



**DAIRY &  
ANIMAL  
SCIENCE**

**DAIRY  
DIGEST**

**EFFECTS OF MILKING FREQUENCY DURING EARLY LACTATION**

Increasing the frequency of milk removal increases milk production in cattle as it does in many species. This has been a management approach used to maximize production per cow and fully optimize capital investment in machinery and facilities. One obvious drawback is the increase in variable costs, mainly labor, required to reap the higher yield of milk. Traditionally, this technique has been employed throughout lactation, but recent evidence suggests that frequent milking appropriately timed within the lactation cycle can have persistent effects, and thus eliminate some of the higher costs while maintaining higher yields. So how does it work? What are the expected outcomes from increased milking frequency? What strategies can be used to exploit frequent milking during early lactation to improve overall yields?

Increasing the number of milkings from 2 (2X) to 3 (3X) each day increases production in cattle across a range of production levels. It is of interest that this appears to be a fixed response. That is, cows producing 40 pounds/day when milked 2X will increase production about 8 pounds/day when shifted to 3X; cows producing 80 pounds/day would also increase production by 8 pounds/day. So management decisions based on percentages can be deceiving, as the absolute response is not very different across production levels yet the percentage response actually decreases as average milk yield increases!

A general response to milking frequency is the effect on secretion of prolactin. Evidence from work by researchers from Illinois (Dahl et al, 2001) suggests that an increase in prolactin early in lactation may increase the number of secretory cells within the mammary gland for that lactation. It appears that in mammary cell growth reaches a peak in late pregnancy but continues into the first few weeks of lactation. Because milk production is a function of the number of mammary secretory cells, starting lactation with a greater number of secretory cells should increase yield. More

importantly, this increase would be expected to persist because cell loss is a constant throughout lactation. Prolactin is thought to have a stimulatory effect on mammary cell development, and the higher prolactin in response to more frequent milking early in lactation may thus explain the persistent effect of this practice on yield.

A recent experiment in Maryland (Table 1) confirmed under field conditions that milking cows 6X in early lactation produced persistent improvements in milk yield even after cows returned to 3X. For the first 42 days of lactation, cows were milked 3X at 8 hr intervals or 6X at approximately 4-5 hr intervals. After d 42 all cows were milked 3X for the rest of the study which lasted through 38 weeks of lactation. Relative to those milked 3X, multiparous cows milked 6X produced more milk throughout the study. On a percentage basis, milkfat was unaffected by treatment whereas milk protein was lower; protein and fat yield, however, were improved overall by 6X treatment. In addition, there was no adverse effect on reproduction as conception rate to the first synchronized ovulation was not different between groups.

**Table 1.** Milk, components and conception rate of cows milked 6X or 3X for the first 42 days of lactation. Data from Henshaw et al., 2000.

Treatment	Milk (lbs/d)	Fat (%)	Protein (%)	Conception Rate (%) <sup>a</sup>
3X	84.2	3.87	2.98	23.3
6X	90.6 <sup>b</sup>	3.92	2.87 <sup>c</sup>	31.0

<sup>a</sup>Results from synchronized breeding at 69 to 76 days in milk.

<sup>b</sup>Significantly greater than 3X controls, P<.01. <sup>c</sup>Significantly lower than 3X controls, P<.05.

Increasing the frequency of milking early in lactation is simple to implement. In a 2X or 3X scheme, fresh cows can be milked first and last at each milking to achieve either a 4X or

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**October 2002 - featured this month**

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6X frequency. While this may not yield exact 6 or 4 hour intervals between each milking, it is likely to provide appropriate stimulation such the persistent increases in milk production are observed. The question then becomes one of duration – that is, how long should the producer milk at increased frequency? Evidence from recent experiments at the University of Illinois suggests that the increased frequency need only be imposed for the first 21 days of lactation. For example, if typically cows are milked 2X at 12 hr intervals, then fresh cows only could be milked at the beginning and end of each milking. In a herd of 120 milking cows, estimate that 10 cows would calve each month, so at any time 7-8 cows would be milked 4X. This would not require any additional labor to be hired, yet the research indicates that an amount of production close to continuous 3X milking can be achieved. Expected returns determined on adopting early lactation frequent milking (4X) in a typical 120 cow herd assuming a 6 pound/cow/day response yields an additional potential profit of \$97.60/cow with a milk price of \$11.00.

**TAKE HOME MESSAGES**

- As little as 21 days of 4X milking early in lactation can increase yield throughout lactation.
- Prolactin increases at milking may be the mechanism to enhance mammary cell growth and thus milk yield.
- Frequent milking early in lactation can improve yields throughout that lactation with little additional cost.

