THE FARM LEVEL EFFECTS OF BETTER ACCESS TO INFORMATION: THE CASE OF DART

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Abstract

In this study, two methods of entering and accessing dairy herd records are compared: the traditional mail-in Dairy Herd Improvement (DHI) system and the Direct Access to Records by Telephone (DART) system, which provides more timely and convenient access to records. An evaluation of DART was carried out using mail survey responses from 117 DART users and telephone surveys of 40 randomly selected users. Results indicate that DART users are generally satisfied with the system and feel that it improves their herd management. Variations in use of the DART system by DART users are explained by herd, cost, and management variables. DART users and comparable non-DART, DHI users are compared with respect to gains in herd production efficiency. Results indicate that DART users made somewhat better gains in most efficiency measures but that the differences were generally not statistically significant.

Key words: Dairy Herd Improvement Association, dairy records, microcomputers, survey, value of information.

The potential for computers and microcomputers to be used to help farmers with management tasks has been widely recognized. With the aid of computers, farmers can more effectively use information to increase their production and marketing efficiency. Sonka notes that better information-processing technology, embodied in a microcomputer, can improve the firm's well-being by: 1) giving a better understanding of the current state of the production and/or marketing process; 2) producing a more accurate probability distribution of the stochastic events affecting the production or marketing outcome; 3) giving the manager a better perception of the firm's current performance and management problems; 4) showing how production and/or marketing efficiency can be improved; and 5) giving a more accurate picture of the relationship between a potential decision and the firm's goals. These potential benefits of information must be weighed against the monetary and time costs of acquiring and processing the information.

The impact of information and data-processing systems on agricultural production and marketing should be evaluated for several reasons. Farmers and farm advisors need to know the costs and returns from information to evaluate what amount of such services to acquire. Because of the high initial costs of developing such systems and the low marginal costs of serving new users, firms may price the product above its marginal cost and may not spend sufficient amounts on developing new products. Thus, there is a potential role for the public sector in providing information systems for agriculture (King). Knowledge of information costs and returns is needed to determine whether public expenditures on information systems should be increased, and, if so, what the returns to such expenditures would be. While much theoretical and empirical work has been done on the economics of information, few studies have used data from actual farms to evaluate the costs and benefits of improved access to data or information.

One area of farm management in which computerized access to information is being increasingly adopted is dairy production. In particular, the Direct Access to Records by Telephone (DART) system has been available to farmers in the region served by the Dairy

Records Processing Center (DRPC) in Raleigh, North Carolina, since 1980.[1] The system allows farmers to access their Dairy Herd Improvement (DHI) records stored on the mainframe computer in Raleigh using a computer terminal, a modem, and DART communications software (Webb and Butcher). The DART system provides several benefits over the conventional mail-in system of DHI record keeping. A major benefit is timely access to records. DART users can enter data at any time during the month and receive reports immediately based on the updated information. Users of the DHI mail-in system update their records once per month and often must wait a week or longer for reports based on the updated information. This timeliness benefit is especially important in decisions related to herd rations, breeding, culling, and health care. A second important type of benefit of DART is its flexibility. Managers have greater ability to create individualized reports with DART than they have with the mail-in system. Reports can be designed to meet the specific needs of the farm, and new reports can be created as the farm's needs and problems change.

The DART system imposes higher costs than the traditional DHI mail-in system. Some type of computer terminal is necessary. Over 90% of the farmers responding to a mail survey, which will be described later, said they use a microcomputer for this purpose. The current range of investment costs for a microcomputer complete with modem, monitor, and printer is estimated to be from $1,100 to $1,800 (Clay). In addition, users pay a monthly fee of $10 plus charges for telephone and computer time. Also, managers must invest time learning to use the system.

