Foot-and-Mouth Disease: A Biosecurity Wake-up Call

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Foot-and-mouth disease (FMD) is a severe, highly infectious viral disease of cloven-hooved animals including cattle, sheep, swine and goats. FMD is not considered a significant health risk for humans although rare cases of mild flu-like symptoms and vesicles (blisters) developing on the hands, feet or mouth have been reported (1).

The United States has been free of FMD since 1929. However, the disease is endemic in many places including countries in Asia, Africa, and South America. Until the recent outbreaks in the United Kingdom, Europe had been considered free of FMD (Table 1, page 2). Foot and mouth disease is not only devastating to the health of affected animals, it also can result in catastrophic economic effects through loss of international markets. Countries where FMD is present are significantly restricted in the international trade of livestock and livestock products. It is estimated that an outbreak of FMD in the United States could cost over 1 billion dollars to control and in lost trade revenue.

The Virus

FMD is caused by a virus that is a member of the Picornoviridae family of viruses. There currently are seven known serotypes of the virus (O, A, C, SAT1, SAT2, SAT3, Asia1) and over 60 different subtypes with different degrees of virulence associated with each strain. Immunity to one serotype is not protective against infection by another serotype. The virus is capable of surviving in the environment for days to weeks under favorable conditions. However, it is readily inactivated by heat, UV light, disinfectants or environments where the pH is < 6.0 or > 9.0.

Signs of The Disease

In animals, the disease is characterized by fever (104-106°F) and blister-like lesions (vesicles) on the tongue and lips, in the mouth, on the teats, and between the hooves. The vesicles may rupture leaving painful open sores. The vesicles and subsequent erosions result in excessive salivation and significant lameness. Severe cases may result in sloughing of large areas of tissue from the hoof wall or tongue. Secondary bacterial infections may develop and complicate recovery. Many affected animals recover, but the disease may leave them debilitated by chronic lameness, mastitis, and inability to gain and maintain weight. Affected animals rarely return to their previous level of productivity. FMD is diagnosed by the recognition of the common signs and by identifying virus in tissues from affected animals. FMD must be differentiated from other diseases of cattle that produce lesions, which resemble those of FMD (summarized in Table 2, page 2.) Cattle, sheep, goats, or pigs with blister-like lesions or open sores involving the mouth or feet should be brought to the immediate attention of a veterinarian.
Transmission of FMD

Animals, people, or materials that bring the virus into contact with susceptible animals can spread FMD. Historically, the most common documented source of FMD outbreaks is the feeding of meat scraps contaminated with the virus to susceptible animals, often swine (2). After infection with the virus, an incubation period of 2-14 days occurs before signs of the disease appear. This facilitates the initial spread of the disease due to movement of animals harboring the virus prior to showing signs of disease. Other reported causes of virus transmission include the following: people wearing contaminated clothes or footwear; contaminated equipment coming in contact with susceptible animals; use of contaminated facilities or vehicles to hold or move susceptible animals; exposure of susceptible animals to materials such as hay, feedstuffs, hides, or water sources contaminated with the virus; vaccines contaminated with live FMD virus; and insemination with semen from an infected animal.

Under appropriate conditions, FMD virus can survive in animal derived products such as chilled, frozen or cured meat, unpasteurized milk products, bone meal, and animal hides. The virus also can survive long enough and in high enough concentrations to be spread through air currents. Spread of the disease up to 62 miles has been documented (3). Physical spread of the virus by other animals, such as birds, is possible. Animals that recover from foot and mouth disease can become carriers of the virus. FMD virus has been recovered from infected cattle for 50 days, infected sheep for 90 days and infected swine for 300 days after experimental challenge (4). People exposed to FMD infected animals can carry the virus in their mouth and throat for up to a week and may serve as a vehicle for virus transmission.

Control and Prevention

Many factors are considered in determining the FMD control procedures in a given area. Eradication, vaccination or a combination of the two are commonly used to control FMD. In countries where the disease is common, eradication is seldom practical. In countries free of FMD, slaughter of all affected and in-contact susceptible ani-

Table 1. Foot-and-mouth disease (FMD) initial outbreaks recorded by country for 2000-2001. Until the recent outbreaks in the United Kingdom, Europe had been considered free of FMD.

<table>
<thead>
<tr>
<th>Countries</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Netherlands</td>
<td>March, 2001</td>
</tr>
<tr>
<td>France</td>
<td>March, 2001</td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>March, 2001</td>
</tr>
<tr>
<td>Scotland</td>
<td>March, 2001</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>March, 2001</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>March, 2001</td>
</tr>
<tr>
<td>Great Britain</td>
<td>February, 2001</td>
</tr>
<tr>
<td>Taiwan</td>
<td>February, 2001, 2000</td>
</tr>
<tr>
<td>Swaziland</td>
<td>December, 2000</td>
</tr>
<tr>
<td>Tanzania</td>
<td>December, 2000</td>
</tr>
<tr>
<td>Pakistan</td>
<td>Fall, 2000</td>
</tr>
<tr>
<td>Uruguay</td>
<td>October, 2000</td>
</tr>
<tr>
<td>South Africa</td>
<td>September, 2000</td>
</tr>
<tr>
<td>Brazil</td>
<td>August, 2000</td>
</tr>
<tr>
<td>Colombia</td>
<td>August, 2000</td>
</tr>
<tr>
<td>Paraguay</td>
<td>August, 2000</td>
</tr>
<tr>
<td>Greece</td>
<td>July, 2000</td>
</tr>
<tr>
<td>Namibia</td>
<td>July, 2000</td>
</tr>
<tr>
<td>Zambia</td>
<td>June, 2000</td>
</tr>
<tr>
<td>Malawi</td>
<td>June, 2000</td>
</tr>
<tr>
<td>Kazakhstan Tajikistan</td>
<td>Spring, 2000</td>
</tr>
<tr>
<td>Egypt</td>
<td>April, 2000</td>
</tr>
<tr>
<td>Kuwait</td>
<td>April, 2000</td>
</tr>
<tr>
<td>Russia</td>
<td>April, 2000</td>
</tr>
<tr>
<td>Uganda</td>
<td>April, 2000</td>
</tr>
<tr>
<td>Japan</td>
<td>March, 2000</td>
</tr>
<tr>
<td>Kenya</td>
<td>March, 2000</td>
</tr>
<tr>
<td>South Korea</td>
<td>March, 2000</td>
</tr>
<tr>
<td>Mongolia</td>
<td>February, 2000</td>
</tr>
<tr>
<td>Turkey</td>
<td>February, 2000</td>
</tr>
<tr>
<td>China</td>
<td>January, 2000</td>
</tr>
<tr>
<td>Malaysia</td>
<td>January, 2000</td>
</tr>
</tbody>
</table>

Table 2. Diseases of cattle with lesions similar to foot-and-mouth disease.

<table>
<thead>
<tr>
<th>Disease and Agent</th>
<th>Species Affected</th>
<th>Lesions</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papular Stomatitis (Poxivirus)</td>
<td>Cattle</td>
<td>round, dark red, raised; found on muzzle and in mouth</td>
<td>common in younger cattle</td>
</tr>
<tr>
<td>Bovine Viral Diarrhea Virus (BVDV)</td>
<td>Cattle</td>
<td>oral erosions, diarrhea</td>
<td>most common in mucosal disease form of BVDV</td>
</tr>
<tr>
<td>Malignant Catarhal fever (Herpesvirus)</td>
<td>Cattle</td>
<td>severe oral erosions, ocular discharge, diarrhea</td>
<td>sporadic</td>
</tr>
<tr>
<td>Blutongue (Orbivirus)</td>
<td>Cattle, Sheep</td>
<td>oral erosions, swelling of lips, nasal and ocular discharge</td>
<td>rare in cattle</td>
</tr>
<tr>
<td>Vesicular Stomatitis</td>
<td>Swine, Cattle, Sheep, Horses</td>
<td>vesicles in mouth</td>
<td>not present in USA</td>
</tr>
</tbody>
</table>
Farm management today is much different than when I was a boy. In the past, the majority of managers worked with cows, whereas today most manage people. In reality, most farmers manage their business, their cows, through management of people. This also is true for small dairy operations as they involve paid and unpaid family members. And working and communicating with family members is just as important as with hired employees. The Michigan dairy industry has identified human resource management and people skills as an important educational area, and therefore, we shall be writing a series of articles in the Michigan Dairy Review to help individuals assess and improve their people management skills.

NOTE: This is a first in a series of articles on human resource management and people skills. The Michigan dairy industry has identified people management skills as an important educational area, and, therefore, the MSU Dairy Team will be writing a series of articles in the MDR to help individuals assess and improve their people management skills.
success of our businesses. Therefore, one of the questions we might ask ourselves is how good are our people skills and how well do we use those skills to accomplish the day-to-day and long-term direction of our business?

Two goals for this article are to outline the value of people management skills and provide you an opportunity to assess your management skills, which include planning, organizing, staffing, directing people, and controlling business performance (3). This self-assessment (see pages 5 and 6) may lead you to identify areas in your management skill set that you may be able to improve.

The Five Management Skills

Five management skills are briefly explained below. Please keep in mind that all five have an influence on how well we manage people.

Planning involves identifying a set of objectives, goals or tasks that you wish to accomplish and setting a time-line to accomplish them. In establishing good plans, you many involve others in the planning process, particularly those who may be involved in carrying out the plans. This tends to build ownership and provides outside thinking. One of the secrets of planning that Steven Covey, author of “7 Habits of Highly Effective People”, promotes is to “start with the end in mind”(2).

Organizing refers to taking a plan, a set of short-term goals, or a set of tasks to be done and mapping out the who, what, when, and where.

Staffing involves recruiting, hiring and training the right person for the right job. This means matching the needs of the job with the skills or skill level of the individual. Staffing involves appraising employees or potential employees that may or may not have the skills or personality to work in a particular position. Staffing includes planning compensation for employees and yourself. Staffing also includes evaluating how well employees perform, providing them feedback on their success in accomplishing tasks and goals, and making corrections when needed.

Directing involves encouraging yourself and your employees. It involves communicating specific tasks, instructions, sets of responsibilities, expectations, and motivating employees and family members. Directing requires an understanding of communications, motivation, people and their behavior. Effective directing means all people involved, family and hired employees, carry out tasks with enthusiasm, and with a clear idea of their place in achieving the goals of the business. Feedback is encouraged!

Controlling performance of the business involves observing responses to changes, i.e., keeping tabs on the progress of your business. Controlling involves comparing what’s been done with what you want to accomplish relative to profitability, milk production, herd health, reproductive performance, and employee performance, for example. Comparisons may be made with set standards; then action is taken when standards are not met.

