Impacts of Dairy Diagnostic Teams on Herd Performance

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ABSTRACT

This study evaluated impacts of educational diagnostic teams of consultants used to transfer technology to dairy farms. Herd management performance changes were measured by comparing Dairy Herd Improvement data from 38 project farms to data from herds that were geographical contemporaries. The value of focused goals for effecting change was also assessed. Interviews provided producers' perception of project outcomes and insight on organization and conduct of dairy diagnostic teams. Changes observed in project herds were small compared with controls with tendencies for increased herd size and improved milk production per cow. Focused goals had greater impacts on increasing herd size, milk per cow, first lactation peak milk, reducing age at first calving, and percentages of cows with subclinical mastitis. Time, money, facility limitations, labor, and alternative priorities were the most cited constraints to implementing changes. Satisfaction scores of producers were significantly related to the degree that team recommendations were followed. Improved attitudes, quality of life, and financial well-being were benefits listed by a majority of producers from participation in the project. If similar projects were to be offered, 83% said they would participate again, and 69% indicated they would pay at least some of the costs. Project farms served as demonstration farms for 1930 other producers in their respective locales, resulting in a multiplier effect of original advice given by consultant teams. Suggestions by farmer participants for improvements in dairy diagnostic teams included needs for at least some unbiased team members, more frequent meetings, more follow-up on recommendations, and consistency of recommendations with family goals.

(Key words: extension methods, practice adoption, team problem solving

Abbreviation key: SWOT = strengths, weaknesses, opportunities, and threats.

INTRODUCTION

The Minnesota Dairy Initiatives extension program was formed in response to a decline in Minnesota's dairy industry. Under conditions such as erratic milk prices and loss of farms, Lionberger and Gwin (1982) reported that a feeling of negativism among producers in rural areas contributed to a declining economic base affecting local communities. The Dairy Initiatives program goals were to enhance quality of dairy farm life, improve farm profitability, strengthen national competitiveness, and increase the vitality of rural communities through educational programming. The mission of the program was to effect positive change on dairy farms and to help ensure the competitive existence of the farms wishing to continue into the future.

Several other states, New York (PRO-DAIRY), Michigan, California, Wisconsin (Dairy 2020), Pennsylvania (Dairy MAP), and Ohio (Dairy Excel) have organized dairy programs with similar objectives (Dolan, 1997). Each program differed slightly in methodology to accomplish its goals, but the end objective was essentially the same: adoption of research-based practices and farm management principles to make their respective regions more competitive (Oelker, 1995). In Minnesota, the Dairy Diagnostic Team project had three purposes: 1) to deliver personalized on-farm education targeted to address the specific needs of each farm; 2) to use networks of local dairy expertise to cooperatively focus on helping farm families progress towards their farm and family goals; and 3) to leverage the expertise of dairy industry professionals.

The current study's objective was to conduct a post-project evaluation of the Dairy Diagnostic Team and demonstration farm concept as it related to changes on participating farms. This evaluation included an assessment of progress made on management performance of participating farms' action plans and the use of focused goals and action plans for effecting changes in herd performance. Finally, the overall impression and reaction of participating producers of the processes employed and progress made during their involvement is reported.

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MATERIALS AND METHODS

Diagnostic Teams and Farms

Forty farms widely distributed across the state were enrolled in the Minnesota Dairy Demonstration Farm project in late 1991, of which 38 participated until the end of the project, ending in December 1994. Criteria for selection of the participating farms included being defined as full-time commercial dairy farms with owners having a positive attitude towards education and technology. Each farm family needed to be willing to cooperate and be financially sound, good communicators, able to document changes through records, and willing to host tours or field days on their respective farms. Each farm family also agreed to participate in the project for at least 2 yr as well as maintain a complete record of farm operations, including crop, DHI, and financial records to be submitted to the University of Minnesota for analysis. This was originally a 2-yr project that was extended to a third year, with reduced team activity and financial support the final year. Several farms had nonfunctioning teams by the end of the third project year.

