

been presented. As more large ranches and rural properties are subdivided, the problem of uncontrolled flocks of domestic fowl will repeat itself.

Key Words: Peafowl, Rancho Palos Verdes

307 Women's participation in livestock production in Bangladesh: Proshika Experience. Md. Nuru Miah and Md. Nuru Miah, *Proshika Manobik Unnayan Kendra.*

Women's participation in livestock production in Bangladesh: Proshika Experience * Md. Nuru Miah
Livestock provides an employment and income generation opportunity for the poor. Women are traditional rearers of cattle and poultry in Bangladesh and possess most of the livestock population in the rural areas. The ownership per household of cattle, goat and poultry are 1.6, 1.03 and 6.8 respectively. Proshika, a national largest Non Govt. Organization (NGO) in Bangladesh has been operating a comprehensive livestock development programme consisting of milch cow, beef cattle, heifer/calf, sheep/goat, commercial poultry (layer and broiler), duckery production through direct participation of about 0.3 million women beneficiaries who are landless, destitute and divorced. The goal of the programme is to increase the productivity of poor's livestock resources

ASAS/ADSA Production, Management, and Environment: Temperature Effects, Production Schemes, and Housing Influence

308 Effect of summer water application on mound microclimate, performance, and body temperature of feedlot steers. M. S. Davis*¹ and T. L. Mader¹, ¹*University of Nebraska, Northeast Research and Extension Center, Concord.*

Ninety-six Bos taurus (Angus, Angus x Charolais) steers (avg. BW = 477 ± 3 kg) were randomly assigned to one of twelve pens to which one of three treatments (TRT; 4 pens/TRT) were applied: no water application (CON), water applied between 1000–1200 h (AM) and 1400–1600 h (PM). Water was applied via ground (mound) sprinklers when predicted average temperature-humidity index ≥ 74. Water flow rate (34 l/hd/d) and area sprinkled (2.4 m²/hd/d) were controlled using an inline meter and valves. On days 30–33, thermistors attached to data loggers recorded hourly tympanic temperature (TT). Concurrent with TT, temperatures were recorded 1 cm below the surface (Ts) and .15 and 1.52 m above the mound. Relative humidity was recorded at .15 and 1.52 m. Water (WI) and DMI were recorded daily and BW was recorded on days 0, 34 and 82 (termination of trial). Panting (0 = normal, 2 = heavy panting) and bunk scores (0 = ≤ 10% feed remaining, 2 = ≥ 50% remaining) were assigned to individual animals and pens, respectively at bi-hourly intervals from 900–2100 h under thermoneutral (avg THI ≤ 74) and hot environmental conditions (avg. THI ≥ 74) accompanied by sprinkling. Sprinkling did not affect BW, ADG or DMI, however feed efficiencies of AM steers were greater (P ≤ .10) than PM steers from days 34–82 (.190 vs .178 ± .004) and 0–82 (.180 vs .168 ± .004). Day 0–34 WI was greater (P ≤ .01) in AM vs PM steers (38.29 vs 35.29 ± .21 l/d). During water application, Ts was higher (P ≤ .05) for CON vs AM and PM mounds at all times, with PM mounds lower (P ≤ .05) than AM at 730 and 1500–2000 h. Tympanic temperature of AM steers was lower (P ≤ .05) than CON and PM steers from 800–900 and 2300–700 h, and lower than PM steers from 1200–1300 h. From 1600–1900 h, PM steers had lower (P ≤ .05) TT than CON, with AM intermediate. Sprinkling feedlot pens under hot environmental conditions lowers TT and mound temperatures. Morning water application maximized animal efficiency relative to afternoon application.