People Management Skills

People are a resource. People are one of the resources necessary to manage a dairy operation. The quality, skill level, training and how we manage this resource obviously influence success of the business. As with most inputs, you will likely pay more for higher quality employees, but business performance probably will be enhanced. With family members and employees, you are leveraging your time by working through others. As herd sizes continue to increase, human resources involved in most dairy businesses will increase.

Managing cows through people. At Michigan State University, we write a lot of technical articles and teach students how to “best” manage cows, but this doesn’t just happen. Even though you have the technical skills, you have to enact your plans through people. This includes the day-to-day routines, seasonal activities and special projects. For example, you may have a family member or employee responsible for feeding the lactating cows. There are certain procedures that you want this individual to follow. Your ability and patience to communicate these procedures will affect the results. Obviously, the skill level and attitude of the individuals will have bearing on the results. They need to communicate back the status of their efforts and what they don’t understand. If they aren’t meeting your expectations, then you need to do some coaching. This may involve additional training or discussion about the procedures and reasons for the procedures to provide a better understanding of what you want them to accomplish. Your goal is to work with the individuals so that the day-to-day routine is done correctly.

Managing people presents a challenge to many of us because we have little or no formal training in this area. Even those that graduate from college with technical skills are not necessarily trained to manage people or themselves. So most of us learn our people skills on the job. And some personality types do better than others at managing people. If you are not one of those types who more easily manage people, take heart, there are ways to learn how to better work through people.

Managing Yourself First

Managing yourself first. Managing people starts with managing yourself and knowing where you want to take your business. Managing yourself involves setting business goals, developing a set of responsibilities and tasks for yourself and identifying responsibilities that you will delegate to others. It involves prioritizing tasks and organizing your time to complete these responsibilities daily, weekly or in some other time frame, then monitoring your progress. So managing yourself involves time management skills. It also includes understanding your personality, including your strengths and weaknesses that can be assessed from The Management Skills (Please see page 7)
The Management Skills Inventory
The Management Skills Inventory can help producers understand the strengths and limitations of their management style. This is not a judgment on how well a producer can manage, but an understanding of how management style can affect your ability to attain goals. Taking the Management Skills Inventory can help you become more aware of the strengths and weaknesses you have as a manager. *The following Management Skills Inventory is reproduced with permission from ProDairy, Cornell University Cooperative Extension.*

Please indicate the extent to which you agree or disagree with the statements on the following pages, answering 1 (strongly disagree) through 5 (strongly agree).

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The goals and objectives of my business are clear and frequently written.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>Everyone working with me has very clear responsibilities, and I frequently write down those responsibilities.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>I can clearly tell if someone is doing a good job and why they are doing well.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>People I work with put in 110% effort to get the job done.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>I regularly match daily performance against standards I have set.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>Given several things to choose from, I find it is difficult for me to make the right choice.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7.</td>
<td>Major problems within the business are the owner’s responsibility.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8.</td>
<td>Evaluating people’s skills and their ability to fit into the jobs is difficult for me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>Motivating people is something I do not do well.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10.</td>
<td>People who work with me don’t control themselves and need a boss to do it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11.</td>
<td>The big picture and the details are very clear to me. I know where I’m going and how to get there.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12.</td>
<td>I have clear procedures for routine chores.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>13.</td>
<td>I plan and carry out good training for everyone working for me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>14.</td>
<td>I know when to let someone else take over a job and do it his or her way.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>15.</td>
<td>The quality and quantity of reports I get are sufficient for the level of control I want.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>16.</td>
<td>I think on my feet and plan as I go along rather than figure out the details first.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>17.</td>
<td>When I am in charge, I like to make all the decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>18.</td>
<td>People working with me are not well trained and don’t know how to do their jobs.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>19.</td>
<td>Most communication concerning my business comes from the top and trickles down.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>20.</td>
<td>The records I use do not keep me well informed of my progress toward goals.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>21.</td>
<td>I am very creative and can easily come up with 10 ideas to solve any problem.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
22. People working with me are responsible and accountable for what they do.  1 2 3 4 5
23. Setting the wages for my employees is easy for me.  1 2 3 4 5
24. The people working for me know what is going on and stay informed of problems and successes.  1 2 3 4 5
25. Those working for me are familiar with the controls and standards that have been set and help to monitor them for problems.  1 2 3 4 5
26. I’m not good with details and often miss the little things when making a plan.  1 2 3 4 5
27. Good workers in my business don’t need to have clearly defined roles and responsibilities.  1 2 3 4 5
28. I have difficulty recruiting a good selection of applicants for any job I have open.  1 2 3 4 5
29. Communication is usually not written even when it is important.  1 2 3 4 5
30. By the time I know I have a problem, it’s too late to do much about it.  1 2 3 4 5

Scoring Sheet
Instructions: In column A, put the number you circled (1 through 5) for that question on the line next to the question number. Add up those numbers, and put the total on the line next to Total A. In column B, add these numbers together and put the answer on the Total line for B. To the Total value for A, add 18, then subtract B in each section.

<table>
<thead>
<tr>
<th>Example</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question # 1.</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>+ Question # 11.</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>+ Question # 21.</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Total A</td>
<td>13</td>
<td>Total B</td>
</tr>
</tbody>
</table>

Total A + 18 - Total B = Total Planning  13 + 18 - 6 = 25 (Reminder: This is an example; your answers and totals will be different.)

<table>
<thead>
<tr>
<th>Staffing</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question # 3.</td>
<td>_____</td>
<td>Question # 8.</td>
</tr>
<tr>
<td>+ Question # 13.</td>
<td>_____</td>
<td>+ Question # 18.</td>
</tr>
<tr>
<td>+ Question # 23.</td>
<td>_____</td>
<td>+ Question # 28.</td>
</tr>
<tr>
<td>Total A</td>
<td>_____</td>
<td>Total B</td>
</tr>
</tbody>
</table>

Total A + 18 - Total B = Total Staffing

<table>
<thead>
<tr>
<th>Directing</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question # 4.</td>
<td>_____</td>
<td>Question # 9.</td>
</tr>
<tr>
<td>+ Question # 14.</td>
<td>_____</td>
<td>+ Question # 19.</td>
</tr>
<tr>
<td>+ Question # 24.</td>
<td>_____</td>
<td>+ Question # 29.</td>
</tr>
<tr>
<td>Total A</td>
<td>_____</td>
<td>Total B</td>
</tr>
</tbody>
</table>

Total A + 18 - Total B = Total Directing

<table>
<thead>
<tr>
<th>Controlling</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question # 5.</td>
<td>_____</td>
<td>Question # 10.</td>
</tr>
<tr>
<td>+ Question # 15.</td>
<td>_____</td>
<td>+ Question # 20.</td>
</tr>
<tr>
<td>+ Question # 25.</td>
<td>_____</td>
<td>+ Question # 30.</td>
</tr>
<tr>
<td>Total A</td>
<td>_____</td>
<td>Total B</td>
</tr>
</tbody>
</table>

Total A + 18 - Total B = Total Controlling
Inventory (pages 5 and 6). Another important part of managing yourself is your ability and determination to balance your business efforts with family, community, spiritual needs, personal development, personal and recreational time.

**Setting direction for your business.** There are two aspects of leadership: visionary and implementation. The first deals with doing the right thing, while the second deals with doing things right (1). Setting direction for your business is an essential component for success. Employees can sense a lack of direction. When employees know where the organization for which they work is headed they may feel more a part of it and are more enthused about their work. They will need less guidance. Managers who don’t make employees feel they are a part of an organization don’t realize how important it is for people to belong. Having a mission statement posted in a highly visible work location and developing long and short term goals with your employees are good practices.

**The Self-Test (pages 5 and 6; 15 minutes)**

Take 15 minutes to answer the questions that relate to each of the five management areas. Then summarize the results in the table at the end of the test. If you score over 25 on all 5 categories you should be writing this article. Once you complete the self-test, take a look at your strengths and weaknesses. For those areas where you score below 20, you may want to focus on educational efforts for improvement. If you work with a partner or have a manager(s) who works with you, have them take the self-test. You can then consider shifting responsibilities to fit each of your strengths. This is part of staffing, putting the right person in the right position based on personality and skills.

**Take Home Message**

In any business, people are a valuable resource. Working through others leverages your time. Cow performance is affected by employee performance. Cows and people perform in good environments. Part of the environment is our ability to manage ourselves and others. Therefore, our success in managing our business, our cows, is related directly to how well we organize and manage those that work with us to achieve our business goals, regardless of the type or size of business. And unless we are working by ourselves in total seclusion, we should have some impetus to become better trained in people skills. As managers, we need to assess ourselves and others on our management team, in the five management skills, and then learn, and practice the necessary skills to improve our ability to work through others. Your goals might be to hire better people, train them well, provide them a good work environment, and manage them better. Good Luck!

**References**


**Further Reading For Dairy Profit U Participants**

Nearly 300 participants attended the recent 2001 Dairy Profit U Conference, listening to nationally renowned dairy experts addressing the theme, “Sharpening Your Dairy Management Skills.”

Sponsoring the Dairy Profit U were the Michigan Milk Producers Association, GreenStone Farm Credit Services, and Michigan State University.

Those in the audience that day, as well as those who were not, would perhaps like to enlarge on the day’s experience from a source closer to home. The pages of the Michigan Dairy Review have been filled with sharp, insightful articles for Michigan’s dairy industry since 1996. In the last 2 years our contributing authors have explored many of the same or similar topics as the speakers at the recent Dairy Profit U Conference. The following is a list of these past Michigan Dairy Review articles.

- You and Your Farm’s Management Team, a Key to Success, by Ted Ferris; Vol. 2 (May 1997), No. 2; page 14.
- Using Incentive Pay on Your Dairy Farm, by Kurt Anderson; Vol. 4 (February 1999), No. 1; page 15.
- What Michigan Dairy Farmers Pay Their Employees, by Kurt Anderson; Vol. 4 (May 1999), No. 2; page 10.
- Addressing Employee Performance Problems, by Dann Bolinger; Vol. 4 (May 1999), No. 2; page 12.
- From Firefighter to Dairy Manager: How to Change your Career, by Barbara Durtt; Vol. 5 (January 2000), No. 1; page 4.
- Management Teams: A Key Strategy, by Dean Ross; Vol. 5 (January 2000), No. 1; page 5.
- Avoiding the Pitfalls of Investigation, by Phil Durst; Vol. 5 (April 2000), No. 2; page 6.
- Motivating Your Employees to Achieve Their Potential, by Dann Bolinger; Vol. 5 (July 2000), No. 3; page 9.
- Are Wages You Pay Competitive, Does it Matter?, by Barbara Dutt and Christopher Wolf; Vol. 5 (October 2000), No. 4; page 1.
- Putting Consistency into Practice with SOPs, by Phil Durst; Vol. 5 (October 2000), No. 4; page 11.

