Relationship Between Herd Management Practices in the Midwest on Milk and Fat Yield

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ABSTRACT

A dairy management survey was conducted in fall 1985 and spring 1986 in the nine-state area served by the Midstates Dairy Records Processing Center in Ames, IA. The questionnaire, consisting of 57 questions with 254 possible choices, was used to survey dairy producers on DHI testing in Arkansas, Illinois, Iowa, Kansas, Missouri, Nebraska, North Dakota, Oklahoma, and South Dakota. The questions covered housing pactices, milking equipment and practices, feeding regimens, calf rearing and feeding, feed additives, various management categories, and artificial insemination usage.

The survey responses were merged with the 1985 year end rolling herd production averages from the processing center. A completely fixed model was fit for all 254 potential responses. The greatest differences among solutions were found in the feeding categories with some of the major differences associated with type of grain and forage fed. Feed additives showed the next largest difference among categories with feed ingredients, such as distillers grain, whole cottonseed, and buffers being associated with higher herd averages. There was a positive association between the length of time a producer had been on DHI and herd averages. Herds using a total AI program had herd averages 506 kg higher than those using only a beef bull.

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INTRODUCTION

To evaluate better the management practices for dairy herds in the nine states that process DHI records at the Midstates Dairy Records Processing Center (DRPC) in Ames, IA, a comprehensive survey was conducted. The states in the survey were Arkansas, Illinois, Iowa, Kansas, Missouri, Nebraska, North Dakota, Oklahoma, and South Dakota. The DHI herds were selected because it was easier to have DHI supervisors collect the data, and production data were readily availble for these herds.

Several other investigators have conducted management surveys on Southern dairy farms (2) and Pennsylvania dairy herds (7). The Southern dairy herd survey by Carley et al. (2) dealt solely with factors affecting dairy farmer profitability, such as DHI usage, education, and concentrate feeding practices. The Pennsylvania study (7) dealt solely with a survey of calf and heifer management practices. Additional surveys by Hartman et al. (6), James et al. (9), and Goodger and Theodore (3, 4) dealt with calf mortality in New York and Virginia and with calf management practices and health management decisions on large California dairies, respectively. An extensive study has also been conducted by Shanks et al. (16) dealing primarily with breeding practices on Illinois Holstein farms. An extensive survey of Ohio dairy herds covering the use of DHI records, as well as relaionships between DHI and herd performance measures, was conducted by Schmidt and Smith (14) and Smith and Schmidt (18).

The survey conducted on Midwest dairy herds was an attempt to survey not only housing practices but also various feeding and management practices used by producers for both mature cows and replacement heifers. A comprehensive survey covering all areas of a dairy operation would be useful in planning extension and research thrusts in the Midwest.

The main objectives of the survey were 1) to quantify management practices associated with

Midwest dairying and to determine those practices that are associated with the highest herd yields for milk and fat, 2) to spot potential and actual problem areas that need intensive extension efforts, as well as a means of defining research goals in management areas, and 3) to use these results as a basis for directing research and extension efforts.

MATERIALS AND METHODS

A survey was developed that addressed seven major aspects of a dairy operation: 1) housing and facilities; 2) milking operation; 3) types of grains and forages fed and methods for dispensing and storing feed; 4) feeding of newborn calves; 5) additives and supplements to feed for heifers and cows; 6) management practices, such as grouping of heifers and milking animals, computer usage, veterinarian programs, estrous detection areas, mastitis control and DHI usage; 7) AI and methods of selecting sires. Questions asked, along with the options given producers for response, are shown in Tables 1 through 7. An attempt was made to list as many of the options as possible that would be considered by producers. The survey form contained 57 questions with 254 possible responses.

Survey forms were sent to the DHI supervisors in the nine-state area during the late winter 1985. The surveys were to be completed with the help of the supervisors during late 1985 and spring 1986. Instructions were sent to the supervisors indicating that for a given question the producer could check more than one option. If producers had no knowledge of the answer or the question, they were instructed to skip the question.

