Texas Agricultural Extension Service Update

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The following projects currently are under way in cooperation with and for Texas dairy producers.

EVALUATING COOLING TECHNIQUES

Heat stress in the dairy cow results when her heat load becomes greater than her ability to dissipate it. External heat load accumulates from several sources, including: solar radiation, high ambient air temperature, and high relative humidity. This load is exacerbated by the heat production associated with rumen fermentation. Generally, the higher producing the cow, the greater the heat load produced by her digestion and metabolism.

Temperature Humidity Index (THI) reflects the combined effects of ambient temperature and relative humidity. The THI is a discomfort statistic, which can be calculated as **[**(0.8 * dry-bulb air temperature) + ((relative humidity) * (air temperature-14.4)) + 46.4**]**. Indexes above 72 are usually associated with heat stress in cattle. During the summer of 1998, our nighttime THIs did not deviate much from those during the day, because humidity increased as the temperature declined throughout the night. Consequently, little nighttime cooling occurred for the animals.

In 1998, a study was conducted in Central Texas and California freestalls to determine the efficiency of different cooling systems. Facilities were chosen for evaluation where one barn could be used as a control (no cooling system) to measure the effects of cooling on both environment and the cows. Respiration rate was used as an indicator of heat stress on the cows. Values are reported as a percentage increase from those observed in the morning (~9:00 am; prior to heat stress) to those observed in mid-afternoon (~2:30 pm; during heat stress). Type of freestall cooling, including facility design (roof type and eave height) and cooling system, were evaluated.

Table 1: Changes in respiration rates of cattle housed in barns with different roof types.

Roof type	% change in RR*
∧-shaped design	
4-12" pitch	2.5
2- or 3-12" pitch	10.5
Stacked design	
3-12" pitch	25.7
< 3-12" pitch	33.0

* The percentage increase in respiration rates in cattle from morning to afternoon.

Facility Design

Roof design. Facilities were divided into those with a simple ∧-shaped design or those with a stacked design (usually containing 2 tiers). Within each design, the pitch was evaluated. Roof pitch has a significant impact on air movement within the barn. The greater the pitch, the greater the air draw through the peak of the roof. Respiration rates of cattle in each facility are reported as the increase from morning to afternoon (Table 1).

Eave height. Freestalls built in the Midwest and Northeastern United States have eave heights of 10 feet. However, when adapting these facilities to the south higher eave heights create greater air flow during summer heat periods. Data collected in 1998 showed a greater increase in respiration rate of cattle housed in facilities with less than 14' sidewalls (Table 2).

Table 2: Increase in respiration rates (am to pm) due to eave height.

Eave height	% change in RR*
14 - 16'	17.8
12 - 13'	31.5
11' or less	24.5

* The percentage increase in respiration rates in cattle from morning to afternoon.

Table 3: Effect of cooling system on barn environment.

System	Change in ^{o}F*	Change in % RH*	Change in THI*
No cooling	-0.3	2.4	0.1
Feed line soakers	.2	-0.3	0.3
Spray & fans	-1.1	2.4	-0.2
High pressure foggers	-4.0	34.9	1.6

*Changes are reported as the difference from AM to PM.

Cooling System

Cooling systems examined include: feed lane soakers, spray and fans, and high pressure foggers. These systems were compared to a control facility with no cooling. Feed lane soakers are fairly common in the dairy industry to attract animals to the feedbunk. Spray and fans are also frequently seen and typically spray water at less than 200 psi. The high pressure fogger system is a new technology in the dairy industry, distributing water at greater than 800 psi. This puts out a very fine mist and is being marketed for potential application in cooling over the freestall beds.

Systems were evaluated for their effect on environmental temperature and humidity and for their effect on cattle respiration rate change from AM to PM. Table 3 illustrates the effects of each system on temperature (^{o}F), relative humidity (%RH), and THI as compared to the control facility with no cooling.

As you can see from Table 3, the only system to change the environment was the high pressure foggers. With no supplemental air movement, the fogging increased the relative humidity tremendously.

Table 4 expresses the changes in cattle respiration rates (AM to PM) in response to the various systems. The ranges associated with each average show individual systems performed at both extremes, good and poor. Feed lane soakers had an impact on respiration rate change, making the investment in this system minimal compared to the benefits returned. The spray and fan system reduced heat stress even further, probably because of the addition of air movement with the water. However, the high pressure fogger system appeared to increase heat stress in cattle, probably because it lacked additional air movement.

Conclusions

Facility design and cooling systems affect cow comfort. The best methods use both water and air. Although the high pressure foggers observed showed no value in cooling cows, systems with added air movement have provided very positive cooling responses. The price of these systems vary from minimal (feed lane soakers) to expensive. By observing changes in cow respiration rates systems, which maximize cooling efficiency can be selected.

Table 4: Effect of cooling system on cattle respiration rate.