If you cannot find any of the above listed MDRs, contact your local Extension Dairy Agent for a copy, or locate it at [http://www.canr.msu.edu/dept/ans/Home/Dairy/Extension/extension.htm](http://www.canr.msu.edu/dept/ans/Home/Dairy/Extension/extension.htm).
What Does the Future Hold?

Dave Beede and Ted Ferris
Dept. of Animal Science

This article is the first in a series to share opinions about the future of the Michigan dairy industry. The series is meant to be thought provoking, and some of the views expressed will not be held by everyone. Individuals wishing to share opinions on this important subject are encouraged to contact the Managing Publisher of the Michigan Dairy Review.

This article sets the stage with some background information on Dairying in Michigan in the 21st Century, recent historical trends in milk production, farm and cow numbers, and the role of Michigan State University Extension (MSUE).

Dairying in the 21st Century

In 1998 the Michigan Dairy Industry Committee in partnership with the dairy faculty of MSU initiated a statewide effort to help chart the dairy industry’s course for the future — Dairying in Michigan in the 21st Century. The objectives were to develop a common vision for the Michigan dairy industry and to define specific goals and actions to achieve those goals. Over 120 individuals from various organizations and positions in Michigan’s dairy industry formed Working Groups to address six key topics: 1) future industry demographics, profile and growth; 2) dairy farms as part of the Michigan community; 3) partnerships and relationships; 4) a varied and diverse Michigan dairy industry — understanding and capitalizing on differences among dairy farmers and their enterprises; 5) dairy farming as a business; and, 6) milk processing and product promotion. Each Working Group developed a “white paper”. These white papers identified specific opportunities, challenges, and recommendations for statewide consideration for a 10- to 20-year planning horizon. Four key overarching themes emerged for further discussion, planning, and action: 1) dairy farming and the rest of society (neighbors, land use, and manure); 2) dairy farming: the business side; 3) an umbrella organization for the Michigan Dairy Industry; and 4) demographics of Michigan’s Dairy Industry in the future. These themes, challenges, and recommendations will be addressed in future columns.

Some Recent History

The document “Revitalization of Animal Agriculture in Michigan” (1994), written as part of the Michigan Animal Agriculture Initiative effort, proposed the possibility of capturing some of the shift in dairy production from other states thereby increasing dairy cow numbers in Michigan. The projected goal was to add to Michigan’s economy and help maintain stability in rural communities.

From 1993 through 2000, Michigan dairy cow numbers declined 10% (330,000 to 300,000), whereas the overall reduction in the national cow herd was only 3.9% during the same period. The number of Michigan herds declined 35% during this time, compared with 42% nationally. National milk production increased 11% from 1993 through 2000. Total annual milk production in Michigan averaged 5.503 billion lb between 1993 and 2000, with no real difference (less than 1% change) across all years except for 3.7% greater production in 2000 compared with the 8-year average. According to projections made in the “Revitalization of Animal Agriculture in Michigan” (1994) document, there was, and still is, potential to expand the dairy herd in Michigan by 50,000 cows over a 5- to 10-year period. In 1994, this was projected to generate $102 million per year, or about $148 million in direct and indirect revenues cycled through local and state economies. Michigan Dairying in the 21st Century discussions suggested that the state has processing capacity for at least an additional 850 million lb of milk (e.g., 50,000 cows each producing 14,000 lb per year) for further discussion, planning, and action:

Critical Tips for New Dairy Farms

When establishing new dairy operations in Michigan two considerations seem absolutely imperative.

1. Prospective dairy producers must have accurate and realistic information about the expected costs, revenues, and profitability of dairy businesses in Michigan. Start-ups that fail in the next 5 to 10 years due to flawed financial plans will not contribute to the long-term viability, success, and positive image of Michigan’s dairy industry.

2. Prospective dairy producers must be aware of Michigan’s Right to Farm Act and its Generally Accepted Agricultural and Management Practices (GAAMPS) for Site Selection and Odor Control for New and Expanding Livestock Operations, and for Manure Management and Utilization. They must understand the absolute necessity for effective manure nutrient management and sound environmental stewardship before deciding to locate in Michigan. Proper siting and nutrient management of individual dairies are crucial to the long-term viability and positive public perception of the entire dairy industry in Michigan.

MSUE Dairy, Farm Information Resources Management (FIRM), and Manure Management Expertise Teams are available to assist prospective dairy farmers with these two critical considerations.
17,000 lb of milk annually).

Although Michigan has not lost ground over the last 8 years in milk production, it has not increased production compared with some other regions of the country. The state has not met projections to expand economic growth in dairying. In 1994, Dr. Larry Hamm of MSU’s Department of Agricultural Economics stated, “The only way to assure long-term vitality of Michigan’s dairy economy is to capture the high-value commercial markets in Michigan. Michigan is the market of first choice. If Michigan dairy production does not capture these high-value, long-term markets, they will be permanently lost to Michigan.” Perhaps the most relevant question today is, “Have these high-value markets been lost?”

Increasing or even sustaining production seems imperative to maintain the state’s dairy infrastructure, market share, and rural economies. This is best done by a combination of growth of existing and new operations, transfer of ownership of operations to the next generation, and purchase of terminal businesses by new or existing entrepreneurs.

One suggestion from the Michigan Dairying in the 21st Century effort was the development of a statewide plan to generate the additional milk production [e.g., increasing the number of cows and/or the number dairy farms]. Some regions of the state have more potential for this than others. Local citizens’ groups or economic development councils can take active roles in attracting or sustaining milk production in their areas.

Role of MSU Extension

For many years, MSUE has provided support and assistance through educational programs and one-on-one consultations to help producers and prospective dairy farmers identify appropriate steps and avoid pitfalls in starting, managing, and (or) expanding their businesses. Such efforts are consistent with the land grant mission of MSU and the state’s legislative support for the Animal Agriculture Initiative in Michigan. MSUE provides programs for various segments of the dairy industry as needs are identified. Owners of existing and new farm operations and small and large farm businesses all have opportunities to benefit from educational programs such as business and employee management to more traditional programs in nutrition, genetics, reproduction, mastitis prevention, facilities, animal health, and forage management.

Recently, MSUE received inquiries about its program efforts with new and prospective dairy producers immigrating to Michigan to purchase or establish dairy operations. MSUE historically has been involved with various community development efforts organized by local development groups and (or) business entities.

In the past few years, a MSU Extension Dairy Agent has worked with local economic development interests in northeast Michigan to raise the awareness of outside dairy producers about farms for sale and opportunities to use the available land base in northeast Michigan for new operations. Local citizens identified a need to recruit dairy farmers to the northeast and formed the Northeast Michigan Dairy Development Council. Dairy development was judged an important element for the future of the local dairy sector and hence community vitality in northeast Michigan. It is believed that new dairies can support crop producers, infuse dollars into the rural economies, and preserve agricultural land and the infrastructure for existing dairy producers. The net effect is to maintain or increase herd and cow numbers and (or) milk volume in the northeast region of the state. This effort is not focused on producers from any particular state or country, but rather on any producers considering relocation. Recently, a realtor working with foreign dairy producers considering immigration contacted the Extension Dairy Agent to look at opportunities in northeast Michigan.

As a publicly supported institution, MSU provides educational programs and materials to all without regard to race, color, creed, national origin, gender, religion, age, disability, political beliefs, sexual orientation, family status, or marital status. In the context of the land grant university mission, this information is generated and delivered by scholarly activities of the faculty and staff through research, teaching, and extension programs. Educational programs and materials are available to all people fitting any combination of demographic categories, including immigrants from other countries. For example, some immigrant dairy producers, as well as established Michigan dairy producers, have enrolled their employees in Dairy Employee Education Programs (DEEP) — Feeder Training Program and Hoof Health Clinic — developed and presented by MSU’s Extension Dairy Team.

In the July issue of MDR we shall start a more in-depth discussion of the opportunities, challenges and recommendations generated from the Dairying in Michigan in the 21st Century effort.
Milk Market Update and Financial Planning

Market Update: Dairy Farm Industry Structural Change Continues

Christopher Wolf
Dept. of Agricultural Economics

Milk production in the 20 major dairy producing states that the U.S. Department of Agriculture tracks closely was down 0.7 percent in January 2001 from December 2000. The number of milk cows was also down 12,000 cows. These developments may signal that the large number of expansions begun in 1998 and 1999 have finished and that prices in 2000 discouraged further expansion.

The forecast for corn and soybean prices is for continued low prices as stocks for both are up and corn exports are lagging 10 percent behind last year primarily due to biotech concerns. Many forecasters indicate that these commodity prices are not likely to go lower and advise locking in feed prices. Given the continued low grain prices without some major shock in those markets, the feed price can only substantially increase through forages. Thus, the feed price incentive to produce more milk continues in 2001.

US Dairy Farm Industry Structure

Table 1 displays the number of milk cows and total milk production in the top 10 milk producing states, the US as a whole, and six other states that were selected based on large changes from 1999 to 2000. Michigan ranked eighth among all states based on milk production, although if the Michigan milk production growth rate continued as in 2000, Texas would soon be passed. Idaho and New Mexico again experienced substantial growth. California added 57,000 cows between 1999 and 2000. This is almost 20 percent of the entire Michigan herd and more than Connecticut and Massachusetts combined. New York was the only state in the top 10 to have a decline in total milk production.

