What Does that Bale of Hay Really Cost?

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Introduction

Traditionally, when asked what something costs, e.g. a bushel of corn, we call the co-op or a feed dealer and ask. When purchasing corn, we know that the price for number 2 yellow corn is good for today and that transportation costs must be covered by the purchaser. If selling corn, the price that you would sell at is less than the market price by costs of transporting the grain to the dealer, the dealer's margin, handling costs, handling loss, and so on. These systems are well established and we know and understand some of these basic concepts. Yet when we ask what does a bale of hay cost, the certainty of understanding diminishes. In the East, there are no well established and high volume hay markets, no well established grades and standards, and no recognized terminal markets for hay. In addition, hay is a bulky (round bales specifically) product that makes transportation by traditional methods higher than for grains. In contrast, in the Great Plains and West there are established markets for hay based on specific standards and hay packages that make transportation less costly, e.g. large square bales. Yet in the East, the cost of hay to either the buyer and/or seller is not easily determined by looking to a local and/or terminal market. Our Eastern markets also do not clearly communicate the market based costs of producing hay. The market price reflects the long-run efficient cost on making a ton of hay. Therefore, farmers cannot easily look on the internet and see both the local price and historical prices of hay and say, "I can grow hay for less than that" or the converse, "I cannot grow hay for that price." In both cases the farmer is making a choice based on their knowledge of their own costs of producing a ton of hay. Thus, the key concept or objective of this paper is to illustrate how to determine your costs of producing hay.

Getting Started

To get stated on answering this question you could start with any of the items required to produce hay: machinery and equipment, species, land, storage/loss, or labor supply. All are important and must be addressed when determining the costs of hay production. Which we choose to discuss first makes little difference.

Defining a few words and explaining how they are used when making decisions will aid your understanding.

> **Fixed costs** (also known as sunk costs) are items that do not vary with level of use. The most common are 1) depreciation[2], interest, taxes, and insurance on equipment and machinery; and 2) depreciation, insurance, taxes, and maintenance on buildings. Fixed costs do not change with the level of use. For example, if hay equipment is used on an additional 30 acres, the interest, taxes, or insurance charges do not change. However, fixed cost measured on the basis of either per

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[2] Depreciation in this document will refer to a reduction in value or obsolescence of an asset over time (not tax depreciation).

acre or per ton of hay harvested decreases as more hay is harvested. Simply, the more you use the hay equipment the less it costs per unit. Conversely, if you stop using the hay equipment you still have to pay the full fixed costs.

Variable costs (also known as out-of-pocket costs) increase with use: an increase in the tons of hay harvested will certainly result in more fuel consumed and higher repair costs. If a farmer stops making hay altogether, variable costs will drop to near zero, but fixed costs will remain essentially unchanged.

Long-run decisions are made based on all costs being covered; that is, the income from hay sales will exceed the fixed and variable costs of machinery and equipment, hay production, storage, labor, management, and return on investment. These costs are important when you start a new venture requiring additional investments.

Short-run decisions are made day-to-day and/or year-to-year to help improve the profitability or reduce the losses of an on-going venture. Short-run decisions consider only variable costs: as long as the income from hay sales are greater than the total variable costs to produce that hay, the farmer is better off continuing to produce hay. What happens when the income from hay sales no longer cover the variable costs to produce that ton of hay? Then the farm business has reached the "**shut down**" or the "**I quit**" point. This situation implies that continuing to produce hay will lead to insufficient funds to pay for fuel, labor, fertilize, and so on.

The question that you should be able to answer after reading or listening to this presentation is, "Have I reached the 'I quit' point for nitrogen fertilized grass hay, given the current costs of fertilizer and fuel?" or "Do I know my 'I quit' points for my farm?"

What Does it Cost to Produce Grass-Clover Hay Crop?

Budgeting: To answer the question "What Does it Cost to Produce Grass-Clover Hay Crop?," some of the basics of budgeting must be explained. The purpose of a budget is to list the annual qualities and prices of inputs involved in the production of hay. The sum of the income items less total expenses leaves an estimate of net income or returns to land, risk, and management. Since the sales price is often the most variable, most budgets concentrate on the cost of inputs like fertilizer. The breakdown of major budget categories and explanations are listed in Table 1.

Table 1: Example Abbreviated Budget for 1 Acre
1. **Gross Receipts** = quality sold (produced) * price
Tons of hay * $/ton (3 tons * $70/ton)
2. **Pre-Harvest Variable Costs**
Units of inputs * $/unit (150 lbs of N * $0.60/lb)
3. **Harvest Variable Costs**
Fuel, Lubrication, and Repairs per acre * $/ac ($50/ac * 1 ac)
4.**Total Variable Costs** – sum lines 2-3

Sum of all costs
5. **Machinery Fixed Costs** (based on new equipment cost)
Ownership costs per ac – prorated to over the typical life of the equipment (depreciation taxes, insurance, interest on investment)
6. **Other Costs**
General Overhead Costs
7. **Total Costs** – sum lines 4, 5, & 6
8. **Projected Net Returns** – line 1- line 7 Returns to land, risk, and management

Gross Receipts: Gross receipts are the sales price or value of a bale or ton of hay times the estimated production units. Hay sold into the equine industry vs. home consumed hay will have to be marketed based on quality, so that hay from different fields may not have the same value and should be reflected as separate items or as an average price representation quality from poor to excellent (Table 2). The yield should indicate long-term average yields, not just the best of the last 10 years.

