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Capital Budgeting for Hay Storage Decisions

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Abstract: *This article illustrates a capital budgeting tool that Extension agents and specialists can use to assist agriculture producers when contemplating the construction of a hay storage facility. Capital budgeting is a tool for evaluating the effects of an investment choice on a business. The payback method is a quick and simple capital budgeting procedure. Use of this method requires producers to estimate hay price, facility construction cost, and potential hay loss per year assuming no storage.*

Introduction

In 2011 a severe drought affected multiple states in the southwestern United States. In addition to massive row-crop failures, pastures, rangeland, and non-irrigated hay production were all adversely affected. Within a few months, limited supplies and high demand caused U.S. hay prices to rise to historic levels. These elevated prices prompted many hay producers to reevaluate their hay storage decisions. In drier climates, it is not unusual for hay bales to be stored outside and unprotected. However, even in areas with only modest precipitation and low humidity, unsheltered hay can deteriorate surprisingly fast.

As educators, Extension professionals are uniquely positioned to help producers investigate the potential benefits and costs of structures that prevent hay storage losses. Extension has a rich history of helping agricultural producers address financial

management issues (Gustafson, 2002). Furthermore, assistance of this type—helping people solve real problems—actively promotes Extension's relevance and usefulness in a time of waning public support (McDowell, 2004). This article presents a tool useful for determining whether or not the construction of a hay storage facility is warranted.

Hay Storage

Round hay bales are often stored outside and uncovered because their shape allows the shedding of some precipitation (Huhnke, n.d.). With exposed round bales, spoilage caused by rain and snow is generally limited to the outer 4 to 8 inches (Taylor, Blasi, & Dhyuvetter, 1995). However, only 3 inches of outside diameter is 27% of volume for a bale that measures 5' x 5'.

Frequently, large squares are also stored unprotected although their shape does not shed moisture. While square bales (large and small) are stored in stacks—protecting the integrity of interior bales—deterioration still occurs on exterior bales. In addition to dry matter losses, bales exposed to inclement weather can quickly transition from high- to low-quality forage (Buckmaster, 1993). Table 1 demonstrates increasing hay value loss, as storage loss increases, over a range of hay prices.

Table 1.

Value of Hay Losses (per ton)

Storage Loss (%)	**Hay price (per ton)**			
	$180	**$220**	**$260**	**$300**
5	$9	$11	$13	$15
10	$18	$22	$26	$30
15	$27	$33	$39	$45
20	$36	$44	$52	$60
25	$45	$55	$65	$75

In areas with relatively low precipitation and humidity, it is not always clear whether the cost of erecting hay storage structures is economically defensible. Storage structures can be expensive and are generally not an efficient use of financial resources when little hay deterioration is expected, especially when hay prices are depressed. However, hay storage structures are justified when the value of hay loss

prevented exceeds the facility's construction cost.

Storage Structures

A common structure for sheltering stored hay is a post frame shed. Essentially a high roof covering a dirt floor, these facilities shield the tops of hay stacks from rain and snow, and the roof helps prevent moisture from accumulating around the bottom of hay bales. Shelters with side walls provide added protection from windblown moisture.

A structure measuring 20'H x 50'W x 80'L will shelter approximately 360 tightly packed large square bales (4' x 4' x 8'). The dimensions of the stack are four bales high, five bales wide, and 18 bales in length. Each bale's volume is 128 ft3, and assuming each bale weighs 1,400 lbs, the hay weight is 10.94 lbs per ft3. Total stack volume equals 46,080 ft3. Assuming a construction cost of $7 per ft2, the initial cost for this structure is $28,000. Table 2 provides estimates of hay loss prevented by the shelter, in volume, weight, and value assuming five different levels of potential deterioration. (These losses are in addition to normal dry matter losses.)

Table 2.

Annual Hay Loss Prevented (volume, weight, & value)

Storage Loss (%)	Cubicfeet	Tons	Hay price (per ton)			
			$180	$220	$260	$300
1	460.8	2.52	$454	$554	$655	$756
2	921.6	5.04	$907	$1,109	$1,310	$1,512
3	1,382.4	7.56	$1,361	$1,663	$1,966	$2,268
4	1,843.2	10.08	$1,814	$2,218	$2,621	$3,024
5	2,304.0	12.60	$2,268	$2,772	$3,276	$3,780

Note: 1% of total stack volume represents approximately a 2" loss from top of stack, 2% of total stack volume represents approximately a 4" loss from top of stack, and 3% of total stack volume represents approximately a 6" loss from top of stack, etc. (Dillivan, 2012).

Capital Budgeting

Farm and ranch managers are frequently presented with business opportunities that have potential for revenue generation, cost reduction, or both. Examples include equipment purchases, facility expansion or renovation, and other projects with profitability potential. The initial cash outlay required to finance these projects is called a "capital expenditure." Analysis of whether or not future revenue streams exceed initial cash investments is called "capital budgeting." There exist several methods for analyzing the profitability of financial projects using capital budgeting (Barry, Ellinger, Hopkin, & Baker, 2000). A quick, simple, and popular capital budgeting procedure is the payback method (Hine, Fulton, & Pritchett, 2005).

Payback Method

The payback method estimates the length of time (in years) it takes to recapture the initial investment. The number of years is referred to as the "payback period." Obviously, a shorter period is preferred to a longer one. The payback period is determined by using the following formula.

$$\text{Payback Period (years)} = \frac{\text{Initial Investment Cost}}{\text{Additional Revenue/Year}}$$

Using a hay shelter cost of $28,000 as the initial investment cost and the value of hay loss prevented from Table 2 as additional revenue, payback periods for the post frame shed are given in Table 3.

Table 3.

Payback Period (in years)

Storage Loss (%)	**Hay price (per ton)**			
	$180	**$220**	**$260**	**$300**
1	61.7	50.5	42.7	37.0
2	30.9	25.2	21.4	18.5
3	20.6	16.8	14.2	12.3
4	15.4	12.6	10.7	9.2
5	12.3	10.1	8.5	7.4

As expected, both higher damage levels and higher hay prices reduce the number of years that are required to recoup the initial investment. Assuming this structure has

a useful life of 30 years, the cumulative revenue provided by the post frame shed will meet or exceed the initial cost when damage is 2% or greater for all hay prices. In this analysis, construction of this facility appears to be a sound investment decision when greater storage losses are prevented for all hay prices.

Summary

The payback method estimates the length of time required for an investment to pay for itself. A shorter period is preferred to a longer period. In this example, the majority of payback periods were less than the facility's assumed useful life. Most managers would likely qualify such quick recovery of initial cost as an acceptable investment. However, any change in construction cost, storage loss, or hay price will obviously affect results. Extension personnel are encouraged to help clients substitute their own estimates for those in this example.

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