ALFALFA HAY HARVESTING COSTS

Karen Klonsky, Steve Blank, and Kate Fuller[1]

Harvesting services and their costs are an important concern to hay producers. In California, those costs are presently expressed in two different ways: costs per acre harvested and costs per ton harvested. Both alfalfa growers (for whom this is a business cost) and custom hay harvesters (for whom this represents the price of their services) have expressed some dissatisfaction with each of these methods of setting costs/prices. Neither method seems to fit all situations. For example, custom harvesters want to charge on a per-ton basis when yields are high, while growers want to pay on a per-acre basis. The reverse is true when yields are low. Thus, either the grower or the custom harvester may be dissatisfied. Therefore, there is a need for a fair and simple method of deriving costs/prices for alfalfa hay harvesting services. This paper offers such a method that is based on the actual costs of those services in any situation. The paper also reports data collected from a survey of custom harvesters in California that supports the logic behind the proposed pricing method.

Another feature of the California hay market that is affecting the pricing of harvesting services is the on-going transition from small bales to large bales. The shift from the traditional bales of 125 pounds or less to large bales of 1,300 pounds or more is changing both the equipment needed to harvest the hay, and the hay market itself. Survey data on the "small-versus-large" bale question is included here.

Finally, there is not just a single market for alfalfa hay harvesting services in California; there are regional markets with different production practices which result in different harvest pricing practices and levels. In this paper, two regions are discussed: the Inter-Mountain region of northern California and the San Joaquin Valley region. Survey data from these two regions are included.

THE SURVEY AND ITS RESPONDENTS

A telephone interview study was conducted during the autumn of 2007. A small sample of custom harvesters were contacted and asked a series of questions about their operations. Included here is a summary of the responses from the 15 harvesters, five from the Inter-Mountain (IM) region and ten from the San Joaquin Valley (SJV) region.

Responses to descriptive questions provide a snapshot of the alfalfa hay harvesting industry. Sixty percent of respondents harvest their own hay and do custom harvesting, 13% harvest their own hay only, and 27% do only custom work. In total, 93% of respondents do small baling and about 73% of respondents do large baling. Their large bales average 1,315 lbs. All respondents that did large baling also did small baling. Finally, 13% did silage/chop harvesting. The total acres serviced by respondents in a year are 27,290, with a range of 190 to 5,000 for individual harvesters. Those harvesters doing custom work have between one and 17

[1] Karen Klonsky and Steve Blank, Extension Economists; Kate Fuller, Graduate Research Assistant, Agricultural and Resource Economics Department, University of California, Davis. Email: klonsky@primal.ucdavis.edu, sblank@primal.ucdavis.edu. The authors acknowledge the assistance of Dan Putnam and Steve Orloff in developing this study and the survey questionnaire. **In:** Proceedings, 37th California Alfalfa & Forage Symposium, Monterey, CA, 17-19 December, 2007. UC Cooperative Extension, Agronomy Research and Information Center, Plant Sciences Department, One Shields Ave., University of California, Davis 95616. (See http://alfalfa.ucdavis.edu for this and other proceedings).

customers in a year, with an average of about seven.

REGIONAL PRODUCTION DIFFERENCES

The geographic and microclimate differences between regions create some obvious differences in cultural practices that lead to some significant differences in output. As shown in Table 1, there are far fewer cuttings per year in the Inter-Mountain region, compared to the San Joaquin Valley, leading to higher average yields per cutting in the mountains. This is significant because yield is an important factor in determining custom harvesting costs, as explained in the next section.

Another difference between regions is in the size of harvesting jobs. Table 2 shows the range of responses from harvesters in each region to questions about the average, smallest, and largest job they have this year. Jobs in the SJV tend to be bigger, on average.

CUSTOM HARVEST RATES AND THE EFFECTS OF YIELD AND JOB SIZE

There are both fixed and variable costs associated with harvesting hay. The fixed costs come from owning the equipment. These costs include the payments on any loan taken out to purchase the equipment, insurance on the equipment, and depreciation. These are referred to as "fixed" costs because their amounts per year are generally fixed no matter how much the equipment is used. Variable costs are directly related to the operation of the equipment and vary in total amount by how much the equipment is used. These costs include fuel, operator labor, and repairs.

