

EXTENSION

40 Performance and serum Vitamin E concentration of calves fed Vitamin E supplementation at 100 or 200 IU/calf/day in calf milk replacer. T. E. Johnson*¹, H. B. Perry¹, B. L. Miller¹, M. A. Fowler¹, R. M. DeGregorio¹, R. L. Horst², and B. J. Nonnecke², ¹*Land O'Lakes Research Farm, Webster City, IA*, ²*USDA/ARS National Animal Disease Center, Ames, IA*.

Two levels of supplemental Vitamin E were included in calf milk replacers to evaluate performance, scour data and Vitamin E status of Holstein bull calves. A total of 162 calves with an initial weight of 43.9 kg were randomly assigned according to body weight and blood gamma globulin concentration to one of two Vitamin E treatments, 100 or 200 IU/calf/day. Milk replacers were formulated to contain 22% protein and 20% fat and were medicated with neo-terramycin. Calves were individually housed in crates and fed two times daily at 700 and 1615 hours. No dry calf starter was fed. Weight gains, milk replacer DM consumption, feed efficiency, scour scores (1–4 scale; 1=normal; 2=loose; 3=water separation; 4=3 with severe dehydration), duration of scours, and medication costs were calculated weekly and for the total 4 week period. Serum Vitamin E concentrations (ng/ml) of calves were measured at the beginning of study and at day 28. Total weight gain, milk replacer DM consumption, feed efficiency, scour score, duration of scours, and medication costs of calves fed milk replacer supplemented with 100 or 200 IU/calf/day of Vitamin E were 11.79, 11.79 kg; 21.09, 21.08 kg; 2.16, 2.25; 1.18, 1.14; 3.76, 2.89 days and \$5.29, \$4.46, respectively ($p > .05$). Day 0 serum Vitamin E concentrations were 531.6, 455.7, respectively ($p > .05$). Day 28 serum Vitamin E concentrations were 1667.3, 2577.8 ng/ml, respectively ($p < .05$). These data indicate that there is no added benefit by increasing total Vitamin E intake from 100 to 200 IU/calf/day except for increasing the concentration of Vitamin E of serum.

Key Words: Vitamin E, Milk Replacer, Calves

41 The effect of USDA inspected red blood cells as an alternative protein source in calf milk replacers. J. D. Arthington*, D. U. Thomson, E. M. Weaver, J. M. Campbell, F. Chi, and L. E. Russell, *American Protein Corporation, Ames, Iowa*.

Recent technology has made possible the production of high-quality, USDA inspected red blood cell protein. This unique ingredient is currently being used as a source of protein in calf milk replacers (CMR). The objective of this study was to examine the effectiveness of displacing milk whey protein with USDA inspected bovine red blood cells in CMR. Holstein bull calves ($n = 90$) were collected from local dairies over a three week period. Calves were allotted to one of three treatments ($n = 30$ /treatment) before 5 days of age. Treatments consisted of: 1) red blood cell CMR with bovine serum protein (d1 to d14), followed by red blood cell CMR without bovine serum protein (d14 to d42; PROGRAM), 2) red blood cell CMR (d1 to d42; SELECT), or 3) all-milk CMR (CONTROL). All diets were formulated to provide 20% protein and 20% fat. All treatment diets were offered at a rate of 454 g/d into two separate 2 L liquid feedings (12.5% solids in final solutions). A common calf starter was offered ad libitum from d14 to d 42. There was no effect of treatment on percent mortality across treatments. Calves receiving red blood cell CMR treatments experienced a greater ($P < .05$) rate of gain compared to CONTROL calves (2.32, 2.32, and 2.09, and 2.34, 2.43, and 2.25 kg/d for PROGRAM, SELECT, and CONTROL calves on d1 to d14, and d14 to d42, respectively). Daily starter intake was also higher ($P < .05$) for calves consuming red blood cell CMR (2.34, 2.34, and 2.09 kg/d for PROGRAM, SELECT, and CONTROL calves, respectively). The results of this study indicate that USDA inspected red blood cells are an effective alternative to more costly milk proteins in calf milk replacer formulations. Calves consuming a red blood cell CMR experienced an improved rate of gain and increased starter feed intake compared to calves consuming an all-milk diet.

