Over the years, many methods of milk culturing have been employed to provide information regarding mastitis prevention, treatment, and control. In general, these efforts have centered on culturing in a laboratory located at a university, milk processor, or veterinary clinic. Products available on the market and efforts required to culture milk on the farm have, in general, been unsuccessful for various reasons. The main reason for frustration with on-farm milk culturing stems from the fact that it has been difficult to train, equip, and motivate farm personnel to ensure ongoing and accurate culturing for making treatment and prevention decisions.

On the other hand, by the time culture results of clinical infections are reported back to the dairy for treatment decisions from off-farm laboratories, too much time has elapsed to be useful. This paper is intended to report on both success and failure in on-farm culturing, based on a methodology reported by Hess et al. (1).

When confronted with an elevated herd somatic cell count (SCC) or an increased number of clinical mastitis cases, most managers of dairy herds are quite knowledgeable about effective measures for controlling and dealing with these problems. It is not so much an issue of lack of knowledge as it is a
ON-FARM MILK CULTURING has many benefits. It can be difficult to train, equip, and motivate farm personnel to engage in on-farm milk culturing, but the realities surrounding clinical mastitis and milk production mean the results may be worth the effort. On-farm culturing allows for monitoring of good sampling technique and shortens the time required to recover and identify organisms, but the clear advantage to on-farm culturing is the timeliness of obtaining results.

Lack of attention to the details of implementation that make the real difference in the production of quality milk. It is simply a matter of milking clean, dry, and comfortable cows with properly functioning milking equipment. Mastitis researcher J. Woodrow Pankey was fond of saying that “there are only four ways that a cow gets mastitis: left front, right front, left rear, right rear!” The trick is to ensure that the bacteria on the outside do not become the bacteria on the inside. There are many strategies for doing this, but they all boil down to two basic tenets: decrease the exposure to bacterial pathogens and increase the resistance of the cow to these infections. Despite all of our advances in both strategies, cows continue to develop intramammary infections, and will for the foreseeable future. The ability to identify these bacteria allows the producer and his employees to devise both prevention and treatment plans to deal with the reality of clinical mastitis.

Bacteria that are commonly associated with mastitis in dairy cows are most commonly categorized by the type of stain that they take in the laboratory. The most commonly employed stain is the Gram stain, and it has two possible outcomes. Gram-positive bacterial cells will have a purple or blue color when observed under the microscope. *Streptococcus* and *Staphylococcus* organisms are common Gram-positive bacteria. Gram-negative mastitis causing organisms, such as *E. coli*, *Aerobacter*, and *Klebsiella*, have cells that stain with a red color when observed under the microscope.

**Technique**

The culturing and treatment technique described by Hess et al. (1) involves collecting milk samples from all clinical cases of mastitis on the farm when first detected, and culturing the samples on differential media in order to determine if the causative organism is either Gram-positive or Gram-negative. Cows that show up as new cases of high SCC on the DHIA monthly test report are California mastitis test (CMT) scored. All suspected high SCC quarters are cultured, as well. The decision to treat or not to treat a quarter is based on the growth of either a Gram-positive or a Gram-negative bacteria.
infected quarter. Gram-negative and all no-growth quarters are left untreated. However, in some cases they may be re-sampled and re-cultured after a 1 to 2 week interval, if there has been no improvement in the nature of the secretion from the affected quarter.

Those quarters with no growth or a Gram-negative infection, identified as growth on MacConkey’s agar, are not treated with intramammary antibiotics. Depending on the assessment of the cow’s condition, supportive systemic therapy is employed according to a set of treatment protocols that are based on observable symptoms and previous favorable responses of animals with similar symptoms within the herd. Gram-positive cultures are treated with intramammary infusion according to treatment protocols that are based on previous favorable treatment outcomes. Cows are not treated either way until there has been a determination of growth or no growth on culture media.

On-farm culturing allows for monitoring of good sampling technique and shortens the time required to recover and identify organisms. It also demonstrates clearly when poor sampling technique has been used, resulting in recovery of mixed organisms in the same sample. It is uncommon for mixed infections in the same quarter to occur; therefore, culture of more than one organism from a quarter is an indication of poor sampling technique or contamination of the sample.

The clear advantage of on-farm culturing is how quickly results can be obtained. Gram-negative organisms can be readily identified, as growth on the agar occurs in as little as 6 to 8 hours. Most of the common Gram-positive organisms will show growth by 24 to 48 hours. Timeliness in recovery of organisms offers a clear advantage because treatment plans can be implemented as soon as the bacteria are identified. Outsourcing milk samples to a laboratory for routine organism identification can result in costly delays in initiating an on-farm treatment plan.

On-farm culturing techniques are not designed to identify clinical mastitis caused by mycoplasma. If mycoplasma is suspected, milk samples should be sent to a diagnostic laboratory for special culture techniques required to identify the organism.

**Equipment**

To effectively culture milk samples on the farm, a reasonable supply of fresh culture plates needs to be on hand. Both bio-plates with just two media on them and plates containing three or four selective media are designed to more specifically differentiate the Gram-positive infectious organisms. In my experience, these plates are best obtained from a commercial source, and only in quantities that allow for timely use. Usually it is best to stock no more than a 3 to 4 week supply of culture plates, as they are prone to either getting contaminated or drying out in refrigerated storage. Sterile collection tubes, a 0.01 ml inoculation loop, a Bunsen burner or small propane torch, and an incubator are required for on-farm culturing.
Some means of systematically recording and retrieving culture results is necessary. This can be as sophisticated as using a computer or other electronic device, or as simple as the use of a notebook.

**Three components**

A successful on-farm culturing plan has three components. First, and by far the most important, is a well-trained person with an interest in doing on-farm microbiology. Second, a mechanism for recording culture results and treatment outcomes is necessary. The third key element is a timely review of the results, which leads to an action plan for treatment and prevention.

Training the appropriate people can be accomplished in many ways, but in my circumstances, I have assumed the role of microbiology instructor on dairies that want to implement on-farm culturing.

The most important key to successful on-farm culturing is the commitment of the person who is responsible to see that samples are plated properly, observed, and recorded in a timely manner. It is in this area where both my biggest failures and successes have occurred. Without someone who will plate samples, read and interpret results, and record these results, the entire process of on-farm culturing will be an exercise in futility. Human nature being what it is, there is a tendency to become complacent after an initial period of good compliance.

That being said, when farm management and the employees believe that milk quality can be continually improved through better informed treatment protocols, then on-farm culturing will contribute to successful outcomes.

**Other requirements**

A trained and committed person must be in charge of culturing. They must have a designated area and access to the materials and equipment necessary to culture milk. Second, the results of culturing and treatment outcomes must be recorded in order to devise protocols that improve treatment decisions. Treatment protocols based on valid culture results should be tailored to the organisms identified. Identification of mastitis pathogens allows the dairy to develop management strategies aimed at reducing exposure to those types of bacteria. Clinical cases can be reduced if farm management works with employees to discuss culture information, milking practices, and housing facilities. Through these discussions, a strategic plan can be developed to reduce exposure to pathogens causing clinical mastitis.

In successful culturing programs, herd managers reduced their use of intramammary antibiotics by half, because they no longer treated quarters that cultured no-growth or had Gram-negative infections. Substantial savings resulted from the use of less antibiotics and a decrease in milk discarded because of antibiotic treatment. Additionally, untreated cows did not pose a violative residue risk to the farm.

In this author’s observations of on-farm culturing, the program’s success or failure was not based on agricultural or educational backgrounds, but based on the commitment of the person selected to be in charge of culturing. In farms where the program failed, they initially had good compliance to the protocol, but as time progressed, they didn’t perceive any tangible benefit for their efforts.

Culturing clinical samples took time away from other duties, and their work schedules were already over extended. Despite encouragement and enthusiasm on my part at each and every herd visit, the program quickly fell into disuse. No amount of brow beating or cajoling from me was successful at reinstating the culturing program. Their incubators lie unplugged and gathering dust on cabinet shelves. In defense of their decision, they already had reasonable milk quality, and they did not believe that their rates of clinical infection could be improved significantly. In other words, they did not yet have a perceived problem, and without conviction on their part, the culturing program became a dead issue. At some point in the future, should they perceive a problem, or my communications skills improve, then culturing on their farm may yet become a reality.

**Summary**

On-farm milk culturing is a viable and useful tool, under the right circumstances, for improving treatment protocols and overall milk quality. The success or failure of these programs is highly dependent upon the motivations, training, and support of the personnel involved in this activity. The materials necessary are easily obtained, economical, and reasonably straightforward to use with proper training. Information derived from culturing is valuable for its timeliness in identification and treatment of mastitis pathogens, as well as its usefulness in the development of control strategies. Overall success is a function of the commitment and motivation of the personnel in charge of culturing.

**Reference**

Environmental Effects of MAEAP Verification

Analysis of the environmental impact of the Michigan Agriculture Environmental Assurance Program on the phosphorus mass balance and phosphorus index of farms revealed that verified farms reduced their phosphorus pollution potential. Many of the changes implemented in an operation were due to increased knowledge and understanding of agronomic conditions, of water flow, of animal management, and of environmental regulations as well as the maintenance of more accurate records.

