W171 Identification of growth hormone-regulated genes in the bovine liver by a microarray analysis. H. Jiang* and S. Eleswarapu, *Virginia Polytechnic Institute and State University, Blacksburg.*

The objective of this study was to identify the genes that are regulated by growth hormone (GH) in the bovine liver. Liver total RNA from three cows before and 7 days after administration of 500 mg recombinant bovine GH in a slow-release formula were subject to a microarray analysis, using the Affymetrix GeneChip® Bovine Genome Arrays that contained 23,000 bovine transcripts. On average, 6,837 (or 30%) of the transcripts were detected in the RNA samples. Analysis of the microarray data using GeneSifter revealed a set of 418 transcripts that were at least 1.5-fold different (P<0.05) in abundance between pre- and post-GH liver samples. Among the 418 transcripts, 392 displayed increased whereas 26 showed decreased expression after GH administration. These differentially expressed transcripts included insulin-like growth factor-I (IGF-I), acid-labile subunit of the IGF-binding protein complex, and hepatocyte nuclear factor 3 gamma, genes that were previously known to increase their expression in response to GH treatment, and IGF binding protein-1 (IGFBP-1), whose expression was previously known to be decreased by GH administration. The pre- and post-GH differences in the expression of these four transcripts were further confirmed by ribonuclease protection assays. The majority of the 418 differentially expressed transcripts were not known to respond to GH treatment before; they therefore represent new candidate genes that mediate GH action in the bovine liver.

Key Words: Growth Hormone, Microarray, Cattle

Production, Management and the Environment III

W172 Effectiveness of ocular thermography for the determination of body temperature in livestock: A multi-species analysis. S. Willard*[1], P. Ryan[1], D. Sykes[1], M. Crenshaw[1], R. Vann[2], R. Randel[3], T. Welsh[3], S. Bowers[1], M. Jones[1], and A. Chromiak[1], [1]*Mississippi State University, Mississippi State,* [2]*Brown Loam Experiment Station, Raymond, MS,* [3]*Texas Agricultural Experiment Station, Overton and College Station, TX.*

The eye may represent a measurement location from which an assessment of body temperature could be obtained. Applications for such measurements, if effective, include the non-invasive acquisition of body temperatures in a variety of species or as a rapid test for identifying sick (febrile) animals. The objectives of this study were to randomly sample livestock to determine whether digital infrared thermal imaging (DITI) of the eye is correlated with rectal temperature (RT). Total numbers of observations by species or breed were as follows: beef steers (n=127), dairy cattle (n=180; n=150 cows and 30 calves), horses (n=119; n=60 mares and 30 foals) and gilts (n=120). Regression analysis and associative correlations between maximum eye temperature (MET) and RT were determined. MET was lower (P<0.05) than RT in beef steers, dairy cattle, mares and gilts, but did not differ (P>0.10) for foals. Beef steers: measurements from two studies indicated high correlations between MET and RT (R=0.80 and 0.78; P<0.01), yet when studies were combined the correlation was moderate (R=0.55; P<0.01). Dairy cattle: cows exhibited a lower correlation (R=0.31; P<0.01) than calves (R=0.52; P<0.01), and when combined the correlation was lower (R=0.29; P<0.01). Horses: mares exhibited a moderate correlation (R=0.41; P<0.05) between MET and RT, however for foals correlations were not significant (R=0.16; P=0.22). When mares and foals were combined the correlation was moderately strong across all horses (R=0.65; P<0.01). Gilts: the relationship between MET and RT was not significant (R=-0.06; P=0.50). The dynamic range of RT and MET obtained was narrow for dairy cattle (1.3 and 3.1 °C) and gilts (1.2 and 4.4 °C) and broader for beef steers (3.7 and 6.1 °C) and horses (2.2 and 5.6 °C), respectively. These data indicate that the effectiveness of ocular thermography as an assessment of body temperature may be species, breed and age dependent, and, when significant, were generally moderately correlated with RT overall. Nevertheless, ocular DITI may have application in screening for animals that are lower or higher than an expected normal range.