Several questions could be asked when evaluating the actual impact DART has had on dairy production. First, to what extent do DART users take full advantage of the timely and flexible access to information? Second, what types of herd, management, and other variables determine how intensively DART is used? Third, what impact has DART use had on herd production efficiency? The purpose of this study is to evaluate the farm level effects of DART on dairy herd production and to compare it with a less sophisticated system of data entry and access, the traditional Dairy Herd Improvement (DHI) mail-in records system.

Three specific objectives of the study are: 1) to determine how DART users view the benefits received from DART as well as how they use the system; 2) to explain variations in the amount of DART services used by producers; and 3) to compare gains made in herd production efficiency by DART users and similar producers who use the DHI mail-in system.

PREVIOUS WORK

Empirical evaluations of information have been done for several areas of agriculture including the use of weather information for crop production (Baquet et al.; Bosch and Eidman; Lave; Sonka et al.; Swaney et al.; Thompson and Brier; Tice and Clouser; Zavaleta et al.) and the use of information to support marketing decisions (Antonovitz and Roe; Bradford and Kelejian; Hayami and Peterson; Leuthold). The general procedure followed in evaluating information is to develop a model of the production and/or marketing environment in which uncertainty exists about the level of one or more variables affecting outputs, prices, and profits. Information which reduces the level of uncertainty is introduced into the model, and the distribution of profits before and after obtaining the information is compared to determine the value of information. The advantage of the modeling approach is that a large number of possible outcomes can be simulated quickly, allowing the distribution of returns to information to be evaluated (Sonka et al.). However, in many cases, it is difficult to quantify information and how it affects production decisions, making the modeling approach difficult to apply.

Alternatively, the researcher can attempt to measure the amount of information acquired by farms and how it affects their production efficiency. This approach was attempted by Muller in his study of differences in technical efficiency on California dairy farms. He used three measures of information: 1) expenditures for DHIA (Dairy Herd Improvement Association) record-keeping services; 2) the herd fertility index (ratio of cows milking to cows dry); and 3) an evaluation of management performance of farmers by California Bureau of Milk Stabilization interviewers. He reasoned that the herd fertility index was ac-

tually "revealed information," while the management evaluation variable was embodied information. Results of the study showed that the information variables could explain differences among managers in technical efficiency. However, two of the three information variables, herd fertility index and management performance, were not direct measures of information.

The advantage of using observed firm data is that variations in production levels are the result of actual management decisions rather than a model that may be specified arbitrarily. The disadvantages are: 1) it may be difficult to measure the different levels of information being accessed by firms; 2) other factors that are not controlled, such as government policy, weather, and output price changes, may also be affecting firm decisions (Sonka); and 3) if the information is related to a decision that is made infrequently (such as a fertilizer application decision), it may be difficult to obtain enough observations to generalize about how information affects the distribution of returns. However, if the information is related to a decision made frequently (such as whether a cow requires breeding), then fewer years of observations may be needed to determine how information affects the distribution of returns.

In this study, observed farm data are used to make the DART evaluation. These data include attitudinal surveys of DART users, monthly expenditures for DART services, and herd production data.

DART SURVEY

A six-page mail survey was sent to all 290 DART users to determine how they use DART, problems they have with its use, and the benefits they perceive from computerized access to records. The users surveyed included all "owner-manager" herds enrolled in DART as of January 1987.[2] Surveys were mailed with stamped, self-addressed return envelopes, and follow-up reminders were mailed to encourage response. A total of 129 responses was obtained of which 117 were usable for a response rate of about 40%. A shortened version of the survey was administered by telephone to 40 randomly selected users who did not respond to the mail survey.

Evidence from the survey indicated that users interact frequently with DART to keep their herd records up to date and to obtain data from their records. Respondents were asked to list the three most important DART reports for their farms and how often they receive them via the computer. About 80% of the respondents received one or more of these three reports at least twice per month, and about 60% received them at least three times per month. Similarly, DART users entered data more frequently than the one time per month possible with a mail-in system. About 85% of the respondents entered herd status changes at least twice per month, and nearly 70% entered these changes three or more times per month.

