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INVESTING IN HAY STORAGE FACILITIES

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SUMMARY

What starts out as a simple, straight-forward inquiry about investment in hay storage facilities quickly becomes more complex than initially anticipated. However, basic approaches used to evaluate alternatives associated with this question differ little from those used to evaluate many farm and ranch management decisions.

Managers generally are familiar with partial budgeting, the process of comparing expected added benefits with expected additional costs from proposed activities. For example, partial budgeting can also be used to evaluating adjustments in input mixes and investments in capital improvements. However simple the idea of partial budgeting, problems often arise when assigning dollar values to benefits and costs of proposed changes.

A notion popular with most producers is the "bottom line." After all discussion and economic analysis is completed, the question is usually "what is the bottom line?" Results presented in this paper illustrate that producers are more likely to build open pole barns for storage than enclosed structures. It also is more likely that producers will investigate alternative preservation techniques which do not utilize relatively expensive buildings.

In the final analysis, it becomes easier to justify investments in hay storage facilities or other protective materials as hay quality and value increases. Estimation of benefits derived from protecting hay continues to be difficult. However, hay producers and ranchers with livestock must be careful not to spend more for facilities, materials, and labor than can be justified by savings accrued from decreasing losses in hay quality and quantity.

INTRODUCTION

Producers and users of high quality hay have probably wondered at some point whether or not to invest in hay storage facilities. Some folks quickly conclude that facilities are bad investments, while others say you can not afford to be without them. Consult your local economist and you are likely to hear the familiar expression, "it depends."

The final decision of whether or not to invest in hay storage facilities rests on the answers to a few key questions:

1. How much will various facilities cost?
2. How much will be saved and how much will quality (value) be maintained by storing hay in specific facilities?
3. What is the value of hay relative to other feed stuffs and what is the market outlook in terms of hay prices, supply, and demand?
4. How much production and storage risk are you willing to bear in your farm or ranch operation?

STORAGE COSTS

There are many different methods for protecting hay from weather, pests, and other hazardous factors that reduce the quantity and quality available for sale or feeding. Each has a wide range of associated construction costs depending on materials, labor, location and other factors. Construction costs for examples used here are estimates from the 1988 Agricultural Building Cost Guide, from county agent result demonstrations, and from private firms.

Typical structures for storing hay include totally enclosed barns, three-sided enclosed barns and open hay sheds. For illustration purposes in this paper, all buildings are assumed to have pole frames and dirt floors.

Total construction costs and annual payments for example storage buildings are shown in Table 1 along with assumptions necessary to make such estimates. Annual payments include principal and interest for a 10-year loan at 13% interest. It is assumed that all money to cover construction costs is borrowed.

Buildings selected for examples vary in capacity due to size and stacking recommendations. Capacities for most enclosed barns and pole barns are based on stacking large, round, 1,200 lb bales two high. The smaller pole barn included here allows for stacking bales three high.

Net savings realized by storing hay in proposed facilities should be evaluated for investment purposes relative to the next best available storage alternative . The most likely alternative for comparison purposes (and the one used in these examples) is uncovered on the ground storage of large round bales.

Many producers are concerned constantly with cash flow. Therefore, analyses reflect the notion that storage facilities are a desirable investment if the annual savings realized from storing hay covers annual loan payments. For example, the amount of hay saved per bale by storing it in the large hay shed open on one side must be worth at least $9.01 per year for 10 years to cover loan payments, assuming a one time turnover of hay inventory. Similarly, savings on each roll stored in a large open pole barn must be $5.88 per year for 10 years to cover annual loan payments. Breakeven savings are estimated to be $10.52 and $6.13 for the three-sided barn and small pole barn, respectively. Any proposed storage facilities or protective measures can be evaluated using similar breakeven analysis.

Payment schedules begin to make it evident that only producers facing significant losses or those producing relatively high quality, high value hay will be able to justify larger, enclosed, more expensive storage facilities. Managers in locations regularly plagued by severe weather causing considerable hay damage also should consider some protection. Producers of high quality hay with relatively greater value in the market place, such as for horse or dairy feed, also might consider strongly such investments.

QUANTITY AND QUALITY SAVINGS

Whether hay is stored outside on the ground, on tires, on pallets, or on gravel pads; whether hay is stored covered or uncovered; or whether it is stacked or stored one roll high; quality and quantity both decrease during storage. The magnitude of these losses depends on type and density of bales, grasses included in the hay, and weather and storage conditions.

Research results from Louisiana (extracted from Doanes Agricultural Report, 1989) demonstrated that loss of nutrients and feeding value of ryegrass and similar fall/winter hays stored outside, uncovered, and on the ground can be substantial in some areas. Total loss from six different storage methods ranged from 65.2% for open ground storage to 3.5% for storage in an enclosed barn. Other storage methods (and the associated total loss) included gravel pad (49.8%), rack (37.9%), rack with cover (13.8%), and tires (43.0%).