Carrie Vollmer-Sanders
Sandra S. Batie
Christopher A. Wolf
Dept. of Agricultural Economics

The Michigan Agriculture Environmental Assurance Program (MAEAP) is a voluntary program created in 1998 by multiple Michigan governmental, industry, and university entities. MAEAP’s purpose is to assist livestock producers with the management of nutrients, particularly manure. A livestock farm must have an accurate and complete Comprehensive Nutrient Management Plan (CNMP), which the livestock producer must implement in order to become MAEAP-verified. Those livestock producers who follow the pollution prevention strategies outlined in their farm-specific CNMP may be able to reduce the risk of pollution discharges, nuisance complaints, and lawsuits. However, to date, the total participation in the MAEAP program has been small relative to potential participation. This article explores the environmental outcomes associated with MAEAP verification.

To determine the environmental impacts of MAEAP, in-person interviews were conducted with 29 producers from farms that were MAEAP-verified or soon-to-be MAEAP-verified as of January 1, 2005. The 29 producers interviewed represented 63% of all MAEAP-verified livestock producers at that time. The number of MAEAP-verified farms has increased steadily since the time of this research. As of December, 2006 there were 173 Livestock, 122 Farmstead, and 63 Cropping MAEAP-verified farms.

Concentrated Animal Feeding Operations (CAFOs) and Animal Feeding Operations (AFOs) of fewer than 1,000 animal units were examined separately. Among dairies, 700 mature dairy cows or 1,000 heifers are considered 1,000 animal units and were classified as CAFOs.

Methods

Interview questions and farm-specific CNMP information were combined to determine the environmental changes and outcomes that resulted from becoming MAEAP-verified. There were changes in CAFO regulations and availability of EQIP cost-share funds during the timeframe referenced in the survey. For example, a livestock producer may have needed to alter management strategies or to purchase capital investments due to the regulation changes or their own business needs. However, if a surveyed livestock producer attributed a change on the farm to becoming MAEAP-verified, then we assumed this attribution was valid.

Two measures were used to examine environmental impacts: the change in farm operation phosphorus (P) mass balance and the change in field P-Index scores. The Michigan P-Index used in this study is still being field tested prior to it being adopted by any governmental agency, university, or MAEAP. Although not released for public use at the time of this research, it was utilized as a measurement tool. For this discussion of P balance and P-index, P refers to $P_2O_5$.

Both methods were used to quantify farm environmental outcomes that occurred through MAEAP verification. The assumption was that if there was an improvement in either of these measures, then the amount of P entering Michigan waters should be reduced.

Cropland P mass balance

The P balance is a measure of how much the net import of P must change for the farm to avoid over-application. Because P can lead to harmful plant growth such as algae in freshwater systems, it must be applied at appropriate agronomic rates. Phosphorus mass balance scores were calculated by subtracting P associated with crop sales, animal sales, manure moved off-farm, and other “exported” P from the amount “imported” onto the farm through commercial fertilizer and feed purchases. Several variables were used to calculate the cropland P mass balance.
The amount of P in manure
The total quantity of manure
The number of spreadable acres below 300 lb. of P per acre
The amount of P the crops on those spreadable acres would use during a growing season
The amount of manure moved off-farm

Any farm will either be in phosphorus mass balance or out of phosphorus mass balance given the spreadable acres available. If the calculations from this research revealed an operation had a phosphorus mass balance score that was within plus or minus 20 percent of the initial pounds of phosphorus consumed by crops, then that farm was considered to be in balance. This range was the result of potential errors in calculating phosphorus in manure, soil phosphorus, and crop uptake. If a farm was out of balance, it had a positive score, signifying that the crops could not consume all of the phosphorus that was applied via manure application and not enough manure had been sold off-farm.

The average dairy farm examined generated more P than the crops could use (was out of mass balance) before implementation of the CNMP and MAEAP verification (Table 1). At least one farm in our survey with other livestock species was out of mass balance before becoming MAEAP-verified. After becoming MAEAP-verified, all farms in the survey had an average P mass balance score that was below zero and, therefore, in mass balance. Ninety-two percent of the 23 farms for which a P mass balance score was calculated were in mass balance after becoming MAEAP-verified. It is expected that farms that are in mass balance have reduced their farm’s potential for soil P build-up and eventual runoff into surface water.

After becoming MAEAP-verified, CAFOs, that on average were in deficit to begin with, decreased P mass balance by an average of 23,750 lb. of P (Table 1). AFOs had a much smaller change in mass balance, but still had a decrease of P mass balance after verification. Two CAFO operators sold some animals, an action that aided these farms coming into or below the P mass balance. The average dairy operation went from a 3,595 lb. surplus to a 20,411 lb. deficit. To achieve this outcome, the average dairy farm spent $5.96 per animal unit annually on management actions that affected the P mass balance score. Actions that directly altered the cropland’s P mass balance for this research included acquiring additional spreadable acres, moving manure off-farm, and recuding fertilizer and feed purchases. These actions were taken because applying manure to the appropriate fields can influence the operation’s cropland P balance.

**P-Index**

A P-Index was calculated in addition to the mass balance calculation. P-Index differs from a mass balance calculation, in that it addresses the transport and source of P on each field and takes into consideration streams that hold water part of the year, field slope, and the field’s hydrological group. The P-Index was calculated using information within the CNMP and was used to estimate the potential for P runoff, but did not include the volume of amount in any potential runoff.

Prior to MAEAP verification 12 farms determined to be at high risk for P pollution had an average score of 18.5 on the P-Index, slightly above the 18.0 threshold under which a producer could spread more manure or commercial fertilizer. The farm averages ranged from 27.7 to 8.7. After these farms became verified, the P-Index score on these same fields ranged from 20.5 to 7.7. This result reflects the adoption of environmentally beneficial practices to decrease P runoff. After the dairy operations became MAEAP-verified, an average P-Index score of 14.9 was achieved, which signified a lowered potential for P runoff on the high risk fields.

To lower the P-Index score of a field, the livestock producer could have made several different management changes or planted a buffer strip or grass waterway. A change in the P-Index score usually resulted from decreasing P runoff potential through less soil erosion (by adopting practices such as planting buffers or grass waterways, and observing setbacks), applying manure over a growing crop, incorporating manure into soil, or applying less manure or commercial P.

More livestock producers chose to implement buffer strips, change crop rotation, or alter tillage practices rather than change the method or amount of P that was applied to a field. The most common change made on a field was adding buffers or setbacks, which also increased the distance to surface water.

**Costs and equipment changes**

About 44% of producer annual costs per animal unit incurred on the high risk farms were attributable to changes made that affected the P-Index ($3.42 of $7.76). Of the high risk farms, there were no CAFOs that received cost-share for any capital investments eligible for EQIP cost-share. On average, the 12 high risk farms received more cost-share per animal unit (average costs of $91.17 per animal unit) than did the other surveyed farms ($54.96 per animal unit). This comparison suggests that larger amounts of cost-share were provided to the farms with the highest potential to pollute surface water from a field.
If a farm was considered high risk according to this study’s criteria, the livestock producer was more likely to change the equipment used to spread manure, add more manure storage, and put rain gutters on the buildings than if the farm was not categorized as high risk.

There were some other differences between the livestock producers with farms having high risk fields and others surveyed. For example, those operators with high risk farms disagreed with the statement, “Even though clean water benefits the public, producers should pay for the majority of mandatory environmental practices to ensure pollution prevention,” more strongly than did the average livestock producer. The 12 high risk farms also had a larger animal unit per acre density than did the 13 other farms in which a CNMP was collected compared with where density was 0.6 animal units per acre.

Summary

This analysis of the environmental impact of MAEAP on the P mass balance and P index of MAEAP-verified farms revealed that verified farms reduced their P pollution potential. Ninety-two percent of farms surveyed were in mass balance after they became MAEAP-verified. The 12 high risk farms, after becoming MAEAP-verified, had P-index scores below the threshold, which indicated that a lower risk of P runoff potential from a field had been achieved. Many of the changes implemented on an operation were due to increased knowledge and understanding of agronomic conditions, of water flow, of animal management, and of environmental regulations as well as by the maintenance of more accurate records.

