AN ANALYSIS OF ALFALFA HARVESTING COSTS: IMPLICATIONS FOR CUSTOM HARVEST CHARGES

Karen Klonsky, Steve Blank, Kate Fuller, Steve Orloff, and Dan Putnam[1]

ABSTRACT

This paper reports an analysis of the overhead (ownership) and operating costs (fuel, repairs, and labor) associated with different alternatives for alfalfa harvest equipment complements. Specifically, costs are calculated for one harvest operation for small bales using a swather with a cutter bar header, small bales using a swather with a rotary header, large bales with a cutter bar header, and large bales with a rotary header. Using a rotary mower lowers costs per cutting per acre by $3.54. Large bales are less expensive to bale and roadside than small bales by $7.48 per cutting per acre. Therefore, the least expensive combination is large bales with a rotary mower.

Key Words: alfalfa, hay harvest, cost of production

INTRODUCTION

Alfalfa hay harvesting costs are a significant concern to the grower, representing about half of total costs. Growers have the option of owning their own harvest equipment, hiring a custom operator to perform harvest operations, or a combination of the two. Also, many growers harvest their own hay and run a custom harvest business in addition to their own farming operation.

New technologies introduced into alfalfa harvest equipment have created more options for custom harvest businesses and farmers. In particular, the use of large bales is increasing in response to demand from dairies. Also, rotary mowers are increasingly replacing cutter bar (sickle bar) mowers. These changes require additional equipment. In particular, a cutter bar header requires a swather with less horsepower than a rotary header. A baler for large bales requires a tractor with more horsepower than a baler for small bales. The system considered here is a balewagon with an additional large bale pickup to move the large bales from the field. Alternatively, there are large bale haulers used for roadsiding but the investment is much greater than a balewagon with a large bale attachment. Consequently, each shift in technology results in tradeoffs between an increase in investment and a decrease in operating costs associated with moving through a field at a faster speed. This paper reports an analysis of the overhead (ownership) and operating costs (fuel, repairs, and labor) associated with different alternatives for alfalfa harvest equipment complements. Specifically, costs are calculated for one harvest operation for small bales using a swather with a cutter bar header, small bales using a swather with a rotary header, large bales with a cutter bar header, and large bales with a rotary header.

[1] K. Klonsky (Klonsky@primal.ucdavis.edu), UCCE Specialist, S. Blank, UCCE Specialist, and K. Fuller, graduate student, Dept. of Agricultural and Resource Economics, D. Putnam, UCCE Specialist, Dept. of Plant Sciences and DANR Program Leader – Agricultural Productivity, UC Davis, One Shields Ave., Davis, CA 95616, and S. Orloff, UCCE Farm Advisor and County Director Siskiyou County, 1655 South Main Street, Yreka, CA 96097; **In**: Proceedings, 38th California Alfalfa & Forage Symposium, December 2-4, 2007, San Diego, CA. Published by: UC Cooperative Extension, Agronomy Research and Extension Center, Plant Sciences Department, University of California, Davis, CA 95616. (See http://alfalfa.ucdavis.edu for this and other alfalfa symposium Proceedings.)

The costs do not include moving equipment to and from a field. The following sections explain the assumptions used in the analysis.

ALFALFA HAY HARVEST COST CALCULATIONS

The costs associated with each harvest operation are calculated based on the following assumptions. The overhead (capital recovery, insurance, and property taxes) and operating (fuel, lube, and repairs) are calculated on a per hour basis for each piece of equipment over the life of that equipment. This approach can be interpreted as what it costs to own and operate equipment if you were renting it to yourself or what the costs are for a custom operator. The hourly cost approach allows the analysis to be scale neutral and is not influenced by the number of acres serviced. The analysis does not take into account the size, condition, or location of the field. In particular, the costs of moving equipment to and from a field are not included.

