298	3.35	9.84	13.19
500	838	4,920	5,758	1.68	9.84	11.52
750	838	7,380	8,218	1.12	9.84	10.96
1,000	838	9,840	10,668	.84	9.84	10.68

[a] Includes 3.67 hours of labor @ $2/hour, a total of $7.34 per ton.

Table 5. Costs for Baler and Bale Accumulator System

Tons	Total Annual Costs: Total Fixed Costs	Total Annual Costs: Total Variable Costs	Total Annual Costs: Total Costs	Costs Per Ton: Ave. F.C.	Costs Per Ton: Ave. V.C.	Costs Per Ton: Ave. T.C.
			Tame Hay			
50	$1,396	$ 152[a]	$1,548	$27.93	$3.04[a]	$30.97
250	1,396	760	2,156	5.59	3.04	8.63
500	1,396	1,520	2,916	2.79	3.04	5.83
750	1,396	2,280	3,676	1.86	3.04	4.90
1,000	1,396	3,040	4,436	1.40	3.04	4.44
			Native Hay			
50	$1,445	$ 211	$1,656	$28.91	$4.22	$33.13
250	1,445	1,055	2,500	5.78	4.22	10.00
500	1,445	2,110	3,555	2.89	4.22	7.11
750	1,445	3,165	4,610	1.93	4.22	6.15
1,000	1,445	4,220	5,665	1.45	4.22	5.67

[a] Includes .65 hours of labor @ $2/hour, a total of $1.30 per ton.

Fixed and variable costs for harvesting native hay, (Table 4) were greater because of the investment in a rake, small tractor and mower and operation of these machines, as compared to a swather used for tame hay harvesting. Since this system requires three men for baling and stacking, $7.34 of the variable costs are labor costs.

The bale accumulator system, compared to manually stacking bales, requires a greater investment because of the addition of a bale accumulator. For harvesting only 50 tons of hay, it is a more costly system. For greater tonnages, costs per ton are less, mainly because less labor is used with this system.

The loader loose hay stacking system, which uses a stack frame and a tractor-loader with a push-off, is the least expensive system of all for small tonnages of hay. Stack moving is a custom operation estimated at $1.50 per ton. Less hay can be put up in a given period of time with the loader loose hay stacking system than with any other system.

Table 6. Loader Loose Hay Stacking System

	Total Annual Costs			Costs Per Ton		
Tons	Total Fixed Costs	Total Variable Costs	Total Costs	Ave. F.C.	Ave. V.C.	Ave. T.C.
			Tame Hay			
50	$650	$ 152[a/]	$ 802	$12.99	$3.05[a/]	$16.04
250	650	762	1,412	2.60	3.05	5.65
500	650	1,525	2,175	1.30	3.05	4.35
750	650	2,287	2,937	.87	3.05	3.92
1,000	650	3,050	3,700	.65	3.05	3.70
			Native Hay			
50	$690	$ 211	$ 901	$13.79	$4.23	$18.02
250	690	1,057	1,747	2.76	4.23	6.99
500	690	2,115	2,805	1.38	4.23	5.61
750	690	3,172	3,862	.92	4.23	5.15
1,000	690	4,230	4,920	.69	4.23	4.92

[a/] Includes .43 hours of labor @ $2/hour, a total of $.86 per ton.

MEDIUM CAPACITY SYSTEMS

Table 7. Costs for Medium Baler and Small Automatic Bale Wagon System

	Total Annual Costs			Costs Per Ton		
Tons	Total Fixed Costs	Total Variable Costs	Total Costs	Ave. F.C.	Ave. V.C.	Ave. T.C.
			Tame Hay			
50	$1,546	$ 131[a/]	$1,677	$30.91	$2.62[a/]	$33.53
250	1,546	655	2,201	6.18	2.62	8.80
500	1,546	1,310	2,856	3.09	2.62	5.71
750	1,546	1,965	3,511	2.06	2.62	4.68
1,000	1,546	2,620	4,166	1.55	2.62	4.17
			Native Hay			
50	$1,595	$ 190	$1,785	$31.89	$3.80	$35.69
250	1,595	950	2,545	6.38	3.80	10.18
500	1,595	1,900	3,495	3.19	3.80	6.99
750	1,595	2,850	4,445	2.13	3.80	5.93
1,000	1,595	3,800	5,395	1.59	3.80	5.40

[a/] Includes .49 hours of labor @ $2/hour, a total of $.98 per ton.

Costs for the small automatic bale wagon system are quite similar to the costs for the bale accumulator system (Table 5). Investment in equipment is approximately $1,400 greater than for the bale accumulator system.