Specialized dairy educators provided leadership for selecting the participating farms and for assisting in the organization and coordination of teams for each farm in their geographic area. The participating farms were then selected through a variety of methods: interviews, completion of an application, or they were selected from their past working relationship with extension. Extension educators worked with the farm families to coordinate and monitor progress made in relation to goals and recommendations offered by the team.

Farm families were responsible for selecting specific team members to serve on their own diagnostic teams. Teams were composed of five to eight members, most of whom were actively engaged in providing services or products to the farm business. A typical team would be composed of the dairy farm family, extension educator (team leader), lender, feed supplier or nutritionist, farm business management instructor, veterinarian, milk processor, and another producer, or various combinations of such individuals. Some team members served on more than one farm team. Campus-based extension specialists provided special workshops in dairy diagnostics and problem solving, developed support materials, and served as resource consultants to the teams.

Each farm family assumed ownership of recommendations, priorities, and action plans made by the team and acted as the final decision-maker on the implementation. At the start, extension educators worked with each farm family in order to establish their goals before the first team meeting. Identifying those items that are important to the farm family was essential in devel-

Figure 1. Process and Flow Diagram of the Dairy Diagnostic Team Analysis.

oping goals upon which each team could focus. The diagnostic team next analyzed the farm operation based on production history, financial history (subject to willingness to share that information), and available farm resources. This analysis was completed to determine the framework and to provide a baseline for each farm at the start of the project. The team then conducted an analysis of strengths, weaknesses, opportunities, and threats (**SWOT**) analysis of the farm (Harsh, et al., 1994). The SWOT analysis was intended to examine all aspects of the farm business and to establish priorities. The SWOT analysis and the family goals were then used by the team to develop recommendations that would support the family's goals within the constraints of the farm resources. Once priorities were established, the team and/or the extension educator worked with each farm family to establish SMART (Specific, Measurable, Attainable, Realistic and Timed) goals (Harsh et al., 1994). Finally, specific action plans were developed for each farm as a means of effectively implementing the recommendations and goals. The process is illustrated in Figure 1.

Data Sources and Collection

The project period was from January, 1992 through December, 1994. Most teams had not met for at least 6 mo before the end of the project; therefore, no adjustments were made for any residual effects of the team's advice. Forty farms were initially enrolled in the project, and two farms discontinued dairying before the project conclusion. The data used in this study included;

- Initial farm goals and recommendations suggested by the team during their initial visit to the farm. Team leader reports submitted annually to the Dairy Initiatives Program updated the program coordinator on the progress made on the initial recommendations.

- DHI monthly herd summary reports from December, 1991 (beginning of the project period) through December, 1994 (end of the project period) for the 38 project herds distributed across Minnesota.
- DHI herd summary reports for all nonproject herds (controls) in the same county as project herds for December, 1991 through December, 1994.
- Personal structured interviews with project cooperators conducted from January to March, 1997. A survey instrument was developed to structure the responses from cooperators for the summary. The interviews with the farm families provided cooperators the opportunity to share their experiences and perceptions about outcomes and about the way that the project was conducted. Follow-up interviews were conducted on 35 of the 38 farms still dairying.

Data Analyses

Changes in herd performance using herd averages for eight DHI variables for each project herd between December, 1991 and December, 1994 were compared to average changes over that same period among control herds. Control herds were the average of nonproject DHI Holstein herds located within the same county. The eight DHI herd average variables (lactation milk per cow, herd size, % DIM, predicted transmitting ability for primiparous and multiparous cows, percentage of primiparous cows culled, percentage of cows dry >70 d, and heat detection rate) were selected as indicators of management changes related to herd size, milk productivity, reproduction, and performance of replacements. A comparison of the performance changes of the project herds to the nonproject herds in respective counties minimized potential bias due to general year-to-year changes, regional weather, and other differences in measuring the project impact. Means, standard errors, and t-tests of significance were estimated. Additional means and differences from the means were calculated for the intervening years, 1992 and 1993, to assess time trends across the period.