A total of 7600 surveys covering all DHI testing systems were sent to supervisors; 4221 surveys (54%) were returned. The percentage response by state ranged from 40 to 79%. Surveys were returned to state extension dairy specialists, and all analyses of data were conducted at the University of Nebraska-Lincoln.

The survey data were merged with the DHI production data from the Midstates DRPC in Ames, IA. The December 1985 rolling herd averages for milk and fat were used. Data were further edited so that only those Holstein herds with a total of 365 d on test in 1985 and on DHIR, DHI, or DHI alternate a.m./p.m. testing were included in the analyses. These restrictions reduced the total number of herds meeting all editing restrictions from 4221 to 2684.

The analysis consisted of fitting a completely fixed model (1):

$$Y_{ij} = \mu + \text{effect}_i + e_{ij}$$

where:

Y_{ij} is the corresponding herd average for milk and fat production at year end 1985, μ is the overall mean, effects_i consists of 254 options covered in the 57 questions, and e_{ij} is a random error with mean 0 and variance σ_e^2.

Solutions were found for all 254 effects (μ + effects_i) by solving the set of linear equations. A direct inverse to the matrix was found. Since producers did not respond to all questions, the equations where no response was listed were set to zero. The interpretation of the mean value can be taken as the herd average for all producers that failed to answer a given question. The mean value was 6025 kg milk and 230 kg fat. A test of significance using the inverse elements of the matrix was used to estimate *t* values for each effect in the model. The *t* values were calculated for both milk and fat for both the 90% and 95% confidence values. Given the number of effects in the model, *t* values should not be taken as implying cause and effect but are presented to indicate potential areas that could be considered for additional investigation.

RESULTS AND DISCUSSION

The results have been divided into seven tables covering the area addressed by the survey. The total number of observations for each category is also listed for each effect. The most significant part of the results are the relative differences among the solutions presented, not the absolute values.

Table 1 shows the solutions for the housing categories included in the survey. Tie stall housing was associated with the highest herd averages and no housing or wind break the lowest. Differences between the two groups were 370 kg milk and 9 kg fat. Very few differences were associated with heifer rearing practices (questions 2 through 4) and herd average production for milk or fat. This survey

TABLE 1. Solutions for herd average milk and fat, number of observations, and significance for various housing categories.

	No. observations	Solutions	
		Milk	Fat
		(kg)	
1. Type of housing			
Stanchion	702	6034	214
Tie stall	303	6176*	219
Warm free stall	81	5961	213
Cold free stall	1234	5992	213
Loose housing	408	5994	213
Wind break	351	5934	210†
No wind break or buildings	63	5806†	202
2. How are heifers housed from 1 to 3 mo?			
Individual, elevated stalls or pens (cold barn)	564	6017	214
Individual pens or stalls (warm barn)	482	6028	215
Hutches	1100	6011	214
Tied in cow barn	59	6121	219
Community or group pen	843	6014	214
Outside	118	5990	213
Other	36	6030	217
3. How are heifers housed from 3 mo to 1 yr?			
Group pens	1644	6083	217
Free stalls grouped by age	112	6161	218
Slatted floors grouped by age	10	5827	206
Bedded pack grouped by age	536	6093	217
Stanchion	5	5989	214
Loose housing no grouping	3[illegible]9	5972	212
Outside shed	748	6022	214
4. How are heifers housed from 1 to 2 yr?			
Group pens	698	5964	212
Free stalls grouped by age	156	6038	216
Slatted floors grouped by age	4	6166	224
Bedded pack grouped by age	277	6091	218
Stanchion	8	6098	214
Loose housing no grouping	604	6043	216
Outside shed	1485	5969	214

*$P<.05$.

†$P<.10$.

did not show any marked advantage for indiviual heifer housing in relation to herd production. Other literature (11) indicates individual housing of calves prior to weaning helps prevent the spread of mastitis and other diseases that can seriously influence first lactation production. Other studies (1, 10) have shown that intersucking by calves can transmit mastitis organisms. Individual housing can prevent this practice and thereby increase subsequent milk production.

