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Removing Obstacles to Use of Records in Dairy Production Medicine: What's Being Done in Minnesota with DHIA and DairyCOMP305

Steven Stewart, DVM
John Fetrow, VMD, MBA
Steven Eicker, MS, DVM

Introduction

Successful production medicine programs require the routine use of DHIA and other records to monitor a herd's performance. Three years ago Minnesota DHIA implemented computerized on-farm data entry using DairyCOMP305. This offered an unprecedented opportunity for veterinarians and other consultants to easily incorporate data analysis and monitoring into their routine services, without the burden of data entry or data extraction.

We currently have about 80 veterinarians, representing about 45 clinics, using this system. These numbers represent more than half the veterinarians in Minnesota who do a significant amount of dairy work. These numbers represent to us an excellent response. This presentation will discuss some of our recent attempts working with Minnesota DHIA, DairyCOMP305, and Minnesota dairy veterinarians to eliminate or lessen the hurdles barring greater usage of the records.

Background on Monitoring Systems

Performance monitoring serves several purposes: It helps alert veterinarians and dairy managers to areas of potential economic losses, assists in client motivation, and can be used as a tool to market other services offered by the veterinarian.

Despite its importance, monitoring cannot be an end unto itself. Problems need to be identified as they arise, followed promptly by the necessary remedial action. Early identification of potential losses, coupled with timely, economically justified interventions, will help avoid crisis situations that exacerbate the client's monetary losses. In addition, crisis situations are seldom excellent opportunities for marketing new or long-term services by the veterinarian.

However, unless both the technical skills and the will to resolve problems are present, the mere identification of areas of economic losses has little value to the dairy. The primary reason we are using these records is to guide us as to which actions are appropriate to pursue. We can expect compensation only if we deliver advice and services that result in actions that benefit the dairy.

Monitoring systems need to be rapid, be routinely utilized in a timely manner, reflect current as well as past performance, and be easily expanded for more in-depth investigations. As margins have become tighter and herds have grown larger, rapid and timely management of the large amount of data needed to monitor dairies is required.

Examining these data usually require the use of computers. Although computers and software are potentially well-suited to this task, veterinarians should be wary of surrendering professional judgment and common sense to the computer. There will always be a need for expert interpretation and filtering of the computer's output for presentation to the dairyman. Veterinarians must be smarter than computers, else there is no reason for them to be involved.

Accessing DHIA Records Quickly and Easily

In many cases, however, performance monitoring (and, as a consequence, production medicine programs) has not be implemented to the level that would best benefit the dairyman and the veterinarian, due largely to logistical constraints accessing and utilizing the record systems. Some of the obstacles and hurdles limiting broader implementation of routine monitoring are:

1. Excessive effort needed to collect, maintain, or otherwise gain access to the records.
2. Excessive effort needed to extract meaning from the records.
3. Disillusionment with slowly changing, confusing, or misleading measures.
4. Reports that do not logically lead to a clear management action.

While taking appropriate action is our ultimate goal, there are some preliminary steps that must be taken before we can take action. The steps needed to ensure appropriate action are:

1. Data collection
2. Data recording
3. Data analysis
4. Data based action.

The *only* step that makes the dairyman money is the last one; the other steps, while essential to the whole process, are of no value unless the final step is taken. We have in the past become upset because dairymen were unwilling to pay us for our efforts in the first three steps; but there was legitimate reason for them to not value our efforts: **We failed to take the final step.**

These are some questions in this four step process in dairy production medicine:

1. How good are we at each of these four steps?
2. How willing are we to do each of these four steps?
3. How well paid can we be at each of these four steps?

Data Collection and Data Entry

In my experience we approach the data collection and data entry with great enthusiasm initially, but quickly become disillusioned with the time commitment needed. We also delude ourselves into believing we can do a better job of data collection and data entry than others, but the reality is that we get bored early and actually do a sloppy job. Finally, data collection and data entry are not areas of sustainable income at the levels we are accustomed to.

