

ANALYZING ALTERNATIVE HAYING SYSTEMS,
BIG BALER versus CUSTOM BALING and STACKING

Agriculture Extension Service,
Division of Agricultural Economics,
University of Wyoming, Laramie

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ANALYZING ALTERNATIVE HAYING SYSTEMS,
BIG BALER versus CUSTOM BALING and STACKING*

Introduction

Farmers, like other business managers, are continually faced with changing economic conditions. Uncertain market prices, increasing production costs and new technologies are some of the variables making business decisions challenging for farm managers.

The subsequent analysis of alternative haying systems attempts to illustrate how a farm manager might analyze a decision situation. The decision maker's goal in this case is to MAXIMIZE NET CASH FLOW AFTER TAXES.

The example is a partial budgeting exercise applying basic economic principles. The final decision is made by comparing annual net cash flows after taxes, discounted to present value basis.

The Case Situation

The case farm is located near Wheatland, an irrigated crop area of southeastern Wyoming. The operator produces alfalfa hay as a cash crop. The enterprise is as follows:

- 1) Three center pivot irrigation systems with 390 acres in alfalfa.
- 2) Average yield is 4 tons of baled hay/ acre in 2 cuttings or 1,560 tons/year.
- 3) The operator sells all hay which is loaded onto trucks from stacks at the edge of fields.

* Prepared by D.E. Agee, Extension Farm Management Specialist and Professor, Division of Agricultural Economics, University of Wyoming, January 1980.

- 4) The farmer provides labor and equipment to load the hay onto buyer's trucks. He estimates little or no difference in costs to load conventional bales versus large one-ton bales.
- 5) The operator swaths hay with his own equipment.
- 6) In past years custom operators have been hired to bale and stack the hay at the edge of fields.

In 1979 custom baling and stacking costs were:

Bale	1,560	tons @ \$ 9	= \$14,040	(30 bales/ton @ \$.30)
Stack	<u>1,560</u>	tons @ \$ 6	= <u>9,360</u>	(30 bales/ton @ \$.20)
Total	1,560	tons @ \$15	= \$23,400	

The Problem and Objective

The problem in the broad sense is the cost-price squeeze continually faced by farmers and ranchers. Farm managers must always be looking for ways to improve the economic efficiency of their operations. The specific problem in this case is that cash costs for custom services and other inputs continues to increase.

The specific objective of the operator is to answer this question, "How would net cash flow after taxes be affected if a large baler (4 ft. X 8 ft. bales @ 1 ton each), bale accumulator (3 bales), and heavy duty front-end loader are purchased to replace custom services?"

Data, assumptions and analyses evaluating this management question are presented subsequently. The step by step procedure might be helpful in guiding managers through similar analyses.

Assumptions and Data:

The operator lists the following assumptions and data as pertinent to the analysis and decision:

- 1) Labor must be hired to turn windrows, operate the baler and to stack bales. It is assumed that labor can be hired.

2) Equipment presently on the farm which is not being used to capacity includes :

- a) 125 hp diesel tractor to pull the baler,
- b) 100 hp diesel tractor to use with front loader,
- c) 40 hp gas tractor to pull side rake,
- d) 8 ft. side rake to double-up windrows, and
- e) 2 ton truck with flat bed to haul bales.

3) Equipment to purchase for big baler option:

	<u>Amount</u>
a) Large baler with accumulator	\$43,100
b) Heavy duty front-end loader	<u>4,200</u>
Total investment	\$47,300

4) Cash available for down payment \$ 5,000

5) Earnings and tax data for 1979 utilizing custom baling and stacking:

	<u>Amount</u>
a) Taxable income before hay harvest expenses	\$54,100 ^{a/}
b) Minus custom bale & stack expense	<u>23,400</u>
c) Equals taxable income for 1979	\$30,700

d) Tax rate schedule Y, married, joint return:

Taxable Income

<u>Over</u>	<u>But Not Over</u>	<u>Tax</u>			
\$16,000	\$20,200	\$2,265	plus	24% over	\$16,000
20,200	24,600	3,273	+	28% over	20,200
24,600	29,900	4,505	+	32% over	24,600
29,900	35,200	6,201	+	37% over	29,900
35,200	45,800	8,162	+	43% over	35,200
45,800	60,000	12,720	+	49% over	45,800
60,000	85,000	19,678	+	54% over	60,000

Source: Publication 17, Your Federal Income Tax for 1979 Returns.
Dept. of Treasury.