Table 2: Example Gross Receipts for Grass Clover Hay	**Grass-clover - 3 ton yield**		
Receipts	**Yield**	**Price**	**Total**
Gross receipts per ton round bales (lower quality)	2.0	$70.00	$140.00
Gross receipts per square bale (higher quality)	50	$4.00	$200.00
Total Gross Receipts			$340.00

Pre-harvest Variable Costs: The current budget estimates of pre-harvest variable costs for grass-clover hay is shown in Table 3. The level of complexity increases when you move to the pre-harvest costs. In the case of hay, the cost of establishing the crop is an expense just like year-to-year maintenance and needs to be prorated over the life of the crop. Calculating establishment costs requires a separate budget (please see the Virginia Cooperative Extension web site for hay establishment budgets http://www.ext.vt.edu/cgi-bin/WebObjects/Docs.woa/wa/getcat?cat=ir-fbmm-bu-cr). The total is prorated over seven years. The remaining items are a listing of the estimated units of inputs like fertilizer, lime, herbicides, and so on, priced at rates that are reflective of 2007. Most farmers use a line-of-credit to finance the needed cash flow in the spring before crops are sold in the summer and/or fall. The production interest charged on the line of credit is calculated on the total pre-harvest costs for six months at the going short term interest rate. The total of these expenses yields the total pre-harvest expenses per acre ($264), per ton, or per bale ($88), depending on what units are used to measure production.

> Side bar: Under the assumptions that the pre-harvest costs are $88/ton. Farmers should ask “Is this standing hay worth $88/ton?” If not, should the hay be harvested? This illustrates one of the “I quit” points. Are you better off grazing?

Table 3: Grass-Clover Hay Pre-harvest Variable Costs, Based on 3 ton yield from 2 cuts

Pre-Harvest Variable Costs	Units	Per Acre	Price $	Total $
Prorated establishment cost	7 yrs	1.00	38.00	38.00
Red clover	Lbs	3.00	2.00	6.00
Phosphate	Lbs	45.00	1.00	45.00
Potash	Lbs	150.00	0.90	135.00
Fertilizer application	Acre	1.00	7.25	7.25
Other costs	Acre	1.00	15.48	15.48
Production interest[3]	$	246.73	7%	17.27
Total Pre-Harvest Costs				**264.00**
Total Pre-Harvest Costs per Ton				**88.00**

Harvest Variable Costs: The first step in addressing the fixed costs is to select the harvest equipment. The estimated harvest costs can vary greatly based on the machinery and equipment selected, e.g. 800 lb. round baler, large square balers, small rectangular balers, and so on. Each of these systems varies in costs, efficiency, and labor required. This analysis will consider a typical round bale system. The costs of machinery must be annualized over the life of each piece of equipment. New hay harvest equipment, total investment, and useful life are listed in Table 4. Table 4 lists the equipment for a traditional round bale system. Round bale systems requires the smallest capital investment, as compared to rectangular bales, or large square bales, at $115,000 based on new costs.

Table 4: Round Baler						
Equipment	**#**	**Unit Costs $**	**Total Costs $**	**Salvage Value $**	**Net Value $**	**Life**
75HP tractor w/loader	1	$43,000	$43,000	$4,300	$38,700	12
55HP tractor	1	$25,000	$25,000	$2,500	$22,500	12
12 ft disc mower conditioner	1	$20,000	$20,000	$2,000	$18,000	10
17 ft tedder		$4,500	$4,500	$450	$4,050	10
18 ft wheeled rake		$4,500	$4,500	$450	$4,050	10
Round baler		$12,000	$12,000	$1,200	$10,800	10
9x20x8 hay wagons	2	$3,000	$6,000	$600	$5,400	10
Totals			**$115,000**	**$11,500**	**$103,500**	

Calculating annual fixed costs for the machinery complements requires allocating those costs over the life of the farm machinery. Allocation of fixed costs is accomplished by using the capital recovery method (I prefer this method; however, there are other methods). The capital recovery method sets up a payment schedule to fully recover the value of the machinery and interest on the investment over the life of the equipment. Capital recovery is based on the assumption that when the machinery is worn-out or obsolete, enough money will be available to

[3] Production interest is calculated on costs that are used prior to fall at the annual interest rate to reflect only 6 months of interest; the total costs are divided in half.

fully replace the machinery with equivalent but updated technology. Table 5 lists the fixed costs of tractors lasting 12 years[4] and other machinery lasting 10 years, an interest rate of 5 percent, and insurance at 1 percent of the total investment. Once this equipment arrives on the farm, the fixed costs must be covered each year, regardless of how much hay is made. Under these assumptions the annualized costs and fixed costs for round baling are $13,402.

Table 5: Fixed Costs Round Bale System		
Items	**Round Baler**	
Useful life ==>	**12 year**	**10 year**
Investment $	**68000**	**47000**
Salvage $	**6800**	**4700**
Amount to be recovered $	**61200**	**42300**
Interest rate (I) %	**0.05**	**0.05**
Number of periods (n)	**12**	**12**
Capital recovery =	**0.11283**	**0.11283**
Periodic recovery $	**6905**	**4773**
Insurance 1%	**680**	**470**
Interest on salvage $	**340**	**235**
Sub-Total $	**7925**	**5478**
Total Annual Costs $	**$13,402**	

See Appendix B for details.