In the past, veterinarians have set up duplicate data entry/collection systems back at their offices and tried to keep up with the data collection and merge their data with DHIA testday data. This has lead to endless hassles of keeping the IDs, fresh dates, dry dates, breeding dates, etc. of all animals the same in DHIA and the veterinarian's systems. I think these "bureau" systems have seldom been sustainable and are now obsolete.

Therefore, this is an area where we want to spend as little time and effort as possible. We need to be sure to use other people's efforts as much as possible and not duplicate them. In most cases, this means working closely with DHIA records. Another critical requirement for these records is they need already be in convenient electronic form and be extremely easy to obtain for any herd.

For the past three years Minnesota DHIA has been entering 100% of their data directly on farm into DairyCOMP305 on all 5,000 Minnesota DHIA farms. This has lead to fewer errors and faster turn-around time from the processing center, since there is no mail delay as with paper records. More importantly, it is much easier to correct mistakes on IDs and dates during the actual data entry while still on farm rather than two weeks later from hundreds of miles away.

For those of you unfamiliar with DairyCOMP305, it has a long history of use as an on-farm record system on many large dairies in California and the Northeast. It therefore has always had rapid data entry and dairy farmer usefulness as a central feature. Access to current previous lactation data and to records of living cows and cows no longer in the herd is simple and straightforward. However, its strongest feature is that the program has extreme flexibility in report generation, easily adapting to the needs of dairymen, DHIA, and consultants. This is the reason it has been used extensively by dairymen and practicing veterinarians in the Midwest.

Therefore, it was an ideal marriage for us to pick up the DairyCOMP305 files generated by the DHIA field representatives and use these files directly in a format we designed to suit the needs of Minnesota and other Midwest dairy veterinarians.

At first, we received the files on floppy disks from the DHIA field reps themselves. This system worked well in some cases, okay in others, and not at all in a few cases. Since January 1995 we have been able to download any herd directly from the DHIA bulletin board automatically via modem, usually the day after testing. We can also use the files from the on-farm DairyCOMP305 and SCOUT programs in a similar manner to the DHIA field reps herds.

The big difference between the Minnesota DHIA download system and others are that we are able to download ALL of the current year's DHIA records (including departed animals and usually at least one previous lactation) without having to maintain IDs, fresh dates, etc., from month to month. The data also is already in a format that needs no further "cleaning up" from one program to another. In other systems usually only pre-defined reports are available; since this is DairyCOMP305 the report flexibility is unlimited.

In my opinion, these factors, along with simple sign-up procedures, are the difference that makes this a successful vehicle for veterinarians to use records extensively on most of their dairies. The alternatives now and in the past have allowed use only on a small numbers of farms and only with much effort.

Data Analysis

What about data analysis? Here's an area we can become good at and also can maintain interest in over a longer period of time. However, I think we have mislead ourselves into thinking this can be a high income item in and of itself. I think we must use methods of screening data in ways that combine accuracy, thoroughness, routineness, and speed to identify problems to take action upon.

Traditional approaches to analyzing dairy records have focused largely on average performance over an extended period of time, usually the last 365 days. These approaches arose mainly from within an academic environment and are excellent to :

1. Uncover general cause and effect relationships for guiding general industry-wide management recommendations.
2. Prove or disprove to scientific certainty differences between treatments or time frames without concern for early detection of problems.
3. Gain general knowledge of a dairy never visited or visited infrequently
4. Emphasize average overall performance, not specific individuals needing attention, potentially masking need for action with individuals with subpar performance.
5. Be concerned with studying a question rather than implementing management changes.
6. Estimate economic losses due to overall past (not necessarily current) performance.
7. Minimize paper and mailing costs.
8. Allow computerized processing of records before the advent of personal computers.
9. Use for client motivation and marketing programs.

However, these summary measures often do a fairly poor job of assessing recent performance or recent changes in performance. Although the rationale usually offered for using historical data is the avoidance of over-reacting to short-term or illusional problems, in my experience it more often lead to masking of problem areas until a true crisis situation exists or to unnecessary discouragement when progress truly has been made.