Over 5,000 livestock producers have attended MAEAP Phase 1 education sessions and may be implementing the knowledge gained from these educational sessions without going through the MAEAP verification process. Thus, it is difficult to conclude exactly how much of an impact MAEAP has had on improving environmental outcomes.

| Table 1. Phosphorus ($P_2O_5$) Balance on Cropland Due to MAEAP -Verification |
|-----------------------------|---------------------------------|---------------------|-----------------|-----------------|-----------------|-----------------|
|                             | Beef                            | Dairy              | Poultry         | Swine           | Total           | CAFO1           | AFO2            |
| $P_2O_5$ mass balance       | Pounds of $P_2O_5$s per year    |                    |                 |                 |                 |                 |                 |
| **BEFORE** verification     | Average                         | -13,558           | 3,595           | -15,171         | -4,663          | -4,744          | -5,361          | -4,075          |
|                             | Standard Deviation              | 15,797            | 57,837          | 127,178         | 19,179          | 55,515          | 76,077          | 20,234          |
|                             | Minimum                         | na                | -58,335         | -196,733        | -29,467         | -196,733        | -196,733        | -38,086          |
|                             | Maximum                         | na                | 97,689          | 95,271          | 44,641          | 97,689          | 97,689          | 40,780          |
| $P_2O_5$ mass balance       | Pounds of $P_2O_5$s per year    |                    |                 |                 |                 |                 |                 |                 |
| **AFTER** verification      | Average                         | -12,675           | -20,411         | -41,341         | -10,391         | -18,332         | -29,111         | -6,654          |
|                             | Standard Deviation              | 17,046            | 26,571          | 104,645         | 11,111          | 41,686          | 53,799          | 18,650          |
|                             | Minimum                         | na                | -63,751         | -196,733        | -29,467         | -196,733        | -196,733        | -38,086          |
|                             | Maximum                         | na                | 13,448          | 31,369          | 8,206           | 31,369          | 180            | 31,369          |
| Change in $P_2O_5$          | Pounds of $P_2O_5$s per year    |                    |                 |                 |                 |                 |                 |                 |
| balance assoc. with         | Average                         | 883               | -24,006         | -26,170         | -5,728          | -13,588         | -23,750         | -2,579          |
| MAEAP-verification         | Standard deviation              | 1,249             | 40,443          | 46,280          | 14,271          | 29,605          | 38,369          | 7,208           |
| Annual producer cost        | 2004 Dollars per Animal Unit   |                    |                 |                 |                 |                 |                 |                 |
| Average                     | 0.69                           | 5.96              | 12.82           | 6.55            | 6.92            | 2.93            | 11.23          |
| Standard Deviation          | 35.96                          | 3.01              | 17.61           | 11.02           | 12.65           | 9.16            | 14.78          |

1 CAFO is “concentrated animal feeding operation” defined as equal to or more than 1,000 animal units.
2 AFO is “animal feeding operation” defined as less than 1,000 animal units.
Cow Comfort

Freestall Bedding Levels and Cow Comfort

Maintaining sand levels in freestalls is one management technique with a clear impact on both cow comfort and milk production. When cows spend more time lying down, they produce more milk. At least one study suggests that keeping bedding level with the freestall curb can increase the amount of time cows spend lying down, with possible benefits for cow comfort and milk production.

Cow comfort is widely recognized as an important factor in determining milk production. Freestall management, and bedding levels in particular, can have a significant effect on the comfort of cows as well as freestall associated lying behavior. Dairy cows housed in barns with freestalls normally spend between 8 and 16 hours per day lying in stalls. Research has demonstrated that blood flow to the mammary gland increases around 25% when cows are lying down as opposed to standing (2). This increase in blood flow to the mammary gland provides precursors for the synthesis of milk components in the gland. More time spent lying down also can lead to greater cud chewing and decreased lameness.

In a series of three experiments, Drissler and coworkers at the University of British Columbia in Canada examined changes in freestall bedding parameters over time as well as associated changes in cow behavior (1). Their findings suggest that keeping bedding level with the freestall curb can increase the amount of time cows spend lying down, with benefits also possible for cow comfort and milk production.

First experiment

In the first experiment, freshly filled and leveled sand bedded freestalls were measured over 10 days for depth and shape of the sand bedding relative to the top of the curb (Table 1). The distance from the top of the curb to the sand bedding increased each day with the greatest daily loss of sand occurring the day after stalls were filled. The surface of the stall beds became concave in shape and was higher towards the edges of the stalls. Stalls with higher occupancy times tended to have greater loss in sand depth. This may have been due to cows dragging or digging sand out of stalls as they used them more frequently.

Second experiment

For the second experiment, stalls were filled and maintained to a depth and shape corresponding to those recorded on days 0, 3, 6, and 9 of Experiment 1 (Table 2). Each treatment was applied for a 2-day period with stall sand bedding depth and shape maintained at treatment specifications by twice

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**Table 1. Sand Loss Relative to Days After Stalls Filled**

<table>
<thead>
<tr>
<th>Days since sand added</th>
<th>0</th>
<th>3</th>
<th>6</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand loss from top of curb (inches)</td>
<td>0.0</td>
<td>3.5</td>
<td>5.2</td>
<td>6.2</td>
</tr>
</tbody>
</table>

**Table 2. Lying Time Relative to Sand Depth in Second Experiment**

<table>
<thead>
<tr>
<th>Average distance from top of curb to sand surface (inches)</th>
<th>0.0</th>
<th>.73</th>
<th>2.0</th>
<th>2.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lying time h/24/h</td>
<td>13.2</td>
<td>12.8</td>
<td>12.5</td>
<td>12.1</td>
</tr>
<tr>
<td>Lying bouts number/24h</td>
<td>11</td>
<td>11.5</td>
<td>11.9</td>
<td>11.3</td>
</tr>
<tr>
<td>Lying bout duration (h/bout)</td>
<td>1.25</td>
<td>1.22</td>
<td>1.15</td>
<td>1.14</td>
</tr>
</tbody>
</table>

**Table 3. Lying Time Relative to Sand Depth in Third Experiment**

<table>
<thead>
<tr>
<th>Average distance from top of curb to sand surface (inches)</th>
<th>0.0</th>
<th>2.4</th>
<th>3.9</th>
<th>5.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lying time h/24/h</td>
<td>13.7</td>
<td>12.4</td>
<td>11.7</td>
<td>11.4</td>
</tr>
<tr>
<td>Lying bouts number/24h</td>
<td>11.3</td>
<td>10.9</td>
<td>10.7</td>
<td>11.4</td>
</tr>
<tr>
<td>Lying bout duration (h/bout)</td>
<td>1.3</td>
<td>1.2</td>
<td>1.2</td>
<td>1.1</td>
</tr>
</tbody>
</table>
daily grooming. Use of stalls by cows was recorded for each
treatment and compared below.

Cows spent 1.1 fewer hours per day lying in freestalls
when the level of the sand surface was 2.4 inches below the
curb versus stalls that were filled with sand to a level that was
even with the curb. The number of lying bouts did not differ
between treatments but duration of lying bouts decreased
as the distance from the top of the curb to the sand surface
increased (Table 2). It was further noted that for each 1 inch
decrease in sand level below curb height cows spent 28 fewer
minutes lying in freestalls.

Third experiment
In the third experiment, sand levels were maintained at a
depth of 0.0, 2.4, 3.9 and 5.4 inches below the top of the curb.
The distance to the sand surface below the curb height was
maintained and the sand bedding was kept level during the
experiment. Each treatment was imposed on the freestalls for
a period of 2 days during which sand level below the curb was
maintained and stalls were leveled by twice daily raking.

Cows spent 2.3 fewer hours per day lying in freestalls
when the level of sand was 5.4 inches below the curb height
than they did in stalls that were filled with sand even with
the top of the curb. The number of lying bouts in Experiment
3 did not differ between treatments. Duration of lying bouts
decreased as the distance from the top of the curb to the sand
surface increased. Cows spent 25 fewer minutes lying down
in freestalls for each 1 inch increase in distance from sand
surface to top of curb.

Conclusion
This series of experiments identified specifically how
sand levels in freestalls decrease over time and by use. In
addition, experiments 2 and 3 demonstrated that cows spent
less time lying in freestalls as the distance between the top of
the curb and the sand surface increased. The authors speculate
that decreased lying time may be indicative of cow discomfort
associated with freestall bedding levels. A reduction in lying
time of 2.3 hours per day out of an expected range of 8 to 16
hours per day may be indicative of suboptimal cow comfort.
The observed 2.3 hour reduction in lying time per day resulted
from an increase in distance between the top of the curb and
the sand surface of only 5.4 inches. It may be beneficial to take
a closer look at the levels of bedding in your dairy’s freestalls
an ensure routine maintenance of sand freestall beds.

References
the bovine mammary gland measured using transit time ultrasound
Tips for Feeding Corn Distiller’s Grains to Dairy Cattle

Distiller’s grains are a byproduct of the distillation process. As ethanol production has increased, distiller’s grains have increasingly been available for use as a feed ingredient for ruminant animals, including those on dairy farms. Research into how to optimize nutritional and economic value is ongoing, but already suggests helpful tips for including distiller’s grains in dairy rations.

Dave Beede
Marcus Hollmann
Herb Bucholtz
Dept. of Animal Science

Corn distiller’s grains (CDG) can be an excellent feed for dairy cattle. However, they must be properly and consistently processed at the ethanol plant, correctly incorporated in ration formulation, and properly stored and fed at the farm to optimize productivity and avoid changes in milk composition. In some cases, it may be possible to incorporate up to 20% of ration dry matter (DM). However, this will depend on the overall fermentability and types of forages in the ration, other sources and amounts of unsaturated (vegetable) fat and protein, and the stage of lactation and milk production level of cows.