The small big baler system uses the smaller type big baler (1,500 pound bale) and a carrier capable of carrying one of these bales. Annual capacity is about the same as for systems using the conventional baler, but investment and costs are generally less.

Table 8. Costs for the Small Big Baler System

Tons	Total Annual Costs: Total Fixed Costs	Total Annual Costs: Total Variable Costs	Total Annual Costs: Total Costs	Costs Per Ton: Ave. F.C.	Costs Per Ton: Ave. V.C.	Costs Per Ton: Ave. T.C.
			Tame Hay			
50	$ 977	$ 116[a]	$1,093	$19.55	$2.33[a]	$21.88
250	977	583	1,560	3.91	2.33	6.24
500	977	1,165	2,142	1.95	2.33	4.29
750	977	1,748	2,725	1.30	2.33	3.63
1,000	977	2,330	3,307	.98	2.33	3.31
			Native Hay			
50	$1,016	$ 176	$1,192	$20.32	$3.51	$23.83
250	1,016	878	1,894	4.06	3.51	7.57
500	1,016	1,755	2,771	2.03	3.51	5.54
750	1,016	2,633	3,649	1.35	3.51	4.87
1,000	1,016	3,510	4,526	1.02	3.51	4.53

[a] Includes .57 hours labor @ $2/hour, a total of $1.14 per ton.

Table 9. Costs for Small Loose Hay Stacking Wagon System

Tons	Total Annual Costs: Total Fixed Costs	Total Annual Costs: Total Variable Costs	Total Annual Costs: Total Costs	Costs Per Ton: Ave. F.C.	Costs Per Ton: Ave. V.C.	Costs Per Ton: Ave. T.C.
			Tame Hay			
50	$1,519	$ 77[a]	$1,596	$30.39	$1.54[a]	$31.93
250	1,519	385	1,904	6.08	1.54	7.62
500	1,519	770	2,289	3.04	1.54	4.58
750	1,519	1,155	2,674	2.03	1.54	3.57
1,000	1,519	1,540	3,059	1.52	1.54	3.06
			Native Hay			
50	$1,558	$ 136	$1,694	$31.17	$2.72	$33.89
250	1,558	680	2,238	6.23	2.72	8.95
500	1,558	1,360	2,918	3.12	2.72	5.84
750	1,558	2,040	3,598	2.08	2.72	4.80
1,000	1,558	2,720	4,278	1.56	2.72	4.28

[a] Includes .33 hours labor @ $2/hour, a total of $.66 per ton.

The small stacking wagon system uses a small hay stacking wagon which makes a three-ton stack of loose hay. Investment for this system is similar to the large baler and small automatic bale wagon system (Table 7), but costs of operation are less. Costs per ton, when compared to the small big baler (Table 8), are higher for low tonnages but are smaller for the larger tonnages. This is because the total variable costs of the small big baler increase at a faster rate than for the small loose hay stacking wagon system, and at greater tonnages the increased variable costs overtake the difference in fixed costs.

Table 10. Costs for Small Hay Chopping System

Tons	Total Annual Costs: Total Fixed Costs	Total Annual Costs: Total Variable Costs	Total Annual Costs: Total Costs	Costs Per Ton: Ave. F.C.	Costs Per Ton: Ave. V.C.	Costs Per Ton: Ave. T.C.
			Tame Hay			
50	$1,658	$ 97[a]	$1,755	$33.15	$1.94[a]	$35.09
250	1,658	485	2,143	6.63	1.94	8.57
500	1,658	970	2,628	3.32	1.94	5.26
750	1,658	1,455	3,113	2.21	1.94	4.15
1,000	1,658	1,940	3,958	1.66	1.94	3.60

[a] Includes .51 hours of labor @ $2/hour, a total of $1.02 per ton.

The small hay chopping system uses a forage harvester (9 ton per hour capacity) which chops the hay into forage wagons. The hay is hauled from the field to the haylage pile, unloaded and packed. Investment and fixed costs for this system are the highest for medium capacity systems. Annual capacity for this system is considerably greater because more hours are available for harvesting high moisture haylage and the capacity of the forage harvester is greater than for the other medium capacity systems.

