Cow longevity is one of the keys to a profitable dairy operation. How long a cow stays in the herd can have a large impact on both net income and the ability to maintain or increase herd size. The current decrease in milk price without a reduction in replacement costs will increase the importance of cow longevity.

It is estimated that the cost of raising dairy replacements accounts for 15 to 20% of total milk production costs, second only to feed costs (1). The cost of replacements is rarely accounted for accurately and most often is hidden in the milk production costs on most farms. Dr. Jack Rodenburg, Dairy Systems and Behavior Specialist at the Ontario Ministry for Agriculture, Food, and Rural Affairs, says that dairy farms raising their own replacements devote about 35% of barn space, 30% of forage, and 20% of labor to heifer rearing. In addition, Dr. Rodenburg believes about 25% of the management time is spent with heifer rations, health care, and other management tasks. Let’s examine in detail some examples of why older cows can make you money.

A Heifer Is An Investment

When does a cow begin to make you money? Before a cow can be profitable, she must pay-off either her purchase cost or the cost to raise her. To determine how long it takes for a cow to “pay off” her replacement cost, let’s work through an example herd where all replacements are purchased. Our assumptions about replacement cost, milk selling price and production costs, first and second and greater lactation yields, calf value, and cull value of the cow are in Table 1. These values will vary from farm to farm and the calculations do not include the time value of money – a dollar earned today is worth more than a dollar earned in the future. However, this example calculation should give you an idea of how to begin to analyze replacement costs.

Using a heifer price of $1370 and a cull value of $370 means a cow has to pay off $1000 of replacement cost before she begins to make you money. Considering the net income of $2 per hundred lb (cwt) of milk and an average calf income of $90, a cow’s first lactation generates $470 of profit [(190 cwt milk yield x $2/cwt) + $90 calf value]. Subtracting this profit from the $1000 heifer purchase cost leaves $530. Using the assumptions in Table 1, a cow’s second lactation will generate $530 profit [(220 cwt milk yield x $2/cwt) + $90 calf value]. In this example, it takes two full lactations before a cow has paid back her replacement cost. A heifer entering the herd may be genetically superior and she also may have fewer health problems. However, she also comes with a debt that must be paid off. Heifers entering the herd are capital investments.
Getting Back Your Investment

According to the Michigan Dairy Herd Improvement Association (DHIA), the average herd on test had a 37% cull rate in 1999 (2). This rate means that a cow is in the average herd for about 2.7 years. These 2.7 years, divided by the 1999 average Michigan DHIA calving interval of 14.6 months (2), indicates a cow goes through about 2.2 lactations and 3.2 calvings before she leaves the herd.

Another way to analyze the cost of replacements is to calculate the cost per cow or per cwt of milk produced using the assumed values in Table 1. The total dollars that the cow must recoup are the heifer cost ($1370) minus the salvage value of the cow ($370) minus the value of calves produced (3.2 calvings x $90 per calf x 0.9 survival rate = $259).

Therefore, the net dollars to be recouped ($1370 - $370 - $259) equal $741. In the example, the cost for the cow to replace herself is $337/lactation, or $1.63/ cwt of milk produced per lactation. Explanation of calculations: net cost of $741 divided by 2.2 lactations equals $337/lactation. Net cost of $741 divided by 454 cwt of total milk produced through 2.2 lactations (190 cwt milk yield in first lactation + 220 cwt milk yield in second lactation + 0.2 of the third lactation x 220 cwt of third lactation) equals $1.63/ cwt per lactation.

If the culling rate is increased (number of lactations is decreased), replacement costs become an even greater burden. Cows in their 3rd, 4th, or later lactations can contribute considerably more to net income because they no longer have the burden of repaying replacement costs. Older cows make you money.

Maintaining Herd Size

How many calvings does it take for a cow to replace herself or for a herd to maintain its size? The above information indicates that the average Michigan cow calves 3.2 times, but not all those calves will make it back into the herd. The first problem is that the bull-to-heifer ratio at birth is about 54-to-46 (3), so only 46% of the potential calves are female. If we assume that 95% of heifer calves live and that 85% of them grow properly and become pregnant, we end up with a success rate of 37%. This means only 37% of calvings will generate a heifer to put back in the herd. Using the above assumptions, it takes 2.7 calvings for a cow to generate her replacement (see Table 2).

In Michigan, the average cow calves 3.2 times. If she must calve 2.7 times to replace herself, this leaves about a ½ calving to spare. However, we must multiply the ½ calving by the 37% success rate. Doing this math indicates that each cow only generates about an extra 0.19 heifer. The average Michigan herd generates 1.19 heifers for each one its needs to maintain a stable herd size. That’s not much of a margin of error. Consider the impact of a streak of bull calves, a scours outbreak causing higher than average death rates, or the use of a beef bull to breed heifers. It doesn’t take much to put a cow herd into a negative cow number situation. As the cull rate goes up, the number of potential calvings goes down and makes it almost impossible for a cow herd to maintain itself. Please note that length of lactation has no impact on this math. For a cow to replace herself from within the herd (not buying her replacement), a cow with an extended calving interval still requires 2.7 calvings to generate a replacement (given a heifer success ratio of 37%).

Cow Longevity

Why don’t we have more older cows or why are cows leaving the herd earlier than desired? Michigan DHIA reported the following reasons for 1999 (Table 3).

About 36% of cows in the Michigan DHIA testing program that were removed from the herd left because of injury and other related reasons. About 16% left because of disease, 13.4% for low production, whereas about 12% died, and another 12% left because of reproductive failure. Nearly 8% left the herd because of mammary infection (mastitis).

These were the numbers for the 65,128 cows that left Michigan DHIA
Examination of the trends, structure, and constraints facing Michigan dairy producers is a crucial element in maintaining the future strength of the industry.

The MSU Michigan Dairy Farm Industry Survey was implemented in 1999 to assess, among other factors, the current industry conditions and future plans of dairy farmers. This article details some of the findings concentrating on the exact reasons why cows are leaving your herd. Be sure to include deaths. Something as simple as a spiral notebook can provide you with valuable information. Even in these times of tight margins, you may need to invest money in a better breeding program, mattresses or sand in the free stalls for less mastitis, or grooving the floors for less cow injury. Cow longevity is a key to profit in any dairy herd. Cows that have paid for their replacement costs can generate more profit in both milk and replacements.

**Take Home Messages**
- Cows can’t make money until they pay for their replacement costs.
- It may take two full lactations before a cow has paid back her replacement cost.
- The average cull rate in Michigan is 37%, which means the average cow calves just over 3 times.
- It takes almost 3 calvings for a cow to generate her replacement.
- Why are cows leaving your herd? It may be cheaper to “fix” the problem and keep the cow longer rather than replacing her with an expensive heifer.

**References**

**Industry Future**

**Michigan Dairy Farm Survey: Looking to the Future - Part 1**

Christopher Wolf
Dept. of Agricultural Economics

**Current Industry Structure**

Michigan dairy farms span a wide range of herd sizes (Table 1). The responding farms with herds of 500 or more cows represented only 3.8% of the farms, but almost 29% of the milk volume. Similarly, the responding dairy operations with herds of 250 or more cows accounted for only 15% of the farms and 48.4% of the milk volume; and herds with 120 or more cows accounted for 55.8% of the farms and 85% of the milk volume.

Approximately 84% of the Michigan dairy farms reporting specialized in milk production, which meant they received 75% or more of total cash receipts from sale of milk and dairy animals. The remaining 16% of the respondents employed a more diversified production strategy, receiving less than 75% of their cash receipts from milk and dairy animals.

**Operator Characteristics**

The age distribution of Michigan dairy farm respondents was dominated...
by older farm operators (Table 2). Nearly 60% of all dairy operators surveyed were over the age of 50. In 1999, dairy operators over 60 years of age represented the largest age category, while those operators under 30 years of age represented the smallest category, comprising only 1.1% of farms.

Table 2 also displays the percentage of respondents planning to retire in the next 10 years and whether or not they plan to transfer the farm to the next generation. Of the 51.1% of farm operators of all ages that plan to retire in the next 10 years, only 28% have plans to transfer the farm. The most critical operators in this examination of future plans are those operators who are over 50 years of age, representing natural exits from the industry. Younger operators were less likely to report their future plans because such plans generally are not relevant. Among operators over 50 years of age, 74% reported plans to retire in the next 10 years, whereas only 44% reported that the farm would be transferred to the next generation.

A couple of characteristics are worth noting before becoming alarmed about the potential number of impending exits in the near future from Michigan's dairy farm industry. First, the rate of plans to transfer increases with the age of the operator. This is a natural phenomenon related to the general tendency to avoid dealing with this issue. Using this information, the relative number of operators in the 40 to 49 year age category with plans to transfer their farm will likely increase as they age. Second, the gap between retirees and transfers might indicate a continued decline in the number of op-

### Table 1. Herd size and milk volume produced, Michigan dairy farms, 1999.

<table>
<thead>
<tr>
<th>Milk cow herd size</th>
<th>Number of farms reporting</th>
<th>Percent of farms reporting</th>
<th>Percent of milk volume reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 40</td>
<td>13</td>
<td>5.5</td>
<td>0.7</td>
</tr>
<tr>
<td>40 to 79</td>
<td>46</td>
<td>19.6</td>
<td>5.4</td>
</tr>
<tr>
<td>80 to 119</td>
<td>45</td>
<td>19.1</td>
<td>8.9</td>
</tr>
<tr>
<td>120 to 159</td>
<td>57</td>
<td>24.3</td>
<td>18.8</td>
</tr>
<tr>
<td>160 to 249</td>
<td>39</td>
<td>16.6</td>
<td>17.9</td>
</tr>
<tr>
<td>250 to 499</td>
<td>26</td>
<td>11.1</td>
<td>19.6</td>
</tr>
<tr>
<td>500 or more</td>
<td>9</td>
<td>3.8</td>
<td>28.8</td>
</tr>
<tr>
<td>Total</td>
<td>235*</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

* Note that because respondents had the option to respond to questions at their discretion, the number of respondents varies by question and category.

