FARMER SATISFACTION WITH HAY AND FORAGE EQUIPMENT IN ALLAMAKEE AND MAHASKA COUNTIES IN IOWA

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ABSTRACT. *There are many opportunities for improvement in equipment used in the hay and forage industry. University and industry groups have listed and prioritized these opportunities. A project was undertaken to evaluate the level of satisfaction farmers in Allamakee and Mahaska counties in Iowa have with their hay and forage equipment, and to have them identify any needed changes in that equipment. The information was obtained through mailed surveys and follow-up phone interviews. The surveys included two evaluation matrices, which farmers used to rank their equipment on a satisfaction scale with respect to several criteria.*

Results show that (1) Farmers are generally satisfied with their hay and forage equipment. (2) Differences of opinions among respondents from the two counties or two herd-types were correlated with differences in opinions of the systems used. (3) Farmers see a need for an on-the-farm forage quality tester. (4) Farmers are dissatisfied with large round bale storage. **Keywords.** *Equipment, Forage, Forage harvesters, Hay.*

Hay and forage are very important crops for Iowa farmers. In 1989, 960 000 ha (2.4 million acres) of hay were harvested, down from the record high of 1.3 million ha (3.2 million acres) in 1988. This hay was worth an estimated 549 million and 507 million dollars in 1989 and 1988, respectively. In fact, for more than 20 years hay and forage have ranked third behind corn and soybeans in the state for area of crop harvested (Iowa Farm Bureau, 1990). When one considers that most of this crop goes into the production of Iowa beef and dairy products, the importance of producing quality forage becomes even more evident. Producing high-quality forage requires proper seeding, fertilizing, and harvesting of the crop. Of these three components, harvesting is the most critical.

The greatest challenges to successful forage harvesting are: (1) weather problems, (2) the amount of labor involved, and (3) the quality of the finished product. In the 1840s when forage harvesting tools consisted of only scythes, forks, and horse drawn wagons, Iowa farmers faced these three challenges (Balas and Baylor, 1987), and today's farmers are still looking for ways to overcome them. Throughout this 150-year period, technological advances have worked to decrease the dependence of forage on weather, to reduce the labor involved in forage production, and to increase the quality of the finished product.

Article was reviewed and approved for publication by the Power and Machinery Div. of ASAE.

Journal Paper J-153769 of the Iowa Agriculture and Home Economics Experimental Station, Ames, Project 2737. Research supported by the National Science Foundation and the Iowa Agriculture and Home Economics Experimental Station.

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Mowers and rakes (1920s), silage and silos (1930s), hand-tie and self-tie balers (1930s and 1940s), large round balers (1970s), and silage baling (1980s) have all worked to improve hay and forage harvesting (Miller 1984). However, challenges still exist and improvements in hay and forage harvesting are still needed.

There are many opportunities for improvement in hay and forage harvesting and handling. In fact, there are so many different opportunities in research and equipment development and manufacturing that there is a need for listing and prioritizing them. An Iowa State University committee created such a list (Wedin, 1989). In 1990, a committee from the Equipment Manufacturers Institute (EMI) also listed and ranked research recommendations for the hay and forage industry (Equipment Manufacturers Institute, 1990). The Iowa State University report listed 23 opportunities, and the EMI report listed 31.

Within these two reports can be seen manufacturers' and researchers' opinions on where improvements are needed. However, neither report directly evaluates the opinions of hay and forage producers. Gathering farmers' opinions of needed changes would provide a third view of the opportunities for improvements in hay and forage equipment and practices.

OBJECTIVES

The research reported in this article had two main objectives.

- Evaluate producers' current satisfaction with their hay and forage equipment and practices.
- Identify changes or improvements that producers believe are needed.

DEFINITIONS

The phrase "hay and forage" is often used. The word forage is defined as any plant or plant part consumed by livestock, including hay, silage, pasture grasses, and many

other plant types (Heath et al., 1985). This article is concerned with hay and silage harvesting equipment and, therefore, the word forage will also include hay and silage. The term "hay" is defined as forage harvested during the growing period and preserved by drying for later use as feed (Balas and Baylor, 1984). This definition of hay will be used throughout the article. This article will also use the term "silage", which is defined as green forage converted to feed by partial anaerobic fermentation (Miller, 1984).

