# 39th Annual Dairy Cattle Day

## Department of Animal Science
## University of California, Davis
## March 22, 2000

# Proceedings of the 39th Annual Dairy Cattle Day

## Hosted by:

## University of California
## Department of Animal Science
## Davis, California

## Main Theater
## March 22, 2000

# DAIRY CATTLE DAY COVER

**University of California, Davis**
**March 22, 2000**

Teaching, Research and Outreach …
Activities of the Dairy Facility.

The picture on the cover of this year's proceedings has the four Student Resident Herd Managers. They are from left to right, Jessica Stokes, Sarah Wedel, Julia Bixby and Kristy Rocha. The students live at the Dairy Facility. Jessica is a sophomore with the goal of studying veterinary medicine and doing large animal medicine. Sarah is a graduating senior who is applying to graduate school to study dairy nutrition. Her goal is to work as a dairy nutritionist. Julia is a sophomore interested in a career in some aspect of the dairy industry. Kristy is a graduating senior who plans to find a marketing position associated with the cheese industry. Kristy completed the CMAB Internship Program last summer. All four of the students applied to live at the dairy to gain hands-on experience with dairy cattle. In exchange for their rooms, they work 32 hours a month. Their responsibilities include feeding the general herd animals, supervision of the general care and well being of animals, and working with the student interns and general public. The students are dedicated and motivated individuals. They are an integral part of the management program, and they are one reason the dairy program has been so successful. Living at the Dairy Facility provides the students with a unique opportunity to gain hands-on experiences with dairy production that would otherwise be difficult to obtain. This is a specialized teaching function of having a dairy facility on the UCD campus.

There are a number of ongoing research studies. The dairy herd is divided into two separate breeding populations for a project conducted by Juan Medrano and Ed DePeters. The objective is to increase the frequency of the B variants of kappa casein and beta lactoglobulin in the Holstein population. The homozygous cows for the B variant of these milk proteins results in about 8% more cheese per 100 pounds of milk than the A variant. Frequency of the B variant of kappa casein is higher in the Jersey and Brown Swiss breeds than the Holstein breeds. At the present time the A Herd (A variant of kappa casein) has an 8% frequency of the B variant. The B Herd (B variant of kappa casein) where bulls of the B variant have been used has resulted in a frequency of the B variant at 39% lower than the frequency in the Brown Swiss (67%) and the Jersey (87%) populations. This coming year we will be make cheese from the milk of each herd to determine the effect on cheese yield of the higher frequency of the B variant of kappa casein in Herd B.

Gary Anderson and his graduate student, Marcelo Bertolini, are conducting the use of ultrasonography as an aid to improve reproductive efficiency. A description of their findings can be found in the Research Highlights section. A feeding study conducting by Peter Robinson and Ed DePeters is evaluating the feeding value of processed Pima cottonseed compared to the typical fuzzy, upland cottonseed. The results of a field study evaluating the nutrient composition of processed Pima are provided in the Research

Highlights. Production performance will be measured using cows in the UCD dairy herd, and any potential effects of gossypol will be determined.

The genetic composition of the animals at the Dairy Facility continues to improve and change. About six years ago, a number of Holstein heifers were donated to the UC Davis Dairy. These animals and their offspring are contributing to the increase in production, which is occurring. We are still receiving animal donations. Last year John Kidd donated a Holstein heifer and Jersey heifers were donated from Phil Fanelli, Vern Wickstrom, Dick Clauss, CA. Russell, and Chuck Ahlem. A Guernsey heifer from Walt and Arnold Kessler and a Milking Shorthorn heifer from Jennifer Wyckoff and Robin and Dan Lynde (Innisfail Dairy) were also new additions to the herd. This past year the Dairy received its first Brown Swiss heifer, which was donated by Jane Rummel to support student interest in dairy cattle. We are now hoping for a donation of an Ayrshire heifer. These animals contribute to our undergraduate teaching program by providing examples of various dairy breeds. They are also popular with visitors to the Dairy Facility.

The UC Davis herd consists of 113 milk cows. The majority of the cows are Holstein with about six Jersey cows and one Milking Shorthorn. The current DHIA herd average is 25,464 pounds of milk, 1036 pounds of fat, and 837 pounds of protein. Milk production has risen quickly over the past year, and production continues to improve. The staff includes Doug Gisi, herd manager, Alan Mazzoleni, assistant manager, and Walter Paroczai and Fred Stewart, milkers. There are also two student herd managers, Sylvia Wawrzyniak and Ricardo Ertze in addition to the student resident managers. The staff and students at the Dairy Facility are doing an excellent job, and the animal performance reflects their efforts. You are welcome to visit the Dairy Teaching and Research Facility at any time.

## Planning for the Future – New Dairy Cattle Facility at UC Davis

The planning process for a new Dairy Teaching and Research Facility on the UC Davis campus began last year. The current facility opened in 1959 and although it has served the dairy and allied industries and the campus well, it no longer represents the technology present in the industry, and it does not support the most innovative research and teaching. Milk is the Number One agricultural commodity in California, and California is the leading dairy state. To support a dynamic dairy industry and its future needs and to ensure that the industry remains the premier industry in California and the US, new facilities are needed.

The current Dairy Facility has a milking herd of about 90 cows, too small to support current and future research and teaching needs. The new facility will milk 300 to 400 cows.

A new dairy facility at the UC Davis campus will complement the activities currently conducted at the California State Universities at San Luis Obispo, Fresno, and Chico, at the Community College level, and at the new dairy facility proposed at the VMTRC in Tulare. A primary mission of the State Universities and Community Colleges is teaching. UC Davis has a triple mission including teaching, research, and extension. These missions and universities complement one another. Many current and future graduate students who conduct dairy research come to UC Davis from the State Universities and Community Colleges. These graduates will work in the dairy and allied industries as technical support professionals, including nutritionists, herd managers, sales and marketing, and commodity-group promotion.

The UC Davis campus has a major role in the Land Grant system for California. Our current campus programs in health, medicine, nutrition, reproduction, molecular genetics, animal behavior and welfare, food science, engineering, environmental sciences, wildlife biology, human resources, plant science, and engineering will continue to expand and position the campus to address new and emerging issues related to agriculture and society. A dairy facility on the UC Davis campus will ensure that the dairy industry receives the support needed to remain competitive.

Teaching is a role of the dairy facility at UC Davis. Animal Science undergraduates totaling over 750 students use the dairy facility in numerous classes. The School of Veterinary Medicine uses the dairy facility in at least three of its courses, and the dairy is important to the training of veterinary students in the food animal program. Undergraduate and veterinarian students are exposed to dairy care and management practices through hands-on training. Although it is difficult to quantify, exposing students to dairy cattle has resulted in some students changing their focus from companion animals to food animals.

Research is supported by the dairy facility at UC Davis. The UC Davis dairy facility is the primary State facility conducting production research. This research includes nutrition, molecular genetics, reproduction, and health to name only a few. The California Dairy Center program (CA Dairy Research Foundation) is unique among other Center programs, because of its investment in preharvest milk production. Improving the nutritional value and manufacturing qualities of milk through genetics, nutrition, and molecular techniques is a

priority of the California Center; consequently, UC Davis and CSU Cal Poly are the national leaders in preharvest research. Much of the information related to waste management and used in the environmental stewardship component of the Dairy Quality Assurance program was developed at UC Davis. The current facility does not provide research opportunities for waste management, but a new facility will. Dairy animals are available to a wide variety of researchers in the School of Veterinary Medicine. The J5 vaccine was developed on the UC Davis campus, and development of the vaccine involved animals at the UC Davis campus. Other health research includes footwarts, protozoal abortion, and Salmonella. Agricultural engineers have developed biosensors to measure automatically progesterone and urea nitrogen in the milk of cows in the milking parlor. These advances will be used to improve management programs on commercial dairies. These production research programs, along with many others too numerous to mention here, will continue to grow and attract funding with a new dairy facility.

A new dairy facility will allow the UC Davis dairy research programs to expand and address new areas. Waste management programs have been developed, but the current outdated facility does not allow research that will provide information that is immediately applicable to the dairy industry. Biosecurity and animal welfare are issues that require solutions. Again, the current facility does not support the most advanced research and teaching programs. A modern facility at UC Davis will allow research programs to expand, will offer new opportunities for research, and will improve the ability of faculty to obtain funding for research that will benefit agriculture and society. The proximity of the UC Davis dairy facility to the State capitol will also be important in the future. With an ever-increasing proportion of the population unaware of how food is produced, the UC Davis campus is situated in a politically important region of California.

The new dairy facilities at UC Davis and the VMTRC will be complementary, not redundant or competitive. The VMTRC dairy will be larger and well suited to applied research studies, many with a health-care focus, and to teaching small numbers of food animal veterinarians. The UC Davis dairy will be smaller with an emphasis on fundamental research and teaching large numbers of undergraduates and veterinary students. The majority of the dairy research faculty, graduate students, and veterinary students are on the Davis campus. The UC Davis dairy will be the site for a wide variety of research projects. To conduct intensive studies requiring frequent sampling and animal monitoring, the animals and facilities need to be close to the researchers and the supporting laboratory facilities. The intensive studies will result in small, applied studies being conducted at the UC Davis dairy; however, many of the new technologies will be transferred to the VMTRC dairy where larger, applied studies can be performed and the findings extended to the surrounding dairy industry. All new technologies need to be adequately evaluated prior to industry introduction. The size, value and importance of the California dairy industry justify more than a single dairy research facility (e.g., UC Davis, VMTRC, Cal Poly) to conduct fundamental and applied research that will benefit the dairy industry and society.

The Davis campus will begin a funding campaign in the near future to build a modern dairy facility on the UC Davis campus. This facility will be designed to find solutions to current and emerging issues facing the dairy industry.

Comments or questions can be directed to Ed DePeters at UC Davis, 530-752-1263; ejdepeters@ucdavis.edu

# DAIRY DAY CONTRIBUTORS

The Department of Animal Science would like to thank all of the contributors for their generous financial support. If not for these individuals and companies, Dairy Cattle Day would not be possible. Donors contributed up to $100, Sponsors contributed $250, and Patrons contributed $500 or more to help cover printing the proceedings and other event costs. Sponsors also support the dairy products provided during the break and at lunch. This select group generously supports the teaching, research and outreach activities associated with the event. The information presented on the program and published in the proceedings is for the benefit of the dairy producers, allied industries, and the dairy industry of California. We hope that you will thank these individuals and company representatives for their support of the 39th Annual Dairy Cattle Day program.

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**DAIRY CATTLE DAY**

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| 9:00 a.m. | **WELCOME**- G.B. Anderson, Chair, Department of Animal Science, UC Davis |
| 9:10 - 9:35 | Practical Considerations of Biosecurity for Johne's Disease in Cattle. William Sischo, VMTRC, School of Veterinary Medicine, UC Davis. |
| 9:40 – 10:05 | Funding the Environmental Capital Expenditures for the Dairy. Max Bojko, Bank of America, Modesto, CA. |
| 10:10 – 10:35 | Research Updates<br>Update on the CA Quality Assurance Program, Chuck Ahlem, Turlock, CA.<br>Scoring Cows for Locomotion, Peter Robinson, Department of Animal Science, UC Davis. |
| 10:40 – 11:05 | Automated sensing of milk components in the parlor. Michael Delwiche, Department of Biological & Agricultural Engineering, UC Davis |
| 11:10 - 11:40 | **BREAK** |
| 11:45 – 12:10 | On-Farm Concentration of Milk: The Future Is Now. Robert Fassbender, T.C. Jacoby & Company, Inc., St. Louis, MO. |
| 12:15 – 1:20 | Panel discussion: Labor management. Gregory Billikopf, UC Cooperative Extension, Moderator<br><br>Mechanic Selection at a dairy and livestock facility. Ward Burroughs, Vista Livestock Co., Denair, CA.<br><br>Employee Performance Appraisal. Tim Wickstrom, Wickstrom Dairy, Livingston, CA |
| 1:30 p.m. | **LUNCH BREAK** |

**AFTERNOON SESSION:**

Demonstrations – Dairy Teaching and Research Facility
Evaluating the Milking Parlor – Steve Jolly
Automated sensing in the parlor – Michael Delwiche, Department of Biological & Agricultural Engineering, UC Davis.
Locomotive & Body Condition Scoring – Steven Berry/Peter Robinson, Department of Animal Science, UC Davis.

