AN ECONOMIC EXAMINATION OF KENTUCKY'S POTENTIAL FOR ALFALFA PRODUCTION

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In managing a farm successfully, a major decision faced by the farmer is the choice of enterprises and the level of production for each of the enterprises chosen. For each enterprise or combination of enterprises, an initial investment in land, buildings, and machinery is required. The enterprises chosen and the production levels of each enterprise must be sufficient to reward investments above their cost. Once the choice of enterprises is made and investment incurred, little flexibility exists in making changes among enterprises unless some investments are liquidated and new investments made.

Within this context, alfalfa—as a farm business enterprise, can be evaluated for its potential profitability. It has become generally accepted that Kentucky has tremendous potential for increased production of alfalfa as a cash crop. This profit potential should be carefully examined using budgeting techniques and some conclusions made as to the profitability of alfalfa in relation to alternative crops. An examination is also needed to determine under what conditions would alfalfa offer a decided competitive advantage.

This paper will address three issues involved in the economic feasibility of alfalfa as a cash crop. First, production costs will be budgeted for the first year after establishment of the stand and for subsequent years during the stand life. Second, estimated production costs and returns will be examined for various yield levels. Third, alfalfa and alternative enterprises will be ranked as to profitability based on 1983 production cost estimates and expected prices and yields.

Required Machinery and Equipment Investment

Alfalfa production requires utilization of specialized harvesting equipment for which no alternative use exists unless other hay is also produced. Table 1 lists machinery items and their cost.

These costs are based on current equipment prices. Producers with existing equipment would have lower annual ownership costs but unless used equipment values have kept pace with new machine prices, these producers are losing in real dollar terms. For this reason, replacement values more closely reflect the true cost of production - even for producers already in business.

Table 1. Investment and Annual Ownership Costs for Production of Alfalfa Hay in Conventional Rectangular Bales.

	Investment	Annual Cost[1]/	Cost Per Acre[2]/
Mower-Conditioner	$ 7,210	$1,333.85	$22.23
Rake	2,290	423.65	7.06
Baler	7,460	1,380.10	23.00
Elevator	900	166.50	2.78
Total	$17,860	$3,304.10	$55.07

1/Based on 1983 replacement cost. Annual cost recovery (depreciation) calculated for 7 years with a 25 percent remaining value, interest at 12 percent on the average remaining value at the beginning of the year, and insurance at .5 percent of average value. Total annual cost of investment is 18.5 percent of new cost.
2/Minimum of 60 acres.

Note that no investment item is listed for hay wagons. Most Kentucky farms are highly diversified and could utilize existing trucks for transport of hay bales.

Tractor and truck investment costs are not shown. Care must be taken in allocating these investments to the alfalfa enterprise. Although this is not easily done, annual ownership costs can be prorated to each enterprise based on the percent of total time devoted to production of each. Such an approach is better than not considering these costs at all.

Alfalfa Budgets

Estimated operating and overhead costs for producing 4 tons of alfalfa per acre are shown in Table 2. These costs are broken down into first year and subsequent years after establishment to reflect the likely differences in actual cash requirements for operating needs. An average is also shown based on a 4-year stand life.

The total cost per ton will be approximately 25 percent higher the first year than in all subsequent years after the year the stand is first established. The 4-year average cost is estimated at $87 per ton. Total non-land costs would average $275 per acre ($349.51 - $75.00 = $274.51) or $69 per ton.

Yield levels affect the cost of production. This is an important consideration to current and potential alfalfa growers. Table 3 gives estimated production costs at various yield levels. As yields increase, the actual cost per ton declines - making alfalfa a more profitable enterprise. The reasons for the cost

Table 2. Estimated Costs of Producing 4 Tons of Alfalfa Hay Per Acre, 1983.

Cost Item	First Year	Subsequent Years	4-Year Average
Operating Expenses			
Fertilizer[1]	$ 43.11	$ 43.11	$ 43.11
Lime[2]	18.00		4.50
Seed[3]	42.50		10.62
Chemicals[4]	30.94	22.80	24.83
Machine Operation[5]	22.50	19.69	20.39
Repairs and Insurance[6]	21.49	21.49	21.49
Hired Labor[7]	12.04	9.88	10.42
Operating Interest[8]	13.34	8.11	9.47
Total Operating Expense	$203.92	$125.15	$144.83
Production and Storage Overhead			
Machinery Depreciation[9]	$ 50.16	$ 50.16	$ 50.16
Interest on Machinery[9]	35.11	35.11	35.11
Storage Depreciation[10]	10.50	10.50	10.50
Interest on Storage[10]	12.60	12.60	12.60
Operator Labor[11]	24.44	20.26	21.31
Land Interest and Taxes[12]	75.00	75.00	75.00
Total Overhead	$207.81	$203.63	$204.68
Total Costs Per Acre	$411.73	$328.78	$349.51
Total Costs Per Ton	$102.93	$ 82.19	$ 87.37