Key Words: Calf, Milk Replacer, Red Blood Cell

42 Protein and energy requirements for rapid heifer growth. M. J. VandeHaar*, *Michigan State University, East Lansing.*

Rapid gains before puberty have been associated with decreased mammary development or milk production in several but not all studies. The possibility that differences in dietary protein account for some of the variation in responses to rapid gains was examined. The severity of mammary impairment in 14 published studies in which rapid gains exceeded 900 g/d was calculated. Mammary development in each study was calculated as parenchymal DNA around the time of puberty or as milk production during first lactation for heifers grown rapidly as a percentage of that for heifers grown slowly. The actual rate of gain of rapidly-grown heifers accounted for only 7% of the variation in mammary impairment. However, across studies, mammary development was directly correlated with dietary protein-to-energy ratio (g CP / Mcal ME). In fact, protein-to-energy ratio accounted for 70% of the variation in mammary parenchymal DNA responses and 80% of the variation in FCM production responses to rapid growth rate. Studies in ewe lambs growing rapidly support this indirect evidence in cattle. Several studies have shown that recommendations for dietary protein in NRC (1989) are optimal for carcass growth and composition at total body gains of 800 to 1000 g/d. When heifers are fed for gains greater than 1000 g/d, feeding more protein per unit energy than NRC (1989) recommends for standard growth may be required to achieve normal mammary development. The supplemental protein should be from true protein sources such as soybean meal, rather than non-protein nitrogen. In conclusion, dietary protein-to-energy ratio accounts for much of the variation in mammary development when heifers are grown rapidly. High dietary protein might improve mammary development when heifers are grown rapidly. However, the risk of decreased mammary development when heifers are fed for gains greater than 1000 g/d seems greater than the potential benefit of decreased age at first calving. Thus, ad libitum feeding of a high energy diet to prepubertal heifers is not recommended, regardless of its protein concentration.

Key Words: Heifers, Growth, Protein

43 Accelerated heifer growth: lactation and economic outcomes. M. E. Van Amburgh*, *Cornell University, Ithaca, NY.*

Acknowledging that heifers represent a true and tangible cost to the profitability of the dairy farm is the first step towards increasing profitability. Recent evaluations of heifer rearing enterprises indicate that raising replacements accounts for 15 to 20 % of the total costs on dairy farms (Karzes 1993). For over 30 years, the benchmark for age at first calving has been 24 months. Age at first calving is the single most important variable influencing costs associated with raising heifers (Cady and Smith 1996). Research has demonstrated a strong positive correlation between prepubertal mammary development, first lactation milk yield and age at first calving. Accelerated calving data determined that lowering the age at first calving from 24.5 months and weighing 549 kg to 21.2 months weighing 520 kg decreased first lactation milk yield by 450 kg. The loss in milk was equivalent to a decrease marginal income of \$45. However, rearing costs were reduced by approximately \$180, therefore the increase in marginal profit per early calving heifer was \$135. Further, the relationship between prepubertal growth rate and milk yield was low ($R^2 = 0.08$) suggesting that factors other than prepubertal growth rate influenced first lactation milk yield. Thus it appears that earlier calving, even at lighter postcalving body weights is profitable if nutrition and management are adequate to meet the requirements of the heifer.