METHODOLOGY

DATA COLLECTION

A short, mailed survey was chosen as the most effective way to collect information from the farmers.

The Sample. The first step in collecting information was to determine the size and location of the sample to be surveyed. In Iowa, hay and forage practices vary from county to county because of differences in weather, land, and product end use. A statewide survey evaluating hay and forage practices in every county would be ideal; however, this was beyond the scope of the project, and a two-county survey was decided upon. Two counties with distinct differences in cropping and livestock practices were chosen.

The two counties surveyed were Allamakee, and Mahaska (fig. 1). They were chosen for their contrasting locations and herd types. Allamakee County farmers raise mostly dairy cattle, while the farmers in Mahaska County raise mostly beef cattle. Evidence of these different herd types is reflected in the number of acres of hay and forage produced in each county. In 1989, Allamakee County farmers harvested 26 000 ha (65,000 acres) of forage, while Mahaska County farmers harvested 8900 ha (22,300 acres) (Iowa Dept. of Agriculture, 1990). The smaller area of forage in Mahaska County may be because most of their beef cattle are grazers and therefore, hay is not produced to feed them.

Names and Addresses. Once the counties were chosen, a method was needed to identify farmers who produced hay and forage in these counties. In Mahaska County, the Iowa Cattlemen's Association provided names and addresses of their members. This list contained 75 names of farmers who produced cattle. The assumption was then made that all farmers who produced cattle also produced hay and forage. Allamakee County producers did not have a large membership in the Iowa Cattlemen's Association because most dairy farmers do not belong to this organization. Therefore, a list of names and addresses of farmers who raised all types of cattle was obtained through the Allamakee County Extension office. From this list of about 400 names, 75 were randomly selected as survey candidates.

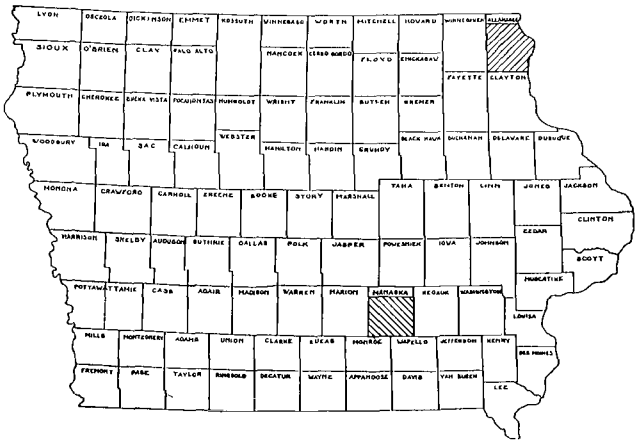

Figure 1–Location of the counties which were surveyed.

The Survey. With the sample selected, a two-page survey was written to obtain the desired information. The main goal of the survey was to evaluate farmers' opinions about their hay and forage practices. Two evaluation matrices were used. In the first of the matrices, farmers were asked to identify the system used and rate that system on seven criteria (cost, convenience, reliability, time between cutting and harvesting, quality of forage, labor requirement, time of operation) and overall effectiveness.

The next section of the survey asked for the percentage of forage fed as silage, fed as hay, sold, or used in some other way. The second evaluation matrix evaluated the farmers' forage feeding practices. Again the producers were asked to list the system they used most and to rate that system from 1 to 10 on five criteria: cost, convenience, labor requirement, nutritional value, and amount of waste.

The final section of the survey was devoted to general questions. Three of these questions asked about storage of hay and forage, and two pertained to the production of hay for commercial sale. One asked the respondents to rank five factors that discouraged their production of hay for sale. The two final questions asked farmers to suggest any changes in equipment or practices they would recommend and to write any additional comments.

Surveys were mailed to the 75 farmers in each county, along with a letter of explanation. This letter explained the purpose of the survey and urged farmers to fill it out and return it as soon as possible. Two weeks later, a postcard reminder was sent to those who had not yet returned their surveys.