Performance changes were also compared according to common specific management goals or recommendations suggested across project farms. These goal-directed performance changes were compared to performance changes in other project herds not having the same specific goal, to assess the consequential outcomes of having a specific goal. Means, standard errors, and t-tests of significance were estimated.

RESULTS AND DISCUSSION

DHI Performance Measures

Project farms herd sizes ranged from 30 to 225 with a mean of 63 cows compared to 56 cows in the control

herds at the initiation of the project. (Table 1) The project herds had significantly ($P < 0.05$) higher sire PTA dollar values for both primiparous and multiparous cows at the start of the project (Table 1).

The mean performance changes in the project herds compared to the control herds (Table 2) showed improvement in some management performance DHI measures. The most notable change was a 0.8 increase in % DIM for project herds in comparison to control herds. Yearly mean $\pm$ SE measures of milk yield of project and control herds are plotted in Figures 2 and 3. These graphs show that the margin of performance numerically trended higher for peak milk of multiparous cows and rolling herd averages in yr 1 and 2 followed by no change or a slight decline in yr 3 for both the project and control herds. It is apparent that there were general performance factors in the final year that affected all herds. In yr 2, there was an average numerical advantage of over 2-kg/cow/yr in peak milk among multiparous cows in project herds compared to control herds, up from a 1-kg difference at the start (Figure 2), but most of that difference disappeared by yr 3. Figure 3 also confirms that rolling herd average means were improving until yr 3. Although some individual project herds made substantial gains in improving milk quality (reducing subclinical mastitis) and increasing herd size, average production changes did not differ significantly between project and control herds. The changes noted in individual herds were specific and are discussed in more detail later.

Peters et al. (1994b) found improvements in milk per cow, SCC, days open, and age at first calving, but in postproject assessment, the project farms did not continue to outperform the state DHI herd average in milk yield or in other efficiency measures 2 yr after that project's conclusion. This study cannot discount the potential of practices reverting back to previous levels. However, there was numerically lower milk production for both project herds and control herds during the final year of the project. Agahi (1993), who surveyed farmers from the same project as the current study, found that less than two-thirds of the farm families had adjusted their initial goals, thus not giving diagnostic teams specific reasons to continue to meet once the initial goals had been accomplished.

Each project farm had specific goals and goal-directed action plans to increase milk/cow, increase herd size, reduce SCC, or make other management improvements. Initial differences between those that had specific common goals and those without that specific goal were compared (Table 3). Herds with goals to increase milk production, increase herd size, lower age at first calving, improve peak milk production, improve milk quality, and lower days open were initially performing

Table 1. Initial means, standard errors, and differences of project herds compared to control herds (Project – Controls).

	Project farms means	Control farms means	Project-control difference	
			Mean	SE
Herd size – cows	63.5	55.9	7.6 ^α	5
% Days in milk	86.9	87.1	–0.2	1.1
Milk kg/cow	7883	8043	–160	186.7
PTA \$ primiparous cows	156.7	138	8.7*	5.7
PTA \$ multiparous cows	106.7	95.3	11.4*	5.6
% culling primiparous cows	10.6	11.9	–1.3 ^α	0.8
% dry >70 d	20.3	25	–4.6†	2.6
Heat detection, %	44.1	44.8	–0.6	2.4

Project farms n = 38, total control farms n = 2408 (appropriate control herds for specific project herds were within respective counties).

Test of significance for a two-tail unequal variance for the difference in means.

* $P \leq 0.05$.

† $P \leq 0.10$.