In many cases, the local veterinarian must take logical action even when scientific proof is lacking and must also address the specific individuals that need the action. Hence, often the need is for measures that are quite sensitive to the possibility of a problem, rather than the need to wait until we are absolutely certain that a problem exists. A true problem can exist even if we can not prove it to a scientific certainty. See the section on burden of proof.

There is likely only limited opportunity for income in data analysis, yet doing a thorough and scientific job of examining the data is critical in dairy production medicine. These are the requirements for a data analysis system:

1. It must be rapid.
2. It must be easy.
3. It must be done routinely, not occasionally.
4. It must give a sense of the variability of the values, as well as the average values.
5. It must have high "sensitivity" (seldom fails to detect a problem).
6. It must be reasonably "specific" (rarely falsely flags an area as a problem).
7. It must be in a format that enhances client education and marketing of services.

Potential Difficulties Assessing Current Performance with Traditional Measures

Traditional measures of average herd performance often fall short of needs when used to identify current problems or current performance. Some of the reasons for this failure are:

1. The use of averages can be misleading with small numbers of animals (Variation).
2. The momentum arising from the use of historical information (Momentum).
3. The lag between when an event occurred, and when it is measured (Lag).
4. The inappropriate inclusion or exclusion of cows (Bias).
5. Failure to clearly state the question the report is attempting to answer.
6. Failure of the report to clearly, logically lead to the next question or to action.

1. **Variation.** Measures that simply report the mean ("average") of the herd or subgroup can lead to problems, especially in smaller herds. When dealing with small numbers of individuals, a single or a few values can greatly skew the mean in either direction. Usually, this skewing is upward since most measures have an absolute lower end, but no maximum value (e.g., voluntary wait period, age at first calving, and somatic cell count all have minimums, but no clearly defined maximums). This can lead to unwarranted alarm due to a single individual's problem, rather than a more pervasive herd problem. On the other hand, **a good average does not mean there are no problem animals in the herd**.

For example, in a 50 cow herd with 25 confirmed pregnant animals, a single cow with days open of 350 days increases the average days open of the currently pregnant cows by 10 days. If this cow is then sold, the average will drop by 10 days (example assumes 120 days). If the operator is unaware of this, false credit for a positive result may be given to an irrelevant intervention. Conversely, two animals conceiving at 30 days would drop the average by 6 days. Inclusion of standard deviations, standard errors, etc., may be helpful in larger herds, but in smaller herds may not add a great deal of additional information. In addition these statistical measures may not be well understood by many dairymen.

2. **Momentum.** In attempts to counteract the problem of low numbers in smaller herds, distant historical data is often included. Difficulties arise here because traditional statistics such as means and standard deviations are not "time-sensitive". For example, if these measures include a whole year's worth of information, it is difficult to differentiate between three problems: one arising recently versus one of long standing versus one already resolved.

Historical data can cause misinterpretation regardless of herd size. A relatively severe and recent problem may have only a small effect on the average due to the dampening effect of the historical data. Conversely, a recent improvement may also not be as dramatically illustrated. False re-assurance arises in the first case; in the second case unwarranted discouragement may cause abandonment of a positive change. This dampening characteristic of data analysis is referred to as "rearward momentum".

3. **Lag.** Lag is the time between when an event happens and when it is measured. Long lag times prevent prompt response to problems. For instance, calving interval requires two consecutive fresh dates. This means the information is at least nine months old (usually much older) and does not reflect any changes in reproductive performance in the last six months! Even a measure such

as days open is dated by at least 35 days for any individual cow since it requires a pregnancy confirmation. If one waits until sufficient numbers of animals accumulate, the information quickly becomes much more historical than the minimum time to report a value for a given individual.

4. **Bias.** Many of these measures also report on the performance of individuals with a positive (or otherwise known outcome), but ignore (or do not reflect) the current numbers of animals either pending status confirmation or past a management cutoff with no action. In addition, bias can arise if a measure either includes cows or excludes cows inappropriately.