Key Words: Thermography, Eye, Temperature

W173 Description and summarization of reticular core-body temperatures obtained from an automatic temperature recording system. J. M. Bewley*[1], D. C. Batson[2], and M. M. Schutz[1], [1]*Purdue University, West Lafayette, IN,* [2]*MaGiiX Inc., Post Falls, ID.*

Automatic temperature recording may be used for dairy management and allow early detection of disease, estrus, heat stress, and the onset of calving. The MaGiiX ™ Cattle Temperature Monitoring System (CTMS, MaGiiX Inc., Post Falls, ID) utilizes a passive bolus equipped with a temperature sensor, a panel reader placed at a parlor entrance or exit to query the bolus, and a software package to collect, analyze, and view data. The biologically inert bolus resides in the cow's reticulum and is queried each time the cow passes the reader (e.g. two or three times per day after milking). Ambient temperature (AT) and humidity (AH) are also measured for each observation. Reticular temperatures (RT) were monitored for a period of ten months (3/20/2005-1/24/2006) for a moderate-sized dairy in Montana milking 3 times daily. Unadjusted mean RT for 37,684 observations during this period was 103.0°F (±0.9). A mixed model including the effects of milking, date, AT, AH, and random cow, was used to compare the effects of morning, afternoon, or evening milking on RT. The RT differed by milking (P<0.001) with LSMean RT of 103.0°F (±0.04), 102.8°F (±0.04), and 103.2°F (±0.04) for morning, afternoon, and evening milkings, respectively. The RT was weakly correlated with AT (r=0.050, P<0.001), temperature humidity index (r=0.051, P<0.001),and AH (r=-0.023, P<0.001). Interpreting high RT to identify cows for further examination or monitoring is problematic. Strictly designating cows with RT greater than 103.5°F, 104.0°F, or 104.5°F as being elevated resulted in 19.0%, 6.7%, and 2.6% of cows identified, respectively. Contrastingly, 1.6% of cows were identified as having a high RT using a cut-off of +2 standard deviations while only 0.4% were identified using a cut-off of +3 standard deviations. Within milking variation (SD) of RT was correlated (p<0.01) with within milking, average AT(r= 0.103), and AH (r= -0.226), and within milking SD of AT (r=0.127).

Key Words: Temperature monitoring, Disease detection, Biosensors

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W174 Qualitative assessment of the irrigation water from separated and aerated flushed dairy manure. M. Hollmann*[1], K. F. Knowlton[1], C. M. Parsons[1], and T. N. Rensch[2], [1]*Virginia Polytechnic Institute and State University, Blacksburg*, [2]*Integrity Nutrient Control Systems, Inc., Chambersburg, PA*.

The objectives were to monitor for one year final irrigation water after separation of solids, and settling and aeration in three tanks on a 140-cow flushed freestall dairy with sawdust bedding. The flushed slurry was separated (screen sizes 0.79 and 3.18 mm). The liquid flowed into a 400 m^3 settling basin, then via gravity into a tank (2.3 Dm^3), and was pumped into the next two successive tanks (2.3 and 4.3 Dm^3). The third tank provided the flush and irrigation water. An aerator (pump volume: 5 kg O2/h) supplied air at a surface depth of 45 cm in each tank. On 21 dates volumes and constituents of the flushwater were determined, and the effects of period (Nov. to Apr. 2005, Apr. to July 2005, Aug. to Dec. 2005) on its composition were analyzed using Proc GLM in SAS. The manure system was primed with 5 Dm^3 fresh water at startup (July 2004). Daily fresh water input ranged from 34 to 56 m^3. Concentrations of solids and nutrients were lowest in the first period. The tanks were pumped down dramatically in Apr. Total, total suspended, volatile, and volatile suspended solids concentrations rose 3, 9, 4, and 8-fold in period two (13.7, 10.9, 9.4, and 8.5 g/l), and dropped in period three (7.0, 3.6, 3.9, and 3.0 g/l, respectively). Total P (63, 253, 147 mg/l), total Kjeldahl N (425, 986, 594 mg/l), and chemical oxygen demand (2.5, 13.5, and 5.4 g/l) were lowest in period one, and highest in period two. Nitrate (0.62 mg/l), nitrite (6.73 μg/l), and pH (8.0) did not change. Dissolved O_2 (1.40, 0.35 and 2.05 mg/l) and oxidation-reduction potential (84, -110, and 47 mV) were lowest in period two. Low initial concentrations were likely due to dilution. After perturbation it took four months for solid and nutrient concentrations to decline and stabilize. Continued sampling will be used to assess whether the values observed since Aug, 2005 are sustainable values for this system.

Key Words: Aeration, Manure composition, Irrigation

W175 Chemical parameters, particle and nutrient removal with separation, settling, and aeration in flushed dairy manure. M. Hollmann*[1], K. F. Knowlton[1], C. M. Parsons[1], and T. N. Rensch[2], [1]*Virginia Polytechnic Institute and State University, Blacksburg*, [2]*Integrity Nutrient Control Systems, Inc., Chambersburg, PA*.