^α $P < 0.15$.

at a lower level when compared to the other project farms. Project farms' action plans were tailored to overcome each farm's constraints in order to achieve the farm families' goal. Therefore, action plans for farms having a common goal varied among farms. For example, increasing milk production may have been limited due to cow comfort, nutrition, or genetics. Although the farm goal may be identical to that of another farm, different constraints to overcome on particular farms would require different action plans and different time expectations to achieve measurable responses.

Changes in performance levels for farms with common specific goals were compared with other project participants not having the same specific goal (Table 4). Goals directed at changes in performance indicated greater progress towards increasing herd size. Manage-

ment areas of milk per cow, peak milk production, reproductive performance, and improving milk quality continued to perform below the other project herds. This comparison suggested the reproductive performance goals did not respond positively, perhaps not surprising because of strong declining trends in reproductive performance in dairy cattle (Washburn et al., 2002). Goals that provided a more rapid visual recognizable response (increasing milk/cow, increasing herd size, and decreasing SCC due to milk quality premiums) achieved a greater degree of change than those areas that required more time to reflect change in the measured response such as the reproductive goals. Therefore, delayed response between implementation of management changes and measured performance change or seasonal fluctuations may have been contributing factors in de-

Table 2. Mean changes¹ in performance during project period for project and control farms.

	Project farms change means	Control farms change means	Project-control change means	Change SE
Herd size – cows	10.1	4.7	5.4†	2.7
% Days in milk	0.8	0	0.8*	0.4
Milk kg/cow	533.4	289.5	243.8 ^α	133.9
PTA\$ primiparous cows	–46.6	–43.7	–2.9	5.6
PTA\$ multiparous cows	–27.5	–32.2	4.7	6.6
% culling primiparous cows	0.7	–0.8	1.5	1
% dry >70 days	–0.8	0.3	–1.1	2.2
Heat detection, %	3.7	–3.6	7.2 ^α	5.1

Project farms n=38, total control farms n=2408.

¹Changes from the start until the end of the project (1991 to 1994).

Test of significance for a two-tail unequal variance for the difference in means.

* $P \leq 0.05$.

† $P \leq 0.10$.

^α $P < 0.15$.

Figure 2. Means and standard errors by year of peak milk for multiparous cows for the project farms and their appropriate controls. Average production changes did not differ significantly between project and control herds.

termining the level of change measured within the herds.

Interview and Survey

Data collected from the interview survey of participating farms provided subjective responses to project organization, delivery, and outcomes. These survey re-

sponses are indicative of each participant's perception of outcomes.

Project farms attributed management changes to their participation in the project: 63%, to an increase in milk/cow; 61%, to a decrease in age at first calving; 58%, to an increase in peak milk; 54%, to an increase in herd size; and 52%, to an improvement in SCC. Individual project participants experienced significant changes, with some farms reducing average age at first calving by 5 to 6 mo, reducing percentage of positive SCC from 52 to 16%, as well as a number of herds improving production by >1400 kg/cow. Peters et al. (1994b), in a similar project, found participants were encouraged by the increases in milk yield per cow and additional changes made within the project period.

Producers were supportive of the benefits the team provided them in nonproduction changes. Seventy-four percent of the producers mentioned an improvement in their attitude; 72% felt an improvement in their quality of life; 72% indicated that they were financially better off than before the project; 64% felt there was an improvement in their ability to pay off debt; 61% commented that they had an increase in discretionary income, and 15 farms noted increases in net worth of \$100,000 or more, although the interviewer did not inquire as to the nature or how these increases occurred.