5. **Question asked.** This has been a source of frustration for many veterinarians in the past. We too often say "We have put lots of effort in collecting all this data, what is it telling us?", rather than "Here's the question, let's find the data to help us answer it." We must frame the question carefully first.

6. **Resulting action.** If the measure is reported to be out of guidelines, it needs to logically lead either to another question or directly to a management action.

What is often needed is not a measurement of the performance of those animals whose outcome (positive or negative) has already been resolved, but rather the identity and status of those animals where positive management action can still be taken.

For example, what does a dairy operator really need to know to determine if they have a problem with prolonged days open due to sub-optimal heat detection? If a problem does exist, what information do they need to decide if any positive action can be taken in the near future?

Possible monitor parameters:

a. Average days open of the pregnant cows ?

Absolutely nothing can be done for pregnant cows to shorten their days open, since it has already been determined.

b. Days in milk at last breeding for cows pending pregnancy diagnosis?

For cows pending confirmation of pregnancy status, prompt examination of those cows at the earliest possible time after breeding can find the open cows and lead to subsequent estrus induction. There can be no effect on days open of the pregnant cows in this group. The cows too early for pregnancy confirmation can only be observed for return to estrus.

c. Number (and identity) past voluntary wait period either not inseminated or confirmed open?

These are the animals that management changes can have the greatest positive effect. Identifying these animals can lead to either improved heat detection efforts or to estrus induction or both.

Statistics - Required Strength of Evidence: Science versus Management

There will always be a certain degree of uncertainty when assessing an individual's or a herd's performance. Traditional descriptive statistics and other data analysis techniques are wonderful tools that assist in quantifying the degree of uncertainty existing in a certain situation. However, they can be used too rigidly, out of context of other on-farm factors. This is unfortunate, since some very simple techniques, coupled with common sense, could be of great benefit to both the veterinarian and the dairyman.

The focus of a scientific investigation is the pursuit of objective "truth". One of the basic tenets of science is that nothing can ever be proven; something can only be disproven. Consequently, most questions in science are posed as "What is the probability this result occurred by chance alone?". The result is then quantified as the percent probability (using the given measurement method) it occurred by chance alone. Scientific "proof" is said to exist only when the probability something occurred by chance is below an arbitrary cut-off. The cut-off point is usually 5% ($p<0.05$).

Operating a dairy farm involves management of risk. The level of evidence required to launch an investigation, or its subsequent intervention, depends on both the strength of the evidence and the potential cost-benefit ratio of the proposed intervention (note intervention here includes changes that improve an already acceptable situation as well as those needed to correct "problem" areas). Therefore, for management purposes, measures that will reliably alert one to potential problems are critical. It is likely far better to occasionally declare that a problem may exist than to provide false reassurance that no problem exists when one truly does. In traditional diagnostic terms, one wants a monitoring system that is very sensitive, i.e., is likely to detect problems if present. Again, mere detection of a problem is no guarantee that the cause is identified, nor is it assurance that intervention is justified.

If there is a very large economic downside potential, but an inexpensive intervention is possible, the evidence needed for implementing this "insurance" may be much less than that required for scientific proof. An example of this might be the routine use of leptospirosis vaccine to prevent abortions. On the other hand, if there is a high cost of implementing a given intervention, but relatively low downside potential, even evidence that is statistically significant may not be enough to justify an intervention.

Determining if a difference between groups of animals is statistically significant requires knowledge of the average difference between the two groups, the distribution (range or "spread") of values, and the number of individuals in each group. If differences between groups are large, if the ranges of values within groups are small, and/or if groups have many individuals, it should be intuitive that it will be much easier to prove significance. However, in small herds large differences may truly exist, yet are not detectable at $p<0.05$ due to small numbers of individuals.

Summary: A result that is not statistically significant at the 5% level does not automatically mean there is no real difference; neither does it imply the difference is not important from a management or economic point of view. The strength of evidence needed from a scientific standpoint may be quite different than that needed for management purposes. Depending on the problem, management "proof" may require either more or less evidence than scientific "proof".