The nutrient profile of CDG is similar to #2 yellow corn grain, except that nutrient concentrations are about three to four times greater in CDG, but they have low starch content. Starch in corn grain is converted to ethanol at the plant. A typical profile of CDG contains 30% crude protein (CP), 39% neutral detergent fiber (NDF), 10% fat (ether extract), 0.83% phosphorus (P), and 0.44% sulfur (S). Corn grain, DM basis, contains 9.4% CP, 9.5% NDF, 4.2% fat, 0.30% P, and 0.10% S (5).

Tips

1. Obtain complete and routine laboratory analyses of CDG. Composition will vary, from plant to plant and from batch to batch, so routine analysis is important.

2. The nutrient composition can vary greatly among wet versus dry CDG, with or without added condensed solubles. Adding condensed solubles to the distiller’s grains whether wet or dry results in a feedstuff containing more fat, phosphorus, and sulfur. Also, the nutrient concentrations may vary depending upon the amount of solubles added, even from the same ethanol plant. This variation emphasizes the need for complete and routine laboratory analyses.

3. Establish appropriate inclusion levels (concentrations) in lactation rations based on nutrient profiles determined by laboratory analyses of CDG and other feed ingredients (concentrates and forages) available for the ration. To optimally balance the ration, this almost always means that the amounts of other ingredients in the ration must be lowered when CDG are introduced. For example, other ingredients contributing significant amounts of crude protein, fat (especially polyunsaturated vegetable oil), phosphorus, and sulfur must be reduced to balance the nutrient composition of the final ration when CDG are incorporated.

4. Initially include no more than 10 to 15% CDG in the ration, and monitor milk production and composition before and after the ration change. A recent evaluation (meta-analysis) of 26 research studies published in refereed scientific articles evaluated the effects of CDG on milk production and composition (3). In the combined analysis of all results (all studies, all ration types, and cows in all stages of lactation) no differences in feed intake, milk yield, or composition were detected with 0 to 30% CDG (DM basis). However, the forage base of the ration made a difference as discussed in Tip #5 below.

5. When the effects of increasing CDG (0 to 30%, DM basis) were compared based on the main forage in the ration (corn silage versus alfalfa), different responses occurred. Milk yield was reduced as CDG content increased with corn silage as the main forage, but not with alfalfa as the main forage. This interaction likely is due to the overall fermentability of the total ration, the different physical form and effective-fiber of the forages, the quality and chemical form of protein, and (or) the overall amount of “corn-based feedstuffs” such as corn grain, CDG, and corn silage in the ration. Rations that have higher concentrations of very fermentable ingredients such as corn silage and corn grain (ground and high moisture) can reduce ruminal pH, feed intake and milk yield, and when in combination with excess polyunsaturated fat (such as corn oil) can reduce fat yield and concentration (1).

6. CDG contain 30 to 40% highly digestible NDF. However, this fiber is not effective to promote a good rumen...
mat and healthy digestive function. When using CDG, incorporating adequate effective-fiber from forages is crucial.

7 CDG have no better protein quality (essential amino acid profile) than corn grain. Both feedstuffs are particularly deficient in lysine, a dietary essential amino acid. If, for example, CDG replace part or all of other supplemental protein sources such as soybean meal or blood meal, which have higher lysine contents, a lysine-deficient ration may result.

8 Balance the rumen degradable protein (RDP) and rumen undegradable protein (RUP or bypass protein) and check the essential amino acid profile of the final ration. Assurance that there is enough RDP to maximize ruminal digestion and microbial protein synthesis is crucial when feeding CDG with other feed ingredients that do not contribute to adequate RDP in the ration.

9 Phosphorus content of CDG with solubles typically is in the range of 0.8 to 1.2% (DM basis). In many lactation rations, incorporation of CDG increases the amount of P beyond the cows’ requirement and increases P in manure. For example, if the P content of the ration increases by 0.05 percentage units (such as from 0.38 to 0.43%, DM basis) above recommendations (5) for a 200-cow Holstein herd, an additional 80 acres will be needed annually for manure application (at a crop removal rate of 50 lb of P₂O₅/acre). To not have excess P in the ration, the most CDG (at 0.83% P, DM basis) that can be incorporated and not result in excess ration P is 15% of the total ration DM if the average P content of the other ingredients is 0.30%, DM basis.

10 The optimal concentration of CDG for high yielding and (or) early lactation cows has not been adequately studied. Doubtless, it is different and likely lower than estimated when combining all available research results from all stages of lactation and rates of milk production into one analysis (3). Unique characteristics of high yielding cows, such as higher feed intake and faster rates of passage, suggest those cows utilize CDG differently than the “average cow”. Also, high yielding cows typically are fed more highly fermentable rations (such as rations with higher corn silage and corn grain) that may reduce ruminal pH and milk fat content (see Tip #5). Therefore, starting at a moderate inclusion level such as 5 to 10% of ration DM for high yielding cows is recommended. If it appears economically feasible to include more CDG, upward adjustments can be made while monitoring feed intake, milk yield and fat composition.

11 Inclusion of more than 20% in the ration DM as wet CDG reduced feed intake and milk yield compared with inclusions between 4 to 20% of ration DM (4). The reasons for this effect are not understood or widely researched.

12 When purchasing wet distiller’s grains, require a specific target for DM content (such as 30% DM) for full payment, and have an agreement for price adjustment below specified target DM content.

13 Periodically, determine the fat, phosphorus, and mycotoxin concentrations in purchased CDG. Aflatoxins, one of the mycotoxins, if present in the original corn grain used to produce ethanol, are able to withstand the elevated temperatures of drying. Thus, they are a potential concern in CDG (2). Aflatoxins in milk are illegal and a human health hazard.

14 Pay especially close attention to the nutritional quality and consistency of CDG for best success. Over-drying can result in heat-damaged protein. Darker dried CDG are associated with heat-damaged protein and poorer nutritional quality. Variable amounts of condensed solubles added back to the grains before drying also can result in variable nutrient composition and quality.

15 For growing dairy heifers, concentrations of 20 to 30% (DM basis) CDG are used in the field. Similar nutritional considerations as listed above for lactating cows should be used to optimize use in heifer rations. Sulfur content of the final ration should not exceed 0.3% (dry basis) for either heifers or lactating cows. Polio encephalomelacia (resulting from excess dietary sulfur) is a concern, especially with heifers.

More research is needed to better define the maximum inclusion concentrations for CDG given different characteristics of rations such as forage type and amount, other protein and fat sources, environmental considerations (such as a possible excess P excretion), economic value, and best processing practices at ethanol plants to optimize nutritional characteristics for maximum use in dairy rations.

Selected References

Calving is a natural inflammatory process, and one for which cows have an equally natural response. Recent research aimed at finding out why fresh cows have an increased risk of contracting severe coliform mastitis, though, suggests that animals’ response to parturient inflammation may have a downside. Using functional genomics, researchers found that the processes surrounding calving create opportunity for increased damage to mammary quarters that become infected with mastitis-causing coliforms.

Jeanne L. Burton
Patty S. Weber
Rachael Kruska
Dept. of Animal Science

Mastitis is a costly disease in dairy production. Coliforms such as Escherichia coli and Klebsiella that are ever-present in a cow’s environment can cause severe mastitis in fresh cows. Coliform infections normally cause a short-lived inflammation of the mammary gland that we observe as a temporary increase in milk somatic cell count. This increase reflects the beneficial movement of white blood cells, called neutrophils, into the udder to fight the infection. Within 12 to 24 hours, the inflammatory response ends and milk somatic cell count returns to normal because the neutrophils clear the infection. However, this beneficial neutrophil response may become harmful to the cow around the time of calving.

The role of neutrophils

In fresh cows, coliform mastitis can become so severe that the life of the animal is threatened. In this severe form of the disease, bacterial toxin (endotoxin) from the infected mammary gland escapes into the blood stream causing cows to go off feed and to stop milking. It also causes inflammation to occur throughout the cow’s body, leading to organ failure and shock. Because the onset of severe coliform mastitis is so rapid, there are no obvious clinical signs until after peak bacterial growth and endotoxin exposure have occurred. By that time, udder inflammation and shock are so massive as to leave few options for successful intervention. Thus, rapid death (or euthanasia) is a typical scenario for affected cows (8).

The question our research is trying to address is why fresh cows have an increased risk for the severe form of coliform mastitis. We designed experiments around two facts: neutrophils are always recruited from blood in response to coliform infection and there is a release of protein degrading enzymes called matrix metalloproteinases (MMPs) by the recruited neutrophils. Although the neutrophils are needed for clearing the infection, their MMPs can cause serious tissue damage. This is because MMPs degrade the blood-tissue barrier (Figure 1) and promote local tissue softening and fluidity so the neutrophils can move around easily to find and kill infecting

Functional Genomics

T.A. Ferris
J. Pérez Laspiur
J.L. Burton
P.M. Coussens
Dept. of Animal Science

Functional genomics is a new tool used to study the link between genes and various functions of animals. The tool enables scientists to see what genes are turned on or off as a result of environmental influences, treatments, or physiological conditions. The knowledge gained about gene expression and functions using functional genomics will first help scientists better understand physiological functions and pathways. Already, researchers are using functional genomics to learn more about diseases such as coliform mastitis. In the future, it may be possible to regulate and select for sets of identified genes to improve animal performance, health, and well-being.