Table 2 lists the 6 questions that dealt with milking systems or procedures. The type of milking system did not have a large association with production; however, herds using side opening parlors, trigon or polygon parlors, and bucket milkers had lower milk yields. Neither number of milking units, automatic takeoff units, nor number of milking personnel was associated with differences in production. When the producer or spouse was responsible for the milking a positive effect in herd production was

TABLE 2. Solutions for herd average milk and fat, number of observations, and significance for various milking categories.

	No. observations	Solutions	
		Milk	Fat
		(kg)	
1. Type of milking system			
Bucket milker	58	5820	209
Bucket milker, transfer station	53	5956	213
High milk pipeline	1559	5986	213
Low milk pipeline	663	5964	212
Rotary parlor	8	6099	217
Herringbone parlor	1074	5951	213
Side opening parlor	274	5829*	208*
Flat milking barn	191	6086	216
Trigon or polygon	12	5567†	203
Other	63	5918	213
2. Number of milking units			
≤4	1561	6145	222
>4	1123	6231	226
3. Automatic takeoff units			
Yes	459	6458	229
No	2225	6490	230
4. Electronic milk recording			
Yes	44	5924	208
No	2640	5787	203
5. Number of milking personnel per milking			
≤2	2670	6024	214
>2	14	6038	218
6. Who does the milking?			
Producer	2355	6127†	220*
Spouse	837	6115*	217
Children	715	6019	216
Employees	729	6063	217

*$P<.05$.

†$P<.10$.

noted. This may be associated with extra time spent on the small details by those being directly involved in the dairy operation.

Table 3 shows that feeding responses showed the largest differences in lactation yields. Herds feeding forage in a tie or stanchion barn in the winter had highest milk yields. A trend emerges that management practices associated with the tie or stanchion barns were related to higher lactation yields than other milking or housing facilities. Alfalfa silage or haylage as winter forages was associated with higher herd averages than either sorghum silage or prairie hay.

Question 3 lists the systems available for feeding forage in the summer. Feeding the forage outside, either in a stack feeder or on the ground, gave lower lactation solutions than those fed indoors. This may be associated with poor cleaning procedures or interaction of the method of feeding with high summer heat. Unlike winter alfalfa, silage or haylage fed in the summer was related to lower production when compared to alfalfa hay fed during the same season.

Table 3 (questions 6 through 12) shows some practices that tend to be associated with

TABLE 3. Solutions for herd average milk and fat, number of observations, and significance for various feeding categories.

	No. observa-tions	Solutions	
		Milk	Fat
		(kg)	
1. Where is forage fed to milking herd in winter?			
Covered bunk	764	6066	217
Open bunk	1419	6034	216
Tie stall or stanchion	701	6122	220†
Free stall barn	356	5892	212
From feed wagon	164	5885	210
Other	87	6133	219
2. Type of forage fed in winter			
Corn silage	1643	5964	215
Sorghum silage	263	5788*	209†
Alfalfa silage or haylage	1220	6169*	220*
Alfalfa hay	2244	6096	217
Prairie hay	409	5881*	210*
Other silage or haylage	185	5989	217
3. Where is forage fed to milking herd in summer?			
Covered bunk	730	6092	218
Open bunk	1526	6089	217
From feed wagon	225	6123	217
Tie stall or stanchion	244	5916	209*
Free stall barn	301	6208	221
Stack feeder	168	5825*	208*
On ground	86	5714*	204*
Other	124	5963	213
4. Type of forage fed in summer			
Pasture	1013	6025	214
Corn silage	970	6047	217
Sorghum silage	154	6019	215
Alfalfa silage or haylage	1469	5826*	210*
Alfalfa hay	1884	6126*	218
Prairie hay	283	6019	215
Other silage or haylage	296	6044	216
5. Where is grain fed			
Tie stall or stanchion	1008	6209†	220
Milking parlor	1243	6143	219
Complete feed	302	5981	212
Computer feeder	304	6009	216
Magnetic feeder	139	6156	218
Bunk	578	6062	216
Other	27	5993	219
6. Method of feeding grain			
Hand scoop	990	6005	217
Scoop shovel	174	6033	216
Mixer wagon with scales	231	6307*	225*
Feed cart with scale	38	5943	211
Feed cart with weigh cells	20	6225	219
Mixer wagon without weigh cell	120	6146	220
Feed cart without weigh cell	128	6123	221*
Computer controlled	319	6108	215
Fed in parlor	877	6001	214
Free choice	218	6111	219

(continued)

TABLE 3. (continued) Solutions for herd average milk and fat, number of observations, and significance for various feeding categories.