The first factor influencing alfalfa hay harvest costs, as expressed on a per-acre basis, is the fixed cost. However, this factor is most useful in explaining differences in costs between one harvester and another; this factor does not normally influence costs specific to one job versus another. Two custom harvest firms will most often have different fixed cost totals, so they will have different average fixed costs per acre harvested, even if they harvest the same number of acres per year. Plus, serving different numbers of acres per year will cause average fixed costs per acre to differ between firms. Therefore, two or more harvesters are most often expected to have different rate structures for a similar harvest job due to differences in fixed costs.

Variable costs per acre are often similar between two or more harvest firms. Fuel costs, labor rates, and other variable costs tend to be similar within a geographic region. That means that two or more firms bidding on the same job will have very similar variable costs on a per-acre basis.

Another important question is what creates differences in harvest costs between one job and another? The two most important factors are yield levels and the size of the job (expressed in total acres).

Yield emerged in the survey data as the single most important job-specific influence on alfalfa hay harvest costs on a per-acre basis. The survey results show that more time is needed per acre as yield increases. In both the Inter-Mountain region (Table 3) and the San Joaquin Valley (Table 4), for both small and large bales, more time is needed to perform harvest operations as average yields increase. Basically, higher yields take more time per acre to complete because the equipment has to slow down to maintain performance levels as it goes through more dense alfalfa. More time needed to complete each acre means more variable costs incurred per acre, thus justifying a higher price for the harvesting service.

One other point about time required per acre: note that baling and hauling/roadsiding are both faster for large bales, compared to small bales, for both regions. The data in tables 3 and 4 show that for all yield levels, those functions favor large bales.

The average size of harvest jobs, expressed as total acres, differs between regions (shown in Table 2) and has some affect on harvest costs. Harvesters tend to charge more per unit of output for small harvest jobs than they do for average or large jobs (tables 5 and 6). This is true for expressing prices of all harvest operations as a single charge per ton, as is common in the IM, and for pricing of individual harvest operations separately, as indicated in the SJV data. (For example, in the SJV swathing and raking are typically charged per acre and baling and hauling are typically priced per bale.) This appears to show that harvesters may be pricing each job separately. It also appears to indicate that some harvesters may be pricing jobs based on fixed costs per *job*, rather than on fixed costs per total acres served annually, as would be expected. This indicates that there are job-specific factors affecting harvest costs, such as the shape and condition of the field and distances the equipment must be moved.

Another surprising result in the survey data is that the custom rates being charged tend to go *down* as yields increase for an average job size, but not consistently across the range of yields. Specifically, rates decreased between low and average yields, but did not change between average and high yields (tables 7 and 8). This raises the final question to be addressed here: how are custom harvesters setting their rates?

RATE SETTING

In the survey, harvesters were asked about their rate setting methods. Two common methods of setting rates are to focus on either variable costs or on fixed costs and to set a minimum rate according to those cost levels. Focusing on variable costs leads to setting a minimum rate per acre. Focusing on fixed costs leads to setting a minimum rate per job. Both methods are used by some harvesters.

Many harvesters have a minimum charge per acre. In the IM region 60% have a minimum and for those harvesters it averages $42.80 per acre. Only 40% of SJV harvesters have a minimum, averaging $21.70 per acre. Clearly, the two regions are separate markets.

Fewer harvesters use a minimum charge per job. In the IM region 40% charge a minimum that averages $500 per job. Just 10% of harvesters in the SJV charge a minimum that averages $200 per job. Again the differences in rates between regions reflect the different market conditions: harvesters in the SJV have more jobs per year, on average, and those jobs tend to be larger in size, thus fixed costs (and possibly variable costs) can be spread wider, resulting in lower minimum rates than those that harvesters in the IM can charge.

Other survey questions asked harvesters to explain how they believe custom rates should be set. The results were clear: 67% of respondents thought that custom charges should be calculated by a combination of factors, 13% thought that custom charges should be calculated based on yield only, and 7% thought that custom charges should be calculated based on acreage only. The reasons for responses favoring only one factor were “can’t think of a better way to do it,” and “otherwise it is too complicated.” Many reasons were given for basing rates on a combination of factors. Some of the most common were:

- There is no possible one-size fits all method.