Fixed Costs and Harvest Acreage

Figure 1 show the dramatic relationship between fixed costs and total acreage harvested. Used machinery may cut the total fixed costs as much as 40 percent; conversely, used machinery may increase annual repair costs. In addition, if the tractors are used in other activities on the farm (silage harvest, custom work, grain crops, etc.), the total fixed costs per hour will be less for the hay enterprise and all other enterprises. In Figure 1, total costs decline sharply as tons or acreage harvested increase. At the lowest acreage, 50 acres (150 tons) yields a total cost of $89.35/ton, and if the equipment was used over 350 acres (1,050 ton), total costs drop to $12.76/ton. Notice that after harvested acres exceed say, 225 acres, the rate of decline in fixed costs slows down considerably. Thus, with this machinery complement farmers should strive for harvesting more than 225 acres per year to achieve a reduction in fixed costs.

Finalizing the harvest costs are the variable costs associated with two harvests - mowing, raking, baling, and moving the hay to a storage site. Table 6 details the assumptions and costs for round baling an acre of grass-clover hay. The total annual cost of harvest is $68.49 per acre and assuming a 3 ton yield, a cost per ton of $22.83. These variable costs apply the same to the first and to the last ton of hay harvested.

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[4]This is a somewhat arbitrary assumption. The life of a new tractor (2WD) is defined as 12,000 hours (American Society of Ag Engineers Standards). In this example both tractors are assumed to be used 1,000 hours annually. Consider if these tractors are used just 200 hours annually, then the expected life of each tractor would be 60 years. So the question for many farmers is "How many years will my tractor out live me?" All attempts at humor aside, matching hours of use and life of equipment is a measure of machinery and capital efficiency for a farm business.

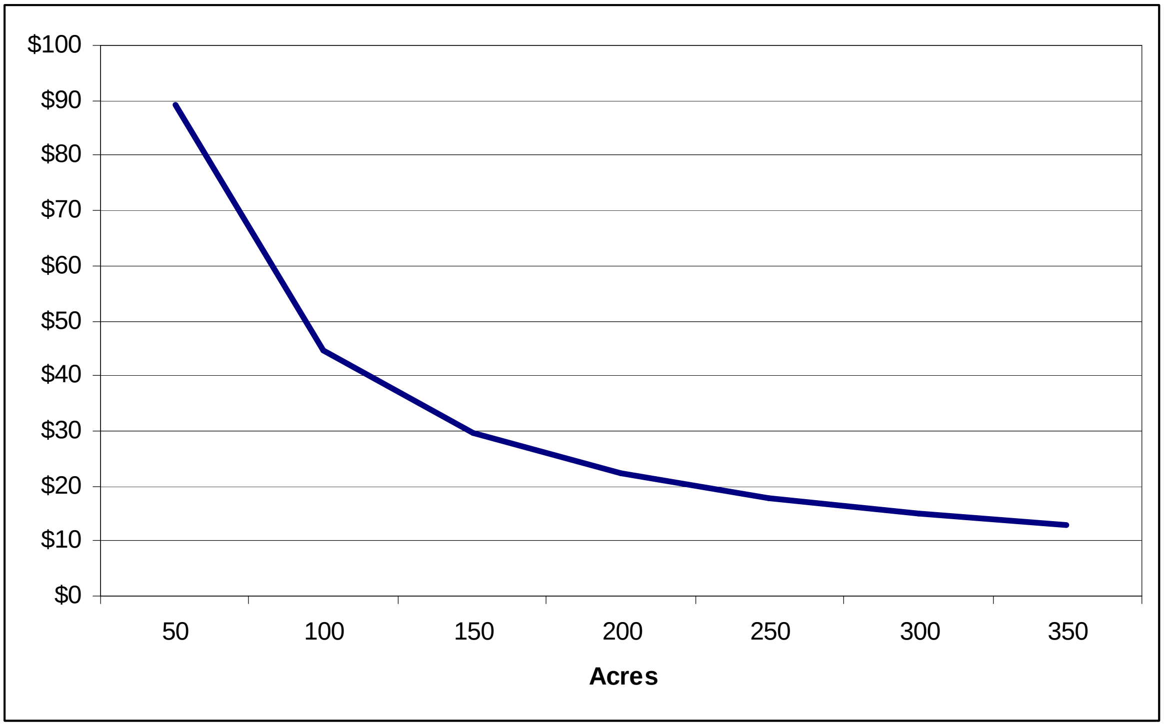

Figure 1: Grass-Clover Hay – Total Fixed Costs

Table 6: Grass-Clover Hay Harvest Variable Costs, Based on 3 Ton Yield from 2 Cuts

Harvest Variable Costs	Units	Per Acre	Price $	Total $
Fuel, Oil, Lube	Acre	1.00	$19.30	$19.30
Repairs	Acre	1.00	$11.78	$11.78
Harvest Labor	Hrs	2.68	$12.00	$32.16
Baler Twine	Ton	3.00	$1.75	$5.25
Total Harvest Costs				**$68.49**
Total Harvest Costs per ton				**$22.83**

Total Costs

Figure 2 sums up the important issues in understanding the cost of making a ton of hay. That is, the variable costs of hay fertilizer, lime, fuel, etc. remain unchanged as acreage increases and fixed costs (ownership) decline (see Appendix A for a summary of the data for orchardgrass and alfalfa). In Figure 2, total costs per ton of hay are $200 when only 50 acres (150 tons) are harvested, and in contrast for 350 acres (1,050 tons) costs are reduced to $126 per

Side bar: If total costs to produce a ton of grass-clover hay approaches $130/ton, then we all must ask "Is this enterprise covering all the costs and should this enterprise continue in the short-run/long-run? This illustrates another of the "I quit" points and we need to ask "Are you better off grazing that field?"

ton. These numbers are a stark contrast to a few years ago when oil-based inputs (fuel and fertilizers) were drastically lower in costs. Under these assumptions, a breakeven price for grass clover hay approaches $130 per ton. And this does not include returns to STORAGE, LAND MANAGEMENT, and/or RISK.