Data were collected for one year from a working manure system consisting of a mechanical screen separator, gravitational settling basin (SB), and three aerated storage tanks in series. The manure from 140 lactating dairy cows was flushed with ~ 40,000 L recycled wastewater four times per day. The blend was separated to solid and liquid portions by a mechanical solid-liquid manure separator consisting of two concave screens, pore size 0.79 mm (screen 1) and 3.18 mm (screen 2). The liquid portion flowed into a SB and by gravity into the first aerated tank (pump power: 5 kg O_2/h). The wastewater was pumped into sequential aerated tanks, with the third tank supplying the flush water. Composite samples of flushed slurry and effluents from the separator, SB, and tanks 1, 2, and 3 were taken every other week (n=14) and then monthly (n=7). Weighted results were analyzed using Proc Mixed with site and date in the model and date as a repeated measure. Mechanical separation of the blend, including the solids and nutrients from the flushwater, reduced total (TS) and volatile solids (VS) by 19 and 25%, total Kjehldahl N (TKN) by 9%, total P (TP) by 18%, and chemical oxygen demand (COD) by 17%. The SB reduced TS by 11%, VS by 12%, and TKN and TP by 10%. The combined effect of aeration and settling in tanks 2 and 3 decreased TS and VS

by 22% and 24%, respectively. Nitrates, TKN, and TP were reduced by 49%, 14%, and 13%. Ortho-P and nitrite concentrations remained steady. The combined tanks reduced COD by 21%, while dissolved oxygen increased from 0.4 to 1.1 mg/l, and the oxidation-reduction potential rose from -230 to 16 mV. Separation of flushed dairy manure with subsequent settling and aeration effectively removed particles and nutrients from the wastewater. Aeration improved dissolved oxygen content and oxidation-reduction potential.

Key Words: Aeration, Manure composition and treatment, Separation

W176 Prediction of ammonia emission from dairy cattle manure based on milk urea N: The relationship of milk urea nitrogen to urine urea nitrogen excretion. S. A. Bugos*, E. J. DePeters, D. Ledgerwood, and J. G. Fadel, *University of California, Davis*.

Ammonia emission from dairy cattle manure occurs when urea excreted in urine reacts with urease produced by microorganism in feces, on barn floors and in soil. The objectives of this study were to assess the relationship between urinary urea N excretion (UUN; g/d) and milk urea N concentration (MUN; mg/dl) and to test whether the relationship was affected by stage of lactation and dietary CP content. Twelve lactating multiparous Holstein cows were randomly selected and blocked into three groups of four cows intended to represent early (123 ± 26 DIM; mean ± SD), mid (175 ± 3) and late (221 ± 12) lactation. Cows within stage of lactation were randomly assigned to a treatment sequence within a split-plot Latin square balanced for carryover effects. Stage of lactation formed the main plots (squares) and dietary CP levels (14, 16, 18 and 20 % diet DM) the subplots. Graded amounts of urea were added to the basal TMR to linearly increase dietary CP content of rations while maintaining the concentration of all other nutrients similar among treatments. The experimental periods were 7 d in length, with d 1 to 6 used for adjustment to diets and d 7 used for total collection of urine and feces as well as milk and blood sample collection. Dry matter intake and yield of milk, fat, protein, lactose and urea N declined progressively with lactation stage. The concentration of urea in milk, plasma and urine and urea output in milk and urine increased in response to a linear increase in dietary CP content. The relationship between UUN and MUN differed among lactation stages. The following equations were obtained for early and late lactation and mid lactation cows, UUN = 18.43 (± 2.03) × MUN - 0.16 (± 0.06) × MUN^2 and UUN = 14.95 (± 0.59) × MUN, respectively. The observed MUN values ranged between 5 and 26 mg/dl for midlacation cows and between 7 and 32 mg/dl for early and late lactation cows. Milk urea N may be a useful tool to predict the amount of urea N excreted in urine as an estimate of ammonia volatilization potential from dairy cattle manure.

Key Words: Milk urea nitrogen, Urine urea nitrogen Excretion, Ammonia emission

W177 Prediction of ammonia emission form dairy cattle manure based on milk urea N: The relationship of milk urea nitrogen to ammonia emission. S. A. Burgos*, N. Marcillac, J. G. Fadel, F. M. Mitloehener, and E. J. DePeters, *University of California, Davis*.