Performance traits, genetics, and environment

A dairy cow’s performance (P) is dependent upon genes (G) from her parents, plus the environment in which she resides (E), as depicted in the equation “P = G + E”. E is the sum of environmental and physiological factors that influence a trait, for example, the amount of milk a cow produces, and may include hormonal changes, nutrition, weather, health, age, season, and stress. Currently, producers and AI studs
expression and functions using functional genomics will first
physiological conditions. The knowledge gained about gene
off as a result of environmental influences, treatments, or

Functional genomics is a new tool used to study the

Figure 1. Neutrophils can be a double-edged sword for infected tissues. These white blood cells are critically needed for immune defense and move into infected tissue. However, matrix metalloproteinases released by the cells as they migrate out of blood degrades the blood vessel wall and the tissue’s extracellular matrix (i.e., blood-tissue barrier). This contributes to local inflammation in the tissue as blood fluids and more cells seep into the site, and to systemic shock as endotoxin leaks from the infected tissue into the blood stream.

Results from our recent studies suggest that the answer might be yes! We employed functional genomics tools developed at the MSU Center for Animal Functional Genomics (1, 4, 7) to study the expression of hundreds of genes in blood neutrophils of cows transitioning from the dry period through calving and early lactation. We did this to get a broad view of animals in response to various treatments, physiological changes such as the process of calving, and environmental conditions such as diet, housing, or heat stress.

What is functional genomics?

Functional genomics provide the potential to link animal traits such as disease resistance or milk production with specific genes, yielding new knowledge about physiological functions such as milk secretion, immune response, digestion, and metabolism at the cellular level (1). This is done by determining which genes are turned on or off as a result of treatments, physiological changes, or environmental conditions. For example, differences in genes expressed can be determined in diseased tissue of animals and that of their healthy counterparts. From these gene expression profiles, the

select superior animals as parents to improve G and management practices, environments, and “products” to improve E are being developed.

For many years, genetic ability of an animal has been estimated for the collective effects of G using Predicted Transmitting Abilities (PTA) for traits such as milk production and fat test. PTAs are computed without knowing what genes are actually involved, their function, when they are expressed, or their DNA sequence. This approach, along with research into environmental factors affecting production and physiological responses, has resulted in significant improvements for many economically important traits in dairy cattle. Now functional genomics allows scientists to take their studies of genetics farther than PTAs, because it is possible to examine thousands of genes in appropriate cells of pathogens.

There are 24 known MMPs. Together, this family of enzymes is responsible for the degradation and turnover of tissue extracellular matrix, which is the scaffolding of structural proteins (such as collagen) that hold tissues together and give them proper structure, strength, elasticity, and function (6). Most MMPs are not expressed in normal healthy tissue. However, these proteases are always present in infected and inflamed tissues. Neutrophils contribute significantly to the MMP content of inflamed tissue by producing and releasing large amounts of two family members, MMP-8 and MMP-9. The activities of these neutrophil MMPs are normally kept in check by natural inhibitor molecules (called tissue inhibitors of metalloproteinases, or TIMPs) to avoid excessive tissue damage while neutrophils do their normal bacteria-fighting job. However, human research has shown that during certain inflammatory diseases in which neutrophils move into the damaged tissue, such as lung infections, arthritis, vascular disease, invasive cancers, the ratio of MMPs to TIMPs becomes dramatically elevated and, if left uncontrolled, leads to massive tissue damage with loss of function and even death. Given this, it is not surprising that medical researchers on the search for novel anti-inflammatory drugs are looking towards agents that inhibit overactive MMPs or stimulate the expression of TIMPs (5). Is it possible that this may be a good approach for controlling severe coliform mastitis in fresh cows?
of what state the neutrophils are in during the time of highest risk for severe coliform mastitis. What we observed was a tremendous increase in neutrophil counts and expression of MMP-8 and MMP-9 during labor, delivery, and 1 to 2 days after calving (2). In addition, there was inhibited expression of TIMP genes and genes that normally keep TIMP expression at normal levels during this period. Furthermore, we could easily detect dramatically heightened MMP activity in the blood serum of these cows, suggesting that neutrophils become activated into a highly pro-inflammatory state with increased tissue destroying capacity around calving. But why does this occur and what could it mean for mammary gland health?

Continuing research

We are conducting further studies to address these questions with the current thinking that calving itself may be similar to a massive inflammatory response, requiring highly activated neutrophils to help prepare the reproductive tract tissues for delivery of the calf. For example, the cow’s cervix must dilate from less than one inch to greater than 24 inches in a matter of 2 to 4 hours during labor if a cow is to calve without difficulty. Neutrophils are excellent candidates to help carry out this process. For example, the cells can be massively recruited into the cervix from blood as their circulating numbers increase during labor. Also, these recruited neutrophils can produce and release their massive stores of MMP-8 and MMP-9 to help soften the cervical tissue for rapid dilation. So, neutrophils in an exaggerated pro-inflammatory state at calving could be considered beneficial for the process of calving itself. However, a caveat may be that mammary quarters becoming infected with coliform bacteria around the time of calving would recruit these same hyperactive neutrophils with increased potential for tissue damage. If our current studies show this to be true, it could explain why severe coliform mastitis has been so difficult to manage and may lead to the development of new anti-inflammatory compounds that effectively treat or prevent severe coliform mastitis in fresh cows.

Conclusion

Our functional genomics research has led us to view bovine calving as a necessary inflammatory process that shifts the role of neutrophils but, in doing so, creates opportunity for increased damage to mammary quarters that become infected with mastitis-causing coliforms.

genes that trigger various pathways responsible for specific functions in the cow can be understood.

Using knowledge gained from functional genomics

Currently, identifying key genes in physiological pathways is the main goal of functional genomics (2,3). For example, scientists are using functional genomics to study why dairy cows are more susceptible to some diseases just prior to calving and how environmental and physiological factors affect gene expression. Once scientists identify genes that cause a beneficial response to a change in environment or treatment, they may be able to develop methods to regulate the appropriate genes. Such methods could involve simple management changes, or using new preventive vaccines, therapeutic drugs, nutritional supplements, or technologies to enhance or block gene expression.

How is functional genomics performed?

When genes are turned on, proteins are synthesized, and when they are turned off, proteins are not synthesized. In this manner, genes are like a set of hundreds of switches that turn on and off to regulate functions. To determine which genes are turned on or off by a condition or treatment, a laboratory tool called a microarray is used. A microarray is a glass slide holding thousands of genes from a dairy cow or other animal. Using a microarray allows scientists to compare the gene expression between a healthy and a diseased dairy cow, and possibly identify the pathways that certain genes enable when they are turned on. Knowing what pathways these genes control helps us understand what is going on when a cow is treated or influenced by a physiological condition. This knowledge may lead to development of new management tools to improve the cow’s health or production.

How is this technology being used today?

A large group of animal scientists belonging to the U.S. National Bovine Functional Genomics Consortium (NBFGC) is using functional genomics. The NBFGC developed a genetic library that contains DNA sequences for 18,263 genes in the bovine genome (4). Scientists in the NBFGC are using functional genomics to learn more about:

- nutrient partitioning during the transition period
References

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Summary
For years, genetic evaluations have been estimated using quantitative methods to compute PTAs for dairy sires and cows without being able to consider the many specific genes involved. Today functional genomics tools allow scientists to link genes with specific functions to further understand animal biology. This is done by addressing:
- which genes are turned on or off as a result of a condition or treatment
- which genes might be involved in a pathway
- what conditions trigger a pathway

With a better understanding of biology, it may be possible to develop new management tools and methods to turn on or turn off the expression of appropriate genes and to select parents with sets of desired genes.

References
During the 50 years since its inception, the Michigan Dairy Memorial and Scholarship Foundation has awarded over $700,000 in scholarships to more than 350 MSU students with dairy interests. The Foundation is the second-largest scholarship program at MSU. This year, over $79,000 in scholarships was awarded by the Foundation and the Howard Cowles estate to dairy-minded students.

**Named Scholarships**

Katy McCracken received the Glenn and Anne Lake Scholarship, which covers all tuition and fees for an academic year. McCracken studies Animal Science with a specialization in Agribusiness Management. Hailing from a dairy farm in Carson City, she plans to work for a company that provides services to farmers after graduating. In addition, she hopes to continue working with her family to help maintain their farm. Katy is past president of the Dairy Club and is on the collegiate Dairy Judging Team.