<table>
<thead>
<tr>
<th>State</th>
<th>Milk Cows 1999</th>
<th>Milk Cows 2000</th>
<th>Milk Production 1999</th>
<th>Milk Production 2000</th>
<th>Change from 1999</th>
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<tbody>
<tr>
<td></td>
<td>1,000 head</td>
<td></td>
<td>million pounds</td>
<td></td>
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<tr>
<td>1. California</td>
<td>1,466</td>
<td>1,523</td>
<td>30,459</td>
<td>32,240</td>
<td>5.8</td>
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<tr>
<td>2. Wisconsin</td>
<td>1,365</td>
<td>1,344</td>
<td>23,071</td>
<td>23,259</td>
<td>0.8</td>
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<tr>
<td>3. New York</td>
<td>701</td>
<td>686</td>
<td>12,082</td>
<td>11,920</td>
<td>-1.3</td>
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<tr>
<td>4. Pennsylvania</td>
<td>616</td>
<td>617</td>
<td>10,931</td>
<td>11,156</td>
<td>2.1</td>
</tr>
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<td>5. Minnesota</td>
<td>545</td>
<td>534</td>
<td>9,478</td>
<td>9,493</td>
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<td>318</td>
<td>347</td>
<td>6,453</td>
<td>7,223</td>
<td>11.9</td>
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<td>7. Texas</td>
<td>345</td>
<td>348</td>
<td>5,618</td>
<td>5,735</td>
<td>2.1</td>
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<tr>
<td>8. Michigan</td>
<td>299</td>
<td>300</td>
<td>5,455</td>
<td>5,705</td>
<td>4.6</td>
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<tr>
<td>9. Washington</td>
<td>247</td>
<td>247</td>
<td>5,535</td>
<td>5,593</td>
<td>1.0</td>
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<tr>
<td>10. New Mexico</td>
<td>232</td>
<td>250</td>
<td>4,724</td>
<td>5,236</td>
<td>10.8</td>
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<tr>
<td>US Total</td>
<td>9,156</td>
<td>9,210</td>
<td>162,716</td>
<td>167,658</td>
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Other states with large production changes

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<tr>
<td>16. Indiana</td>
<td>136</td>
<td>145</td>
<td>2185</td>
<td>2365</td>
<td>8.2</td>
</tr>
<tr>
<td>19. Colorado</td>
<td>83</td>
<td>89</td>
<td>1728</td>
<td>1924</td>
<td>11.3</td>
</tr>
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<td>25. Kansas</td>
<td>86</td>
<td>91</td>
<td>1405</td>
<td>1520</td>
<td>8.2</td>
</tr>
<tr>
<td>37. Connecticut</td>
<td>29</td>
<td>26</td>
<td>520</td>
<td>478</td>
<td>-8.1</td>
</tr>
<tr>
<td>46. Delaware</td>
<td>11</td>
<td>10</td>
<td>171</td>
<td>149</td>
<td>-12.8</td>
</tr>
</tbody>
</table>

these operations had more than 500 milk cows but those operations produced 20 percent of the Michigan milk production. This is representative of the increasing importance of the large operations everywhere. In Indiana, one half of one percent of milk operations had more than 500 milk cows but produced 10 percent of the milk. The extremes nationally were Kentucky where operations with 500 or more cows produced only two percent of the milk to New Mexico where these same operations produced 98 percent of the milk.

Michigan Milk Prices

Figure 1 displays the minimum Class I (fluid) price applied in the Midwest order along with the cooperative premium in Michigan. As is evident, fluid milk prices were higher in the early months of 2001 than 2000. Adding in the premium resulted in a fluid milk price that hit a high of $16.79/cwt in January 2001. The Michigan premium is related to the premiums that the Northeast Compact produces but is not collected by a governmental agency. As you can tell from the graph, the premium generally declines a bit when prices increase a lot and increases when the minimum milk price falls. In contrast, the Compact sets a floor and does not move with market signals. In most of the country, cooperative fluid premiums are collected.

As of press time, the milk-to-feed price ratio could only be calculated through 2000 (Figure 2). With continued low feed prices, the ratio bounced up at the end of 2000. The milk prices in early 2001 should result in that upward trend continuing at least for the first 3 months of the year.
A Survey Study: Long-Range Financial Planning

G. William Robb
Extension Dairy Agent
Southwest Michigan

Farmers can make high-quality decisions with sound financial data such as those supplied by the FINPACK™ computer software program. Michigan State University Extension has utilized the FINPACK™ computer software program from the University of Minnesota to assist farmers in financial projections. (FINLRB) Financial Long Range Planning is one segment of the FINPACK™ program that is a decision-making support tool.

A review of past FINLRBs compared the accuracy of the projections with actual investments. One hundred and two dairy farmers in 13 southwest Michigan counties and 12 dairy farmers in six Minnesota counties were contacted for permission to use their electronic files in this study. Twenty-nine Michigan farmers and nine Minnesota farmers were interviewed with a personal survey instrument to learn more about how dairy farmers make decisions for major investments. The FINLRB tool and the role of Extension personnel in conducting financial projections also were evaluated.

Survey Results

The FINLRBs were completed to answer a wide range of questions about dairy farm businesses. Twenty-five farms added cows, 18 added free stalls, and 12 milking parlors were built, four of which were flat parlors. Other farms investigated the potential for adding partners, refinancing loans, contract raising heifers, or feed and cropping program changes. Seven farms chose not to invest. The FINLRB data were as important to these non-investing farm businesses and families as those that decided to make major investments.

Thirty-one of the 38 farms interviewed had completed investments at the time of the survey. They reported actual investments totaling $12,802,161 for an average of $412,973 per farm. Cattle ($5,361,075) and barns ($4,234,674) represented the largest expenditures combining for 75% of total investments. Milking parlor expenditures totaled $2,196,320 and represented another 17% of total investments. Several of the expansions were renovations or additions of existing facilities and flat parlors. Feeding equipment such as totally mixed ration (TMR) mixers and field equipment investments like choppers represented only 3 and 2% of total expenditures, respectively. But these were often not included in the projection. Facilities and equipment to handle manure represented 3% of expenditures at $390,530 on eight of the farms.

The FINLRB projections of depreciable added capital items totaled $10,567,634 for 27 farms. As a group the farms spent 21% more or $2,234,767 in the actual investments than used in the FINLRB projection. Many of these differences in expenditures could be explained by changes in plans compared with the choices at the time of the FINLRB input. A frequent farmer response was “we selected a combination of two alternatives”.

One way to compile investment numbers (see Figure 1) is to estimate average investment per stall or per cow. The 31 farms made investments from April 1995 to March of 2000 and averaged $1,087 per barn free stall and $1,216 per cow purchased, primarily as late pregnant heifers. Parlor investments averaged $13,128 per parlor stall. Nearly all had milking machine take-off automation, and several included computer identification and sort gates. The investments in flat barns or step-up parlors involved renovations to existing barn shells and averaged $2,684 per stall. Heifer prices increased significantly, some by $300 per heifer, during the later part of this period and increased the total expenditure for cattle on several projects.

Extension’s Role and Farmer Recommendations

The 38 farmers felt very comfortable in sharing detailed financial information with the Extension Agent who conducted the FINLRB’s in this study. The quality of the technical assistance of the Extension personnel conducting the FINLRB was reported “very” or “extremely” good by 36 of the 38 farms. All the farmers would recommend the program to their neighbors. When asked how much they would pay for these FINLRB results, many calculated an hourly rate of a comparable consultant or accountant, or related it to the cost of the personal FINPACK™ program. These responses varied from $90 to $5,000, averaging $750, and were sometimes dependant on size of the project.
Conclusions

The FINLRB tool rated very favorably in supporting the decision-making process and in overall usefulness. The farmers valued the results at an average of $750 per FINLRB. The farms surveyed invested $2,234,767 more than listed in the FINLRB projections - an additional 21% more expenditure. Excavating, concrete, and farm building labor were underestimated and should be more carefully projected. Cattle prices and replacements also were underestimated. Many other differences in projected and actual investments were due to changes in the projects over time.

A major goal of the study was to identify items that could lead Extension Agents to conduct a more accurate and meaningful financial projection. Running additional alternatives could reduce many of the above-mentioned problems. Running a FINFLO (cash flow) also may offer farmers a more accurate financial picture during and immediately after a building project. Both the Extension Agents and farmers recognized the importance of accurate data for input. The quality of the farms’ record keeping and retrieval of that information by categories that match the FINPACK format help to determine accuracy of the data input. The speed of this compilation also impacts the amount of time available to review and evaluate the output. Proper time to study and evaluate the results should be planned to reduce errors and better forecast the final project.

Appreciation is expressed to the dairy farmers that took time from their busy schedules, allowed an interview, and shared financial data for this study.

Managing Publisher’s Note:
This survey of the usefulness of FINLRB was conducted by G. W. Robb during his 6-month extension study leave ending July 31, 2000.

Nutrition

Selenium Supplementation for Dry, Late Pregnant Cattle

R. W. Mellenberger
Dept. of Animal Science

Selenium (Se) has long been recognized as an essential trace mineral for cattle. Use of Se injections in ruminants for prevention or treatment of nutritional myodegeneration (white muscle disease) has been recognized for several decades. Maas (5) stated that a major role of Se in cattle is as a part of the glutathione-peroxidase (GSH-Px) complex. GSH-Px not only functions as part of the body’s immune system, but also as part of the specific immune response to infections of the mammary gland. Se also works synergistically with vitamin E to maintain cellular integrity and to improve the immune response (6). Adequate supplementation of Se and vitamin E to dry cows and bred heifers decreases incidence of retained placenta, uterine infection and clinical mastitis in early lactation. Adequate supplementation of Se to a pregnant cow or heifer also has a positive effect on calf health and survivability.

The advent of total mixed rations (TMRs) and availability of Se supplements has in most cases met the Se needs of lactating cows. However, dry cows and bred heifers are more likely to receive high forage diets that may not be supplemented with Se. In addition, dry cows and heifers on pasture are less likely to receive grain. Grain or concentrate mixes normally are used as a carrier to provide Se and vitamin E supplementation. Relying on trace mineral salt blocks containing Se or a trace mineralized salt fed free choice to supply Se is a poor way to insure proper Se and vitamin E supplementation as some animals may choose not to eat the salt.

Injectable Se Studied

Dairy and beef cattle farmers in an attempt to provide Se to pastured animals or dry cows and heifers have utilized injectable Se. The unknown results from Se injectables led Dr. John Maas and his research group at the University of California at Davis to study the use of injectable Se as a way of providing Se to Se-deficient animals or as a method of maintaining normal Se levels in whole blood. Hereford heifers were maintained on a Se-deficient diet and were determined to be, in fact, Se-deficient with 0.024 + 0.012 ug Se/ml body weight) failed to significantly increase blood serum Se (2).

Work at Michigan State University by Dr. Roger Ellis (3) supported the California research by showing that blood concentration of Se in pregnant cows peaked within 24 to 48 hours after a single intramuscular injection of Se and then promptly returned to pre-treatment concentrations. Research with steers also concluded that a single injection of Se (0.15 mg injectable Se/kg body weight) failed to significantly increase blood serum Se (2).
The reason for the short term effect of injectable Se on blood Se concentrations in the pregnant female is the fetus. Fetal demand for Se must be satisfied before a dam’s needs can be met (1). Supplying sufficient Se continuously to a pregnant cow or pregnant heifer results in higher blood Se concentrations in beef calves both before the calves started nursing and during the nursing period (1). In addition, cows supplemented on a daily basis via the diet with Se had normal (adequate) Se in whole blood after calving.