The objectives of this study were to determine the effect of stage of lactation and dietary CP level on the composition of and NH_3 emission from dairy cattle manure and to evaluate the potential of milk urea N concentration (MUN) as a predictor of NH_3 emission from dairy cattle manure. Twelve lactating multiparous Holstein cows were randomly selected and grouped by lactation stage (four early, mid and late lactation) and fed linearly increasing dietary CP levels (14, 16, 18

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and 20 % diet DM) by supplementation of a basal TMR with graded amounts of urea. The experimental design was a split-plot Latin square with stage of lactation forming the main plots and dietary CP content the subplots. The experimental periods were 7 d in length, with d 1 to 6 used for adjustment to diets. Composite urine and fecal samples were taken from urinary and fecal 24-h total collection periods of d 7 of the experimental period. A flux chamber system was used to measure NH_3 emission over a 24- h period from slurries prepared by combining feces and urine in the proportions in which they were excreted for each treatment. The proportion of urine and the initial concentration of urea N in slurry increased linearly with dietary CP content, while the DM varied inversely. There were no differences in initial slurry NH_3 concentration. Ammonia emission increased linearly (2.75, 3.99, 5.75and 7.97 g N/h) with treatments. Cumulative N emission from fresh slurries represented 12% of N intake of cows in the basal TMR and increased linearly up to 20% for cows fed the highest CP level and progressively with lactation stage (14, 15 and16% for early, mid and late lactation, respectively). The relationship between ammonia emission and MUN was linear over the range of MUN values observed and was not different between stages of lactation. The following equation is proposed to predict NH_3 emission from dairy cattle manure based on MUN: NH_3 emission (g N/h) = 0.3 ($\pm$ 0.02) $\times$ MUN (mg/dl).

Key Words: Milk urea nitrogen, Urine urea nitrogen excretion, Ammonia emission

W178 Effect of frequency of irrigation in growth and vermicompost chemical parameters of red earthworm (*Eisenia* spp). J. A. Hernandez[1], S. Pietromoli*[1], A. Faria[1], R. Canelon[2], R. Palma[2], and J. Martinez[1], [1]*Facultad de Agronomia. La Universidad del Zulia, Maracaibo, Zulia, Venezuela*, [2]*Proyecto FONACIT, Maracaibo, Zulia, Venezuela.*

A semi-commercial scale experiment was conducted to evaluate the effect of irrigation frequency on the growth of red earthworms (*Eisenia* spp.) and the chemical properties of the resulting vermicompost. The experiment was conducted in Zulia state, Venezuela. Frequency of irrigation tested were none (**N**), once (**O**) or twice (**T**) a week. Earthworms (2000/m^2) were deposited in 1-m^2 concrete containers (199.0 $\pm$ 0.39 mg/earthworm). The **N** containers were covered to avoid water loss. Each container was considered an experimental unit. Bovine manure (0.15m^3) was used as substrate. At the beginning of the trial, all treatments received 24 L of water. Biomass was measured every 24 days, and the first 40 earthworms found in the top of each container were weighed. Cocoon production was determined at 42 days by counting cocoons that were found in five 240 cm^3 sub-samples of substrate. Final biomass was determined at day 92, weighing all earthworms located in two quarters of each container. Vermicompost was chemically characterized for OM, P, K, Ca, Mg, Zn, Fe, Mn, and Cu concentrations and pH and electrical conductivity were measured. Humidity of the substrate was established every 21 days through a gravimetric method. A completely randomized design with 5 observations per treatment was used. Statistical differences were established for biomass at day 84, with the heaviest earthworms observed in **N** (193.26 $\pm$ 0.22 mg/earthworm) and the lightest in **O** (111.05 $\pm$ 8.77 mg/earthworm). Cocoon production differed ($P <$ 0.05) between **T** (69.2 $\pm$ 0.03 cocoons/240 cm^3) and **O** (33.4 $\pm$ 4.86 cocoons/240 cm^3), whereas **N** was similar to the others treatments (48.9 $\pm$ 1.41 cocoons/240 cm^3). No differences were established for final earthworm biomass and the chemical characteristics of vermicompost. Frequency of irrigation affected biomass and cocoon production

of red earthworms. It is suggested that covering the containers is a practical management practice to supply sufficient humidity under hot conditions to obtain adequate earthworm performance. Collateral benefits include reduction of labor required for irrigation activities.

Key Words: Earthworm, Irrigation frequency, Biomass

W179 Distribution of phosphorus and nitrogen when dairy manure is separated into solids and liquids. Z. Wu* and D. Burns, *Pennsylvania State University, University Park.*