Labor. Hourly wages for workers are $10.75 for machine operators. Adding 33% for the employer's share of federal and state payroll taxes, workers compensation insurance for field crops, and other possible benefits gives the labor rate of $14.29 per hour for machine labor. Labor time for operations are 20 percent higher than the operation time in the field to account for the extra labor involved in equipment set up, moving, maintenance, work breaks, and field repair.

Equipment Operating Costs. Repair costs are based on purchase price, annual hours of use, total hours of life, and repair coefficients developed by the American Society of Agricultural Engineers (ASAE). Fuel use and lubrication costs are also determined using ASAE equations based on maximum power takeoff (PTO) horsepower, and fuel type. The price for on-farm delivery of diesel is $3.54 per gallon. Fuel costs are derived from American Automobile Association (AAA) and Energy Information Administration 2008 monthly data. The cost includes a two percent local sales tax on diesel fuel. Tractor time is 10 percent higher than implement time for a given operation to account for setup, travel and down time.

Table 5 shows the equipment used and the hours per acre for each harvest operation. The corresponding equipment operating costs (fuel, lube, and repairs) are determined by multiplying the operating cost per hour in Table 3 by the hours per acre in Table 5 for each piece of equipment. The operating cost for each operation is the sum of the operating costs of each piece of equipment used in the operation.

Equipment Overhead Costs. Overhead costs for equipment ownership include property taxes, property insurance, and capital recovery costs. The annual overhead costs are shown in Table 2. The hourly overhead costs for each piece of equipment are shown in Table 4. The overhead costs per operation are calculated by multiplying the hours per acre in Table 5 times the hourly overhead costs in Table 4. The overhead cost for each operation is the sum of the overhead costs of each piece of equipment used in that operation.

Counties charge a base property tax rate of 1% on the assessed value of the property. In some counties special assessment districts exist and charge additional taxes on property including equipment, buildings, and improvements. For this study, county taxes are calculated as one

percent of the average value of the property. Average value equals new cost plus salvage value divided by two.

Insurance for farm investments varies depending on the assets included and the amount of coverage. Property insurance provides coverage for property loss and is charged at 0.714% of the average value of the assets over their useful life.

Capital recovery cost is the annual depreciation and interest costs for a capital investment. It is the amount of money required each year to recover the difference between the purchase price and salvage value (unrecovered capital). It is equivalent to the annual payment on a loan for the investment with the down payment equal to the discounted salvage value. This is a more complex method of calculating ownership costs than straight-line depreciation and opportunity costs, but more accurately represents the annual costs of ownership because it takes the time value of money into account. The formula for the calculation of the annual capital recovery costs is:

((Purchase Price – Salvage Value) x Capital Recovery Factor) + (Salvage Value x Interest Rate)

Salvage Value. Salvage value is an estimate of the remaining value of an investment at the end of its useful life. For farm machinery (tractors and implements) the remaining value is a percentage of the new cost of the investment. The percent remaining value is calculated from equations developed by the American Society of Agricultural Engineers (ASAE) based on equipment type and years of life. The life in years is estimated by dividing the wear out life, as given by ASAE by the annual hours of use. The purchase price and salvage value for equipment are shown in Table 2.

Capital Recovery Factor. Capital recovery factor is the amortization factor or annual payment whose present value at compound interest is 1. The amortization factor is based on the interest rate used and the years of life of the machine.

Interest Rate. An interest rate of 7.25% is used to calculate capital recovery. The rate will vary depending upon loan amount and other lending agency conditions, but is the basic suggested rate by a farm lending agency.

ALFALFA HAY HARVEST COST COMPARISONS

The cost of four alternative equipment complements was compared based on the cost estimation procedure described above. They include small and large bales with either a cutter bar or rotary header used for swathing. The purchase prices and specifications of the equipment used in this analysis are given in Table 1. The annual overhead costs and hourly operating costs are shown in Tables 2 and 3, respectively. Table 4 shows the total hourly operating costs for each piece of equipment combining the results from Tables 2 and 3. Finally, the costs per operation for each of the alternative equipment combinations are given in Table 5.