Key Words: sprinkling, microclimate, feedlot

309 An evaluation of different types of commercial fans with or without misters in cooling high producing cows in the summer months in the sub-tropics. CN Lee*¹ and KS Baek^{1,2}, ¹*University of Hawaii-Manoa, Honolulu, HI 96822,* ²*National Livestock Research Institute, Namwon, S.Korea.*

In Hawaii, data collected from dairies on Oahu showed that when THI increases milk production decreases. The THI can exceed 81 in the hot months. Milk production could decrease by 25% with in high production herds and by 10% in low production herds. However, the use of fans and misters could alleviate this summer slump. This

which contributes substantially to poverty alleviation efforts by raising their income. Extension support like vaccination, deworming, treatment, artificial insemination, fodder production is provided to the involved farmers through well trained vaccinators, paravets, artificial inseminators etc. belong to Proshika target groups. Technical training of farmers on particular skill, credit, follow-up, monitoring and marketing support is provided from Proshika through its 950 technical workers. A central team of 17 livestock experts are providing planning, technical guidance & supervision of the programme. Five poultry breeder's farm alongwith five hatcheries and feed mills are in operation to supply 100000 day old chicks and 80 MT. feed weekly to the beneficiaries. Adaptive research activities are implemented at the farmers level to disseminate appropriate technologies on livestock. The impact of these activities showed that mortality reduced from 10 percent to 3.5 percent incase of cattle and from 20 percent to 5–8 percent incase of poultry in the project areas, farmers have been able to raise their income by 150 percent through livestock raising, women's status increased in the family and society.

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Key Words: Milch cow, Duckery, NGOs

study evaluated the efficacy of 4 types of fans with/out misters in cooling cows under heat stress :- Gp.A-Korral-Kool(2hp)+Schaffer fan (n=111), Gp.B-Universal Foggers(1hp)(n=144), Gp.C-Universal Foggers(1.5hp)(n=135)and Gp.D-Schaefer fan(1/2hp) w/o misters(n=103). Cows were housed in open lot under shade. Temperature and humidity readings were taken prior to the start of monitoring respiration rate (RR) and at the end of the each collection period not exceeding 30 min. The avg. THI(n=16) were 77 for am and 78 for pm. No differences in mean RR were observed in Gp. A, B, and C in am; 66.7, 65.2, 63.8 respectively. Gp.D had higher RR, 73.3(p<0.05). Higher RR were observed in pm period for Gp. A,B,C but there were not different between groups; 76.1, 72.7, 73.9. Gp.D had RR of 88.0 (p<0.05). The avg. wind speed (kmh) at 4.8m from the fan and 76 cm from the ground for Gp.A,B,C,D were 3.8, 4.2, 6.3, 4.9 respectively. The data suggest that wind speed and misters are important to cool cows. Milk production slump was alleviated in Gp.A,B and C. Energy cost per fan was evaluated.

Key Words: Respiration rate, Heat stress, Milk production

310 Impact of Fan Location upon Milk Production, Feed Intake and Respiration Rates of Lactating Dairy Cattle Housed in a 4-row Freestall Barn. M.J. Brouk*, J.F. Smith, and J.P. Harner,III, *Kansas State University.*

One hundred mid-lactation Holstein cows averaging 173 DIM and producing 44.25 kg/c/d of milk were blocked by milk production and DIM and randomly assigned to one of 4 pens of a 4-row freestall barn. Two replicates, north and south halves of the barn, contained 2 pens each. Fan treatments were 91.4 cm fans mounted every 6.1 m on the feed line (F) or 91.4 cm fans mounted every 6.1 m on the feed line and over the center of the head-to-head freestalls (F&S). All pens were equipped with feed line sprinklers that operated on a 15 min cycle (3 on and 12 off) when temperatures were above 23.8°C. All fans operated when the temperature was above 21.1°C. A switch back design with 5 two-wk periods was utilized to evaluate fan placement. Cows and treatments were switched at the start of each period within each replicate. Cows were milked 2x and milk production was measured every two weeks throughout the 10 wk trial. All pens received the same diet. Amounts of feeds offered and refused were measured and recorded daily. Dry matter content of the diet and refusal of each was determined twice weekly. Cow respiration rates were measured on three separate days under heat stress. Fifteen cows were randomly selected from the 25 study cows in each pen and respiration rates were measured in the morning (0700-0800 hr), afternoon (1500-1600 hr) and at night (2200-2300 hr) on each of the three days. Cows exposed to treatment FS produced more (P<.01) milk (38.8 vs 36.2 kg/c/d) during the trial than those exposed to the F treatment. Respiration rates were lower (P<.06) in the morning (71.7 vs 79.3