*Gabriella A. Varga  
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**The Hot Summer of 2002**

Now it is history! The summer of 2002 was indeed a hot, dry summer. Just how hot was it? It’s interesting how quickly we forget the details of weather or how quickly the memories of the weather of one summer blend with memories of other summers. We may remember how hot it was for the July 4<sup>th</sup> picnic, but we may not realize the cumulative effect of the hot weather. Your records of milk production and conception rates during the summer give a pretty good indicator of the severity of the summer, especially if you didn’t take any measures to provide heat stress relief for your dairy cows.

A good way to summarize weather for a season is to use “temperature bins.” Hourly climatic data for Middletown (Dauphin County) were obtained on-line from the PA State Climatologist ([http://pasc.met.psu.edu/PA\\_Climatologist](http://pasc.met.psu.edu/PA_Climatologist)) for the four-month period from June 1 through September 30. The hourly temperatures (all temperatures are in degrees Fahrenheit) for the summer of 2002 are summarized concisely with temperature bins as follows:

$t \leq 60$	163 hours	$80 < t \leq 85$	455 hours	$t_{max} = 98$
$60 < t \leq 65$	413	$85 < t \leq 90$	215	$t_{min} = 49$
$65 < t \leq 70$	431	$90 < t \leq 95$	113	
$70 < t \leq 75$	488	$95 < t \leq 100$	14	
$75 < t \leq 80$	529	$100 < t$	0	

The interpretation of the above temperature bin data is that, for

example, there were 529 hours in the summer when the air temperature was greater than 75 but less than or equal to 80 F. Likewise, there were 113 hours when the temperature was greater than 90 but less than or equal to 95 F.

As mentioned in an earlier article, the THI (Temperature-Humidity Index) is an effective indicator of the combined effects of temperature and humidity on the comfort levels and performance of dairy cows. The calculated values of THI for Middletown for this summer are presented in bins below. The data indicate that the cows experienced heat stress (whenever THI is greater than 74) for 856 hours during the summer.

$THI \leq 70$	1252 hours	$78 < THI \leq 80$	155 hours	$THI_{max} = 85$
$70 < THI \leq 72$	361	$80 < THI \leq 82$	128	$THI_{min} = 54$
$72 < THI \leq 74$	352	$82 < THI \leq 84$	58	
$74 < THI \leq 76$	303	$84 < THI \leq 86$	9	
$76 < THI \leq 78$	203	$86 < THI$	0	

**Note:** The hourly values of temperature and THI do not total 2928 (the number of hours from June through September) because of missing data for 107 hours during this four-month period.

Now is the time to begin developing plans for providing heat stress relief for your cows for the summer of 2003 and beyond. Don’t wait until we have some hot days next April or May to begin the planning. Various steps that should be considered include: 1) effective shading from the sun, 2) increased air movement around the cows, 3) cow access to feed, water, and shade at the same location, 4) misting systems, and 5) innovative systems for evaporative cooling. The potential of using misting and other forms of evaporative cooling will be discussed in future articles.

*Dennis Buffington,  
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**Tips For Reducing Feed Costs**

The current scenario of high feed costs, low milk prices, and less than ideal forage quality has put many producers in a quandary – how to get maximum production without going broke. Here are 5 simple steps that a producer can follow to reduce feed costs without affecting production.

1. Evaluate the current forage inventory. Planning the year’s forage inventory allows for a projection of the concentrate ingredient usage. This could be advantageous to locking in prices for certain commodities. If a complete grain mix is used, consider getting feed bids from at least 3 companies on the same formula. Planning the 2002-2003 feeding strategy now not only helps control feed costs, but a cow’s performance is optimized when the ration remains consistent over the long term. Anytime major changes occur to forage quantities fed, which requires the nutritionist to make significant alterations to the diet, usually result in decreased production.