3:30 p.m. **ADJOURN**

# BIOSECURITY AND JOHNE'S DISEASE

**William M. Sischo and John M. Adaska**
**School of Veterinary Medicine and**
**California Animal Health and Food Safety Laboratory System**
**VMTRC Tulare CA 93274**

Definitions:

**Biosecurity**—Protecting the production unit, animals and people within the unit, and the environment from biological hazards existing outside or within the unit.

**Johne's Disease**—A bacterial disease caused by *Mycobacterium avium* subspecies *paratuberculosis* that affects cattle and causes a wasting disease. The organism may be related to a disease in humans called Crohn's Disease which is also a wasting disease.

**Principles of biosecurity**

The dairy industry has long discussed biosecurity, but until recently, not much has been accomplished in developing and implementing plans. Part of the reason is that the dairy industry consisted of mainly small herds (<100 milking cows). These herds were closed (except for the annual 4H shows where animals moved to the fairs and back home again), few people were on the farm other than family, friends, veterinarians, milk haulers, and the occasional salesman, and most of the inputs (feed) and outputs (manure) were from the farm and stayed on the farm. In a simple way, biosecurity existed because these herds were 'isolated' and not because of a plan. The California dairy industry long ago pioneered a model with large and open herds, hired labor, large numbers of consultants visiting the farm, inputs from many off-farm sources, and outputs moving away from the production unit. In this model, biosecurity cannot exist without a plan.

A general biosecurity plan needs to acknowledge 3 pieces: *Incoming, internal,* and *outgoing* biosecurity.

- *Incoming* biosecurity is about protecting the herd from biological hazards that originate from off-farm. This aspect of biosecurity is often discussed and shows up as an item on many dairy programs.[1] Incoming biosecurity is concerned with purchased animals and feeds, off-farm trucks, cars, people, and animals visiting the farm.
- *Internal* biosecurity is a unique concern for the large herd. Internal biosecurity is focused on controlling the circulation of microbiologic and toxicologic hazards on the farm. All (or most) dairy production units have a variety of animal classes including newborns, replacement heifers, dry cows, fresh cows, bulls, hospital cows, and lactating animals. The unique feature of the large herd is that there are always animals in these groups year around. In contrast, the small herd may have no animals in some of these groups during the year.

  In poultry and swine production, animal flow is often described as "all in-all out" or "continuous flow". All in-all out is considered the optimum strategy and describes an animal flow where a group arrives together as a cohort and leaves the

facility at the same time. This approach allows facilities to be cleaned, repaired, and the personnel to rest. Continuous flow is less desirable since it means animals are constantly arriving and leaving a facility. The small herd is analogous to all in-all out and the large herd is a continuous flow operation. This is an essential difference and makes disease management more difficult for the large herd and requires a plan to manage and prevent the spread of disease.

- *Outgoing* biosecurity is a concern for all dairy units and addresses the potential for exporting biohazards off the farm premise into the community. Outgoing biosecurity is concerned with animals moving into sales yards, slaughter facilities, and contract animal units. It is also concerned with odors, manure, water, and dust moving off the farm.

**Details of Johne's Disease**

Although Johne's Disease, or paratuberculosis, is a well-described disease it received little attention in California until recently. Part of the new concern is the possibility that the causative organism is zoonotic, i.e. can be transmitted from cows to humans. Another concern is that we are ignorant about how much Johne's Disease there is in our state's dairy herds. Some important points about Johne's Disease are.[2]

- Paratuberculosis decreases milk production of infected cows as early as first lactation. These animals are not clinically affected.
- Cattle infected with paratuberculosis leave the herd sooner than uninfected herdmates.
- Young animals (<6 months of age) are more likely to become infected than older animals.
- The main route of infection is fecal-oral but the disease can be transmitted *in-utero* and in colostrums and milk. These routes of infection are more likely when a cow is in a late-stage of the infection but can occur even when the cow appears normal.
- The disease is slow to manifest but is quickly transmitted between animals within the herd and will spread unless an active control program is in place.
- Culling clinically infected cows will not control the spread of the disease.
- The most likely way to introduce paratuberculosis into the herd is by purchasing infected animals.

**Johne's and biosecurity**

A plan to protect your herd from paratuberculosis has to take into account all the elements of biosecurity and incorporate basic knowledge about the disease. The place to begin designing the biosecurity program is with the three basics components: incoming, internal, and outgoing biosecurity.

*Incoming Biosecurity and Johne's Disease*—Protect your herd from paratuberculosis from external sources. THE MOST LIKELY WAY TO INTRODUCE JOHNE'S INTO YOUR HERD IS BY PURCHASING INFECTED ANIMALS. Since there is no active program to identify animal sources as free of Johne's Disease and subclinical infection is difficult to detect, you cannot purchase animals with any assurance that cows or heifers

are free of paratuberculosis. The ironclad incoming biosecurity program is: Do not purchase animals.

For herds that are expanding quickly or choose to purchase replacement animals this is not an option. For these herds, the possibility of introducing Johne's Disease into the herd through incoming animals can be reduced by purchasing animals from negative herds. It is ill advised to buy new animals at auction where herd of origin may be unknown. The best option is to purchase from or through a reliable source and provide the quality of animals you need. Although our current tests for paratuberculosis are not perfect at identifying individual infected animals, particularly if they are early in the infection, they are very good at identifying herds that are infected. A herd with persistent Johne's infection will likely have test positive animals in their 3+ lactation group. This is a signal that the herd has a problem and may extend to their young heifers. In this situation, look elsewhere for your replacements.

Since it is common to contract calf raising to specialized facilities it is important to consider the risk that your returning heifers may pose to the herd. It is documented that paratuberculosis can be shed in milk from infected animals and that calves are the most susceptible to infection. It is common that heifer facilities purchase waste milk from dairies, usually hospital milk. If this milk is effectively pasteurized, paratuberculosis should not survive, but effective pasteurization on heifer ranches is probably the exception rather than the rule. Since the practice of feeding waste milk to calves poses a risk to your herd you should make sure that your contract heifer raiser take precautions to prevent Johne's transmission from milk to your calves.

*Internal biosecurity and Johne's Disease*—Internal biosecurity is concerned with preventing the spread of disease within your herd. Since few California dairy producers know the paratuberculosis status of their herd, it is best to start your biosecurity plan by testing your herd. As discussed previously, the current ELISA test more effectively identifies infected animals with advanced disease than animals with early infections. Since the tests are not perfect it is good to interpret the test results relative to your suspicion that paratuberculosis may be in the herd. If you cull cows as 'poor-doers', thin, or with chronic diarrhea you should be concerned that you have symptoms of Johne's. With these clinical signs a positive test result for an individual animal is highly indicative of paratuberculosis infection. Even without clinical signs, a test positive cow from a herd with suspected Johne's should be considered positive. On the other hand, if you and your veterinarian have little or no belief that your herd is infected, a test positive cow may only be a mistake in the test and not indicate infection. Work with your veterinarian to help interpret the test results.

Regardless of the test results, you should develop and implement a biosecurity plan. The urgency to develop the program depends on the test results. If the tests indicate that paratuberculosis is in the herd, it is imperative to implement an internal biosecurity plan. Even if the tests suggest no or little risk you should still implement an internal biosecurity plan. This strategy is best for several reasons. The disease is slow to develop and may take several years before you recognize clinical disease. Unfortunately, by the time you recognize the herd is infected it has already spread throughout the herd. If your herd is

infected you need to stop the spread of infection immediately. Even if your herd is not infected and has a good incoming biosecurity program, the risks and consequences of introducing Johne's Disease is great enough to warrant implementing an internal biosecurity plan.

There are four points about the spread of paratuberculosis that are critical in the design of the internal biosecurity plan: calves are most susceptible to infection, transmission is primarily oral fecal, transmission can occur through milk, and shedding of organism is more likely in older animals. With these ideas, the plan focuses on maintaining a strict separation between cows and calves. The elements of the plan are:

- Calving pens need to be free of manure and clean between calvings
- Calving pens should not hold cows longer than necessary
- Calves should be removed from the calving pen immediately after calving
- Colostrum should not be pooled
- Calves should be housed in an area distinct from cow facilities
- Calves should be cared for separately from cows
- Hospital milk should not be fed to calves
- Milk fed to the calves should be pasteurized
- Calves should never come in contact with manure from cows

*Outgoing biosecurity and Johne's Disease*—Johne's Disease is not a regulated disease so farms, animals, and materials from the farm are not controlled. Despite this, it is important that we consider the potential public and animal health consequences of selling paratuberculosis infected animals. The essential question is: What responsibility exists when we have knowledge that a herd is infected with paratuberculosis. Paratuberculosis spreads because of cow movement. Infected animals that are purchased and transferred between dairies carry the disease to the new dairy. One herd's infection can quickly spread to many herds in a dispersal sale. The dairy industry prospers by its good standing with the public. We have a responsibility to our industry to appropriately manage these infected animals and not compound the potential problem. Good stewardship, ethics, and concern for public and animal health dictate that test positive animals not are sold for either dairy purpose or slaughter.

Developing a biosecurity plan for preventing the introduction and spread of Johne's Disease on your dairy is good for you and for the industry. Although the information in this paper is specific to paratuberculosis, the implementation of a biosecurity plan has many elements that will prevent many other diseases that are transmitted in the same manner. The cost is minimal but the resulting plan will pay dividends to you and the industry in general.

**References**


1. Elrod CC. Biosecurity: It's not just for vets anymore. *Proc Dairy Cattle Day* 1999;38:16-21.

2. Garry F. 10 myths about Johne's Disease: Information dairy producers need to consider. *Western Dairy Mgmt Conference* 1999;4:5-12.

# FUNDING ENVIRONMENTAL CAPITAL IMPROVEMENTS

**Max Bojko**
**Bank of America**
**Modesto, CA 95354**

The US EPA has mandated that it is the legal obligation of the dairymen to contain all manure, wastewaters, and contaminated rainfall on their property, and they will not contaminate surface or underground water. To this end, various government agencies have been empowered to enforce this mandate and inspect facilities. Unresolved violations place a financial burden on the dairy, and disrupt dairy management.

1. Keep your banker informed:
   - Discuss the inspection process.
   - Review the letter of acknowledgement or letter of violation with your banker immediately.
   - Include the banker as part of the response team.
   - Develop cost projections and time-line for completion of corrective actions.
   - Provide your banker with a copy of your Comprehensive Nutrient Management Plan.

2. Sources of funds:
   - Cash.
   - Sale of farm assets (equipment, heifers, quota, and land easements).
   - Sale of non-farm assets.
   - Borrowing the cash value of life insurance policy.
   - Refinancing of assets (real estate, equipment, cows).
   - Government loan programs related to environmental or conservation improvements.

3. Eligible expenses that would qualify for loan funds:
   - New facilities, expansion or rehabilitation of existing facilities.
   - Soft costs: permits, architectural and engineering plans, survey, legal and consulting fees.
   - Hard costs: ground work (excavation/grading/soil improvements/cement), equipment, corals, wastewater pond, and pipelines.

4. Maturity and collateral types:
   - Short term 1 to 5 years (unsecured, cows, equipment).
   - Intermediate term loan 7 to 10 years (cows, equipment, quota, real estate).
   - Long term loan 11 to 25 years (real estate).

5. Repayment terms:
   - Monthly payments principal plus interest (lower total interest cost)
   - Monthly payments combined principal and interest (lower payments).

- Amortization schedule on real estate loans.
- Prepayment penalties.

6. Interest rates:
   - Variable rate can change daily (lowest rate producer assumes rate risk).
   - Fixed rates 1 to 10 years (higher rate producers and bank share rate risk).
   - Various interest rate indexes (CD, treasuries, LIBOR and Prime Rate).

7. Advance rates:
   - Cow 75% loan to Bank appraised value.
   - Real estate 60% to 80% of Bank appraised value.

8. Debit service:
   - Historical cash flow
   - Future available cash flow from projections.
   - Net income after taxes plus depreciation and interest expense/CPLTD plus interest expense minus personal draws.
   - Minimum debt coverage ratio 1.25:1.

9. Financial ratios:
   - Current ratio 1.00:1.
   - Debt-to-worth ratio 1.50:1.

10. Financial institutions:
    - Banks (large and community) and savings and loans.
    - Farm credit system (PCA and FLB)
    - Farmer Mac and SBA.

