Agriculture & Business Management Notes ...

Colorado State University Extension

Analyzing Hay Storage Investments

Quick Notes...

When analyzing a hay storage investment focus on: 1) profitability, 2) cash flow, and 3) risk.

Typical hay losses in Colorado due to spoilage in outside storage averages between 10 - 15 percent.

Investment in hay storage should be considered if:

1) A premium is available on covered hay,
2) Hay losses are substantial; or
3) The investment cost of hay storage facilities is reasonably priced.

Over 4 million tons of hay are produced annually in Colorado. Typical hay losses in outside storage averages between 10 and 15 percent, but can range as high as 30-35 percent. During the winter months, hay buyers frequently refuse to buy the top layer (tier) of bales on an uncovered hay stack because of its damaged condition. They may not even want the second layer and occasionally will not take the bottom layer of bales. Consequently hay growers are showing more interest in storing hay under shelter to prevent spoilage losses.

In analyzing a hay storage investment, growers will want to focus on three financial issues 1) profitability, 2) cash flow, and 3) risk. Profitability should be the initial concern. If the investment has little chance of being profitable, there is little point in examining the cash flow and risk issues. A profitable hay storage investment will generate sufficient returns to cover all investment related costs, including the cost of the capital used to finance the storage.

The cash flow analysis should determine whether or not the investment will generate enough cash returns to retire debt as it comes due. Even though an investment may be profitable, it may have an unacceptable cash flow if it is heavily financed with debt carrying a short repayment schedule. In this case, the cash flow position of the overall business may deteriorate, since funds must be diverted from other areas of the business to retire hay storage debt as it comes due.

The third consideration is the impact of the storage investment on the growers risk bearing position. Typically, debt will be used to finance the hay storage investment, thereby putting additional strain on the growers cash flow. Fixed principal and interest payments, coupled with variability in the price premium for stored hay and/or savings in storage losses, may increase the risk of financial loss beyond a level the grower and/or lender is willing to assume.

Hay Storage Benefits

There are three major benefits from storing hay under shelter: (1) less spoilage, (2) receiving a price premium, and (3) income tax advantages.

Reduced Hay Spoilage

Table 1 shows that the rejection of just one tier of bales means the loss of 14.5% of the hay from a seven-layer stack, which is the height of stacks made with some bale loaders and stackers. It amounts to 11.2% and 11.1% on nine-layer stacks, which are the height of stacks made by most other types of bale loaders and stackers. Even when rejected hay is salvaged, it is usually sold for less than the current market price of undamaged hay.

Table 1. Possible Moisture Damage of Hay in Uncovered Stacks

	Bales per stacker loader					
	55 bales 7 layers 2W x 4L		89 bales 9 layers 2W x 5L		135 bales 9 layers 3W x 5L	
Amount damaged	# of bales	% of bales	# of bales	% of bales	# of bales	% of bales
1 tier	8	14.5	10	11.2	15	11.1
2 tier	16	29.1	20	22.5	30	22.2
3 tier	24	43.6	30	33.7	45	33.3

Source: Doran, S.M. and W.P. Ford, "Should You Invest in a Hay Shed?" EM 3898, Cooperative Extension, Washington State University, Revised April, 1978.

Hay losses can be quite expensive. For example, if the market value of hay is $80 per ton and you had 792 tons in storage at the beginning of the feeding period, you have a $63,360 investment. A 20 percent loss will cost you $12,672 or 158 tons of hay. In order to analyze whether investment in hay storage would be feasible, the grower must assess what actual losses are.

Winter Price Premiums for Covered Hay

Buyers will typically pay a higher price for hay marketed from under cover during the winter months compared to uncovered hay marketed during the summer and fall period. The price premium has typically varied between $5 and $20 per ton, depending on hay quality and regional hay supply and demand factors. A related benefit is a better market for covered hay during a year of surplus hay stocks. Moreover, it is often argued by growers that it is easier to sell uncovered hay in the summer and/or fall months when they also agree to sell the buyer their covered hay during the winter months.