LARGE CAPACITY SYSTEMS

Table 11. Costs for Large Automatic Bale Wagon System

Tons	Total Annual Costs: Total Fixed Costs	Total Annual Costs: Total Variable Costs	Total Annual Costs: Total Costs	Costs Per Ton: Ave. F.C.	Costs Per Ton: Ave. V.C.	Costs Per Ton: Ave. T.C.
			Tame Hay			
50	$1,950	$ 125[a]	$2,075	$39.01	$2.49[a]	$41.50
250	1,950	623	2,573	7.08	2.49	10.29
500	1,950	1,245	3,195	3.90	2.49	6.39
750	1,950	1,868	3,818	2.60	2.49	5.09
1,000	1,950	2,490	4,440	1.95	2.49	4.44
			Native Hay			
50	$1,965	$ 190	$2,155	$39.29	$3.79	$43.08
250	1,965	948	2,913	9.82	3.79	11.65
500	1,965	1,895	3,859	3.93	3.79	7.72
750	1,965	2,842	4,807	2.69	3.79	6.41
1,000	1,965	3,790	5,755	1.96	3.79	5.76

[a] Includes $.39 hours of labor @ $2/hour, a total of $.78 per ton.

The large automatic bale wagon system uses a larger baler and bale wagon than the small automatic bale wagon system. Investment in equipment and costs per ton are higher than for the smaller systems. Capacity, however, is greater. Costs per ton for this system are comparable to the larger hay chopping system.

The large big bale system uses a baler that makes a 2,500 bale and a bale carrier capable of handling one of these large bales. Of the large capacity systems, the large big baler method is the least expensive for harvesting hay. Annual capacity is slightly less than the large automatic bale wagon system and considerably less than the large hay chopping system.

Table 12. Costs for the Large Big-Bale Harvesting System

Tons	Total Annual Costs: Total Fixed Costs	Total Variable Costs	Total Costs	Costs Per Ton: Ave. F.C.	Ave. V.C.	Ave. T.C.
			Tame Hay			
50	$1,246	$ 97[a]	$1,349	$24.91	$1.94[a]	$26.85
250	1,246	485	1,731	4.98	1.94	6.92
500	1,246	970	2,216	2.49	1.94	4.43
750	1,246	1,455	2,701	1.66	1.94	3.60
1,000	1,246	1,940	3,186	1.25	1.94	3.19
			Native Hay			
50	$1,252	$ 162	$1,414	$25.04	$3.24	$28.28
250	1,252	810	2,062	5.01	3.24	8.25
500	1,252	1,620	2,872	2.50	3.24	5.74
750	1,252	2,430	3,682	1.67	3.24	4.91
1,000	1,252	3,240	4,492	1.25	3.24	4.49

[a] Includes .39 hours of labor @ $2/hour, a total of $.78 per ton.

Table 13. Costs for Large Loose Hay Stacking Wagon System

Tons	Total Annual Costs: Total Fixed Costs	Total Variable Costs	Total Costs	Costs Per Ton: Ave. F.C.	Ave. V.C.	Ave. T.C.
			Tame Hay			
50	$2,215	$ 74[a]	$2,289	$44.31	$1.47[a]	$45.78
250	2,215	368	2,583	8.86	1.47	10.33
500	2,215	735	2,951	4.43	1.47	5.90
750	2,215	1,103	3,318	2.95	1.47	4.42
1,000	2,215	1,470	3,686	2.22	1.47	3.67
			Native Hay			
50	$2,225	$ 139	$2,364	$44.50	$2.77	$47.27
250	2,225	693	2,918	8.90	2.77	11.67
500	2,225	1,385	3,610	4.45	2.77	7.22
750	2,225	2,078	4.303	2.97	2.77	5.74
1,000	2,225	2,770	4,995	2.23	2.77	5.00

[a] Includes .25 hours labor @ $2/hour, a total of $.50 per ton.

A six-ton hay stacking wagon is used with this system. Next to the forage harvester, the large loose hay stacking wagon system has the largest capacity. It ranks second in least cost per ton to the large big baler system.

Table 14. Costs for the Large Hay Chopping System

Tons	Total Annual Costs: Total Fixed Costs	Total Variable Costs	Total Costs	Costs Per Ton: Ave. F.C.	Ave. V.C.	Ave. T.C.
			Tame Hay			
50	$2,053	$ 82[a]	$2,134	$41.05	$1.63[a]	$42.68
250	2,053	408	2,460	8.21	1.63	9.84
500	2,053	815	2,868	4.11	1.63	5.74
750	2,053	1,223	3,257	2.74	1.63	4.37
1,000	2,053	1,630	3,683	2.05	1.63	3.68

[a] Includes .40 hours labor @ $2/hour, a total of $.80 per ton.

The large hay chopping system is the largest capacity system of harvesting tame hay. Although investment in this system is less than for the large hay stacking wagon system, costs per ton are only slightly different. No costs are given for native hay, as chopping is not commonly used to harvest wild hay.

Hay Feeding Costs

In addition to the costs of hay harvesting, the costs of feeding hay must be considered. The decision to invest in a hay harvesting system may depend on the additional investment for feeding machinery and equipment, labor required, and the capacity of the feeding system. A large number of hay feeding systems or variations of systems are available. The more simple and less expensive systems of feeding are considered in this study.