# UPDATE ON THE CALIFORNIA DAIRY QUALITY ASSURANCE PROGRAM

**Chuck Ahlem, Michael Payne, and Deanne Meyer**
**Charles Ahlem Dairy, Turlock, CA; Departments of Environmental Toxicology and Animal Science, UC Davis**

The California Dairy Quality Assurance Program (CDQAP) is a voluntary, producer-directed education and certification program. The CDQAP offers three different modules: Environmental Stewardship, Food Safety and Animal Health and Welfare. Progress made in the last twelve months in each of these areas is outlined below.

## Environmental Stewardship Module

In the wake of the floods of 1998, the CDQAP steering committee directed that the environmental stewardship module receive the highest attention. In this module producers would attend a UC short course, develop a pollution prevention plan and have his or her facility certified as meeting all regulations by a third party evaluator. The following progress has been made in the last twelve months.

- UCD has continued to offer its Environmental Stewardship Short-course throughout the state. To date more then 800 producers have finished all six hours of training with an additional 600 producers having taken at least two hours of training.
- On Sept. 9 the U.S. Environmental Protection Agency joined 14 other state, federal, academic and industry organizations by signing the CDQAP's Environmental Stewardship Partnership Agreement. By becoming a "Partner" EPA endorses and assists in this education and certification program.
- Also on Sept. 9 the EPA announced a $443,740 grant to the CDQAP to be used to continue the Short-courses and for non-regulatory environmental dairy evaluations.
- The members of the partnership agreement cooperatively developed a "Checklist" consolidating all federal, state and local environmental regulations. This is the first time such a unified resource has been available to the state's producers.
- A pilot project used 12 commercial dairies to evaluate the effectiveness of the Checklist in identifying potential environmental problems.
- A number of other preparations for the non-regulatory evaluations have been completed or are nearing completion:
    1. Finalization of procedures by which a dairy facility becomes certified.
    2. Training of 25 people who can assist producers in implementing a stewardship program (creamery and service organization field staff, consultants, etc.)
    3. Training of seven third party evaluators.
- A computer program was developed to allow for quick, easy calculation for necessary pond capacity.
- Work has begun on a "Research Priority List" which will allow researchers to concentrate on the environmental issues most critical to dairy farmers.
- Non-regulatory evaluations should begin this summer.

## Food Safety Module

Over the last two years two botulism outbreaks and one pesticide poisoning left almost eight hundred cattle dead and threatened condemnation of millions of dollars worth of dairy product. This last year, with a framework for the environmental module laid, the committee focused renewed attention on food safety.

- The CDQAP participated in the CDFA's Food Safety Task Force. This Task Force is developing a "action plan" designed to stem distribution of contaminated milk or animals with foreign diseases. The goal of the Task Force is to minimize losses to a producer, a creamery or even the state's dairy industry as a whole.
- The Task Force organized a study (funded by the California Dairy Research Foundation) to determine if indeed botulism toxin is excreted in cow milk.
- A grant obtained from the USDA allowed for work on a "Food Safety Short Course" to begin. Course materials include slide sets and videos developed here in California.
- Management of every California slaughterhouse killing cull dairy cows was surveyed. The goal of the survey was to determine what information would allow producers to maximize cull cow price and steer clear of regulatory problems.
- A group of dairy veterinarians has agreed to assist in the Food Safety Short Course delivery and is assisting in the development of course materials.
- A new workgroup of dairy extension advisors, dairy specialists and others has been formed that will assist in the Food Safety Short Course delivery.
- The groundwork has been laid for the creation of a "Food Safety Partnership Agreement". Patterned after the Environmental Stewardship Partnership Agreement, it will allow for state and federal recognition of a dairy certified in food safety.
- The Food Safety Short Course curriculum will be completed and ready for delivery before the end of the year.

## Animal Health and Welfare Module

Initial discussions have begun on the Animal Health and Welfare Module. Tentatively this module will address issues including Johne's, Biosecurity, Prevention of Foreign Animal Disease, Downer Cows, etc.

# SCORING COWS FOR LOCOMOTION AND USE OF THE VALUES

**P.H. Robinson and S.L. Berry.**
**UCCE, Department of Animal Science, UC Davis**

Locomotion of dairy cows is influenced by numerous management, disease, and nutritional factors. Several of these factors are poorly understood and interactions between them has been little researched. Whatever the cause, lame cows are at greater risk of being culled from the herd for management or production reasons.

Visual scoring systems have been developed in both the US and the UK that aim to quantify the extent of the locomotion problems in cows, rather than describing their cause. The US system (Sprecher et al. 1997; Theriogenology 47:1179-1187) is reproduced below as it is best suited to California conditions.

A locomotion score (LS) of 1 describes cows with no locomotion problems, LS values of 2 and 3 describe sub-clinically lame cows, and LS 4 and 5 describe clinically lame cows. Prevalence of LS 5 cows in commercial herds should be near zero.

## USE OF LOCOMOTION SCORES

Locomotion scores can be used in numerous ways. The average score of a string of cows documents the absolute extent of locomotion problems relative to other groups on that dairy, or other dairies, while changes relative to time can be used as a quantitative assessment of the efficacy of imposed management changes. In addition, the proportion of cows in LS categories 2 and 3 (sub-clinical lameness) can be used to predict future clinical lameness, as cows often progress from these categories to the LS 4 category.

As the soreness of the feet and legs of cows increase, they walk less and intake can be affected. Examination of a large number of cows in which LS was related to milk energy output suggests that the decline of intake with increasing LS increases at an increasing rate and can be described as:

Relative Dry Matter Intake (% of expected) = $(1.005 + (.005*(1-e^{(.7*LS)})))*100$

***Locomotion scoring is a relative rapid system that can be used as a management tool on commercial California Dairies.***

**TABLE 1. Criteria used to assign a lameness score and clinical description to cattle.**

| Lameness score | Clinical description | Back posture[1] | Assessment criteria |
|---|---|---|---|
| 1 | Normal | ¾ or ¾ | The cow stands and walks with a level-back posture. Her gait is normal |
| 2 | Mildly lame | ¾ or Ç | The cow stands with a level-back posture, but develops an arched-back posture while walking. Her gait remains normal. |
| 3 | Moderately lame | Ç or Ç | An arched-back posture is evident both while standing and walking. Her gait is affected and is best described as short-strided with one or more limbs. |
| 4 | Lame | Ç or Ç | An arched-back posture always is evident and gait is best described as one deliberate step at a time. The cow favors one or more limbs/feet. |
| 5 | Severely lame | 3-legged | The cow additionally demonstrates an inability or extreme reluctance to bear weight on one or more of her limbs/feet. |

***1Back posture while the cow is standing or walking. The symbols ¾ and Ç indicate a flat-back and arched back posture.***

# AUTOMATED SENSING OF MILK COMPONENTS IN THE PARLOR

**Michael Delwiche[1], Daniel Jenkins[1], Xinkui Tang[1], Robert BonDurant[2], Edward DePeters[3], Coralie Munro[2]**

**[1]Department of Biological and Agricultural Engineering, [2]School of Veterinary Medicine, [3]Department of Animal Science, UC Davis**

## 1. Estrus Detection with a Progesterone Biosensor

### Introduction

Successful reproductive management relies heavily on efficient and accurate detection of estrus, the time in the reproductive cycle just prior to ovulation. Decreasing the calving-to-conception interval would increase profit by increasing the accumulated lifetime milk production, reducing the cull rate caused by missed breeding, and reducing the breeding costs due to failed insemination attempts. The most effective method for detection of estrus and prediction of ovulation is daily measurement of hormone concentrations. Over the past seven years, we have been working on the development of on-line sensors for measurement of progesterone during machine milking (Claycomb et al, 1998; Claycomb and Delwiche, 1998). Our objectives in this phase of the research were to (1) improve the sensitivity of the real-time assay, (2) design a second generation biosensor incorporating the improved detection chemistry, and (3) evaluate the performance of the sensor for estrus detection.

### Experimental Methods

A rapid enzyme immunoassay was developed using monoclonal antibody immobilized on 7.9 mm diameter disks of nitrocellulose membrane (12 μ pore size). The sensor was designed using miniature valves and pumps for fluid transport, photoelectronics for optical density measurement, and a control computer. An automated sampler was also developed to connect with the long milk tube. The sensor was calibrated using raw milk by comparison with radioimmunoassay (RIA) measurements, and with progesterone spiked milk taken from cows shortly after parturition. A measurement cycle was about 10 minutes and the lower limit of sensitivity was 0.1 - 0.2 ng/ml (Figure 1). Tests were conducted on 11 cows over 55 days to compare ovulation prediction using the sensor with human observation of standing heat and an activity monitor. True ovulatory events were determined by RIA for progesterone.

### Results and Discussion

Progesterone concentration profiles from the sensor and RIA are shown for one of the test cows in Figure 2. A suspected ovulatory event was identified from the sensor data when the average progesterone concentration of the current and previous day was less than 2 ng/ml, and the three-day average before this was above the 2 ng/ml threshold. A suspected ovulatory event was classified with the activity monitor when the current count exceeded the previous 10-day mean plus 2.5 standard deviations. A comparison of ovulation detection performance is shown in Table 1. The biosensor system correctly

identified all of the true ovulatory events during its test period, but had a 25% rate of false positives. Human observation missed many ovulatory events (39% success rate), probably due to a lack of distinct estrus behavior, and had a 36% rate of false positives. The activity monitoring system detected more true ovulatory events than the herd manager (50% success rate), but showed a higher rate of false positives (53%).

**Future Work**

Work has begun on a immunochromatographic assay for progesterone to reduce the number of fluid reagents and, thus, simplify the sensor design.

**Table 1. Estrus Detection Performance**

| **Ovulatory Events** | **Detection Methods** | | |
|---|---|---|---|
| | Human Observation | Activity Monitor | Biosensor |
| **Identified**<br>true pos.<br>false pos. | <br>7<br>5 | <br>9<br>10 | <br>15<br>5 |
| **Missed** | 11 | 9 | 0 |
| Actual | **18** | **18** | **15** |

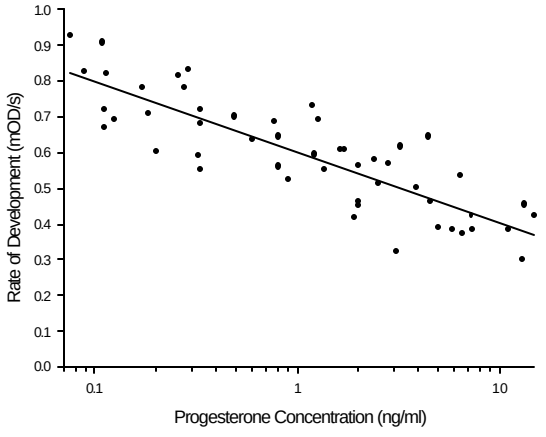


**Figure 1. Calibration of the biosensor by radioimmunoassay of foremilk.**

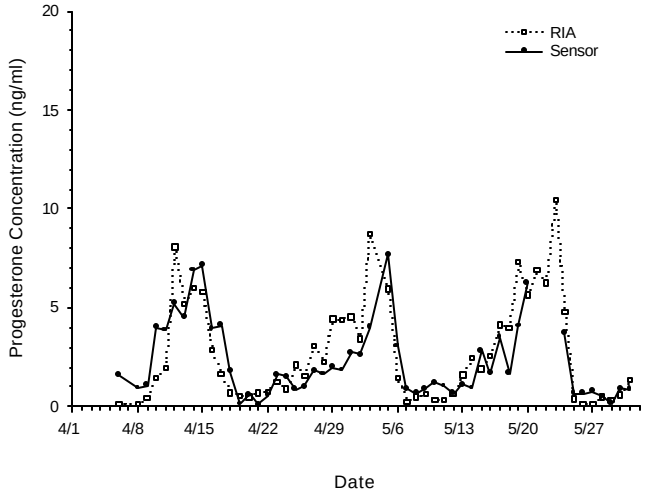


**Figure 2. Progesterone concentration from radioimmunoassay and the biosensor.**

## 2. On-Line Biosensor for Milk Urea Nitrogen

### Introduction

In recent years milk urea nitrogen (MUN) has been established as a reliable indicator of the efficiency of protein and energy utilization. Management of herd diets based on observed MUN values can lead to considerable savings in feed costs, and may further lead to decreases in waste nitrogen and improvement of reproductive performance. Milk from many dairies is tested for MUN at remote labs, but the expense and difficulty of collecting, shipping, and analyzing samples prohibits frequent testing. Furthermore, test results may not be known for a period of several days, and there is always the possibility of mishandling the samples. An automated device on farm to measure MUN will eliminate these problems.