The Russel Erickson Scholarship of $5,000 was awarded to Mary TenBrink of Coopersville. Mary grew up on a 180-cow dairy farm and plans to return to the farm full time after graduation in May. At MSU, Mary completed the Ag Tech Dairy Management program and an internship on a large dairy farm in California. She also participated on the MSU Dairy Judging Team and earned the opportunity to travel to judging contests in Europe in 2006. Currently, Mary is the president of the MSU Dairy Club and is also a member of the MSU Agronomy Club.

The Jack and Betty Barnes International Michigan Dairy Memorial Endowed Scholarship of $1,000 was awarded to Amy Garrison. Garrison chose to major in Agricultural Communications to pursue a career that promotes agriculture through education. A native of Lenawee County, Amy currently participates in Dairy Club, Block and Bridle, Collegiate Farm Bureau as Vice President, and is the CANR Ambassadors Coordinator. She hopes to obtain an internship that allows her to promote awareness about agriculture and dairy farming.

The Howard Cowles Dairy Scholarship of $1000 was awarded to Colleen Jackson. Colleen Jackson is the fourth generation in her family to be involved in their Caro, Michigan dairy farm. This past year, she became Michigan’s first Dairy Ambassador and will carry out the responsibilities of this role by representing and promoting the dairy industry throughout the state, as well as serving on the Great Lakes Dairy Conference committee. After graduating with a degree in Animal Science, she plans to secure a job in the industry.

**$1500 Freshman Scholarships**

- Elizabeth Adams
- Hannah Carruthers
- Jordan Drumm
- Joe Pasch
- Nicole Schaendorf
- Bill Shuler
- Lynnae Slavik

**$2000 Ag Tech Scholarships**

- Jake Brindley
- Tim Gamble
- Ashley Messing
- Adam Preston
- Rose City
- Pinconning
- Homer
- Weidman
- Allegan
- Baroda
- Ashley

**$3,500 Dairy Memorial Scholarships**

- Jesse Chase
- Ted Costigan
- Amy Garrison
- Jessica Geurink
- Joann Greenfield
- Tyler Hake
- Colleen Jackson
- Matthew Jakubik
- Maria Johnson
- Greta Koebel
- Alyssa Selesky
- Pieter Serne
- Kent Thelen
- Jennifer Venlet
- Paul Windemuller
- Hastings
- Lansing
- Onsted
- Allendale
- Annapolis, MD
- Edon, OH
- Caro
- Whittemore
- Pittsford
- Three Oaks
- Lakeview
- Lowell
- Fowler
- Conklin
- Zeeland

For information on honoring members of the dairy industry or supporting student scholarships, please contact College of Agriculture and Natural Resources External Relations at 517-355-0284. To learn more about the Michigan Dairy Memorial and Scholarship Foundation, contact Miriam Weber Nielsen at 517-432-5443 or msw@msu.edu.
Michigan Dairy Judging Teams Cap Fall Season with Win in Louisville

Joe Domecq  
Dept. of Animal Science

The Michigan State University Collegiate, Ag Tech, and several Michigan 4-H Dairy Judging Teams spent many weekends visiting farms and judging cows in preparation for the 2006 judging season. That hard work resulted in outstanding performances at three national dairy judging contests.

The Michigan 4-H teams are selected from the top 25 individuals at the state judging contest held during Michigan Dairy Expo. These individuals are invited to participate in several workouts during August, and the teams for each contest are selected at the end of August. All 4-H youth are invited and encouraged to participate in the contest at Michigan Dairy Expo and tryout for one of the national teams. The Collegiate and Ag Tech team members are selected from students at Michigan State University who have completed a judging course and participated in the MSU judging program.


Special thanks are extended to Sarah Black, Sara Long, Renee Mc Caulley, and Karolyn Terpstra who coached and traveled with the teams to various contests and workouts this fall.

Results

Collegiate Dairy Judging Team members were Baylee Drown (Cedar Springs), Jessica Geurink (Allendale), Matt Sneller (Sebewaing), and Mary TenBrink (Coopersville). The MSU Ag Tech Dairy Management Program was represented by Tim Gamble (New Carlisle, IN), Ashley Messing (Bad Axe), Adam Preston (Quincy), and Kenda Quist (McBain).

Pennsylvania All-American Dairy Show, Harrisburg, PA. Michigan 4-H was represented by Katie Arndt (Elsie), Sara Mann (Camden), Sarah Mowry (Burlington), and Billy Shuler (Baroda). Heather Fry (Blanchard), Jake Shepard (Brown City), Eric Sneller (Sebewaing), and Kendra Stieg (Hersey) competed as the Michigan team in the FFA division.

The Collegiate Team placed 2nd in Jerseys, 4th in Holsteins, 5th in oral reasons, and 7th overall. Individually, Jessica was 6th in Holsteins. Matt was 10th in Holsteins and oral reasons. The Michigan 4-H Team placed 7th in Holsteins and Jerseys, 9th in Brown Swiss, 10th in linear evaluation and oral reasons, and 10th overall. Katie was 11th in Jerseys and Bill was 6th in Holsteins. In the FFA division, the Michigan team placed 1st in oral reasons and Guernseys, 2nd in Holsteins, 3rd in linear evaluation and Brown Swiss, and 4th in Ayrshires.

World Dairy Expo, Madison, WI. Michigan 4-H Team members included Gail Carpenter (Dansville), Jessica Fry (Blanchard), Billy Shuler (Baroda), and Amanda Zwagerman (Zeeland). The 4-H Team placed 4th in Ayrshires, 2nd in Brown Swiss and Jerseys, 9th in Guernseys, 1st in oral reasons, and 3rd overall. Gail was 9th in Ayrshires, 3rd in reasons, and 8th overall. Jessica was 6th in Jerseys and 12th in oral reasons. Amanda was 8th in Brown Swiss, 10th in reasons and 12th overall. The Collegiate Team placed 1st in Milking Shorthorns and Guernseys, 3rd in Ayrshires, 5th in Brown Swiss, 3rd in oral reasons, and 6th overall. Individually, Mary was 2nd in Milking Shorthorns, 6th in Ayrshires, 9th in Guernseys, and 11th in oral reasons. Jessica was 3rd in Brown Swiss, 10th in Milking Shorthorns, and 9th in oral reasons. Matt was 8th in Ayrshires, 5th in Milking Shorthorns, and 10th overall. The Ag Tech Team placed 5th in Ayrshires, 4th in Brown Swiss, 3rd in Holsteins, 4th in reasons, and 4th overall. Individually, Kenda placed 7th in Brown Swiss and 8th in Red and Whites. Ashley was 6th in Red and Whites. Tim placed 3rd in Ayrshires and 6th in Milking Shorthorns. Adam was 5th in Ayrshires, 9th in Brown Swiss, 2nd in Holsteins, 10th in Red and Whites, 1st in Jerseys, 9th in reasons, and was the 2nd high individual overall. In the Practical Contest, The Ag Tech Team placed 1st in commercial heifer evaluation, 3rd in registered heifers, 4th in linear evaluation, and 2nd overall. The Collegiate Team was 3rd in commercial heifers, 6th in registered heifers, 8th in linear evaluation, and 4th overall. The Michigan 4-H Team was 10th in commercial heifers, 7th in linear evaluation and 10th overall.

North American International Livestock Exposition, Louisville, KY. The Collegiate Team placed 1st in Holsteins and Jerseys, 3rd in Guernseys, 4th in Brown Swiss, 2nd in oral reasons, and 1st overall. Matt placed 3rd in Holsteins, 9th in Guernseys, 1st in Jerseys, 2nd in oral reasons, and 2nd overall. Mary was 5th in Brown Swiss, 1st in Guernseys, and 7th overall. Jessica placed 8th in Holsteins, 2nd in Jerseys, and 9th in oral reasons. Baylee placed 3rd in Ayrshires. The Ag Tech Team placed 4th in Ayrshires, 3rd in Guernseys, 4th in Holsteins, 5th in Jerseys, 4th in oral reasons, and 5th overall. Tim was 8th in Ayrshires, 3rd in Guernseys, 6th in Holsteins, 5th in Jerseys, and 3rd in oral reasons and overall. Adam was 7th in Guernseys and Kenda was 10th in Holsteins. Michigan 4-H was represented in this contest by Emily Butcher (Corrunna), Grady Drown (Cedar Springs), Becky Hale (Brown City), and Amanda Sollman (Brown City). This team placed 5th in Ayrshires and Guernseys and 15th overall. Emily was 4th in Guernseys and 11th in reasons. Grady was 4th in Ayrshires.
MSU Names New Director of Animal Agriculture Environmental Stewardship

Dr. Wendy Powers, formerly associate professor of animal science and agricultural and biosystems engineering at Iowa State University, is the new director of the program for environmental stewardship for animal agriculture and professor of animal science and biosystems and agricultural engineering at Michigan State University.