The Interview. While working on the survey, the researchers decided that there was a need for direct interaction with the participants. Follow-up phone interviews were used to gain more information from some of the farmers who returned surveys. The farmers who provided interesting or useful comments were chosen because they seemed most likely to provide useful information during the interviews. Nineteen producers were selected and interviewed by telephone. Each was asked the same questions from a standard two-page questionnaire during a 15- to 20-min conversation. Farmers were asked about their harvesting and feeding systems. They were then asked to list any advantages or disadvantages of each system and whether they considered it the best system available.

The farmers were then asked if they thought there would be an increasing commercial market for hay in the next five years. A question asked exclusively of those who sold hay inquired about how hay was delivered after the sale, how far it was shipped, and at what cost per bale. Another question asked what they considered the biggest problem with their current hay package. The final section of the interview asked the farmers for their opinion on six listed changes for the hay and forage industry. The farmers were

asked to answer simply "yes" or "no" depending on whether they thought the listed change was needed. A general comments section was also included.

Data Analysis

Data were analyzed by a computer spreadsheet that averaged rankings from the two evaluation matrices and calculated averages for all respondents together and for specialized categories of respondents, such as those who harvested with large round balers, those who raised mostly stock cows, those who lived in Mahaska County, as well as some other groupings. Comments from the general comments sections and the interviews were reviewed, and some responses are included in this report.

Results

The surveys and interviews evaluated farmers' opinions of their hay and forage practices. Information collected is presented in tables 1 through 7. The highlights of these tables will be discussed to explain how conclusions of the research were drawn.

Survey Return Information

Table 1 contains information about the mailed and returned surveys. The respondents completed and returned 71 of 150 surveys (47%) in usable form.

Table 2 breaks down the survey return information by county, harvesting system, and herd type. Note that more than two-thirds of the returned surveys were completed by farmers who raised mostly beef cattle.

The percentages of hay and forage uses for all categories of respondents can be found in table 3. Note that 35% of hay and forage harvested was fed as silage, 58% was fed as hay and only 7% was sold. Table 3 also shows that those who most often used the small square bale system sold the largest percentage of hay (18%). Mahaska County farmers sold 11% of all hay harvested, whereas Allamakee County farmers sold only 1% of their hay (fig. 2). From table 3 one can conclude that most farmers raise hay and forage for their own use; only six respondents sold more than 50% of their forage production.

Satisfaction with the Harvesting Systems

Table 4 summarizes farmers' satisfaction with their harvesting systems. From this table it seems that farmers are generally satisfied with their harvesting equipment (all overall satisfaction ratings were 7.2/10 or higher). The criterion that producers were the least satisfied with was the down time between cutting and harvesting.

Note that large round bale users were very satisfied with the criteria of labor, convenience, and time, giving them ratings of 9.1, 8.9, and 8.8, respectively. On the other hand, they were less satisfied with the quality of the large round bale package (6.9). In fact, the large round bale system of harvesting received the lowest quality rating of any category, indicating a definite problem with quality.

Those who use the small square baling system have somewhat opposite views. They gave labor a rating of 4.7, convenience a rating of 6.4, and time required a rating of 5.6. These ratings are the lowest, in their respective criterion, of any of the categories. Those who used small square bales were more satisfied with the quality of the hay package. They rated the quality criterion at 7.4.

Respondents using the silage system gave the highest rating for the quality criterion (9.2). They also gave a high rating for convenience (8.9). The farmers using a silage system were the least satisfied with cost, giving it their lowest rating at 7.1. This cost rating is the lowest of any system.

Comparisons between the two counties show some general differences. Allamakee County respondents gave higher satisfaction ratings for five of the eight criteria. Mahaska County respondents were more satisfied with the criteria of convenience, labor, and time. Interestingly, these are the same three criteria for which the small square bale users gave the lowest ratings. An explanation for this correlation may be that more than 50% of the small square bale users were from Allamakee County.