Key Words: Heifer, Growth, Profitability

44 Determining optimum body size of Holstein replacement heifers. P. C. Hoffman*, *University of Wisconsin-Madison.*

Research and field observations have demonstrated a positive relationship between body size and calving and first lactation milk yield. Body size is commonly defined as live body weight (LBW). Defining an optimum body size at calving for Holstein replacement heifers using a single LBW as the sole criteria has numerous problems. First, there is genetic variation of LBW which needs to be appropriately accounted for. Second, research has demonstrated that frame size measurements may be better correlated to first lactation yield than LBW. Third, LBW provides no inference to body composition, which is related to dry matter intake, metabolic problems, and ultimately, to milk production. Body size of Holstein heifers can be defined using other measurements such as wither height, body length, pelvic area, and body condition score. Recent research has provided enough data that compilation of these secondary measurements are now possible. Development of robust growth guidelines aids replacement heifer research and enhances field recommendations. The objective of this paper is to propose enhancements in defining optimum body size and growth characteristics of Holstein replacement heifers. Proposed enhancements include better quantification of frame size, body composition, and genetic variance of body size in the U.S. Holstein genotype. In addition, this paper will propose improved quantification of body size of replacement heifers in heifer research protocols.

Key Words: Heifer, Dairy, Growth

45 Characterizing teat end lesions for lactating dairy cows. L. L. Timms*¹, M. A. Faust¹, and M. Kehrl², ¹*Iowa State University, Ames,* ²*NADC, Ames.*

Objective for our study was to identify factors that influenced teat end lesions for dairy cows. A 5-point linear scoring system for teat ends was: 1 - smooth, no callous or ring at teat orifice; 2 - visibly raised ring or callous; 3 - prominent raised ring or callous; 4 - raised ring and breaks in skin; 5 - prominent lesion, scab, or excessive hyperkeratosis. Scores were assigned every third day during 12/96-3/97 (24 scoring days) by 3 independent scorers using .5 point increments; generally, 2 scorers evaluated teat ends on a given day. Scores were collected for a total of 113 cows (2709 teats scored) housed in three barns that represented different environmental conditions and combinations of breeds, parities, and stages of lactation. Overall, distribution of scores was: 1 (26.7%), 1.5-2 (45.3%), 2.5-3 (7.1%), 3.5-4 (17.7%), and 4.5-5 (3.2%). Scorer was not an important source of variability for teat end score. Mean scores for scoring day differed ($P < .0001$), and ranged from 1.84 to 2.98. Scores differed for barns ($P = .067$) and differed for a given day in barns; distribution of scores >3 ranged from 14.6% to 26.4% for barns. Largest difference between barns for score on a given day was 1.04. Mean scores for udder halves did not differ, but scores for front teats were larger by .13 than scores for rear teats. Results suggest that the linear scoring system devised for this study was effective for characterizing changes of teat end lesions, and scores assigned by trained scorers were consistent. Severity of teat end lesion may be related to environmental and housing conditions and/or to characteristics of the cow.

Key Words: Teats, Cow, Lesion

46 Use of video image analysis, USDA ribeye grids, and linear measurements to predict *longissimus* muscle area. J. A. Unruh, A. T. Waylan*, and R. E. Campbell, *Kansas State University, Manhattan.*

USDA ribeye grids, linear measurements, and video image analysis (VIA) were used to determine *longissimus* muscle (LM) area. At a commercial packing facility, LM between the 12th and 13th rib from the right and left sides of 265 beef carcasses were traced onto acetate paper. Area of the LM was measured by both USDA ribeye grids and VIA. In addition, LM linear measurements of length, center mid-width, and widest width were estimated to the nearest .0254 cm using a calibrated ruler. A paired t-test revealed no difference ($P=.48$) between LM areas measured by VIA from right (83.35 cm^2) and left (83.55 cm^2) carcass sides. However, when USDA ribeye grids were used, LM area from the left sides (84.19 cm^2) were slightly larger ($P<.01$) than LM from the right sides (82.97 cm^2). This difference is negligible considering the wide range in variation ($SD=4.39 \text{ cm}^2$) between right and left side LM areas. Correlations between grid and VIA LM areas were high for both the right and left carcass sides (.96 and .95, respectively). The correlations between LM left and right sides when using either USDA ribeye grids or VIA were .93. Regression equations were developed to predict VIA LM area ($n=530$) from linear ruler measurements of LM length, mid-width, and widest width.