“I am excited to be joining Michigan State because of the caliber of the institution and the departments I am joining, and also because of the diversity of agriculture in Michigan,” Powers said. “That diversity offers both unique challenges and unique opportunities. My goal is to facilitate a coordinated effort to address animal production environmental issues by working with clients to implement technology as it is developed and by working with policy-makers to convey science-based information so that relevant and effective policy can be developed.”

A national expert on evaluating air quality for livestock, Powers uses a multispecies approach in her research to address environmental issues that affect animal agriculture. She will work closely with other MSU researchers to evaluate the impact of air and water quality on human health.

“Dr. Powers will develop a cutting-edge program that links animal agriculture, the environment and human health using an interdisciplinary, integrated approach,” said Jeffrey Armstrong, dean of the College of Agriculture and Natural Resources. “Her work will provide science-based information that will ultimately benefit all animal producers in the state.”

As director of environmental stewardship for animal agriculture, Powers will work to influence policy and practices that will mitigate and improve the effects of livestock production on the environment. She will have a leadership role in developing collaborative, multidisciplinary research and outreach programs focused on enhancing environmental stewardship in Michigan’s animal agriculture industry.

“I am thrilled that we were able to attract Dr. Powers to MSU,” said Karen Plaut, chairperson of the Department of Animal Science. “Her expertise in air quality and her understanding of the environmental issues that are facing animal agriculture ensure that Michigan producers will continue to be seen as leaders in the stewardship of our land, air and water.”

A prolific author and speaker, Powers is a current and former member of numerous professional associations and government committees, including the Iowa State University College of Agriculture Concentrated Animal Feeding Operations Response Team, the Iowa State University College of Agriculture/University of Iowa Department of Public Health/State of Iowa Air Quality Task Force, the Iowa Nutrient Management Task Force, the National Academy of Sciences Committee on Air Emissions from Animal Feed Operations, the American Dairy Science Association/American Society of Animal Science Program Committee for Contemporary and Emerging Issues (chair in 2003-04), and the Environmental Protection Agency Safe Harbor Monitoring Plan Committee.

Powers had been at Iowa State since 1997, first as assistant professor, then associate professor. In 2006, she received a Standards Developer Award from the American Society of Agricultural and Biological Engineers; in 2004, she received the Distinguished Scientist Award from the Iowa Academy of Science, and in 2003, she received the Iowa State University Foundation Award for Outstanding Early Achievement in Extension and the American Society of Animal Science Midwestern Section Young Extension Specialist Award.

Powers received her bachelor’s degree in animal science from Cornell University in 1989 and both her master’s degree in dairy science and her doctorate in animal science from the University of Florida, in 1993 and 1997, respectively.
Dollars and $ense

G. William Robb
Extension Dairy Educator
West Central Michigan

Michigan dairy producers faced a significant decline in the price of milk in 2006 and are now facing sharp increases in the cost of production. “Dollars and Sense,” a project of the MSU Extension Dairy and Farm Management Teams, is intended to help producers manage and utilize their resources most efficiently. Through this program dairy producers and their consultants can work together to analyze and make decisions that will assist in cash flow and maximize profit potential.

Producers can take advantage of this program from several different formats:

- A web site that pulls together some of the dairy farm information at MSU in one location at <http://dairyteam.msu.edu/dollarsandsense>. The Web site offers business analysis worksheets that can help calculate costs for individual farms and partial budget worksheets to help guide purchase decisions.

- Producers can utilize these worksheets in collaboration with veterinarians, nutritionists, bankers, milk cooperatives, dairy sales companies, and other agribusinesses who share in the desire to grow a healthier Michigan dairy industry. Producers will have the opportunity to engage in on-one-one meetings with these agribusiness consultants or Michigan State University Extension Educators with an aim to build long-term profitability into their businesses.

- Regional “Positioning Your Dairy Business” workshops will offer producers a detailed evaluation and planning opportunities for long-term profits in your business.

Feel free to contact regional or campus-based extension staff (see pages 3 and 24 for contact information) with questions regarding these programs or information contained in this web site.

Market Plan$

Craig Thomas
Extension Dairy Educator
Sanilac, Huron, Lapeer, St. Clair, and Tuscola Counties

In January, 2007 the Michigan State University Extension Dairy and FIRM Teams kick-off a major educational program in dairy marketing for dairy producers and their employees called Market Plan$. The goal is to teach producers basic and intermediate dairy marketing skills and to aid producers in developing, implementing, tracking, and evaluating a comprehensive written marketing plan for their farm business.

Market Plan$ consists of three major components. The first is a series of 3-day workshops designed to teach dairy producers basic and intermediate dairy marketing skills. These workshops will cover a broad spectrum of topics designed to help participants develop a personal marketing plan for their milk through the use of the various marketing tools available and learn the ramifications of their use on the farm business’s finances. Meetings will be held in: McBain, Jan. 3, 10, 17; Fremont, Jan. 11, 18, Feb. 1; Zeeland, Jan. 24, 31, Feb. 7; Perrinton, Feb. 13, 20, 27; and Bad Axe, Feb. 15, 22, Mar. 1. For more information, check the MSU Extension Dairy Team Web site at <http://www.dairyteam.msu.edu> or contact your area MSU Extension Dairy Educator. Marketing workshops cost $95 for the first person from each farm and $45 for each additional person.

The second part of the Market Plan$ effort will consist of intensive personal assistance for dairy producers in developing, implementing, tracking, and evaluating a comprehensive milk marketing plan specifically for their dairy farm business. This portion of Market Plan$ will aid dairy producers in determining the financial and marketing risk for their dairy operation.

Third, monthly Ag Market Update meetings currently are being held in Sandusky and St. Johns. The purpose of the Ag Market Update is to apprise producers, and other interested parties, of the current situation and outlook for all the major agricultural markets (e.g., corn, soybeans, wheat, dairy, and beef). A major goal of the Market Plan$ program is to establish two more Ag Market Update groups meeting on a monthly basis in McBain and in Zeeland (or Fremont).

If you are interested in any aspect of the Market Plan$ program you can obtain more information by calling MSU Extension Educators Fred Hinkley at 989-345-0692 or Craig Thomas at 810-648-2515. Information is also available on the MSU-Extension Dairy Team web site at <http://www.dairyteam.msu.edu>.
Dan Elzinga has watched his Ottawa County farm change a lot over the years. He’s seen it grow from a 60-cow tie-stall operation to 205 milking cows in free-stalls. He’s watched four kids grow up and three have made the dairy part of their livelihoods. He’s seen computers become an integral part of farm management and has witnessed first hand the fact that on a dairy farm, adaptation is key.

And it began with an effort nearly 3 decades back to use the TelFarm record-keeping system.

“I worked with Larry Stebbins on that, and it was one of the first things I ever did with extension,” said Elzinga, who says he’s worked with Michigan State University Extension Educators and other dairy experts on many of the changes he’s implemented over the years.

“As you mature, the relationship changes,” Elzinga said when asked about the dynamic between Extension Educators and himself. “But I’ve always thought of MSU and its representatives as a place to go for unbiased information.”

Over the years he has worked with Extension Educators Bill Robb and Ira Krupp as well as district farm management agent Tom Purdy and MSU faculty members to employ practices he says are aimed at keeping his farm profitable and pleasant.

One of those changes was employing Ovsynch to synchronize ovulation for timed breeding, a switch spurred by an MSU-affiliated meeting on reproductive management. Another change was reducing the amount of commercial synthetic fertilizer spread on fields, something Elzinga says is proving to have been a good move.

“There’s something about when you buy fertilizer and put it on there you feel good about it but we’ve had good results in the last few years and we’re using less fertilizer.”

Elzinga’s adult son Nathan said lowering the phosphorus in the ration, a move spurred by his involvement in the Agricultural Technology program at MSU, also has had positive effects on the farm. He currently is working to develop a comprehensive nutrient management plan for the farm to help meet stiffer regulations in the event the farm is reclassified a concentrated animal feeding operation down the road. His father stands by such forward thinking, especially considering the charged atmosphere surrounding dairy farms and environmental issues.

“My thinking is if we can just try to do a good job and not have complaints it’ll go easier for us,” Elzinga said.

Elzinga also is involved in a pilot study conducted by MSU agricultural economist Steve Harsh that is looking at whether wind power can be harnessed effectively on farms. Right now that means there’s an anemometer, or wind meter, attached to the top of a long pole behind Elzinga’s bunker silos, but in the future it could mean more.

“If it shows it might be profitable we’ll pursue it more,” Elzinga said of the experiment with wind power. “Figuring out if you’ve got the potential is the first step to see if it’ll work.”

MSUE Educator Bill Robb says the Elzinga farm is a good example of extension and dairy producers working together.

“We try not to be only a brain trust of information but try to encourage people who want to be leaders in the industry. There are lots of ways we can assist them in making decisions and seeing they have enough information to make those decisions.”

NATHAN AND DAN ELZINGA discuss trends in dairy nutrition with Michigan State University Extension Educator Bill Robb in Fall, 2006. The Elzinga farm supports three families and has benefited from a cooperative relationship with MSU Extension efforts, Nathan and Dan say.