### Sensor Design

A sensor has been developed to operate on-line in the dairy parlor to measure and record MUN values automatically during milking. The sensor is based on a chemical reaction in which the urea is hydrolyzed by the enzyme urease and pressure is generated due to the volatilization of $CO_2$ (Jenkins et al., 1999a). The fluids are pumped through the sensor with a positive displacement pump (50 µl stroke) and a series of pinch valves, and the pressure generated in the reaction cell is measured with a 10 kPa differential pressure transducer (Figure 3). These components are driven with an embedded controller containing a keypad and LCD for user interface.

### Results and Discussion

The sensor is robust to the difficult working properties of raw milk because the sensing element itself never comes into contact with the fluid. Observed sensitivities to urea were not significantly different between milk samples, PBS buffer, or distilled water (1). No significant chemical interferences have been observed for the sensor with the exception of bronopol, a common preservative in milk. The effect of bronopol, however, is remediated by the addition of cysteine to the sample (Jenkins et al., 1999b). The enzyme cost for a single measurement of MUN is about US $0.03. The sensor is simple, inexpensive, and accurate in the physiological range of MUN (Figure 4).

### Future Work

Future work will focus on application of the on-line sensor in the field. The sensor will be used once daily during milking to monitor MUN values for each of a group of several cows over a period of about a month. These data will further be analyzed to better understand how to apply the sensor intelligently given normal variations in MUN values over time and between individuals.

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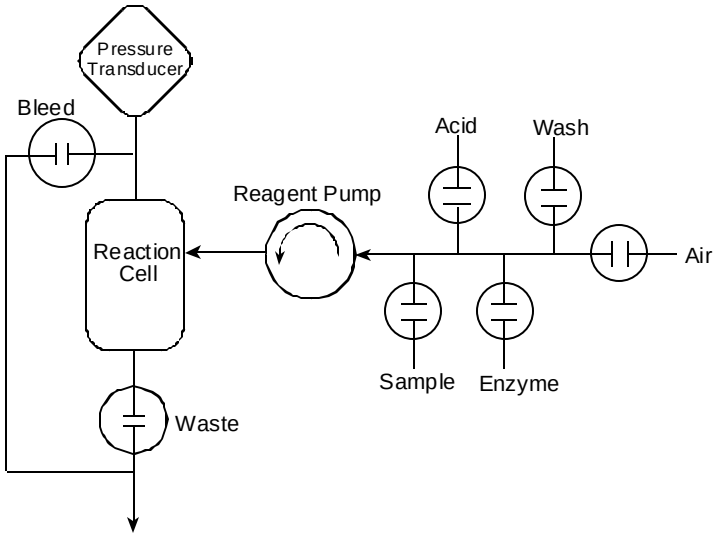


**Figure 3. Hardware schematic for automated sensor.**

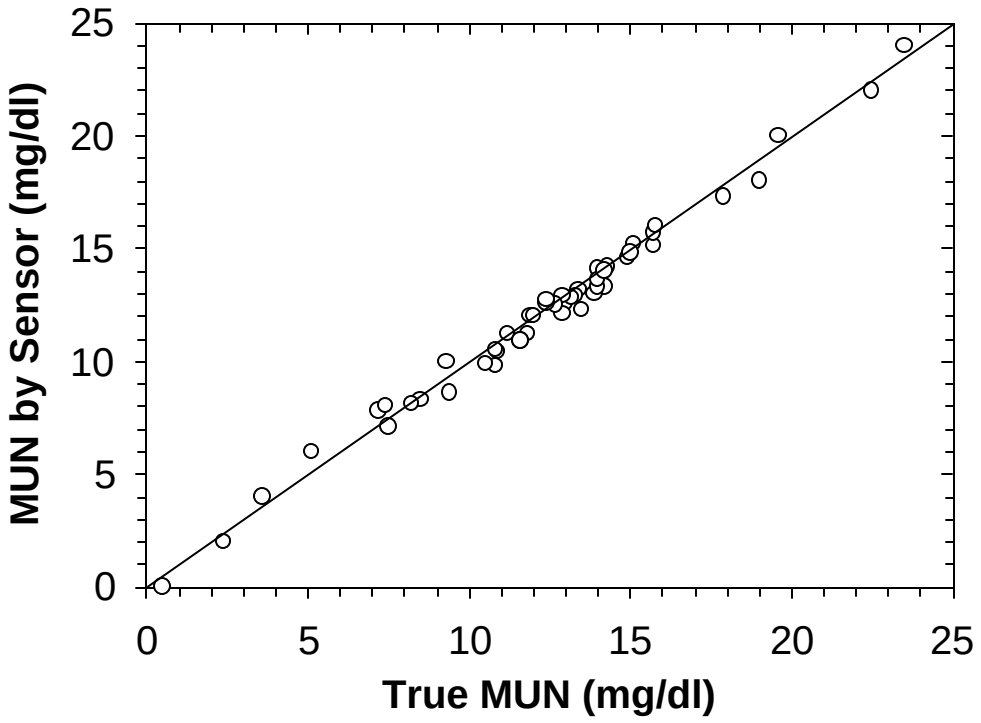


**Figure 4. Comparison of MUN measured by sensor with known**

# ON-FARM™ CONCENTRATION
# THE FUTURE IS NOW

**Robert Fassbender**
**T. C. Jacoby and Company**
**St. Louis, MO 63127**

**Introduction:**
Membrane separation of fluid milk is an energy efficient process capable of concentrating or fractionating the milk. Components of milk are separated by forcing a milk stream to flow under pressure and through a membrane. Components smaller than the membrane pore size pass through the membrane (permeate) while the larger components are retained (retentate) in the milk. There will always be two product streams leaving the system.[1]

The use of membranes to process milk has been commercially available since 1927. The first application for milk on a dairy farm was in France in the 1960's. The first commercial trial in the United States occurred in 1984 near Lodi, CA. Fourteen million pounds of milk was processed using conventional "warm" Ultrafiltration technology in the trial. This trial resulted in several questions about the viability of the technology however, and the technology remained dormant for the next 10 years.

As the dairy production industry migrated to more remote regions of the country and as the dairies grew in size, an economical means to move and balance the milk became necessary. The concept of membrane processing on the farm was revisited again in the mid 1990's.

**On-Farm™ Concentration:**
The current membrane technology utilizes cold processing techniques. FDA approved the On-Farm™ process in late 1996 after extensive study was completed at UC-Davis regarding the growth and death of bacteria in both raw and concentrated milk. Additionally, FDA required that the process be single-pass rather than recirculating and that the temperature of the milk must remain less than 45º F at all times during processing and storage.

The first On-Farm™ facility began operation in December 1996. Since that time, there have been three additional UF (ultra filtered) plants and an RO (reverse osmosis) plant constructed. The plants are located in New Mexico and Texas and are currently processing about 1.5 million pounds of milk daily. The customer base for the output of the facilities ranges from Texas to Georgia (RO product) and North Dakota to Ohio (UF product). The processing facilities cost from $2 to $3.2 million dollars to build and are located on a dairy site. An individual facility will process the milk from a minimum of 4,000 to 10, 000 or more cows daily.

**Advantages of On-Farm™ Concentration:**
The RO process removes only water and concentrates the milk to 2 ½ times its original concentration, going from 12 ¼% total solids to 30% or more total solids. The UF process removes about two thirds of the lactose and about one half of the ash from the milk as well as water. The UF process concentrates the fat and protein content of the milk to 3 ½ times its original concentration, going from 12 ¼% total solids to about 28% total solids.

The net result of the processing effort is the ability to haul the equivalent of 2 ½ loads of milk in one tanker (in the case of RO) and 3 ½ loads of milk in one tanker (in the case of UF). This can be and is a substantial savings to the dairyman, particularly if the dairy is of considerable distance from the market.

- 600 miles to market at $1.80 = $1,080 cost per load of milk
  4,000 cows (75 lb. avg.) = 300,000 pounds of milk per day to market
  6 loads of milk per day = $6,480 daily hauling cost.

- This same milk volume = 2 loads of UF milk per day
  2 loads of milk = $2,160 daily hauling cost.

- Savings = $4320 per day ($1.44 per cwt production)
  The cost to pay for and operate the UF system will be about $.85 per cwt for a net savings of $.59 per cwt or about $650,000 annually.

- If the dairy is 300 or more miles from the market, the hauling savings offset the cost of operations and save the dairyman money.

Additionally, the use of On-Farm™ Concentration technology can open distant markets for the dairyman, often providing better pay prices through increased competition for the milk.

The retentate does provide efficiencies to the purchasing plant allowing the seller to potentially extract premium dollars from the sale as well.

- RO milk is currently used in the production of premium ice cream with potential uses in the fluid milk industry and in exporting to milk deficit regions of the world.

- UF milk is primarily used for standardizing milk to higher solids in cheese production.

**By-Products:**
The permeate that is left over from the membrane process has value to the dairyman as well. The RO process removes only water (BOD of about 200) that in many areas is of better quality than the ground water. The processing of 250,000 pounds of milk will result in the generation of about 17,500 gallons of water daily which can be used in cleaning applications, watering cattle, or irrigation.

The UF processing removes permeate that is rich in lactose and minerals that can be fed back to the dairy cows as part of their TMR. The permeate is slightly over 5% total solids. Processing 600,000 pounds of milk per day will result in about 46,000 gallons of permeate containing about 14,000 pounds of lactose and 6,000 pounds of minerals. Studies have shown that the lactose is an excellent energy source for cattle and can be fed at a rate of up to 2 pounds per animal per day.

**Conclusion:**
On-Farm™ Concentration of milk is ideally suited for large dairies located long distances from their market. The process adds value for the dairyman in not only potential cost savings but also in improving the marketability and marketing of the milk they produce.

**References:**
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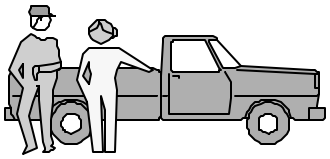

# AGRICULTURAL LABOR MANAGEMENT: EMPLOYEE SELECTION & PERFORMANCE APPRAISAL

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**University of California Agricultural Extension**

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**Panel:**

**Mechanic Selection at a Dairy and Livestock Facility,**
**Ward Burroughs, Vista Livestock Co., Denair, CA.**

**Employee Performance Appraisal,**
**Tim Wickstrom, Wickstrom Dairy, Livingston, CA.**

You have probably heard a great deal about the decline in worker output. Research I have conducted shows that worker productivity is not a constant, and that farmers can play an important role in shaping work outcomes. My intention in this paper is to briefly introduce two topics that can affect dairy employee productivity: employee selection and performance appraisal.

For personnel management to be successful, it must benefit both dairy farmer and worker in the long run. Labor management must do much more than foment good relationships between farmers and workers; it must also provide dairy farmers with more creative and cost-efficient ways of managing agricultural labor.

This paper is based on the author's book, ***Labor Management in Agriculture: Cultivating Personnel Productivity***. The most updated version of the book can be found on the Web, at *Agricultural Labor Management*, http://www.cnr.berkeley.edu/ucce50/ag-labor/ under "book." For more information E-mail gebillikopf@ucdavis.edu.

## Employee Selection

The right person working for you—or the wrong one—can make a vast difference to the operation of your small farm enterprise. Selection may contribute more to worker productivity, perhaps, than any other single management tool. The employee selection requirements may fruitfully emphasize skills, knowledge, or ability areas not easily

learned on the job. While there will almost always be areas of training needed, some talents may be easier to learn than others. Many candidates who in good faith try to learn some skills after the job is offered to them, are never able to do so—even after taking classes in the subject. A word of broader caution is not to take *any* skill, ability, or knowledge for granted!

An overview of a practical approach to a systematic selection process follows.

**STEP 1**. Sometimes a new employee is needed urgently. Cows will not get milked, tractors driven, or fertilizer bought on their own while farmers invest time in a careful selection process. An alternative to either (1) leaving a position unfilled until going through a thorough selection procedure, or (2) hiring a new replacement quickly but perhaps not as effectively, is to hire a provisional herd manager, tractor driver, or farming supervisor. Workers hired for a temporary position can apply for the regular job later. Written employment contracts may be especially useful for such fixed-term employment to avoid misunderstandings and possible litigation emanating from them.

**STEP 2**. Clear understanding of the job to be performed by a new employee is fundamental to a successful employee selection strategy. This insight is obtained through analyzing the job. Job analysis involves collecting information about the position through such means as (1) interviews of workers, supervisors, or other farmers, and (2) direct observation of incumbents. Dairymen can be creative and need not feel constrained to what has been done in the past. This might mean either adding or deleting some assignments from the position.