Parameter Estimates (cm)				
Intercept	Length	Mid-Width	Widest Width	R ²
-61.961	6.106	8.425		.85
-70.393	6.205		8.501	.86
-71.039	5.629	4.666	5.448	.91

Potentially, these linear measurements could be collected rapidly at chain speeds of commercial plants. By incorporating these measures into regression equations, LM areas could be predicted with reasonable accuracy.

Key Words: Beef, *Longissimus* Muscle, Video Image Analysis

47 Impact of the Nebraska and South Dakota Swine Nutrition Guide. D. E. Reese*, S. L. Tilton, S. K. Rockwell, and J. W. Furgason, *University of Nebraska, Lincoln.*

A mail survey instrument was developed to determine what impact the Nebraska and South Dakota Swine Nutrition Guide had on improving the user's knowledge of nutrition and on how pigs are fed on farms. The survey was mailed to a random sample of people (206) in 31 states who had purchased the Guide during 1996. Chi-square analyses were used to evaluate differences in opinions between members of the intended audience (IN) for the Guide (producers, veterinarians, and industry sales personnel) and affiliated personnel (AFF; nutritionists, consultants, and extension educators). The total return rate was 60% and the usable return rate was 48%. Eighty-seven percent of the respondents rated the Guide above average to excellent. Sixty-nine percent rated the Guide a better source of information about swine nutrition than other sources, while 72% of the respondents agreed it motivated them to focus more attention on applying sound nutrition practices. Forty-eight percent of the producers said that their operation's profits increased as a result of using the Guide, while 13% said it remained constant. Ninety-one percent of the veterinarians, agribusiness people, and extension educators used the Guide to influence producers to use modern feeding programs. Most respondents (61%) changed some aspect of the swine diets in their operation or recommended to their clients or customers to make changes after using the Guide. The IN respondents used farm-generated production data to design a feeding program and budget feeding procedures more frequently after using the Guide than before, whereas AFF respondents did not (audience \times time, $P < .05$). More ($P < .05$) IN than AFF respondents said the Guide provided them with new information about the nutritional needs of pigs (85 vs 58%), how to make better nutrient source choices (78 vs 32%), how to develop a more cost-effective feeding program (67 vs 43%), and the concept of nutrient bioavailability (77 vs 44%). These results indicate that the Guide increased the user's knowledge of swine nutrition and it improved pig feeding practices on farms.

Key Words: Pigs, Publication, Impact

48 Use of milk urea nitrogen (MUN) testing in commercial Wisconsin dairy herds. D. A. McCullough^{1,2}, R. D. Shaver^{1*}, and J. Amdall², ¹*University of Wisconsin-Madison*, ²*AgSource Cooperative Services, Verona, Wisconsin.*

The objectives of this study were to determine how MUN testing was being used in the field and to provide benchmark values for dairy herds receiving MUN testing from AgSource Cooperative Services. First, a two page survey was sent to 16 Wisconsin ration advisors in July 1997. Questions addressed MUN testing usage, sample collection strategies, and usefulness of results. Fourteen surveys were returned although one of those was not completed. The respondents consisted of two county extension agents, two veterinarians, and ten nutrition consultants. The nutrition consultants could be further classified as follows: three premix company nutritionists, two formula feed company nutritionists, two feed dealer ration advisors, and two private consultants (one respondent did not identify himself). Twelve of thirteen respondents used MUN testing in less than 5% of their client herds. Respondents typically used the average of individual cow samples and avoided bulk tank samples. Four out of thirteen respondents had utilized MUN results to adjust rations, but only one thought it was a useful tool for fine-tuning rations at the current time. Variability of results was a major concern. Respondents were split on whether there is enough technical information available and whether MUN testing should be promoted more. To address the second objective, a dataset was developed that included all milk samples tested for MUN by AgSource at their Menomonie milk laboratory from February through September 1997. The 11,532 samples from 253 herds averaged 15.4 mg% MUN with sd of 4.2 mg%. Only 42% of herds tested >50% of their cows and 22% of herds tested <10% of their cows. Only 25% of herds tested for MUN more than one month. It is concluded that many ration advisors in Wisconsin have some reservations about the usefulness of MUN testing and that education is needed on the importance of testing the majority of cows in a herd and establishing a herd baseline.