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2. Monitor dry matters regularly on high moisture feeds. Control the ration being fed by monitoring dry matter of the silages and high moisture grain on a routine basis. This can reduce the risk of over-feeding or under-feeding a forage or a concentrate and causing an imbalance of nutrients, especially protein and energy.
3. Check mineral levels in the diet, especially phosphorus. Most nutritionists are guilty to some degree of including a buffer when formulating diets. For many dairy farms, this is unnecessary. Phosphorus is a good example. There have been numerous studies conducted over multiple lactations that show diets formulated to the 2001 NRC recommendations will not impede production or reproduction. Try this simple check; look at the current ration for the lactating herd. If the phosphorus level is greater than 0.44%, than it is very likely that the phosphorus level can be lowered which will help reduce feed costs. An Excel spreadsheet is available from Penn State, which evaluates groups of cows, and lists phosphorus requirements based on the new NRC. (Email [vishler@psu.edu](mailto:vishler@psu.edu) for a copy)
4. Consider reducing protein in the ration by at least 1%. Cows technically do not have a crude protein requirement per se, but rather requirements for amino acids. Protein levels can be lowered if the following criteria are met:
  - a. The nutritionist is balancing for rumen degradable and undegradable protein.
  - b. A computer model is being used that examines the levels of amino acids in the diet.
  - c. Forage quality is not a limiting factor affecting dry matter intake.
  - d. Milk urea nitrogen (MUN) is being used as a tool to evaluate the nutritional status of the herd.
  - e. The herd is being monitored on a regular basis for production and milk components.
5. Justify the use of a feed additive. The vast majority of farms are feeding multiple additives to their cows. Now is the time to seriously evaluate and prioritize additives being fed and what they are providing to the cow. For example, it is highly probable that molds and mycotoxins will be an issue this year. In this case, an additive that has proven itself in minimizing herd problems should not be eliminated from the ration. However, if an additive is being fed and the benefits are not obvious, maybe it's time to discontinue using that product.

*Virginia Ishler  
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Penn State Dairy Alliance*

### **Continuing Education Program**

The key to high milk quality is superior udder health. All that touches the udder and teat ends can have an effect on its health and the milk that is produced. **Healthy Teat Ends: Key to Quality Milk** is a program that will use a series of lectures and break-out sessions to discuss a number of factors that can

influence udder health in a dairy herd. This continuing education program will be held on November 13, 2002, at the Lancaster Host Resort and Conference Center, Lancaster, PA.

This continuing education program is for ag - professionals including veterinarians, county extension agents, milk co-op representatives, dairy sanitarians, and milking equipment technicians. Dairy producers who are involved in the production of excellent milk quality may also be interested in attending. Veterinarians will earn 6 continuing education credit hours.

The agenda and a copy of the registration form can be found at <http://www.vetsci.psu.edu/Ext/ced/TeatEnds.htm>. For more information, contact Carol Burns at (814) 863-0489 or email at [cmb3@psu.edu](mailto:cmb3@psu.edu).

*Carolyn M. Burns  
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### **Innovative Business Arrangements – Buying and Marketing Clubs**

In this article, the topic of buying and marketing clubs will be discussed. In many areas of the state, buying and marketing clubs have existed for a number of years and interest in forming them is only increasing. These clubs serve a variety of purposes in addition to the obvious. This article will concentrate on both tangible and intangible advantages and disadvantages of each.

First though, what are buying and marketing clubs? For those unfamiliar with them, these clubs consist of a group of producers with a common goal. Sometimes there may be a non-producer club leader, such as an extension agent or industry professional. Their basic purpose is simple.

Buying clubs are usually formed to take advantage of discounts that may be available for services contracted or supplies bought in large quantities. Many supply companies offer discounts on bulk purchases. So, for example, a group of producers may decide to join forces so that they can get a bulk discount on a purchase order of fertilizer. By participating in a buying club, member producers are taking advantage of an avenue by which to lower their expenses.

Marketing clubs, sometimes also referred to selling clubs, on the other hand, are formed for the purpose of obtaining a higher price for goods sold by the members. For dairy producers this may mean negotiating a contract with milk hauler or cooperative. Whatever the product the club members may be marketing, their goal is to receive a higher selling price than would be possible if each were selling the product individually. Achieving this goal results in increased profit per unit produced and sold.

Often, while the initial reason for the formation of the buying or marketing club was to obtain discounts on inputs/services or higher prices on products for sale, the club evolves into a place where its members can go for educational

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purposes. Frequently, producers find that just talking to the others in the club can be just as meaningful as getting the formal objectives of the club accomplished. This is because members have an opportunity to discuss various subjects with people outside their business and obtain a different point of view. Belonging to a buying or marketing club can offer other educational opportunities as well. They can range from inviting a local industry or educational member in to discuss a particular topic of interest to arranging trips to farms where innovative or new practices are being used.

Whether a buying or marketing club, advantages and disadvantages exist from the simple fact that a group of people must agree upon a course of action. Advantages of these types of clubs include:

- Opportunity to increase profits,
- Increase market power,
- Learn from peers and industry professionals,
- Develop professional relationships,

Disadvantages, while few, consist of:

- Disagreement concerning products to buy or service contractors to hire,
- Disagreement concerning price to sell product(s) for and/or company to sell product to, and
- Need to insure consistency and quality of products across producers.