^{a/} This is gross farm income reduced by all exemptions and operating expenses except custom baling and stacking hay. Gross income is assumed to be the same for both alternatives.

e) Taxes paid and net cash after taxes for 1979:

Taxable income	\$30,700 (item c above)
Minus	<u>29,900</u> (from tax table)
Equals	800
Then: (.37 marginal rate) (\$800) + \$6,201 = \$6,497 tax due	
Taxable income	\$30,700
Minus taxes due	<u>6,497</u>
Equals net income after taxes	\$24,203 ^{a/}

6) Estimated machine performance and labor requirements for big baler option:

<u>Operation</u>	<u>Crew</u>	<u>Tractor</u>	<u>Equip.</u>	<u>Rate</u>	<u>Machine and man hours</u>
a) Double-up windrows	1	40 hp.	rake	7.8 acre/hr	100
b) Bale Hay	1	125 hp.	baler	16 T./hr	100
c) Load & unload bales	1	100 hp.	loader	12 T./hr	130
d) Haul to edge of field	1	2 T. truck	—	600 mi/1560T.	130

7) Estimated fuel usage:

	<u>Load</u>	<u>Fuel/hr</u> ^{b/}	<u>Units</u>	<u>Total</u>
a) 125 hp diesel tractor	medium	6.5 gal	100 hrs.	650 gal
b) 100 hp diesel tractor	low	4.7 gal	130 hrs.	<u>611 gal</u>
Subtotal, diesel				1,261 gal
c) 40 hp gas tractor	low	2.8 gal	100 hrs.	280 gal
d) 2 ton truck	—	5 mi/gal	600 mi.	<u>120 gal</u>
Subtotal, gasoline				400 gal

^{a/} Net income after taxes determined here was reduced by depreciation allowances. Thus, the amount of depreciation claimed could be added to net income after taxes to get net cash balance after taxes. This fact does not affect the subsequent comparison.

^{b/} Rates from "Costs of Producing Crops, Torrington-Wheatland, Area, Wyo. 1977-78", Bull .665, p.33.

8) Estimated added per unit cash costs for big baler option:

<u>Item</u>	<u>Unit</u>	<u>1979^{a/}</u>	<u>year 1</u> <u>1980</u>	<u>year 2</u> <u>1981</u>	<u>year 3</u> <u>1982</u>	<u>year 4</u> <u>1983</u>	<u>year 5</u> <u>1984</u>
125 hp tractor ^{b/}	\$/hr.	2.44	2.68	2.95	3.24	3.57	3.92
100 hp tractor ^{b/}	"	1.92	2.11	2.32	2.55	2.81	3.09
40 hp tractor ^{b/}	"	1.36	1.50	1.65	1.81	2.00	2.20
Baler & accumulator ^{b/}	"	_____	warranty	7.00	7.70	8.47	9.32
Side rake ^{b/}	"	1.29	1.42	1.56	1.72	1.89	2.08
Front loader ^{b/}	"	1.49	1.64	1.80	1.98	2.18	2.40
Twine	\$/T. hay	.60	.66	.73	.80	.88	.97
Labor & S.S. taxes	\$/ hr	_____	5.00	5.50	6.05	6.65	7.32
Truck ^{b/}	\$/ mi	.32	.35	.38	.42	.46	.51
Diesel	\$/ gal	_____	1.00	1.10	1.21	1.33	1.46
Gasoline	\$/ gal	_____	1.10	1.21	1.33	1.46	1.61

a/ Estimated from "Costs of Producing Crops, Torrington-Wheatland area, Wyo, 1977-78", Bull. 665,p.33 updated to 1979. Rates increased 10% per year thereafter.

b/ Includes repairs, oil and lube per unit of use.