System	Change in RR*, %	Range of RR change, %
No cooling	23	3 – 52
Feed line soakers	18	4 – 36
Spray & fans	14	0 – 34
High pressure foggers	41	32 – 50

*Changes are reported as the difference from AM to PM effect.

COMPARISON OF TWO SYNCHRONIZATION PROTOCOLS FOR FIRST SERVICE

This demonstration is under way in Erath county and will continue for a period of one year. All cows at this dairy are assigned to one of two treatment groups based on alternating weeks of calving. The demonstration goal is to breed all cows in the herd within three days of attaining the prescribed voluntary waiting period with a conception rate of 50% in the cool season and 25% under heat stress. One treatment group will be time bred and the other group will be bred based on detection of estrus or at a given time.

The Postpartum Management

1. Identify potential problem cows, those which had retained placenta, assisted births (3 or greater), twins, milk fever, or dead calf. Give 2 cc of ECP® on day one.
2. Take temperature of each fresh cow daily for the first 10 days with a GLA® thermometer. (The GLA® thermometer gives an accurate result in about 15 seconds.)
3. Cows found to have a temperature greater than 103^{o} F receive 2cc of Naxcel® per 100 lbs. of bodyweight (at least 25 ml per day) for a minimum of 3 days. If the fever persists treatment continues for up to 5 days.
4. Cows with a fever also receive 10 ml of Predef 2X® to maintain appetite and help with toxemia. **Never** give more than one dose of Predef 2X®.
5. Any cow identified as being a problem cow as defined in item 1 or having a temperature receives one *clean-up shot*, 5 ml injection of Lutalyse®, 14-21 days postpartum.

Treatments

Treatment 1: A voluntary waiting period of 60 days is used with the following injection schedule:

Injection 1 - Lutalyse® (cows from 36 to 42 days PP)
Wait 2 weeks
Injection 2 - GnRH (cows from 50 to 56 days PP)
Wait 7 days
Injection 3 - Lutalyse® at 8 a.m. (Cows from 57 to 63 days PP)
Breed at heat on days 1 and 2
Breed remainder of cows at 72 hours after injection 3 (Lutalyse®), which should be at 8 a.m.
Continue to breed cows based on signs of heat.

Treatment 2: A voluntary waiting period of 60 days is used with following injection schedule:

Injection 1 - Lutalyse® (cows from 36 to 42 days PP)
Wait 2 weeks
Injection 2 - GnRH (cows from 50 to 56 days PP)
Wait 7 days
Injection 3 - Lutalyse® at 8 a.m. (Cows from 57 to 63 days PP)
Wait 48 hours
Injection 4 - GnRH at 8 a.m.
Breed all cows 24 hours (8 a.m.) after injection 4.
Do not breed cows based on heat signs.

Evaluation

The design includes two treatment groups in two housing systems. Evaluation parameters include: average number of days to first service (not expected to differ by more than one day), % pregnant by 70 days PP, conception at first service, services per conception, services per cow, and percent pregnant by 90, 120 and 150 days postpartum. Weeks will serve as replicates. In addition, the conception rate in treatment one on cows bred at 72 hours will be compared to that of cows bred on day 1, 2 or $\geq$4 based on standing heat. The pregnancy rate of cows bred only at the 72 hour appointment breeding in Treatment 1 will be compared to the appointment breeding in treatment 2. In addition, reason for PP treatment and number of days receiving Naxcel® will be included in the regression analysis to determine their effect on success rate at first insemination.

Results to Date

After the first replicates, we did not have the kind of results sought. Previously this herd had a 24% conception rate and was finding approximately half the cows in heat, resulting in a pregnancy rate of 12%. In treatment 1 and 2, we are now breeding all the cows calving within a given week, so our pregnancy rate actually doubled because the conception rate either stayed the same or improved slightly. Insufficient data is available at this point to conduct statistical analysis. Herd management has been evaluated by the researchers in cooperation with the herd consultants and modified in an effort to attain the desired conception rates.

Table 5: Summary of data for first 6 weeks of reproduction trial.

	Herd 1 No. (%)	Herd 2 No. (%)	Combined No. (%)
Treatment 1			
Seen in heat	51/85 (60%)	33/78 (42.3%)	94/163 (56.6%)
Total pregnant	29/85 (34.1%)	26/78 (33.3%)	55/163 (33.7%)
Pregnant from d3 only breeding	14/85 (16.5%)	18/78 (23.1%)	32/163 (19.6%)
Treatment 2			
No. seen in heat	4/47 (8.5%)	8/46 (17.4%)	12/93 (12.9%)
Total pregnant	19/47 (40.4%)	10/46 (21.7%)	29/93 (31.1%)
Pregnant if in heat	17/47 (36.1%)	10/46 (21.7%)	27/93 (29%)

DHI: PROVIDING A MEASUREMENT TOOL FOR DAIRY PRODUCTION

Dairy Herd Improvement has been an integral part of extension programming for the past 50 years. Recently, due to acceptance of microcomputer based programming and the opportunity to use non-historic service providers for herd recording, the program has under gone significant change. However, for the 1998 testing year production has continued to increase as well as participation, based on number of cows (Figure 1).