Main Points to Consider When Performing Data Analysis to Improve Management

1. Errors of omission (failure to take action when action is needed or would be beneficial) are often at least as costly (and may be more common) as errors of commission (taking action where none is needed or is detrimental).

Obviously, spending money on a nonexistent problem is foolish, as is spending more money on a real problem than will be returned in the solution. However, on many farms the biggest economic losses occur because of failure to take action when a problem first arises. The problems tend to drag on, increasing economic losses until a crisis situation exists. We then are absolutely sure a problem existed, yet the opportunity to fix the problem is less when we are faced with a hostile, discouraged, cash-short client. This situation is seldom a golden opportunity to market services.

2. A measure that never gives false reassurance (but occasionally may falsely signal a problem exists) will usually meet management needs better than one that gives false reassurance.

3. Performance measures that include values both from recent and more historical time frames must be viewed with some degree of skepticism as to how well they reflect current performance. These measures can be used to assess progress from one point to another if the individual values and their distribution are examined.

4. Measures of performance including values from more than the recent past can dampen or mask effects of recent negative performance, leading to unwarranted complacency. Alternatively, recent positive management changes may be obscured, leading to unjustified discouragement.

5. The degree of certainty needed to properly manage a dairy herd is different than that required for scientific proof. Science deals with determining the degree of uncertainty about "truth"; operation of a profitable business requires successfully managing risk.

6. Usually, less evidence is needed to initiate an investigation than to implement an intervention.

7. Smaller herds may require a lower level of evidence to initiate an investigation than a larger herd due to greater uncertainty when dealing with smaller numbers. Likewise, practical reality may dictate that smaller herds require a lower level of evidence to implement an intervention for adequate risk management than a larger herd.

8. The recent direction of change may be more important than the absolute level of performance.

9. Past performance may not accurately reflect current performance. Therefore, identifying the existence and the level of current problems is usually more important than determining cause of problems existing in the past.

10. An average that meets an acceptable target does not mean there are no individuals in need of immediate attention or that there are no economic losses occurring. One nearly always needs to examine the pattern or distribution of values of individuals contained in the average calculation, as well as identifying those animals with performance below target. The distribution need not be

appraised only through descriptive statistics such as standard deviations or standard errors of means. Graphical displays such as scatter graphs can quickly give much more information concerning distribution than the descriptive statistic. This may be especially true in smaller herds or when a time component exists in the parameter.

11. An average that meets an acceptable target may give false reassurance if a few very good individuals are offsetting a majority of cows not reaching the target range. Conversely, an average that does not meet an acceptable target may give rise to unnecessary concern if a few poorly performing individuals are causing the average to be skewed out of the acceptable range.

12. The only goal of monitoring is to change management. Thus, a measure should have a logical follow-up question; e.g., a count of individuals with performance below a target level suggests a list identifying those individuals. Furthermore, the final step in a logical sequence of questions in an investigation should have a clear and immediate management implication. For example, a long list of cows currently open an excessive length of time logically leads to prostaglandin injections.

13. Use of graphical reports, especially scatter plots, can greatly increase abilities to diagnose and pinpoint problems, quickly see distribution of individual values, and isolate differences between groups of cows.

Rapid Data Analysis Techniques

Therefore, we need data analysis screening tools that flag problems as early as possible. We have incorporated reports within DairyCOMP305 that produce sorted lists and summarize data by group. One technique we have found especially useful in smaller herds has been scatter graphs. These graphs allow us to get a sense of the average value in the herd without losing sight of the underlying variability of the data and extreme individuals that may skew averages.

As mentioned earlier, it is important when performing data analysis to formulate the question being posed carefully so that the appropriate data can be selected. In general, the following list are the typical questions one would pose when examining production, reproduction, somatic cell counts, and other management categories:

1. What is the current absolute status/level of each cow?
    a. Which days in milk cows are high?
    b. Which lactation number cows are high?
2. How has the status of the cows changed from last month to this month?
3. What is the status of the cows that freshened recently, both on an absolute basis and as compared to cows that freshened longer ago?
4. How has the status of cows changed from freshening to the current test?
5. What is the highest cows have been this lactation?
6. How have cows changed over the dry period?