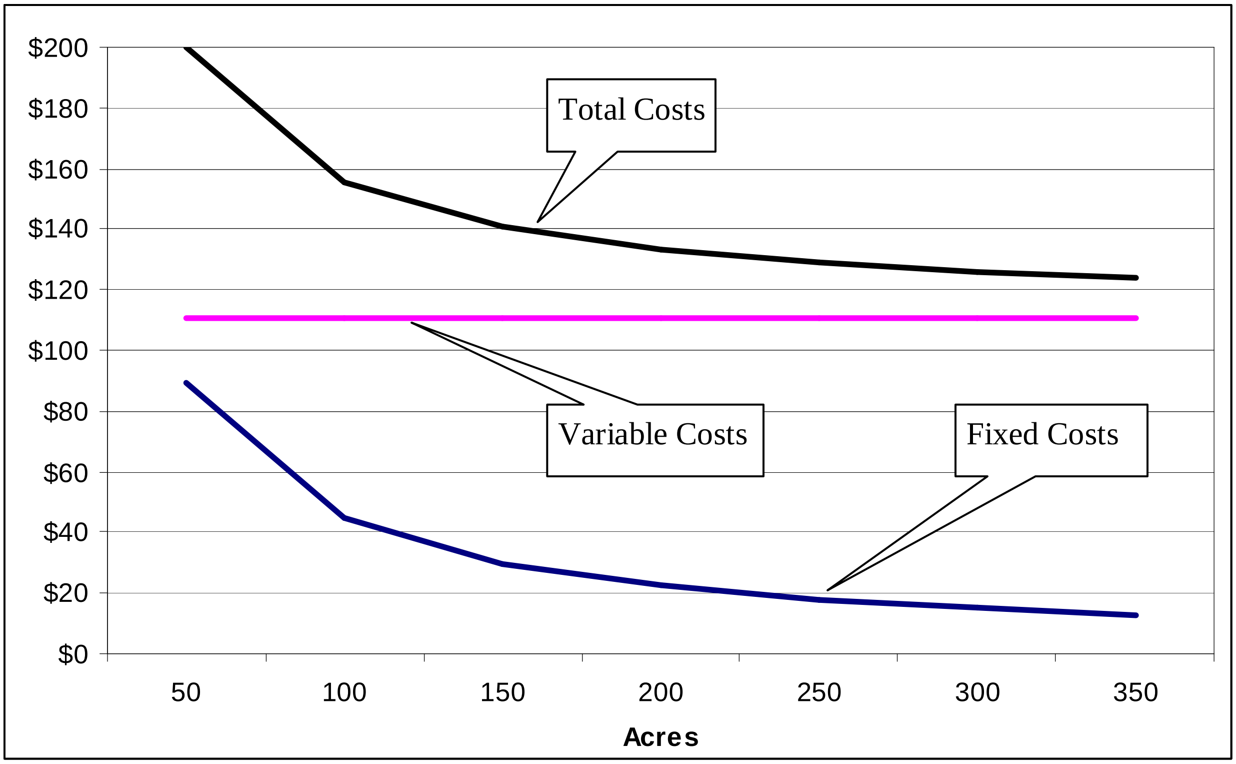

Figure 2: Grass-Clover Hay – Total Costs

Storage and Storage Loss

Once the hay is harvested, you have two decisions: 1) store outside or 2) store inside, or at least protect the hay from the elements. The answers to these questions are not straight forward. In a pervious study (Groover, 2003), I discussed the costs of different storage methods with the final conclusion that storage and reducing hay losses depends on the value of the hay being stored. Thus, if your hay supplies are limited or you purchase all your hay, then storage is a wise investment. For example, if you are buying hay for $150 per ton, then the math is simple: for every 1 percentage drop in storage loss, you get $1.50 back. So, if you reduce your loss from 30% round bales outside to 10% by storing in a pole barn, then you save $30 per ton annually. However, if your hay is worth only $70 per ton, then this same savings in loss would be worth only $14 per ton annually. What do we conclude from this? The short story is “We need to do the math on savings verses the costs of storage.” Home grown (machinery costs and remember these are sunk costs) hay destined for the cow herd with few alternatives for sale may not justify investment in storage structures other than gravel areas to reduce ground contact. However, higher quality hay destined for animals requiring higher quality forages (dairy cows, stocker, and sheep) or hay to be sold to horse owners should consider an investment in a storage structure. The University of Kentucky has an excellent publication titled Round Bale Hay Storage in Kentucky that lists out alternative methods and loss comparisons.