### Table 2. Age of owners and retirement plans, Michigan dairy farms, 1999.

<table>
<thead>
<tr>
<th>Age of the farm's principal operator (yr)</th>
<th>Number of farms reporting</th>
<th>Percent of farms reporting</th>
<th>Operator retiring in next 10 years (percent)</th>
<th>Farm being transferred to next generation (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 30</td>
<td>3</td>
<td>1.1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30-39</td>
<td>20</td>
<td>7.6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40-49</td>
<td>85</td>
<td>32.2</td>
<td>23.5</td>
<td>5.9</td>
</tr>
<tr>
<td>50-59</td>
<td>69</td>
<td>26.1</td>
<td>63.8</td>
<td>26.1</td>
</tr>
<tr>
<td>60 and up</td>
<td>87</td>
<td>33.0</td>
<td>81.6</td>
<td>58.6</td>
</tr>
<tr>
<td>Total</td>
<td>264</td>
<td>100.0</td>
<td>51.1</td>
<td>28.0</td>
</tr>
</tbody>
</table>

### Table 3. Plans for milking facility changes, Michigan dairy farms, 1999.

<table>
<thead>
<tr>
<th>Plans for milking facility changes</th>
<th>Number of farms reporting</th>
<th>Percent of farms reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continue using existing facilities</td>
<td>198</td>
<td>69.7</td>
</tr>
<tr>
<td>Modify or enlarge existing facilities</td>
<td>53</td>
<td>18.7</td>
</tr>
<tr>
<td>Build new or renovate existing facilities</td>
<td>33</td>
<td>11.6</td>
</tr>
<tr>
<td>Total</td>
<td>284</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Future Investment Plans

Future plans of dairy operators were examined measuring two variables, facility changes and herd sizes. Most (69.7%) farms surveyed anticipated no change to their existing milking facilities (Table 3). Approximately 30% reported plans to modify, expand, or build new facilities in the future.

Over 50% of operations were planning some form of expansion in their milking herd and facilities (Table 4). Larger farms more commonly indicated a plan to expand than did smaller farms. More than 70% of the largest farms reported plans to expand in each of the four investment categories. Smaller farms indicated less planned future investment although 40% of the smallest herds planned to expand their herds.

In the past 10 years, most larger Michigan dairy herds grew significantly (Table 5). The values in Table 5 are average herd sizes for that herd size category (e.g., 120 to 159 cows). For example, the average herd in the 120 to 159 cow size category had 137 cows in 1999, had 113 cows 10 years ago and plans to have 158 cows in the herd in 2004.

The smaller herd sizes on average have been fairly static in the past 10 years. In contrast, herds with 120 cows or more had grown in size. Herds with greater than 250 cows had 510 cows in 1999. This largest herd size category on average almost doubled in size (from 280 cows) in the past 10 years and planned to grow by about one-third in the next 5 years. Mid-sized herds, 40 to 79 and 80 to 119 cows, expected less relative growth in the next 5 years.

Implications

This survey of Michigan dairy farms revealed that the primary farm managers on Michigan dairy farms were generally above 50 years of age and almost all above 40. The respondents indicated a general lack of plans to transfer the farm. This situation may indicate a future concern if the lack of estate transfer plans does not change prior to retirement of these producers. Without farm transfers, these agricultural resources may be absorbed by existing farms or removed from agriculture. However, many Michigan dairy farmers are optimistic about the future as evidenced by the prevalence of current plans to expand and invest in facilities and cattle.

Summary of other findings of the survey related to future plans of respondents will appear in the July issue of Michigan Dairy Review.

NOTE: The Michigan Dairy Farm Industry Survey was funded partially by the Michigan Animal Agriculture Initiative through the competitive grants program of the MSU Animal Industry Coalition.
Management

Avoiding the Pitfalls of Investigation

Phil Durst
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If the pathway to a successful investigation of a herd problem is taken in steps, then potential pitfalls can be avoided. Pitfalls can sidetrack, limit, or even dead-end an investigation. Falling into one of the following pitfalls results in herd problems that are not properly diagnosed and treatment is, therefore, haphazard.

1. Failure to convert data to information

The method and extent of recording data vary by producer. However, the thoroughness of detail matters little if the data are not converted into information useful to decision making. Problems are more easily noticed when individual pieces of data are connected.

Individual data may consist of records such as cow 386 had a displaced abomasum (DA) today, 292 turned-up lame, 333 was treated for a uterine infection, and 401 had a DA later in the month. Unless it is noted that two recently fresh cows had DA’s, you may fail to notice a persistent, although occasional, problem. Data of individual cows are important, but of little use unless summarized and compared with goals.

At the end of each month, go back through your records and total each problem for the month. That information will be helpful, but go even further to make it more useful. Divide the number of cows with each problem by the number of cows at risk, for instance, note the cows at risk of having a DA within the first 40 days in milk. If you had four cows with a DA out of 32 cows in that stage of lactation, then the incidence rate is 12%. Because problems sometimes ebb and flow throughout the year, you might keep a running cumulative percentage of problems for the year.

Establish action levels for your herd. These are the points when you predetermine that you will or must take action. For example, if your lameness rate exceeds 10%, you might begin an aggressive investigation and control program.

A trait that distinguishes top managers is that they detect problems early. Your ability to do that will be enhanced by summarizing herd data monthly.

2. Considering too narrow a range of possible causes

In the initial stages of investigation, you ought to have a long list of possible causes that is narrowed down through the course of the investigation. When the range of possible causes is restricted too early in the investigation, misleading diagnoses are more likely to occur.

Consider an example. When calves experience respiratory problems, possible causes such as Pasteurella, IBR, BRSV should be on your list. Environmental conditions should be considered as contributing factors. But, is Salmonella on your list of possible causes? Salmonella usually shows up as diarrhea, but it also can manifest itself as respiratory problems without diarrhea. If Salmonella was the cause, but not on your list, your investigation may have reached a dead end or cost extra time and money until Salmonella was diagnosed.

It is not likely that you will know all the possibilities that should be included on your list of potential causes. That is exactly why a Management Team meeting with a variety of trusted advisors can be helpful. Bringing together your veterinarian, feed consultant, extension agent, dairy sanitarian, and other consultants results in a group with broad knowledge, experience, and viewpoints. Your investigation will be more efficient and perhaps even less costly when you bring a team of people together for discussion. For more information on Management Teams, see the article by D. Ross in the January 2000 issue of Michigan Dairy Review.

3. Submitting the wrong sample

The sample can be wrong for several different reasons. It may be that an improper sample was sent to a laboratory because the wrong animals were sampled, or that a single blood sample was sent for titer measurements, or that the sample was taken at the wrong time. In each case, the producer may have false confidence that he or she sampled the herd for a possible cause and now has the correct information to proceed.

Let’s consider an example. Performing an autopsy on a calf that died from scours may reveal some things about the cause of death. However, it also could be the case that the primary problem became masked by secondary causes, which are all that are evident at the necropsy. When calf mortality is a problem, examining a live animal that is exhibiting signs characteristic of the herd problem will often yield better information about the true cause than a dead calf.

Diagnostic results may be misleading when too few animals are sampled. When screening for a disease that can occur at a very low rate within a herd, such as Johne’s disease, testing one animal is not very productive. In addition, because the sensitivity of the testing procedure is not much more than 50%, sampling just a few animals can result in the seriousness of the disease being undetected or underestimated even though a positive animal was sampled. When Johne’s disease is suspected within a herd that has not been tested previously for the disease, the best results would be obtained by testing a group of animals in addition to the one in question. If the disease is not found to be present in any of the tested animals, more confidence can be placed in a negative test for a particular animal. Refer to page 8 of this issue for more information.
4. Searching for the silver bullet

Sometimes, producers simply seek to purchase or sell something to solve the problem, without making the management changes necessary to decrease a herd problem. An example is culling high cell count cows without determining the causative organism. If the somatic cell count is high as a result of an environmental organism, then culling will neither solve the problem, nor protect any herdmates. Vaccinating newborn calves against respiratory disease that is more related to the calf’s environment, or adding a coccidiostat to calf feed to solve a problem caused by poor colostrum feeding management are other examples of failure to solve the problem.

With each investigation, determine what management practices may contribute to the problem and be willing to change them. Management practices, nutrition, and disease are often intertwined as causes of herd problems. Attempting to solve herd-level problems without changing management practices usually results in a short-lived fix.

5. No follow-up monitoring

After an investigation reveals the probable cause of a problem and a plan to correct it is implemented, monitoring is necessary to determine if the problem has indeed been corrected.

Monitoring must begin with a goal. What is it that you want to achieve by solving the problem? Is it a reduction in ketosis or abortion incidence rates? If so, to what level should they be reduced? Or, what is your goal for the herd incidence of Johne’s disease or bovine leukemia? What percentage of the herd should be within a certain range of body condition scores? Success of an intervention plan will be determined by achieving your goal. Your Management Team advisors may be able to help you set realistic goals.

However, far too often, once a course of action is determined, the producer and others assume the problem is solved and go on “to fry other fish”. Maybe the problem is solved and maybe it isn’t. In a situation where the goal is highly visible, such as increased milk production, or reduced calf mortality or diarrhea, it may be easy to subjectively note that improvement is being made. However, for problems that can only be detected by testing, whether it is the level of cows infected by Staphlococcus aureus, Johne’s or Bovine Leukosis Virus, only by monitoring the herd with regular screening tests will you know whether you have achieved your goal.