breaths/c/m), at night (76.0 vs 80.1) and daily (79.4 vs 83.2) under the FS treatment compared to the F treatment. Afternoon respiration rates were unaffected by treatment. This study clearly demonstrated that in a 4-row freestall barn greater milk production and a lower respiration rate was obtained by locating fans on both the feed line and over the freestalls. Based on respiration rates, the duration of heat stress was reduced by the FS treatment demonstrated by lower respiration rates in the morning and at night. Appropriate fan location in combination with feed line sprinklers reduced heat stress in lactating dairy cattle housed in a 4-row freestall building.

Key Words: Heat stress, Facilities, Dairy cattle

311 Evaluation of Heat Stress in 4- and 6-Row Freestall Buildings Located in Northwest Iowa. J.F. Smith*, M.J. Brouk, and J.P. Harner, III, *Kansas State University*.

The objective of this trial was to evaluate the effect of 4- and 6-row freestall barns located in Northwest Iowa on barn temperature, humidity, and THI. In addition, respiration rates of lactating Holstein cows were also evaluated. Six freestall barns (three, 4-row and three, 6-row barns) with east-west orientation located on five dairies were utilized in this experiment. Temperature and humidity readings were collected at four locations near cow level in each barn. Ambient temperature and humidity were collected at two locations in close proximity to each freestall barn. Temperature and humidity data were collected continuously at 15 minute intervals from June 9 until September 27, 2000 using HOBO® data loggers. Respiration rates were collected in the morning (06:00-08:00) and afternoon (14:00-16:00) on three different days during August 2000. During each observation period respiration rates were collected from 50 cows, 25 from the north and 25 from south half of each barn. For data analysis, the 25 data points from each of the halves of the barn were averaged by day and observation period. Temperature and humidity data were averaged by 3-hr periods for each day. Data were then analyzed as a replicated single factor experiment with 4-row and 6-row barn as the treatments. Statistical differences were detected ($P < .05$) in difference between ambient and barn conditions with respect to temperature, relative humidity and THI. On the days respiration rates were measured, 6-row barns as compared to ambient conditions were .25° C warmer ($P < .01$), had less ($P < .01$) humidity (.69 %) and greater ($P < .01$) THI (.45) than 4-row barns. Respiration rates were higher ($P < .05$) in 6-row vs. 4-row freestall barns in the morning (65.8 vs. 60.5 breaths/c/m), afternoon (78.4 vs. 73.8) and daily average (72.1 vs. 67.2). Although statistical differences exist in differences between ambient and barn temperature and THI, the magnitude of these differences may not explain the differences detected in respiration rates. It is possible that increasing animal density may change the relationship between social interaction and animal density. It could also be possible that additional mechanical ventilation may be required to keep cows comfortable in 6-row barns.

Key Words: Heat stress, Facilities, Dairy cattle

312 Influence of Freestall Barn Orientation upon Summer Heat Stress in Lactating Dairy Cattle. J.F. Smith*, M.J. Brouk, and J.P. Harner, III, *Kansas State University*.

The objective of this trial was to evaluate the effect of freestall barn orientation (North-South (NS) vs. East-West (EW)) of 4-row freestall barns located near Tulare, California on barn temperature, humidity, and THI. Effects on respiration rates of lactating Holstein cows were also evaluated. Six freestall barns (three NS and three EW barns) on six dairies were utilized in this experiment. Temperature and humidity readings were collected at four locations in each barn. Ambient temperature and humidity were collected at two locations in close proximity to each freestall barn. Temperature and humidity data were collected continuously every 15 minutes from April through August 2000 using HOBO® data loggers. Respiration rates of lactating dairy cattle were collected in the morning (06:00-07:00) and afternoon (15:00-16:00) on three different days during August 2000. During each observation period, respiration rates were collected from 50 cows, 25 from each half of each barn. Individual data points were averaged by day, barn and observation period for analysis. Temperature and humidity data were averaged daily by 3-hr periods. Data collected were analyzed as a replicated single factor experiment with barn orientation (E/W and N/S) as the treatments. The difference between barn and ambient conditions showed that NS barns were .24° C cooler ($P < .01$), humidity .44%