Figure 3 shows the results of comparing the annualized costs of the three methods (hay shed, reusable tarp, and elevated stack). The graph shows the value of dry matter savings from the three storage methods over just ground storage as the value of hay increases from $15 to $155 per ton. Dry matter savings over ground storage are 26% for the hay shed, 23% for the reusable trap, and 13% for the elevated stack. The first thing to observe from Figure 3 is that the value of hay saved over ground only storage pays for the additional costs of shed, tarp, and stack storage with the exception of shed storage for hay valued at $45 per ton. Second, when hay values exceed $75 the preferred storage methods shift entirely to tarp and shed. Third, as the value of hay to your farm increases, the less advantage tarp storage has over a shed. The advantage for tarps could diminish if additional labor must be hired to stack, cover, and recover hay during the year. If the hay shed could be filled 1.5 times per year, e.g. store 150 tons instead of 100 tons, then the advantage at the $75 value would favor building a hay shed. A 2008 update on Figure 3, given that grass-cover hay variable costs are around $111/ton, the value of the hay saved from a shed or tarp should be considered. Caution: We all must realize that with the financial uncertainty we are experiencing anything could happen to input/output prices. In the last few years crude oil prices have gone from $30 to $160 back to $50 per barrel. So doing the math is very important. Note: Appendix B (Estimate of Annual Machine Cost) can easily be adapted to building to determine the annual fixed costs for comparison to hay savings from storage.

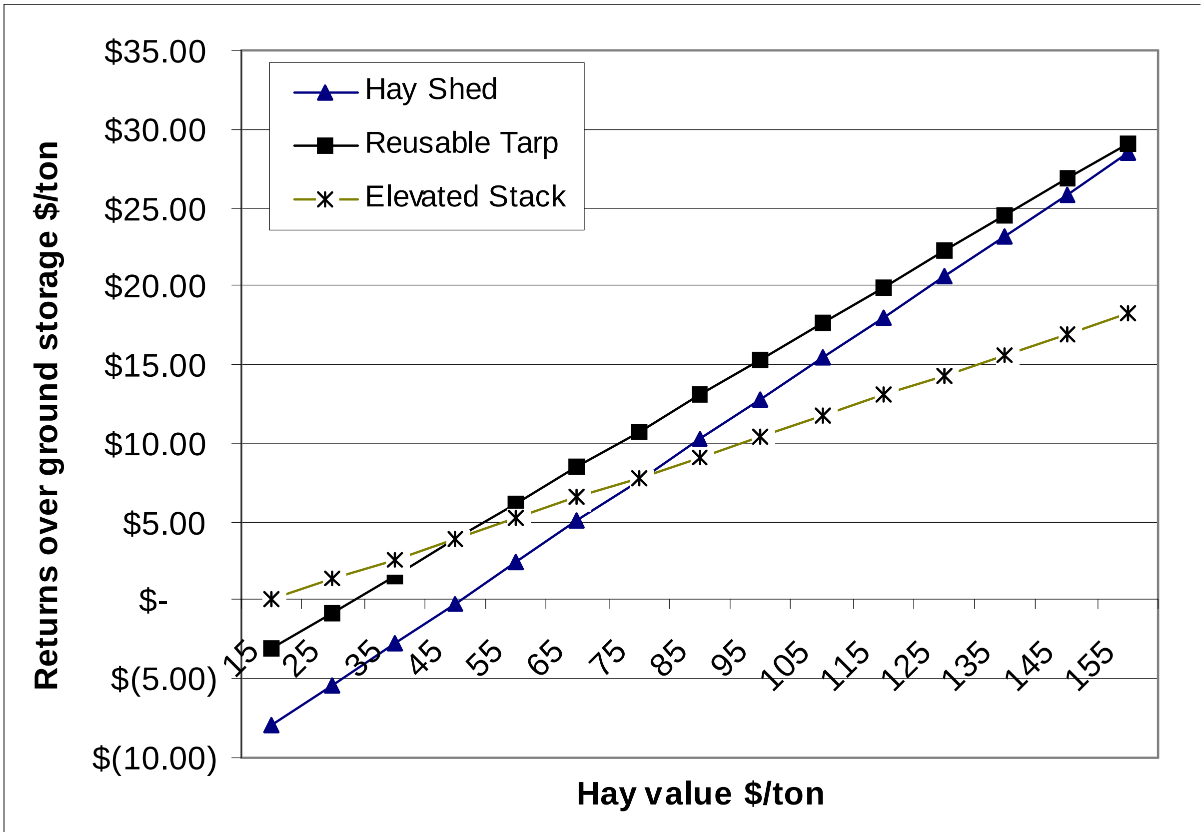

Figure 3: Comparison of Returns Over Storage Costs (Groover, 2003)

Land and Labor Costs

Labor can be important when considering a new enterprise or if you must hire labor to complete a task. Yet how to value labor costs always provide some challenges because many farmers have a mixture of family and hired labor (sometimes only family labor). This is further complicated since many farmers operate as a sole proprietor for tax purposes, and their labor and possibly a spouse's labor are a residual claim (what's left over after paying all cash expenses and debt payments) on the net returns from the farm business. This residual claim is often considered the family living draw and makes estimating a per hour value of labor very difficult. Furthermore, family labor (sometimes all labor) tends to be more like a fixed cost in that the total cost of labor does not change much within a year. But labor can be reallocated from a lower priority to a more important task; thus, any labor saved on one task can be made available to a higher priority task. Thus, the labor value to the farm is based on the opportunity costs of that labor in another activity on or off the farm. In all reality most farmers do not put a price tag on their own or their family members' labor. But they do set priorities on tasks or jobs based on opportunity costs. For example, baling hay before a summer thunder storm soaks the hay is a good example of a higher opportunity cost than say trimming the grass around the farm's sign. So the value of labor does not need to be included in the budget unless it is hired or family labor that can be used in a competing (more profitable) enterprise.