Key Words: Milk Urea Nitrogen

49 DairyTQM: A tool for use in on-farm dairy HACCP programs. J. K. Reneau*¹, W. E. Marsh¹, R. H. Craven¹, W. W. Coleman², D. W. Richardson¹, J. Frietag¹, W. Stoll³, and D. Bartholomew³, ¹*University of Minnesota, St. Paul*, ²*Minnesota Department of Agriculture, St. Paul*, ³*Agricultural Utilization Research Institute, St. Paul, MN.*

Current Minnesota law requires that every Grade A be inspected twice per year. The existing program employs a high cost punitive approach. An alternative, sharply focused performance based program is being considered. Performance based inspection would reduce or eliminate the need of State inspector visits to those farms that meet and maintain food safety and quality standards. However, an on-farm HACCP based plan and a means to document the quality and safety of the raw milk produced would be necessary for each dairy enrolled in a performance based inspection program. DairyTQM is a PC based on-farm software designed as a tool for use as an integral part of an on-farm HACCP program. It is a computerized treatment record system with the capability of providing daily meat and milk withholding action lists based on default values in the FARAD tables or as specified by the attending veterinarian. DairyTQM tracks farm level measures and monitors to support total quality management (TQM) practices. Electronic interfaces accommodate download of milk plant bulk tank milk quality and safety data. DairyTQM interfaces with continuous recording bulk tank thermometers to track bulk tank temperature. The program uses statistical process control (SPC) methods like Shewhart control charts as a means of aiding farm decisions on whether the processes that effect the safety and quality of raw milk production are "in control" or "out of control". This program will work as a stand alone or as a companion to other dairy management software or DHI records.

Key Words: HACCP, Software

50 Impacts of dairy diagnostic teams on herd performance. D. A. Weinand* and B. J. Conlin, *University of Minnesota, St. Paul.*

Dairy diagnostic teams (DT) were organized for 39 MN dairy farms and were active through the period 1992 to 1995. Teams were organized by County Extension Educators and selected by each dairy producer. Herds were widely distributed across the state. Teams met an average of 8 times. Typically a team consisted of a lender, veterinarian, extension educator, feed consultant, farm business management instructor and a dairy producer. Diagnostic teams conducted a SWOT analysis, identified farm goals with the family, established priorities, and developed a plan of action. Action plans were to be consistent with the farm goals and the result of the SWOT analysis. Examples of action plans ranged from farm transfer, to decreasing age at first calving (AFC), SCC, or increasing milk production. DHI and survey information were used to evaluate changes in performance over the 1991 to 1995 period, compared to other farms in the same county (control herds), and changes associated with the action priorities. Performance change differences (DT Herds – Control herds) were: Herd milk +108 kg, AFC +.2 MOs, days dry –.5 days, days open (DO) +.8 days, and percent cows SCC positive –2.8%. DT herds averaged five cows larger and produced –212 kg milk compared to control herds in the start year. Action plan priorities were evaluated by comparing changes within the DT herds having the specific plan with those without. Herds with plans to increase milk differed by –568 kg DHI herd milk per cow at DT enrollment, but increased production +279 kg more (1992–95) than the herds without action plans to increase milk. Respective values for DO; beginning difference 2.7 days and change difference 6.2 days; AFC, beginning difference 3.4 months and change difference 1.9 months; percent cows SCC positive, beginning difference 10.3% and change difference –.5%; herd size beginning difference 14.1 cows and change difference 8.4 cows. Performance changes relative to the focus of the action plans were highly variable. Changes in performance appear to be highly dependent on the producers commitment and ability to incorporate management changes.