Users were presented with a list of statements describing possible DART benefits and were asked to respond to each by answering agree, slightly agree, slightly disagree, disagree, or don't know. The suggested benefits and responses are summarized in Table 1. An average response was calculated by assigning the following weights to the responses: agree 4; slightly agree 3; slightly disagree 2; and disagree 1. Those not responding or responding "don't know" were not included in computing averages.

The responses indicated fairly strong agreement with some of the benefits, especially those suggested in more general terms. For example, the benefit of increased overall herd management quality received an average score of 3.78, indicating nearly unanimous agreement with this suggested benefit. Similarly, the benefits of making herd management less time consuming, improving herd culling decisions, and improving DHIA input accuracy received high average scores, indicating general support. Users appeared to be satisfied with the system, indicated by the 3.53 average response to the suggestion that "DART has met or exceeded my expectations." Other benefits also received support, although not as often as those previously mentioned. For example, increased milk production received average support of 3.18, indicating somewhat more than slight agreement on average. Similarly, reduced days open, a measure of increased reproductive efficiency, received average support of 3.13. Better heifer herd management also received an average score of better than 3.01, while the benefits of better feeding decisions and better

TABLE 1. MAIL AND TELEPHONE SURVEY RESPONSES BY DART USERS TO SELECTED DART BENEFITS

Suggested DART Benefit	Survey Source[a] (Tel. or Mail)	Number Respond.	Mean Response	Signif. Level[b]
Has met or exceeded expectations	Tel.	39	3.31	.18
	Mail	107	3.53	
Improves overall herd mgmt. quality	Tel.	39	3.64	.175
	Mail	107	3.78	
Herd mgmt. less time consuming	Tel.	39	3.26	.014
	Mail	109	3.69	
Increased average milk production	Tel.	34	2.50	.001
	Mail	93	3.18	
Better herd culling decisions	Tel.	39	3.23	.089
	Mail	108	3.51	
Better feeding decisions	Mail	94	2.96	
Better heat detection effic.	Mail	102	2.93	
Reduced average days open	Mail	102	3.13	
Better sire selection	Mail	87	2.57	
Reduced herd health problems	Mail	95	2.65	
Better heifer herd mgmt.	Mail	93	3.01	
Improved DHIA input accuracy	Mail	100	3.58	

[a]"Mail" refers to the results from the mail survey sent to all 290 DART users. "Tel." refers to the results from the telephone survey of 40 DART users who did not respond to the mail survey.

[b]Significance level refers to the test that the mean responses from the telephone and mail surveys were significantly different.

heat detection received support close to 3.0. Suggested benefits of reduced herd health problems and better sire selection decisions received lower levels of support.

These responses indicate that managers use DART to give them more frequent access to their herd records and that they view it as helping to improve the quality of herd management. One question which arises is whether those responding to the survey are representative of the total number of users. Possibly, survey responders are those who are most active in using DART and who view the benefits of DART most positively. To determine whether nonresponders had different views, we administered a shortened version of the survey by telephone to a randomly selected sample of 40 users who had not responded to the mail survey. Given that 161 users did not respond to the survey, a sample size of 40 is sufficient to have 90% confidence that the characteristics of the sample will be within 11% of the characteristics of the population of nonresponders (Krejcie and Morgan).

In order to keep the telephone survey brief,

we only asked users about five of the benefits shown in Table 1. The responses were analyzed using a nonparametric statistics package (Pirie) to determine if the mean responses from the telephone and mail survey were significantly different. The significance levels reported in Table 1 are one-sided significance levels calculated using the Wilcoxon Rank Sum procedure (Hollander and Wolfe). The results shown in Table 1 indicate that telephone responders gave somewhat lower evaluations of the benefits than mail responders but that the differences were significant at the 0.05 level in only two of the five cases. The largest difference in responses occurred for the "increased average milk production benefit." The responses to the benefits of "improved overall herd management quality," "better herd culling decisions," and "has met or exceeded expectations" were not significantly different for the two groups.