Adequate Se Intake Important

It is apparent that one or two injections of Se cannot maintain adequate blood Se concentrations in pregnant dry cows or pregnant heifers (7, 2, 4). Pregnant cows and heifers must be provided with rations that provide adequate Se intake on a daily basis. This is critical for dry cows and heifers on pasture or for animals that do not have access to a grain mix or concentrate mix that can be utilized to provide the Se. Injectable Se compounds can be used or should be used only to boost the daily intake of Se in late gestation.

About Dietary Selenium Supplementation

Above R. W. Mellenberger clearly suggests that supplemental dietary selenium, instead of or in addition to injectable selenium is needed by late pregnant dairy cattle to meet selenium requirements. Current Food and Drug Administration (1997) regulations limit selenium supplementation to 0.3 parts per million (ppm) of diet for all classes of dairy animals. Reviewing available research results, NRC (2001) indicated that the selenium requirement was provided and normal blood concentrations maintained by 0.3 ppm (milligram/kilogram) of selenium in total ration dry matter.

References


Formulating Lactating Cow Diets For Carbohydrates: Part 1

One of the most challenging aspects of diet formulation for lactating dairy cows is balancing for carbohydrates. Effective fiber must be provided to stimulate chewing and secretion of salivary buffers. However, effective fiber is more filling than other nutritional components of the diet and the filling effect of the diet often limits energy intake of high producing cows. Therefore, diets for high producing cows should be balanced to provide adequate effective fiber with the least filling effect.

A balance must also be attained for ruminal carbohydrate fermentation. Carbohydrate fermentation in the rumen is desirable to provide fuels for microbial growth and production of microbial protein, yet the fermentability of the diet must be limited to prevent excessive production of fermentation acids. Inadequate effective fiber or excessive fermentability of the diet can decrease ruminal pH, feed intake, diet digestibility, and microbial protein production. This is a major problem on many dairy farms that results in poor health, and reduces milk yield and farm profitability.

On the other hand, diets with excessive effective fiber that are more filling and diets that are poorly fermentable can also result in lower milk yield and profitability because of reduced energy intake and microbial yield. Both situations can be thought of as lost opportunity for maximization of farm profits. Understanding the complex factors that interact to determine energy intake and microbial protein production in the rumen can pay off generously by allowing increased milk yield and reduced diet costs. The goal of formulating diets for carbohydrates is to provide low fill, highly fermentable diets that result in consistent ruminal fermentation over time. Part 1 of this article discusses how carbohydrates affect feed intake, ruminal pH and microbial protein production and Part 2, which will be in the next issue of the Michigan Dairy Review, will address how to formulate diets to attain this goal on your farm.

Dietary Carbohydrates

The main carbohydrates in diets for dairy cattle are those in the neutral-detergent fiber (NDF) fraction (cellulose and
hemicellulose) and starch. The starch content of dairy cattle diets is related inversely to the NDF content and concentrations of both are typically in the range of ~ 25 to 35% of dietary dry matter (DM) for lactating cows. Other common carbohydrates include pectin and sugars, both with concentrations that are typically less than ~5% of dietary DM. The highly digestible carbohydrates including starch, sugars, and pectin are often referred to collectively as non-fiber carbohydrates (NFC). Because NFC is obtained by subtracting the measured fractions NDF, crude protein, fat and ash from 100%, it is subject to many errors. It is also a misnomer because it doesn’t include all non-fiber carbohydrates (the protein fraction is overestimated when non-protein nitrogen is present) and because it includes soluble fiber (pectin, gums). In addition, when fermented feeds are included in the diet, NFC includes fermentation products such as lactic acid, acetic acid, and ethanol.

Long fiber particles (effective fiber, mostly from forage) are needed in the diet to maximize production at least three different ways:

1) stimulation of chewing, which results in secretion of saliva;
2) formation of a rumen mat that entraps small particles, increasing their ruminal digestibility; and,
3) providing a consistent source of fuels to the microbes in the rumen, which functions to provide a steady supply of fuels to the liver and mammary gland over time.

Some sources of fiber are very effective at stimulating chewing and mat formation in the rumen (long and coarsely chopped forages) while others are not (most high fiber by-products such as soyhulls). Also, sources of fiber vary greatly in NDF digestibility and retention time in the rumen. All three of these functions mentioned above are important to maximize milk yield and the most valuable sources of fiber are those that are effective at stimulating chewing and formation of the rumen mat, and are also highly digestible with a rapid rumen turnover (less filling).

Starch is an inexpensive source of energy that can be fermented by microbes in the rumen to produce microbial protein and volatile fatty acids (VFA) used as fuels by the cow. Starch that passes from the rumen also can be digested in the small intestine or fermented in the large intestine, also providing fuel, but not microbial protein, to the cow. A large fraction of the fuels produced (propionate, lactate) are used by the liver to produce glucose, which the mammary gland needs to produce lactose, the major determinant of milk yield; 100 lb of milk contains nearly 5 lb of lactose. Ruminal digestibility of starch can range from less than 40% to greater than 90% depending on the type of grain (barley, corn, sorghum), conservation method (dry, high moisture), and processing (ground, rolled, steam flaked). Alteration of rate and site of starch digestion is important for optimal diet formulation as discussed below.

Pectin normally is found in low concentrations in most feeds consumed by dairy cows (< 2-3%) but several feeds contain higher concentrations such as citrus pulp (~15%), beet pulp (~15-20%), and alfalfa (3-10%). Pectin is of interest because it is highly fermentable and whole tract digestibility is high but it can help moderate fermentation in the rumen. This is because, unlike fermentation of starch, rate of fermentation of pectin slows as ruminal pH decreases. This might help attenuate the rapid decline in ruminal pH following a meal and keep ruminal pH within a narrower desirable range. Sugars are highly fermentable and completely digested. Like pectin, the sugar content of most feeds is low but there are exceptions such as fresh forages, molasses, whey, citrus pulp, and candy waste.

Concentrations and characteristics (physical and fermentation) of these different types of carbohydrate vary greatly in diets of lactating cows and this variation can have dramatic effects on feed intake, ruminal pH, digestibility and microbial protein production. One of the greatest opportunities to increase milk yield and profitability is to understand how dietary carbohydrates can be manipulated to maximize energy intake and microbial yield.

**Regulation of Intake**

Feed intake is a function of meal size and meal frequency. The brain receives many different signals that affect satiety and hunger. British researcher, Dr. Mike Forbes, recently proposed that animals eat the amount of a particular diet that minimizes the total discomfort produced by signals from various receptors in the body to the brain. Distension in the rumen causes discomfort and can reduce feed intake but high producing animals might tolerate a greater degree of discomfort from physical fill to offset discomfort from hunger. Manipulating diets to increase meal size and increase frequency of meals, can lead to greater feed intake. An understanding of the basic mechanisms regulating intake is invaluable for diet formulation to maximize milk yield. Although regulation of feed intake is very complex, two primary mechanisms regulating DMI that are related to dietary carbohydrates are:

- filling effect of diets; and,
- ruminal fermentability of diets.

Ruminal fill can limit intake of high producing cows and other cows fed high forage diets. The rumen doesn’t have to be full for ruminal fill to limit intake; there are receptors in the rumen wall that signal the brain when the rumen is stretched. Diets with a greater filling effect limit meal size but hunger occurs sooner and the number of meals consumed per day might partially or completely compensate for the decreased meal size. When a group of cows is offered a diet, feed intake of the highest producing cows are most limited by ruminal fill, and these cows present the greatest opportunity to increase
energy intake by manipulation of dietary carbohydrates. When the filling effect of the diet is decreased, problems can occur with slug feeding because low-fill diets can be consumed rapidly. This is a common problem when cows compete for feed bunk space in over-crowded facilities and requires diets that are either more filling or less fermentable to prevent ruminal acidosis.

Rapid fermentation of ingested feed during a meal produces VFA that can cause satiety. Although acetate is produced in the greatest quantity, propionate has a greater effect on limiting intake. When dietary NDF is held constant, increasing the fermentability of the diet by substituting a rapidly fermentable starch source such as ground high moisture corn for a starch source with more moderate rate of fermentation such as ground dry corn likely will reduce meal size, and possibly decrease daily DMI. The degree to which fermentation acids limit DMI depends upon many factors which are being investigated currently.

**Filling Effect of Diets**

The filling effect of a diet is determined primarily by the initial bulk density of feeds as well as their filling effect over time in the rumen. The overall filling effect is determined by:

- forage NDF content;
- forage particle size;
- forage type (legumes, perennial grasses, annual grasses); and,
- NDF digestibility (within a forage type).

Forage NDF is less dense initially, digests more slowly, and is retained in the rumen longer than other diet components. Feed intake of high producing cows is often dramatically reduced by increasing the forage NDF concentration of the diet. Several studies in the literature showed a decrease in DMI of ~5 to 9 lb/d when diet NDF content was increased from 25 to 35% by substituting forages for concentrates. Although most studies reported a significant decrease in DMI as forage NDF increased, the DMI response was variable, depending upon the degree to which intake was limited by ruminal fill. Higher producing cows are limited by fill to the greatest extent and the filling effect of forage fiber varies depending upon particle size and fermentation characteristics.

Experiments that have evaluated effects of forage particle size generally have shown small effects on DMI. However, one experiment showed little effect of particle size of alfalfa silage when fed in high grain diets but a large reduction in DMI for the diet containing longer alfalfa silage when fed in a high forage diet. Feed intake might have only been limited by ruminal fill in the high forage diet, which could explain the interaction observed.

Increasing diet NDF content by substituting non-forage fiber sources (NFFS) for concentrate feeds has shown little effect on DMI in studies reported in the literature. NFFS include by-product feeds with significant concentrations of NDF such as soyhulls, beet pulp, cottonseeds, corn gluten feed, and distiller’s grains. Fiber in NFFS is probably much less filling than forage NDF (FNDF) because it is less filling both initially (smaller particle size) and over time in the rumen because it digests and passes from the rumen more quickly.