Key Words: Dairy, Diagnostic, Teams

51 Financial benchmarks for improved decision making. H. D. Jose* and R. J. Grant, *University of Nebraska, Lincoln.*

The dairy sector is undergoing major structural changes and economic adjustments. Increased competitiveness has kept milk prices relatively stable, but higher input costs have put additional pressure on profit margins which were already narrow. Producers must minimize costs to remain competitive and to maintain a positive profit margin. To remain financially viable, producers must be able to assess their own financial situation and compare their operation with accepted industry norms. A standard survey instrument was developed by Nebraska to collect farm financial data in states representative of the dairy industry across the U.S. Contributing states were GA, IA, MN, NM, NY, VA, and WI. The financial data collected by the cooperating states were merged with DHI production and management data to develop a set of benchmarks for the dairy industry. The data has also been integrated with financial summaries from farm business records programs where sufficient dairy farm data are available (MN, WI). Participating states have cooperated on a regional basis, such as GA and FL, to collect data and publish it in spreadsheet format. Contributing states have published the data in extension bulletins (FL and NE) and on a website (WI). Providing dairy producers and agribusiness with these financial benchmarks improves understanding of the range in performance across the industry by region of the U.S. The benchmark financial data will assist in the development of decision aids to evaluate farm business performance and develop financial plans for producers who are considering expansion and structural change. Future objectives include the development of a standard format for dairy enterprise budgets. These budgets will be integrated with research results on dairy production management systems for economic analyses of systems ranging from confinement to grazing dairies.

Key Words: Dairy, Profitability, Financial Benchmarks

52 Decision models for large milking parlors. C. V. Thomas*¹ and M. A. DeLorenzo², ¹*Michigan State University, Sandusky,* ²*University of Florida, Gainesville.*

A network simulation model of large herringbone and parallel milking parlors was built that predicted parlor cow throughput and milk output. The model considered milking labor, milking system vacuum and pulsation ratio, and milk yield per cow. Model validation was achieved by comparison to actual performance of four large herringbone or parallel parlors. Differences between simulated and observed parlor performance means were less than .05%. Parlors were then analyzed using the simulation in a series of factorial experiments and showed that smaller parlors were more efficient. Turns per hour and milk per stall per hour for double-16, -20, -32, and -40 parallel parlors were 5.87, 5.91, 5.21, 5.00 turns and 56.19, 56.46, 49.66, 47.94 kg/h, respectively. Widening pulsation ratio (60:40 to 70:30) or increasing vacuum (46.6 to 50.8 kPa) increased performance 4% and 6%, respectively. Parallel parlors outperformed herringbones by 8%. Abbreviated milking procedures (attach units) increased performance measures by 6% over standard milking procedures (predip, wipe, attach units). Performance response diminished when milking labor exceeded 20 to 32 units per milker for abbreviated procedures or 13.3 to 16 units per milker for standard procedures. Turns per hour decreased as cow milk yield increased, but milk per stall per hour increased. Economic analysis using a stochastic parlor capital budget compared parlor options with equal numbers of stalls using stochastic dominance. For 32 and 40 stall parlors the parallel always dominated the herringbone. In 64 and 80 stall parlors two smaller parlors (two double-16 or two double-20) always dominated a single large parlor (double-32 or double-40). Economic advantages of dominant parlors ranged from \$688,940 to \$2,793,855 (net present returns to ownership and non-parlor fixed costs over a 15 yr planning horizon). Economic advantage on all dominant parlors was maximized by operation at a high vacuum pressure (50.8 kPa), wide pulsation ratio (70:30), abbreviated milking procedures, and minimal amounts of milking labor.

