

offered the 8 mm diet (35.18). Feeding whole wheat cereal grain significantly increased egg production, total egg weight, average egg weight and shell surface area. Gizzard weight was significantly increased with the inclusion of whole wheat grains in comparison to both the particle size and feed form treatments. The high grinding pressure and abrasive action generated in the gizzard to effectively crush whole grain cereals have resulted in muscle mass increase, therefore, significantly increasing the weight. Whole wheat grains plus balancer gave

the best overall performance in terms of egg production and egg weight. In addition, DMI was significantly lower for the whole wheat plus balancer treatment than for the other treatments. It is concluded, in terms of particle size, 5 mm is optimal for egg production. Whole cereal grain plus balancer resulted in significantly better egg production, egg weight and DMI in comparison to the other feed forms investigated.

Key Words: Particle Size, Feed Form, Laying Hen

Production, Management and the Environment: Dairy and Livestock Management

494 Influence of rearing environment and season on growth performance of growing-finishing pigs. R. Myer* and R. Bucklin, *University of Florida, Gainesville.*

An eight year study was conducted to determine the effects of three different rearing environments on growth performance of growing and finishing pigs (from 28 to 107 kg avg. body wt.) reared during the summer or winter in north Florida USA (31°N latitude). The three rearing environments were 1) concrete-floored pens in a semi-confinement building or outside dirt lot pens with minimal shelter that 2) have ("old") or 3) have not ("new") been occupied previously by pigs. Two trials were conducted each year (summer and winter) and each involved 36 crossbred pigs. All pigs were routinely dewormed. Overall, pigs reared during the summer on average grew 3% slower (0.83 vs. 0.86 kg/d; $P < 0.001$) but required 3% less feed (3.32 vs. 3.41 kg; $P < 0.001$) per kg of weight gain than pigs reared during the winter. Rearing environment influenced ADG ($P < 0.001$; 0.82, 0.85, and 0.86 kg/d for "old", "new", and concrete pens, respectively) and F/G ($P < 0.001$; 3.48, 3.35, and 3.26). A pen x season interaction ($P < 0.01$) was noted for F/G in that pigs reared on dirt had poorer F/G compared to pigs reared on concrete during winter but during summer, F/G was similar. Average backfat thickness (mean = 2.5 cm) was influenced by rearing environment ($P = 0.01$) and somewhat by season ($P = 0.08$). Results indicate that growing-finishing pigs can be effectively reared in outside dirt lots under the environmental conditions of the southeastern USA, in particular if the lots are periodically rotated to "new" ground. However, pigs reared outside will require slightly more feed per unit of weight gain than pigs reared in confinement, especially during the winter.

Key Words: Pigs, Housing, Season

495 Repeatability of measures of Brahman bull temperament and their association with serum cortisol concentrations. K. Curley, Jr.^{1,2}, J. Paschal³, T. Welsh, Jr.¹, and R. Randel², ¹Texas Agricultural Experiment Station, College Station, ²Texas Agricultural Experiment Station, Overton, ³Texas Cooperative Extension, Corpus Christi.

The objectives of this study were (1) to compare temperament assessments, using multiple techniques, over repeated observations to gauge temperament over the long-term and (2) to evaluate the relationship of the temperament appraisals with serum concentrations of cortisol (CS). Measures of temperament were gathered over 3 repeated observations (60-d interval) of yearling, fall-born Brahman bulls (initial BW=320 ± 4 kg; n=66). Temperament assessments included exit velocity (EV), the rate at which the bulls exited the squeeze chute and traversed a fixed distance (1.83 m); pen scores (PEN; 1=quiet to 5=excited), ascertained from animal behavior while penned in small groups (n=5); and chute scores (CHUTE; 1=quiet to 5=excited), determined from behavioral responses to restraint on the scale. All serial EV measures were positively correlated ($r \geq 0.31$, $P < 0.02$). All PEN were positively correlated ($r \geq 0.31$, $P < 0.01$), while serial measures of CHUTE were not ($P > 0.3$). EV was positively correlated with CS within times 1 and 3; EV1 to CS1 ($r=0.26$, $P=0.04$), and EV3 to CS3 ($r=0.44$, $P < 0.01$). The EV data obtained at Time 1 were transformed into a discrete variable, exit velocity ranking (EV RANK; 1 to 3 scale)

where 1 equated to < 1 SD below the mean, and 3 equated to > 1 SD above the mean). Repeated measures ANOVA was conducted using the MIXED procedure of SAS for a factorial analysis of time and EV RANK effects on EV and CS. EV was influenced ($P < 0.01$) by time as mean EV decreased from Time 1 (2.82 ± 0.07 m/sec) to Time 3 (2.11 ± 0.10 m/sec). Time also influenced ($P < 0.01$) CS, as mean CS dropped between Time 1 (14.56 ± 0.65 ng/mL) and Time 3 (11.12 ± 0.82 ng/mL). A time by EV RANK interaction ($P < 0.01$) was also observed. Measures of EV can be a valuable tool for both the assessment of cattle temperament and a possible predictor of both temperament and stress responsiveness to future animal handling events.