Photo by
Jacob McCarthy
Roquefort-sur-Soulzon: A Great Place for a Case of the “Blues”

John A. Partridge
Dept. of Food Science and Human Nutrition

For a variety of sound and silly reasons, our virtual, world cheese tour has turned into a marathon. On our last installment in April of 2005, we visited the Canton of Bern in west-central Switzerland followed by a quick stop on the French-Swiss border to learn about the Swiss-type cheeses, Emmental and Gruyere, respectively. Now, let us continue west and south into France with an eye on eventually reaching Spain. However, before we ascend the mighty Pyrenees Mountains, we need to make a stopover in the town of Roquefort-sur-Soulzon in the French Department of Aveyron for a taste of the world-renowned Roquefort cheese.

“Blue-veined” is the general classification of Roquefort cheese. Joining Roquefort in this “Blue” classification are a variety of cheeses made primarily from cows’ milk, including: Bleu d’auvergne, from France; Danablu, from Denmark; Stilton from England; Gorgonzola from Italy; and a variety of Blue cheeses made in the United States and other countries. One of the major distinctions of Roquefort cheese from most other cheese in this classification is the requirement that raw ewe’s milk from the Aveyron area be used as the sole source of milk. Because sheep milk is characteristically low in carotenoids (orange/yellow pigments), the cheese curd is very white. Some of the cow milk versions may add food grade ingredients such as chlorophyll to mask the yellow color of the cows’ milk. The mold, Penicillium roqueforti, is responsible for the characteristic “Blue” veins running through Roquefort and other Blue cheeses.

The addition of rennet forms the curd, generally without the aid of a defined, microbial starter culture. The naturally occurring lactic acid bacteria are responsible for acidification and production of carbon dioxide during the make procedure. After approximately 2 hours, the curd is cut, drained and mixed with spores of the P. roqueforti before being placed in perforated metal molds about 7.5 inches in diameter and 6 inches tall. The cheeses are turned several times over the next 4-5 days as the whey is drained without pressing the cheese. After removal from the molds, the surface is dry salted daily for about 1 week, followed by piercing with long spikes to allow the entry of oxygen, which is necessary for the growth of the P. roqueforti.

The Roquefort cheeses are aged in the natural limestone caves for a period of 3 to 5 months during which time they are regularly cleaned of any surface contaminants. These caves just happen to provide the ideal temperature and humidity conditions for the ripening process. The natural contamination of the caves with the P. roqueforti mold lends credence to the legend of a romantic shepherd forgetting his plain cheese lunch in a cool cavern when distracted by his shepherdess. Upon returning to the cavern months later and finding himself hungry, he remembered his old lunch and found that he now had “Blue” cheese. As with many of our food legends, this one is hard to prove but does seem somewhat probable given the ideal natural conditions available to a romantic Frenchman.

Roquefort cheese is probably the best example of a “Protected Designation of Origin” (PDO) product from the European Union. Deeds and other legal documents from as early as the 8th century and a letter of patent signed in the 15th century by Charles IV provide early evidence for the importance of this cheese. The first law in France for the protection of Roquefort cheese was published on August 31, 1696, giving the people of Roquefort the exclusive right to ripen their cheese in the caves at the foot of Combalou Mountain. The first legislation protecting the name, Roquefort, was published on July 26, 1925. The current PDO specifies that Roquefort cheese must be made by traditional methods from raw, whole ewe’s milk from a region that comprises most of Aveyron and part of the adjacent départements of Lozère, Gard, Hérault, and Tarn.

The peppery, salty, piquant flavor of Roquefort cheese is distinct due to the sheep milk origin, which makes it a winner in a wide variety of applications where robust flavor is needed to improve a snack or a meal. Many enjoy Roquefort with a piece of good bread and a robust wine while others will find uses in entrees, sauces, and dressings where its smooth, creamy texture provides a wonderful mouthfeel along with the outstanding flavor. Now, if you can tear yourself away from this wonderful cheese and beautiful scenery of Aveyron (view the Web site below for pictures), the time has come to head off to Spain for a date with a Manchego maker.

Resources
Currently, milk production is greater than a year ago with large gains in California, Idaho and Texas. The number of milk cows increased in October and November following a three month decline prior to those months. Cheese production through October 2006 was up 3.7% year-to-date over 2005. Stocks of all cheese were up 6.5% over a year earlier. Butter stocks at the end of October were 38.6% higher than a year earlier. These kind of statistics usually spell a relatively low milk price outlook yet at the end of 2006 both the Class III futures and USDA outlook were for 2007 milk prices above historical averages. What is driving these high milk prices? Two factors: corn prices and world dairy markets.

Domestically the drive to build ethanol plants spurred by the recent high oil prices and national policy has led to a potentially very large demand for corn starting this next year. If all the planned plants are built, it is even possible that Iowa could become a corn deficit state. The result is a corn price that is priced at $4 per bushel for March. The result of this high corn price is an expectation for a dramatic increase in corn acreage this next year which can have the trickle down effect of increasing the prices of crops that compete for land base.

Land rents also will increase. These increases in the largest production cost are driving milk prices higher.

Internationally, the US dollar is weak and world supply-demand is tight. This has led to nonfat dry milk and dry whey prices which encourage US exports. The dry whey prices are especially helping the Class III price of milk.

Will the market forecasts be correct with a Class III milk price of $13-14/cwt or higher in 2007? The answer depends on the feed cost and how quickly milk production responds. Currently, the country has an abundance of replacement heifers ready to enter production.

Dairy policy continues to boil over. The recent decision to only slightly increase the make allowance for cheese has left some cheese manufacturers—including manufacturing cooperatives—upset about what they see as too little, and some bargaining cooperatives upset about the subsequent decline in the farm pay price. In fact, by the time you read this it is even possible that we will have fewer Federal Milk Marketing Orders as cooperatives express their unhappiness with the make allowance decision by voting an Order or two down.

The 2007 Farm Bill looms and dairy policy will be an important part of the discussion. Once again the Milk Income Loss Contract will be an important topic as legislators from the Northeast and Wisconsin push for its continuance.
Calendar of Events
January - March

Market Plans
Jan. 24, 31, Feb. 7
Zeeland Township Hall, 6582 Byron Rd.
Zeeland
http://www.dairyteam.msu.edu
Contact: Craig Thomas, 810-648-2515; Fred Hinckley, 989-345-0692.

Northern Michigan Small Farm Conference
Jan. 27
Grayling High School, Grayling
http://www.antrimcounty.org

Agriculture’s Conference on the Environment
Jan. 30
Lansing Center, Lansing
http://www.maeap.org
contact: Jim Van Arkel, 517-241-2232.

Dairy Herd Management Update
Jan. 31. 10 a.m. to 2:30 p.m.
Carl T. Johnson Hunting and Fishing Center, Cadillac
Contact: Kathy Lee, 231-839-4667.

Great Lakes Regional Dairy Conference
Feb. 8-10
Bavarian Inn lodge and Conference Center, Frankenmuth
http://www.glrdc.msu.edu
Contact: Sara Long, 989-834-9656; Brian Troyer, 616-293-3189.

Market Plans
Feb. 13, 20, 27
Fulton Township Hall, M57, Perrinton
http://www.dairyteam.msu.edu
Contact: Craig Thomas, 810-648-2515; Fred Hinckley, 989-345-0692.

Market Plans
Feb. 15, 22, Mar. 1
Franklin Inn, 1060 E. Huron Ave., Bad Axe
http://www.dairyteam.msu.edu
Contact: Craig Thomas, 810-648-2515; Fred Hinckley, 989-345-0692.

Young Farmer Leaders Conference
Feb. 23-25
Doubletree Hotel, Bay City
Contact: Michigan Farm Bureau, 1-800-292-2680, ext. 3234.

ANR Week
March 2-10
Michigan State University, East Lansing
Contact: Sandi Bauer, 517-353-3175.

PCDART Workshop - Basics
March 6. 9:30 a.m. to 3:00 p.m.
Anthony Hall, MSU, East Lansing
Contact: NorthStar DHI Services, 800-631-3510; Kathy Lee, 231-839-4667.

PCDART Workshop - Advanced
March 7. 9:30 a.m. to 3:00 p.m.
Anthony Hall, MSU, East Lansing
Contact: NorthStar DHI Services, 800-631-3510; Kathy Lee, 231-839-4667.

PCDART Workshop - Advanced
March 8. 9:30 a.m. to 3:00 p.m.
Montcalm Community College, Ionia
Contact: NorthStar DHI Services, 800-631-3510; Kathy Lee, 231-839-4667.

Michigan Agri-Energy Conference
March 13-14
Holiday Inn South, Lansing
Contact: Terri Novak, 517-930-3170.

PCDART Workshop - Advanced
March 15. 9:30 a.m. to 3:00 p.m.
Baker College, Cadillac.
Contact: NorthStar DHI Services, 800-631-3510; Kathy Lee, 231-839-4667.

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Department of Animal Science
Michigan State University
2265L Anthony Hall
East Lansing, MI 48824-1225