greater ($P < .01$) and THI .26 less ($P < .01$) as compared to EW barns during August 2000. Respiration rates were greater ($P < .05$) in NS vs. EW orientated barns in the morning (56.4 vs. 52.2, breaths/c/m), afternoon (77.4 vs. 68.8) and daily averages (66.9 vs. 60.5). The differences of barn temperature and humidity did not appear to explain differences in respiration rates between the two different types of barn orientation studied. Other factors including exposure to solar radiation, airflow, and animal stress may have contributed to the differences observed in respiration rates.

Key Words: Heat stress, Facilities, Dairy cattle

313 Influence of Headlocks upon Summertime Milk Production and Feed Intake of Lactating Dairy Cattle Housed in 2-row Freestall Barns. M.J. Brouk*, J.F. Smith, and J.P. Harner, III, *Kansas State University*.

Two hundred sixteen Holstein cows in mid-lactation (110 primiparous, averaging 189 DIM and 38.7 kg/c/d milk; and 106 multiparous, averaging 178 DIM and 42.0 kg/c/d milk) were blocked by lactation DIM and production and allotted to two 108 cow 2-row freestall barns. Both barns were equipped with similar equipment and heat abatement systems. A switchback design with two 4 wk periods was utilized to evaluate the effects of headlocks upon milk production and feed intake. Feed line barrier treatments were either standard headlocks (H) or a post and rail (P&R). Treatments were physically switched between barns at the beginning of the second period. Cows were milked 3x and milk production data was captured electronically every milking throughout the trial. Amounts fed and refused were measured and recorded daily. Dry matter content of the diet and refusal was determined twice weekly and daily pen dry matter intakes were determined. Daily milk production and pen dry matter intakes were averaged by pen and week for data analysis. Milk production (35.2 vs 34.7 kg/c/d respectively for H and P&R) was not affected ($P = .16$) by treatment. Primiparous cattle averaged 34.6 kg/c/day of milk when exposed to H versus 34.3 kg/c/d when exposed to P&R. Multiparous cattle averaged 35.7 kg/c/d when exposed to H versus 35.2 kg/c/d when exposed to P&R. While primiparous cattle produced ($P < .01$) less milk than multiparous cattle neither group was affected ($P = .25$) by treatment. Pen dry matter intakes were also unaffected ($P = .08$) by treatment (22.8 vs 23.5 kg/c/d). The use of headlocks did not result in a decrease in feed intake or milk production of primiparous and multiparous cattle in this study. Cattle in this study were previously exposed to headlocks, thus the effects of headlocks upon untrained cattle was not determined. With trained cattle, removal of headlocks did not increase milk production or feed intake. Results of this study showed that headlocks could be used effectively without negatively impacting the performance of lactating dairy cattle.

Key Words: Heat stress, Facilities, Dairy cattle

314 Influence of ambient temperature, humidity and bovine somatotropin (bST) on reproductive performance of postpartum Holstein cows. R. Flores*¹, M. L. Looper¹, J. J. DeRuyter², D. M. Hallford¹, and M. G. Thomas¹, ¹New Mexico State University, Las Cruces, New Mexico, ²Mountain View Dairy, Mesquite, New Mexico.