	No. observa-tions	Solutions	
		Milk	Fat
		(kg)	
7. Source of grain			
Home mix	1952	5879†	211
Commercial brand	385	6041	213
Custom mix	483	5981	214
8. Type of grain in custom or home mix			
Corn dry ear	413	6064	217
Corn dry shelled	1455	5956	212†
Milo	466	6116	218†
Oats	856	6061	217†
High moisture shell corn	517	6110	216
High moisture ear corn	124	5940	210
Barley	146	5992	213
Wheat	115	5980	212
Other	119	6040	215
9. How many times per day do you feed grain?			
≤2	2018	5800*	208†
>2	666	6010	216
10. How many times per day do you feed forages?			
≤2	1602	6018	213
>2	1122	6137	217
11. How is succulent roughage stored?			
Conventional upright silo	1451	6138*	219*
O_2 limiting upright silo	570	5990	214
Trench	259	5948	213
Bunk	173	6072	216
Bag	195	6010	214
Stacked on ground	248	5851*	208*
12. Do you feed your heifers			
With the cows	242	5945	212
Separately	2503	6038	217

*$P<.05$.

†$P<.10$.

higher production. Feeding a complete ration produced more milk than individual cow feeding (question 6). The home mix gave a lower solution than the commercial or custom mix. This may suggest poor ration balancing of home mixes. An association was noted between the number of times grain and forages were fed and production. Feeding grain and forage more frequently was associated with higher herd averages. Covered roughage storage facilities on a nonpermeable surface were favored for higher production than stacking roughage on the ground. A 287-kg difference in milk yield was found between herds where grain was stored in a conventional upright silo versus those where silage was stacked on the ground.

Table 4 (questions 1 through 6) addresses calf feeding practices. Various studies (15, 17, 20) have explored the relationship between early heifer rearing programs and their effect on

TABLE 4. Solutions for herd average milk and fat, number of observations, and significance for various calf feeding categories.

	No. observations	Solutions Milk	Solutions Fat
		(kg)	
1. When is first colostrum fed after birth?			
Within 1 h	880	6041	216
Within 4 h	1231	6018	214
Within 8 h	453	6022	214
Within 12 h	171	6054	216
2. How is colostrum fed?			
Nursed	1145	5904*	211*
Hand fed	2251	6099	218
3. Amount of colostrum fed at first feeding			
≤1.36 kg	1067	6027	216
>1.36 kg	1657	6140†	219†
4. Kind of colostrum fed			
Fresh	2652	6070	218
Fermented	60	5914	214
Commercial preparation	3	5762	213
5. Feeding program to weaning			
Nurse cow	52	5941	210
Hand fed, whole milk	1134	6064	218
Hand fed, whole milk and replacer	1048	6019	214
Hand fed, milk replacer only	406	5992	215
Hand fed, fermented colostrum	149	6157†	219
Waste milk	899	6088	216
Machine fed	12	6190	222
6. Frequency of feeding on first day			
Twice daily	2519	6065	214
Once daily	61	6089	217
Other	59	6297	222

*$P<.05$.

†$P<.10$.

subsequent lactation yield and performance. When colostrum was first fed following birth made little difference, but how it was fed and the amount fed did make a difference. This response might be expected if producers did not adequately watch their cows when freshening and, therefore, did not know the actual time of freshening. Staley and Bush (19) reported that early feeding of colostrum is necessary for proper absorption of immunoglobulins. Goodger and Theodore (4) found 64% of California dairy producers had no schedule for observing the calving area to check for newborn animals, and 27% of the calving areas were not physically near areas of high activity. Feeding waste milk and feeding only once daily did not have detrimental effects on herd milk yields compared with feeding whole milk or milk replacers and twice-a-day feeding.