The assumptions for determining hay feeding costs are:

- 13.5 percent of the value of the tractor used in feeding is charged to feeding system costs.
- Costs of a front end tractor loader are charged to feeding and included in Table 14. However, a loader is necessary for harvesting with the bale accumulator system, so loader costs were charged to harvesting. Therefore, total fixed costs for the bale feeding system should be reduced from $403.47 to $247.38 if the bale feeding system is used with the bale accumulator harvesting method.
- Feed wagons used for hay chopping are not charged to haylage feeding. They were included in the harvesting costs.

The feeding systems used are:

Feeding System for Baled Hay - Bales are loaded by hand from the stack to a loader mounted on a tractor. The bales are then hauled to a hayrack where the twine strings are cut, the bales dropped into the rack, and the hay is self-fed. One worker is necessary for feeding baled hay.

Big Bale Feeding System - One bale is carried with a loader mounted on a tractor to the feeding area. The twine is cut and the bale dumped into a hayrack for self-feeding. One worker is required to feed hay with this system.

Haylage Feeding System - Chopped hay is removed from the haylage pile by means of a loader mounted on a tractor. The haylage is loaded onto a feed wagon, hauled to the feeding area, and unloaded into feed bunks. Only the amount the cattle can eat is fed to prevent excess waste. To feed haylage, one worker is required.

Loose Hay Feeding System - Loose hay is removed from the haystack with a grapple fork on a loader. The hay is hauled from the stack to a hayrack where it is dropped and self-fed. One worker is required.

The costs of feeding various tonnages are listed for each of the four feeding systems (Table 15).

Table 15. Costs of Four Hay Feeding Systems

	Total Annual Costs			Costs Per Ton		
Tons	Total Fixed Costs	Total Variable Costs	Total Costs	Ave. F.C.	Ave. V.C.	Ave. T.C.
		Feeding System for Baled Hay				
50	$403	$ 81[a]	$ 484	$8.07	$1.61[a]	$9.68
250	403	403	806	1.61	1.61	3.22
500	403	805	1,208	.81	1.61	2.42
750	403	1,208	1,611	.54	1.61	2.15
1,000	403	1,610	2,013	.40	1.61	2.01
		Feeding System for Big Bales				
50	$367	$ 32	$ 399	$7.34	$ .64	$7.98
250	367	160	527	1.47	.64	2.11
500	367	320	687	.73	.64	1.37
750	367	480	847	.49	.64	1.13
1,000	367	640	1,007	.37	.64	1.01
		Haylage Feeding System				
50	$426	$ 59	$ 485	$8.52	$1.18	$9.70
250	426	295	721	1.70	1.18	2.88
500	426	590	1,016	.85	1.18	2.03
750	426	885	1,311	.57	1.18	1.75
1,000	426	1,180	1,606	.43	1.18	1.61
		Loose Hay Feeding System				
50	$453	$ 41	$ 494	$9.07	$ .82	$9.89
250	453	205	658	1.81	.82	2.63
500	453	410	863	.91	.82	1.73
750	453	615	1,068	.60	.82	1.42
1,000	453	820	1,273	.45	.82	1.27

[a] Includes labor.

Hay Losses

The amount of hay lost due to weather or storage losses, along with the amount of hay wasted by cattle after they have been fed (or feeding losses), are considered part of the total haying costs. Hay storage losses are expressed as a percentage of total hay. Feeding losses are expressed as a percentage of total hay fed. In order to determine the value of storage and feeding losses, multiply the percentage loss by the value of a ton of hay.

The storage and feeding losses for different hay systems and the value of these losses with hay priced at $30; $40 and $50 per ton are given in Table 16.

Table 16. Storage and Feeding Losses for Different Haying Systems

Type of Hay	Storage Loss Percent of Hay Harvested	Feeding Loss Percent of Hay Fed	Total Loss/Ton If Hay Is Valued at		
			$30/ton	$40/ton	$50/ton
Loose hay (loader-stacker)	3.5	2.34	$1.74	$2.32	$2.90
Bales	4.5	4.00	2.55	3.40	4.25
Big Bales	3.5	4.40	2.37	3.16	3.95
Loose hay (stacking wagon)	3.5	2.34	1.74	2.32	2.90
Haylage	12.5	-------1/	3.75	5.00	6.25

1/ Haylage not considered to have a significant feeding loss.

Summary

To determine total costs of hay harvesting and feeding, the costs for the harvesting system, the feeding system, and for storage and feeding losses should be added together. Comparisons for different systems and for different tonnages can then be made. Costs for a particular system can also be compared to current custom rates to determine which might be the least expensive alternative.

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