Income Tax Benefits

Assuming a profitable business with taxable income, an investment in hay storage provides income tax benefits. Such benefits include tax savings from the deduction of depreciation, interest on debt, insurance premiums, and repairs.

Hay Storage Costs

The annual cost of storing hay can be classified under two categories: fixed costs and variable costs. Fixed costs do not vary with the tonnage of hay stored in an already constructed shed. Depreciation, interest on the investment, repairs, and insurance are fixed costs. Costs varying with the tonnage of hay stored in a particular shelter are variable costs. Such costs include hay insurance, shrinkage, interest on the hay investment, and high stacking bales.

A brief explanation of fixed and variable costs appears below.

Annual Fixed Costs

Depreciation. Instead of charging the entire cost of the shelter off in the year of construction, it is proper to spread the cost over the years the shelter will be used.

Depreciation is the appropriate annual charge and it is computed by the following formula:

$$\text{Depreciation} = \frac{\text{New cost - Salvage value (if any)}}{\text{Years of use}}$$

Consequently, depreciation is the annual decline in the value of the investment due to age, wear and tear, and obsolescence. Stated alternatively, it is the amount of money that must be set aside annually to permit replacement of the shelter at the end of its useful life. Depreciation, as defined and calculated in this publication, may not correspond to the depreciation allowed under the federal income tax law.

Interest on the investment. Purchase of a hay shelter ties up capital; consequently, a capital cost should be assigned to the investment. If capital is borrowed to finance the investment, that cost should be at least large enough to cover the interest paid on the loan. Furthermore, an equity capital investment has an implied cost in the form of earnings foregone by not investing in the best alternative use of funds - either within or external to the farm business. In the analysis to follow, the annual interest charge is computed by multiplying the appropriate annual interest rate times the average annual value of the investment. The average investment is derived by dividing the initial cost by two. This procedure assumes the shelter has no salvage value at the end of its useful life.

Repairs. Repair costs depend on the type and quality of construction, size of structure, weather, and care in stacking and removing bales. For planning purposes, annual repairs on pole and metal sheds can be estimated to be 1.5% and 0.75% of the new shed price, respectively.

Insurance. Most hay growers will opt to protect their hay shed investment from loss due to fire by purchasing fire insurance. The cost of the insurance depends on the type of structure, nature of insurance coverage, and location of shed.

Annual Variable Costs

High stacking bales. Mechanized bale wagons stack hay seven or nine bales high. Typically, this leaves substantial room between the top tier of bales and the shed roof. Growers commonly hire stackers to place bales in this available space. The cost of high stacking bales should be charged against the hay shed.

Hay insurance. Insurance is often purchased by growers to obtain protection against the possible loss of hay due to fire. If purchase of the shelter results in a change in marketing policy so that hay is stored long enough to justify the purchase of insurance for the first time, the entire cost of the insurance should be assigned to the hay shelter. In contrast, if purchase of the shelter does not result in a lengthening of the storage period, yet increases the value of the hay, only the added insurance cost required to protect the additional hay value should be attributed to the shed investment.

Shrinkage. Stored baled hay may lose as much as 5%-11% of its moisture weight by mid-winter. Thus, purchase of a shelter and an associated lengthening of the storage period results in a shrinkage cost that should be attributed to the hay storage investment. The actual cost depends on the weight loss and the value of the stored hay.

Interest on the hay investment. When the purchase of a hay shelter results in a lengthening of the storage period, growers should recognize that the capital embodied

in the hay is tied up longer and therefore, carries an added interest cost. The extent of the interest cost depends on the interest rate, how much longer the hay is stored, and the value of the hay. An added interest cost should also be assigned to the shelter even when the storage period is not lengthened, since the value of hay stored under shelter should increase.