Land is important to a hay enterprise and carries similar considerations of opportunity costs as family labor. The question that arises is what other more profitable alternatives can use this land? If the land base and the enterprises are fixed, then there is no reason to consider the opportunity costs of the land outside of the tax and insurance that are annual land-based costs. However, if the land base is rented, rental payments must be included as a part of the variable cost of the hay enterprise. However, converting hay land to pasture does present a more complex decision involving the land base. For example, if all winter feeding was supplied via stockpiled fescues and off-farm purchase of hay, then the farm could increase the carrying capacity or stocking rate and potentially improve the overall profitability. This analysis is beyond the scope of the paper, yet the potential increased profitability would be gained from lower fixed costs of hay equipment and increased cattle sales but offset by greater investments in fence and water systems.

Now What?

First, know your costs-of-producing a ton of hay (fixed and variable), keep financial and production records, and analyze these records. Question why you are doing all these production practices; for example, ask why you make hay, what alternatives are there to making hay, and if you can improve your bottom line by investing in cattle and not machinery. Second, strive to size your machinery to your acreage to keep fixed costs as low as possible and still make a quality product. The bottom line requires that all costs, including handling, transportation, and management, must be covered for the hay business to remain profitable relative to purchasing hay. Third, collect enterprise budgets to see how it is done – we (Ag Economists) all follow the same basic process but there are differences that might work better for your farm. The key is to develop your own base and know your farm's costs and returns. Forth, spend some time working out your own answers to the questions I have posed below.

Q: Given the high costs of all inputs, what should I do first?
A: First, a basic concept; hopefully, you have heard of diminishing marginal returns. This concept follows the basic yield response function, i.e. you get a bigger response to the first unit of an input than the last unit. Applying dollar values to the inputs and outputs allows us to compare the added value of the response to costs of the next input unit. When they are equal we stop adding inputs. For example, if you could spend $10 on another 10 lbs. of fertilizer and get $9.00 in hay or grazing to feed or sell, the obvious conclusion is - **don't do that**! This simple concept is not simple to apply in a field situation because farmers do not routinely have enough field data to support these fine tuned management decisions. But you do have soil maps, historical knowledge of yields of fields, and your observations over the years. Using these observations and soil tests allows you to roughly estimate the response to fertilizers. Thus, apply fertilizers to the fields that will respond the most and moving down the list from the most productive fields to the least. Keep in mind that the first unit of an input applied gives the biggest bang for the buck. This could result in some fields not receiving any fertilizers. Is this a problem? Maybe not if the left out fields are droughty and routinely low yielding, regardless of your best efforts. Also, consider in large fields locating the areas that are eroded or sallow levels of top soil and reducing fertilizer use on these areas. Note: New GPS technologies combined with variable rate fertilizer applications have addressed these concerns for row crop farmers.

Q: Okay, but what's that got to do with the price of fertilizer in Fredrick?
A: Here's another way to think about the first question. Individual farmers can do very little about the price of fertilizer. However, farmers can respond in a manner that makes efficient/profitable use of that fertilizer. We know that a forage crop grown on two different fields may respond very differently to fertilizer. Let's consider Nitrogen. Assume we have two fields and N is $0.80/lb. (includes spreading costs). Thus, the question "Should we put N down and where should it be spread?" We also know that hay prices have been going up but we can get hay delivered to the farm for $120/ton or $0.06 per lb. (opportunity costs/value of our hay). Let's look at the break even yield you need to cover the added costs. We divide the price of nitrogen $0.80/lb. by the price of hay $0.06 per lb. and this yields the value of 13 lbs. of hay being equal to the costs of a $0.80/lb. of nitrogen. Or if we applied 50 lbs. of N per acre, then we'd need to have a yield increase of about one third of a ton of hay (667 lbs) per acre to breakeven on applying 50 lbs. of N at $0.80 per lb. So if you know the production history of these two fields, then ask yourself "Will 50 lbs. of N make me at least a one-third a ton of hay/forage?" So if you say no, then **don't do that**!

Q: If nitrogen is so expensive, what are the alternatives?
A: We all know about the synergistic relationship between legumes and grasses, and that with sufficient levels of legumes (Chris Teutsch tells me 35%-40%) nitrogen fertilization can be avoided. Lets assume that sufficient levels of legumes in pasture or hay field will allow for an average yield of 3 tons per acre. Given the rule of thumb that a ton of grass hay needs 40 lbs. of nitrogen, and we assume that nitrogen is $0.80/lb., then we have saved $96 (3 tons * 40 lbs./ton) * $0.80/lb.). Now consider using legumes to provide the N. For ease of math we'll apply 6 lbs. of seed (both red and ladino) at $3.00/lb. yields $18; add to that the $7.50 application costs per acre to provide the same benefit as 120 lbs of N. Under these assumptions, what's the breakeven price of nitrogen = ($18+$7.50) ÷ $96 = $0.27 per lb.? Thus, the price of nitrogen would have to

drop to $0.27 per lb. before you would switch back to nitrogen instead of using legumes. This assumes that, N, clover seed, and spreading costs stay the same. What's the added forage quality benefit of the legume in that pasture or bale of hay?

Q: With the relative change in fertilizer prices, what about alfalfa verses grass hay?
A: To answer, let's compare an orchard grass budget to alfalfa that takes into consideration yield difference and the life of each stand. Comparing three budgets based on the following assumption: $3.50/gallon for fuel, $0.80/lb. for N, $1.00 for P, and $0.90/lb. for K, 7 years of life for an orchard grass stand, 5 years for an alfalfa stand, 3-ton yield for orchard grass, and 5-ton yield for alfalfa (for the details please see our enterprise budgets at www.extension.agecon.vt.edu/enterprisebudgetsdetail.html). Table 1 reports the total costs per ton.