There was a wide variety of recommendations offered to the project farms. Table 5 lists the variety of recommendations presented to the 38 project farms and the frequency the recommendations occurred. It is important to note that, although these items all relate to the performance of the dairy, the family element of the business was not omitted from analysis, and it often played an important role in the underlying adoption of the recommendation. There was a broad array of team recommendations, many of which could not be measured using DHI records, such as labor issues, vacations or time off, farm business transfers, and others. In the opinions of the participants, the personal satisfaction towards improvements made per recommendation is important in determining the success of the project. In most cases, perception is reality for those actively engaged in production agriculture. For example, one project farm reduced the percentage of cows with SCC >200,000 from 52 to 16%, which was the lowest level ever achieved on that farm, and they were extremely proud of that accomplishment. However, when pooled, the other project farms did not differ significantly from the control group. During exit interviews, farm families were asked to assign a satisfaction score to each of their recommendations, using the survey instrument. This subjective measurement was based on a scale of 1 to 5. Labor and quality of life, nutrition, herd health, and feeding system redesign received the highest mean sat-

Figure 3. Means and standard errors by year of rolling herd averages for the project farms and their appropriate controls. Average production changes did not differ significantly between project and control herds.

Table 3. Initial comparison (1991) of 38 project herds with and without specific goals in common.

Specific goals	N goal/ no goal	Goal-directed action plans		Nongoal-directed action plans		Difference	
		Means	SE	Means	SE	Means	SE
Increase milk/cow, kg	12/26	7418.1	378.4	7910.6	961.0	-492.5*	-582.6
Herd size – cows	7/31	66.6	20.9	70.9	6.8	-4.3*	14.1
Age 1st calving, mo	12/26	27.8	1.1	26.4	0.6	1.4*	0.5
Peak milk 1st Lact., kg	12/26	26.2	1.2	28.4	0.7	-2.2*	0.5
% Subclinical mastitis	8/30	55.1	3.0	48.8	2.3	6.3*	0.8
Linear SCC score	8/30	3.8	0.1	3.2	0.1	0.6	0.0
Days open	4/34	126.0	5.5	130.0	3.4	-4.0*	2.1
Conception rate, %	4/34	58.0	4.0	57.2	2.0	0.8	1.9
Heat detection, %	4/34	46.5	3.0	45.2	1.9	1.3	1.1

Test of significance for a two-tail unequal variance for the difference in means.

* $P \leq 0.05$.

isfaction scores. The number of times the team met with the farm families also varied. The average number of team meetings over the 3-yr project period was 7, with a range of 1 to 24. It is important to note that the satisfaction score did not necessarily increase with an increase in the number of meetings. The level of satisfaction or the score relating to a specific recommendation could relate to the inability to overcome constraints, to implement, agree with the recommendation, or to understand the potential benefits. If a producer was unable to implement a selected recommendation, the satisfaction score would likely be lower.

Agahi (1993) found a low positive correlation between the adoption of practices by project herds and the number of team visits by the diagnostic team. Therefore, Agahi assumed that the producers within the program were all innovative and had adopted most of the practices used to measure innovativeness. Agahi conducted his study 1 yr after the start of the project using the same producers as this study. Some of the changes recommended by the team may have been accepted but not fully implemented. Contrary to Agahi's (1993)

study, the current report points out a difference between acceptance of a recommendation and full implementation of it on the farm. For example, there is a huge difference between breeding AI and having a cleanup bull or teat dipping when it is convenient. Diagnostic team visits serve to confirm and reinforce the importance of decisions already made and assist in the implementation of those recommendations.

More complex issues required more meetings. For example, the mean number of meetings for profitability analysis and farm transfer were greater than for issues of labor, quality of life, and feeding system. Meeting discussions did not always focus on only one issue because of the interrelationships of issues. Fewer meetings did not necessarily mean that an issue was easier to solve, but that the participating project farm may have been more receptive to information on that topic than others.

Several factors may have affected full implementation on some farms. The survey interviews queried producers about the constraints to full implementation of each recommendation. They were asked, "To what de-

Table 4. Comparison of performance changes¹ (Project–Controls) in project herds with and without specific goals in common.