The Analysis Procedure

To facilitate the analysis of a proposed hay storage investment, two worksheets have been constructed. Use ***Worksheet 1*** *when the purchase of a shed results in a lengthening of the storage period. If the storage period is not changed, use* ***Worksheet 2.***

Two worksheets are needed because of differences in hay shrinkage, insurance, and interest costs. For example, if the purchase of a shed does not lengthen the storage period, there is no added shrinkage cost to be charged against the shed. Also, hay interest and insurance costs are based only on the added value of stored hay when the storage period is not lengthened (that is, additional time does not contribute to further increases in these costs). Each worksheet provides step-by-step directions about the required information and computations. Provided the reader has the necessary information, completion of the relevant worksheet provides an indication of the before and after tax profitability of the shed investment, the price premium per ton for stored hay needed to make the hay shed a break-even investment, and the number of years required to recover any debt used to finance the shed. The two following examples illustrate how to use the worksheets.

Example 1: Increased Storage Period

1. Background Information.

A grower has typically marketed his hay during the summer and fall months without the benefit of cover. He is thinking about investing in a shed and storing the hay for an additional 6 months. The following information has been collected for the purpose of analyzing the investment:

a. Type, size and cost of shed:

   Pole, 44' x 168' x 22', $6 per square foot, purchase price (including construction) = $44,400

b. Tons of hay stored annually = 792[1]

c. Years shed will last = 20.

d. Interest rate on shed investment = 10%. Most of the money used to finance the shed will be borrowed, with funds carrying a 10% interest rate. Consequently, the grower decides to use a 10% interest rate in the analysis.

e. Annual cost for building repair, property tax and insurance, expressed as a percent of the shed's cost:

Repairs	=	1.75%
Insurance	=	0.25%
TOTAL	=	2.00%

[1]See Appendix 3 for the storage capacity of metal and pole buildings of varying dimensions.

Worksheet 1: Increase In Storage Period

Hay Storage Investment Analysis

Investment Information:		
1. Enter investment purchase price	$44,400	
2. Enter tons of hay stored annually	792	
3. Enter useful life of investment (years)	20	
4. Enter interest rate on investment (decimal)	0.10	
5. Enter annual cost of repairs, taxes, and insurance (expressed as a percent of the purchase price)	0.02	
6. Enter the producers marginal tax rate (decimal)	0.28	
Annual Shed Benefits:		
7. Enter price premium ($ per ton) for covered hay compared to hay stored outside	$15.00	
8. Benefit from price premium: (line 7 x line 2)	$11,880	
9. Enter percent of hay stored outside that is typically spoiled or discolored.	0.15	
10. Enter reduction in price ($ per ton) for damaged hay	$10.00	
11. Benefit from reduced damage: (line 9 x line 10 x line 2)	$1,188	
12. Total annual shed benefits: (line 8 plus line 11)		$13,068
Per ton (line 12 divided by line 2)		$16.50
Annual Storage Costs:		
13. Depreciation (line 1 divided by line 3)	$2,220	
14. Interest on storage investment (line 1 x .5 x line 4)	$2,220	
15. Repairs, and insurance (line 5 x line 1)	$888	
16. Total annual shed costs (lines 13 + 14 + 15)		$5,328
17. High stacking: (6000 bales x $0.25 per bale)	$1,500	
18. Enter average value of stored hay ($87.50 per ton x line 2)	$69,300	
19. Hay insurance (line 18 x 0.016 insurance rate)	$1,109	
20. Shrinkage (5.00% weight loss x line 18)	$3,465	
21. Interest on hay 10.00% (annual interest) x .5 (fraction of year stored) x line 18	$3,465	
22. Total annual other storage costs (line 17 + sum of lines 19 thru21)		$9,539
23. Total annual storage costs (line 16 + line 22)		$14,867
Per ton (line 23 divided by line 2)		$18.77

Worksheet 1: Increase In Storage Period

Financial Analysis

A. Profitability

24. Net income before taxes (line 12 minus line 23)		($1,799)
25. Net income after taxes (1.0 minus line 6 x line 24)		($1,295)
26. Approximate break-even price premium ($/ton) ((line 11 minus line 23) divided by line 2))		$17.27