1/Based on nutrient removal. P_2O_5 priced at 27 cents per pound and K_2O at 14 cents per pound. Includes spreading cost.
2/Two-tons, custom applied the first year to raise soil pH to 6.8.
3/Seeding rate of 15 pounds per acre, custom seeded.
4/Includes annual weed control and one application each for leafhopper and alfalfa weevil control. Includes chemical cost of establishment in the first year.
5/Includes fuel, oil, and twine. 4 cuttings per year. First year includes cost of seedbed preparation.
6/On machinery and storage.
7/Assumed to be one-third of total labor requirement at a wage rate of $6.00 per hour.
8/Interest on operating expense for 6 months at 14 percent APR.
9/Includes prorated share of tractor and truck investment, based on 500-700 total tillable acres.
10/Based on 15 square feet per ton at a cost of $3.50 per square foot, 20-year depreciation, and interest at 12 percent.
11/Two-thirds of total requirement at $6.00 per hour.
12/Return on investment and taxes totaling 5 percent of land value. Land valued at $1500 per acre at 4 ton yield level.

decline are twofold. First, not all operating expenses will necessarily increase and those that do will be in less proportion than the increase in yield. Second, production overhead (especially machinery and operator labor) will be less per ton. Increasing production from 3 tons to 9 tons per acre will increase non-land cost from $231 per acre to $417 per acre! The non-land cost per ton, however, would decline from $77 per ton to $46 per ton.

Table 3. Estimated Costs of Producing Alfalfa Hay at Various Yield Levels, 1983[1/].

Cost Item	Yield Per Acre			
	3 Tons	5 Tons	7 Tons	9 Tons
Operating Expenses				
Fertilizer[2/]	$ 29.17	$ 49.52	$ 72.83	$ 92.64
Lime	4.50	4.50	4.50	4.50
Seed	10.62	10.62	10.62	10.62
Chemicals	24.83	24.83	24.83	24.83
Machine Operation[3/]	15.68	21.83	27.98	30.86
Repairs and Insurance[4/]	15.65	24.45	33.68	39.54
Hired Labor	8.63	11.81	14.95	16.03
Operating Interest	7.64	10.33	13.25	15.33
Total Operating Expense	$116.72	$157.89	$202.60	$234.35
Production and Storage Overhead				
Machinery Depreciation[5/]	$ 46.69	$ 51.57	$ 55.61	$ 57.64
Interest on Machinery[5/]	32.68	36.10	38.93	40.35
Storage Depreciation	7.87	13.12	18.37	23.62
Interest on Storage	9.44	15.74	22.05	28.35
Operator Labor	17.52	23.97	30.34	32.55
Land Interest and Taxes[6/]	60.00	90.00	115.00	135.00
Total Overhead	$174.20	$230.50	$280.30	$317.51
Total Cost Per Acre	$290.92	$388.39	$482.90	$551.86
Total Cost Per Ton	$ 96.97	$ 77.68	$ 68.98	$ 61.32

1/Assumes a 4-year stand life.
2/Based on removal. Split applications at 7 and 9 ton yield level. Includes spreading cost.
3/Increases as yield increases due to additional cuttings and hauling of bales. Based on 3 cuttings at 3 tons, 4 cuttings at 5 tons, and 5 cuttings at 7 and 9 ton yield levels.
4/Repairs increase with higher use of equipment.
5/As yields (cuttings) increase, a higher proportion of tractor and truck time is spent on alfalfa production.
6/5-percent of land value.

These budgets do not consider the effects of inflation on production inputs and non-land capital items during the life of the alfalfa stand. All costs were estimated at current price levels, even for subsequent years after stand establishment. Since an alfalfa stand may be viewed as an investment giving multi-year cash-flows, it might be advised to at least mention cost inflation as it may affect profitability.

Given a 4-year stand life, an eight percent annual inflation rate during each of 3 subsequent years after the year of establishment would increase the non-land cost to $317 per acre or $79 per ton with a 4 ton per acre yield. This compares to $69 per ton with zero percent inflation (Table 2).

Returns to Land and Management

The reward to land and operator management (risk-taking) is an often-used measure of profitability of an enterprise. It is the residual amount of total production receipts above operating expenses and non-land overhead (machinery, storage, and operator labor). It is a measure of long-term profit after allowing for replacement of depreciable capital items at current price levels.