**STEP 3**. A dairy farmer who wants to hire a cow feeder may weight the importance of every skill, knowledge and ability expected in a prospective employee. Some skills will be more important than others.

**STEP 4**. The chances of finding qualified applicants increases as the applicant pool expands. The number may also depend on the area involved, pay, and the reputation of the agricultural enterprise. There are many channels through which farmers can advertise a job opening. Some of the more common ones include networks of present employees, other farmers, and previous applicants; trade journals; local newspapers; vocational schools; universities; and employment agencies. Spots in Spanish radio stations can be very effective. The most thorough selection approach cannot make up for a poor candidate pool.

**STEP 5**. Dairy farmers need to determine where in the selection process they will measure the various talents searched for. For instance, one may obtain information about an applicant's equipment operation skills through the application, interview, written or practical tests, reference check, and even letters of recommendation. Some selection tools are more suitable than others. I favor practical skill tests and interviews, although time restraints make the use of other tools necessary. Factors dealing with worker motivation (e.g., punctuality, attendance), may be addressed through the interview, but perhaps not as well as through contacting previous employers. It is usually a good idea to

verify evidence of worker merit in specific skill, knowledge, and ability areas in more than one place in the selection process.

**STEP 6**. This step consists of converting general areas of skill importance into specific questions or activities for applications, interviews, and practical and written tests. The weighting process can help farm managers to emphasize evaluation of various skills according to their importance. If driving of a feed wagon or front end loader is important, or if the job is heavy in animal handling, these skills should be examined closely.

**STEP 7**. Once a dairy farmer has decided which selection tools to use, he may want to think of the process as a set of hurdles that applicants must jump in order to obtain the job. Each hurdle—which may consist of several selection tools—acts as a filter to eliminate some applicants from contention. Multiple hurdles are often used when dairy farmers are inundated with more applicants than what they know what to do with. The placement sequence of these hurdles is important. However, if all applicants are going to be interviewed and receive a practical test, it probably does not matter which of the two comes first.

**STEP 8**. The employee selection process itself can be designed to give employees a *realistic job preview*. Such a preview involves painting a precise picture of what the job is truly like. When properly carried out, a realistic job preview will encourage some applicants to pursue the job (some will feel, "this job has my name on it") and others to drop it. Although many unqualified applicants will drop out, some will attempt to stay in contention—especially when they feel the selection process will not make their weakness apparent. Even though a realistic job preview will help dairy farmers weed out some unqualified applicants, it is still important to conduct a thorough selection approach.

**STEP 9**. Misinformation or misinterpretations about the job can be minimized through good communication during the preliminary interview. At this point, the dairy farmer does not have to make any decisions about screening any applicants from the next stage, but some will drop out on their own—better now than after they are already on the job.

**STEP 10**. Properly constructed application blanks may be useful in helping farmers check for minimum skill areas and for job history, especially for year round personnel. Having potential applicants fill out a 3 by 5 card with their name, what position they desire, and how the dairy farmer can get a hold of them, is more likely to increase the number of potential applicants to are willing to fill out the information, than filling out a complete job application. What applicants say they can do in applications and résumés, and what they can do on the job is not always the same.

**STEP 11**. There are a number of useful tests that may be given applicants. The more practical and job related the tests, the more productive they are likely to be. I prefer to construct my own home-made tests than to purchase standardized tests. Practical tests may include asking applicants to go through a series of activities such as pruning vines, lifting fertilizer, driving a tractor, and so on.

**STEP 12**. The greater the amount of interpersonal relations required by a position, the more essential an interview becomes. It is in the interview that the farmer has the best chance to gauge an applicant's leadership qualities, and personality—or at least compatibility.

**STEP 13**. Reference checking involves obtaining information about applicants from previous employers. Meeting references in person—or next best, on the phone—is usually more productive than asking them to respond in writing. Employers are becoming more hesitant about providing references given our libel happy society.

Checking with more than one reference increases the chances of getting a better all-around picture of the applicant's past performance.

**STEP 14**. Even after taking all these steps, a dairy farmer may have trouble making a decision. A few nagging questions may remain about a candidate's skills, knowledge, or other qualifications. A final interview for the top two or three candidates in contention might help a farmer determine whom—if anyone—to hire. This concluding encounter can take a number of shapes ranging from another formal interview to a dinner meeting or other activity. By this stage, applicants will probably have developed more questions about the job.

**STEP 15**. A well-planned pre-employment post offer physical depends on the examining physician's understanding of the job requirements. There are doctors and medical facilities who are willing to work closely with employers to develop a job-related physical examination, including drug test.

**STEP 16**. An employer who has followed this process normally feels that a decision can be based on substantial data, rather than on intuition alone. Usually only one of many applicants is hired. The farmer has done well if most applicants can feel that they gained something, even if not a job, from the application process. Applicants can get discouraged, so farmers may want to try and make the process a confidence-building and enjoyable one for all participants.

Although lamentable, it is well worth starting all over if the farmer is not satisfied with any of the applicants. Offering the job to someone because "we've come this far" could result in much more trouble than reopening the recruitment.

## Performance Appraisals

Although workers may informally develop useful perceptions of their performance, these may not always be accurate. Employees may seek the opinions of colleagues, supervisors, and others on their performance. Dairy farmers need not rely on this informal process of performance appraisal.

Performance appraisal consists of (1) collecting information about an employee's accomplishments on the one hand, and (2) on the other hand, communicating the results of such an evaluation to the employee.

*Employee need for feedback*. Most workers generally want to know how well they are performing. The difficulty in delivering critique, however, even when it is meant to be constructive, is to do so without having the recipient become defensive. It helps when the employee can be empowered to recognize her own difficulties and is then encouraged to formulate a plan to overcome these challenges.

Data from performance appraisals can aid dairy farmers, for instance, to (1) design training programs, (2) plan for long term staffing and worker development, (3) give pay raises or other monetary rewards, (4) set up an employee counseling session, or (5) institute discipline or discharge procedures.

*Obtaining reliable and valid data on worker performance*. It is not always easy to obtain useful and reliable data on worker performance. All too often *subjective* supervisory evaluations are used to assess worker performance.

Supervisory evaluations often suffer from a number of deficiencies and biases. Evaluations may be affected by factors that are not job related. Some raters are tougher than others. Consistency is difficult to achieve.

Input into the appraisal of worker performance may come from the employee, co-workers, supervisors, subordinates, or even persons outside the organization. Ratings from multiple sources usually yield performance appraisals that are more accurate and reliable.

*Assessing what and how data is collected*. One way to classify on-the-job worker behaviors is by considering both *achievement* (what was done) and *conduct* (how it was done). These two factors are not mutually exclusive and may both be considered in performance appraisals.

* *Achievement*. Examples of achievement may include reducing calf mortality, or mastitis. Achievements often focus on the past. Directing at least partial attention to worker proficiency factors during the performance appraisal assures that deficient worker ability is not blocking future performance.

* *Conduct*. Personal traits such as independence, character, disposition, personality, motivation, willingness to take instruction and make corrections, cooperation, teamwork, harmony, approachability, friendliness, initiative, dependability, and appearance may be considered. Conduct ratings may say more about how supervisors get along with an employee rather than how well the employee performs on the job. Nevertheless, worker conduct is important. Dairy farmers are unlikely to want to reward performance—no matter how excellent it is—if a worker only performs after repeated admonitions, and then only grudgingly.

*Critical incidents.* The critical incidence performance appraisal technique involves noting particular situations where workers reacted particularly well or poorly to a given situation. For instance, some negative critical incidents may include not observing elevated milk tank temperatures, milking cows with antibiotics into the tank, or allowing a diesel tractor to run out of gas. Some noteworthy positive incidents may include

milkers who on their own accord let the dairy farmer know a cow is in heat; having a worker stay over after work hours to help with an emergency; or an employee who noticed and averted an upcoming disaster outside normal responsibility areas.

The critical incident approach may take on negative connotations when it is slanted towards noting more unfavorable than productive behaviors. Long periods of time may not yield any particularly good or poor behavior. In some cases, employees may have difficulty translating critical incident reports into improved day-to-day performance.

Employees often want concrete examples of what they have done that made them rate low or high in a given scale. By the time of the performance appraisal interview most supervisors have forgotten specific incidents.

*Narratives*. A performance appraisal in a narrative form is often more meaningful to employees than receiving a simple adjective or numerical rating.

*Pre-determined anchors and scales*. The great disadvantage of the critical incident approach and the narrative approach to performance appraisals is the amount of thought and time invested by the rater who conscientiously uses these methods. Less time consuming are performance appraisals where raters simply check, circle, or mark the best corresponding anchor or alternative presented. The ease of use may be deceiving however, with many raters giving the appraisal less time and thought than it deserves.

*Combination approach*. Sometimes both numerical and descriptive approaches can be included together.

### *Delivering useful and palatable information to employees.*

Evaluations work best when workers know on what criteria they will be evaluated ahead of time. Next to employee discipline, performance appraisal interviews are probably the most dreaded management activity. While delivering the good news about employee performance can be fun, few find it easy to tell employees where they fall short or how they could improve.

Supervisors are often hesitant to tell employees the truth during performance appraisals ... unless, of course, all the news is good. They fear that an employee who was not performing well to begin with might turn even worse. Or that the bad performance rating will reflect poorly on the supervisor. Regardless of the reason, many supervisors avoid using low ratings:

> As with olives, where a small olive may be graded "large," and the largest "super" or "colossal," the worst rating many companies give their employees on appraisals is "good." Thus, the employer might be in the position of arguing that "good" actually means "bad."[1]

[1] Schlei, Barbara Lindemann & Grossman, Paul. *Employment Discrimination Law*, Bureau of National Affairs, 1983, p. 531.

Undeserved positive performance evaluations might later help make a worker's case against the farmer for wrongful discharge or discrimination.

Traditional performance appraisals put the supervisor in a position of being the expert on the employee's performance. Some come to know it as the "vinegar sandwich": The supervisor delivers good news, then bad news, then some more good news. While there are many other styles such as the "sweet and sour" and the feared "hot and spicy" approaches, most of them have one thing in common: *it is the supervisor who delivers the information*. Sometimes a worker will be grateful for information on his shortcomings and will do his best to change. Just as often, perhaps, the worker reacts with passive resistance or defensiveness. No wonder supervisors are often hesitant to deliver bad news to workers. It is also easier to ignore it and hope it goes away.

*Involving the Worker: A Change in Roles*. A dairy farmer or herds manager can make things easier for herself by putting more responsibility on the worker for the performance appraisal. For instance, a diary farmer can ask a subordinate to bring three lists to the appraisal interview: first, of those things he has always done well; second, of areas where there has been recent improvement; and third, of areas that need further improvement. For this approach to work well, however, the farmer must (1) also prepare a corresponding set of lists on the employee's performance, and (2) advise the employee of this intention.

This technique allows the subordinate to think of her performance in terms of both (a) her own expectations, and (b) perceived supervisor expectations. It allows for discussion of the specific areas in which the employee does well, has improved in, or needs improvement in, rather than a vague discussion of whether the employee is good or bad. A worker who knows the supervisor is also going to fill out such a list is likely to come up with a more accurate self-report. While people will normally prefer not to dwell on their weakness, most will prefer to point out their own shortcomings than having them pointed out.

When the worker has acknowledged and "owns" those areas that need improvement, a change in roles can take place. Rather than an expert telling someone about his faults, the supervisor can now be an active listener, offering support and help to the worker in changing dysfunctional behaviors. Next, goals can be set for improvement.

Allowing the worker to take a major role in the performance appraisal interview—regardless of its format—may not make the interview fun, but it can do much to reduce its dreadfulness.

Having the employee prepare a fourth list, based on the question, "What can I do differently, as your supervisor, so you can do a better job of helping me," can take the appraisal from somewhat effective to exciting. Your operation will never be the same as employees understand you are more interested in fixing problems than in assigning blame.

For more complete information on this and other subjects related to agricultural labor management, visit http://www.cnr.berkeley.edu/ucce50/ag-labor/ .

# RESEARCH HIGHLIGHTS

The Research Highlights are summaries of various projects that are currently in progress within the Department of Animal Science. This is not an exhaustive list of research activities, but the Highlights provide a view of the diversity of research topics that are being investigated with the objective of serving the dairy and livestock industries in California. If you should wish further information on a project, you may contact the investigator.