B. Cashflow

27. Enter loan amount	$33,000	
28. Enter average annual interest paid on loan	$2,124	
29. Before tax cash flow (line 24 + line 14 minus line 28)	($1,703)	
30. After tax cash flow ((1.0 minus line 6) times line 29)	($1,226)	
31. Annual cash available for retirement of principal on shed loan (line 13 plus line 30)	$994	
32. Storage debt payback period (line 26 divided by line 31)	Years:	33.51

f. Grower's marginal tax rate = 28%

This is the tax rate that applies to any change in taxable income resulting from the shed investment.

g. Price premium for hay sold under cover during winter months = $15 per ton. The grower estimates that hay sold during the summer and fall will bring about $80 per ton and covered hay sold six months later in the winter should command a price of $95 per ton, a premium of $15.

h. Percent of the hay stored outside that is typically spoiled or discolored = 15%. This represents the top tier of the stack that is slightly spoiled or discolored due to summer and/or fall rain plus some bales in tier two and some bottom bales. The damaged hay is typically sold at a discount of $10 per ton.

i. The custom rate for high stacking bales = 25¢ - 40¢ per bale.

j. The average value of the stored hay is the beginning bale, $80, plus the value at sale, $95, divided by 2 = $87.50 per ton.

k. Hay insurance = 0.16¢ per $1 of coverage.

l. Shrinkage in weight of hay during the 6-month storage period = 5%.

m. Interest on hay investment = 10%. The grower knows that borrowed operating capital will likely cost 10%, so use that rate to calculate interest on the money tied up in stored hay for 6 months.

n. The grower will finance the $44,400 investment with a $33,300 loan (10% interest, 5-year repayment schedule) and $11,100 of his own money. The shed loan requires five, even annual principal and interest payments of $8,784.46 each. The average annual interest payment is computed as follows:

$ 8,784.46	Annual principal and interest payment
x 5	Number of payments
$43,922.30	Total principal and interest payments
-33,300.00	Amount borrowed
$10,622.30	Total interest paid over 5 years
÷ 5	Years in loan repayment period
$ 2,124.46	Average annual interest payment

After collecting the above data, the grower should complete Worksheet 1 (see following page).

2. Interpretation of Analysis

The analysis indicates that the shed will have annual benefits of $13,068 ($16.50 per ton) and increase annual costs by $14,867 ($18.77 per ton) resulting in a net income before taxes of <$1,799> (line 24). The net income after taxes is estimated to be a <$1,295> (line 25). As indicated by line 25, the price received for winter sales would have to exceed the summer and fall sales price by $17.27 per ton for the investment to break-even. This assumes the $10 per ton discount for spoiled hay is eliminated by purchasing the shed.

Perhaps the most troublesome aspect of the analysis is the projected debt recovery period (line 32). Because the shed was not profitable, it is estimated that it will take 33.51 years to recover the debt used to finance the shed. Yet, the shed loan was amortized over 5 years. Accordingly, funds will have to be diverted from the farm's cash flow to meet

principal payments on the shed loan. This will increase demands on the farm's overall cash flow.

Whether or not the prolonged debt recovery period is a serious problem depends on the current strength of the farm's cash flow. If cash flow is strong, setting the loan up for 5 years rather than, for example, 10 years will reduce annual interest costs without threatening business viability. However, if cash flow is already weak, a 5 year loan may cause substantial financial hardship. This would suggest a need to negotiate a longer loan repayment schedule (10 - 12 years), even though total interest costs will be higher if the grower wishes to pursue the shed investment.

Example 2: No Increase in Storage Period

1. Background Information.

A grower has been marketing uncovered hay during the winter months. He is thinking about buying a shed to reduce hay discoloration and spoilage losses. The assumptions applying to the hay shed are the same as those expressed in Example 1, except for the following:

a. Price premium for winter sales of covered relative to uncovered hay = $10 per ton.

b. Percent of hay stored outside that is typically spoiled or discolored = 15%. The grower has a bale wagon which holds 89 bales per load. Generally, the top tier of the stack has been sold at a substantial discount because of spoilage.

c. Price discount for spoiled hay = $25 per ton.