- A large, high-yielding field can have a lot of problems that will drive costs up for the harvester.
- What is important is tonnage/hour. Many factors go into this.
- It must make economic sense to run a machine. This is not determined by any one factor.

The survey responses about rate setting indicate that a simple method is needed that bases charges on a combination of factors. One suggestion is offered here in an effort to start the debate within the industry.

As a minimum a pricing system should lead to a total charge that covers all the costs incurred by a custom harvester, both fixed and variable. Otherwise, the harvester will not have sufficient cash to replace worn out equipment and will eventually go out of business. This does not mean that different harvesters will offer the same price to a particular grower; differences in fixed costs between custom harvesters will always exist, leading to differences in rates.

A simple pricing method begins with a rate per acre based on the fixed and variable costs that would be incurred to move the equipment over an empty field that is flat and in good condition. In other words, what would it cost to "harvest" a field with zero yield? That cost is the base for pricing a job. The actual rate charged is the base rate plus an adjustment for the actual yield. That means the base rate is increased by the increases in variable costs that are due to higher yields. Therefore, quoting rates on a per-acre basis that includes a yield adjustment would standardize and improve on the pricing methods currently observed in California.

Table 1. Differences in Cuttings and Yield between Regions

	Inter-Mountain	*SJ Valley*
Average number of cuttings per field per year	2.8	7.1
Range in number of cuttings per field per year	2 – 3	6 – 10
	(*tons/acre*)	
Average yield per acre for the **first cutting**	2.3	1.25
Low end of yields per acre for the **first cutting**	1.5	0.8
High end of yields per acre for the **first cutting**	2.8	1.7
Average yield per acre for the **last cutting**	1.3	0.9
Low end of yields per acre for the **last cutting**	0.9	0.6
High end of yields per acre for the **last cutting**	1.7	1.3

Note: the data reported in this table for low end and high end are averages of all responses.

Table 2. Differences in Size of Jobs between Regions (in Acres)

	Inter-Mountain	*SJ Valley*
Average job size: range of responses	30 - 300	50 - 1,500
Smallest job size: range of responses	10 - 40	7.5 - 1,500
Largest job size: range of responses	80 - 1,000	180 - 2,000

Table 3. Acres covered per hour, by operation, across yields: Inter-Mountain Region

Small bales:

Operations(s)	*Yield: 1 ton/acre*	*2 ton/acre*	*3 ton/acre*
Swath (n=5)	Range: 7-18 Average: 12	Range: 6-16 Average: 10	Range: 4-14 Average:8.3
Rake (n=5)	Range: 4.5-15 Average: 9.9	Range: 10-15 Average:11.4	Range: 4.5-15 Average:9.4
Bale (n=5)	Range: 4-11 Average:6.9	Range: 3.5-7.5 Average: 5	Range: 2-5 Average: 3.4
Haul off the field (to nearest point (n=5) (80% most often roadside the hay, 20% most often barns the hay)	Range: 3.5-17.5 Average:11.2	Range: 1.5-10.5 Average:7	Range: 1.5-7 Average: 4.8

Large bales:

Swath (n=5)	Range: 7-18, Average: 12	Range: 6-16 Average: 10	Range: 4-14 Average:8.3
Rake(n=5)	Range: 4.5-15 Average: 9.9	Range: 10-15 Average:11.4	Range: 4.5 15 Average:9.4
Bale (n=3)	Range: 10-17 Average:13	Range: 9.5-15 Average:12.2	Range: 7-10 Average:8.7
Haul off the field (to nearest point, (n=3) (100% roadside the hay)	Range: 10-20 Average:15	Range: 8-17 Average:12.5	Range: 6-10 Average: 8

Note: “n” refers to the number of respondents.