**Recurrence of Footwarts (Papillomatous Digital Dermatitis) During the 11 Months After Treatment with Lincomycin**
S. L. Berry: Department of Animal Science, UC Davis
M. Mongini: Department of Animal Science, UC Davis
C. A. Meadows: Department of Animal Science, UC Davis
S. T. Essex: Department of Animal Science, UC Davis

**Evaluation of Nutritive Value of Pima Cottonseed Varieties**
P. H. Robinson: UCCE, Department of Animal Science, UC Davis
G. Getachew: UCCE, Department of Animal Science, UC Davis
E.J. DePeters: Department of Animal Science, UC Davis

**Influence of Storage on Nutritive Value of Cracked Pima Cottonseed**
P. H. Robinson: UCCE, Department of Animal Science, UC Davis
G. Getachew: UCCE, Department of Animal Science, UC Davis
E.J. DePeters: Department of Animal Science, UC Davis

**The Use of Ultrasonography as an Aid to Reduce the Calving Interval, Improving the Reproductive Efficiency in Dairy Cattle**
M. Bertolini: Department of Animal Science, UC Davis
D.D. Gisi: Department of Animal Science, UC Davis
A. Mazzoleni: Department of Animal Science, UC Davis
G.B. Anderson: Department of Animal Science, UC Davis

**Late Prepartum Protein Supplementation and Performance of Dairy Cows**
P.H. Robinson: UCCE, Department of Animal Science, UC Davis
J.M. Moorby: IGER, Aberystwyth, UK
M. Arana: UCCE, Stockton, CA
R. Hinders: Hinders Nutrition Consulting, Acampo, CA
T. Graham: Graham & Associates, Davis, CA
L. Castelanelli: Castelanelli Dairy, Lodi, CA
N. Barney: Lignotech USA, Overland Park, KS

**Genetic Selection Within the Holstein Cows for Milk Protein Composition to Improve Cheese Yield**
J.F. Medrano: Department of Animal Science, UC Davis
E. J. DePeters: Department of Animal Science, UC Davis

**Questions and Answers About the California Dairy Quality Assurance Program (CDQAP)**
D. Meyer: UCCE, Department of Animal Science, UC Davis

**California Dairy Quality Assurance Program –Environmental Stewardship Certification: *What Do I Do To Certify?***
D. Meyer: UCCE, Department of Animal Science, UC Davis

**How Much Water Do You Use At Your Dairy?**
An on-going study by:
D. Meyer; UCCE, Department of Animal Science, UC Davis
B. Reed: UCCE, Orland, CA
C. Batchelder: Department of Animal Science, UC Davis
T. Shultz: UCCE, Visalia, CA
J. Higginbotham: UCCE, Fresno, CA
J. Merriam: UCCE, Modesto, CA
M. Arana: UCCE, Stockton, CA

**Cloning Creates New Dimensions For The Dairy Industry**
C. Batchelder: Department of Animal Science, UC Davis
G. Anderson: Department of Animal Science, UC Davis

# RECURRENCE OF FOOTWARTS (PAPILLOMATOUS DIGITAL DERMATITIS) DURING THE 11 MONTHS AFTER TREATMENT WITH LINCOMYCIN

**S. L. Berry, A. M. Mongini, C. A. Meadows, S. T. Essex**
**Department of Animal Science, UC Davis**

Previous treatment studies for papillomatous digital dermatitis (PDD) have found that recurrence of lesions is high and that treatment must be on going to control the disease. In a previous study we found that 18/22 lesions treated with lincomycin or oxytetracycline in a foot wrap appeared to be healed one month after treatment. When biopsies were examined we found that 10/18 (55%) of the lesions that appeared to be healed had some microscopic evidence of activity. We could not differentiate between lesions that were incompletely healed and those that were new infections. This study was designed to follow 30 cows with PDD for one year after treatment. Observations were to be made at monthly intervals.

Thirty cows with active, painful PDD on one or both rear feet were identified from a high-prevalence dairy. The dairy was milking about 1,200 cows on a freestall facility. On day 1, cows were restrained on a hydraulic tilt-table and feet were examined, photographed, and treated with 10 g Lincomix® Soluble Powder. Cows with lesions on both rear feet had 1 foot selected for the study. All active lesions were treated, however. The lincomycin was mixed with about 4 ml deionized water to make a paste, applied to a 4X4 gauze, and held in place with a Vetrap® bandage. Ten of the 30 cows were biopsied on day 1 (before treatment), and again on days 10, 20, and 30 after treatment. The other 20 cows were biopsied on days 1 and 30. Each month thereafter, all remaining cows were restrained on the tilt-table where feet were examined and photographed. Cows with lesions that recurred were biopsied and treated as necessary.

Three cows were sold during the course of the study (2 for mastitis, 1 for laminitis), 2 cows were missing for the month 8 evaluation and 3 cows were missing on the month 11 examination, which left 24 cows on the study on month 11. The month 7 observations were missed due to heavy rain during that month. The months 9 and 10 observations were missed due to the producer remodeling the dairy and removing the tilt table. The month 11 (day 341) observation was made using a commercial hoof trimmer and the study was concluded. Histopathology is pending. Of the 24 cows that were present at the end of the study: 3 (13%) were treated only once, 14 (58%) were treated twice, 7 (29%) were treated three or more times. Eleven of the 14 cows treated twice were treated only on days 1 and 341. The rough recurrence rate for 11 months was 88%. This was on a dairy that had no regular hoof trimming program, no regular PDD treatment program, very poor freestall management, and many concurrent hoof problems, most notably, chronic laminitis. The dairy had a PDD prevalence of approximately 50% at the beginning of the study.

# EVALUATION OF NUTRITIVE VALUE OF PIMA COTTONSEED VARIETIES

**P. H. Robinson*, G. Getachew* and E.J. DePeters**
**UCCE*, Department of Animal Science, UC Davis**

Cottonseed is one of the major feed ingredients used in dairy cattle rations in California. The availability of Pima cottonseed has increased in recent years and there are a number of Pima cottonseed varieties grown in the southwest United States. However, data on nutritional characteristics of these varieties are not available. Such data are extremely important to decisions on inclusion levels in rations for different classes of dairy cattle. The objective was to determine the nutritional characteristics of Pima cottonseed produced in the southwest USA during the 1999 growing season.

Six varieties of Pima cottonseeds (Phytogen 57, CH252, HTO, Conquistador, S6, and S7) were collected from 10 locations (7 in California, 1 in west Texas, 1 in New Mexico, and 1 in Arizona). Samples were analyzed for chemical components as well as *in vitro* degradability of neutral detergent fiber.

| Components | Varieties | | | | | | |
|---|---|---|---|---|---|---|---|
| | Conquistador | CH 252 | HTO | Phy 57 | S 6 | S 7 | SE |
| DM (%) | 93.2 | 93.2 | 93.3 | 92.8 | 93.5 | 93.6 | 0.27 |
| OM (%DM) | 95.0 | 95.0 | 95.0 | 95.2 | 95.5 | 95.2 | 0.19 |
| Fat (%DM) | 27.0 | 27.0 | 28.0 | 25.8 | 27.5 | 27.4 | 1.80 |
| CP (%DM) | 29.8 | 29.8 | 29.1 | 29.6 | 26.8 | 30.6 | 1.36 |
| SOLP (% CP) | 27.0 | 28.5 | 27.0 | 26.6 | 23.4 | 27.1 | 1.50 |
| ADICP (% CP) | 5.7 | 4.8 | 4.3 | 3.9 | 4.4 | 3.2 | 0.89 |
| NDF (%DM) | 48.4 | 48.4 | 44.5 | 44.5 | 44.4 | 44.2 | 2.96 |
| dNDF(% NDF) | 61.9 | 61.9 | 56.1 | 49.5 | 53.0 | 55.6 | 4.19 |
| ADF (%DM) | 35.6 | 35.6 | 31.8 | 32.3 | 31.0 | 29.8 | 2.87 |

DM, Dry matter; OM; Organic matter; CP, Crude Protein; SOLP, soluble protein; ADICP, acid detergent insoluble crude protein; ADF, Acid detergent fiber; NDF, Neutral detergent fiber; dNDF, 30 h *in vitro* digestibility of NDF.

There was no statistically significant difference (P>0.05) among varieties in chemical components. Pima cottonseed varieties were similar in DM and OM contents (P>0.05). Although numerically large differences occurred among the varieties for crude protein (26.8 to 30.6%), crude fat (25.8 to 28.0%), neutral detergent fiber (44.4 to 48.4%), rumen digestible of neutral detergent fiber (50% to 62%), and acid detergent fiber (29.8 to 35.6%), they were not statistically significant (P>0.05). Although solubility of Pima cottonseed protein was low, about 90 % of total protein was potentially digestible.

Pima cottonseed varieties were found to be similar in nutritional composition, but somewhat variable within varieties.

# INFLUENCE OF STORAGE ON NUTRITIVE VALUE OF CRACKED PIMA COTTONSEED

**P. H. Robinson*, G. Getachew* and E.J. DePeters**
**UCCE*, Department of Animal Science, UC Davis**

The effect of post harvest handling of seeds on nutritionally important components depends on the nature of the seeds and conditions of storage. When harvested for seed, the moisture content of cottonseed is normally less than 12%, suggesting that they can be stored for long periods of time without decomposition. However, high fat cottonseeds such as Pima may not store for prolonged periods once processing has occurred. The effect of simulated commercial storage of cracked Pima cottonseed on commercial dairies was evaluated with 15-tonne piles at four locations. Chemical composition and indices of decomposition were evaluated in samples collected from each pile the day after processing and at approximately three-day intervals through day 22. Samples were analyzed for nutritional components and indices of decomposition. Temperatures in the pile and physical characteristics of the seed were recorded at sampling.

| | Length of storage (days) | | | | | | | | | Time |
|---|---|---|---|---|---|---|---|---|---|---|
| Components | 1 | 3 | 6 | 9 | 13 | 15 | 20 | 22 | SE | P |
| DM (%) | 93.4 | 93.4 | 93.3 | 93.4 | 93.3 | 93.5 | 93.4 | 93.4 | 0.02 | 0.97 |
| CP(% DM) | 31.1 | 30.9 | 32.7 | 31.0 | 31.8 | 31.5 | 32.1 | 32.1 | 0.83 | 0.89 |
| ADICP(% DM) | 1.1 | 1.4 | 1.0 | 1.3 | 1.3 | 1.1 | 1.2 | 1.3 | 0.01 | 0.38 |
| ADF(% DM) | 21.4 | 28.0 | 26.6 | 29.3 | 30.4 | 30.8 | 30.8 | 29.7 | 1.49 | 0.01 |
| NDF(% DM) | 32.5 | 38.2 | 33.8 | 35.4 | 40.0 | 38.5 | 42.7 | 42.2 | 1.59 | <0.01 |
| dNDF(% NDF) | 62.8 | 64.7 | 64.1 | 60.5 | 65.8 | 64.6 | 68.4 | 61.7 | 9.50 | 0.93 |
| Temperature ($^{o}$C) | 30.2 | 29.4 | 27.4 | 27.0 | 26.4 | 25.5 | 23.4 | 21.8 | 3.08 | 0.24 |
| FFA (% DM) | 2.4 | 2.4 | 2.5 | 2.6 | 2.8 | 2.7 | 3.0 | 3.0 | 0.02 | 0.33 |
| Molds (per g; x$10^{-3}$) | 10.4 | 10.6 | 6.9 | 4.9 | 6.1 | 11.1 | 6.2 | 9.3 | 3937 | 0.57 |

DM, Dry matter; CP, Crude Protein; ADICP, Acid detergent insoluble crude protein; ADF, Acid detergent fiber; NDF, Neutral detergent fiber; dNDF, 30 h in vitro digestibility of NDF; FFA, Free fatty acid

There was no influence (P>0.05) of length of storage on DM, CP, and *in vitro* degradability of NDF. However, fiber content (NDF and ADF) was affected by storage (P<0.05). The free fatty acid content, an index of rancidity of fat, was not affected (P>0.05) by length of storage, peroxide values never reached detectable levels, and mold levels were not influenced (P>0.05).

Cracked Pima cottonseed can be stored under cover from weather for up to 22 days with no significant decomposition, or effects on nutritional value.