2. Interpretation of Analysis

Completion of Worksheet 2 (see following page) indicates that the hay shed investment is likely to be profitable. Average annual after-tax net income is expected to increase by about $2,407 (line 21). Also, if the price premium for covered hay is greater than $5.78 per ton (line 22) the investment will be profitable. This break-even premium assumes that the 15% spoilage loss valued at $25 per ton will also be eliminated.

The cash flow of the proposed investment is also quite favorable. As indicated on line 30 of the worksheet, the $33,300 loan used to partially finance the shed is estimated to be recovered in 7.2 years. Since the loan is scheduled to be repaid in 5 years, the hay shed will not generate sufficient funds to repay the debt in a timely manner. Like the first example some funds will have to be diverted from the farm's cash flow to meet principal payments, unless the length of the loan is extended beyond 7.2 years

The primary difference between Worksheet 1 and Worksheet 2 is the cost of storing the hay the additional six months. These costs include hay insurance, shrinkage and interest on hay. Storing the hay for the additional six months increases the cost by $7,320.

What About Covering Hay with *Tarps*?
Rather than investing in a hay shed, growers may wish to protect their hay with Tarps. Of course, economic considerations will be a major factor in deciding which of these two alternatives is most desirable. The analysis in Table 2 illustrates how growers can estimate the cost of covering hay with tarps. Assumptions adopted for the analysis are the same as for example one.

Worksheet 2: No Increase In Storage Period
Hay Storage Investment Analysis

Investment Information:

1. Enter investment purchase price	$44,400	
2. Enter tons of hay stored annually	792	
3. Enter useful life of investment (years)	20	
4. Enter interest rate on investment (decimal)	0.10	
5. Enter annual cost of repairs, taxes, and insurance (expressed as (a percent of the purchase price)	0.02	
6. Enter the producers marginal tax rate (decimal)	0.28	

Annual Shed Benefits:

7. Enter price premium ($ per ton) for covered hay compared to hay stored outside	$10.00	
8. Benefit from price premium: (line 7 x line 2)	$7,920	
9. Enter percent of hay stored outside that is typically spoiled or discolored	0.15	
10. Enter reduction in price ($ per ton) for damaged hay	$25.00	
11. Benefit from reduced damage: (line 9 x line 10 x line 2	$2,970	
12. Total annual shed benefits: (line 8 + line 11)		$10,890
Per ton (line 12 divided by line 2)		$13.75

Annual Storage Costs:

13. Depreciation (line 1 divided by line 3)	$2,220	
14. Interest on storage investment (line 1 x .5 x line 4)	$2,220	
15. Repairs and insurance (line 5 x line 1)	$888	
16. High stacking: (6000 bales x $0.25 per bale)	$1,500	
17. Added hay insurance (line 12 x 0.016 insurance rate)	$174	
18. Added interest on hay 10.00% annual interest x 0.5 fraction of year stored x line 12	$545	
19. Total storage costs (sum of lines 13 thru 18)		$7,547
Per ton (line 19 divided by line 2)		$9.53

Financial Analysis

A. Profitability

20. Net Income Before Taxes (line 12 minus line 19)	$3,343
21. Net Income After Taxes (1.0 minus line 6 x line 20)	$2,407
22. Approximate Break-Even Price Premium ($/ton) ((line 11 minus line 19) divided by line 2))	$5.78

Worksheet 2: No Increase in Storage Period - Continued

B. Cashflow

23. Enter loan amount	$33,300	
24. Enter average annual interest paid on loan	$2,225	
25. Before tax cash flow (line 20 plus line 14 minus line 24	$3,338	
26. After tax cash flow (1.0 minus line 6) times line 25	$2,404	
27. Annual cash available for retirement of principal on shed loan (line 13 plus line 26)		$4,624
28. Storage debt pay back period (line 23 divided by line 27)	Years:	7.2

Table 2. Cost Per Ton of Hay Storage Utilizing Tarps (792 ton example)

	$ per Ton Hay
Tarp Expense:	
Tarps	
5 - 30' x 60' @ $200 each	1.26
Labor	0.10
Interest on Tarps	
10% x .5 yr. x $1.26 (tarp value)	0.06
Total Tarp Expense Per Ton	1.42
Storage Expense:	
Insurance	
1 ton x $80 hay value x 0.16	1.28
Shrinkage	
5% shrink x 1 ton x $80	4.00
Interest on Hay	
10% x .5 yr x $80	4.00
Hay Damage	
25% loss x 15% x $80	3.00
Total Storage Expense	$12.28
Total Tarp & Storage Expense	$13.70

As indicated in Table 2, the cost of covering a 792 ton stack of hay with tarps under the above assumptions is $13.70 per ton. How does this compare with the cost of shed storage?