We recommend doing this on farm with the client and on the computer screen rather than printing out very many of these reports. This eases charging for the time spent and also gets the client much more involved in both identification of problems and the decision whether to take action.

Using a combination of approaches, including scatter graphs, lists, and tables, we have found we can screen a herd for somatic cell count, production, reproduction, and disease in only a few minutes and have a very good idea of where potential problems lie. We can then make our action lists and go look at the cows with the dairyman. We must never forget the one advantage our profession possesses over others: Our ability to look at cows and environment and distinguish the normal from the abnormal. Many times the records do not make the diagnosis, but they can greatly help us narrow down the things we need to look at.

I feel the combination of easy access to data and rapid screening for data analysis will open a great opportunity for use to market production medicine services in the areas of nutrition, milk quality, and reproduction. If we fail to capitalize on this opportunity, it will be our own fault.

On the next few pages are some example DairyCOMP305 reports. More examples will be shown during the presentation.

Reproduction Example

21 day Heat Trial/21 day Pregnancy Rate Analysis

This option performs several tasks. Its columns are:

Date	Start date of each 21 day interval.
Ht Elig	Number of cows entering the interval eligible to be detected in heat. Assumes a first heat at 50 DIM.
Heat	Number of cows actually detected in heat.
Pct	Percent cows actually detected in heat/Total eligible.
Pg Elig	Number of cows entering the interval eligible to become pregnant. Will usually be same as Ht Elig number.
Preg	Number of cows that actually conceived.
Pct	Percent cows conceived/Total eligible.

The other columns (25%, 50%, 75%, 100%) are used with the horizontal histograms. H is the Heat Detection Rate and P is Pregnancy Rate.

At the end of the report the total for the year (or other time interval if \D is used) is reported. The heat detection rate is calculated through yesterday. The pregnancy rate is current to 42 days ago. Not shown is conception rate, but could be calculated by dividing the number pregnant by the number detected in heat, assuming if a cow had been detected in heat she would have been inseminated.

```
BREDSUM FOR LACT>0\E

    Date  Ht Elig   Heat   Pct  Pg Elig   Preg   Pct    25   50   75  100
========  =======   ====   ===  =======   ====   ===     %    %    %    %
 2/24/96      147     40    27      147     21    14  P H
 3/16/96      183     52    28      183     24    13  P  H
 4/ 6/96      204     76    37      204     40    19   P  H
 4/27/96      205     69    33      205     37    18   P  H
 5/18/96      193     78    40      193     43    22    P  H
 6/ 8/96      182     30    16      182     19    10  PH
 6/29/96      185     47    25      185     21    11  P H
 7/20/96      190     38    20      190     16     8 P H
 8/10/96      208     65    31      208     37    17   P H
 8/31/96      225     71    31      225     19     8 P   H
 9/21/96      245     88    35      245     38    15   P   H
10/12/96      258     84    32      258     42    16   P  H
11/ 2/96      269     82    30      269     34    12  P  H
11/23/96      165     82    49      165     33    20    P    H
12/14/96      153     80    50      153     41    26     P   H
 1/ 4/97      130     72    51      130     31    23    P    H
 1/25/97      148     81    54        0      0     0          H
 2/15/97      124     64    51        0      0     0          H
--------  -------   ----   ---  -------   ----   ---
   Total     3414   1199    35     3142    496    16   P  H
```

Somatic Cell Example

The example below uses a scatter graph approach to present the current testday somatic cell count for individual cows. Each point represents a cow and is labeled with the cow's lactation group number (1,2,or 3(=3+)). At a glance one can quickly assess the relative number above the cut-off line, as well as which lactation groups are affected as well as the days in milk of the affected individuals.