# THE USE OF ULTRASONOGRAPHY AS AN AID TO REDUCE THE CALVING INTERVAL, IMPROVING THE REPRODUCTIVE EFFICIENCY IN DAIRY CATTLE

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Ultrasonography is a powerful technology that can exceed rectal palpation under field conditions for the assessment, characterization and enhancement of the bovine reproductive status of both the individual animals and the dairy herd as a whole. This method can effectively be used for the (a) detection of abnormal pregnancies and pathologies of the genital tract; (b) determination of embryonic and fetal viability; (c) identification of twins; (d) prediction of fetal gender and, most importantly, (e) for the early diagnosis of pregnancy and embryonic/fetal losses. The purpose of the present work is to improve the reproductive efficiency of the UCD dairy herd, by the use of ultrasonography as an early and accurate diagnostic tool to enhance bovine reproductive management. Ultrasound examinations were performed on a weekly basis, for a period of 52 weeks, using a real-time, B-mode veterinary diagnostic ultrasound scanner (Aloka 500V) equipped with a 5 MHz linear array transducer designed for intrarectal use in large animals. A total of 170 reproductively mature females, predominantly Holstein, including heifers and cows, were systematically examined (526 exams) for: **(1)** pregnancy diagnosis and identification of open animals to be re-cycled (26 to 33 days after the last immediate service; mean±s.d. – 29.5 ± 1.9 days) – 299 exams; **(2)** confirmation of fetal viability, fetal gender diagnosis and identification of twins (56 to 73 days after conception; mean±s.d. – 59.9 ± 3.2 days) – 152 exams; **(3)** evaluation of potential pregnancy losses by reexamining only animals with signs not consistent with the maintenance of pregnancy (between days 34 and 55, and after day 74 of gestation; mean±s.d. – 40.6 ± 6.7 days and 89.7 ± 17.6 days) – 49 and 9 exams; and **(4)** diagnosis of reproductive pathologies, such as cystic ovarian disease (COD) – 17 exams. The pregnancy rate observed between days 26 and 33 after breeding was 58.9% (176/299). After the examination between days 34 and 55, 56 and 73 and 74 and 121 of gestation, respectively, 67.3% (33/49), 95.4% 145/152) and 44.4% (4/9) of the females were re-confirmed pregnant. However, a variable proportion of these animals in each examination interval carried nonviable pregnancies, characterized by the presence of dead embryos or fetuses, or remnants of membranes and fluids in the uterine lumen, associated with a persistent corpus luteum, a condition that may remain undetected for up to 5 weeks after embryonic or fetal death.

Table 1: Incidence of embryonic and fetal loss from day 26 to 121 of pregnancy

| Examination intervals (days) | Pregnancy loss* | | Nonviable pregnancies | | Total pregnancy loss | |
|---|---|---|---|---|---|---|
| | n | (%) | n | (%) | n | (%) |
| 26 to 33 | | | 19 | (10.8) | 19 | (10.8) |
| 34 to 55 | 16 | (9.1) | 4 | (2.3) | 20 | (11.4) |
| 56 to 73 | 7 | (3.9) | 4 | (2.3) | 11 | (6.2) |
| 74 to 121 | 5 | (2.8) | 0 | (0.0) | 5 | (2.8) |
| Total (26 to 121) | 28 | (15.9) | 27 | (15.3) | 55 | (31.2) |

* represents animals previously diagnosed pregnant and open upon reexamination with no signs of fetal tissue or membranes.

According to the results displayed in Table 1, approximately a third of all established pregnancies are lost within the first third of gestation, with the highest incidence occurring before 60 days post-conception (22.2%). Overall, this indicates that nearly 60% of all bred animals fail either to conceive or to carry a pregnancy to term. For the optimal re-utilization of such animals, the ultrasound scanning can assist with the characterization of the reproductive status of each individual, as shown in Table 2. In that way, the most efficient treatment or management decision can be made in order to reduce the open interval by early re-breeding.

Table 2: Characterization of the reproductive status of non-pregnant females after ultrasound examination

| **Reproductive status (possible stage of estrous cycle)** | **n** | **(%)** |
|---|---|---|
| Nonviable pregnancies (persistent corpus luteum) | 27 | 13.8 |
| Corpus luteum (diestrus/late metestrus) | 72 | 36.9 |
| Follicles (proestrus/estrus) | 22 | 11.3 |
| No significant structures (early metestrus) | 30 | 15.4 |
| Luteal cysts | 15 | 7.7 |
| Follicular cysts | 29 | 14.9 |
| Total | 195 | |

# LATE PREPARTUM PROTEIN SUPPLEMENTATION AND PERFORMANCE OF DAIRY COWS

**P.H. Robinson[1], J.M. Moorby[2], M. Arana[3], R. Hinders[4], T. Graham[5], L. Castelanelli[6], and N. Barney[7].**

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The nutrient content of the close-up dry period ration can influence productive performance of cows in the subsequent lactation. Recent US and UK studies report higher performance (primarily milk and/or milk protein) of dairy cows fed protein (CP) levels of close-up dry cow rations higher than current NRC recommendations of 12%. However not all studies report similar effects and some report no effects at all.

This study was designed to compare the impact of supplementing Holstein cows in the late dry period, fed a diet slightly below current NRC recommendations (10.8% CP) to above NRC recommendations (13.4% CP) on full lactation productive and reproductive performance under commercial conditions.

## METHODS

Holstein cows on a commercial California dairy were moved from a far-off dry cow group (where they were offered the control diet but without corn and barley grain) and assigned at random to one of two close-up dry cow groups that were fed either:

1) Control (C): a ration of corn silage, alfalfa cubes, oat hay, corn and barley grain, or
2) Supplemented (S): as C plus 0.8 kg/d of a high UIP supplement (60% SoyPass®, 20% dried distillers grains, 20% blood meal/feather meal/fish meal).

Primiparous (41; C and 55; S) and mature cows (110; C and 113; S) were assigned to close-up dry cow groups over a 90 d period. After calving, cows were treated with BSt, moved through three production groups and handled reproductively by the herd manager.

## RESULTS

Milk, fat and protein production increased for all cows as time close-up increased. Body condition and locomotion scores were not influenced. Cows tended to start on BSt later in lactation, were in the high production group longer, and conceived later as time close-up increased. Protein supplemented primiparous cows tended to receive BSt longer, stay in the high production group for less time and conceive later. Protein supplemented mature cows tended to start on BSt earlier, but other parameters of BSt use, time in production groups and reproductive performance were not influenced.

There were substantial benefits of increasing time close-up and providing supplemental protein on full lactation performance of all cows, with greater overall benefits for primiparous cows. These pre-partum factors had collateral effects on post-partum management decisions relative to use of BSt, movement through production groups and reproductive performance.

# GENETIC SELECTION WITHIN THE HOLSTEIN COWS FOR MILK PROTEIN COMPOSITION TO IMPROVE CHEESE YIELD

**Juan Medrano and Ed DePeters**
**Department of Animal Science, UC Davis**

The UC Davis dairy herd has been divided into two distinct breeding populations. The objective is to modify the gene frequency of milk proteins to improve the cheese manufacturing properties of the milk. The proteins of interest are kappa casein and beta lactoglobulin. There is an A and a B variant of each protein. Research demonstrated that milk from cows of the B variant resulted in about 8% more cheese from 100 pounds of milk. The frequency of the B variant of these proteins is lower in the Holstein breed compared to the Jersey breed. Using genetics to improve the manufacturing properties is a preharvest approach.

The objective of the research is to increase the frequency of the B variants of kappa casein and beta lactoglobulin in the Holstein cows in the UC Davis dairy herd. Bulls have been identified with either the A or the B variant of these proteins. The cow population was divided into the A herd and the B herd. Bulls of the A variant are used in the A herd and bulls of the B variant are used in the B herd. This project has been in progress for three years, and offspring of the breeding program are now entering the milk string. The frequency of the A and B alleles in the A and B herds are shown below. Breeding for the B protein variants has increased the frequency of the genes in the population. In the general Holstein population on commercial dairies, the frequency of the B variant of kappa casein is 0.18 (18%) and the B variant of beta lactoglobulin is 0.54. Within the selected herd at UC Davis (B Herd), the frequencies have been increased to 0.39 for kappa casein and 0.75 for beta lactoglobulin. This year milk from both herds will be collected and cheese produced to determine the impact of altering the frequency of the B variants on cheese yield and quality.

| | kappa casein frequency | | beta lactoglobulin frequency | |
|---|---|---|---|---|
| Herd | A | B | A | B |
| A | 1.0 | 0 | 0.68 | 0.32 |
| B | 0.61 | 0.39 | 0.25 | 0.75 |
| Holstein Population | 0.82 | 0.18 | 0.46 | 0.54 |

# QUESTIONS AND ANSWERS ABOUT THE CALIFORNIA DAIRY QUALITY ASSURANCE PROGRAM (CDQAP)

**What is the CDQAP?**

*The CDQAP is a voluntary program that allows producers to become certified in Food Safety, Animal Health and Welfare, and Environmental Stewardship.*

**Who runs the CDQAP?**

*The program is a collaborative effort by the dairy industry, the University of California, and state and federal regulatory agencies. A committee of dairy industry representatives must approve all program activities.*

**Who is eligible to become certified?**

*Any dairy producer in California can become certified, regardless of marketing or trade association affiliation. This program is offered statewide.*

**Do I have to certify in all three components (animal health, food safety, and environmental stewardship)?**

*No. Producers may become certified in any or all components of this program.*

**Which components are available?**

*The environmental stewardship is available now. The animal health and food safety components will be available for certification in 2000.*

**Will dairy producers be required to participate in the components of (CDQAP)?**

*No. The CDQAP is strictly a voluntary program. No producer is required to participate.*

**How much will this program cost me?**

*The program's environmental stewardship component has been funded through various grants and agencies through June 2002.*

**What do I need to do to be certified in Environmental Stewardship (ES)?**

*Producers will attend all three classes of the University of California Cooperative Extension (UCCE) – Environmental Stewardship Short Course I (ESSC), develop an Environmental Stewardship Farm Management Plan, and successfully complete an on-site evaluation by a non-regulatory third party.*

**Who will do the third party evaluations?**

*Currently, the designated third party evaluator is employed by the California Department of Food and Agriculture (CDFA). The local milk inspector will not be used as the third party evaluator. Provisions are being made to identify other third party evaluators.*

**Can my dairy field representative certify my facility?**

*No. Your field representative can be very helpful in helping you prepare for your on-site evaluation. A third party evaluator can not have a vested interest in the outcome of the evaluation.*

**Can the environmental stewardship on-site evaluation hurt me?**

*No. The evaluation checklist and records involved with the evaluation will remain on the dairy and are the property of the dairy producer.*

**Will participating in the CDQAP keep me from being inspected by the Environmental Protection Agency (EPA)?**

*No. US EPA already knows where all dairies in California are located and are committed to inspect each facility by 2005. The CDQAP evaluation is your best management tool to prepare for EPA (regulatory) inspections.*

**Why should I certify in environmental stewardship?**

*Certification reassures my neighbors, any passers-by, and me that my facilities meet Federal, State, and local environmental regulations.*

**What happens if, during the on site evaluation, deficiencies are identified?**

*Nothing. You and your evaluator will work together to determine what actions need to be taken and arrange a date for re-evaluation. You can always choose to discontinue the certification process. Again, the program is strictly voluntary.*

**How does certification help the California dairy industry?**

*Participation in this program may reduce or eliminate the need for additional government regulations. It will give trade associations and the California Milk Advisory Board a positive story to tell and provide evidence that California dairy producers are working to protect the environment. Voluntary participation should result in compliance with regulations. This should prevent situations that result in fines. Additionally, some processors may chose to use this program as a marketing tool.*

**How much is this program worth to me?**

*Knowing that your facility is in compliance with all environmental regulations is invaluable. However, preliminary estimates indicate that the cost of hiring private consultants to provide these instruction/evaluation services would be in excess of $8,000.00 per producer.*

**Are there other financial benefits?**

*Already mentioned above is prevention of fines and potential use by your processor as a marketing tool. In addition, classroom training and on-site evaluation may identify improvements that could reduce dairy management costs, minimize disease, and increase production.*

*For further information on classes, you may contact your UCCE Dairy Advisor or trade association representative.*

# CALIFORNIA DAIRY QUALITY ASSURANCE PROGRAM – ENVIRONMENTAL STEWARDSHIP CERTIFICATION

## *What do I do to certify?*

Any dairy producer in California may certify in Environmental Stewardship. These certification requirements will assist the producer to comply with the federal, state, and local laws and water quality regulations. Participation in the program by a dairy producer is strictly voluntary. The requirements are:

***1.*** *Complete the Environmental Stewardship Short Course 1 (ESSC1) for dairy producers;*

***2.*** *Develop and implement an Environmental Stewardship Farm Management Plan (ESFMP);*

***3.*** *Successfully complete an On-site Evaluation by an independent, third party evaluator who has no financial ties to the operator or facility.*

***Complete these requirements before scheduling your third party evaluation.***

**Requirements for Producer Certification**

1. ***Complete the Environmental Stewardship Short Course 1*** *(ESSC1)* - Each producer (or authorized employee representing the dairy) must complete the three classes of the *Environmental Stewardship Short Course 1* presented by the University of California Cooperative Extension (UCCE). Certificates of participation are provided to the producer that attends all three sessions of the ESSC1. The records of attendance are kept by UCCE.