VARIATIONS IN USE OF DART SERVICES

It is of interest to know what factors pro-

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mote heavier DART use among subscribers, since in general those who use DART more should gain more benefits from it. A good measure of DART use is the amount of telephone and computer time spent per month entering data and acquiring reports. This time determines much of the monthly cost of DART use.

At the time of the study, DART costs were $.10 per minute for computer connect time between midnight and 8:00 A.M. as well as all day Saturday and Sunday, and $.30 per minute during other times. Telephone charges were $.27; $.21, and $.15 per minute during the day, evening, and nighttime hours, respectively. Users were charged only for telephone connect time for inputting data. Also, farmers received a credit of $.03 per cow for entering at least 95% of milk weights, 98% of new cow identifications, and all status changes with DART.

Monthly expenditures for November 1986 and January 1987 were averaged for all users who responded to the mail survey.[3] Monthly expenditures equaled the $10 base fee plus telephone and computer charges minus the credit, if any, for complete data input. The mean, standard deviation, minimum, and maximum of average expenditures for the two months were $36.98, $38.57, −$2.30, and $286.91, respectively.

One would expect use of DART to increase as the user becomes more knowledgeable about DART, to increase with herd size, and to increase as the cost per minute of DART use decreases. Cost per minute can be lowered by using the system at less convenient times, such as nights and weekends, when computer and telephone rates are lower.

The estimated relationship between minutes of DART output time used (MDO) and herd, management, and cost variables is shown in equation (1). Figures in parentheses show t statistics for the coefficient estimates.

$$(1) \quad MDO = 82.37 - 135.09 \; OUTACOS + $$
$$ (2.85) \quad\;\; (-2.31)$$

$$.057 \; COWS * HELP + $$
$$(2.97)$$

$$.087 \; COWS * EDUC1$$
$$(3.54)$$

$$+ \; .109 \; COWS * EDUC2$$
$$(5.5)$$

$$+ \; .101 \; COWS * EDUC3$$
$$(2.43)$$

$$R^2 = .60.$$

MDO represents the average number of minutes of computer time for the two months used for output-related activities such as creating and printing reports, OUTACOS is the average cost per minute for telephone and computer time, and COWS is the number of cows in the herd. HELP is a dummy variable which takes on a value of one if the user requested help from a DART expert by telephone five or more times within the first three months after enrollment. EDUC1, EDUC2, and EDUC3 are dummy variables which take on values of one when the respondent's highest level of education was some college (EDUC1), college Bachelor's degree (EDUC2), or degree beyond the Bachelor's (EDUC3).

The equation shows that for users with education beyond high school, use of DART for output purposes increases with herd size by an amount ranging from 8.7 minutes per 100 cows for users with some college to 10.9 minutes per 100 cows for users with a college degree. Also, those users who contacted a DART expert at least five times by telephone the first three months after enrollment (HELP = 1) increased their use by an additional 5.7 minutes per 100 cows compared with those who made fewer calls for help. This finding may simply indicate that some users wished to obtain more types of information and reports from DART than others; consequently, they made more calls to DART experts after enrollment to determine how to create these reports, and afterwards they continued to use the system more heavily. Another variable related to user assistance, number of visits made to the farm by a DART expert within three months of enrollment, did not significantly explain variations in use. Other variables, including age of the user, attendance at DART workshops, and number of months experience with DART, were also not significant at the .10 level.

Equation (1) shows a negative relationship

[3]Only the January 1987 cost was evaluated for those farmers who enrolled in DART after November 1986.

between minutes of use and average cost per minute. Average costs decline with heavier use for two reasons. First, heavier users scheduled more use during less convenient times (nights and weekends) to get cheaper rates. Second, long distance telephone charges are levied by the minute; as a result, the user who logs on for only a few seconds is still charged for a full minute of telephone service, which tends to increase average cost when monthly use declines.