Key Words: Exit Velocity, Temperament, Cortisol

496 Postpartum productivity of suckled beef cows supplemented with the fibrolytic enzyme Cattle-Ase™. L. Jonovich^{1,2}, D. Neuendorff², A. Lewis², T. Welsh, Jr.¹, and R. Randel², ¹Texas Agricultural Experiment Station, College Station, ²Texas Agricultural Experiment Station, Overton.

The effect of Cattle-Ase™ (Loveland Industries Inc., Greeley, CO) supplementation on postpartum productivity was studied in suckled multiparous Brahman (B, n=44) and Romosinuano crossbred (R, n=39) cows. Within 24 hours after calving cows were weighed, body condition scored, calves identified and weighed and the cow-calf pair randomly allotted to either a control (C) or Cattle-Ase™ (A) ration. The pairs were maintained in a dry-lot 7d after calving and then moved to pasture for the remainder of the trial. While in pens the diet consisted of free choice Coastal bermudagrass hay and 3:1 corn:soybean meal supplement (1.8 kg/hd/d). Once moved to rye-ryegrass pasture the diets included 4:1 corn:soybean meal supplement (0.9 kg/hd/d). Cattle-Ase™ was supplemented at a rate of 2.5 g/hd/d. Data were analyzed using SAS's ANOVA procedures. Cow ADG to the end of supplementation was affected by treatment (C=4.8±38.4g, A=150.7±36.5g, $P < 0.01$), though ADG until weaning was not affected ($P=0.61$). Calf ADG to weaning was affected by breed of calf (BXAngus=952.3±35.3g, B=861.8±12.5g, R=845.8±15.7g, $P < 0.01$) and sex of calf (M=889.2±16.0g, F=844.9±12.7g, $P < 0.01$) but not treatment ($P=0.95$). Calf ADG to the end of supplementation was also affected by sex of calf (M=1027.3±23.1g, F=953.8±16.8g, $P=0.04$) but not treatment ($P=0.13$). Cow BCS change to the end of the trial was not affected by treatment ($P=0.82$) but was affected by breed (B=-0.07±0.10, R=0.51±0.15, $P < 0.01$). Cow BCS through the end of supplementation was also affected by breed (B=0.32±0.08, R=0.89±0.12, $P < 0.01$) but not treatment ($P=0.37$). Calf weaning weight was not affected by treatment ($P=0.89$) but was affected by calf breed (BXAngus=203.4±6.9kg, B=189.7 ± 3.2kg, R=214.4±4.5kg, $P < 0.01$). Postpartum interval was not affected by treatment ($P=0.30$) but was affected by breed (B=62.3±3.5d, R=80.2±3.5d, $P < 0.01$). Number of days to conception was also affected by breed (B=78.5±3.2, R=100.6±3.5, $P < 0.01$) but not treatment ($P=0.52$). It was determined that Cattle-Ase™ supplementation only affected cow ADG during the supplemental feeding portion of the trial while all other parameters were unaffected.

Key Words: Fibrolytic Enzyme, Postpartum, Cattle

497 Production traits differ in different breedtypes of suckled beef cows. L. Jonovich^{*1,2}, D. Neuendorff², A. Lewis², T. Welsh, Jr¹, and R. Randel², ¹Texas Agricultural Experiment Station, College Station, ²Texas Agricultural Experiment Station, Overton.