The distribution of P and N when dairy manure is separated into solids and liquids was determined using an 850-cow farm. Manure in the collection pit was pumped under agitation to a stationary screw press separator (Fan Separator GmbH; Germany) and subjected to double screens with 3 and 1 mm pore openings. The farm used manure solids for bedding, and when bedding material was needed the exhaust plate of the screw press separator was set up to produce drier solids (23% DM, bedding). At all other times the press was set to result in solids that were less dry and used for field spreading (19% DM, spreading). On 7 occasions the separator was operated to produce solids for bedding or spreading for 20 min, resulting in 14 collections. For each collection, the amount of DM of the manure processed (influent) was estimated from volume, specific gravity, and DM content. The amount of DM of separated solids was calculated from wet weight and DM content, and the amount of DM of liquids was calculated by difference. Distribution of N and P in solids and liquids was calculated based on these DM amounts and nutrient concentrations. Approximately 97% of the P and N in processed manure was accounted for in separated solids and liquids. The recovery in solids was 48.2 and 51.4% for DM, 12.5 and 15.1% for P, and 22.7 and 25.7% for N, when manure was processed to produce solids suitable for bedding and spreading, respectively. Increasing the tightness of the screw separator reduced the recovery of DM, P, and N in solids, and most of the P and N in dairy manure were associated with liquids after separation.

Table 1.

Item	Bedding	Spreading	SEM	P
Influent DM, kg	353.0	361.6	10.2	0.58
Solid DM, kg	168.3	185.6	3.3	0.01
Liquid DM, kg	184.7	175.8	7.6	0.45
Influent P, kg	2.54	2.53	0.08	0.94
Solid P, kg	0.30	0.38	0.01	0.01
Liquid P, kg	2.16	2.08	0.07	0.46
Influent N, kg	10.07	10.16	0.30	0.84
Solid N, kg	2.22	2.60	0.07	0.01
Liquid N, kg	7.82	7.30	0.27	0.23
DM recovery in solids, %	48.2	51.4	0.7	0.01
P recovery in solids, %	12.5	15.1	0.5	0.01
N recovery in solids, %	22.7	25.7	0.7	0.02

Key Words: Manure, Phosphorus, Nitrogen

W180 Effects of essential oils on viability of *Escherichia coli* O157:H7 in treated beef cattle manure slurries and on prevalence from treated feedlot surfaces. J. E. Wells*, E. D. Berry, and V. H. Varel, *USDA, ARS, U.S. Meat Animal Research Center, Clay Center, NE.*

Escherichia coli O157:H7 is commonly found in cattle waste and its survival in manures is a concern for the environment and food safety.

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To determine the potential antimicrobial effects of different plant essential oil additives on this zoonotic pathogen, a selected strain of *E. coli* O157:H7 with known tolerance to the manure environment was inoculated into beef cattle manure slurry treatments (n = 3 reps/trt). Fresh feces were collected from pens of cattle fed a finishing ration (83% rolled corn), blended with urine and plant essential oil additives, and inoculated with streptomycin-resistant *E. coli* O157:H7 strain ATCC 43895. On d 0, a 1 g sample from each inoculated slurry was diluted and viable counts were determined by plating onto agar medium with streptomycin. Viable counts were determined daily until no longer detectable. In mixed slurries without additives, the decreases in viability of *E. coli* O157:H7 (death rate, 0.427 $\log_{10}$ colony forming units per gram feces per day) were similar and no viable counts were recovered after 12 d. Death rates of *E. coli* O157:H7 were 5.5-fold faster ($P < 0.05$) in manure slurries treated with thymol and were 2.8- to 2.9-fold ($P < 0.05$) faster in manure slurries treated with terpineol, geraniol, plinol, and glidox when compared to the non-treated control slurries. In further studies, terpineol and thymol applications were evaluated on feedlot surfaces (3 pens/trt) to control *E. coli* O157 prevalence over a 4-wk period in summer 2005. Terpineol application did not affect *E. coli* O157 prevalence in soil samples compared to untreated pens, but thymol application reduced prevalence by more than 50% ($P < 0.05$). These experiments suggest that some essential oils may control pathogens in cattle waste slurries and on feedlot surfaces. Additional studies with these compounds in the feedlot are needed to determine if higher concentrations and/or season affect pathogen prevalence.

Key Words: Cattle manure, Pathogens, Essential Oils

W181 Evolution of ^{15}N abundance in cattle manure in relation to cumulative ammonia losses. A. N. Hristov[*1], L. Campbell[1], and J. H. Harrison[2], [1]*University of Idaho*, *Moscow*, [2]*Washington State University*, *Puyallup*.