Key Words: Simulation Model, Milking Parlors

53 Aspects of nutrition and management on dairy heifer calves with implications to growth, health, and productivity. A. J. Heinrichs* and H. Chester-Jones, *The Pennsylvania State University, University Park, and University of Minnesota, Waseca.*

Nutrition and management play an important part in the growth, health and productivity of dairy heifers. Various experiment stations involved in NC-119 have studied the parameters that affect all aspects of calf and heifer growth and performance. Studies from Minnesota and Pennsylvania evaluated energy and protein levels in milk replacers. Other milk replacer studies compared various milk protein sources, as well as plasma and spray-dried red blood cells as a dietary protein source. Studies with calf starters have used protein levels ranging from 14 to 22 percent. Different sources of protein for starters have also been used to alter the UIP fraction of the diet and observe growth and feed efficiency. Individual experiments have compared various types of calf hutches on health of calves while others have focused on nutrient needs of calves in hutches or inside housing. Both experiment stations have been involved in multi-farm studies to evaluate calf growth and health. These studies have evaluated the effects of nutrition, management, and disease on average daily gain (ADG) of heifers. A Pennsylvania State University study showed that various aspects of housing, DMI, season and farm all affected ADG. Calves born in winter had higher ADG, while group pens and typing newborn calves with cows were detrimental. Calving location, dam party and delivery score also had an impact on calf ADG. Many of these parameters were less important by calving age. A Minnesota study found that late fall and early winter born calves raised in hutches had poorer colostrum immunity transfer which resulted in more health problems. These studies all help to understand and determine optimal systems to raise dairy calves that minimize health related problems while maximizing growth and cost efficiencies.

Key Words: Calf, Heifer, Growth

54 Reducing heat stress to improve cow comfort. J. F. Smith*¹ and D. V. Armstrong², ¹*Kansas State University, Manhattan*, ²*University of Arizona, Tucson*.

In the United States milk production per cow continues to increase. As production per cow increases the interest in cow comfort issues has increased. In many areas milk production and reproductive efficiency are reduced in summer months and are an economic loss to commercial dairies. The NC-119 regional research project has been active in developing cooling systems and management strategies to reduce heat stress in lactating dairy cattle on commercial dairies. Dairy cows can be cooled in several locations on the dairy including the holding pen, exit lanes from the parlor, housing areas and feeding areas. Methods in which cows can be cooled are dependent on the climate and the type of cow housing. Often the investment required to install cooling systems and reduce heat stress on a commercial dairy operation is significant. An individual dairy has to evaluate the severity and duration of heat stress and the effects on milk production and reproduction in their location to determine the economic benefit of installing cooling systems.

Key Words: Heat Stress, Lactating, Dairy Cattle

55 Hybrid effects on the nutritive value of corn silage. M. S. Allen*, *Michigan State University, East Lansing*.

Corn hybrids have repeatable differences in several quality traits that affect energy and protein contents as well as forage and(or) DM intake. Specific quality traits that have been reported to vary by hybrid include DM digestibility, NDF content and digestibility, starch content and digestibility, and sugar, lipid, and crude protein contents. The relative importance of different quality traits depends on how the silage is fed and the animal to which it is fed. Differences in energy and protein contents among forages affect ration costs when diets are adjusted to account for these differences. However, these differences are often less important economically than differences in value of DM yield among hybrids. In contrast, when diets are not adjusted for differences in NDF, energy, and protein contents, the resulting effects on animal performance can be more important economically than the value of differences in DM yield among hybrids. Whereas it is relatively simple to adjust diets for differences in NDF, lipid, or protein contents of hybrids by adding suitable concentrate feeds, there are fewer options available to adjust for differences in digestibility of NDF or starch. Because of this, digestibility of NDF and starch are important quality factors to consider for corn hybrids for silage. Differences in NDF digestibility also might affect DMI when physical limitations to intake exist. This is because NDF that is more digestible is less filling because it digests and passes from the rumen more quickly. Quality differences among hybrids become more important when animal performance is affected and this is more likely when physical limitations to intake exist such as with high producing animals and when diets are not adjusted for quality differences. One single ranking of hybrids is inappropriate because consideration of diets and animal requirements is required for assessment of the relative importance of hybrid effects on nutritive value.