By turning to the example one analysis on Worksheet 1, we see that total storage costs are $14,867 (line 23). Thus, total costs for shed storage are $14,867 or $18.77 per ton for the 792 tons.

While this is $5.07 per ton more costly than storage under tarps, it should be recognized that Colorado growers seldom receive a price premium for hay stored under tarps. In this example, the premium for hay stored in a shed over hay stored under tarps would have to exceed only $5.07 per ton for the hay shed to be the most economical alternative.

If the price premium received by Colorado growers exceeds $5.07 per ton, the hay shed is the best choice for the example grower. However, one needs to carefully analyze the financial feasibility of the investments.

A Cautionary Note

It should be emphasized that the outcome of the above example analyses are not recommendations for or against the purchase of a hay shed. Instead, the intent has been to use the examples to illustrate an analysis procedure. The basis for good decision making is an appropriate analysis using assumptions specific to the case at hand. Accordingly, hay growers are encouraged to use the blank worksheet(s) in the Appendix and their own assumptions to analyze potential shed investments.

Sources: Willett, Gayle S. and Ford, William P., "How to Analyze a Hay Shed Investment?" Extension Bulletin 1210, Cooperative Extension, Washington State University, Revised April 1978.

Dalsted & Haslem, "Analyzing the Costs of Hay Storage Losses," Cattle Guard, September 1986.

Smith, Johnson, and Rust, "A Procedure to Evaluate Investment in a Hay Storage Building," Extension Bulletin EB 112, Extension Service, Montana State University, September, 1992.

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Appendix 1: Worksheet 1 - Increase in Storage Period

Hay Storage Investment Analysis

Investment Information:

1. Enter investment purchase price _____
2. Enter tons of hay stored annually _____
3. Enter useful life of investment (years) _____
4. Enter interest rate on investment (decimal) _____
5. Enter annual cost of repairs, taxes, and insurance (expressed (as a percent of the purchase price) _____
6. Enter the producers marginal tax rate (decimal) _____

Annual Shed Benefits:

7. Enter price premium ($ per ton) for covered hay compared to hay stored outside _____
8. Benefit from price premium: (line 7 x line 2) _____
9. Enter percent of hay stored outside that is typically spoiled or discolored _____
10. Enter reduction in price ($ per ton) for damaged hay _____
11. Benefit from reduced damage: (line 9 x line 10 x line 2) _____
12. Total annual shed benefits: (line 8 plus line 11) _____
    Per ton 9 (line 12 divided by line 2) _____

Annual Storage Costs:

13. Depreciation (line 1 divided by line 3) _____
14. Interest on storage investment (line 1 x .5 x line 4) _____
15. Repairs, and insurance (line 5 x line 1) _____
16. Total annual shed costs (lines 13 + 14 + 15) _____
17. High Stacking: _____ bales x _____ per bale _____
18. Enter avg. value of stored hay _____ per ton x line 2 _____
19. Hay insurance (line 18 x _____ insurance rate) _____
20. Shrinkage _____ % weight loss x line 18 _____
21. Interest on hay _____ annual interest x _____ fraction of year hay is stored x line 18 _____
22. Total annual other storage costs (line 17 + sum of lines 19 thru 21) _____
23. Total Annual Storage Costs _____
    Per ton (line 23 divided by line 2) _____

Appendix 1: Worksheet 1 - Increase in Storage Period - Continued

Financial Analysis

A. Profitability

24. Net Income Before Taxes (line 12 minus line 23) _____
25. Net Income After Taxes (1.0 minus line 6 x line 24) _____
26. Approximate Break-Even Price Premium ($/ton)
((line 11 minus (line 23 divided by line 2)) _____