Summary

Systematic investigation of herd problems takes time and thought. However, that process will be more successful in achieving accurate diagnosis and, therefore, controlling problems. Even if the herd problem “disappears” after a “shot-in-the-dark” change, the trouble is that you won’t know what to do if it reappears, nor why it reappeared. As much as possible, know the reasons for your successes and the reasons for your failures. In that way you can better repeat successes and avoid future failures.

Investigating and solving herd problems is essential to maintaining profitability. Navigating around the pitfalls will keep your investigation headed on the right track. Don’t try to do it all on your own, rather direct a Management Team of trusted advisors to help you meet the goals that you have for your operation.

Evaluating Your Farm Based on Averages Can Be Misleading

Roger Mellenberger
Dept. of Animal Science

Webster’s dictionary defines average as the numerical result obtained by dividing the sum of two or more quantities by the number of quantities; an arithmetical mean. What does an average indicate to you on the farm when you are attempting to evaluate your farm, change management, or add a new management practice?

Using an average number may be of little or no value in helping you with your analysis. For example, the average age of 32 heifers in your herd at first calving is 24 months. Many people looking at your records would say you are doing a fine job of raising your heifers to calve on time. However, you need to do a distribution of those calvings to see if this assessment is accurate. What we might find when we look at all your heifers is that six heifers calved at 20 months of age (all had calving problems), six heifers calved at 21 months, two calved at 22 months, two calved at 23 months, none calved at 24 months, five calved at 25 months, two calved at 26 months, four calved at 27 months, two calved at 28 months and three calved at 30 months. Is your heifer program really in good shape? Analysis would say that you have a problem; namely, no control over heifer reproduction.

We can carry the same argument from the heifer example to days to first service, days open, days dry, calving interval, days in milk and other measurements. Dairy Herd Improvement (DHI) records provide averages and, in some cases, a limited distribution analysis. For example, we don’t want to know average days dry in the herd. We want to know how many cows or what percentage of cows hit your target of 55 to 70 days dry. If 90 to 95% of cows had a dry period of 55 to 70 days, you know that you succeeded in achieving your goal. Bull-bred herds (100% of breedings) in which producers do not keep the bull separated from
Johne’s disease was reviewed recently in the Michigan Dairy Review, (August 1999, p. 1.) Johne’s disease is an infectious disease that is a growing concern in the United States cattle industry. Nationwide, 22% of dairy herds are infected with Johne’s disease. A recent study suggested that at least 55% of Michigan dairy herds have Johne’s disease. Economic losses from Johne’s disease occur through premature culling, reduced weight of culled cows, increased cow death rates, reduced milk production, and reduced value of seedstock. A 1996 National Animal Health Monitoring System study estimated the annual economic loss due to Johne’s disease at between $40 and $227 per cow per year, depending on the prevalence of the disease in a herd. In addition to economic losses, other factors have focused attention on the need to control this disease. These include the potential liability of selling cattle infected with Johne’s disease to other cattle operations and the possibility that Mycobacterium paratuberculosis, the causative agent of Johne’s disease, may be a concern to public health.

The Michigan Department of Agriculture (MDA) has instituted the Michigan Voluntary Johne’s Disease Status and Management Programs to help cattle producers establish and maintain their herd free of Johne’s disease or to help eliminate the disease if it is known to exist in the herd. The Michigan Johne’s Disease Advisory Board consisting of industry, regulatory and MSU personnel, and Michigan cattle producers developed these programs. The programs were developed with the following objectives in mind:

1. to be market driven;
2. to provide information for cattle buyers;
3. to be producer-friendly;
4. to encourage testing; and,
5. to assist in disease control and on-farm eradication.

The two programs have been developed to address the specific needs of those herds infected and those not infected with Johne’s disease.

Status Program

The Michigan Voluntary Johne’s Disease Status Program is equivalent to the United States Voluntary Johne’s Disease Herd Status Program (VJDHSP) that was designed to identify herds from which buyers could safely buy replacement cattle that are at low risk for being infected with Johne’s disease. Four program levels (Levels 1-4) exist, with each succeeding level more likely to be free of Johne’s disease. The Michigan status program levels are equivalent to the VJDHSP levels,
thus making them recognizable by other states that are incorporating similar plans.

Management Program
The Michigan Voluntary Johne’s Disease Management Program was developed to aid in the control and eventual eradication of Johne’s disease from those cattle herds infected with the disease. The management program is designed to encourage producers to work towards participation in the status level program. Four levels (Levels A-D) comprise the management program with each level related to the prevalence of Johne’s disease in a herd.

Participation in Programs
Participation in the programs consists of annual testing for Johne’s disease in a predetermined proportion of adult cattle in the herd. In addition, specific biosecurity measures must be instituted to reduce the chance of Johne’s disease being introduced into a herd. Samples for the program must be collected by or under the direct supervision of an accredited veterinarian. To encourage participation, MDA will provide cost sharing for the laboratory testing required. Cost sharing is only applicable if testing is done through designated program laboratories (MDA Geagley Laboratory or MSU Animal Health Diagnostic Laboratory). The cost sharing depends on the type of test being conducted and the status or management level of the herd. As an example, to achieve Michigan Voluntary Johne’s Disease Status Level 1, blood samples from 30 randomly selected 2nd lactation or greater cows must be submitted for Johne’s disease ELISA testing. Under the current plan, MDA will pay all of the laboratory cost ($6/sample) for testing of these 30 samples. The producer pays the cost for collecting the samples by an accredited veterinarian.

The benefits of participating in this program are significant. Obviously, if Johne’s disease is present in a herd, elimination of the disease may be of economical benefit through better overall performance of the herd. Participating herds potentially will benefit from the increased marketability that proactive testing and disease control may bring. Short term, this may be of specific benefit to producers marketing seedstock or replacement cattle. In the long term, a premium for animals or products may be demanded if the market recognizes the value of Johne’s disease control.

For more information on these programs, contact your veterinarian, The Michigan Department of Agriculture Animal Industry Division (517-373-1077), or Michigan State University College of Veterinary Medicine Extension (517-353-0618).

MSU Researchers Study Ways to Control Bovine TB in Deer

Pam Jahnke
Dept. of Animal Science

In an effort to control the spread of bovine tuberculosis (TB) in the state’s white-tailed deer population, a Michigan State University professor of epidemiology is leading a team of university and government scientists in formulating a plan that may significantly reduce the spread of disease.

John Kaneene, Director of the Population Medicine Center, recently received a grant renewal from the U.S. Department of Agriculture (USDA) to study the epidemiology, or the tracking of the disease along with methods of control, prevention and eradication. The team is studying the different routes of transmission involved with bovine TB, how deer become infected and what other species can get the organism. This is the first time an “active surveillance program” has been conducted on a large scale to determine the prevalence of bovine TB in the deer population, Kaneene noted.

What is the Risk?
Recent reports of TB-positive deer outside of an area where it was thought the disease had been confined, and one infected dairy herd in northeast Michigan, indicate there is a risk, Kaneene said. The disease has been found in wild deer beyond the 11-county area, east of I-75 and north of M-55, west of Tawas City. “The threat is real. It’s difficult to say how big it is,” he said. Just the mention of the term “bovine tuberculosis,” is enough to send ripples of panic through dairy farmers fearing the prospect of destroyed herds and devastating economic losses, Kaneene said.

The 157-animal dairy herd in Presque Isle County has been under quarantine since early December. As of March 16, milk was being sold because “there is nothing wrong with the milk from the herd,” explained Kevin Kirk, animal health liaison for the Michigan Department of Agriculture. The infected animal and a few others have been removed from the farm.

Mycobacterium bovis, the bacterium causing bovine TB infects a range of hosts in North America, including cattle, goats, deer, bison, wild carnivores, dogs, cats and humans. Transmission of the organism generally occurs by inhaling nasal secretions in sneezes or coughs, or through direct physical contact with these secretions. It also may be passed through ingestion of contaminated feed, water, milk, or contaminated carcasses (in the case of carnivores), or may be passed in utero.

While it’s possible to transmit bovine TB from animals to people, it’s extremely rare in this country because milk pasteurization and adequate cooking kill the organism.

The strain that accounts for most of the TB cases is a different organism Mycobacterium tuberculosis, which causes the disease in humans and pets and is usually transmitted through coughing and sneezing. A third organism, Mycobacterium avium, affects chickens, cats, dogs and other birds, but does not actually cause TB in
humans - except in immunocompromised people, Kaneene said.

In 1994, a 4-year-old male white-tailed deer infected with bovine TB was shot and killed by a hunter in southwestern Alpena County. That incident led scientists to determine the disease to be self-sustaining in free-ranging wildlife. To date, the area of infection has spread from 4 to 11 counties, affecting at least 228 deer, 6 coyotes, 2 raccoons, 1 bear, 1 bobcat, 1 red fox, 4 beef cattle farms and 1 dairy herd. The carnivores may have become infected after consuming parts of the lungs and lymph nodes of the TB-infected deer.

“The fact that we have found bovine TB in deer makes me feel it has been here awhile,” Kaneene explained. Did the cattle pass it to deer or vice-versa? “I don’t know and it doesn’t really matter because it’s a problem and it’s going to take all parties concerned to team-up and solve the problem,” he explained.

Highlights of a 3-Year Plan

Here are some highlights of the 3-year study plan.

1. To estimate the risk of the disease being transferred into domesticated livestock from the deer and determine the means of transmission of Mycobacterium bovis into deer and other species. Infected deer that appear to be healthy and show no visible signs of being infected, are the ones most worrisome to Kaneene because these animals can still transmit the organisms to other susceptible animals.

2. To determine risk factors that may influence transmission of Mycobacterium bovis. One such factor is believed to be supplemental feedings. Good Samaritans and hunters often put out a variety of feedstuffs for deer during the winter. This encourages deer to congregate in unusually large numbers, resulting in higher risk of transmission of the disease in one of two ways - sneezing on one another or direct contact with mucus from their mouths and (or) fecal matter. The Michigan Department of Natural Resources has placed restrictions on baiting (winter feeding) in northeastern Michigan.