In an effort to increase the utilization of DHI data, a section ***Where Am I*** has been added to the DHI WEB page that allows producers and consultants to access averages based on yearly and monthly management variables. The values are categorized by herd size, housing type and parlor. The dataset contains herds processed through DRMS (Raleigh), Agritech and DHI-Provo that are Texas service affiliate members.

The web page may be accessed at:
http://tdhia.tamu.edu

CHAIN PRODUCTION SYSTEMS

Integration continues to be the key to success on a dairy facility. The ability to easily move from one data set to another to estimate profitability has been an elusive target for dairy producers. Historically management parameters were independent. Production data did not integrate with financial data and feed inventory data did not integrate with ration formulation data.

In the past, significant effort has been directed to developing programs that utilize open data base architecture in order to allow the querying of different databases. Additional emphasis has been directed to develop programs that also allow the interrogation of these databases to provide a systematic approach to problem solving.

Currently, we are working on a model to integrate production, feed, financial, labor and environmental components to provide a holistic approach to dairy management. The chain concept attempts to integrate the many data information points in the separate data sets into a linked chain of events. The events that impact each chain are allowed to flow to that segment, without the need to re-enter redundant data into each segment. Utilizing this concept, we are developing a system model that allows a producer or consultant to query current data to evaluate present management. But more importantly, the model facilitates incorporation of an individual's data bases, augmented with other relevant data points, to forecast profitability of management options in the next 3, 6 or 12 months. This tool will not only accommodate evaluation of management options, but enhances a producer's ability to be more involved with forecast planning.

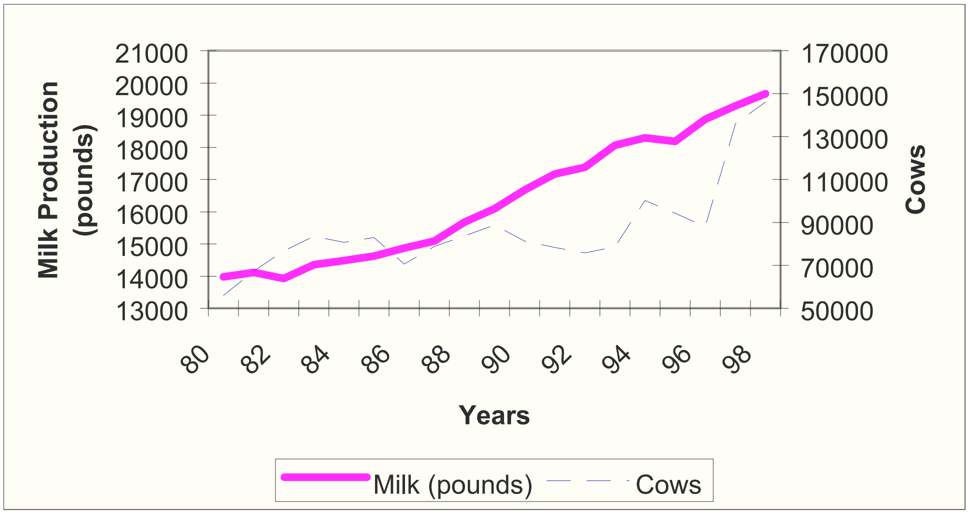

Figure 1: Production per cow and number of cows enrolled in DHI from 1980 to 1998.

319H PROJECT

Nitrogen and phosphorus excretion has become a significant problem for the dairy industry in Texas. The inefficient use of these nutrients in dairy production environments reduces the nutritional efficiency of the feeding operation and increases nitrogen and phosphorous content of run-off water.

Currently, no systematic monitoring programs are available to facilitate the implementation of nutritional best management practices. Best management practices presently in use focus on excrement management. Best management practices to alter composition of the excreta via manipulation of the biological unit are virtually non-existent. Balancing nitrogen and phosphorous intake with animal's requirement results in an increased efficiency of nutrient utilization and decreases the quantity of these nutrients excreted. During the past year, the Texas Agricultural Extension Service, under contract from the Texas State Soil and Water Conservation Board, has been the lead agency in developing a monitoring system for nitrogen and phosphorous in dairy cattle production systems.

Samples of forage, feed ingredients, and total mixed ration have been collected during monthly visits to cooperator herds. Feces was also collected from 5% of the lactating herd at the time of the visit.

As we enter the second phase of the study, we will develop feeding guidelines to reduce non-point source pollution of ground and surface water. Nutritional requirements for optimum nitrogen and phosphorous utilization will be formulated to use in decision support systems. These systems will be implemented into practice through producer groups and nutritional consultants. The BMPs shown to be effective in reducing nitrogen and phosphorous will be implemented in CAFOs. This transfer will be made by conducting field days and short courses on-site for producers and nutritional consultants.