Buying and marketing clubs offer great opportunities for increasing profitability and advancing one's knowledge. Producers only need to keep an open mind as to how a group of common-minded individuals can work together to benefit all.

The next article in the series will focus on mentoring arrangements, a great way to pass on knowledge (and possibly the farm business) to the next generation.

*Sarah Roth  
Penn State Dairy Alliance*

## **Penn State's NEW Website Offers Nutrient Management Information.**

Dairy Alliance in cooperation with the College of Agricultural Sciences and USDA-ARS has developed a comprehensive website for accessing resources and reference materials in the area of nutrient management. The URL <http://nutrient.psu.edu> provides an easy route to information on:

Livestock



Regulations & Planning Resources



Water & Environmental Policy



Phosphorus & the P-index



Nutrient management encompasses many areas and can become overwhelming due to the magnitude of information needed. Penn State has developed a user friendly site that contains four focus areas. The first link, livestock, provides timely information on what is happening in the areas of water and air quality. The species covered are cattle, horse, swine, and poultry. Resources are available in the topic areas of crops, economics, health, manure, nutrition, policy, storage, and water.

The regulations and planning resources link covers the current laws and regulations in Pennsylvania. Updates on financial assistance and education programs occurring within the state are provided. Certified planners, conservation district staff, and NRCS offices are also listed.

The water and environmental policy site maintains resources that help Pennsylvanians understand environmental policy. Coverage includes agricultural affects on water quality, concentrated animal feeding operations (CAFO), and total maximum daily loads (TMDL). The link is an excellent resource to check out how the 2002 Farm Bill impacts Pennsylvania producers and the connection to conservation funding and environmental issues.

The National Phosphorus Research Project link provides pertinent information about phosphorus and the P-index. The material located here is very timely in light of moving towards phosphorus based nutrient management plans. It contains assessment tools for using the P-index.

There are several interactive components to the web site. The first is a calendar of events, which contains continuing education programs being held in Pennsylvania for certified nutrient management specialists, persons interested in becoming specialists, and workshops geared to producers and the agricultural industry. In addition, the calendar allows the user to submit upcoming training and educational events.

A listserv has been developed to help disseminate information and address questions that individuals have regarding any area in nutrient management. An "Ask an Expert" portion is also available. Both of these interactive components are managed by Dairy Alliance and they are designed to provide *anonymity to the user*.

The main challenge producers and Ag professionals face is trying to find information easily on nutrient management. As policies and management recommendations change to accommodate environmental issues, a web site that keeps its clientele up-to-date on current issues and provides practical resources will be critical to keeping the livestock industry informed.

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## **PENN STATE DAIRY ALLIANCE INTRODUCES BUSINESSSENSE: MANAGEMENT TRAINING FOR DAIRY CFOS**

**University Park, Pa.** – Penn State Dairy Alliance is offering a program to provide hands on training in data collection and interpretation for Chief Financial Officers (CFOs) of dairy businesses throughout the state this fall and winter. The program offers a unique combination of formal instruction, group discussion and hands-on computer analysis in a small group setting, providing participants with the opportunity to *learn from each other*, as well as the instructors. According to Brad Hilty, Information Management Specialist with Dairy Alliance, “Monitoring business performance is critical to maintaining a competitive position in today’s dairy environment. Key decision makers of the business must know what data is important and how to interpret it. The chief financial officer of the business, which in many cases is the dairy producer and farm owner or their spouse, must know how to collect, organize, process and report that data in a format that is more easily interpreted. BusinessSense has been designed to train key decision makers of dairy businesses, and those responsible for providing them with information to make those decisions, in a systematic and standardized approach to data management and analysis. Participants in the BusinessSense program will learn:

- 1) What benchmarks are important in monitoring the performance of a dairy business?
- 2) How can benchmarks be used to pinpoint bottlenecks in an operation?
- 3) How can standardization in data collection and organization improve the quality of information used for decision-making?
- 4) The importance of knowing and controlling production costs.

BusinessSense is a series of three meetings designed to progressively build the participants knowledge and use of best management practices in information and business management. Participants will analyze their dairy business using the Penn State / Cornell Dairy Farm Business Summary and a systematic approach to business analysis developed by Hilty. Program locations and dates for this fall include:

- **Lancaster County:** October 25th, November 8th, and November 15th, 2002. Location: Lancaster Farm & Home Center. Lancaster & surrounding counties
- **Central Susquehanna Valley Region:** October 24th, November 7th, November 26th, 2002. Location: Columbia County Extension Office (Bloomsburg, PA). Columbia, Union, Snyder, Northumberland and surrounding counties.
- **Capital Region - Dates:** October 30th, November 22nd, and December 6, 2002. Location: Cumberland County Extension Office. Cumberland, Franklin, Adams & surrounding counties.