The most striking feature found by comparing the two herd types is that beef cattle producers gave higher ratings for every category. In three criteria, stock cattle producer ratings were greater than one unit more than those of dairy producers. These three criteria were convenience, labor, and time. There seems to be a correlation between the dairy producers' ratings and those of small square bale users. Again this correlation may be due to the large number of dairy farmers who use small square balers and the large number of beef cattle producers who use the other two systems.

Table 1. Survey return information

Surveys mailed	150	100%
Surveys returned	81	54%
Unanswered	10	7%
Usable	71	47%

Table 2. Numbers of respondents by location, harvesting system, and predominant livestock

Category	Allamakee Co.	Mahaska Co.	Total
All respondents	26	45	71
Large round bale system	7	21	28
Small square bale system	13	6	19
Silage system	5	19	24
Dairy cattle*	16	5	21
Beef cattle*	9	36	45

* Not all respondents specified herd type.

Table 3. Hay and forage uses by harvesting system, county, and herd type

Category	Number	% Fed as Silage	% Fed as Hay	% Sold
All respondents	71	35	58	7
Large round bales	28	15	79	6
Small square bales	19	4	79	18
Silage	24	82	17	1
Allamakee Co.	26	21	78	1
Mahaska Co.	45	44	45	11
Dairy cattle	21	31	69	0
Beef cattle	44	40	53	8

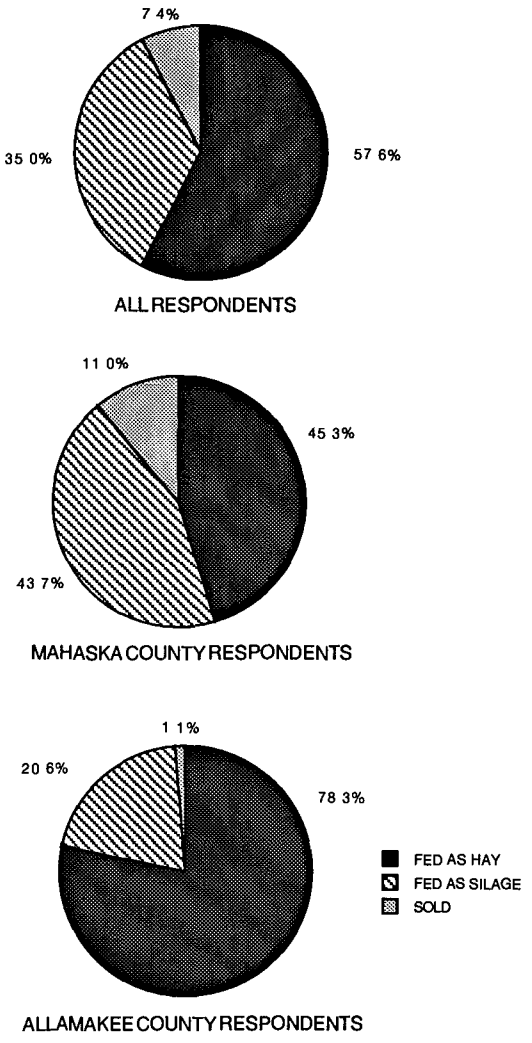

Figure 2–Hay and forage uses by county.

One can also look at table 4 for trends among the different criteria. For the reliability criterion, there are high values throughout the table, suggesting that the respondents are satisfied with their equipment's reliability. The criterion of time between cutting and harvesting received low ratings fairly consistently, suggesting that many farmers are dissatisfied with the time requirement.

Satisfaction with Feeding Systems

A summary of feeding system views is presented in table 5. Overall, it seems that farmers are generally satisfied with their feeding systems. The range of ratings varies from 8.7 for convenience to 7.9 for cost. However, when one looks at the responses in each of eight categories some interesting features appear.