3. To find out how long the Mycobacterium bovis organism survives in the environment whether it’s a pond, soil or feed such as hay bales. If the length of time is known, then the opportunity to develop individualized control programs for infected farms would be improved.

4. To develop risk-based “eradication programs” and methods for evaluating the effectiveness of such programs. Kaneene said, “Are the programs working or not, where do we need to improve?”

5. To develop extension and outreach programs at each stage to provide the public with accurate information and to keep panic at bay. There are social, psychological and economical impacts of the disease, said Kaneene, who receives many calls from concerned farmers. Currently, farmers should increase biosecurity on their farms to limit the contact of their cattle with wild deer and other carnivores. He also encourages farmers to comply with a state testing program soon to be proposed.

Currently, Kaneene has an arrangement with the Michigan Department of Community Health to obtain information on any new case of bovine TB in the state. Kaneene said the Department will determine where the individual was exposed to the disease and whether Mycobacterium bovis, if isolated, is genetically the same or different from the one isolated in the deer. So far, no cases of bovine TB in humans have been linked to the current outbreak of Mycobacterium bovis in Michigan. There have been some cases reported of bovine TB, but they have occurred in people who moved to Michigan after being infected, Kaneene said.

Kaneene said a long-term goal of the USDA grant is to devise practical solutions for eradicating the disease in livestock and wildlife.

What’s the Status?

Meanwhile, it recently was reported that a USDA team may recommend that Michigan’s designation as free of bovine tuberculosis be revoked. That could result in the testing of all 1.2 million beef and dairy cows in Michigan, making it harder to sell the animals for shipment to other states. Some states will not let cattle from states without TB-free status to be transferred into their boundaries without being TB tested.

TB-positive deer have been found in Antrim, Osceola and Mecosta Counties outside of an 11-county northeast Michigan zone. A USDA team that recently visited Michigan said the state may not retain its status as TB-free, a status that already has been taken away in the 11-county area. A final ruling is forthcoming.

More than 50,000 tests have been performed on 1,100 farms since the fall of 1997. Fourteen cattle in five farms tested positive.

A MSU study in 1998 found that the loss of TB-free status could cost the state economy up to $156 million over a decade. Currently, the state is considering modifying its requirement that when one animal tests positive for bovine TB, the entire herd must be sacrificed. Farmers may be given the option of depopulating or undergoing a rigorous program of test and slaughter of positive animals to prevent the spread of, and eventually eradicate, the disease in their herds.
Why Do Vaccines Fail?

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Modern vaccination was born because of pioneering research by Edward Jenner, who observed that milkmaids were more resistant to smallpox. He eventually realized that it was previous exposure to cow pox lesions on teats from cows that was associated with this protection.

In fact, the term vaccine is derived from the Latin word for cow, vacca. Vaccination is the process of exposing a host immune system (cow, human, or otherwise) to a disease-causing pathogen, such as a virus or bacteria, so that the immune system learns to recognize it more quickly and with greater immune activity than if not previously exposed. Usually, the form of the pathogen in the vaccine is weakened, or even killed. Thus, exposure of the animal to the vaccine won’t cause a serious disease, but will “train” the immune system to be better prepared when exposed to a real infection. This is the key issue of vaccination, which relies on the ability of the immune system to have a memory of previously recognized pathogens.

Much of this memory is carried by white blood cells termed lymphocytes. One type of lymphocyte is called the “B” lymphocyte. When an animal is exposed to a disease-causing agent, B-lymphocytes are transformed into cells that produce antibodies (immunoglobulins) against that agent. Antibodies are proteins that actively bind and help to destroy invading pathogens. Each B-lymphocyte makes a specific type of antibody, or clone, that will only bind to one specific part of a pathogen and nowhere else. The process of vaccination stimulates antibody production in the immunized animal, which is termed active immunity. This is different than passive transfer of immunity, which occurs when a calf is fed colostrum from the dam; the cow produces the antibody and transfers it directly to the calf.

Vaccination is a key part of a preventive program to control infectious disease in a dairy herd. Most dairies in Michigan practice vaccination to some extent. However, a vaccination program for a herd will vary depending on trafficking of cows into the herd, previous herd history, environment, availability of labor to handle animals, the presence of a bull to service cows, and other challenges to animal health, such as extreme weather. It is highly recommended to develop the vaccination plan with the advice of the herd veterinarian. Many commercial vaccines are available for use in a variety of dairy cattle of all ages and stages of lactation, and numerous infectious agents (also termed pathogens) are represented. Vaccines undergo a licensing process to insure their ability and effectiveness to protect against disease. Many of the pathogens affecting cows are well identified. Nonetheless, at times the results in terms of protection seem less than adequate. How the immune system responds to a vaccine is a complex interaction of many types of cells, and the failure of just one small step in this interaction can result in poor immunity. When a disease outbreak occurs due to a pathogen against which the cows were vaccinated, the question arises, why didn’t the vaccine protect our herd? There are several possible reasons.

1. The vaccine actually offered some protection, however it wasn’t complete protection.

Depending on the pathogen, some vaccines provide incomplete protection. This reduces the severity of infections, but may not necessarily prevent infections. Examples of this concept are Brucellosis, Bovine Viral Diarrhea (BVD), and the J-5 (anti-coliform mastitis) vaccines. Disease may still occur, but at a greatly reduced mortality and economic loss than if the herd was not vaccinated.

2. The wild (disease causing) type of the pathogen is a version that is not presented in the vaccine, so the immune system cannot recognize it sufficiently well to mount a memory response.

Particularly for viruses, new strains can appear that were not previously used in development of commercially prepared vaccines. Thus, the existing vaccines offered only minimal protection because the immune system does not fully recognize the new strain.

3. The vaccine was not stored properly, had expired, or was not administered according to directions.

Vaccines are more sensitive than many drugs with respect to storage temperature. Vaccines must always be refrigerated AT PROPER TEMPERATURES. Dry vaccines that are mixed and reconstituted with a solution should not be stored longer than the day they are mixed. Booster injections refer to a repeat vaccination, often within 2 to 4 weeks after the initial vaccination. Boosters, if recommended on the label, should be given, and a regular schedule should be followed so that annual or semi-annual vaccinations are really on time. A study performed at Pennsylvania State University demonstrated that a substantial majority of dairy farms that considered their herds to be “vaccinated” did not follow the recommended vaccination schedules. Don’t expect optimal protection with a haphazard vaccination protocol.

4. The vaccine was mixed with another vaccine or drug.

This should never happen. If two vaccines are given, use two separate injection sites and syringes. Vaccines are a sus-
pension that includes the pathogen and an adjuvant. An adjuvant is a compound that helps to stimulate the immune system in the location of the injection. Adjuvants and suspension vehicles (oil or water) vary from vaccine to vaccine and some may be incompatible.

5. The cow’s immune system wasn’t competent, or “ready” to respond to the vaccination.

Research has demonstrated that leukocytes from cows at calving have impaired function, and this includes the lymphocytes that are critical for memory and antibody production. Cows vaccinated at calving do not produce antibodies as well as cows vaccinated at other times in the lactation cycle. Marginal dietary deficiencies of trace elements such as copper or selenium can impair immune function as well. Likewise, vaccinating at times of metabolic disturbances or severe infection may result in a suboptimal vaccination response.

Infectious agents such as BVD and Salmonella can cause immune suppression, and calves in the first 2 to 4 months life may have maternal interference from the colostral antibodies received from the dam, which may actually impair the effect of the vaccine. Environment also can influence vaccination response. Don’t expect any vaccine to offer substantial benefits when vaccinated cattle are kept in unsanitary conditions, or places with poor ventilation. The challenge, or numbers of pathogens, invading the body can be so great as to overwhelm a competent immune system.

6. The cows were given too many vaccines at one time.

Research in this area is sketchy at best. Nonetheless, in some herd situations, cows receive up to 15 different pathogen types during one vaccination session. It is uncertain what effect this has on the cow’s ability to respond most effectively to any one pathogen. If less than desirable results are being achieved, it might be appropriate to reduce the number of vaccines administered at any one time. Additionally, multiple immunizations (greater than four) with the same vaccine over a short period of time has the potential for causing a poor response, in which the immune system may not respond to the vaccine.

7. The outbreak of disease is not caused by the pathogen(s) in the vaccine, which also is known as “wrong diagnosis.”

Above all else, if an outbreak occurs despite vaccination, work with your veterinarian to confirm the causative agents. Basing a diagnosis on previous herd history may result in failure to recognize an emerging pathogen in the herd. The diagnostic work-up may include serology, virus isolation, microbiological culture, histopathology, or necropsy. It should be thorough; a little expense up front can save additional and substantial expenses down the road.

Summary

- Some vaccines may not provide complete protection, but they may reduce mortality and economic loss compared with no vaccination.
- Some vaccines will not protect completely against new wild type pathogens (especially viruses.).
- If vaccines are not stored at proper temperature and prepared exactly according to label don’t expect optimal protection.
- Never mix a single vaccine with other vaccine or drug preparations.
- Administer vaccines at the proper time in the animal’s life cycle according to the label. Vaccination near the time of calving or during health disturbances or several infections should be avoided.
- It may not be most effective to give multiple different vaccines at the same time.
- Work with your veterinarian to determine the exact pathogens(s) causing problems when developing your comprehensive vaccination program.

Extra Label Drug Use Violation Is Easier Than You Think

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Violation of the provisions of extra label drug use (ELDU) may be occurring on your farm and you do not even know it. You may be in violation if you do any of the following.