The objective of this experiment was to investigate the relationship between ^{15}N abundance of cattle manure and cumulative ammonia losses during storage. Fresh spot fecal and urine samples were collected from randomly selected lactating dairy cows fed on the same diet from seven commercial dairy farms in the Pacific Northwest (15 cows/farm). Composite fecal and urine samples were transported to the laboratory and used to study ammonia losses in a closed system *in vitro* apparatus. Feces were mixed with urine (2:1 ratio) and incubated for 14 days. Cumulative ammonia loss was estimated based on daily emissions and daily manure and ammonia samples were analyzed for ^{15}N abundance. Overall ammonia losses varied significantly among manure samples averaging 341±81.9 m*M* in 14 days (minimum and maximum of 130 and 749 m*M*, respectively). Cumulative ammonia losses curves were fitted to an exponential rise to a maximum model of the type: f=y0+a*(1-exp(-b*x)) (R^2 = 0.991 to 0.999). The average rate of ammonia released from manure was 0.06±0.010 m*M*/d (minimum and maximum of 0.03 and 0.10 m*M*/d, respectively). Average ^{15}N abundance (δ^{15}N) of ammonia emitted from manure was –19.9±0.92‰. Due to the loss of highly depleted in ^{15}N ammonia, the ^{15}N abundance of the residual manure increased ($P < 0.001$) from an average of 4.6±0.47‰ (day 1) to 7.6±0.34‰ (day 14 of the incubation). Simple correlations between cumulative ammonia losses and ^{15}N abundance of manure N ranged from r = 0.70 to r = 0.92 ($P = 0.005$ to $P < 0.001$). The relationship between manure δ^{15}N and the cumulative ammonia loss was linear ($P < 0.001$): Cumulative ammonia loss = -406.2 (SE = 67.73) + 102.3 (SE = 7.76) manure δ^{15}N (farm was a random effect). This study demonstrated that ^{15}N abundance of the ammonia emitted

from cattle manure during storage is relatively constant and δ^{15}N of aged manure could potentially be used to predict ammonia emissions from cattle manure.

Key Words: Ammonia emission, Cattle manure, Stable isotope

W182 Environmental perspective of nitrogen use efficiency in dairy farms. H. Arriaga[1], M. Pinto[1], P. Merino[1], and S. Calsamiglia[*2], [1]*NEIKER A.B. Basque Institute for Agricultural Research and Development*, *Basque Country, Spain*, [2]*Universitat Autonoma Barcelona. Faculty of Veterinary*, *Barcelona, Spain*.

In intensive farming areas of the European Union, reduction of N losses from animal husbandry is a major concern. A survey was conducted on 64 Basque commercial dairy farms from July-2003 to April-2004 to determine the efficiency of N utilization in dairy farms. Data on management practices, including herd size (ranged from 19 to 300 lactating cows), production level (ranged from 5541 to 12166 kg/cow/year), DMI (ranged from 14.9 to 26.7 Kg/cow/day), feeding system (TMR, grass silage based non-TMR and purchased complete feed), number of feeding groups (one or two) and slurry spread area (ranged from 9 to 215 Ha), and samples of ration ingredients, milk tank, faeces and urine were collected from lactating cows in each farm and analyzed for N content. The CNCPS 5.0 model was used to estimate daily faecal and urinary excretion volumes. Mean N utilization efficiency (NUE) was 26.1% (SD = 3.0), ranging from 19.2% to 32.3%. Highest NUE was achieved with 3.8 kg/d of CP and 22.4 kg/d of DM intakes. Milk yield was positively correlated to NUE (r2 = 0.30). Feeding systems and having different feeding groups did not influence NUE. A multivariate regression model with overall N excretion at farm level (NEFL) as a dependant variable indicated that NEFL expressed in g/d was dependent on the number of animals per farm (r = 0.22) and CP intake (r=0.34), and NEFL per Ha (g/d/Ha) was mostly dependent on herd size and slurry spread area. At average NUE, NEFL ranged from 366.8 g/d/Ha to 935.9 g/d/Ha. It is concluded that NUE may be improved by adjusting CP intake and increasing average milk production per cow. At farm level, an environmental approach requires NUE interpretation together with slurry spreading area and the number of cows per farm to minimize N excretion.

Key Words: Nitrogen efficiency, Environment

W183 The effects of floor space on pig growth performance and carcass characteristics in a commercial wean-to-finish facility. B. A. Peterson[*1], M. Ellis[1], B. F. Wolter[2], R. Bowman[2], J. M. DeDecker[1], and M. J. Ritter[1], [1]*University of Illinois*, *Urbana*, [2]*The Maschhoffs, Inc.*, *Carlyle, IL*.