The impact of alfalfa price and yield on the returns to land and management is shown in Table 4. Returns increase as price and yield increase. At a yield of only 3 tons per acre, an alfalfa price of over $70 per ton is needed to bring positive returns to land and management. At $50 per ton, yields of over 7 tons per acre are needed to bring positive returns.

Table 4. Estimated Per Acre Returns to Land and Management at Various Alfalfa Prices and Yields, 1983.

Price[1/]	3 Tons	4 Tons	5 Tons	7 Tons	9 Tons
$ 50	-$80.92	-$ 74.51	-$ 48.39	-$ 17.90	$ 33.14
60	- 50.92	- 34.51	1.61	52.10	123.14
70	- 20.92	5.49	51.61	122.10	213.14
80	9.08	45.49	101.61	192.10	303.14
90	39.08	85.49	151.61	262.10	393.14
100	69.08	125.49	201.61	332.10	483.14
110	99.08	165.49	251.61	392.10	573.14

1/Net farm price. Does not include transportation costs incurred in marketing of hay.

The costs budgeted in Tables 2 and 3 assume that no irrigation is needed to attain highest yield levels. Should irrigation be needed, the returns to land and management would be lower than shown in Table 4. Irrigation investment overhead and repairs for a 60-acre towable hose system and fuel and labor for 7 one-inch applications would peg irrigation costs at an estimated $87 per acre annually.

If irrigating to obtain 9 tons per acre, an alfalfa price of over $50 per ton will be needed to obtain positive returns to land and management. At the 7 ton per acre yield level, a price of over $60 per ton will be needed to obtain positive returns.

Alfalfa's Current Competitive Status

During the past 10 years, alfalfa prices have significantly increased in relation to the prices of all other hay. In Figure 1, the trend lines display the widening of the difference between alfalfa price and the prices of all other hay. The reasons for the rapid rise in the price of alfalfa have not been investigated but most likely is due to an increase in the demand for alfalfa hay relative to other hays.

The average price received in Kentucky for alfalfa in 1982 was $87 per ton compared to $86 per ton in 1981 and $73 per ton in 1980. Using only the trend evidenced in Figure 1, the expected 1983 average price for alfalfa hay in Kentucky is $90.50 per ton.

During the past 6 years from 1977 to 1982, alfalfa yields in Kentucky have averaged 3.26 tons per acre with yields of 3.6 tons per acre in 1981 and an estimated 3.8 tons per acre in 1982. Alfalfa hay yields are improving.

Alfalfa and 3 competitive enterprises are ranked in Table 5 according to their relative returns to land and management. Prices are 1983 expected average prices. Competitive crop yields are thought to be consistent with management, soils, and weather necessary to produce 4 tons per acre of alfalfa based on yield histories in Kentucky.

Table 5. Ranking of Alfalfa With Other Cash Crops, Estimated, 1983.

	Yield	Price	Value	Non-Land[1]/ Cost/Acre	Return to Land and Management[2]/	ROI[3]/
Alfalfa	4	$90.50	$362.00	$274.51	$ 87.49	7.1
Soybeans	40	5.75	230.00	163.22	66.78	5.1
Wheat-Soybeans	45-30	3.25-5.75	254.38	254.38	64.37	5.0
Corn	115	2.65	304.75	242.23	62.52	5.0

1/All operating expense and overhead including operator labor but excluding land interest and taxes.
2/Gross value per acre minus non-land cost.
3/Return on investment. Percent return on average value of land, machinery, and building investments. Equals gross value of production minus operating expense, depreciation, and operator labor - as a percent of the average value of investment per acre.