• You routinely use oxytocin on dairy cows in the milking parlor. ELDU can only be used for therapeutic purposes and not to enhance milk production.
• You add antibiotics or other drugs to your feed in amounts different than listed on the label. ELDU cannot be applied to feed additives.
• You inject gentamicin (aminoglycoside antibiotic) into cattle. ELDU may not be used if it results in violative drug residues or presents a risk to public health. Aminoglycoside antibiotics (e.g., gentamicin) have been found in kidney tissue of cattle 18 months after therapeutic use. The American Association of Bovine Practitioners encourages its members to refrain from intramuscular (IM), subcutaneous (SubQ), or intravenous (IV) extra label use of the aminoglycoside class of antibiotics in cattle.
• You treat mastitis with a mixture of drugs. Only Food and Drug Administration (FDA) approved drugs can be used as an ELDU. Mixing of multiple drugs is called compounding and cannot be employed as an ELDU.
• You treat a 600-pound steer with diarrhea with 20 cc of penicillin IM. In this case, penicillin is not labeled for diarrhea and the label dose is 10 cc. ELDU includes species, class of the animal (dairy or beef), disease or condition treated, dose, route of administration, withdrawal and discard times. Unless strictly followed, it is considered
ELDU.

- You are using a drug as an ELDU and the container is NOT labeled with the veterinarian’s name, drug name, identification of animals to be treated, dose, duration and frequency of treatment, and a specific withdrawal or discard time for meat or milk. ELDU can only be used by or under the order of a veterinarian. There must be a valid veterinarian/client/patient relationship established as a prerequisite for all ELDU.

- You use Baytril® (fluoroquinolone) in an ELDU manner. Some drugs cannot be used as an ELDU. This group includes chloramphenicol, clenbuterol, diethylstilbestrol, fluoroquinolones, plus others.

- You treat your livestock with an ELDU and do not keep appropriate records. ELDU requires that you keep records that include animal identification, species, condition treated, drug name, dosage, duration of treatment, and specified withdrawal or discard times. These records must be kept for a minimum of 2 years.

If you think you could be in violation of ELDU, consult your local veterinarian. Violation could lead to legal proceedings.

References


Footbaths to Curb Lameness - Michigan Status

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In the February 1999 issue of the Michigan Dairy Review (MDR), we described a project that evaluated lameness in mid-Michigan dairy cattle. The on-farm portion of the study has been completed and a report of our findings on claw lesions appeared in the MDR, November 1999. In this issue, we report specific responses to the on-farm management survey concerning the use of footbaths.

Based on the responses, we have included a section in this article that reviews the proper use of footbaths. The on-farm management survey was administered by our veterinary field investigator (Dr. Leslie Fowler) to 95 dairy producers located within a 75 mile radius from Lansing, MI, that subscribed to the Dairy Herd Improvement Association recording system, and whose herd size was not less than 50, but not greater than 300 milking cows. Concerning the use of footbaths and treatments for lame cattle, the producers were asked the following questions.

1. Is a footbath used on your farm?
2. If, yes, where is the footbath located?
3. What product(s) is used in the footbath?
4. How often do you change the contents of the footbath?
5. Besides a footbath, are any other foot treatments used on a regular basis?

Responses to the above questions are given in Tables 1-4.

For all respondents except two, footbaths were located at the entrance to the milking parlor. For the two exceptions, the footbath was positioned in the exit alley.

Given the above responses, the following questions should be considered.

1. What types of foot problems are treated effectively by using a properly maintained footbath?

Footbaths are best used to treat, control and (or) prevent infectious causes of foot problems. These include papillomatous digital dermatitis (heel warts), interdigital dermatitis, and foot rot. Other causes of lameness such as sole ulcers, white line disease, abscesses, and hemorrhage in the sole are not caused by infectious agents such as bacteria. Finding these types of non-infectious lesions should prompt a producer to look at the environment and make assessment of the following: bunk space, number and comfort of free stalls, amount of time cows stand in the holding area, and condition of flooring. Also, many non-infectious foot lesions may indicate laminitis, which often is a result of a nutritional problem.

2. What products are effective for treatment of infectious causes of foot problems?

There is no one treatment that will be effective for all infectious foot diseases in all farms. For treatment of large numbers of animals, daily use of a properly maintained footbath can be very effective. Commonly recommended solutions for footbaths include formalin, copper sulfate, zinc sulfate, and various antibiotics including tetracycline and lincomycin. Extreme care should be exercised in handling and mixing of all of these agents to appropriate concentrations. Formalin is especially hazardous. Consult your local veterinary practitioner for proper concentrations. If treat-
ment of only a few animals is needed, or if several animals are severely affected, injectable antibiotics such as penicillin, tetracycline, sulfadimethoxine (Albon), and ceftiofur (Naxcel) have been used successfully. Also, topical sprays or foot wraps using iodine or tetracycline products may be effective as solo treatments, or in conjunction with injectable antibiotics. On some farms, a combination of the above may be needed. Consultation with your veterinarian concerning proper use of therapeutic agents is encouraged strongly to maximize treatment success and to minimize the possibility of antibiotic residues.

Whatever treatment is used, it is important to critically evaluate response to the treatment in individual animals and on a herd basis. Consider if the treatment is being used properly. For example, is the product in the footbath being mixed to provide the correct concentration? If an injectable drug is used, is the dose, frequency of dosing, and duration of treatment appropriate? From a herd standpoint, the following questions should be reviewed. Is the problem spreading? If so, can the affected animals be segregated from non-affected cattle to minimize spread? What are possible sources of the infection? Have there been recent additions of cattle to the herd? Are animals suffering foot injuries from stones or broken concrete that allow infections to develop?

3. How often should the contents of a footbath be changed?

It appears from our survey of mid-Michigan dairy producers that 65% changed their footbaths at least daily.

| Table 2. Types of products used in footbaths for treatment of lame cattle by dairy producers that use footbaths (n = 74).* |
|-----------------|----------------|
| **Product**     | **Number of Responses** |
| Copper sulfate  | 32              |
| Tetracycline    | 27              |
| Formalin        | 14              |
| Lincomycin      | 7               |
| Zinc sulfate    | 1               |
| Dish soap with salt | 1           |
| Peroxide        | 1               |
| Lime            | 1               |

*Respondents were asked to list all products, therefore, the number of responses is greater than the number of respondents.

Whether or not this is adequate can not be determined without additional information. For maximum effectiveness, regardless of the product used, the footbath needs to be as clean as possible. Herd size and size of the footbath, season of the year (rainy versus dry), time allowed for cattle to loiter in and soil the footbath, and use of a prebath to minimize contamination of the footbath are items that determine how frequently the solution should be changed. Regular use of a filthy footbath is likely to cause more problems than not using a footbath at all.

In summary, footbaths are best used to treat and control foot diseases arising from infectious causes. If your management system is such that proper location and maintenance of a footbath are not possible, alternative means of therapy should be pursued.

| Table 3. Types of therapies in addition to footbaths, that were used by 45 mid-Michigan dairy producers to treat lameness. |
|--------------------------------------------------|----------------|
| **Product**                                      | **Number of Responses** |
| Tetracycline (injectable)                        | 31               |
| Victory                                          | 14               |
| Tetracycline spray                               | 7                |
| Coppertox                                       | 4                |
| Naxcel (injectable)                              | 3                |
| Lincomycin (injectable)                          | 3                |
| Formalin (foot wrap)                             | 3                |
| Tetracycline (foot wrap)                         | 2                |
| Penicillin (injectable)                          | 1                |
| Albon (sulfadimethoxine)                         | 1                |
| Zinc (foot wrap)                                 | 1                |

*Listing of product names is for clarity only, and does not imply endorsement over similar products which may be equally effective. *Respondents were asked to list all the products that were used, therefore, the number of responses is greater than the number of respondents.

| Table 4. Producer responses (n = 71) for how frequently the contents of their footbaths are changed. |
|--------------------------------------------------|----------------|
| **Frequency**                                    | **% of Respondents** |
| After each milking                               | 25               |
| Daily                                           | 40               |
| After 3 milkings                                 | 13               |
| Every other day                                  | 11               |
| Every third day                                  | 8                |
| Once a week                                      | 3                |

NOTE: The Lameness Study was funded partially by the Michigan Animal Agriculture Initiative through the competitive grants program of the MSU Animal Industry Coalition.
Successful AI: Manage the Details - Part 2

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If conception rate in your herd is as high as you desire and if all of your calves are conceived from artificial insemination (AI), stop reading and move to the next article of interest. This article is the second in a series that focuses on the technical details of AI. A goal of this series is to guide you through a review of procedures for success with AI. It is suggested that you use this discussion as a check list. To insure that the review of your procedures is objective and critical, invite a neutral observer who is a specialist with AI to evaluate your procedures. If your technique differs from proven guidelines, you should make appropriate changes.

From the first article in this series (see Michigan Dairy Review, January 2000, p. 9), remember these points.

1. Your biggest opportunity to increase reproductive success in your herd is to increase heat detection rate, to inseminate more cows, and thus to increase pregnancy rate. Technique for AI should not be a major opportunity to increase reproductive success. But, be sure that AI technique does not limit success in your herd.
2. Maintain an accurate inventory of semen in the tank at your farm.
3. Manage the semen tank gently.
4. To remove semen from the tank and to thaw semen, follow instructions carefully.

This article will focus on removing semen from your tank and thawing semen.

A. AI Equipment

1. Non-disposable equipment should be cleaned after each use. Do not use soap.
2. Maintain reliable working condition of all equipment. Your equipment should include:
   a. straw cutter - keep clean and sharp;
   b. forceps designed specifically to grasp straws;
   c. spring clips to hold a canister up in the neck of the tank;
   d. insulated container to thaw semen; and,
   e. a thermometer.
3. Keep a spare of all critical equipment.