Table 1: Budgets (budgets referenced below have be change to reflect prices listed above)	Costs $/ton
N fertilized orchard grass hay www.ext.vt.edu/departments/agecon/spreadsheets/crops/2007/OrchardgrassRedCloverHay.pdf	$184
Alfalfa hay www.ext.vt.edu/departments/agecon/spreadsheets/crops/2007/ALFALFAHay.pdf	$153
Orchard grass and clovers hay www.ext.vt.edu/departments/agecon/spreadsheets/crops/2007/OrchardgrassRedCloverHay.pdf	$141

The total costs in Table 1 speak for themselves. The relative costs per ton for alfalfa and orchard grass-legumes are significantly less than annual applications of nitrogen to a cool-season grass. In addition there are other positives, mostly the added quality of the legumes and mixes. A potential downside may occur for hay growers marketing to the equine industry where some horse owners are reluctant to purchase grass-clover hay – may limit your market.

Summary

The first decision is to understand the hay market in your area and get good estimates on prices for low to excellent quality hay. This will help set the base or the long-run costs of producing a ton of hay – a benchmark for your farm business. Second, understand your total cost of making hay and develop individual budgets for each crop (orchardgrass, fescue alfalfa, timothy, bermudagrass …). Third, develop a machinery budget (see Appendix B) to cover all costs of making hay. This budget should have costs broken down per ton and per acre based on typical yields. Fourth, combine the crop, machinery, and overhead to estimate total costs. Finally, compare estimated purchase prices in your region to your estimated total costs and ask, "Am I better off making my own hay?" Obviously, if the difference is positive you are better off making hay on your farm. If not, consider alternatives to owning hay equipment.

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Appendix A: Estimated Costs for Orchardgrass and Alfalfa Hay - Round Baled

Orchardgrass Nitrogen Fertilized							
Acres harvested – 3 tons	50	100	150	200	250	300	350
Equivalent tons harvested	150	300	450	600	750	900	1050
Fixed costs per ton $	89.35	44.67	29.78	22.34	17.87	14.89	12.76
Pre-Harvest variable costs per ton $	135.94	135.94	135.94	135.94	135.94	135.94	135.94
Harvest variable costs per ton $	22.83	22.83	22.83	22.83	22.83	22.83	22.83
Sub-total variable costs per ton $	158.77	158.77	158.77	158.77	158.77	158.77	158.77
Total costs per ton $	248.12	203.44	188.55	181.10	176.64	173.66	171.53

Orchardgrass and Clover							
Acres harvested – 3 tons	50	100	150	200	250	300	350
Equivalent tons harvested	150	300	450	600	750	900	1050
Fixed costs per ton $	89.35	44.67	29.78	22.34	17.87	14.89	12.76
Pre-Harvest variable costs per ton $	88.00	88.00	88.00	88.00	88.00	88.00	88.00
Harvest variable costs per ton $	22.83	22.83	22.83	22.83	22.83	22.83	22.83
Sub-total variable costs per ton $	110.83	110.83	110.83	110.83	110.83	110.83	110.83
Total costs per ton $	200.18	155.50	140.61	133.17	128.70	125.72	123.59

Alfalfa						
Acres harvested – 5 tons	10	25	50	100	150	200
Equivalent tons harvested	50	125	250	500	750	1000
Fixed costs per ton $	268.05	107.22	53.61	26.80	17.87	13.40
Pre-Harvest variable costs per ton $	100.17	100.17	100.17	100.17	100.17	100.17
Harvest variable costs per ton $	26.97	26.97	26.97	26.97	26.97	26.97
Sub-total variable costs per ton $	127.14	127.14	127.14	127.14	127.14	127.14
Total costs per ton $	395.19	234.36	180.75	153.95	145.01	140.54

Appendix B: Estimate of Annual Machine Cost

____
(Machine name)

Line		Amount
1.	Purchase cost	$_______
2.	Salvage value	$_______
3.	Cost to be recovered (line 1 minus line 2)	$_______
4.	Estimated years of life	_______
5.	Units of estimated annual use (hours, acres, miles, etc.)	_______

Fixed or Ownership Costs:

6.	Cost recovery and (____%) interest factor (from table on back)	_______
7.	Cost recovery and interest (line 3 x line 6)	$______
8.	Interest on salvage value (line 2 x interest rate ____%)	$______
9.	Insurance, taxes, housing (line 1 x 1%)	$______
10.	License	$______
11.	Total Fixed Cost (add lines 7 thru 10)	$______
12.	Fixed cost per unit (line 11 + line 5)	$______

Variable or Operating Costs:

13.*	Fuel (____ gal. / ____ x ____ ____ x ____ price/gal.) unit no. units	$______
14.	Oil, grease, anti-freeze -15% of total fuel costs	$______
15.	Repairs (including service labor), tires, etc. (VCE crop budgets)	$______
16.	Total Variable Cost (add lines 13 thru 15)	$______
17.	Variable Cost per Unit (line 16 + line 5)	$______
18.	TOTAL ANNUAL MACHINE COST (line 11 + line 16)	$______
19.	TOTAL COST PER UNIT (line 18 + line 5)	$______

* Fuel consumption per hour can be estimated by multiplying the maximum PTO Hp by one of the factors below:

Gasoline engines - 0.060 x maximum PTO horsepower
Diesel engines - 0.044 x maximum PTO horsepower

Capital Recovery (CR) Table

Annual interest rate i

Years - n	0.04	0.05	0.06	0.07	0.08	0.09	0.1	0.11	0.12	0.13	0.14	0.15	0.16
1	1.04000	1.05000	1.06000	1.07000	1.08000	1.09000	1.10000	1.11000	1.12000	1.13000	1.14000	1.15000	1.16000
2	0.53020	0.53780	0.54544	0.55309	0.56077	0.56847	0.57619	0.58393	0.59170	0.59948	0.60729	0.61512	0.62296
3	0.36035	0.36721	0.37411	0.38105	0.38803	0.39505	0.40211	0.40921	0.41635	0.42352	0.43073	0.43798	0.44526
4	0.27549	0.28201	0.28859	0.29523	0.30192	0.30867	0.31547	0.32233	0.32923	0.33619	0.34320	0.35027	0.35738
5	0.22463	0.23097	0.23740	0.24389	0.25046	0.25709	0.26380	0.27057	0.27741	0.28431	0.29128	0.29832	0.30541
6	0.19076	0.19702	0.20336	0.20980	0.21632	0.22292	0.22961	0.23638	0.24323	0.25015	0.25716	0.26424	0.27139
7	0.16661	0.17282	0.17914	0.18555	0.19207	0.19869	0.20541	0.21222	0.21912	0.22611	0.23319	0.24036	0.24761
8	0.14853	0.15472	0.16104	0.16747	0.17401	0.18067	0.18744	0.19432	0.20130	0.20839	0.21557	0.22285	0.23022
9	0.13449	0.14069	0.14702	0.15349	0.16008	0.16680	0.17364	0.18060	0.18768	0.19487	0.20217	0.20957	0.21708
10	0.12329	0.12950	0.13587	0.14238	0.14903	0.15582	0.16275	0.16980	0.17698	0.18429	0.19171	0.19925	0.20690
11	0.11415	0.12039	0.12679	0.13336	0.14008	0.14695	0.15396	0.16112	0.16842	0.17584	0.18339	0.19107	0.19886
12	0.10655	0.11283	0.11928	0.12590	0.13270	0.13965	0.14676	0.15403	0.16144	0.16899	0.17667	0.18448	0.19241
13	0.10014	0.10646	0.11296	0.11965	0.12652	0.13357	0.14078	0.14815	0.15568	0.16335	0.17116	0.17911	0.18718
14	0.09467	0.10102	0.10758	0.11434	0.12130	0.12843	0.13575	0.14323	0.15087	0.15867	0.16661	0.17469	0.18290
15	0.08994	0.09634	0.10296	0.10979	0.11683	0.12406	0.13147	0.13907	0.14682	0.15474	0.16281	0.17102	0.17936
16	0.08582	0.09227	0.09895	0.10586	0.11298	0.12030	0.12782	0.13552	0.14339	0.15143	0.15962	0.16795	0.17641
17	0.08220	0.08870	0.09544	0.10243	0.10963	0.11705	0.12466	0.13247	0.14046	0.14861	0.15692	0.16537	0.17395
18	0.07899	0.08555	0.09236	0.09941	0.10670	0.11421	0.12193	0.12984	0.13794	0.14620	0.15462	0.16319	0.17188
19	0.07614	0.08275	0.08962	0.09675	0.10413	0.11173	0.11955	0.12756	0.13576	0.14413	0.15266	0.16134	0.17014
20	0.07358	0.08024	0.08718	0.09439	0.10185	0.10955	0.11746	0.12558	0.13388	0.14235	0.15099	0.15976	0.16867
21	0.07128	0.07800	0.08500	0.09229	0.09983	0.10762	0.11562	0.12384	0.13224	0.14081	0.14954	0.15842	0.16742
22	0.06920	0.07597	0.08305	0.09041	0.09803	0.10590	0.11401	0.12231	0.13081	0.13948	0.14830	0.15727	0.16635
23	0.06731	0.07414	0.08128	0.08871	0.09642	0.10438	0.11257	0.12097	0.12956	0.13832	0.14723	0.15628	0.16545
24	0.06559	0.07247	0.07968	0.08719	0.09498	0.10302	0.11130	0.11979	0.12846	0.13731	0.14630	0.15543	0.16467
25	0.06401	0.07095	0.07823	0.08581	0.09368	0.10181	0.11017	0.11874	0.12750	0.13643	0.14550	0.15470	0.16401
26	0.06257	0.06956	0.07690	0.08456	0.09251	0.10072	0.10916	0.11781	0.12665	0.13565	0.14480	0.15407	0.16345
27	0.06124	0.06829	0.07570	0.08343	0.09145	0.09973	0.10826	0.11699	0.12590	0.13498	0.14419	0.15353	0.16296
28	0.06001	0.06712	0.07459	0.08239	0.09049	0.09885	0.10745	0.11626	0.12524	0.13439	0.14366	0.15306	0.16255
29	0.05888	0.06605	0.07358	0.08145	0.08962	0.09806	0.10673	0.11561	0.12466	0.13387	0.14320	0.15265	0.16219
30	0.05783	0.06505	0.07265	0.08059	0.08883	0.09734	0.10608	0.11502	0.12414	0.13341	0.14280	0.15230	0.16189

$$CR \quad \frac{i}{1-(1+i)^{-n}}$$