Besides a loss of material, the quality of hay measured as dry matter digestibility (DDM) and protein digestion also declined during storage. DDM ranged from 44.8% for ground storage to 53.9% for barn storage. Protein digestion ranged from 30.5% for gravel pad storage to 48.4% for barn storage.

Results of several demonstrations conducted over the past several years by county Extension agents in East Texas illustrated estimated losses from alternative storage methods for bermudagrass and similar summer grass hays. Total losses by weight for hay stored in barns averaged about 3.5% while similar hay stored uncovered outside on the ground lost about 20.5%. The weight of rolls stored uncovered outside on pallets or tires decreased about 12.0% .

Covering hay stored outside substantially decreased losses. Weight losses were only about 7% for hay stored on pallets or tires and covered, while losses were nearly 13% for hay stored on the ground and covered.

The dollar value of lost hay can be substantial depending on the extent of the loss and the value of the hay, Table 2. For example, current market prices for average coastal hay in 1,200 lb large round bales is about $40 per ton. This translates into an estimated total loss of $8.20 per ton using a weight loss factor of 20.5% for hay stored uncovered, outside, on the ground. However, the net amount of increased income generated by storing hay in a barn rather than uncovered, outside, on the ground is about $6.80 per ton (difference between 3.5% and 20.5%).

Comparing expected benefits of storage alternatives with the costs of building and maintaining them indicates which alternatives would be profitable and which would not. The $6.80 savings per roll calculated above, when compared with annual payments estimated in Table 1, is sufficient to justify constructing the large and small pole barns, but neither of the other two facilities.

It is almost a certainty that hay prices will not remain constant over 10 consecutive years necessary to repay a loan for construction costs. An alternative approach to evaluating the investment decision involves estimating the net amount of hay that must be saved under alternative hay price levels in order to cover annual storage facility payments. As expected, less physical loss is necessary to cover construction costs as the value or market price for hay increases, Table 3. The magnitude of these losses provides a clue as to why producers and/or users of hay in East Texas oftentimes are slow to invest in permanent structures for hay storage.

There are several alternatives to buildings for protecting hay from the elements; some are mentioned above. Costs of these systems are highly variable, ranging from about $2.00 to $5.00 per large round bale when considering all costs.

HAY VALUE AND MARKET PRICES

Farmers and ranchers commonly face the critical problem of how to estimate the economic value of what they produce. Hay prices often get quoted as averages with a range of quotes above and below averages. However, there seldom are quality attributes associated with prices. Producers find it difficult to place a specific value or price on what they are offering for sale or are going to feed to their livestock. Hay prices are expected to increase as quality increases. Relatively higher quality hay contributes more value in its end use than relatively poorer hay. The importance of having an estimate of hay value for making storage investment decisions has been noted previously. It also is important to know the relative value of products in order to do an effective job of marketing.

Economic value refers to estimates of what hay is worth relative to other commodities considered substitutes for feeding purposes. This value also reflects the general level of hay prices as influenced by current supply and demand conditions. Estimates of economic value in this paper are variations from a norm or base set of conditions found in the marketplace.

For example, hay is a valuable feed source for maintaining beef cows through the winter. Thus, hay provides crude protein (CP) and total digestible nutrients (TDN) and its value can be estimated relative to alternative feeds, namely corn and cottonseed meal (CSM). Feed substitutability factors are used to make adjustments to market prices of an average baseline hay.

One of several alternative methods of calculating hay economic value based on the percent TDN and CP is demonstrated in Table 4. This example holds TDN constant at 55% to demonstrate how value changes with differences in CP levels. TDN and CP content of the sample hay are compared to a reference hay of known TDN, CP, and market price. The value of energy and protein in hay samples is calculated based on concentrate replacement cost of corn grain and cottonseed meal for TDN and protein sources.

Careful study of Table 4 reveals that hay testing 12% CP and 55% TDN is worth about $58.40 per ton or $35.04 per 1,200 lb bale. These values are based on a standard of 8% CP hay with a TDN of 55% selling for $40 per ton or $24 per 1,200 lb bale, with corn selling for $2.45 per bu. and CSM selling for $230 per ton.

Resulting estimates of economic value are approximate since they do not take into account differences in the efficiency of protein or energy utilization between hays of various quality, or between hay and corn or cottonseed meal. This type analysis calculates hay values which should be used only as guides in buying, selling, or feeding.

It is important to remember that economic value may differ from price. The two values can vary dramatically depending on other market factors, transportation costs, or hay appearance. Prices for specific loads of hay ultimately are determined through negotiations between buyers and sellers.