Table 4. Evaluation of harvesting systems

Category	Cost	Convenience	Reliability	Down Time	Quality	Labor	Time	Overall
All	8 00	8.37	8.56	7.63	7.89	7 78	7.82	8 11
Large round	8.30	8.93	8 04	7.19	6.89	9.11	8.81	7.65
Small square	7.58	6.37	7.95	6 78	7.42	4.68	5.58	7.22
Silage	7.14	8 91	8.73	8.18	9.22	8.48	8.17	8 96
Allamakee	8 52	8 35	9.05	7 78	8.17	7.35	7.78	8 36
Mahaska	7.61	8.64	8.24	7.50	7 98	8 36	8.07	8.17
Dairy	7.59	7.36	8.19	7.09	7 36	6 45	6.77	7 57
Stock	7 76	8.76	8 38	7.56	8.05	8 38	8.29	8.21

Note: 1 = Very dissatisfied. 10 = Completely satisfied.

Table 5. Evaluation of feeding systems

Category	No. of Responses	Cost	Convenience	Labor	Nutrition	Waste
All	60	7.88	8.67	8.23	8.22	8.07
Silage	24	6.63	9.00	8.58	9.21	9.33
Bale-ring	19	9.16	9.37	9.63	7.37	6.47
Small square	14	9.14	8.00	6.21	8.71	8.64
Grind Bale	2	6.00	7.50	8.50	8.00	9.00
Allamakee	20	9.10	8.65	7.50	8.30	8.35
Mahaska	40	7.38	8.80	8.80	8.50	8.30
Dairy cattle	20	7.95	7.90	7.00	7.55	7.60
Beef cattle	40	7.65	8.78	8.63	8.40	8.20

Note: 1 = Very dissatisfied. 10 = Completely satisfied.

The first category includes the farmers who use a silage system. All these systems consist of silos and bunks that convey silage to cattle in feedlots. Those who used a silage system gave a low rating for cost at 6.6, but all other criteria were ranked relatively high, ranging from 8.6 to 9.3. They gave the highest ratings of any category for nutritional value at 9.2 and waste at 9.3.

The next category includes all the farmers who used a bale-ring feeding system. A bale-ring is a small circular fence that is placed around a large round bale allowing the cattle to feed from the bale without trampling the hay into the ground. The bale-ring category has three criteria with high ratings: cost at 9.2, convenience at 9.4, and labor at 9.6. These ratings indicate a high degree of satisfaction. On the other hand, those who used bale rings gave low ratings for waste at 6.5 and nutritional value at 7.4, which shows some dissatisfaction with these criteria.

Fourteen respondents used some type of small square bale feeding system. These systems involve manually or mechanically placing the bale in a bunk or feedlot. The small square bale users gave a very high rating for cost at 9.1. They also gave the lowest rating of any category for labor at 6.2.

The next category contains respondents who use a bale grinder. This machine loads large round bales and grinds them into loose material that can be mechanically unloaded directly into a bunk. The ratings given by these respondents may not be completely representative of this system because only two of the farmers who were surveyed used this system. These respondents gave low ratings to cost at 6.0 and convenience at 7.5. However, the respondents were satisfied with the labor required and with the amount of waste, giving these two criteria ratings of 8.5 and 9.0, respectively.

The respondents of the two counties gave similar ratings for the criteria of convenience, nutritional value, and waste. There are, however, relatively large differences between the counties in the criteria of cost and labor. Allamakee County had a high rating for cost at 9.2 versus 7.3 for Mahaska. On the other hand, Mahaska County gave a higher rating for labor at 8.8 versus 7.5 for Allamakee County. The ratings given by the Allamakee County respondents again correlate well with those given by the small square bale users.

Table 6. Deterrent factors in the commercial production of hay

Category	Lack of Market	Shipping Cost	Shipping Convience	Lack of Quality	Not Profitable
All	2.2	3.0	2.7	2.9	3.5
Large round	2.2	3.2	3.1	2.9	3.4
Small square	2.3	3.1	2.6	3.2	4.2
Silage	2.3	3.4	2.8	3.1	3.4
Allamakee	2.1	2.8	2.7	3.2	3.3
Mahaska	2.4	3.4	3.2	3.1	3.6
Dairy cattle	1.9	2.7	2.2	2.5	3.2
Beef cattle	2.3	3.3	3.2	3.0	3.6
Sell most hay	2.6	2.6	2.2	2.3	3.8

Note: Respondents ranked the factors from 1 to 5 with 1 being the most discouraging factor.