**In addition**, the program will be offered in seven other locations around the state from January to March of 2003. The cost of the program is \$200.00 per producer. However, a grant from the Northeast Risk Management Education Center will cover 50% of the registration fee, so producers will have to pay only \$100.00. Additional people from the same dairy business attend for \$35.00 per person. Participation is limited to the first 15-16 producers who register.

For additional information about BusinessSense or to register for a session near you, please call the Dairy Alliance Office at 888-373-7232 or e-mail [bhilty@psu.edu](mailto:bhilty@psu.edu).

## **Factors Affecting Susceptibility of Dry Cow To Mastitis**

Several risk factors contribute to the variation in susceptibility to new intramammary infection during the dry period. These factors include:

### **Bacterial populations on the teat end**

The cessations of milking hygiene practices, such as teat dipping, allows bacterial populations on teat skin to increase. *Staphylococcus aureus* and environmental *Streptococci* bacterial numbers on teat skin are high immediately after drying-off. Coliform organisms are more prevalent on teat skin late in the dry period and at calving time.

### **Variations in the teat streak canal**

Studies suggest that the teat canal is more easily penetrated by bacteria during the early dry period. Similarly, swelling of the mammary gland, the increasing volume of secretion, and the leaking of colostrum, contribute to the high risk of new infection during the prepartum period.

### **Resistance mechanisms within the mammary gland**

Throughout the dry period, there are marked changes in the composition of mammary gland secretions. There is an increase in the concentration of protective factors such as leucocytes, immunoglobulins, and lactoferrin. These changes influence the variation in susceptibility to both environmental and contagious pathogens. When the gland is completely involuted, resistance to new intramammary infections is high.

### **Follow These Dry Cow Treatment Procedures**

- Milk the udder out completely.
- Immediately following teat-cup removal, dip all teats in an effective teat dip.
- Allow the teat dip to dry. If necessary, remove excess dip from the teat-ends with a clean single service paper towel.
- Disinfect each teat-end by scrubbing for a few seconds with a separate alcohol-soaked cotton swab. Start with the teats on the far side of the udder, and work toward the near side.
- Infuse each quarter with a single-dose syringe of a recommended dry cow treatment. Start with teats on the near side of the udder, and work toward the far side. Use the partial insertion method for administering treatment into the teat streak canal.
- Dip all teats in an effective teat dip immediately following treatments.

*Source: Udder Topics, the National Mastitis Council Newsletter.*

## PENNSYLVANIA DAIRY STAKEHOLDERS ANNUAL CONFERENCE

The Northeast dairy industry has come to a fork in the road. What we do today will define what the industry will become. The planning committee for the 2002 PA Dairy Stakeholders Conference has developed a program to stimulate thinking and action on how we can take hold of the responsibilities and opportunities to define our industry's future and keep it strong and prosperous in the Northeast.

The conference will be held December 11 & 12, 2002, at the Holiday Inn Harrisburg East. This is a change in location from previous conferences. Panel discussions that include dairy producers, processors and other professionals will provide opportunities for everyone to actively participate. For example, Carl Theinus, a dairy producer from Wisconsin, will speak on building a successful and successive dairy operation. Carl will join a panel discussion with several of the younger Pennsylvania producers who entered the business in very different ways.

Christine Kellett, from Penn State's Dickinson School of Law, will address the issue of "freedom to operate". Dr. Kellett will be joined on this panel by a lobbyist for the Pennsylvania Association of Township Supervisors, a representative from the swine industry, and a Lancaster County dairy producer who is a township supervisor.

"What's our game strategy? New opportunities awaiting the industry" is the topic to be addressed by Dr. John Lord, Professor of Marketing at St. Joseph's University. He will provide an update on consumer preferences and new opportunities for dairy products.

There will be several other timely presentations. If you have not received a brochure for this conference and want to register contact Michelle Jaymes-Parks, Conference Coordinator, Phone: 717-948-6609 or Email: mmj113@psu.edu. Advanced early registration deadline is November 25<sup>th</sup>.

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**Dairy Digest is published monthly by the Cooperative Extension and the Department of Dairy and Animal Science - 324 Henning Building, The Pennsylvania State University, University Park, PA 16802.**

**The publication is available in alternative media on request.**

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**Issued in furtherance of Cooperative Extension Work, Acts of Congress May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture and the Pennsylvania Legislature. T.R. Alter, Director of Cooperative Extension, The Pennsylvania State University.**

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