B. Removing Semen From the Tank

The upper 3 inches of the tank should be viewed as a danger zone for semen. This is because in the neck of the tank the temperature is too warm for semen to stay frozen and stable. Ice in semen is stable only when the temperature is colder than minus 112 degrees Fahrenheit. The problem is that the upper neck of a semen tank is too warm to stabilize the ice within the semen. Only those straws that will be removed from the tank should be raised into the neck of the tank.

Remember two things about frozen bull semen in straws. First, the large surface area of a straw will allow very rapid changes in the temperature of the small volume of semen. Second, ice in semen can be unstable even with no visible signs that the semen is thawing. Damage to sperm from unstable ice or from temperature abuse (hot or cold) is negative and permanent.

When the tank is open and canisters are lifted you should be adding or removing semen to the tank. You should not be lifting canisters or canes to search for semen. Your map of the semen tank for semen inventory should guide you immediately to the exact location of the desired semen (see Michigan Dairy Review, January 2000, p. 9).

1. Any canister elevated from the body of the tank must stay more than 3 inches below the top of the neck. The canister must be even lower in the neck if the tank is not filled completely with liquid nitrogen. A canister should not be held in the base of the neck of the tank for more than 15 seconds. When you lower a canister to the base of the tank, if you hear the liquid nitrogen boil and there is a cloud of vapor, you have elevated a canister too long or the tank needs liquid nitrogen.
2. Use a spring clip to hold canister while you lift the cane with one hand and grasp the straw with forceps.
3. Reach down into the neck of the tank with the forceps to grasp a straw. Forceps for straws are designed to allow you to reach down into the neck of the tank and to get a firm grip on a straw. Do not use fingers to remove straws from the tank. Fingers are too short, provide an uncertain grasp, and will start to thaw the semen at the point of contact. Also, forceps will avoid injury to your fingers from frost.
4. Retrieve the semen and lower the canister within 15 seconds.
5. Recap the tank as soon as possible.
6. Record semen used so inventory is current and correct.
7. Be sure that all equipment and your hands are clean!
8. Any individual straw that is removed from the tank should be used to inseminate a female within 15 minutes or should be discarded.

C. Thawing Semen

1. To thaw semen use an insulated container with a volume of at least 1 pint. Be sure that the container and water are clean.
2. Be sure that the water to thaw semen is at the proper temperature before you remove semen from the tank.
3. Before a straw is placed into the warm water, gently shake the straw to remove liquid nitrogen from the open end of the straw. When placed into warm water, even a tiny drop of liquid nitrogen in a straw can literally launch a straw out of the thaw cup or damage the straw directly. Either way the semen...
is ruined.

4. Temperature and duration for thawing.
   a. Follow the instructions of the company that packaged the semen. If specific instructions are not available, thawing semen in warm water (95 degrees Fahrenheit for 1 minute) is always a good choice. Do not thaw semen in your pocket or in a cow unless you are absolutely sure that the semen has been tested for this method. After thawing semen in warm water, the major risk is that the semen will cool while thawed. Therefore, take great care to maintain warm temperature of thawed semen. Because of the large surface area of a straw, slight changes in the temperature of the environment outside the straw can rapidly increase or decrease temperature of the semen inside a straw. To maintain a constant warm temperature for thawed semen requires that you are attentive to the environment that affects the straw directly, even if you are comfortable in shorts and a T-shirt.
   b. Check temperature of the thaw water with a thermometer. Do not guess! It is true that using a thermometer will consume some time. But, the few minutes that you save today by not using a thermometer could very easily cost the female that is inseminated an additional 21 days not pregnant and cost you another dose of semen.
   c. Check accuracy of your thermometer monthly or whenever the AI specialist is at your farm, whichever is more frequent.
   d. Maintain a spare thawing container and calibrated thermometer.

5. Be sure that equipment and hands are clean!

6. General considerations for thawing semen.
   a. If there are multiple animals to inseminate, it is tempting to thaw multiple straws at the same time. But, the recommendations are clear to thaw only 1 straw at a time and to deposit thawed semen within 15 minutes!
   b. If you do thaw multiple straws at the same time, use a large thaw vessel (one pint warm water per straw thawed) so that the water does not cool too fast and straws stay separated.

Summary

There are literally thousands of details that affect the success of AI. The challenge is to attend to many details while you recognize and apply these selected principles.

1. There are no details too trivial to ignore. Do not allow the routine of AI or distractions of other responsibilities to make you careless with any specific aspect of handling semen.
2. To perform AI procedures perfectly is not difficult and will not consume extra time. The time used to perform AI correctly will not reduce your time for other jobs and will not reduce your accomplishments for a day. Perform AI correctly now and make the first insemination successful for most cows!

If a cow or heifer does not conceive to AI, be sure that people and technique are not the cause. For continued success with AI you must be informed, you must take your time, and you must concentrate on the details!

References

come better scholars in their chosen endeavor or field of study.

Since Tuck came to Michigan State University in 1962, people have been the consistent and dominant theme of his professional and personal life. In describing Tuck, a colleague wrote: “Some faculty have graduate students in order to conduct research. In contrast, Dr. Tucker does research in order to train graduate students.” With guidance from Tuck, graduate and many undergraduate students fostered a love for learning, developed a passion for research, and became very attentive to the quality of their work. Many of these students are now successful and productive as researchers, teachers, and extension specialists at other universities, in industry, and even in other countries.

A Successful Mentor

Tuck was an especially successful mentor of students and faculty because he is the consummate teacher not only in the classroom, but also in a variety of other settings. Tuck always strived to be informed and energetic as a teacher. His concern about the quality of his performance was motivated by his pride and commitment to provide the best information to his audience. Despite all his years of experience, Dr. Tucker always practiced and sought critical review for an upcoming lecture or seminar. Whether the venue was classroom, office, group meeting, or large auditorium, Tuck’s chief motivation to teach was because he loved to share his knowledge and to see others learn. Okay, he liked to perform and to be the center of attention too!

In addition to undergraduate and graduate students, Dr. Tucker mentored many faculty at MSU. Much of the success of young and seasoned faculty, especially in research, has been due to guidance and advice from Dr. Tucker about logic, writing, critical thought, and understanding the significance of the research. Any person who has ever presented an oral or written proposal to Dr. Tucker has been asked or has seen scribbled in red ink across their grant:

“So what?”, “Why is this important?”, “I have no earthly idea what this means!”, “Irrelevant!”, or “Redundant!”. Sometimes there is an inspiring “Well written!” His criticisms occasionally evoked temporary rancorous behavior followed by a state of depression in many of us! However, we also knew that if we followed his advice that we would benefit by a well-delivered speech or that a successful grant was forthcoming.

Dr. Tucker is known and respected internationally as a basic scientist who has increased our understanding of how milk secretion from the mammary glands is regulated. His research philosophy was to study basic biological events to generate new knowledge that would further enhance performance of dairy cows. To be successful, basic scientists must be very focused on details and thus may develop a narrow perspective. Indeed, some scientists lose sight of the application of the new knowledge they generate. But, explaining the significance of the results of basic research to the dairy industry was always very important to Tuck. He believed it was never acceptable to do research just because you had a certain new research tool or because it would be interesting to “peek under that rock” or to “go fishing”. Indeed, Tuck made it his “business” to remind other scientists and students that they must understand and be motivated by the significance of the research to the real world. A speaker or grant writer usually failed Tuck’s “so what” test just one time!

“Mr. Nice Guy”?

Many of us have spent unpleasant moments in the presence of Dr. Tucker. Some have even argued that Dr. Tucker was not “Mr. Nice Guy”. However, Tuck was never concerned with popularity. Rather, his long-standing goal was to train people to become independent thinkers by encouraging them to think critically, to explain their results clearly, and to be able to defend what they said. While the trips to Tuck’s “woodshead” could be painful at times, as already mentioned, these experiences were motivated by honesty, fairness, and his sincere commitment to help us all develop as independent scientists and professionals.

Although he was employed fully with his responsibilities to do research and to teach mammary physiology, Dr. Tucker also fulfilled many civic responsibilities at MSU. For example, when asked to participate in activities for youth he almost always accepted. These activities included judging 4-H Science Projects and especially the 4-H Dairy Quiz Bowl. We estimate that in the 26-year history of the 4-H Dairy Quiz Bowl at MSU, Dr. Tucker has been a moderator or judge at least 23 years. With the young participants in these events Dr. Tucker was always positive, constructive, entertaining, and when appropriate he was instructive. In these roles with youth he was a powerful troubadour for MSU and science. In addition, he served on many guidance committees for graduate students, many committees for academic governance, selection committees to hire new faculty, and various advisory groups. Independent of the group or venue, Tuck stayed grounded but looked with vision into the future. The presence of Dr. Tucker was always evident because of his ability to grasp “the nub of the matter”, to ask critical questions, and to pose viable solutions. His general approach to this type of service is like the sign on his door, “Do not bring me problems. Bring me options”.

Outside of MSU, Dr. Tucker has served on editorial boards in various roles for several scientific journals and he has served on federal panels to review grant applications for research. Through these efforts, Dr. Tucker has helped sustain and enhance the quality and quantity of research to benefit the dairy industry, the Department of Animal Science, and the image of MSU.

Throughout his years in basic research to study hormonal control of lactation, Dr. Tucker maintained an avid interest in practical aspects of dairy farming. He coauthored a textbook, “Dairy Cattle: Principles, Practices, Problems, Profits”,

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that is still the best available. Sadly, this book will not be revised again, at least not by Dr. Tucker. For topics related to his expertise, it was common for Dr. Tucker to give presentations to farmers or industry groups three to five times annually. When the idea for Michigan Dairy Review was proposed in 1995, it was not a surprise that Dr. Tucker accepted the request to serve as its editor. A large measure of the vitality, diversity of topics, excitement of authors to contribute, and the quality of the final articles is due to Tuck’s influence.