Seventy-nine estrous cycles of multiparous Holstein cows ($n = 44$) during May to August were evaluated for the effects of ambient temperature, humidity and bST on reproductive performance. At 60 to 75 d in milk (DIM), all cows were fitted with a HeatWatch (DDx Inc., Denver, CO) transmitter and estrous activity was recorded. Cows were randomly assigned to treatment with bST (Monsanto Co., St. Louis, MO; 500 mg, s.c., every 14 d) or without (nbST) beginning at 80 DIM. Milk yield (kg), DIM and body condition score were 42 ± 1.6 , 69 ± 1.5 and 2.8 ± 0.1 for bST cows and 41 ± 2.3 , 72 ± 1.6 and 2.8 ± 0.2 for nbST cows, respectively. Weekly plasma samples were collected and concentrations of progesterone were quantified. Maximum ambient temperatures and relative humidity were recorded daily and a temperature-humidity index (THI) was calculated for the day of estrous onset. Range of THI was 68 to 80. Duration of estrus, number of mounts and quiescent periods between mounts were similar ($P > 0.10$) between treatments. Mean duration of estrus was 6.0 ± 0.7 h for bST cows and 6.2 ± 0.9 h for nbST cows. Mean number of mounts was 10.0 ± 1.0 and 8.0 ± 1.2 for bST and nbST cows, respectively. Quiescent periods between mounts averaged 2.7 ± 0.4 and 2.5 ± 0.5 for bST and nbST cows, respectively. Duration of estrus and number of mounts were not influenced ($P > 0.10$)

by THI. Quiescent periods observed between mounts tended ($P = 0.10$) to be influenced by THI and were 1.7 ± 0.5 , 3.0 ± 0.4 and 3.2 ± 0.5 h for THI 1 (< 74), THI 2 (74 to 77) and THI 3 (>77), respectively. First service conception rates were not influenced by treatment or THI. First service conception rates for bST and nbST cows were 31 and 23%, respectively. Pregnancy rates tended ($P = 0.13$) to be affected by THI. Pregnancy rates were 66, 28 and 35% for THI 1, THI 2 and THI 3, respectively. Treatment of postpartum cows with bST during mild heat stress did not alter estrous characteristics. Time of quiescence between mounts was increased and pregnancy rates were decreased as THI elevated. Reproductive performance of postpartum cows was reduced by increased temperatures and humidity.

Key Words: Estrus, Somatotropin, Temperature-Humidity Index

315 Getting a handle on costs of production: a quick and easy method for dairy producers. D. Shoemaker* and J. Polson, *The Ohio State University, Wooster, Ohio.*

All dairymen who will be competitive in the U.S. dairy industry must make decisions for their businesses based on the expected impacts of the decisions they make on both milk production and cost of production. Most Ohio dairy farms have not used cost of production information in their regular decision making processes. Additionally, new opportunities are now available to put a floor under or set a dairy farm's milk prices. Dairy farm managers who do not know their costs of production may make inappropriate decisions. Once a dairy farmer calculates their cost of production and integrates known costs into the decision making process, he can begin to fine tune the process of record keeping and cost and return calculations.

A quick and easy worksheet for calculating a farm's historical cost of production and a projected, long-term planning price for milk was developed to help farmers use typical Midwest financial record information in making daily decisions. Six dairy farms, ranging from 65 to 350 cows, were used to pilot the worksheet. These farms' long term planning prices for milk ranged from \$12.50 to \$16.02 per cwt. based on 1999 data. This price would cover the short term costs of producing milk, principal payments, a return to the operator, reinvestment in the business and income taxes. The process for calculating this information was then incorporated into Extension teaching efforts.

Key Words: Cost of production, Long term planning price, Planning

316 Comparing dairy herd information with a dynamic web-based tool called DairyMetrics. C.N. Vierhout*¹ and J.S. Clay¹, ¹*Dairy Records Management Systems, North Carolina State University, Raleigh.*

DairyMetrics is benchmarking software for dairy herd performance evaluation. It allows users to select information that will be displayed about an individual herd in comparison to cohort herds. Individual producers, commercial consultants or extension personnel can compare an individual herd to cohorts or analyze an entire group of herds. This web application allows users to select cohorts based on their individual parameters within the classifications of general, production, udder health, reproduction and genetic information. Within the five classes of parameters, there are 76 variables from which to choose. The underlying database includes herd summary information from almost 14,000 herds that are routinely processed by Dairy Records Management Systems. The database is updated nightly to maintain current herd information. DairyMetrics displays information about the specified herd plus the means, standard deviations, minimums and maximums for the cohort herds. It also presents the percentiles for each herd performance parameter in comparison to the cohort group. Users have the option of graphing their herd and its cohorts for the previous 3 months and from data 1-year prior.