B. Cashflow

27. Enter loan amount _____
28. Enter average annual interest paid on loan _____
29. Line 23 plus line 14 minus line 28 _____
30. (1.0 minus line 6) times line 29 _____
31. Annual cash available for retirement of principal on shed loan (line 13 plus line 30) _____
32. Storage pay back period (line 27 divided by line 31) Years: _____

Appendix 2: Worksheet 2 - No Increase in Storage Period

Hay Storage Investment Analysis

Investment Information:

1. Enter investment purchase price _____
2. Enter tons of hay stored annually _____
3. Enter useful life of investment (years) _____
4. Enter interest rate on investment (decimal) _____
5. Enter annual cost of repairs, taxes, and insurance (expressed as a percent of the purchase price) _____
6. Enter the producers marginal tax rate (decimal) _____

Annual Shed Benefits:

7. Enter price premium ($ per ton) for covered hay compared to hay stored outside _____
8. Benefit from price premium: (line 7 x line 2) _____
9. Enter percent of hay stored outside that is typically spoiled or discolored _____
10. Enter reduction in price ($ per ton) for damaged hay _____
11. Benefit from reduced damage: (line 9 x line 10 x line 2) _____
12. Total annual shed benefits: (line 8 plus line 11) _____
    Per ton (line 12 divided by line 2) _____

Annual Storage Costs:

13. Depreciation (line 1 divided by line 3) _____
14. Interest on storage investment (line 1 x .5 x line 4) _____
15. Repairs, taxes, and insurance (line 5 x line 1) _____
16. High Stacking: _____ bales x _____ per bale _____
17. Added hay insurance (line 12 x _____ insurance rate) _____
18. Added interest on hay _____ annual interest x _____ fraction of year hay is stored x line 12 _____
19. Total annual storage costs (sum of lines 13 thru 18) _____
    Per ton (line 19 divided by line 2) _____

Appendix 2: Worksheet 2 - No Increase in Storage Period - Continued

Financial Analysis

A. Profitability

20. Net Income Before Taxes (line 12 minus line 19) _____
21. Net Income After Taxes (1.0 minus line 6 x line 20) _____
22. Approximate Break-Even Price Premium ($/ton)
((line 11 minus line 19) divided by line 2) _____

B. Cashflow

23. Enter loan amount _____
24. Enter average annual interest paid on loan _____
25. Line 20 plus line 14 minus line 24 _____
26. (1.0 minus line 6) times line 25 _____
27. Annual cash available for retirement of principal on loan (line 13 plus line 26) _____
28. Storage pay back period (line 23 divided by line 27) Years: _____

Appendix 3:
Storage Capacity of Selected Wood-Frame (pole) and Metal Open-Sided Hay Sheds

Pole Shed

Size of Building	44'x56'	44'x84'	44'x112'	44'x126'	44' x 140'	44' x 154'	44'x168'	44'x182'	44'x196'
Truss Height (ft.)	22	22	22	22	12	22	22	22	22
Height - No. of bales	14	14	14	14	14	14	14	14	14
Width - No. of bales	10	10	10	10	10	10	10	10	10
Length - No. of bales	40	60	80	90	100	110	120	130	140
Capacity - bales	5,560	8,340	11,120	12,510	13,900	15,290	16,680	18,070	19,460

Metal Shed

Size of Building	60'x50'	60'x75'	60'x100'	60'x125'	60'x150'	60'x175'	60'x200'
Truss Height (ft.)	20	20	20	20	20	20	20
Height - No. of bales	13	13	13	13	13	13	13
Width - No. of bales	12	12	12	12	12	12	12
Length - No. of bales	35	50	70	90	105	125	140
Capacity - bales	5,418	7,740	10,836	13,932	16,254	19,350	21,672

Source: Doran, S.M. and W.P. Ford, “Should You Invest in a Hay Shed?” EM3898, Cooperative Extension, Washington State University, Revised April 1978.