From these general comments, it should be obvious that as a professional Dr. Tucker made major contributions to MSU, to dairy science, and to the dairy industry. Here are some tangible examples.

- He authored or coauthored more than 355 scientific articles.
- He was the major advisor for 45 graduate students, post-doctoral trainees, and visiting professors.
- He was awarded over $4.5 million for competitive grants to conduct research.
- He received MSU’s Distinguished Faculty Award.
- He has received numerous major national awards from the American Dairy Science Association and the American Society of Animal Science including the Casida Award for excellence in graduate training, and the Morrison Award, the Borden Award, the Upjohn Physiology Award, and the Cyanamid Animal Physiology & Endocrinology Award for excellence in research and contributions to these professional societies.
- In addition to professional success, Tuck has been married to Ann for over 40 years! Their three sons were all Eagle Scouts and now have their own very successful careers.
- Despite all the aforementioned accomplishments, we believe Tuck will be most remembered and appreciated for his unflagging attention to the growth, development and success of others. He has set the standard for the next generation of faculty at MSU.
- We also are pleased to have this opportunity to acknowledge and review some of Tuck’s achievements. On a personal note, Fogwell and Ireland are especially thankful that daily and directly for the past 23 years we had the opportunity to be influenced by Dr. H Allen Tucker!

We are also very happy to announce that during his retirement Tuck has agreed to continue to edit the Michigan Dairy Review and he will continue to assist the faculty in our Department to write grants. Always the teacher!

Thanks Tuck for showing us all the “light”!

Authors’ note: In contrast to our normal process, Dr. Tucker did not review or even see this article before publication in Michigan Dairy Review. Thus, any limitations to our presentation or challenges to you readers are because Dr. Tucker did not have an opportunity to improve our writing.

Dairy Science - Education and Career Options

Pam Jahnke
Dept. of Animal Science

There is no time like the present for high school juniors and seniors to decide which college to attend. If students are inclined to study animal science with a dairy emphasis, there are a wide variety of 4-year and 2-year curriculum options offered within the Department of Animal Science at Michigan State University.

Within the animal science major in the 4-year Bachelor of Science (B.S.) program, there are three curriculum options from which students can choose: agribusiness management, science, or pre-veterinary medicine. Students in any of these options can focus on a specific species, including dairy or beef cattle, goats, horses, poultry, sheep, or swine.

Upon graduation, agriculture opportunities are not limited to farming. Rather, most jobs are in other agricultural sectors, notes Miriam Weber, assistant professor and coordinator of the 4-year dairy management program.

“The programs at MSU offer the chance for students to see new and different ways of dairying,” says Weber. She and other representatives of the Animal Science Department visited several Michigan high schools this winter to meet with prospective students.

Weber also stated, “Our undergraduate program and extracurricular activities build on a strong tradition of dairy science education at MSU.” For example, the management option prepares students for careers in managing livestock operations or for careers involving interaction with farm managers. The science option is designed for students preparing for graduate study and careers in research. However, those students wishing to pursue a career in veterinary medicine - working with farm and food-producing animals - can complete the science course requirements for admission to the MSU College of Veterinary Medicine, while completing the requirements for the B.S. degree with a major in animal science. In addition, graduation requirements include other department, college, and university courses designed to provide a well-rounded educational experience.

In the 2-year Ag Tech Dairy Management Program, students learn various aspects of dairy and business knowledge and skills, and exposes students to as many people and ideas as possible, says Joe Domecq, the program coordinator. This program is part of the Institute of Agricultural Technology at MSU. Areas of study include dairy herd management,
Two-Year Dairy Management Program
A practical approach to learning with an emphasis in dairy production & management. This program is designed to prepare students for all aspects of the industry including business, feeding, breeding, and herd health.

Four-Year Animal Science Major
Bachelor of Science degree program offering options in dairy agribusiness management, science and pre-veterinary emphases. Plans of study are constructed to fit individual interests. Areas of study include physiology, dairy products, breeding and genetics, nutrition and herd management topics.

Dairy Associates Program
An extension of the classroom experience to allow hands-on application of basic principles of dairy production to real-life situations.

High School Preparation
Before students are accepted into MSU, several requirements must be met. Students are admitted to the 4-year program at MSU on the basis of grades, the quality of their high school program, test scores, performance trend, and personal comments from advisors.

Typical students range in age from 18 to 22.
Throughout their academic career, both 4- and 2-year students build contacts with professors, extension specialists, industry representatives, and producers in classes, extracurricular activities, and at regional and national dairy conferences, said Weber.

2. Three years of mathematics, including completion of intermediate algebra.
3. Three years of social science with at least 1 year of history and 1 year in areas such as sociology, anthropology, economics, geography, government, political science, and psychology.
4. Two years of college preparatory science from the disciplines of biology, chemistry, physics, and earth science.
5. Two years of one foreign language.

For the Ag Tech Dairy Program, high school preparation should be a balanced program in the student’s area of interest along with taking classes in writing, speaking, mathematics, biological sciences, vocational agriculture and computers. There are no specific course requirements for admission to the Ag Tech program. A high school diploma with at least a C or
greater grade point average (GPA) is required along with some experience in dairy production. ACT or SAT scores are not required, Domecq explained.

Last year’s 33 incoming 4-year animal science students had an average high school GPA of 3.51 on a 4.0 scale. Average test scores were 24.3 for the ACT, 573 for the SAT math score, and 557 for the SAT verbal score. There are 280 undergraduate animal science students, and about one half of those arrive at MSU through internal transfer from other majors within the university. Pre-veterinary majors who are not admitted to veterinary school after the first 2 years at MSU often change to a major in animal science, Weber noted.

**Extracurricular Activities**

Although no one can underestimate the value of academic preparation, extracurricular activities should not be overlooked. Community involvement, academic honors, and membership in groups such as breed organizations, 4-H clubs, and FFA chapters are important assets to MSU applicants.

Personal experience in working on a farm, family farm or otherwise, is another plus. A “wide variety of experience and leadership-type skills” will result in a “well-balanced and well-rounded” person. “It’s not any one thing that’s going to get it done,” Domecq said.

After arriving on campus, students are encouraged to join a student organization related to animal science such as the Dairy Club, which sponsors visits to dairy facilities across the country, or the MSU Dairy Judging Team.

**Application Deadline**

Ideally, when a student is a senior he or she would meet with their high school counselor when school resumes in September, so the application can be mailed from the high school. The application deadline is normally 30 days prior to the beginning of the semester. However, the deadline is subject to change without notice because in recent years there have been more qualified freshmen than available spaces for all 4-year programs at MSU. The application and nonrefundable $30 processing fee must be received before the deadline. Once the required materials have been submitted, notification of acceptance to MSU will occur within 4 to 8 weeks. In the 2-year program, students need to turn in applications by August 1 for the upcoming fall semester. Early application to both the 2- and 4-year program is encouraged and is important to the process of obtaining financial aid.

**Financial Assistance**

Many scholarships are available for animal science students in the 4-year program and the Ag Tech Dairy Program. One-quarter to one-third of the students in both programs have scholarships ranging from $500 to 1 year of full tuition. Some of the scholarships include the Michigan Dairy Memorial Scholarship, Glenn Lake Scholarship, Carl Rossman Award, Lee J. and Grace Ashley Scholarship, Bashian Endowed Scholarship, Clark L. Brody Scholarship, Centennial Farm Association Scholarship, For-Mar Scholarship Fund, Milk Marketing Inc. Scholarship, Eliza Rossman Scholarship, the Kenneth Kingsley Smith Memorial Scholarship, and more. Michigan Milk Producers Association and Michigan Dairy Herd Improvement Association provide scholarships specifically for 2-year students. Applications and more information are available in the Animal Science Undergraduate Student Affairs Office in Room 1250, Anthony Hall or the CANR Student Affairs Office in Room 121, Agriculture Hall.

**Career Opportunities**

About 48,000 jobs are created annually for college graduates with expertise in agriculture and related industries, according to a recent United States Department of Agriculture report. “We’re not producing enough graduates to fill the available jobs at this point,” Weber said. In fact, she predicts several job opportunities will be available for each graduate. Areas in great need of students include the service industries that provide information to dairy producers.

When their studies are completed, students have several options ranging from entering veterinary school, returning to work on the family farm, pursuing careers in genetics or nutrition-related industries, or attending graduate school, Domecq and Weber noted. Other job possibilities include communication and service organizations, and extension.

**For More Information**

For more information regarding MSU dairy educational programs, contact Dr. Miriam Weber at (517) 432-5443, or at msw@msu.edu or Dr. Joe Domecq at (517) 353-7855 or at domecqjo@msu.edu. Both are available to visit high schools or meet with student groups to discuss MSU programs.

**Dairy Judging Teams Wrap Up Successful 1999**

Joe Domecq
Dept. of Animal Science

Members of the Michigan State University Collegiate and Ag Tech Dairy Judging Teams and over 25 Michigan youth members spent many summer and fall weekends visiting farms and judging cows in preparation for the fall judging season. The teams visited farms in Michigan, Ohio, Indiana, Wisconsin, and Ontario, Canada and also worked out at the Genesee and Shiawasee County Fairs and the Michigan State Fair. All of the practice and preparation paid off as the state of Michigan was successfully represented in three national contests. For the first time in many years, all three youth teams placed in the top ten overall in each national judging contest.
All-American Dairy Show

The first contest of the year was the Pennsylvania All-American Dairy Show in Harrisburg, PA. The MSU Collegiate team members were Ben Church (Tecumseh), Dana Kirk (St. Johns), and Sarah Smuts (Charlotte). The team placed 4th in Holsteins and 10th overall. Michigan 4-H was represented by Fred Ludwig (Fosteria), Beth Munsell (Fowlerville), and Sarah Poling (Addison). This team placed 10th overall and Sarah was 12th overall. In addition, a second youth team, comprised of Michigan FFA members, competed in the FFA division of the contest to gain experience for future contests. Team members included Gina Blough (Lowell), Brandon Delong (Fremont), and Bobbie Jean Meyer (Byron Center). This team placed 5th in Brown Swiss and Holsteins and 6th overall. Brandon was 2nd in Brown Swiss, 4th in Ayrshires, and 10th overall. Bobbie was 11th overall.