Table 5 shows the feed ingredient and additive categories (questions 1 through 9). The feed additives had almost as much relation to production as did the feeding systems in Table 3. Distillers grains and whole cottonseed were

TABLE 5. Solutions for herd average milk and fat, number of observations, and significance for various feed additive categories.

	No. observations	Solutions	
		Milk	Fat
		(kg)	
1. By-products fed			
Hominy	17	6067	210
Soy hulls	93	5988	212
Distillers grain	116	6200*	224*
Corn gluten meal	200	6044	215
Brewers grain	64	6034	212
Whole cottonseed	146	6262*	223*
Dried brewers grain	40	5853	208
Other	136	5947	212
2. Protein supplement source			
Commercial supplement, no urea	1188	6025	215
Commercial supplement, with urea	196	5977	213
Soybeans	170	6014	214
Soybean meal	1243	5913*	211*
Anhydrous ammonia with corn silage	60	6018	214
Natural and urea	16	6172	219
Cottonseed meal	88	6061	214
Other	103	6223	221
3. Where are minerals fed?			
Grain mix	1773	6030	214
Forage	150	6154	220
Complete mixed ration	337	6144†	219
Free choice	1590	6016	214
Top dressed	214	6026	216
Other	16	6183	223
4. Do you use buffers?			
Yes	1462	6442*	228*
No	1222	6114	216
5. Do you feed the following additives to heifers?			
Rumensin	459	6030	214
Antibiotics	332	5980	215
Yeast	56	5956	215
Enzymes	28	5952	210
Dewormers	936	5911*	211*

*$P<.05$.

†$P<.10$.

associated with higher production. Soybean meal, when used as a supplement, showed a slight decrease in production. There was little difference in other protein sources. Of all additives, the use of buffers seemed to be associated with the highest herd averages. Four questions were asked regarding producers' awareness of various feed additives. Because there were no significant differences between the groups these questions have not been listed.

There are only a few management practices in Table 6 that were significant. Grouping the milking herd by age or days carried calf was significant for milk and fat production (ques-

TABLE 6. Solutions for herd average milk and fat, number of observations, and significance for various management factor categories.

	No. observations	Solutions	
		Milk	Fat
		(kg)	
1. Do you feed a separate dry cow ration?			
Yes	1543	5835	210
No	1141	5824	210
2. How many groups do you have in your milking herd?			
≤2	2628	6136	218
>2	329	6107	219
3. Are cows changed from one group to another?			
Yes	565	6018	214
No	1846	6067	216
4. How are milking animals grouped?			
Production	600	5954	212
Age	61	6235†	221
Days in milk	210	5984	214
Days carried calf	73	6203	222†
Nutrient requirements	57	6203	219
Body weight	63	6013	214
Other	59	5937	212
5. Do you have or use a computer?			
Yes	327	6304	225
No	2353	6336	224
6. Do you have a routine veterinarian program?			
Yes	1725	5858	209
No	930	5644†	202†
7. How many times does the veterinarian visit your herd?			
≤12	1459	5914	212
≥12	1225	5973	214
8. Who is responsible for estrous detection?			
Producer	2183	6070	216
Spouse	694	6007	215
Children	656	6013	215
Hired help	576	6070	217
Partner	182	6093	218
All of the above	342	6089	218
9. How many times do you check for estrus daily?			
≤2	1631	5943	213
>2	1053	5994	214
10. Is an estrous detection aid used?			
Gomar animal	114	5982	212
Kamar	641	5953†	212
Chalk or grease pencil	386	6144*	220*
Other	90	6077	219
11. Do you participate in a DHI-SCC program?			
Yes	1396	6162	220
No	1159	6227*	222*

(continued)

TABLE 6. (continued) Solutions for herd average milk and fat, number of observations, and significance for various management factor categories.