2. ***Develop and Implement an Environmental Stewardship Farm Management Plan (ESFMP) and associated documents.*** These written plans are the property of the producer and will remain in their possession (at the dairy).

*These plans will include (but are not necessarily limited to):*

- **A.** Develop an action plan to reduce risk of contaminating surface and ground water resources.
  1) List all categories with a Risk Ranking of 1 from Section 3 of the ESSC1.
  2) Select an appropriate alternative for implementation at your facility to reduce risk.
  3) Describe your implementation time line.
- **B.** Calculate needed water storage capacity.
  1) A computer printout from the *UCCE software.
- **C.** Calculate existing water storage capacity
  1) A computer printout from the *UCCE software.
- **D.** Develop a ***Storm Water Pollution Prevention Plan*** (SWPPP).
- **E.** Develop a ***Manure Management Emergency Plan*** *(homework from ESSC1)*.

**F.** Documentation that the operator has fulfilled the local, state and federal environmental regulatory requirements.

1) This includes anything relating to permits or waivers required by the federal, state, or local government. The documents must be originals or copies of what is on file at that appropriate agency.

* A computer program was developed by UCCE to standardize necessary calculations to estimate storage requirements. Producers are encouraged to use this standardized program to expedite the third party evaluation.

2) Copies of annual reports for Waste Discharge Requirements and the National Pollutant Discharge Elimination System (NPDES) Storm Water Permit.

**G.** Documentation that the operator meets applicable requirements for dairy storage ponds and land application of manure and wastewater.

***3. On-site Evaluation*** - The producer will request an on-site evaluation by a third party. A checklist developed by the participants of the Environmental Stewardship Partnership Agreement will be used as the evaluation tool. Evaluations will rely heavily on examination of the Environmental Stewardship Farm Management Plan and related documents developed by the producer. **ALL** written material will remain at the dairy at the end of the evaluation, no matter the outcome of the evaluation.

1) Complete the "do ahead" part of the checklist. These questions should be answered before the evaluator arrives to minimize the time needed for the evaluation.

**4. *"During Evaluation"*** – Class attendee and persons familiar with the daily operation of manure should accompany the third party evaluator.

1) The evaluation will include a visual assessment of the waste containment and runoff control facilities. The on-site evaluation will be non-regulatory in nature. Following successful completion of an evaluation, the third party will notify UCCE, which will complete the certification process.
2) In the event that the on-site evaluation reveals circumstances, which need to be corrected, the evaluator will leave the checklist and discuss with the producer items that need corrections and will schedule a subsequent re-evaluation. Upon successful completion of the re-evaluation, the third party will notify UCCE, which will complete the certification process.

Call to schedule your third party evaluation

Review items on the "During the Evaluation."

Have third party evaluation.

Schedule follow-up third party evaluation if needed.

Modify irregularities and deficiencies prior to follow-up evaluation.

*If a producer owns more than one facility, an employee representing each facility will only have to attend the Environmental Stewardship Short course once. A separate Environmental Stewardship Farm Management Plan and associated documents will have to be completed for each facility where livestock are kept.*

***If you are interested in having your dairy evaluated to become certified, please contact Bob Donnalley at the California Department of Food and Agriculture (CDFA) at (916) 653-6681, to receive information and schedule an appointment.***

# # #

# HOW MUCH WATER DO YOU USE AT YOUR DAIRY?

**An on-going study by Deanne Meyer, Barbara Reed, Cindy Batchelder, Tom Shultz, Jerry Higginbotham, Jonathan Merriam and Marit Arana**

Water use on dairies continues to be a topic of discussion. Certainly, drinking water is a must. All animals at the facility must have access to quality drinking water. Water used for cooling animals is beneficially used. Then there is the water used for milking and cow sanitation (plate cooler, sprinkler pen, flush, drop hoses). How much water is really used for these purposes?

A group of dairy producers throughout the Central Valley are participating in a project to measure water use. Meters were installed at facilities to measure water use. What is measured is a function of how the parlors are plumbed. In some parlors we measure total water use, in others we can measure sprinkler pen water, equipment water, and flush water.

The cost of the meters and installation ranged from $200 to $2,200. Some producers installed the meters themselves to save money.

It has been assumed for many years that equipment and sanitation uses were about 50 gallons per cow per day. For a herd of 1,000 milking cows, this would generate 18.5 acre feet of wash water for a 120 day storage period (winter storage).

Actual averages ranged from 44 to 151 gallons per cow per day. Facilities reused plate cooler water for sprinkler pen use. Yet, most facilities needed extra ground water for their water needs. At one dairy, the average water use was 151 gallons per day. Some 64 gallons per cow per day were used in the sprinkler pen and an additional 97 gallons per cow per day were used to flush the milk parlor. One facility used 280,000 gallons of water a day in the sprinkler pen. (Cows were washed three times for two minutes each time.)

What have we learned? The amount of water used for milking equipment and sanitation is VERY variable. It is critical to have a good understanding of water use. Individuals short of storage capacity should evaluate water use in the sprinkler pen, flushing, and in parlor hoses. Reducing sprinkler pen on time through use of a lock out timer can reduce water use. Alterations in flushing can drastically reduce water use when parlors are flushed and not hosed clean.

Reduced water use will reduce the storage requirements and will also reduce electricity costs. Be sure that any changes in sprinkler pen operation do not alter milk quality.

# CLONING CREATES NEW DIMENSIONS FOR THE DAIRY INDUSTRY

**Cynthia A. Batchelder and Gary B. Anderson**
**Department of Animal Science, UC Davis**

Cloning simply defined is the asexual reproduction to produce a genetically identical individual. Plant breeders have used this technique for years to produce and expand unique plant varieties. The Macintosh apple is an example of a plant variety developed through cloning technology. Mammalian cloning first became useful in the 1970s with the culture of individual cells of an early embryo. In 1986, mammalian cloning by nuclear transfer was reported when a nucleus from an early sheep embryonic cell was used to clone a viable lamb. The birth of Dolly, announced in 1997, captured the interest of the public, the media, and the scientific community as cloning from adult somatic cells was demonstrated for the first time in mammals. Subsequently, births of live young from adult somatic cell nuclear transfer have been reported in other species and from a variety of donor tissue types. In cattle, successful donor cell types include mammary gland cells, skin cells from the ear and tail, and cells lining the female reproductive tract. Despite intensive scientific experimentation, success rate in birth of live young from somatic cell nuclear transfer is still disappointingly low.

Our project aims to improve the success rate of cloning in cattle by comparing the ability of various donor cell types to supply nuclei capable of directing embryonic and fetal development after nuclear transfer. Cells are collected from tissues of donor animals and established in cell culture. Single cells containing the donor cow's genetic information are inserted into unfertilized oocytes (eggs) from which the maternal chromosomes have been removed. The nuclear transfer embryos develop in culture and are nonsurgically transferred to recipient females by standard embryo transfer techniques. The resulting calves will be genetically identical to the cow from which the nuclear donor cells were obtained. Our hypothesis is that nuclei from less differentiated donor cells will be more successfully cloned than nuclei from differentiated cells. Cell types being tested include cumulus cells (surrounding the growing egg), granulosa cells lining the developing follicle, and cells obtained from the corpus luteum. Mammary epithelial cells cultured from early lactation milk samples will also be tested.

Information generated by our project should improve the efficiency of cloning in cattle, making the technique practical for research and commercial applications. The potential to clone adult dairy cattle creates entirely new dimensions for the dairy industry. A cow of desired, unique phenotype can be precisely reproduced, capturing traits that are difficult to develop through traditional breeding practices. For example, a cow with unusually high protein content in her milk, or with an unusual combination of milk protein variants, or with unusual mammary desaturase activity could be cloned to provide multiple copies. Selective breeding from an individual animal might not be expected to be successful, but selective breeding from a nucleus herd of such animals likely would be.

# THE TOM MEAD DAIRY AWARD
# OFFERED BY WORLD-WIDES SIRES, INC.

World-Wide Sires, Inc., 5545 Avenida de los Robles, Visalia, CA supports this undergraduate award in memory of Professor Tom Mead. Professor Mead was a member of the Department of Animal Science. He began his career in 1920 at Rutgers and joined the Davis faculty in 1924 bringing with him the Jersey inbreeding experiment from Rutgers which included three sires and 31 cows. His research dealt with genetics, nutrition and management. Professor Mead retired in 1962, and he passed away on December 19, 1971.

World-Wide Sires is the world's largest exporter of U.S. frozen livestock semen. The President is Bill Clark, a UC Davis alumnus. On behalf of the dairy industry within California, World-Wide Sires provides the funds to offer the Tom Mead Dairy Award to a promising young undergraduate that shows interest in the dairy industry.

The 1999/00 recipient of the World-Wide Sires Tom Mead Dairy Award is Frank Martin.

Frank is a senior majoring in Animal Science. Frank was raised on dairy in Etna, California. Frank was a Student Herd-Manager at the UCD Dairy Teaching and Research Facility last year. As a student herd-manager Frank was involved in the day to day operations of the facility. Frank also contributed significantly to the teaching and outreach activities associated with dairy cattle. Frank is involved in numerous extracurricular activities. He is a member of Ag Ambassadors, which educates the general public about agriculture. He was a member of the Livestock Judging Team, the Davis Horse Polo Team, and the animal science undergraduate club, Block and Bridle. He is a member of the Ag Student Leadership Committee and was a founding member of the new UCD Dairy Club. Frank has been involved in Ag Science Field Day and UCD Dairy Cattle Day events. Last year he provided a demonstration at the UCD Dairy Cattle Day program on using low heat to clip hair on the udder and flanks of dairy cows. Last summer Frank participated in the California Milk Advisory Board internship program related to dairy product evaluation and quality improvement programs. As a member of the Research and Outreach Team of participating interns from various universities in California, Frank became familiar with how milk is marketed and the future direction of marketing programs. Frank's career goal is to obtain a position that in involved with the dairy industry.


**Frank Martin**

# DAIRY NEWS

## Three UC Davis Dairy Scientists Receive National Dairy Awards

Three researchers from the University of California, Department of Animal Science, received awards at the 94th annual meeting of the American Dairy Science Association in Memphis, TN, in June 1999.

The awards were presented to Gary Anderson, professor and chair of the animal science department, Cooperative Extension Specialist Deanne Meyer, and Professor Ed DePeters.

Anderson, an authority on mammalian embryo development, received the Pharmacia & Upjohn Physiology Award in recognition of his research leadership in embryo biotechnology and physiology. His early research was directed towards developing the technology needed for bovine embryo culture and refrigeration. His current research is focused on the study of the natural mechanisms that protect the fetus from maternal immunological attack. He was one of the first scientists to use gene transfer technology in dairy cattle.

Meyer, waste management specialist, received the American Dairy Science Foundation's Young Scholar Award in recognition for her early achievements in education and research. Meyer's research and educational activities are focused towards helping livestock producers manage and utilize the nutrients found in livestock waste. She developed the Environmental Stewardship Short Course, a series of three classes, for dairy producers.

DePeters, a dairy cattle nutritionist, was awarded the Nutrition Professionals, Inc. Applied Nutrition Award in recognition of the outstanding quality of his work in applied dairy nutrition. His research has focused on the affect of dietary fat and nonstructural carbohydrates on milk protein synthesis by the lactating cow. This information is aimed at improving the yield of cheese from milk. He is also an authority on feeding fat and the use of by-product feeds for dairy cattle. DePeters works closely with nutrition professionals and his research has immediate application to dairy producers.

**Ed DePeters, Deanne Meyer and Gary Anderson**

The American Dairy Science Association is an international organization of more than 5,200 members including educators, scientists, and industry representatives who are committed to advancing the dairy industry.