Key Words: Corn Silage, Hybrid, Nutritive Value

56 Crop processing effects on the nutritive value of corn silage. L. D. Satter*, *U.S. Dairy Forage Research Center, USDA-Agricultural Research Service, Madison, WI*.

The use of roller mills (kernel crackers, kernel processors) on forage harvesters used for corn silage are commonplace in parts of north Europe. The widespread use of custom harvesters in Europe has made it easier to justify the added machine expense for kernel processing. Further, it has been reported that flint corn played a more prominent role in the development of North European corn hybrids than in North American hybrids, perhaps presenting a larger opportunity for benefit. The potential for benefit from kernel processing is greater with more mature corn (<65% moisture), longer chop length, and high inclusion rates of corn silage in the diet. Variety of corn and differences in growing conditions can also influence efficacy of roller milling. The increased attention that corn breeders are paying to rapid dry-down of grain and stay-green characteristics of the vegetative part of the corn plant may be increasing chances of benefit from kernel processing of corn silage in North America. Livestock producers and researchers report processing of corn silage results in decreased corn grain in the manure, fewer cob pieces left in the feed manger, and increased milk production. Kernel processing should also increase the harvest window for corn silage, and facilitate a longer chop to increase effective fiber without compromising ensiling characteristics of the plant material. Based upon a summary of seven lactation trials comparing rolled with unrolled corn silage, feeding rolled corn silage resulted in a .64 kg increase in daily milk production. If roller mill equipment costs \$10,000–15,000, either as a stationary mill at the silo blower or as part of the forage harvester, then small herds (less than about 50 cows) may not be able to support this level of investment. If this cost is spread over more cows, as in a larger herd or via custom corn silage harvest, potential for benefit appears good.

Key Words: Roller Milling, Corn Silage, Digestibility

57 Analyzing the nutritive value of corn silage. J. G. Linn*¹, C. S. Kuehn¹, and R. D. Shaver², ¹*University of Minnesota, St. Paul*, ²*University of Wisconsin, Madison*.

Animal production responses to feeds is dependent on the amount and availability of the nutrients contained in the feeds. As corn silage feeding to lactating dairy cows increases, the ability to accurately determine the amount and availability of nutrients in corn silage becomes increasingly more important. A typical corn silage analysis today is for a limited number of chemical components (DM, CP, ADF, NDF, some minerals and possibly soluble protein and starch). Digestibility or energy values are calculated from fiber based on an inverse relationship between the two components. As genetic changes in corn silages occur (i.e. lower lignin, increased oil, amino acid profiles and starch content) and the relationship between physical form and nutrient availability become better known, it is apparent the current analysis scheme is inadequate for describing the nutritive value of corn silage. New approaches to determining the nutritive value of corn silage include *in vitro* DM digestibility, *in vitro* NDF digestibility and new equations for estimating TDN or NEL like the Ohio State summative equation. These approaches may better account for the energy contributing nutrients or components such as fat, NFC, fiber and protein in corn silage, but do not account for any effects physical form may have on nutrient availability. Current research has shown physical form (particle size) of whole plant corn silage and grains greatly affect nutrient availability and ultimately animal performance. Thus, a nutritional quality evaluation of corn silage must include both chemical and physical form measurements. Use of new approaches like the Ohio State summative equation which include analyses for fat and lignin along with ruminal digestibility measurements for protein, NDF and starch are needed to better define the energy content of corn silage. In addition, physical measurements such as kernel hardness, particle size and possibly cob hardness need to be factored into chemical and digestibility measurements to more accurately predict nutrient availability.

Key Words: Corn Silage, Nutritive Value