Table 4. Acres covered per hour, by operation, across yields: San Joaquin Valley Region

Small bales:

Operations(s)	*Yield: 0.75 ton/acre*	*1.25 ton/acre*	*2 ton/acre*
Swath (n=10)	Range: 5-25 Average:10	Range:5-25 Average:9.4	Range: 5-25 Average:7.3
Rake(n=10)	Range: 12-35 Average: 19	Range: 12-35 Average:18.8	Range: 12-35 Average:18.6
Bale(n=9)	Range: 6-20 Average: 11.75	Range: 5-15 Average:9.4	Range: 4-10 Average: 7.3
Haul off the field (to nearest point, (n=5) (80% roadside the hay, 20% most often barns the hay)	Range: 10-31 Average: 19.5	Range: 10-25 Average:14.6	Range: 7.5-18 Average:11.3

Large bales:

Swath (n=10)	Range: 5-25 Average:10	Range:5-25 Average:9.4	Range: 5-25 Average:7.3
Rake(n=10)	Range: 12-35 Average: 19	Range: 12-35 Average:18.8	Range: 12-35 Average:18.6
Bale (n=8)	Range: 10-50 Average: 22.5	Range: 9-40 Average: 19.25	Range: 8-30 Average: 16.25
Haul off the field (to nearest point, (n=4) (100% most often roadside their hay)	Range: 13-50 Average: 28	Range:11.5-40 Average: 23.6	Range: 7.2-30 Average: 20

Note: “n” refers to the number of respondents.

Table 5. Custom rates ($/ton), by operation, across job sizes with fixed yield of 2 t/ac: Inter-Mountain Region

Small bales:

Operations(s)	*Smallest job*	*Average job*	*Largest job*
Total hay harvest (roadside) (n=5)	Range: 38-50 Average: 44	Range: 36-45 Average: 40.2	Range: 36-45 Average: 40.2
Total hay harvest (in shed) (n=5)	Range: 41.3-52 Average:46.5	Range: 38-47 Average: 42.7	Range: 38-47 Average: 42.7

Large bales:

Total hay harvest (roadside) (n=3)	Range: 35-45 Average:39.3	Range: 32-40 Average: 36.7	Range: 31-40 Average:36.3
Total hay harvest (in shed) (n=3)	Range: 37-48 Average:41.7	Range: 34-43 Average: 39.1	Range: 33-43 Average:38.7

Table 6. Custom rates ($/acre or $/ton or $/bale), by operation, across job sizes with fixed yield of 1.25 t/ac: San Joaquin Valley

Small bales:

Operations(s)	*Smallest job*	*Average job*	*Largest job*
Swath (n=5)	Range: 10.5-17/ac Average: 13/ac	Range: 10.5-17/ac Average: 12.7/ac	Range: 10.5-17/ac Average:12.7/ac
Rake (n=5)	Range:4.5-6/ac Average:5.2/ac	Range: 3.5-6/ac Average: 5/ac	Range: 3.5-6/ac Average: 5/ac
Rake and Swath (n=6)	Range: 14-22/ac Average:17.2/ac	Range: 14-22/ac Average: 16.8/ac	Range: 14-22/ac Average: 16.8/ac
Bale (n=5)	Range: 0.75-1.1/bale Average:0.95/bale	Range: 0.75-1/bale Average:0.92/bale	Range: 0.75-1/bale Average:0.92/bale
Swath, rake, and large bale (n=2)	Range: 27-29/ton Average: 28/ton	Range: 27-29/ton Average: 28/ton	Range: 27-29/ton Average: 28/ton
Haul off the field (n=2)	Range: 0.36-0.4/bale Average:0.38/bale	Range: 0.36-0.4/bale Average:0.38/bale	Range: 0.36-0.4/bale Average:0.38/bale
Total hay harvest (roadside) (n=1)	30/ton	30/ton	30/ton

Large bales:

Swath (n=5)	Range: 10.5-17/ac Average: 13/ac	Range: 10.5-17/ac Average: 12.7/ac	Range: 10.5-17/ac Average:12.7/ac
Rake (n=5)	Range:4.5-6/ac Average:5.2/ac	Range: 3.5-6/ac Average: 5/ac	Range: 3.5-6/ac Average: 5/ac
Rake and Swath (n=6)	Range: 14-22/ac Average:17.2/ac	Range: 14-22/ac Average: 16.8/ac	Range: 14-22/ac Average: 16.8/ac
Bale	Range:6.5-11/bale Average:8.75/bale (n=4)	Range:6.5-11/bale Average: 9.1/bale (n=5)	Range:6.5-11/bale Average: 9.1/bale (n=5)
Swath, rake, and large bale (n=2)	Range: 27-29/ton Average: 28/ton	Range: 27-29/ton Average: 28/ton	Range: 27-29/ton Average: 28/ton
Haul off the field	3/bale (n=1)	Range: 3-3.95/bale Average: 3.5/bale (n=2)	Range: 3-3.95/bale Average: 3.5/bale (n=2)
Total hay harvest (roadside) (n=1)	30/ton	30/ton	30/ton