9) Estimated added annual cash costs for big baler option:^{a/}

Item	Use or Unit	year 1 1980	year 2 1981	year 3 1982	year 4 1983	year 5 1984
<u>Repairs, oil, lube:</u>		\$ / year				
125 hp tractor	100 hrs	268	295	324	357	392
100 hp tractor	130 hrs	274	302	332	365	402
40 hp tractor	100 hrs	150	165	181	200	220
Baler & accumulator	100 hrs warranty	700	770	847	932	
Side rake	100 hrs	142	156	172	189	208
Truck	600 mi	210	228	252	276	306
Front loader	130 hrs	<u>213</u>	<u>234</u>	<u>257</u>	<u>283</u>	<u>312</u>
Subtotal, added repairs		1,257	2,080	2,288	2,517	2,772
Twine for	1,560 tons	1,030	1,139	1,248	1,373	1,513
Labor added	460 hrs	2,300	2,530	2,783	3,059	3,367
Diesel	1,261 gal	1,261	1,387	1,526	1,677	1,841
Gasoline	400 gal	440	484	532	584	644
Taxes on new equipment ^{b/}		482	358	296	234	172
Insurance on new equip. ^{c/}		<u>189</u>	<u>140</u>	<u>116</u>	<u>92</u>	<u>64</u>
Total added cash costs		6,959	8,118	8,789	9,536	10,373

^{a/} Annual cash costs are estimated by multiplying per unit added costs (from item 8 above) times annual use or units used.

^{b/} Taxes on new equipment estimated as: (.15) (book value) (mill levy .068).

^{c/} Insurance carried on new equipment to cover only the amount financed.

- 10) Estimated annual interest and principal payments on borrowed funds for big baler option:

Borrowed \$42,300 at 14% for 5 years, equal

annual payments, dollars/year:^{a/}

	1980	1981	1982	1983	1984
Interest	5,922	5,026	4,005	2,840	1,513
Principal	6,400	7,296	8,317	9,482	10,805
Annual	12,322	12,322	12,322	12,322	12,318
Balance owed					
end-of-year ^{b/}	35,900	28,604	20,287	10,805	-0-

- 11) Estimated investment credit, depreciation allowances and end-of-year book values for big baler option:

Item	1980	1981	1982	1983	1984
<u>Investment credit:</u>					
\$47,300 X 10%	\$4,730 ^{c/}	—	—	—	—
<u>Annual depreciation:</u>					
Baler & Accumulator ^{d/}	\$5,541	5,541	5,541	5,541	5,541
Front Loader ^{e/}	\$ 540	540	540	540	540
<u>End-of-year book values:</u>					
Baler & Accumulator	\$37,559	32,018	26,477	20,936	15,395
Front Loader	\$ 3,660	3,120	2,580	2,040	1,500

a/ Annual interest and principal payments can be obtained from loan officer or, calculated using factors from present value of annuity tables.

b/ Amount owed at beginning of year minus principal paid during the year (\$42,300 borrowed minus \$6,400 paid 1st year equals amount owed at end of 1st year).

c/ Investment credit may be carried over if not fully used in 1980.

d/ Annual straight line:

$$\frac{\text{cost minus 10\% salvage}}{\text{useful life}} = \frac{\$43,100 - \$4,310}{7 \text{ years}} = \$5,541/\text{yr.}$$

e/ Annual straight line:

$$\frac{\$4,200 - 420}{7 \text{ years}} = \$540/\text{yr.}$$

12) Cash outflows and expense summary for big baler option:

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
<u>Non-tax deductible</u> (cash out): _____ \$/ year _____					
Down payment	5,000	_____	_____	_____	_____
Principal payment on loan	<u>6,400</u>	<u>7,296</u>	<u>8,317</u>	<u>9,482</u>	<u>10,805</u>
Subtotal, non-tax deductible	11,400	7,296	8,317	9,482	10,805
<u>Tax deductible expenses</u> (cash out):					
Interest on loan	5,922	5,026	4,005	2,840	1,513
Added cash cost from item 9	<u>6,959</u>	<u>8,118</u>	<u>8,789</u>	<u>9,536</u>	<u>10,373</u>
subtotal, cash deductible	<u>12,881</u>	<u>13,144</u>	<u>12,794</u>	<u>12,376</u>	<u>11,886</u>
<u>Non-cash:</u>					
Depreciation	<u>6,081</u>	<u>6,081</u>	<u>6,081</u>	<u>6,081</u>	<u>6,081</u>
Subtotal tax deductible	18,962	19,225	18,875	18,457	17,967

Upon completing the assumptions and input data, items 1 through 12, the budgeter can now summarize and estimate net cash flows after taxes for the two options.