Milk production (MP) and its effect on postpartum productivity was studied in suckled multiparous Brahman (B, n=44) and Romosinuano crossbred (R, n=39) cows. The cows were maintained on rye-ryegrass pasture and received 4:1 corn:soybean meal supplement (0.9 kg/hd/d). Four-hour milk production was assessed between postpartum d 26-28. Cows were classified as having moderate (M) MP if MP was within 0.5 standard deviations of the mean for their breedtype and as low (L) MP if they produced more than 0.5 standard deviations less than the mean or high (H) if they produced more than 0.5 standard deviations greater than the mean for their breedtype. Data were analyzed using SAS's ANOVA and correlation procedures. MP was not affected by treatment (P=0.62) or cow breed (P=0.26). MP was correlated to calf ADG in R (r=0.56, P<0.01) but not B. Within R, L had lower calf ADG (L=747.8±36.4g) than M (M=862.3±36.4g, P<0.01) and H (H=885.3±17.5g, P<0.01). Calf ADG did not differ within B (P=0.29). Calf weaning weight was significantly correlated in R (r=0.49, P<0.01), but not B. Level of MP did not effect weaning weight in B (P=0.18), but within R L had lower weaning weights (L=199.1±8.9kg) than M (M=222.2±4.3kg, P=0.02) and H (H=225.8±6.7kg, P<0.02). Calf BCS at weaning tended to be correlated to MP in R (r=0.32, P=0.08), but not B. Level of milk production did not affect calf BCS in B, but within R L had lower calf BCS (L=5.1±0.2) than M (M=5.6±0.1, P=0.01). MP was negatively correlated with PPI in B (r=-0.43, P=0.03), but not R. Within B, L had longer PPI (L=87.7±9.1d) than H milk producers (H=54.6±6.2d, P<0.01). Level of MP had no effect on PPI within R (P=0.59). R tended to have a negative correlation between days to conception and MP (r=-0.34, P=0.08), but not B. The number of days to conception tended to differ between levels of MP in B (L=89.3±3.5d, M=90.3±6.3d, H=73.5±4.2d, P=0.07) and R (L=115.8±6.5d, M=98.0±4.4d, H=103.1±5.6d, P=0.07). Thus, B and R differ in the effect of milk production on postpartum productivity.

Key Words: Milk, Beef Cattle, Postpartum

498 Comparison of cattle identification costs using conventional or electronic systems in Spain. C. Saa, M. J. Milán, G. Caja^{*}, and J. J. Ghirardi, *Universitat Autònoma de Barcelona, Bellaterra, Spain.*

Regulation EC 1760/2000 established a mandatory system of identification and registration for cattle in the European Union based on double ear tagging (before 20 d of age or leaving the farm of birth), an individual passport (to record and communicate animal movements), and a national data base. A decision on the use of electronic identification (by using ISO complying transponders) is foreseen in the regulation but no information is available on the cost impact of the decision. With this aim, a simulation model was built up to evaluate the cost of cattle identification when different strategies are used. Strategies were: 1) **CID**, conventional identification of all animals by using two officially approved ear tags (polyurethane flaps and antifraud; 1.3 \$/each; 6% annual loss rate); 2) **EID**, electronic identification of all animals by using one electronic ear tag (button; 2.86 \$/each; 3% annual loss rate) and one conventional ear tag; and, 3) **BID**, electronic identification of all animals by using one electronic bolus (ceramic; 3.25 \$/each; 0.3% annual loss rate) and one conventional ear tag. The model was applied to the total Spanish cattle population in 2002 (6,477,900 animals) and for three types farms according to productive option and size: dairy (100 cows), suckler (600 cows) and fattening (1,000 calves/year). Annual costs of identification (conversion rate 1 euro = 1.3 US\$), in the total cattle population were 15.86, 20.05 and 20.41 \$/animal for CID, EID and BID, respectively. Annual values by farm type were (for CID, EID and BID, respectively): dairy (8.98, 8.92 and 8.48 \$/animal), suckler (9.07, 8.03 and 7.41 \$/animal), and fattening (2.38, 1.20 and 0.79 \$/animal). The EID and BID were the cheapest strategies for the farmer, in the three farm types considered. Moreover, extra benefits for EID and BID are foreseen. Results indicated that electronic identification of cattle is a cost benefit affordable option for cattle farmers and cattle industry in Spain. A reduction of device and equipment prices

would make the use of electronic identification the cheapest strategy in the future.

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Key Words: Animal Identification, Cost Analysis, Electronic Identification

499 Economic study of milk production in Iran. A. Karbasi^{*1} and A. Sarvari², ¹Zabol Islamic Azad University, ²Zabol University.

Milk is one of the most essential foods in stabilizing a nation's food supply. Securing a stable milk supply is also important for development of a country's livestock sector and related industries. In addition, milk has a special place in diets of Iranian families, due to the economic impact of employing people in traditional and industrial livestock sectors. In recent years, the Iranian government has provided increased support of the dairy sector through policy and subsidies. With increased emphasis on the dairy sector, milk supply and consumption has increased. This study has two objectives. First, to determine cow productivity, milk price and the production breakeven level in the Khorasan province (second largest dairy province in Iran in 2003) for traditional, semi-industrial and industrial dairy operations. Secondly, after estimating milk demand and supply, determine the effect of increasing prices on producer and consumer welfare in 1959-2003. Based upon this analysis, forecasting methods were used to estimate the effect of milk prices on producer and consumer welfare from 2004-2010, using the ARIMA and Holt methods. The results showed that productivity, milk price and production breakeven level in industrial dairy operations is greater than traditional and semi-industrial dairy operations. Also, increasing milk price increased producers' welfare and decreased consumers' welfare.