Table 7. Custom rates ($/ton), by operation, across yields with fixed job size: Inter-Mountain Region

Small bales:

Operations(s)	*Yield: 1 ton/acre Average acreage*	*2 ton/acre Average acreage*	*3 ton/acre Average acreage*
Total hay harvest (roadside) (n=5)	Range: 36-50 Average:41.2	Range: 36-45 Average: 40.2	Range: 36-43 Average:39.8
Total hay harvest (in shed) (n=5)	Range: 38-52 Average:43.7	Range: 38-47 Average: 42.7	Range: 42.3 Average:42.3

Large bales:

Total hay harvest (roadside) (n=2)	Range: 38-40 Average:38.7	Range: 32-40 Average: 36.7	Range: 35-40 Average:37.7
Total hay harvest (in shed) (n=2)	Range: 40-43 Average:41.6	Range: 40-43 Average: 41.6	Range: 40-43 Average:41.6

Table 8. Custom rates ($/acre or $/ton or $/bale), by operation, across yields with fixed job size: San Joaquin Valley

Small bales:

Operations(s)	*Yield: 0.75 ton/acre Average acreage*	*1.25 ton/acre Average acreage*	*2 ton/acre Average acreage*
Swath (n=5)	Range: 10.5-17/ac Average: 13/ac	Range: 10.5-17/ac Average: 12.7/ac	Range: 10.5-17/ac Average:12.7/ac
Rake (n=5)	Range:4.5-6/ac Average:5.2/ac	Range: 3.5-6/ac Average: 5/ac	Range: 3.5-6/ac Average: 5/ac
Swath and Rake (n=6)	Range: 14-22/ac Average:17.2/ac	Range: 14-22/ac Average: 16.8/ac	Range: 14-22/ac Average: 16.8/ac
Bale (n=5)	Range: 0.75-1.1/bale Average:0.95/bale	Range: 0.75-1/bale Average:0.92/bale	Range: 0.75-1/bale Average:0.92/bale
Swath, rake, and small bale (n=2)	Range: 27-29/ton Average: 28/ton	Range: 27-29/ton Average: 28/ton	Range: 27-29/ton Average: 28/ton
Haul off the field (n=2)	Range: 0.36-0.4/bale Average:0.38/bale	Range: 0.36-0.4/bale Average:0.38/bale	Range: 0.36-0.4/bale Average:0.38/bale
Total hay harvest (roadside) (n=1)	30/ton	30/ton	30/ton

Large bales:

Swath (n=5)	Range: 10.5-17/ac Average: 13/ac	Range: 10.5-17/ac Average: 12.7/ac	Range: 10.5-17/ac Average:12.7/ac
Rake (n=5)	Range:4.5-6/ac Average:5.2/ac	Range: 3.5-6/ac Average: 5/ac	Range: 3.5-6/ac Average: 5/ac
Rake and Swath (n=6)	Range: 14-22/ac Average:17.2/ac	Range: 14-22/ac Average: 16.8/ac	Range: 14-22/ac Average:16.8/ac
Bale	Range:7.5-11/bale Average:9.5/bale (n=3)	Range:7.5-11/bale Average: 9.1/bale (n=4)	Range:6.5-11/bale Average: 9.1/bale (n=4)
Swath, rake, and large bale (n=2)	Range: 27-29/ton Average: 28/ton	Range: 27-29/ton Average: 28/ton	Range: 27-29/ton Average: 28/ton
Haul off the field	3/bale (n=1)	Range: 3-3.95/bale Average: 3.5 (n=2)	Range:3-3.95/bale Average: 3.5/bale (n=2)
Total hay harvest (roadside) (n=1)	30/ton	30/ton	30/ton