Forage NDF has a much longer ruminal retention time than other major dietary components. Retention time in the rumen is longer because of longer initial particle size, and greater buoyancy in the rumen over time, which differs greatly across forages. As forages mature, the NDF fraction generally becomes more lignified. Lignin is a component of plant cell walls that helps stiffen the plant and prevent lodging. It is also essentially indigestible by ruminal microbes and limits fermentation of cellulose and hemicellulose. Within a forage type, the degree to which NDF is lignified is related to the filling effects of the NDF. Fiber that is less lignified clears from the rumen faster, allowing more space for the next meal. However, ruminal retention time of NDF from perennial grasses generally is longer than for legume NDF in spite of being less lignified. Because of this, it is more filling and should not be included in high concentrations in diets of cows for which feed intake is limited by ruminal fill, unless it is of exceptionally high quality. Corn is an annual grass, and corn silage NDF digests and passes from the rumen quickly and can be an excellent source of FNDF for high producing cows.

The extent of lignification of NDF is a useful way to estimate the filling effects of forage NDF. **To calculate lignification of NDF, divide the lignin content as a percent of DM by the NDF content as a percent of DM and multiply by 100.** Data from the upper Midwest indicate that the lignin content of alfalfa NDF ranges from ~11 to 20% and the lignin content of corn silage NDF ranges from ~3 to 9% when measured as acid-detergent sulfuric acid lignin. Forages with low lignified NDF are especially valuable and should be targeted to the highest producing cows to allow them to consume more feed and attain higher milk yield. This is true even if the forage has low protein content or high NDF content, both of which can be compensated for by diet formulation. Forages with greater lignification of NDF should be targeted to animals in which DMI is not limited by ruminal fill such as cows in late lactation, dry cows (except those close to calving), and heifers.

Besides forage maturity, the extent to which NDF is lignified also is affected greatly by growing conditions such as light, heat, and water stress. Lignification of NDF is not related to NDF or protein content for either alfalfa or corn silage. Because alfalfa is priced in some markets based upon NDF or protein content or relative feed value (RFV), and not on the lignification of NDF, this presents an opportunity to purchase a valuable diet ingredient (effective, digestible NDF) inexpensively.
**Ruminal Fermentability of Diets**

The fermentability of diets depends on digestion and passage characteristics of individual feed ingredients and interactions among them. Starch generally is fermented faster than NDF, but passes from the rumen more quickly. Although NFC is often used as a proxy for the fermentability of diets, it is poorly related to fermentability because fermentability of both starch and NDF vary greatly by source.

Factors affecting ruminal fermentability of fiber include extent of lignification, rate of fermentation, and ruminal retention time. As discussed above, rate of fermentation is dependent on intrinsic characteristics of the feed and on ruminal pH over time. Rate of passage is related to particle size and fermentation characteristics that affect buoyancy in the rumen over time. Retention time of forage NDF ranges from 24 to over 40 h for lactating cows depending on the amount of feed intake, diet characteristics and source of NDF.

Ruminal fermentation of starch is affected by particle size, gelatinization of starch, and amount and solubility of endosperm proteins. Dry rolling and grinding decrease particle size of grains, which increases surface area and also gelatinizes starch, which increases accessibility by microbes and rate of fermentation. Endosperm proteins surround starch granules and inhibit accessibility to starch by ruminal microbes. Different grain types such as wheat, barley, corn, and sorghum have major differences in amount and solubility of endosperm proteins that dramatically affect rate of fermentation. Wheat and barley have low concentrations of soluble starch and are digested more slowly than corn or sorghum. There is also great variation in amount and solubility of endosperm proteins among corn hybrids. Some hybrids have floury endosperm with soluble proteins and are more readily digested, and others have more vitreous endosperm with insoluble proteins and are more resistant to digestion. High moisture fermentation results in proteolysis and an increase in the solubility of endosperm proteins, increasing rate of starch digestion.

As previously discussed, the extent of ruminal starch fermentation ranges from less than 40% to greater than 90% depending upon source. Ruminal fermentability depends upon rate of digestion and rate of passage from the rumen, which depend upon intrinsic characteristics of individual feeds, other diet components, and on characteristics of the animals fed. For instance, rate of starch digestion for a particular feed depends on the population of starch digesting microbes in the rumen. Rate of starch fermentation can increase dramatically when the fermentable starch content of the diet is increased. Rate of passage is affected by the size and density of particles but also by the filtering effects of the rumen mat and by level of intake. The major limitation to fermentation rate of sugars is accessibility by rumen microbes. Although sugars from whey or molasses are fermented very quickly and completely, sugars in fresh forages are less accessible and probably fermented more slowly but completely because of the long retention time of forage particles in the rumen.

Fermentation of organic matter (OM) in the rumen results in the production of fermentation acids. The primary acids produced are acetic, propionic and butyric but other acids are produced as well. For example, lactic acid is produced, but its rate of utilization by microbes is usually sufficient to keep concentrations low. If a diet suddenly becomes more fermentable, lactic acid concentrations can increase and ruminal pH can drop rapidly because lactic acid is a much stronger acid than the VFA. This happens when abrupt changes occur in the diet such as when a much more fermentable starch source is substituted for one that is less fermentable, or when heavy rains result in greater forage moisture content and less forage DM and NDF added when total mixed rations are mixed. When cows have clinical ruminal acidosis it is because of elevated lactic acid concentrations. Increasing consistency in all aspects of your feeding program, paying particular attention to mixing and to variation in forage DM and NDF content will help prevent lactic acidosis. Lactic acid is not usually a factor in sub-clinical acidosis, which results in lower energy intake and poor microbial efficiency. This happens when production of VFA exceeds the buffering capacity of the rumen contents, resulting in a decline in ruminal pH.

The optimal ruminal pH to maximize milk yield and efficiency of milk production is unknown. It probably varies for different cows and feeding conditions. However, we do know that fiber digestion decreases as pH is reduced from ~ pH 6 to pH 5.5 and below. This is because growth of fiber-digesting microbes becomes inhibited as pH declines. We also know that once populations of fiber digesting microbes are reduced, it can take many days to restore their numbers. On the other hand, the starch-digesting microbes have shorter doubling times and their populations can increase quickly. The implication of slower fiber digestion in the rumen is that fiber becomes more filling and feed intake might decrease. Fermentation acids also are absorbed from the rumen more quickly as pH declines and this might result in smaller meal size. While this might benefit cows “on the edge” of ruminal acidosis, it might result in lower DMI for others. The average ruminal pH throughout a day is much less meaningful than the fraction of time ruminal pH is below a threshold value such as pH 5.7. Therefore, feeding management decisions should be made to minimize variation not only from day-to-day but also within a day. Factors affecting variation in ruminal pH throughout a day include those that affect the number and size of meals discussed above, and the fermentability of diets.

The production rate of fermentation acids depends upon the amount of OM fermented per unit time and the efficiency at which microbes utilize this OM for growth. When large amounts of highly fermentable OM are provided to ruminal microbes quickly, they sometimes uncouple growth from fermentation. This is called energy spilling and is undesirable.
for two reasons. The first is that less microbial protein will be produced per lb of OM fermented. The second is that much more acid will be produced per lb of OM fermented, which adds to the acid load in the rumen that must be neutralized or buffered. Efficiency of microbial protein production is decreased as starch digestion in the animal increases, which is dependent upon amount and fermentability of starch in the diet.

Ruminal Fermentation Consistency

There are many benefits to a high level of ruminal fermentation that is consistent over time. This can be attained by feeding highly fermentable, effective NDF and starch with moderate rate of fermentation with a moderate to slow passage rate from the rumen. It is also important to feed ad libitum, and avoid over-crowding to decrease slug feeding. Starch sources that ferment rapidly result in a more variable fermentation over time with a much greater production of fermentation acids immediately following a meal than prior to the meal. Less variation in fermentation acid production over time translates to greater minimum ruminal pH and allows more fermentable diets to be fed. A consistent supply of available carbohydrate in the rumen will increase efficiency of microbial protein production, reducing the need for expensive sources of bypass protein. This will ensure consistent production and absorption of VFA into the blood which will help increase feed intake and possibly result in less insulin release, and therefore greater partitioning of energy to milk.

Summary

- The goal of formulating diets for carbohydrates is to provide low fill, highly fermentable diets that result in consistent ruminal fermentation over time.

- Forage fiber contents of diets limit feed intake of high producing cows.

- Rapidly fermented starch sources can decrease feed intake and efficiency of microbial protein production.

- Forages with highly digestible NDF with a high ruminal turnover rate are most valuable for high producing cows.

- Consideration of carbohydrate digestion characteristics when formulating diets is important to maximize energy intake and microbial protein production.

Part 2 of this article will appear in the next issue of MDR and will discuss a system for formulating diets to maximize energy intake and microbial protein production.

Reproduction

Thawed Sperm Cannot Wait

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In recent years, a major development in the dairy industry has been increased number of cows per herd. In many cases expansion of herds has increased concern about time available to perform certain tasks, such as artificial insemination (AI). Increased size of herds has increased the number of cows in the breeding group and increased the number of cows in estrus (heat) per day. Increased use of tools for synchronization of heat and ovulation has intentionally grouped cows to exhibit heat at the same time. Also with larger herds it is likely that there is more distance between the location to thaw semen and the location to inseminate cows. However, there is little evidence that facilities to sort and restrain cows for AI have been installed or improved to parallel the other developments and to serve the consequent increased need to sort and restrain animals. These circumstances have increased the opportunity, temptation, and presumably the practice to thaw the same number of straws of semen as the number of cows to inseminate. For example, with six cows in heat at the same time it is tempting to thaw six straws of semen together as a batch. The major purpose of this article is to discuss whether batch thawing of semen can affect the success of artificial insemination (AI).

On many farms, batch thawing of semen may have created a situation like congested airplane traffic at a busy airport. Fuel is used on the runway, but the planes do not get closer to the destination. Specifically, for thawed sperm that are still in a straw fuel is consumed but does not contribute to the activity necessary for a sperm to survive and to ultimately fertilize an oocyte (egg).

Imagine that you are on a flight from Chicago to Hawaii. The pilot announces to the passengers that there is bad news and good news. The bad news is that there is not enough fuel for the plane to get to Hawaii. The good news is that there is enough fuel to get to San Francisco to refuel.

In contrast to airplanes, thawed sperm in straws cannot be refueled. When metabolism consumes all fuel, the sperm will die. Dead sperm cannot fertilize an egg. To fertilize an egg after AI, sperm must be deposited into the uterus and travel to the oviducts of a cow. Once at the oviducts, sperm must actively swim around to increase the probability that a sperm will contact an egg. For fertilization to occur sperm must have all of their functional parts, fuel, active metabolism, and motility up to and even after the time that a sperm contacts an egg.