Specific goals	N goal/ no goal	Goal-directed action plans		Nongoal-directed action plans		Difference	
		Means	SE	Means	SE	Mean difference	SE
Increase milk/cow, kg	12/26	8060.0	640.9	8403.9	171.8	-343.9*	469.1
Herd size – cows	7/31	102.6	26.8	79.8	9.2	22.8*	17.6
Age 1st calving, mo.	12/26	26.8	0.7	26.6	0.6	0.2	0.1
Peak milk 1st Lact., kg	12/26	27.3	1.0	30.0	0.6	-2.7*	0.4
% Subclinical mastitis	8/30	40.6	2.5	35.5	1.7	5.1*	0.8
Linear SCC score	8/30	3.6	0.1	3.2	0.1	.4	0.0
Days open	4/34	150.5	4.8	144.7	5.7	5.8*	-0.9
Conception rate, %	4/34	45.5	1.8	50.9	2.0	-5.4*	-0.2
Heat detection, %	4/34	45.0	2.5	44.7	1.8	0.3	0.7

¹Changes from the start until the end of the project (1991 to 1994).

Test of significance for a two-tail unequal variance for the difference in means.

* $P < 0.05$.

Table 5. Number of meetings during the 3-yr project and farm participant scores¹ for satisfaction and follow-through for various team recommendations.

Recommendations	Farms	Number meetings		Satisfaction score		Follow-through score	
		Mean	SE	Mean	SE	Mean	SE
Labor and quality of life	4	3.8	0.9	4.3	0.3	3.5	0.5
Feeding system	2	3.0	1.0	4.0	...	3.0	2.0
Nutrition	12	6.6	1.1	4.2	0.2	3.9	0.3
SCC	11	7.8	2.5	3.7	0.2	3.5	0.3
Heifer raising	16	5.3	1.2	3.8	0.3	3.8	0.3
Genetics	2	5.5	3.1	3.5	0.5	2.5	0.5
Farm transfer	9	8.8	2.8	3.7	0.2	2.9	0.5
Herd health	6	8.3	3.5	4.2	0.3	4.7	0.2
Forage production	8	5.7	1.7	3.7	0.3	3.9	0.5
Profitability analysis	12	9.8	2.7	3.5	0.3	3.8	0.4
Manure utilization	4	4.0	1.2	3.8	0.3	2.8	0.8
Dry cows	2	6.0	...	3.0	...	5.0	...
Reproduction	3	7.5	3.2	3.5	0.7	3.0	0.8
Production/cow	5	7.4	1.3	3.8	0.6	3.8	0.2
Facilities	13	8.1	1.7	3.7	0.3	3.4	0.4

¹Score (1=low, 5=high).

gree did you give priority (pr) to solving the situation?"; "To what degree did you follow through (f) with the recommendation?"; and, "To what degree did you agree (a) with the recommendation?" These questions were asked independently and were rated on a comparison scale of 1 (low) to 5 (high) and are shown in Table 6. Satisfaction scores of 1 (low) to 5 (high) for the 110 recommendation responses were regressed on the score responses for priority, follow through, and agreement. These three independent variables accounted for 20.8% of the variation in satisfaction score and were significant ($P < 0.01$). The resulting multiple regression equation was $Y = 1.98 + 0.14pr + 0.21f + 0.12a$, where Y is the satisfaction score. The degree of follow through was statistically significant at ($P < 0.01$). This result further confirms that commitment is necessary to achieve goals.

The survey instrument also questioned participants as to the constraints they encountered in implementing the recommendations suggested by their diagnostic

team. A list of possibilities was provided to allow for easier and quicker response time. Table 7 lists the constraints in rank order that inhibited participants from achieving a greater level of satisfaction and performance. There were 234 responses to constraints noted to implementing the 110 recommendations. The most prevalent constraints were time, money, facility constraints, and adequate labor. Addressing these constraints early and finding ways to overcome them will allow for greater progress in achieving goals or recommendations offered by an agricultural professional.