The relationship between the average for the two months of number of minutes used to input data to the DART system (MDI) and herd and management variables is shown in equation (2).

$$(2)\ MDI\ =\ 1.41\ +\ .031\ COWS\ +$$
$$(0.57)\quad (4.58)$$

$$.023\ COWS\ *HELP\ +$$
$$(3.52)$$

$$8.82\ CREDIT$$
$$(2.75)$$

$$R^2\ =\ .62.$$

MDI represents actual minutes spent transmitting the data to the computer in Raleigh. Prior to this transmission, the manager or other employee must spend time entering the data into a file for transmission. Thus, MDI is representative of effort inputting data but does not account for all the time spent on this task. CREDIT is a dummy variable set equal to one for users who received a credit for entering data with DART. The equation indicates that input use is positively related to herd size and that use is larger for herds that received a credit for complete data input. Users who made more than five telephone calls for assistance within three months of enrollment used an additional 2.3 minutes per 100 cows for data input purposes. There was no significant relationship between average input cost per minute and minutes of time used. The lack of significance may be partially explained by the fact that for many herds the DHI supervisor enters much of the data into the DART system when milk weight and test samples are collected. This data entry would likely be done at the supervisor's convenience without regard to the long distance telephone rate in effect at that time.

The estimation of equations (1) and (2) sug-

gests some implications for those who manage or promote computerized information services for farmers. Telephone help was positively associated with use, while farm visits and attendance at workshops were not. Telephone help services may be more cost-effective strategies for promoting computer use compared with individual visits to the farm. Heavier users attempted to lower their average costs by using the system at less convenient times; consequently, having a variable rate structure for different times of operation may encourage use. Finally, the positive CREDIT coefficient (equation (2)) suggests that users will respond to monetary incentives for helping maintain their databases.

EFFECTS OF DART USE ON HERD PRODUCTION

A goal of the DART program is to help producers manage their herds more effectively and thereby increase herd production efficiency. An ideal measure of DART's impact would be based on the gains in herd production efficiency made by DART herds after enrollment compared with the gains they would have made without DART. However, the latter is an unobservable variable. Here, the approach taken is to compare DART efficiency gains over a three-year period with the gains made by paired non-DART herds. The assumption is that the progress made by non-DART herds is a reasonable approximation of the progress DART herds would have made without DART. The paired non-DART herds faced the same price, weather, policy, and other environmental conditions as the DART herds; thus, the relative progress made by the DART herds compared to non-DART herds should reflect the contribution of DART. Pairing herds to evaluate dairy management differences has been done by others (Erickson and Meadows).

The DART herds chosen for analysis were those who enrolled in DART in 1984 and were still enrolled in April of 1987. DHI records from April of 1984 and April of 1987 were used to compare their progress with those of non-DART herds over the same period. The DART users who enrolled any time in 1984 would have had at least 28 months and at most 40 months by April 1987 to incorporate DART into their herd management program. The herds were paired with non-DART herds using the following characteristics: farm location, herd size, percentage growth or decline

in herd size over the period, and level of production efficiency at the beginning of the period.

The pairing procedure is summarized as follows:

1. The county containing a given DART herd and all counties directly adjacent to that county were selected to make up the area from which a non-DART herd would be chosen.[4]

2. The mean herd size for all DHI herds in that area in April 1984 was determined.

3. If the DART herd was larger (smaller) than the mean, it was compared with all non-DART herds in the area which were larger (smaller) than the mean.

4. The area non-DART herd for which herd summary data were available for April 1984 and April 1987 and which minimized the sum of weighted deviations (D),

$$(3) \ D = \sum_{i=1}^{3} (d_i/S_{di}),$$

was selected to be paired with the DART herd, where d_i refers to the difference between the DART and non-DART herds for the ith characteristic and S_{di} is the standard deviation of that characteristic for all DHI herds in the DRPC region. The three characteristics for comparison were: average days open at the beginning of the period, average milk production at the beginning of the period, and percentage change in herd size from 1984 to 1987. Matching herds with similar rates of growth is important because of evidence that, at least in the short term, increasing size has a negative impact on average levels of milk production (Brown and White).