While sperm are frozen, metabolism in sperm is for all practical purposes
stopped and virtually no fuel is used. However, after sperm are thawed metabolism is activated and fuel is consumed whether the sperm are in a straw, the uterus, or the oviducts of a cow. For sperm that are alive, fuel must be consumed to support metabolism, and for sperm that are in straws the rate that fuel is consumed cannot be slowed and the limited supply of fuel cannot be replenished. Therefore, increased time that thawed sperm are in a straw before deposition into a cow will increase the risk that all fuel will be consumed and that sperm will die before fertilization of an egg.

Watch the Clock
A major opportunity to manage the fuel supply in semen is to control the amount of time between thawing and deposition of sperm into a cow or heifer. Shorter periods of time that sperm are thawed before deposition will leave more fuel in those sperm that do arrive at the oviducts. Except for chemical-, physical-, or temperature-induced trauma to sperm, as long as there is fuel for metabolism sperm should be alive and motile. In the oviducts, motility is critical for sperm to contact and fertilize an egg. Sperm that die for any reason, including no fuel supply, can and do get into the oviducts. However, even in the oviducts dead sperm cannot fertilize an egg. So, you should be very concerned about the amount of time that sperm are thawed before deposition into a female. How might batch thawing of semen affect the amount of time that semen is thawed before deposition into a female? Does the amount of time that sperm are thawed affect reproductive success? Do empty fuel tanks over the Pacific Ocean affect whether your jet plane will get to Hawaii?

For many years it was recommended that semen should be deposited into the uterus of a female within 15 minutes after semen was thawed. With larger herds and more animals to inseminate at the same time, the concern is that some straws of semen are thawed too long before the semen is deposited into a female. Is there any evidence that this might be a problem?

Reduced Fertility Addressed

Last summer at the meetings of the American Dairy Science Association there was a report from Colorado on conception rates when four straws of semen were thawed simultaneously. Promptly after thawing each straw was loaded into an insemination gun. The order that semen from each straw was deposited into a cow and whether the cow conceived were recorded. From this study, it is clear that conception rates with the third and fourth straw (<20%) were lower than with the first and second straw (45%). There were very similar results from a study in Hawaii. From both of these studies it is apparent that there will be negative consequences to fertility when more than two straws of semen are thawed at the same time. However, it is not clear why fertility is reduced. The authors for this research suggested that no more than two straws of semen should be thawed at the same time.

However, is the issue really the number of straws thawed at the same time? A concern with thawing multiple straws of frozen semen is the challenge to maintain proper temperature and rate of thawing within the thawing bath. To address these concerns up to 20 straws of semen were thawed as a batch and motility of sperm was evaluated in a laboratory. Immediately and 4 hours after thaw, the number of straws thawed as a batch did not affect mobility of sperm. However, batch thawing of semen had significant adverse effects on mobility of sperm from some bulls. The problem is that we do not know which bulls are susceptible to reduced viability due to batch thawing. This research did not test actual fertility of batch-thawed semen in cows. Therefore you should not conclude that batch thawing will support successful AI in your herd. In addition and possibly more important is the point that no research has addressed directly the amount of time that semen can be thawed before deposition into a cow. If circumstances for insemination are planned and ideal, AI should require about 2 minutes per cow. If 20 straws are batch thawed, the last straw deposited would be thawed for about 40 minutes.

Before deposition into a cow, what is the best place to hold thawed semen? Is it in the thaw bath or in the AI gun? Frankly, this is not known. However, from the laboratory research and known environmental hazards to semen in AI guns, it is reasonable to speculate that retention of semen in the thawing bath is probably the best option. From the two studies of fertility in cows after thawing up to four straws of semen, the data could be interpreted that the problem or issue is simply increased number of straws are thawed simultaneously. In contrast, the data from laboratory research is very clear that number of straws thawed does not affect viability of sperm. So, if there is a concern about batch thawing of semen, it is most likely that the issue is the amount of time that semen is thawed before deposition into a cow.

Number of Straws Debated

With attention to the amount of time semen is thawed, you should consider what is the number of straws of thawed semen that you can deposit into females within an acceptable amount of time? Acceptable amount of time is before the fuel within sperm is exhausted or before there is environment-induced lethal trauma to sperm. Nothing can be done to change the amount of fuel in sperm or how long it will last. However, retaining thawed semen in the thawing bath rather than loading into an AI gun may reduce risk of trauma from the environment. Note that greater amount of time that thawed semen is in an AI gun will increase the risk of a lethal challenge from the environment, especially during seasonal extremes of cold or hot temperatures. Based on previous recommendations, the maximal acceptable duration of the period that thawed sperm can wait to be deposited is approximately 15 minutes after semen is
thawed. The guideline is for you to thaw no more straws of semen than you are certain that you can deposit into the uterus of different cows within 15 minutes.

Based on the fertility data reported from Colorado and Hawaii, in herds that thaw three or more straws of semen, the average conception rate (30.3%) will be lower than the average conception rate (48.4%) in herds that thaw one or two straws of semen at a time. What are the consequences of lower conception rate to the number of cows that are pregnant after a maximum of four successive inseminations? After a maximum of four inseminations, 93% of cows will be pregnant after a maximum of four inseminations. Compared to thawing three or more straws, thawing one or two straws of semen combined with timely deposition of semen into cows will cause 17 (93 minus 76) more cows to get pregnant for every 100 cows in the breeding group. When more than two straws are thawed the reduced conception rate for each insemination is cumulative over successive inseminations so that number of pregnant cows can be reduced more than is expected from average conception rate. Independent of the goal for average calving interval in your herd, unplanned extended periods that cows are not pregnant (days open) cause a problem because you have lost control to manage the duration of lactation and of the “dry period”. Whether you thaw one or multiple straws, how you manage thawed semen can have profound effects on the reproductive performance of your herd.

There Is No Right Number

A specific maximum number of straws to thaw that will provide an adequate number of thawed sperm for successful AI has not been established. Remember that success of batch thawing varied among bulls. In addition more sperm in a straw will increase the rate that fuel is consumed and thus will reduce viability of sperm. Number of sperm per straw varies among bulls and different AI companies. In fact, the number of straws that can be batch thawed and sustain success with AI probably varies among bulls, herds, and even AI companies. In some circumstances semen that is thawed for 5 minutes may be too long while in other circumstances 30 minutes may be just fine. Therefore to not mislead you with this discussion, there will be no mention of a specific number of straws or a specific time that semen can remain thawed before deposition. However, please recognize that there is sufficient evidence for you to be concerned that success of AI will decline if semen is thawed too long before deposition into a uterus. As managers of an AI program you should recognize this potential problem and adjust your practices for AI accordingly. Note that whether you thaw one or multiple straws, it is entirely possible for thawed semen to wait too long!

Prepare for the Unexpected

What can you do to reduce the time or at least prevent unexpected extensions of time before thawed semen is deposited into a female? First, is to restrain the animals to be inseminated before semen is thawed. Some type of facility specifically for this purpose will prove very effective (see Michigan Dairy Review, August 1999, p.10). Second, do whatever is possible to minimize the distance from where semen is thawed to where cows are inseminated. This is especially important in cold weather. Third, you must remember that sperm are microscopic. Consequently, the amount of fuel that is stored in sperm is very small and can be exhausted in a short time after sperm are thawed. In addition to concerns about fuel for sperm, the fact that sperm are microscopic makes them very sensitive to the negative effects of the environment that surrounds a straw. Independent of your comfort as a person wearing clothing, while you are handling semen, imagine that you are microscopic and that you are naked. Without regard for your modesty or embarrassment, this perspective should make you extremely sensitive and attentive to protect the tiny environment in which thawed sperm must survive (see Michigan Dairy Review, January 2000, p. 9; April 2000, p. 15; July 2000, p. 15). As suggested above, holding thawed semen in the thaw bath may provide protection from and reduce variation caused by the environment. Fourth, plan for surprises such as cows that escape from restraint or those cows that present extra difficulty to pass the AI gun through the cervix. Thaw a number of straws that is conservative so if there are problems with animals, people, or equipment there will be some flexible time to deposit semen while sperm still have fuel.

With increased numbers of cows in herds and increased use of synchronization, it is critical to handle semen correctly and to schedule AI accurately. This means that you should review critically your procedures for AI so you are certain to satisfy the rules for AI while you simultaneously benefit from a larger herd and synchronization of heat. A critical review of your plan and procedures for AI should reveal the benefit and the need for a facility to sort and restrain animals efficiently and safely. It is critical to recognize that the fuel supply in sperm does not allow for you to thaw semen first and then chase, sort, and restrain cows for AI. Independent of fuel in sperm, note that without proper facilities, sorting, handling, and chasing animals before AI is usually stressful for cattle and people. Stressful movement or handling of cows before AI will lower fertility. Where gang-lock stanchions exist and are used to restrain cows for AI, consider a vehicle such as a golf cart on which you can carry records, frozen semen, and all equipment and supplies directly to the cows. Even with an assistant in this vehicle, there would be no need and there is a possible disadvantage, to thaw more than two straws of semen at the same time.

Summary

Success with AI requires that most
of the sperm from a straw will reach the oviducts of a cow and that sperm in ovi-
ducts must still be alive and have a re-
serve of fuel. You should strive to mini-
mize the amount of time that fuel is con-
sumed before semen is deposited into
the uterus. Your best approach is to be
very organized before semen is thawed.
This means that you should arrange ani-
mals and all equipment necessary so that
thawed semen is in an AI gun for a mini-
mal amount of time and can be depos-
ted into cows almost immediately.
Factors that affect the success of
batch-thawed semen will not be known
for each herd, each bull, or each AI com-
pany. So, specific recommendations and
guidelines are not available. Therefore,
your general practices should manage
all thawed semen with the attitude that
the fuel supply for sperm will be con-
sumed very quickly. Assume that fuel
in sperm will be consumed earlier rather
than later after thawing. This attitude
should insure that most sperm still have
fuel when they arrive in the oviducts.
**Do not make thawed sperm wait too
long!**

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### University & Industry

#### Record Numbers of Youth at 2000 Michigan Dairy Expo

**Mike Peters and Richard Pursley**  
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A record number, 200 enthusiastic youth and 300 willing
cattle, participated in events at last year’s Michigan Dairy
Expo. The passion displayed by Michigan’s youth for this
event has translated into more than a three-fold increase in
participants from 4 years ago.