Agricultural professionals (Dolan, 1997) identified farmers' greatest challenges in meeting their goals in rank order: financing, management, business planning, labor management, use of teamwork decision-making, and use of appropriate consulting services. Peters et al. (1994b) reported issues that were important in convincing producers to accept management recommendations: a coordinated team effort aimed at integrated problem solving, written recommendations, regular dialogue

Table 6. Number of meetings, priority, follow-through, and agreement scores for recommendations listed by satisfaction score.¹

Satisfaction score	N ²	Average number of meetings	SE	Average priority score	SE	Average follow score	SE	Average agree score	SE
1	3	5.3	0.3	2.3	1.3	2.3	1.3	3.3	0.9
2	4	9.5	2.1	4.3	0.5	3.0	0.4	3.8	0.5
3	29	10.1	1.6	3.4	0.2	3.0	0.2	3.4	0.2
4	47	5.8	0.7	4.1	0.1	3.7	0.2	4.1	0.2
5	24	6.2	0.8	4.4	0.2	4.4	0.2	4.4	0.2

¹Score (1 = low, 5 = high).²N = number of responses including multiple responses from some farms.

Table 7. Frequencies of constraints identified by the project participants as limiting implementation of recommendations.

Constraint	N ¹
Time	48
Money	39
Facility constraints	34
Labor	26
Different priority	19
Didn't fit goals	12
Inadequate resources	11
Other	10
Unable to adapt	10
Didn't agree w/ recom.	9
Didn't know how	9
Didn't believe it would work	7

¹Number of observations can be greater than number of surveyed farms (n = 35) because of multiple responses from some farms.

with the producer, and possession of effective social decision-making skills by the participant.

Producers' appraisal of the team experience and effectiveness varied, but the overall impression was positive. Eighty-two percent of the participants said the team cooperated well together, 76% said the team did a good job identifying problems, 69% said the team found creative solutions to their problems, 67% said the consultation was positive, and 48% said more follow-up was needed. Furthermore, 83% of the participants expressed that they would participate in the project again if it was offered. Sixty-nine percent of the producers also stated that they would be willing to pay to participate.

Bracewell's (1993) focus group and Dolan's (1997) results indicated that the team members also saw the benefits of being a part of a diagnostic team in learning from each other and/or having a better appreciation for the complexity of the decisions made on the project farms.

The team make up is important to the success of the farm. While no ideal number was established, no team was identified as having too many members. Instead, participants more often spoke of the team having too few participants. Teams were required to have at least the following members: a veterinarian, a financial representative, and an extension educator. Veterinarians are important because of their high farmer credibility; financial representatives are important because most new practices have a financial consideration, Extension educators are important because they are perceived as the "glue" which holds the process and team together. Having team members with whom the farmer cooperator has an established business or professional relationship, appeared to be a matter of personal choice (Bracewell, 1993).

The team members volunteered their time and expertise in an effort to benefit the farm family in accomplish-

ing the family's goals. Agricultural professionals, with diverse interests, meeting with farmers to solve specific, complex sets of problems was, for most participants, an effective and unique way to effect change (Bracewell, 1993). Dolan's (1997) study concluded that Minnesota agricultural professionals accepted the networking and/or teamwork concept as an element of dairy farm management. Along with the acceptance of this concept was the understanding of the different roles. The players (team members) understand the strength of sharing information, indicating that although there were significant benefits to the participating farms, there was also the benefit of cross training to the other team members.

Producers offered the following suggestions on how the project could have been a more fulfilling experience:

- Teams should meet at least quarterly.
- More follow-up on recommendations would be helpful during the adoption and implementation phases of the project.
- Recommendations should be consistent with family goals.
- Teams should include members who are not current service providers working with the farm in order to minimize bias and offer a fresh perspective.
- Once a diagnostic team was established, membership on it should not be changed.
- All members of the diagnostic team must be present at each of the diagnostic visits to achieve maximum effectiveness.
- More follow-up and reporting back to producers on progress completed to date should be provided.