The effects of floor space on growth performance and carcass characteristics of pigs housed in a commercial wean-to-finish production system were evaluated in a study that used 1740 crossbred barrows from four commercial genotypes. The study was carried out as a randomized complete block design with five floor space treatments: 0.57, 0.61, 0.65, 0.69, and 0.73 m²/pig. Pigs were housed in groups of 29 and pen sizes were adjusted to the desired floor spaces. At weaning (17 ± 1 d), pigs were individually weighed and formed into outcome groups of five pigs based on similar genotype and weight and randomly assigned to one of the five floor spaces. The study was carried out between weaning and ~127 kg BW. Pigs were weighed at weaning and wk 4, 8, 12, 14, 16, 18, and 19 post-weaning and ~127 kg BW. An eight-phase-feeding program formulated to meet or exceed NRC (1998) recommendations was used and pigs had ad libitum access

to feed and water. Feed delivered to each feeder was recorded. At an average pen weight of 127 kg, the entire pen was shipped to a commercial abattoir for harvest and carcass measurements. From weaning to wk 19 post-weaning, pigs at 0.73 and 0.69 m^2/pig had higher ADG (871, 862, 853, 848, 830 g/day for 0.73, 0.69, 0.65, 0.61, and 0.57 m^2/pig, respectively), ADFI (1.88, 1.85, 1.82, 1.82, 1.81 kg/day for 0.73, 0.69, 0.65, 0.61, and 0.57 m^2/pig, respectively) and were heavier (122.4, 121.6, 120.1, 119.4, 117.2 kg for 0.73, 0.69, 0.65, 0.61, and 0.57 m^2/pig, respectively) than pigs at 0.65, 0.61, and 0.57 m^2/pig. Floor space had no affect on morbidity and mortality. Pigs at 0.57 m^2/pig had less backfat and higher percent lean than those at 0.65, 0.69, and 0.73 m^2/pig. These results suggest that 0.69 m^2/pig is the optimum floor space for maximizing pig growth performance in wean-to-finish systems which is less than commonly recommended floor spaces.

Key Words: Pigs, Growth performance, Floor space

W184 Association of number of services and reservice intervals with reproductive performances in female pigs on commercial farms. Y. Takai* and Y. Koketsu, *Meiji University, Kawasaki, Kanagawa, Japan*.

Increased number of services and prolonged reservice intervals (RI) lowered herd productivity. Our objectives were to observe a reservice occurrence and RI; farrowing rate and subsequent pigs born alive (PBA) by the number of services and RI; and an interaction between the number of services and parity with the reproductive performances. We used 115,731 serviced and 94,086 farrowed female pig records from 117 farms in 2002 in this study. A service was defined as one or more mating events in a 10-d time period. The number of services were categorized into three groups: first, second, and third or later-services. Six groups of RI were formed: 11 - 17, 18 - 24, 25 - 38, 39 - 45, 46 - 107, and 108 - 150 d. Farrowing rate and PBA by the number of services and the RI groups were compared using the statistical mixed models. All models included farm and mated mo as a random effect. The proportions of the serviced female pigs by first, second, and third or later-services were 88.6, 9.7, and 1.7%, respectively. Farrowing rate decreased from 83.7 to 48.4% as the number of services increased from first to third or later-services (P < 0.05). The second-service group had 0.4 or more PBA than the first-service group at parity 1 and 2 (P < 0.05). No difference in PBA was found between the number of service groups at parity 0 and ≥ 3. The mean of the RI was 44.4 ± 0.3 d. The proportions of the RI 18 - 24 and 39 - 45 d groups were 39.3 and 12.3%, respectively. As parity increased from 0 to ≥ 6, the proportions of the RI 18 - 24 d group increased from 37.6 to 44.1%, while the proportions of the RI 39 - 45 d group decreased from 13.3 to 8.9% (P < 0.05). The RI 18 - 24 d group had a lower farrowing rate than the RI 25 - 38 d group (P < 0.05), but had farrowing rates similar to the RI 11 - 17, 39 - 45, 46 - 107, and 108 - 150 d groups. No difference in PBA was found between the RI groups. In conclusion, increasing farrowing rate at first service, and minimizing the RI in reserviced females improved herd productivity.

Key Words: Days to reservice, Return to service

W185 Variability and repeatability of gestation length across parity associated with reproductive performance in a cohort of gilts on commercial farms. Y. Sasaki* and Y. Koketsu, *Meiji University, Kawasaki, Kanagawa, Japan*.