The swath operation with a rotary mower requires a larger swather than a cutter bar and therefore, more fuel per hour. However, this increase is offset by the reduced time needed to

move across a field. Using our assumptions, a rotary mower can complete 13 acres an hour compared to 6 acres per hour with a cutter bar mower. The overhead investment in a higher horsepower swather and rotary mower is more than compensated for by the decrease in fuel and labor costs per hour compared to a smaller swather with a cutter bar header with a total of $7.01 per cutting per acre for the rotary mower and $10.56 per cutting per acre for the cutter bar mower It is worth noting that the fuel costs are lower for the rotary mower even though the horsepower requirements are greater because it is able to operate so much faster. There are other obvious advantages from getting through a field faster especially at times of threatening weather.

The analysis assumes a PTO baler for large bales but not small bales. Therefore, the large - bale baler requires a larger tractor than the small - bale - baler but the small - bale baler requires additional fuel use beyond the tractor. A large – bale baler can get through a field faster than a small – bale baler reducing labor costs per acre. The net result is slightly higher fuel use per cutting with the small baler due to running the two engines and the greater time despite the smaller tractor. Similarly, the greater investment in the large-bale baler is offset by the faster speed. The total costs for baling using a small baler is $10.05 per cutting per acre compared to $8.04 per cutting per acre for the large bales. The cost of twine is not included because the value is insignificant on a per acre basis. It should be noted that large bales use less twine than small bales on a per ton basis. Therefore, the costs of materials and labor hours to service a baler are lower for large bales.

Roadsiding small bales versus large bales require different equipment. Standard balewagons come equipped with pickups for small bales. Switching to large bales requires an additional capital investment. Many growers use a loader and a truck to remove the bales from the field. There are also large-bale haulers made especially for larger bales, or the same balewagon can be used with an attachment for large bales (the equipment combination selected for this evaluation). Under average conditions about 50 percent more large bales are removed from the field than small bales in the same amount of time resulting in lower fuel and labor costs per cutting. .

Table 5 compares the total harvest costs per cutting per acre including swathing, raking, baling, and roadsiding for the alternative equipment scenarios. Using a rotary mower lowers costs per cutting per acre by $3.54. Large bales are less expensive to bale and roadside than small bales by $7.48 per cutting per acre. Therefore, the least expensive combination is large bales with a rotary mower.

Of course there are many other factors to consider when selecting an equipment complement. These include the demand from customers for large or small bales (i.e., large scale dairy market versus horse market), the curing conditions and the ability to dry the hay down to a safe level for large bales, access to credit for equipment investments, the current equipment owned, and any change in acres harvested in the foreseeable future. Also, the number of cuttings and the tonnage per cutting may affect the speed of the harvest operations and impact the bottom line.

Table 1. Hay Harvest Equipment

Equipment Type	New Price	Specifications
Swather – 126 HP	$74,000	
Swather – 186 HP	$91,000	
Header – cutter bar 14’	$21,000	Uses the H8040 swather
Header – rotary cutter 15.5’	$25,000	Uses the H8060 swather
Baler PTO – Large 3’ x 4’	$90.00	Uses 122 – 150 Hp tractor
Baler – Small 14” x 18”	$68,000	Uses 62 Hp tractor
Balewagon – 173 HP	$143,000	
Pickup attachment for H9880	$20,000	Large bale feeder for balewagon
Tractor – 4wd, 150 PTO HP	$95,000	
Tractor – 4wd 62 PTO HP	$32,000	
Rake - Center Delivery	$22,000	Two Rakes on Hydraulic Hitch

Table 2. Annual Alfalfa Harvest Equipment Overhead Cost ($ per year)