World Dairy Expo

In late September, the Collegiate, Ag Tech, and youth teams traveled to Madison, WI for the national contest at World Dairy Expo. Ag Tech team members included David Bennett (Mayville), Carrie Dillon (Jerome), Matt Dillon (Jerome), and Beth Lozmack (Galién). Michigan 4-H was represented by Attie Hardy (North Adams), Betty Jo Meyer (Byron Center), Ann Munsell (Fowlerville), and Allan Sickner (Otter Lake). The Collegiate team placed 8th in Ayrshires, 14th in Brown Swiss, 15th in Guernseys and 19th overall. Dana placed 7th in the linear evaluation portion of the contest. The Ag Tech team placed 5th in Ayrshires, 4th in Brown Swiss, 5th in Jerseys, 2nd in Guernseys, 5th in reasons, and 4th overall. The MSU Ag Tech team has placed in the top five in this contest 7 out of the last 8 years and is the only junior college team in the country with this record. Individually, David was 2nd in Jerseys, 4th in Holsteins, and 5th overall. Beth placed 9th in Ayrshires, 5th in Holsteins, 10th in Guernseys and 8th overall. The Michigan 4-H team had an outstanding day placing 9th overall in the 34-team youth contest. They were 4th in Ayrshires, 1st in Brown Swiss, 3rd in Guernseys, and 10th in reasons. Attie was 4th in Brown Swiss and 10th overall; and Betty Jo was 1st in Ayrshires, 3rd in Brown Swiss and 12th in reasons.

The Collegiate, Ag Tech, and youth teams participated in the practical contest at World Dairy Expo. This contest consists of three sections. The first section is evaluating and selecting bred heifers for commercial use based on price, health status, and production records. Team members evaluate body condition, feet and legs, udder promise, and estimate body weights and heights. Appropriateness of service sires also is evaluated. The second part of the practical contest involves evaluating a group of registered heifers (including pedigrees and genetic values) and determining economic values of the heifers. Finally, team members performed linear evaluation on six cows. The practical contest is new at World Dairy Expo and offers team members an opportunity to utilize practical knowledge and to experience some aspects of commercial cattle evaluation. The 4-H team was 3rd in the linear evaluation, 9th in registered heifers, and 8th overall. The Ag Tech team was 9th in linear evaluation, 3rd in registered heifers, 8th in commercial heifers, and 6th overall. Finally, the collegiate team was 6th in linear evaluation, 1st in registered heifers, and 5th overall.

International Exposition

The final contest of the year was held at the North American International Livestock Exposition in Louisville, KY. The collegiate team placed 15th overall, and Sarah Smuts was 7th in Ayrshires. The Ag Tech team was 2nd in Holsteins and 6th overall. Beth Lozmack was 6th in Guernseys and 3rd in Holsteins. David Bennett was 9th in Holsteins. The 4-H team members were Calby Garrison (Onsted), Andrew Gust (Manitou Beach), Honor Howe (Fremont), Michelle Reed (North Adams), and Carl Sickner (Otter Lake). This team was 2nd in Guernseys, 4th in Holsteins, 9th in Jerseys, 8th in reasons, and 8th overall. Carl was 3rd in Guernseys, Andrew was 7th in Holsteins, Calby was 9th in Holsteins, 4th in Jerseys, 10th in reasons and 7th overall.

The Michigan 4-H teams are selected from the top 25 individuals at the state judging contest held during Michigan Dairy Expo in July. These individuals are invited to participate in several workouts during August, and the teams for each contest are selected at the end of August. All 4-H youth are invited and encouraged to participate in the contest at Michigan Dairy Expo and tryout for one of the state teams. The Collegiate and Ag Tech team members are selected from students at Michigan State University who have completed a judging course and have been part of the judging program during their education at MSU. ABS Global, United Dairy Industry of Michigan, Northstar/Select Sires, Department of Animal Science, and Michigan Holstein Association provide financial support for the MSU Dairy Judging Program. Team members also participate in fund raisers throughout the year, including the Spartan Spectacular Calf Sale.

The MSU Dairy Judging Program extends appreciation to all of the individuals, farms, and agricultural businesses that support the Program by providing cattle, expertise, and financial support. Special thanks go to assistant coaches, Mrs. Sara Macrae-Long, Mrs. Sarah Black, and Mr. Adam Shafer, former MSU Dairy Judging team members. The MSU Dairy Judging Program is coordinated by Dr. Joe Domecq.

Look for MDR on the Web

Milk Market Update

Christopher Wolf
Dept. of Agricultural Economics

1999 Finishes on a Low Note

With most of the information for 1999 now available, the average milk price level was high. However, as in most recent years, the milk price was quite variable in 1999. The blend price in Michigan spent most of 1999 climbing back from the precipitous drop that began the year (Figure 1). The most recent drop, which occurred in the basic formula price in November 1999, is not represented in this figure. As usual, the premium offset some of the variability in the blend price of milk, increasing when prices declined.

The story behind the variability in the milk price lies in national production and stor­able stocks, such as cheese and butter. Total 1999 Michigan milk production was 5.455 billion pounds which represented a 1.7 percent increase over 1998. In general, Michigan milk production has been relatively steady in recent years (Figure 2). A peak in April and May is the normal spring flush of milk. The valley in February’s milk production occurs because the month is shorter, and the effects of winter result in decreased milk production. The number of milk cows in Michigan rebounded some­what in 1999, but was still below previous numbers (Figure 2).

Total U.S. milk production in 1999 was up 3.4 percent compared to 1998 (Table 1). This increase is the culprit in the recent drop in milk price. U.S. milk cow numbers were constant from 1998 to 1999 so that the increase in milk production was due to increased productivity per cow. Barring severe weather events, this increased level of national milk production is projected to confirm the dismal milk price forecasts for 2000.

The next installments of the Michigan Milk Market Update will use the new pricing system that was part of the milk marketing order reform. The key changes of this reform are discussed below.

Reformed Milk Marketing Orders

January 2000 marks the first month under the reformed milk marketing orders. The major changes of the reform that affect Michigan milk prices include the following.

• Consolidation of orders. The former 31 federal orders now number 11. Michigan formerly had two orders, one in each peninsula. These Michigan milk marketing orders (numbers 40 and 44) merged with orders in Ohio, Indiana, western Pennsylvania, northern Kentucky, and parts of West Virginia. The new order is the “Mideast” order (number 33). The only exception is the Upper Peninsula counties that border Wisconsin are included in the “Upper Midwest” order.

Figure 1. 1997-99 Blend milk price and premium in Michigan.

Figure 2. 1997-99 Milk production and number of milk cows in Michigan.

<table>
<thead>
<tr>
<th>Year</th>
<th>Milk cows (thousands)</th>
<th>Milk/cow (lb)</th>
<th>Total milk production (million lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>9,351</td>
<td>16,505</td>
<td>154,331</td>
</tr>
<tr>
<td>1997</td>
<td>9,258</td>
<td>16,915</td>
<td>156,602</td>
</tr>
<tr>
<td>1998</td>
<td>9,154</td>
<td>17,189</td>
<td>157,348</td>
</tr>
<tr>
<td>1999</td>
<td>9,156</td>
<td>17,771</td>
<td>162,711</td>
</tr>
</tbody>
</table>

Source: “Milk Production,” National Agricultural Statistics Service, USDA.

• **Uniform classification of milk.** The previous system had three or four classes of milk depending on the order. The new system has four classes in all orders. Where class I is fluid, class II is soft dairy products (e.g., ice cream), class III is cheese, and class IV is butter and nonfat dry milk.

• **The Basic Formula Price (BFP) was replaced.** The former pricing system based all minimum prices off of the BFP. The new system uses the higher of either class III or class IV to establish the base price for class I and class II prices.

The effects these changes will have on Michigan dairy producers are mixed.

• **Fluid utilization is the ratio of fluid milk to the total amount of milk marketed.** Because fluid milk generally receives the highest price, higher fluid utilization means higher blend prices for dairy producers. Consolidation of orders increased fluid utilization for Michigan farmers that were in the Southern Michigan order, but decreased the fluid utilization for farmers in the Upper Peninsula. The new Mideast order includes several cities such as Cleveland, Cincinnati, Columbus, Indianapolis, and Pittsburgh. Fluid utilization in the previously existing orders south of Michigan was around 60% prior to consolidation. Southern Michigan had a fluid utilization often below 50%, so the utilization increased meaning a higher blend price. For example, in January, 2000, the fluid utilization of the Midwest order was 52% whereas the December 1999 Southern Michigan order fluid utilization was 47%. Conversely, the fluid utilization in the Upper Peninsula in December 1999 was 84% so those farms realized a decline in fluid utilization.

• **The creation of “new” class IV is a change in name only for Michigan dairy producers because both Michigan orders had separate butter and cheese classes (in class III and class III-A under the old order system).**

• **The new base price, also called the “advance” price, was projected to be slightly lower than the old BFP.** Bob Cropp, agricultural economist at the University of Wisconsin, advises that farmers should plan for the new price to be 20 to 30 cents per hundredweight (cwt) lower than the old system. However, he also notes that we need to see how the market participants adjust. Recent calculations by the USDA point out that in 1999, the new prices would have been higher than the old prices about half the time. For example, the base price would have been over a dollar higher than the BFP was in November and December 1999 if the new system had been in effect.

With some pluses, including higher class I utilization, and potential minuses, including the new base price, the results for Michigan dairy producers are not clear at the present time.