The calculation of the ratio is illustrated using an example DART and non-DART herd from the sample. The DART herd has a beginning average daily milk production level of 54.2 pounds, average days open of 149, and a percentage change in herd size over the 1984–1987 period of +14.4%. The comparable figures for the paired non-DART herd are 51.1 pounds, 152 days open, and +19.8%. The standard deviations of average daily milk production, days open, and percentage change in size for the entire Southeast region are 11.56 pounds, 37.6 days, and 68.9%.[5] These values are inserted into equation (3), and a ratio of 0.43 is obtained. The pairing procedure was done for 32 DART herds. The mean and standard deviation of D obtained for the 32 paired herds were 0.78 and 0.48, respectively.

The paired herds were compared with respect to changes in average daily milk production, average feed cost, reproductive efficiency, genetic merit of sires used for breeding, herd health, and productivity of heifers entering the herd. The differences between DART and non-DART herds were tested to determine if they were significantly different from zero. The test statistic used is shown in equation (4):

$$(4) \quad t = \frac{\overline{d_j}*(n^{.5})}{S_{dj}},$$

where $\overline{d_j}$ is the mean of differences between the paired herds for the jth production variable, n is the number of pairs in the sample, and S_{dj} is the standard deviation of differences between the paired herds for the jth production variable. Results of the comparison for the period April 1984 to April 1987 are shown in Table 2.[6]

The DART herds achieved an average gain of 2.33 lbs/day in milk production compared with 0.86 lbs/day for the non-DART herds. Significant variation in the gain in milk production was observed within both groups as indicated by the large standard deviations relative to the means. The difference between the two groups in gain in milk production was not significant at the 0.05 level. The DART herds achieved greater reductions in feed cost than non-DART herds, and they managed to reduce average days to first breeding while

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[4]In some cases in Florida and Texas, it was necessary to include some non-adjacent counties to obtain a satisfactory match.

[5]The 68.9% standard deviation may seem large, especially in view of the fact that average herd size increased from 99.4 to 107.2 cows over the period, for an increase of 7.8%. However, average changes masked much of the variations in individual herds as increases in some herds canceled out decreases in other herds. The large fluctuations in individual herd sizes may be partially explained by the fact that both the paid milk diversion and dairy termination programs were in effect during parts of the 1984-1987 period.

[6]Three of the variables shown, change in average heifer milk production, change in average SCC, and change in percentage of herd with high SCC, are evaluated from April 1985 to April 1987 since the variables were not measured in 1984.

TABLE 2. COMPARISON OF PAIRED DART AND NON-DART HERDS WITH RESPECT TO GAINS IN PRODUCTION EFFICIENCY OVER THREE YEARS

| | DART | | Non-DART | | t | Mean Dif. |
	Mean	Std.Dev.	Mean	Std.Dev.	Statistic[a]	Signif. at .05 Level?
Chg. in Ave Milk Prod.(lbs/day)	2.33	9.05	0.86	6.70	.95	No
Chg. in Feed Cost ($/cwt)	− 1.45	1.83	− 0.97	1.47	.90	No
Chg. in Ave. Days to First Breeding	− 2.16	16.52	4.38	19.29	1.34	No
Chg. in Ave. Days Open	13.91	29.89	14.03	20.28	.02	No
Chg. in Pred. Dif. ($) of Service Sires	27.79	30.45	26.69	21.95	.12	No
Chg. in Ave. Age of First Calf Hfrs. (mos)	− 0.28	2.91	− 0.28	1.90	.00	No
Chg. in Ave. Hfr. Milk Prodn. (lbs/day)[b]	5.74	8.83	− 0.23	8.38	2.29	Yes
Chg. in Ave. SCC[c]	0.73	1.51	0.47	1.43	1.16	No
Chg. in % Herd with High SCC[d]	1.83	3.28	2.58	3.88	.00	No

[a]t statistic is the value calculated in equation (4).