GRAPH LGSCC BY DIMTD LCTGP FOR LGSCC>0\T

```
     8.6 |        1     3 1
     8.4 |                 1            1
     8.1 |   3                                              1
     7.9 |              3    3   3     3       1
     7.7 |                  2
     7.4 |        3                  1
     7.2 |         1  213      32     1
     6.9 |                3 2 3   31 1
     6.7 |2     3   1       3   3            3                 1
     6.5 |  2 3
     6.2 |  1         3    2   32 3      2
     6.0 |                          2          1
     5.8 |   23 13  1        3      2  21
     5.5 |   3     1    1          33            1
L    5.3 | 3       11      32   3     3
G    5.0 |   33       2      3   31 3        1                         1
S    4.8 |      2          1         1
C    4.6 |   2           3  2    3 1            1
C    4.3 |  123 1                     1 3                  1
     4.1 |          1       12                          23
     3.9 |   23 1          1  1  33   2 1      1
     3.6 | 2      3 331         2 2   1            1
     3.4 |   2                    3
     3.1 |1  22    11 33 2 1   3 3  2  1       2 1                   1
     2.9 |3   3     1  3 323 213 2     21       3  2
     2.7 |  2      2        33 1  3 231                   2               1
     2.4 |          1 3     32 3 2  113 3     1  1
     2.2 |3123233  131 3  31 213 131 1 21   12    1        1
     2.0 |      223  3   23 231313            1   1     1
     1.7 |
     1.5 |3  23    313 2   112 3 2     211              1
     1.2 |33  3    11  3333112 23 3 1   1   3    1          1
     1.0 |
     0.8 |
     0.5 |2  1311  1  1312123213 2 211 2 1     1             1
         +-------------------+----------------------------------------------
          8      82     157     231     306     381     455     530     605
                                   DIMTD
```

The next example illustrates the use of 2x2 summary tables to present the number and percent of cows falling into each of four categories (low/low, high/low, high/high, low/high) based on current and previous linear score.

SUM LGSCC=4 PRVLG=4 FOR LGSCC>0 PRVLG>0

```
                        PRVLG
                         4.0
                  18  |      91    109
                   5% |      25%    30%
   LGSCC:4.0   -------+-------
                 227  |      31    258
                  62% |       8%    70%
               ====================
                245         122    367
                 67%         33%   100%
```

Production Example

Below is another example that utilizes a scatter graph approach to present production data. Here the parameter under question is the deviation from expected milk (the difference between what a cow actually milked versus what she was expected to milk at most recent testday). One can see the early lactation are as a group above their expected milk, while the later lactation cows are at best equal to their expected milk. A logical follow-up to this report is a list of cows with negative expected milk to be discussed further with the dairyman.

GRAPH MKDEV FOR LACT>0 DIMTD<306\T BY DIMTD LCTGP

```
       44 |    3
       42 |
       40 |
       38 |
       36 |
       34 |    3    1
       32 |    3  1
       31 |
       29 |     1
       27 |     2                      3
       25 |  3                3                                      2
       23 |    2                                3
       21 |2    3                                            2
       19 |    3   3 3                          33
       18 |            2                               3
       16 |   1   1      3 33  3            1    2  32  2          1
       14 |    11 31        33           3       33   23  2
       12 |      1 1                    1  2      3 3            1      1
M      10 |     1  1  33     2 2 2    3    3 1     1    1    121   1
K       8 |3    3112  3  1   1         1   2           2  1   3  1  21
D       7 |        11  3 231   3      11 3 3         333         3     1
E       5 |  3   3 1        2                32     21
V       3 |       2       1  3      313 22 222       3       1   1
        1 |__32____3____2_3____2__32113_3______1______312_1_2____1___3__1____
       -1 |    1            3        1  3   11    3 3      1  111     2
       -3 |     1   1   3    1   3 21            12 3  3  13  3        1
       -5 |                3    3 3  13233  2   3    2      2   1   2    11
       -6 |         1      2      1   3         3         1 1     1     3
       -8 |              2  3  32    3     3    3   2           1      1   2
      -10 |      2                  32    3   1            1  1 2223
      -12 |               3          2        3 3     3         1     2
      -14 |                             2  3          2 3
      -16 |                        3      3       2          2       2
      -18 |             3 3                                3
      -19 |                                                           3
      -21 |
      -23 |                                2    3
      -25 |
      -27 |                                 2
      -29 |                                                         2
      -30 |                                           3
          +--------------------------------+--------------------------------
          76      104     132     160     189     217     245     273     302
                                    DIMTD
```

Culled Cow Report Example

This report lists in table form the count of cows culled in the previous year, grouped by the reason reported to DHIA for culling. A follow up could consist of examination of the individual's cowcard or a list of the culled cows for further discussion.