Key Words: DairyMetrics, benchmarking, dairy management

317 Developing Six Sigma Quality Management Programs for Dairy Farms. T.P. Tylutki* and D.G. Fox, *Cornell University, Ithaca NY.*

As margins and environmental pressure forces dairy producers and nutritionists to decrease safety factors and nutrient excretion, the potential for animal production variability increases. A robust quality management program is required that will identify and control the variance

sources that result in animal production variability. Attempts have been made utilizing total quality management principles; however adoption rates have tended to be low. Six Sigma is the current quality paradigm with the objectives of: 1.) Business transformation, 2.) Strategic improvement within the business, and 3.) Problem solving. Six sigma combines human resource management, quality control, and quality planning.

The feeding system on a case study farm has been used to develop and implement a six sigma quality management program. Sources of variation were identified (feed dry matter, feed chemical composition, feeder accuracy, mixing and delivery, etc.) and data collected to determine within farm variances for feed dry matter and chemical composition (Table 1). Feed variance results were used to develop a sample frequency schedule based on a 95% confidence interval with varying levels of precision. The feeder has been receiving training in basic animal nutrition, developing quality control charts, and simple statistics. Several components of the feeding system have been targeted as weak points by this study including limitations in current software for feeding, unknown scale accuracy, rapid and reliable dry matter analysis, and training in root cause and statistical analysis. A quality management manual is being developed that will contain: standard operating procedures, feed sampling protocols, mixer reliability and reproducibility studies, control charts (development and interpretation), root cause analysis, record keeping (inventory, equipment service, and diet/weather changes), and professional development plans for staff.

Table 1. Composition of home grown feeds sampled at feeding.

	1998 corn silage	1999 corn silage	Grass	Alfalfa
Mean DM	27.72	31.02	30.75	35.10
DM CV %	6.4	9.1	28.4	23.2
Mean NDF (% DM)	50.46	44.76	59.75	46.67
NDF CV %	8.7	9.8	11.9	12.5

Key Words: Quality management, Six Sigma, Feed variance

318 Programmed exercise improved physical fitness of non-lactating, pregnant and non-pregnant dairy cows. J. A. Davidson*, R. R. Devins, and D. K. Beede, *Michigan State University, East Lansing.*

Objective was to determine the effects of a programmed exercise regimen (PER) and pregnancy of Holstein cows on physical fitness, acid-base status, and blood mineral element concentrations. Non-lactating, multiparous pregnant or non-pregnant cows ($n=52$) were blocked by parity and expected calving date and assigned randomly to treatments: no exercise or exercise at a walk (3.25 km/h) every other day for 1.25 h, d 0 to 30; and, 1.5 h, d 31 to calving (d 70 of PER) in a mechanical walker with a circular lane (33.8 m circumf.). All cows completed treadmill exercise tests (ET) on d 0, 30 and 60 of PER. Treadmill ET consisted of walking 4 km/h for 3 min followed by 5 km/h with incremental increases in incline every 3 min until cows refused to walk. Length of time to refusal during the ET was one indication of physical fitness. Jugular blood was sampled every 3 min during the ET and the 18 min recovery period (RP) after the ET. Physical fitness improved with the PER; exercised cows walked longer during the ET compared with non-exercised cows (21.6 vs. 18.7 min, $P<0.01$). Venous whole blood pH and concentrations of K were lower for exercised compared with non-exercised cows during ET ($P<0.05$). Concentrations of K, hematocrit (HCT) and pO_2 increased during ET as time increased whereas ionized Ca concentrations decreased ($P<0.05$). Normalized ionized Ca (nCa, pH adjusted) concentration during the d 60 ET was higher for exercised compared with non-exercised cows, and was higher for pregnant than non-pregnant cows ($P<0.06$). During ET, pCO_2 was lower for pregnant cows compared with non-pregnant cows and decreased as time increased ($P<0.06$). Concentrations of Na were higher for pregnant compared with non-pregnant cows during d 60 test ($P<0.01$). During RP, venous concentrations of Cl, Na, nCa, and pCO_2 increased as time increased whereas K, HCT and pO_2 decreased ($P<0.01$). However, the magnitude of changes were very small during the RP. The pH of venous blood during RP was lower for non-exercised cows compared with exercised cows ($P<0.10$). Blood volume was not affected by exercise. Pregnant cows had larger blood volumes than non-pregnant cows ($P<0.05$). A PER reduced changes of acid-base status and increased physical fitness of dairy

cows. Pregnancy altered blood volume, pCO₂, and concentrations of nCa and Na during the ET.