[b]Average daily milk production for first 100 days for first-year lactating cows.

[c]Cows are given scores ranging from 0 to 9 as the SCC (somatic cell count) increases from the lowest to the highest possible reading.

[d]High SCC refers to cows in classes 7, 8, or 9 which means they have SCC readings exceeding 1,130,000.

the average increased for non-DART herds. These differences between the two groups were not statistically significant, however.

The average days open increased for both groups although the mean increase was slightly smaller for the DART group. The increase of nearly 14 days was quite large. One contributing factor to the increase may have been that the DART herd sizes in the sample increased an average of 57% over the period while the non-DART herds increased by an average of 58%. The influx of new cows and/or the reduced culling needed to increase herd size may have contributed to the rise in days open.

The DART group achieved a somewhat larger gain in service sire quality indicated by the larger increase in predicted differences of service sires. Both groups achieved the same mean reduction in average age of first-calf heifers. Average milk production for the first 100 days of lactation for first-calf heifers increased for the DART group and declined slightly for the non-DART group. The mean difference was significant at the 0.05 level. Both groups had problems with udder health over the period as indicated by an increase in their SCC (somatic cell count). The DART group actually showed a larger mean increase than the non-DART group in average SCC (somatic cell count) score.[7] However, the DART group had a smaller increase in the percentage of the herd with a high SCC score (greater than 1,130,000). The mean values of these variables were not significantly different at the 0.05 level for the two groups.

To summarize, Table 2 shows that the DART group had higher mean gains in several measures of herd production efficiency compared with the non-DART group.

[7]Cows are given scores varying from 0 to 9 as their SCC increases.

However, there was considerable variation in gains made within both groups, and the mean differences were generally not significant at the 0.05 level. The lack of significance may indicate that, while DART use has some positive impact on herd production efficiency, its effect is not large relative to other factors affecting the herd. For example, the mean and standard deviation of percentage change in herd size over the period was approximately 57% and 85%, respectively, for the DART group and 58% and 114% for the non-DART group. These variations in herd size may have effects on efficiency which overshadow the effects of DART use. However, these increases in herd size may have motivated managers to use DART because it enabled them to more effectively manage the herd under expansion.

SUMMARY

In this study, a computerized system available in the Southeast for accessing DHI records was evaluated. Users responding to a mail survey indicated that they used the system to enter data and retrieve reports more frequently than is possible with the traditional mail-in DHI system. Users indicated general satisfaction with the system and agreement that it improved overall management quality, made herd management less time consuming, and helped them make better culling decisions. However, agreement with more specific benefits such as increased average milk production was less strong. DART users vary considerably in the amount of computer time they use per month. Much of the variation can be explained by herd size, education of the user, amount of telephone assistance provided to the user, and average cost of computer time. Comparison of gains in herd production efficiency made by DART users with gains made by users of the DHI mail-in record system indicated that users made somewhat larger gains in specific herd production variables over a period of several years but that the differences were generally not statistically significant.

It seems likely that advances in information-processing hardware and software will continue to be made and that this technology will be increasingly adopted on farms. Thus, additional efforts should be made to evaluate the costs and benefits of better access to information. These efforts should include evaluating the effects of better information on specific enterprises as was done in this study as well as the effects at the whole-farm level. Efforts to quantify information costs and benefits are complicated by several factors, two of which are mentioned here. First, one of the main costs of adopting information technology such as computers is the manager's time spent learning to use the technology, a cost which is difficult to quantify. Second, information acquisition is closely related to the quality of the manager, that is, good managers are more apt to recognize the information they need and take steps to acquire it than are less skilled managers. As a result, it may be difficult to isolate the effects of better information technology from the quality of the manager.

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