Agahi (1993) confirmed that the demonstration farm project exhibited in the community the improvements that are possible utilizing this approach. Upon completion of this project, approximately 1930 people had visited project farms during the 3-yr period. Farm tours were facilitated by extension educators and industry professionals. Others visited a farm due to an indication of the farm's participation by a sign at the end of the driveway. While some farms had more farm tours and visits than others, an average of 51 visitors per farm reflects the interest generated in each farm's progress. Lionberger and Gwin (1982) explained that the demonstration project could achieve a multiplier effect by fitting innovations into on-farm operations, promoting the use of new ideas and practices, and involving people in the change effort. Control farms were not surveyed, but it is likely that some control farms experienced improvements in various measures either as influenced by changes on project farms near them directly or indirectly through various team members. Approximately one-third of the project farms could cite a specific example of a practice other producers had adopted as a result

of their example, for instance, earlier harvest of forages. Such changes as a result of the active project prevent measures on control farms from being completely independent in comparison to project farms. Bracewell's (1993) focus group found that participants believed farmers learn best from other farmers and that the most practical place to teach and to learn is at the place of business, the farmer cooperator's farm.

CONCLUSIONS

During the 3-yr project, farms made improvements in performance in specific management areas compared to non-project contemporaries. Changes in performance were highly variable and relative to the focus of the action plans and the willingness of the producer to follow recommendations offered by the team. Changes were dependent on each producer's level of commitment and ability to overcome constraints. Diagnostic teams created a positive environment for change and were perceived to be highly effective by producers. Producers credited teams for many positive changes, including attitude, quality of life, and financial well-being, and they were supportive of the diagnostic team concept. When working with producers, it is important to consider the goals of the farm and family. It is also important to offer recommendations that would result in relatively quick, visible outcomes in order to encourage further adoption and implementation of management practices, while not offering too many recommendations. Diagnostic teams also improved communication between team members, effecting a transfer of knowledge. Practices adopted on project farms served as effective teaching (or demonstration) models for other farms.

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REFERENCES

- Agahi, H. 1993. Farmer assessment of the initiative demonstration farm program in Minnesota. Ph.D. Thesis. Univ. Minnesota, St. Paul.
- Bracewell, E. W. 1993. Pages 4–19 in *Windows of opportunity*. Division of Agricultural Education. Univ. Minnesota. St. Paul.
- Dolan, T. 1997. Building industry and extension networks to impact change. M.S. Thesis, Univ. Minnesota, St. Paul.
- Harsh, S., J. Shaltry, and T. Ferris. 1994. Animal management advancement project for Michigan producers. Michigan State Univ. Ext.
- Lionberger, H. F., and P. H. Gwin. 1982. Pages 5–20 in *Communication Strategies: A Guide for Agricultural Change Agents*. Interstate Printers and Publishers. Danville, IL.
- Oelker, E. 1995. Dairy excel: not extension business as usual. *J. Extension*. 33:6. www.joe.org/joe/1995december/a5.html.
- Peters, R. R., E. K. Cassel, M. A. Varner, R. C. Eickelberger, L. R. Vough, J. E. Manspeaker, L. E. Stewart, and J. W. Wysong. 1994a. A demonstration project of interdisciplinary dairy herd extension advising funded by industry and users. *J. Dairy Sci.* 77:2438–2449.
- Peters, R. R., E. K. Cassel, M. A. Varner, L. W. Douglass, J. W. Wysong, and R. C. Eickelberger. 1994b. A demonstration project of interdisciplinary dairy herd extension advising funded by industry and users. *J. Dairy Sci.* 77:2450–2460.
- Washburn, S. P., W. J. Silvia, C. H. Brown, B. T. McDaniel, and A. J. McAllister. 2002. Trends in reproductive performance in Southeastern Holstein and Jersey DHI herds. *J. Dairy Sci.* 85:244–251.