Key Words: Exercise, Pregnancy, Dairy Cows

319 Profit maximizing calving interval with limited labor resources. C. C. Risch* and C. A. Wolf, *Michigan State University.*

Many dairy farms consistently exceed the industry benchmark calving interval of 13 months, instead having calving intervals of 14 to 16 months. Previous literature typically supports the 13 month benchmark but does not consider resource constraints (e.g., labor, capital, feed) common to dairy farms. This study examines the profit-maximizing calving interval decision when the managerial and skilled labor are limited. An optimizing linear programming model that explicitly considers managerial and skilled labor constraints was developed to identify the calving interval that maximizes net returns to a dairy herd. The model considered 13 to 18 month calving intervals in terms of lactation stage distribution effects on net returns and labor use. Revenues and expenses associated with calving interval and included in the model are milk, calf and cull revenues, as well as replacement and herd health costs. The model allowed various labor allocations in meeting the herd health and reproductive requirements needed to maintain a given calving interval. Results indicate that, although a 13 month calving interval is associated with the highest revenues, the profit-maximizing calving interval for a farm varies significantly with both managerial and skilled labor constraints. Further, labor allocation across reproductive and herd health activities is crucial in determining the profit-maximizing calving interval. Data from a 200 cow herd was used in the model, which resulted in an optimal calving interval of 14 months, achieved with hired labor contributing substantially to heat detection and breeding activities. Labor skill level and wage rate contribute significantly to the optimal calving interval for a given herd.

Key Words: Calving interval, Labor constraint, Linear programming

320 Dry matter intake of lactating dairy cows housed in freestall barns. D.M. Allen*^{1,4}, J.G. Linn^{1,4}, K.A. Janni^{2,4}, and S.C. Stewart^{3,4}, ¹*Department of Animal Science*, ²*Department of Biosystems and Agricultural Engineering*, ³*Department of Clinical and Population Sciences, College of Veterinary Medicine*, ⁴*University of Minnesota.*

Data was collected from twenty groups of lactating dairy cows on three commercial farms from November 1999 to January 2001. All cows were housed in freestall barns. Groups for all three farms were managed based on stage of lactation, reproductive status and parity. Twelve groups had headlocks at the manger, 5 groups had rail-line feeding and 3 groups were fed in J-bunks. On average, 2075 lactating cows were represented in the milk and DM intake (DMI) data collected each month. Body condition score and body weight (BW) were determined on thirty-five percent of the cows in each group once per month. Feed DM offered each group daily was recorded using EZ Feed™ software. Weighbacks, corrected to a DM basis, were recorded from each group and subtracted from feed DM offered to determine DMI. Group means for milk production and days in milk (DIM) were recorded daily by DairyComp 305™. Bulk tank milk composition was recorded daily from each farm. Group means and standard deviations (SD), categorized by DIM and parity, for BW, milk, and DMI are reported. DMI was predicted using the NRC 2001 equation for DMI from group mean data. The difference between actual and predicted DMI within farm and category is similar to the

mean square prediction error reported for the DMI prediction equation in the NRC 2001.