	New Price	Years of Life	Salvage Value	Capital Recovery	Insur-ance	Taxes	Over-head Costs
145 HP 4WD Tractor	$95,000	16	$17,015	$7,540	$414	$560	$8,514
62 HP 4WD Tractor	32,000	16	5,731	2,540	140	189	2,868
Baler,Large	90,000	10	14,855	10,012	388	524	10,924
Baler,Small	68,000	10	11,223	7,564	293	397	8,254
Balewagon	125,000	10	20,631	13,905	539	728	15,172
Header,Cutterbar 14'	25,000	10	4,126	2,781	108	146	3,034
Header,Rotary cutter 15.5’	21,000	10	3,466	2,336	91	122	2,549
Large Bale Pickup	20,000	10	3,301	2,225	86	117	2,428
Rake-27' Center Delivery	22,000	10	3,891	2,426	96	129	2,651
Swather, SP126HP	74,000	12	18,501	6,786	342	463	7,591
Swather, SP186HP	91,000	12	22,751	8,345	421	569	9,335

Table 3. Hourly Operating Costs (S per hour)

	Hours of Life	Repairs	Fuel & Lube	Operating Costs
145 HP 4WD Tractor	16,000	$1.62	$30.71	$32.33
62 HP 4WD Tractor	16,000	0.55	15.99	16.54
Baler, Large bales	3,000	8.16		8.16
Baler, Small bales	2,000	6.33	7.08	13.41
Balewagon	2,000	18.84	28.35	47.19
Header, Cutterbar 14'	2,500	2.48		2.48
Header, Rotary Cutter 15.5'	2,500	2.08		2.08
Large Bale Pickup	2,000	3.02		3.02
Rake - 27' Center Delivery	2,500	2.08		2.08
Swather, SP 126 HP	12,000	2.28	29.77	32.05
Swather, SP 186 HP	12,000	2.80	53.40	56.20

Table 4. Total Hourly Equipment Costs

	Equipment Overhead			Operating Costs		
	Capital Recovery	Insur-ance	Taxes	Repairs	Fuel & Lube	Total Costs
145 HP 4WD Tractor	3.02	0.17	0.22	1.62	30.71	35.74
62 HP 4WD Tractor	1.02	0.06	0.08	0.55	15.99	17.69
Baler PTO, Large bales	13.37	0.52	0.70	8.16		22.74
Baler, Small bales	15.13	.59	.79	6.33	6.37	29.21
Balewagon	27.85	1.08	1.46	18.84	28.35	77.58
Header, Cutterbar	4.45	0.17	0.23	2.48		7.33
Header, Rotary Cutter	3.74	0.14	0.20	2.08		6.16
Large Bale Pickup	4.47	0.17	0.23	3.02		7.89
Rake - 27' Center Delivery	3.89	0.15	0.21	2.08		6.34
Swather, SP 126 HP	2.72	0.14	0.19	2.28	29.77	35.09
Swather, SP 186 HP	3.34	0.17	0.23	2.80	53.40	59.94

Table 5. Alfalfa Hay Harvest Costs by Operation ($ per acre)

Operation	Equipment	Acres per hour	Hours per acre	Labor	Operating costs	Overhead costs	Total
Swath- cutterbar	Swather - 126 HP Header, cutterbar	5.88	0.17	$2.88	$6.34	$1.34	$10.56
Swath - rotary	Swather SP 186 HP Header, rotary	12.66	0.08	1.35	5.04	0.62	7.01
Rake	Tractor - 62 HP Rake	13.16	0.08	1.30	1.54	0.41	3.25
Bale- small bales	Tractor - 62 HP Baler - small bales	6.54	0.15	2.62	4.73	2.70	10.05
Bale - Large bales	Tractor - 145 HP Baler - Large bales	9.80	.10	1.75	4.46	1.84	8.04
Roadside small bales	Balewagon	5.10	0.20	3.36	10.18	5.96	19.50
Roadside large bales	Balewagon Large bale pickup	7.65	0.13	2.24	7.18	4.61	14.02
Total - small bale	Swath - cutterbar		0.59	10.15	22.78	10.41	43.35
Total - small bale	Swath - rotary		0.50	8.63	21.49	9.69	39.81
Total - large bale	Swath - cutterbar		0.48	8.16	19.52	8.19	35.87
Total - large bale	Swath - rotary		0.39	6.64	18.23	7.47	32.34