Projected net cash flows using CUSTOM Baling and Stacking:

<u>Item:</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
Taxable income before deducting	-----\$/ year-----				
custom expenses	54,100	54,100	54,100	54,100	54,100
Minus deductible expenses ^{a/}	<u>25,740</u>	<u>28,314</u>	<u>31,145</u>	<u>34,260</u>	<u>37,686</u>
Equals taxable income	28,360	25,786	22,955	19,840	16,414
Marginal tax rate	.32	.32	.28	.24	.24
Estimated taxes due	<u>5,708</u>	<u>4,885</u>	<u>4,044</u>	<u>3,187</u>	<u>2,364</u>
Net Cash after taxes ^{b/}	22,652	20,901	18,911	16,653	14,050
Discount factor @ 10% ^{c/}	.909	.826	.751	.683	.621
Discounted: Net cash flow (PV)	20,591	17,264	14,202	11,374	8,725
Accumulated	20,591	37,855	52,057	63,431	72,156

The projected present value of cash flows using the custom harvesting option is \$72,156 at the end of 5 years. Projected net cash flows for the big baler option should exceed this amount to logically select it over the custom system.

a/ Custom harvest expenses are projected to increase 10% per year.

b/ "Net cash after taxes" would be higher by the amount of depreciation claimed for other than custom baling and stacking. This would be the same for both options.

c/ Various discount rates could be used. Factors are available in tables of discount factors found in many financial management texts or from officers of lending institutions.

Projected net cash flows using BIG BALER systems:

<u>Item</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
Taxable income before deducting	\$ / year				
harvest expenses	54,100	54,100	54,100	54,100	54,100
Minus, deductible expenses	<u>18,962</u>	<u>19,225</u>	<u>18,875</u>	<u>18,457</u>	<u>17,967</u>
Equals, Taxable income	35,138	34,875	35,225	35,643	36,133
Marginal tax rate	.37	.37	.43	.43	.43
Estimated taxes before credit	8,139	8,042	8,173	8,352	8,563
Minus, investment credit	<u>4,730</u>	—	—	—	—
Equals, Estimated taxes due	3,409	8,042	8,173	8,352	8,563
Net income after taxes	31,729	26,833	27,052	27,291	27,570
Add: Depreciation (non-cash)	6,081	6,081	6,081	6,081	6,081
Minus: Down payment	5,000	—	—	—	—
Principal	<u>6,400</u>	<u>7,296</u>	<u>8,317</u>	<u>9,482</u>	<u>10,805</u>
Equals, NET Cash after Taxes	26,410	25,618	24,816	23,890	22,846
Discount factor @ 10%	.909	.826	.751	.683	.621
Discounted: Net cash flow (PV)	24,007	21,160	18,637	16,317	14,187
Accumulated	24,007	45,167	63,804	80,121	94,308
Discounted book values ^{a/}	37,468	29,024	21,822	15,693	10,492

Evaluation of CUSTOM versus BIG BALER cash flow analysis:

The comparison shows net cash flows after taxes (before discounting to present value) are greater for the big baler option than for the custom system.

^{a/} Discounted book values (cost minus depreciation) of baler, accumulator and front loader at end of each year.

This is true even though considerably more income taxes would be payable under the big baler option.

Discounted cash flows accumulated to the end of the 5-year period shows:

	<u>PV cash flows</u>
Big Baler System	\$94,308
Custom System	<u>72,156</u>
Difference	\$22,152

The big baler system shows a cash flow advantage of \$22,152 over the 5-year period which is equivalent to \$2.84/ton for 7,800 tons of hay.

In addition to the cash flow advantages would be the discounted cash salvage values of the baler, accumulator and front loader. Note that the discounted book values at the end of each year exceed somewhat the balance owed on borrowed funds as shown in step 10.

The Decision

The management decision, based on data and assumptions in this analysis, would be to adopt the big baler system.