	Farm A		Farm B		Farm C	
	Mean	SD	Mean	SD	Mean	SD
Lactating Cows/Farm	889		503		682	
Multiparous						
DIM 80 to 130						
Number of groups	2		1		2	
BW, kg	601.5	71.6	680.5	62.7	598.6	62.3
Milk, kg/d	45.2	4.8	52.1	2.8	42.2	7.3
DMI, kg/d	25.5	2.7	27.6	2.9	24.0	3.2
Predicted DMI, kg/d	26.9		30.2		25.7	
DIM 201 to 310						
Number of groups	3		1		2	
BW, kg	570.2	47.2	693.2	83.5	594.3	68.9
Milk, kg/d	32.2	2.0	33.9	2.9	31.3	5.8
DMI, kg/d	23.4	5.2	23.7	3.5	22.8	1.9
Predicted DMI, kg/d	22.5		24.7		22.6	
Primiparous						
DIM 80 to 130						
Number of groups	2		1		1	
BW, kg	530.8	61.7	581.9	64.7	514.0	46.8
Milk, kg/d	34.0	2.4	41.2	2.2	34.9	1.7
DMI, kg/d	19.9	3.9	23.1	2.5	19.5	1.5
Predicted DMI, kg/d	21.6		25.2		21.7	

Key Words: DMI, group, lactating dairy cows

321 Performance, health, and management of calves housed in a greenhouse barn (GHB) versus traditional wooden hutch (WH) during a Mississippi winter. M. L. Scott* and W. B. Tucker, *Mississippi State University, Mississippi State.*

The primary objective was to evaluate housing based upon management and health of young calves during wintry conditions. Forty dairy calves (32 Holstein; 8 Jersey) were randomly assigned at birth, blocked by breed and calving date, to a traditional WH or novel GHB (December 1997 to April 1998). Incidence and severity of scours, dietary intake, body weight changes, feed efficiency, respiration rate, rectal temperature, morbidity, and mortality were recorded from birth to 56 d. Calving assistance, Ig absorption, and calf vigor (birth to 1 h postpartum) were also recorded. Milk diet was 50% milk replacer (22% CP; 12% fat) and 50% waste milk. Gross energy were determined on daily samples composited by week. Dry feed (16% CP) was offered at 5d. Neither ADG (0.420±0.03, WH and 0.459±0.05 kg, GHB) nor feed efficiency (1.36±0.10, WH and 1.45±1.00 kg, GHB) were significantly different by housing. Weight gain was higher (P<0.05) for GHB than WH postweaning, 0.886±0.06 and 0.622±0.72 kg, respectively. Calves housed in WH consumed grain 1 wk earlier than GHB. Rectal temperatures at birth and overall were similar between housing. Fecal scores were 2.24±0.04 and 2.28±0.04 for WH and GHB, respectively. Observed health requiring medical attention were higher for GHB than WH (scours, respiratory and naval infection). Management and morbidity of GHB is similar to other barns. Nonetheless, GHB appears to be a suitable alternative to classical WH during winter, based upon growth.

Key Words: Greenhouse barn, Housing, Winter

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322 The effects of pH on acid resistance of cattle fecal *Escherichia coli* and O157:H7 in continuous culture or pure culture. C. J. Fu*, J. Porter, J. W. Lehmkuhler, E.E.D. Felton, D. Schmidt, M. Huck, and M.S. Kerley, *University of Missouri-Columbia, Columbia, MO 65211.*

Twelve single-phase continuous culture (CC) fermentors with a 0.045/hr dilution rate (D) and pure culture incubations were used to determine the effect of pH on acid resistance of fecal *E.Coli.* and *E.Coli.* O157:H7, respectively. The pH tested was 7.5, 7.0, and 6.5 in CC and 7.5, 7.0, 6.5, and 6.0 in pure culture. The basal diet fed to the CC was corn and

soybean meal (95% + 5% on DM basis). The CC fecal inoculants were combined from 20 feedlot steers. The microflora samples were taken from the CC after 96 h of growth. The media used for the pure culture incubations was tryptic soy broth (TSB) without dextrose. Tubes were inoculated with *E.Coli.* O157:H7 (ATCC 43895) and then sampled after 24 h of incubation. The viable *E.Coli.* was enumerated by multi-tube method using lauryl sulfate trypticase broth (LST) as media. The viability of fecal *E.Coli.* linearly (P < 0.01) decreased (3.5, 0.7, and 0.007%) after extreme acid shock (pH = 2, 1 h) as the culture pH increased in CC. No *E.Coli.* O157:H7 was found in CC. The O157:H7 pure cul-