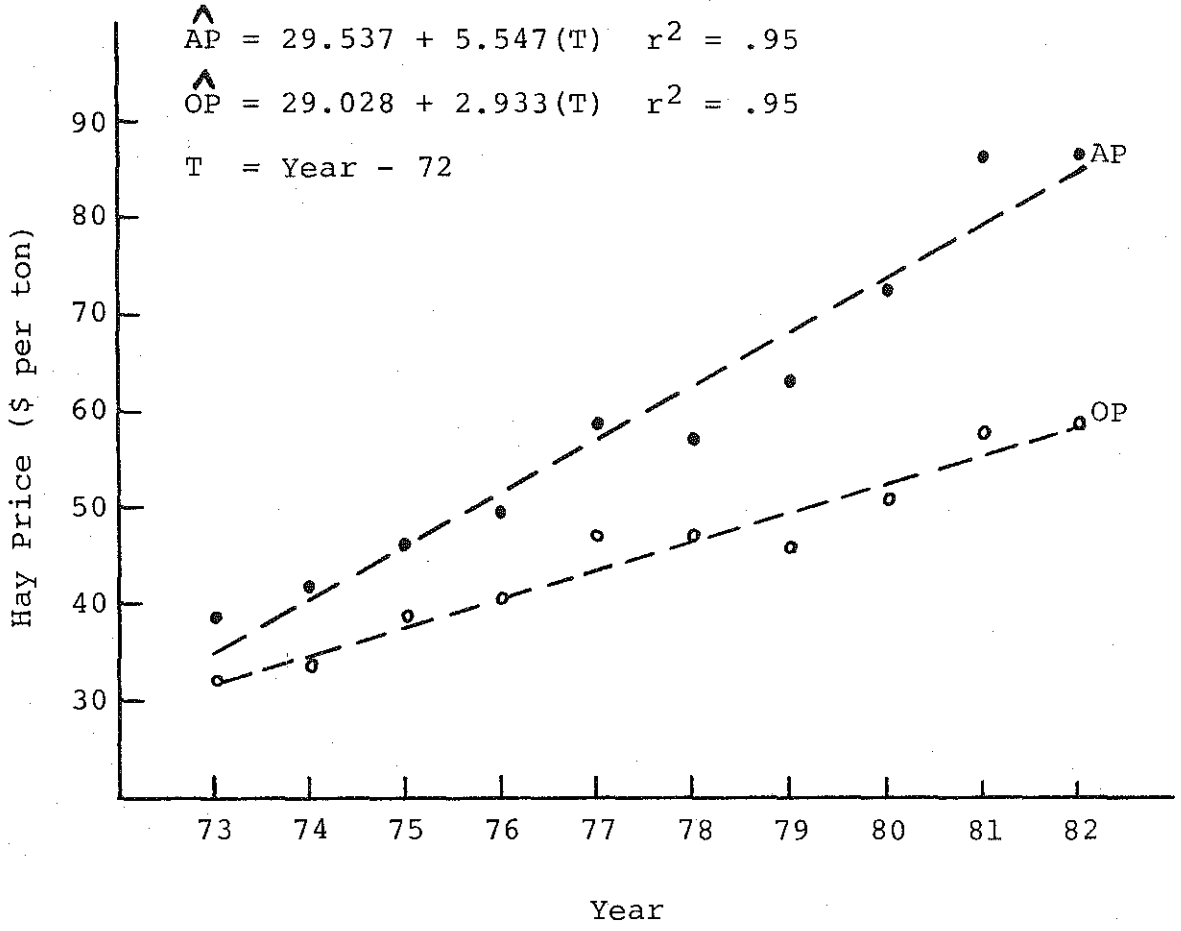

Figure 1. Timewise Regression of Annual Average Prices Received for Alfalfa Hay (AP) and Other Hays (OP) in Kentucky, 1973-1982.

Alfalfa hay production has the highest non-land cost per acre compared to the alternative cropping systems considered. Alfalfa currently shows the highest return to land and management and the highest return on investment, however.

Another important consideration not given due attention in the past is the concept of risk management through enterprise diversification as it relates to alfalfa's potential as a cash crop. Given the current expanding demand for alfalfa hay and the continued variability of grain prices, production of alfalfa hay as a cash crop could also have an income stabilizing effect on grain farms.

Profit Pointers

The potential for alfalfa hay production as a cash crop lies in several factors. At the individual farm level, the producer must produce high yields of quality hay to bring the highest returns and a high return on investment. Low yields cannot bring returns that would be competitive with other enterprises unless the hay is of above average quality.

Alfalfa is a labor intensive enterprise. Depending on yield and number of cuttings, on an acre for acre basis, hay production can require from 2 to 3 times the labor needed to produce corn. Because timing of harvesting operations is so critical to yield and quality of alfalfa hay, producers must have enough labor available at the right time to assure highest returns.

For this same reason, custom-hire of hay harvesting must be questioned. Unless hired services are dependable and timely, higher yields and quality could best be achieved if harvesting is done by the producer, provided a more timely job can be done. In general, alfalfa acreage should be large enough to justify the ownership of equipment rather than risk a potentially high-profit enterprise on questionnable custom services.

At the state and local level, new markets must be developed and current markets maintained. Interested producers must work together to develop markets and provide consistent high quality and quantity alfalfa hay. Hay associations can aid in this regard and help assure hay buyers that Kentucky can be a reliable source of quality alfalfa hay in the quantities needed and at a competitive price.

Producers dedicated to achieving high returns through careful management and local and state efforts to establish hay markets can result in reaching the economic potential that production of alfalfa hay in Kentucky most certainly has.

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