Economic values can be useful as individuals progress through the price discovery process. Sellers also should be aware of production costs as well as transportation and other marketing costs. Buyers should take into account intended uses of the hay and its feeding value in addition to transportation and other procurement costs which might be incurred.

Table 1. Building construction costs, annual loan payments, and supporting information for hay storage facilities.

	Hay Shed Open One Side (1)	Three-sided Barn (2)	Large Hay Shed (3)	Small Hay Shed (4)
Construction costs				
Total	$29,330.00	$12,500.00	$19,150.00	$7,181.00
Per year (5)	$1,466.50	$625.00	$957.50	$359.05
One-time capac. (6)	600	219	600	216
Per roll/year	$2.44	$2.85	$1.60	$1.66
Loan payments				
Loan length, yrs	10	10	10	10
Interest rate, %	13	13	13	13
Annual payment	$5,405.21	$2,303.62	$3,529.14	$1,323.38
Annual payment/bale	$9.01	$10.52	$5.88	$6.13
Annual payment/ton	$15.01	$17.53	$9.80	$10.21

(1) 8,000 sq ft, pole frame construction, dirt floor, gable roof with corrugated metal roof, no electrical service, metal siding on girts.
(2) Costs and capacities provided by Rusk Co. contractor
(3) Open on four sides, 8,000 sq ft, pole frame construction, dirt floor, gable roof with corrugated metal, no electrical service
(4) Open on four sides, 3,000 sq ft, pole frame construction, dirt floor, gable roof with corrugated metal, no electrical service
(5) Buildings all assumed a useful life of 20 years.
(6) One inventory turn per year; approx. 5'X5' round bales averaging 1,200 lb.

Table 2. Dollar value of hay losses, selected hay prices and percentage loss.

Hay Price ($/1,200 lb roll)	Proportion of Hay Lost (percent) 5	10	15	20	25	30
	($/1,200 lb roll)					
20.00	1.00	2.00	3.00	4.00	5.00	6.00
25.00	1.25	2.50	3.75	5.00	6.25	7.50
30.00	1.50	3.00	4.50	6.00	7.50	9.00
35.00	1.75	3.50	5.25	7.00	8.75	10.50
40.00	2.00	4.00	6.00	8.00	10.00	12.00
45.00	2.25	4.50	6.75	9.00	11.25	13.50
50.00	2.50	5.00	7.50	10.00	12.50	15.00

Annual payment per 1,200 lb roll, 600 roll enclosed barn	$9.01
Annual payment per 1,200 lb roll, 219 roll three-sided barn	$10.52
Annual payment per 1,200 lb roll, 600 roll pole barn	$5.88
Annual payment per 1,200 lb roll, 216 roll poll barn	$6.13

Table 3. Breakeven amount of hay which must be saved to cover cost of storage methods at selected hay prices.

Hay Price ($/1,200 lb roll)	600 roll Enclosed Barn	219 roll Three-sided barn	600 roll Pole Barn	216 roll Pole Barn
	(percent)			
20.00	45.0	52.6	29.4	30.6
25.00	36.0	42.1	23.5	24.5
30.00	30.0	35.1	19.6	20.4
35.00	25.7	30.1	16.8	17.5
40.00	22.5	26.3	14.7	15.3
45.00	20.0	23.4	13.1	13.6
50.00	18.0	21.0	11.8	12.3

Table 4. Economic value of hay relative to cottonseed meal and corn, based on protein content and TDN*

Crude Protein	TDN	Digestible Protein	Value per ton	Value per 1,200 lb roll
5.00	55.00	1.90	$26.20	$15.72
6.00	55.00	2.86	$30.80	$18.48
7.00	55.00	3.82	$35.40	$21.24
8.00	55.00	4.78	$40.00	$24.00
9.00	55.00	5.74	$44.60	$26.76
10.00	55.00	6.70	$49.20	$29.52
11.00	55.00	7.66	$53.80	$32.28
12.00	55.00	8.62	$58.40	$35.04
13.00	55.00	9.58	$63.00	$37.80
14.00	55.00	10.54	$67.61	$40.56
15.00	55.00	11.50	$72.21	$43.32
16.00	55.00	12.46	$76.81	$46.08
17.00	55.00	13.42	$81.41	$48.84
18.00	55.00	14.38	$86.01	$51.61
19.00	55.00	15.34	$90.61	$54.37
20.00	55.00	16.30	$95.21	$57.13

*Price based on standard of:

BASE HAY:

8	percent crude protein
55	percent TDN
$40.00	per ton
1200	average roll weight, lbs
$2.45	CORN PRICE/BU
$230.00	COTTONSEED MEAL PRICE/TON