The Expo was held July 10 through July 14 at Michigan
State University’s Pavilion for Agriculture and Livestock Edu-
cation. It was a week filled with fun and excitement for people
of all ages and backgrounds. Tuesday, July 11, was the Michi-
gan 4-H State Dairy Show. That morning, over 100 youth
competed for the title of Supreme Showperson. Lindsay Kirk
of Clinton County earned the title of Supreme Showperson.
After the showmanship contest, over 300 head of cattle were
exhibited in seven different breed shows. The 2000 Supreme
Champion cow was Davisdene Moonbeam Emily exhibited
by Danny Benjamin of Ingham County. All youth involved
in the show did an excellent job displaying their skills and ex-
hibiting their animals.

#### The Great Dairy Adventure

Wednesday of Expo week featured two separate
events, The Great Dairy Adventure and the State 4-H Dairy
Judging Contest. The Great Dairy Adventure is a consumer
education program that just completed its second successful
year. Nearly 2000 young people and their chaperones visited
the MSU Pavilion to learn where milk comes from. Many of
these youngsters (and adults) were thrilled to get their Milk
Mustache picture taken with MSU football star T. J. Duckett.

T. J. said he had a lot of fun too! The kids learned how dairy
products are produced, how to milk a cow, and why milk and
milk products are a healthy dietary choice.

Over 150 youth participated in the Michigan Youth Dairy
Cattle Judging Contest. In the junior division of the contest,
Danny Benjamin was the high individual, while Mary TenBrink
of Ottawa County was the high individual in reasons. The
winning team in the junior judging contest was the A team
from Ottawa County. In the senior division of the dairy judg-
ing contest, high individual honors went to Faye Vanderhoff
from Lenawee County and top individual in oral reasons was
Katie McCune from Gratiot County. The high team overall
was the Lenawee County team.

#### Youth Events

Youth events wrapped up on Thursday with the State Dairy
Bowl Competition. The senior team from Livingston County
took home top honors in the dairy bowl and earned the right
to compete in the National 4-H Quiz Bowl in Louisville, Ken-
tucky. The team from Ottawa County grabbed first place in
the junior division of the Dairy Bowl.

Expo week culminated with the traditional open shows for the
state’s different breed associations. Ayrshire, Brown Swiss,
and Red and White breeders had a successful day in the
showring on Thursday. Then on Friday, the 2000 Michigan
Dairy Expo wrapped up with the Jersey and Holstein open
shows. After the open shows were completed, all breed chal-
engers returned to the ring for the naming of the Open Show
Supreme Champion. Supreme Champion was Leela C C
Donna E. “Donna” is a Senior Holstein Three Year Old ex-
hibited by Long Haven Farms, Inc. from Clayton, MI.
Sponsors Support Dairy Expo

We would like to thank our great sponsors and gracious volunteers for making the 2000 Michigan Dairy Expo a huge success. The excitement already is building for this summer. Make plans now to attend the Michigan Dairy Expo on July 16 through 20, 2001.

The following organizations, companies and individuals provided support for this year’s Expo:
- Jerry and Pam Caryl, Dansville; Ira Krupp, Grand Haven; George Atkeson, Greenville; Mary Jo and Jerry Godfrey, Davison; Monsanto; ABS Global; Cargill Animal Nutrition; Consumer Energy; Country Fresh; Dairy Farmers of America; Farmco; Genesee County 4-H Dairy Committee; Genex Cooperative, Inc.; Greenstone - Farm Credit Services; Kent County Dairy Development; Kramer Family Farm; Merial Limited; Michigan Farm Bureau; Michigan Milk Producers Association.; MSU Dairy Club; MSU Dairy Judging Team; Munsel Farm; Northstar Cooperative; Osceola County Dairy Boosters; Ottawa County 4-H Dairy Committee; Pfizer Animal Health; Shiawassee Dairy Association, and the United Dairy Industry of Michigan.

The 2001 Dairy Expo

The 2001 Michigan Dairy Expo and 4-H Dairy Days will take place July 16 to July 20 at the Pavilion for Agriculture and Livestock Education on the campus of Michigan State University. As in previous years the main events for the Dairy Expo are Michigan 4-H Dairy Youth activities and the open shows for Michigan’s dairy breed associations. Some of the youth events scheduled for the week include the state 4-H Dairy Show, the state 4-H and FFA dairy cattle judging contest, the state 4-H quiz bowl competition, and a dairy management contest. The dairy management contest is new to Michigan Dairy Expo this year and will give youth an opportunity to display skills that are used in everyday management of dairy operations. Various youth activities are scheduled between July 16 and July 19. The open shows for Michigan’s dairy breed associations will take place on July 19 and 20. Plans are also underway for the 3rd annual consumer education program during the week of Dairy Expo. In 2000, the consumer education program reached approximately 1800 youth and adult consumers. Anyone interested in attending or participating in any of the events during the Michigan Dairy Expo is welcome. For further information on Michigan Dairy Expo events or to inquire about sponsoring or volunteering for our program please contact Mike Peters at (517) 355-8319.

MSU Dairy Judging Program Completes A Successful Year

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Members of the Michigan State University Collegiate and Ag Tech Dairy Judging Teams and over 25 Michigan 4-H members spent many summer and fall weekends visiting farms and judging cows in preparation for the fall judging season. The teams visited dairy farms in Michigan, Ohio, Indiana, Wisconsin, and Ontario, Canada. Practices were held at the Genesee and Shiawassee County Fairs and the Community Fair in Hudsonville, MI. A final summer workout was held at the Michigan State Fair. All of the practice and preparation paid off as the state of Michigan was successfully represented in three national contests.

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 for 2000 were Jason Canaday (Colrain, MA), Michelle Hyde (Morley), Sarah Krippes (Fowlerville), and Josh Miller (Elsie). The team placed 5th in linear evaluation, 6th in Jerseys, and 11th overall. Jason was 5th in Jerseys and 13th in linear evaluation. Michigan 4-H was represented by Gina Blough (Lowell), Lindsay Kirk (St. Johns), Bobbie Meyer (Byron Center), and Brian Ponstein (Hudsonville). This team placed 5th in Jerseys, and 10th overall. Bobbie was 4th in Guernseys. Lindsay was 4th in Holsteins and 5th overall. A second 4-H team, comprised of Michigan FFA members, competed in the FFA division of the contest to gain experience for future 4-H contests. Team members included Courtney Baker (Lowell), Katie McCune (St. Louis), Emily Snellar (Sebewaing), and Faye Vanderhof (Clayton). This team placed 2nd in Ayrshires, 4th in Brown Swiss, 3rd in Guernseys and Jerseys, 1st in Holsteins, linear evaluation, and oral reasons. The team placed 2nd overall in the contest. Faye was 4th in Ayrshires, 1st in linear evaluation, 9th in oral reasons, and 10th overall. Emily was 1st in Holsteins, 4th in linear evaluation, 8th in oral reasons, and 5th overall. Katie was 4th in Jerseys, 1st in reasons, and 6th overall. Courtney was 4th in oral reasons.

World Dairy Expo Contest

In late September, the Collegiate, Ag Tech, and 4-H teams traveled to Madison, WI for the national contest at World Dairy Expo. Ag Tech team members included Brent Lucas (Alpena), Gabe Papoi (Charlotte), and Nick Protzman (Caseville). Michigan 4-H was represented by Betsy Atherton (Gaines), Calby Garrison (Onsted), Lindsay Kirk (St. Johns), and Katie McCune (St. Louis). The Collegiate team placed 10th in Brown Swiss, 7th in Jerseys, 4th in Milking Shorthorns, 12th in oral.
reasons, and 16th overall. Jason was 11th in Brown Swiss. Sarah was 7th in Ayrshires. Josh was 11th in Milking Shorthorns. Michelle was 9th in Jerseys. The Ag Tech team placed 5th in Milking Shorthorns and 12th overall. Nick was 7th in Milking Shorthorns. The Michigan 4-H team placed 5th in Milking Shorthorns and 12th overall. Nick was 7th in Milking Shorthorns. The 4-H team was 8th in Jerseys, and 10th in reasons. Calby was 5th in Guernseys, 8th in Holsteins, 16th in reasons, and 23rd overall. Lindsay was 5th in Jerseys, while Katie was 15th in Jerseys.

The Collegiate, Ag Tech and 4-H teams also participated in the practical contest at World Dairy Expo. This contest consists of three sections. The first section is evaluating and selecting commercial-bred heifers based on price, health status, and production records. Team members evaluate body condition, feet and legs, udder promise, and estimate heifer weights and heights. Appropriateness of service sires is also 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, the team members had to perform linear evaluation on six cows. The practical contest offers team members an opportunity to utilize practical knowledge and experience. The 4-H team was 2nd in the commercial bred heifer evaluation, while the Ag Tech team was 5th. The Collegiate team was 10th in the registered heifer evaluation and 10th overall in the practical contest.

The Final Contest

The final contest of the year was held at the North American International Livestock Exposition in Louisville, KY. The collegiate team placed 8th in Holsteins and 15th overall. The Ag Tech team was 5th in Jerseys, 6th in Brown Swiss, 6th in oral reasons, and 8th overall. Brentt Lucas was 9th in Brown Swiss and 7th in Jerseys. Nick was 7th in Ayrshires, 9th in Guernseys, and 12th in oral reasons. The 4-H team members were Gayle Brasher (Pittsford), Honor Howe (Fremont), Fred Ludwig (Fostoria), and Beth Munsell (Fowlerville). This team was 7th in Brown Swiss and Jerseys, 5th in Guernseys, 1st in Holsteins, tied for 1st in oral reasons, and 5th overall. Beth was 6th in Brown Swiss and 9th in Holsteins. Fred was 8th in Guernseys, 10th in Holsteins, and 6th in reasons. Gayle was 2nd in Holsteins, 4th in Jerseys, and 8th in reasons. A second 4-H team, made up of Michigan FFA members also competed in the contest. Team members included Brandon Delong (Fremont), Will Green (Elsie), and Ben and Aaron Kaeb (Lowell). This team was 9th in Ayrshires and Jerseys, 6th in Holsteins, and 12th overall. Will was 7th in Jerseys.

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 try out 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.

Thanks to the Supporters!

ABS Global, United Dairy Industry of Michigan, Northstar Cooperative, and Michigan Holstein Association provide major 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 would like to extend appreciation to all of the individuals, farms, and agricultural businesses that support the program by providing cattle, expertise, and financial support. Special thanks to assistant coaches, Mrs. Sara Long, Mrs. Sarah Black, Ms. Renee Nugent, and Ms. Laurie Davis. The MSU Dairy Judging Program is coordinated by Dr. Joe Domecq.

Look for MDR on the Web