Key Words: Milk, Economic, Product

500 Development of an intraruminal device for data sampling and transmission. A. K. Sievers^{*1}, K.-H. Suedekum^{1,2}, H.-J. Laue³, N. B. Kristensen⁴, and S. Wolfram¹, ¹University of Kiel, Kiel, Germany, ²University of Bonn, Bonn, Germany, ³University of Applied Sciences, Kiel, Germany, ⁴Danish Institute of Agricultural Sciences, Tjele, Denmark.

In Europe, the number of cows per herd is increasing whereas, the time available for surveillance of each cow decreases. The objective of the present study was to develop an intraruminal device for monitoring changes in intraruminal conductivity, pressure, and temperature in individual cows. An intraruminal device is independent of external disturbing factors, can not be manipulated from the outside, and cannot be lost easily. We developed a plastic bolus (length, 16.5 cm; outer diameter, 3.6 cm; weight, 245 g; specific weight, 1.47 g/cm³) which contains a barometer, a thermometer, an electrical conductivity meter, a chip for data storage and energy management, and a rechargeable battery. For loading and programming, the bolus is connected to a computer by a serial interface. In a series of in vitro and in vivo experiments, the basic functioning of the bolus was evaluated and data was compared to those obtained by external reference devices.

Water temperatures could be recorded in vitro with an accuracy of 0.1°C. In vivo, using four ruminally cannulated lactating cows, a significant correlation was found between intraruminal temperature recorded by the device and the rectal temperature (n = 36; Pearson r = 0.918; r² = 0.843). Pressure changes were recorded in vitro with an efficiency of 66%. In vivo pressure recordings were successfully used for registration of contractions of the reticulo-rumen and to detect changes in contraction frequency. During the in vitro evaluation all changes in conductivity, effected by the addition of single VFA, silage particles, or changes in osmolarity, were recorded by the device, and were correlated with those recorded by an external conductivity meter (n = 14; Pearson r = 0.916; r² = 0.839). The in vivo situation, however, is much more complex due to a high number of overlapping effects. The conductivity values determined in vivo by the bolus and the reference device were of no value. In conclusion, the intraruminal device successfully monitored changes in body temperature and

forestomach motility and might be beneficial to future management systems for cattle.

Key Words: Dairy Cow, Rumen, Data Sampling

501 Open-air windrows for winter disposal of large animal mortalities: effects of ambient temperature and windrow dimensions. K. Stanford*, V. Nelson, and B. Sexton, *Alberta Agriculture, Food and Rural Development, Lethbridge, AB, Canada.*

Three open-air mortality compost windrows were constructed in January 2004 (REP1). Windrow A included a base of barley straw (min. 46 cm), a layer of cattle mortalities (n=12) and a layer of stockpiled manure (min. 46 cm) covering the mortalities. Windrow B was similar in makeup to windrow A, although 2 layers of straw, mortalities and manure were constructed containing a total of 9 mortalities. After 1 mo, replicate windrows of each type were constructed using the same number of mortalities and organization of layers (REP2). Due to low ambient temperatures, cattle mortalities (n=66, 236-673 kg) were frozen before addition to windrows. Type 'T' thermocouples were embedded within

the lower layers of B and C windrows, while temperatures within 1 m of the surface were measured on all windrows using a stainless steel dial probe (C.E. Franklin Ltd, Calgary AB). Windrows were turned 3 times at approx. 3 mo intervals and 10 1-kg samples were collected from initial compost amendments and at each turning for determination of DM, OM, N and C. Temperatures were measured daily for the first wk after windrow construction and weekly thereafter. Ambient temperature was higher ($P < 0.05$) during the heating of REP2 as compared to REP1 compost, as evidenced by the 13°C mean differential between replicates during the initial heating period. Accordingly, temperature decline of REP2 compost was more gradual ($P < 0.001$) than that of REP1. However the time spent at maximum temperature did not differ ($P > 0.74$) between replicates and all windrows heated in excess of 55°C. Temperature profiles were not affected by windrow type (A, B, or C). After 3 heating periods and 9 mo, flesh was not evident and only fragments of bones (max wt. 740 g) were found. Results of this study demonstrate that reduced ambient temperatures and frozen mortalities provide no barrier to the use of open-air windrows for disposal of cattle mortalities.