Evaluate using accelerated depreciation:

The manager may now ask, "How would cash flows after taxes be affected if I use accelerated depreciation for the purchased equipment?" The budgeter proceeds by calculating allowable accelerated depreciation for the baler, accumulator and front loader.

13) Accelerated depreciation for purchased equipment:

<u>Item</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
<u>Depreciation:</u>	_____ \$/ year _____				
Additional 1st year ^{a/}	4,000	_____	_____	_____	_____
Declining balance:					
Baler & accumulator ^{b/}	10,948	7,833	5,675	4,086	2,942
Loader ^{c/}	<u>1,176</u>	<u>847</u>	<u>610</u>	<u>439</u>	<u>316</u>
Total depreciation	16,124	8,730	6,285	4,525	3,258
Book value end-of-year ^{d/}	31,176	22,446	16,161	11,636	8,378

a/ Calculated at 20% of \$20,000. Additional 1st year depreciation is limited to 20% of \$20,000 of purchases for a joint return.

b/ Declining balance at 2 times the straight line rate of 14%. For 1st year \$43,100 cost minus \$4000 x .28 = \$10,948.

c/ For 1st year; \$4,200 x .28 = \$1,176.

d/ Cost \$47,300 minus \$16,124 depreciation = \$31,176 end-of-year book value.

Projected net cash flows using BIG BALER system and accelerated depreciation:

<u>Item</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
Taxable income before hay					
harvest expenses	54,100	54,100	54,100	54,100	54,100
Minus: cash expenses ^{a/}	12,881	13,144	12,794	12,376	11,886
depreciation	<u>16,124</u>	<u>8,730</u>	<u>6,285</u>	<u>4,525</u>	<u>3,258</u>
Equals, taxable income	25,095	32,226	35,021	37,199	38,956
Marginal tax rate	.32	.37	.37	.43	.43
Estimated taxes before credit	4,663	7,062	8,096	9,022	9,777
Minus, investment credit ^{b/}	<u>4,663</u>	<u>67</u>	<u>—</u>	<u>—</u>	<u>—</u>
Equals, taxes due	-0-	6,995	8,096	9,022	9,777
Net income after taxes	25,095	25,231	26,925	28,177	29,179
Add: depreciation (non-cash)	16,124	8,730	6,285	4,525	3,258
Minus: down payment	5,000	—	—	—	—
principal payment	<u>6,400</u>	<u>7,296</u>	<u>8,317</u>	<u>9,482</u>	<u>10,805</u>
Equals, Net Cash after Taxes	29,819	26,665	24,893	23,220	21,632
Discount factor @ 10%	.909	.826	.751	.683	.621
Discounted: Net Cash Flow (PV)	27,105	22,025	18,695	15,859	13,433
Accumulated	27,105	49,130	67,825	83,684	97,117
Discounted book values ^{c/}	28,339	18,540	12,137	7,947	5,203

^{a/} Includes repairs, labor, twine, etc. and interest on loan. (from item 12).

^{b/} Investment credit in first year is limited to the amount of taxes due so balance is carried over to 2nd year.

^{c/} Cost minus depreciation times the discount rate. Because of rapid depreciation, book values could be lower than market values of the equipment.

Evaluation of net cash flows under accelerated depreciation:

Accumulated net cash flows at the end of the 5-year planning period are about \$2,809 higher (\$97,117 versus \$94,308) for accelerated depreciation than for straight line. Compared to the straight line option accelerated depreciation would make more cash available to the business in the first three years of the comparison and slightly less cash available in the last two years. The accelerated depreciation option is thus economically more desirable than the straight line depreciation option. Accelerated depreciation thus helps to ease the cash flow squeeze.

Additional Considerations

Accelerated depreciation reduces asset values in balance sheets faster than straight line depreciation. Thus, asset book values may decline at a faster rate than the liability incurred (money borrowed) to purchase the asset. In this case, the liability to asset ratio may not be as desirable as using straight line depreciation.

Obviously, analyses as presented here are time consuming and require numerous calculations. These types of analyses are thus well suited for computer programming and solving. The budgeter must develop all assumptions and coefficients, then the data could be inputted for computer analysis. A big advantage of using the computer is that specific inputs can be changed and effects noted.