	No. observations	Solutions Milk	Solutions Fat
		(kg)	
12. What mastitis control programs do you use?			
Teat dip	2374	6219*	222*
Dry cow treatment	2369	6116	219
Somatic cell count	1322	5985	213
California or Wisconsin test	584	5982	214
Vaccines	225	6051	216
Paper towels to dry teats	1468	6086	217
Other	129	6065	214
13. How long have you been dairying?			
1 to 5 yr	232	6101	217
6 to 10 yr	389	6093	217
11 to 25 yr	1097	6075	216
>25 yr	989	6061	217
14. How long have you been enrolled in DHI?			
1 to 5 yr	631	5839	207
6 to 10 yr	647	6042	213
11 to 25 yr	1023	6160	218
>25 yr	357	6252	223
15. What are your two major reasons for culling?			
Low production	2144	5931†	212
Mastitis	1113	5923*	211*
Breeding	1973	6067	216
Feet and legs	194	5957	214
Other	72	6038	216
16. What would you like most to see changed in your herd?			
Production	1849	5514*	197*
Reproduction	1104	6107*	218*
Culling	353	6046	215
Other	118	6341*	222*

*$P<.05$.

†$P<.10$.

tion 4). The advantage of a routine herd health program is evident with those responding "No" having milk and fat production of 214 kg and 7 kg less than those responding "Yes." Hansen et al. (5) reported that selection for milk production increased the health care requirements of dairy cattle.

Of the questions addressing estrous detection, the only area where significant differences were observed was addressed in question 10: where the use of Kamar estrous detectors and chalk or grease pencils was associated with increased production. Holmann et al. (8) found tht tail paint or estrous detectors with routine observation is also more economical than unassisted visual observations under a wide range of dairy situations.

Teat dipping as a means of mastitis control was associated with higher herd production. This is in agreement with results of Natzke (12)

TABLE 7. Solutions for herd average milk and fat, number of observations, and significance for various artificial insemination categories.

	No. observa-tions	Solutions	
		Milk	Fat
		(kg)	
1. Do you use AI?			
Yes, totally	1813	6198*	222*
Yes, milking herd only	398	5886*	211
Yes, bull as clean up	708	5943†	212
No, dairy bull	243	5934	212
No, beef bull	29	5692*	201*
No, beef and dairy bull	54	5845	210
2. How do you primarily select sires on production traits?			
Predicted Difference Dollars	1035	6048	214
Predicted Difference Milk	977	5964	213
Predicted Difference Fat	568	6119†	219*
Total Performance Index	1170	6033	215
Other	335	5904*	210*
3. Do you select sires mainly on Predicted Difference Type?			
Yes	531	6021	214
No	2006	6057	215
4. What type of mating system do you use?			
None	864	6108	218
Breed association	410	6138*	219*
Triple a analysis aAa	225	6062	217
AI Program	835	6053	216
Consultant	249	6064	216
Other	191	6184	221

*$P<.05$.

†$P<.10$.

and Philpot (13) where effectiveness of teat dip and dry cow treatment is demonstrated. The length of time a producer had been in dairying made no difference in herd production (question 13), whereas there was a trend for herd production to increase in direct relation to the years the herd had been on DHI test (question 14). Solutions to questions 15 and 16 show producers that have problems with production or mastitis are well aware of the fact and would like to change the situation.

The last group of questions in Table 7 addresses the use of AI. Herds using AI, rather than strictly using a beef bull, totally produced 506 kg more milk and 21 kg more fat. Question 2 shows that those producers selecting on PD Fat had the highest herd averages for milk. With the high genetic relationship between PD Fat and PD Milk those producers selecting on PD Fat may emphasize PD Milk more than they realize. Data suggest the differences among type of mating system to use are not great. The breed association program is only slightly more beneficial than no program. Shanks et al. (16) concluded Illinois dairy producers with higher production dairy herds selected on superior genetics and PD Milk, were more active in AI organizations than producers of lower producing herds.

The results presented in Tables 1 through 7 may serve as a guide for additional investigations of management and environmental traits that affect production. The survey was a first attempt to investigate all management areas simultaneously. The results cannot be interpreted as direct cause-and-effect relationships, but they can point out trends and associations of management practices that would warrant additional investigations.

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