Cows sold/dead from 2/11/96 through 2/10/97

By DCAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOT
Sold -- low product.	6	0	1	0	1	1	1	0	0	1	1	1	13
Sold -- breeding	1	2	0	3	1	2	1	4	0	0	1	0	15
Sold -- injury, sick	5	5	1	1	6	2	2	5	5	5	4	0	41
Died	2	4	1	2	1	2	1	5	3	3	2	2	28
Sold -- mastitis	10	4	4	0	3	0	1	1	4	1	2	0	30
Totals	24	15	7	6	12	7	6	15	12	10	10	3	127

Disease and Management Events Example

This example shows one available option for presenting counts of disease and management events by month of occurrence. A follow up could consist of examination of the individual's cowcard or a list of the cows experiencing a given event for further discussion.

EVENTS FOR LACT>0\5

#	Event	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	FRESH	443	44	28	23	14	31	40	49	52	44	43	43	32
2	OK	52	0	0	52	0	0	0	0	0	0	0	0	0
3	RECK	6	0	0	6	0	0	0	0	0	0	0	0	0
4	HEAT	1	1	0	0	0	0	0	0	0	0	0	0	0
5	BRED	983	96	86	64	68	64	35	81	102	111	113	100	63
6	PREG	378	28	21	24	25	42	21	29	16	39	38	46	49
7	OPEN	228	32	15	22	15	10	10	21	16	22	16	26	23
9	MOVE	1056	89	172	9	18	32	53	105	114	104	131	94	135
10	BULLPEN	60	0	1	8	21	16	14	0	0	0	0	0	0
11	DRY	181	18	26	0	1	1	1	5	20	20	28	27	34
12	ABORT	38	5	6	2	1	6	2	4	5	1	2	4	0
13	DNB	14	3	1	1	1	0	6	0	0	1	0	1	0
14	SOLD	39	13	6	0	0	0	0	0	0	0	1	7	12
15	DIED	12	3	3	0	0	0	0	0	0	0	1	3	2
17	CALFVAC	1	0	0	0	1	0	0	0	0	0	0	0	0
18	XID	1	0	0	1	0	0	0	0	0	0	0	0	0
20	MEASURE	14	0	0	0	14	0	0	0	0	0	0	0	0
21	FOOTRIM	218	75	26	3	0	0	6	0	20	22	22	22	22
23	VACC	765	91	59	50	62	34	32	70	72	57	93	73	72
27	SCORE	56	0	0	31	25	0	0	0	0	0	0	0	0
28	BSTART	377	0	0	0	0	0	177	54	52	21	73	0	0
29	BSTOP	78	0	0	0	0	0	0	0	10	35	16	17	0
30	CULTURE	42	18	11	5	1	0	6	0	1	0	0	0	0
32	DA	77	9	9	5	7	6	10	8	3	5	3	3	9
33	DIARHEA	24	0	0	0	4	1	3	0	1	2	0	5	8
35	KETOSIS	45	3	5	1	2	9	5	9	2	1	1	4	3
36	LAME	47	4	1	0	4	2	4	5	5	7	7	4	4
37	MAST	422	75	45	10	25	10	15	15	44	46	34	24	79
38	METR	55	6	5	0	3	4	6	4	9	12	4	1	1
40	OFFEED	322	59	1	0	1	0	30	44	32	24	28	40	63
41	PNEU	56	0	1	6	5	4	12	7	1	9	4	7	0
42	RP	44	3	7	3	0	8	6	3	3	1	4	1	5
	TOTALS	6135	675	535	326	318	280	494	513	580	584	662	552	616

Total cows listed : 647