Commercial Hay Production

Table 6 contains a summary of the responses to the survey question that asked the respondents to rank five factors that deterred commercial production of hay. From table 6 one can see several interesting trends. Of all the deterrents listed, the least detrimental to commercial hay production was unprofitability, that is, most respondents thought that producing hay for sale could be profitable. The deterrent that was most detrimental to the production of hay for sale was the lack of a market. These responses were given mostly by farmers who did not produce hay commercially.

Slightly different responses were given by those producers who currently sell more than 50% of the hay that they raise. The last category in table 6 contains responses of farmers who sell most of their hay. These respondents also listed unprofitability as the least detrimental factor to the production of hay for sale. The most detrimental factor to these farmers was poor shipping convenience, followed closely by lack of consistent quality. There were, however, only six respondents in this category; therefore, the opinions of the entire sample are best represented by the other categories.

The interview questions pertaining to commercial production of hay gave interesting results. When the farmers were asked if they felt there would be an expanding market for hay in the next five years, eight answered "yes", five "no", and six were unsure. Of the eight who said yes, only one indicated that he would try to tap this market. The answers to these questions indicate that their view of the future of commercialized hay production is uncertain.

Table 7. Results of the "yes" and "no" interview questions

Yes	No	Question: "Is there a need for a(n)...:
11	8	Portable hay and forage moisture tester."
18	1	On-the-farm hay and forage quality tester."
14	5	Chemical or mechanism to reduce drying time."
14	5	Chemical or mechanism to reduce leaf loss."
3	6	More efficient package for feeding and handling."
14	5	Foreign object detector for harvesting machines."

"Yes" and "No" Interview Questions

Table 7 summarizes interview respondents' answers to the "yes" and "no" questions pertaining to possible future changes in the hay and forage industry. Ninety-five percent of those interviewed felt that there was a need for a forage quality tester. Most of the farmers interviewed said that they could get their hay tested through their feed company, but this test usually takes five to seven days. Many farmers said that an on-the-farm quality test would help them create healthier feed rations and a more stable hay market.

General Comments

Many of the farmers who were surveyed and interviewed listed areas that they thought needed improvement. Some suggestions were very specific while others were more general. Many of the respondents suggested the same areas for improvement. For example, 11 of the farmers said that improvement in large round bale storage was needed. Five respondents stated that there was a need to reduce the entire time required to complete forage harvesting. Five of the farmers believed a bale grinder for feeding large round bales would be beneficial. Five also felt that there was a need for a way to reduce leaf loss. Three respondents listed a need for better seeding practices. Other suggestions included a one-pass harvesting system and a smaller large round baler.

Other respondents gave additional comments. Three farmers said that weather was the most important factor in putting up good quality hay. Four of the respondents said that if large round balers had less storage waste they would prefer this harvesting system. Others said that Iowa farmers should practice more crop rotation. Two of the respondents said fertilizers and herbicides should be used to take better care of the growing hay crop. Many of the respondents also mentioned that timing of harvesting operations was very crucial.

Conclusions

Several conclusions can be drawn from the results of this project.

- Most farmers are generally satisfied with their equipment. The satisfaction matrices gave relatively high ratings for each criterion, when averaged for all respondents.
- Differences between the respondents of the two counties and herd types were correlated with the different systems. The ratings given by the Allamakee County and dairy herd-type respondents matched well with the ratings given by the small square bale users. Similarly a correlation existed among the Mahaska County and beef herd respondents with the large round bale and silage systems.
- Farmers defined a need for an affordable on-the-farm hay and forage tester. This conclusion was drawn from the fact that 95% of the farmers felt they could benefit from a quality tester.
- Farmers are dissatisfied with large round bale storage. Farmers indicated this dissatisfaction through the satisfaction matrices and in their general comments.

The results of the project show there are needed improvements in the hay and forage industry. Researchers and manufacturers need to be aware of these needs. They especially need to be aware of the ones listed by the producers. Working to improve these areas can reduce the challenges involved in producing quality hay and forage.

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