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Key Words: Mortality Disposal, Compost, Cattle

Production, Management and the Environment: Heat Stress

502 Evaluation of environmental conditions in 4 and 6 row freestall barns that are tunnel ventilated with evaporative pads and located in Indiana. J. F. Smith*¹, M. J. VanBaale², M. J. Brouk¹, B. Prokop³, and J. P. Harner¹, ¹*Kansas State University, Manhattan*, ²*The University of Arizona, Tucson*, ³*Herrema Dairy, Fair Oaks, IN.*

Throughout July and August of 2003, HOBO Pro RH/Temp/Data Loggers[®] were installed to collect temperature and % relative humidity (RH) in recently constructed 4 and 6 row freestall barns with tunnel ventilation and evaporative pads located in northern Indiana. The 4 row barn had evaporative pads located in the middle of the barn with fans located on the east and west ends. In the 4 row barn four loggers/pen were evenly spaced in 4 pens over the head to head stalls. The 6 row barn had evaporative pads located on the east end and fans on the west end. In the 6 row barn eight loggers/pen were evenly spaced in two rows over the head to head stalls and over the single row of stalls in two pens. Loggers were set to take measurements at 15 min intervals 24 h daily. Data was averaged by hour and analyzed using the mixed procedure in SAS. Average ambient high and low temperature was 30.3 and 17.7°C and average ambient high and low % RH was 100 and 63.2, respectively. Overall maximum afternoon temperature was 2.9°C cooler, THI was 4.9 points lower and % RH was 23.6 higher in the 4 row barn as compared to ambient conditions. During hours 0:00 - 7:59 and 21:00 to 23:59, the 4 row barn temperature (1.3±0.9) and THI (2.2±1.2) were higher as compared to ambient conditions. Similar differences in temperature, and THI were observed in the 6 row barn. However, the magnitude of these differences was lower on the outside rows of freestalls in the 6 row barn compared to the inside row (head to head stalls). Temperature, THI, and % RH differed from air intake to air exhaust in both the 4 and 6 row barns. Specifically, temperature was 1.8°C higher, THI was 4.2 points higher and RH was 9% lower at the air exhaust as compared to the air intake. In summary afternoon temperature and THI were lower in both the 4 and 6 row freestall barns as compared to ambient conditions. Early morning temperature and THI were higher in both 4 and 6 row structures versus ambient conditions, respectively. Air moving through these buildings increased in temperature and THI and decreased in % RH.

Key Words: Tunnel Ventilation, Evaporative Cooling, Dairy Cattle

503 Impact of using feedline soakers in combination with tunnel ventilation and evaporative pads to minimize heat stress in lactating dairy cows located in Thailand. J. F. Smith*¹, D.V. Armstrong², M. J. Brouk¹, V. Wuthironarith³, and J. P. Harner¹, ¹*Kansas State University, Manhattan*, ²*University of Arizona, Tucson*, ³*Charoen Pokphanol Group Co., LTD, Bangkok, Thailand.*

Twenty four lactating Holstein cows housed in a two row tunnel ventilated free stall barn equipped with evaporative pads and a feedline soaker system were arranged in a 4 x 4 Latin square design. The free stall barn was 16 by 113 m with a ceiling height of 2.6 m. The structure had 55.7 sq m of evaporative pads on end and eleven 130 cm fans on the opposite end of the barn. Treatments included control, feed line soaking in the afternoon (12:00 to 21:00), feedline soaking at night (21:00 to 6:00), and feed line soaking afternoon and night (12:00 to 6:00). Treatments were rotated from pen to pen each day. Individual cows were fitted with vaginal temperature recorders that allowed temperature to be recorded every minute. Feedline soakers operated when the barn temperature exceeded 21°C. The soaker cycle was 0.5 minute on and 4.5 minutes off. The median ambient temperature (°C) was 29.8 ± 5.0, percent relative humidity of 69 ± 26 and a THI of 79.8 ± 4.7. The median barn temperature was 25.5 ± 2, percent relative humidity was 94 ± 7 and THI was 77 ± 3.4. On average, barn temperature was 4.2°C lower, percent relative humidity was 28 higher and THI was 3.1 lower than ambient conditions. The maximum differences occurred in the heat of the day and when barn temperature was 9.1 lower, percent relative humidity was 52 higher and THI was 6.0 lower in the barn. Feedline soaking both in the afternoon and night was more effective in reducing respiration rates than soaking only at night. Feedline soaking in the afternoon was as effective as feedline soaking both afternoon and night in lowering respiration rates. Vaginal temperatures were lower when cows had access to soaking both afternoon and night as compared to soaking the control. The results of this trial suggest that feed line soaking can be used in combination with tunnel ventilation and evaporative pads to reduce heat stress.