Assistance to sows and piglets during farrowing and early lactation enables producers to decrease perinatal mortality. It is useful for producers to estimate gestation length (GL) and the due birth dates to farrowing in individual sows, because early inductions of parturition cause high neonatal mortality. The objectives were to observe the GL across parities; repeatability and correlation of the GL between consecutive parities; and the associations between GL and three litter size variables (total pigs born, pigs born alive, and dead piglets). An observational study over 6 yr was conducted by using 94 farms containing 67,028 farrowed records of 14,140 gilts born during 1999. Variance components analysis was used to determine repeatability of GL. Partial correlation analysis was done using total pigs born as a controlled variable. The GL was categorized into seven groups: ≤ 112, 113, 114, 115, 116, 117, and ≥ 118 d. Mixed models were used to analyze the associations between GL and the litter size variables. Random effects were farm, farrowing yr, the four periods of three-mo intervals, and the yr x the four periods. The means of GL across parities were from 115.2 to 115.4 d. The GL ranged from 105 to 125 d. The proportions of sows with GL 114, 115, and 116 d in all farrowing events were 19.2, 30.8, and 22.2%, respectively. A difference of frequency distributions of GL across parities was not found. The GL between consecutive parities from 1 to 6 were correlated (0.41 ≤ r ≤ 0.58; P < 0.05). The repeatability of GL was 0.47. Sows with GL 113 - 116 d had greater pigs born alive than those with GL ≤ 112 and ≥ 117 d (P < 0.05). Sows with GL ≤ 112 d had greater dead piglets than those with GL ≥ 113 d (P < 0.05). The GL became shorter, as total pigs born increased. Sows farrowed ≥ 14 pigs had 0.7 d shorter GL than those with ≤ 8 pigs (P < 0.05). High repeatability and correlations in the GL were found in this study. Keeping records of GL at each parity is recommended to estimate subsequent GL.

Key Words: Management, Parturition, Sows

W186 Lifetime assessment of sows mated 4 to 6 days after weaning in commercial breeding herds. Y. Hoshino* and Y. Koketsu, *Meiji University, Kawasaki, Kanagawa, Japan*.

Our objectives were to examine weaning-to-first-mating interval (WMI) across parities; probability of sows being mated 4 - 6 d postweaning at subsequent parity; repeatability and correlations in WMI between consecutive parities; and an association between lactation length (LL) and probability of sows being mated 4 - 6 d postweaning. An observational cohort study over 6 yr was conducted by using 94 farms containing 58,144 WMI records of 14,140 gilts born during 1999. Five groups of WMI were formed: 0 - 3, 4 - 6, 7 - 20, 21 - 27, and ≥ 28 d. Spearman rank correlation analysis was done. Variance components analysis was used to determine repeatability of the WMI groups. Mixed models were used to analyze the associations of the WMI groups and LL with the probability of sows being mated 4 - 6 d postweaning at subsequent parity. Random effects were farm, farrowing yr, the four periods of three-mo intervals, and the yr x the four periods in all models. The overall proportion of WMI 4 - 6 d group in all WMI groups was 81.8%. As parity increased from 1 to ≥ 7, the means of WMI decreased from 9.7 to 5.8 d, and the proportion of WMI 4 - 6 d increased from 67.0 to 90.4% (P < 0.05). The WMI 4 - 6 d group had the highest farrowing rate, and had greater subsequent pigs born alive than the WMI 7 - 20 d group (P < 0.05). The correlation coefficients

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of WMI between consecutive parities were low ($0.11 \leq r \leq 0.18$; $P < 0.05$). The repeatability of WMI was low (0.08). The probabilities of sows being mated 4 - 6 d postweaning at subsequent parity in the WMI 0 - 3, 4 - 6, 7 - 20, 21 - 27, and $\geq$ 28 d were 82.6, 88.4, 73.9, 75.6, and 69.6%, respectively. The probability of sows being mated 4 - 6 d increased from 59.8 to 83.0% as LL increased from 8 to 31 d ($P <$ 0.05). These results indicated that sows in any WMI group were more likely to be mated 4 - 6 d postweaning at subsequent parity. Increasing LL at subsequent parity can be used for sows with prolonged WMI to increase the probability of sows being mated 4 - 6 d postweaning at subsequent parity.

Key Words: Farm management, Weaning-to-first-mating interval

Ruminant Nutrition: Analytical Techniques

W187 Can the chemical composition of the whole body of a goat be estimated from parts of its body? I. A. M. A. Teixeira*[1,4], K. T. Resende[1], J. M. Pereira Filho[2], M. M. Salin[1], R. A. Gomes[1], R. C. Canesin[1], and L. O. Tedeschi[3], [1]*Universidade Estadual Paulista/FCAV, Jaboticabal, SP, Brazil*, [2]*Universidade Federal de Campina Grande, Patos, PB, Brazil*, [3]*Texas A&M University, College Station*, [4]*FAPESP, São Paulo, SP, Brazil*.

Two trials were conducted to determine which part of the empty body of Boer x Saanen male kids can be used to predict chemical composition of the whole body. In the first trial, kids were fed *ad libitum* and were slaughtered at 5, 10, and 15 kg BW. Eighteen animals were allocated to one of three nutritional levels (*ad libitum* and restricted to 30 and 60% of the *ad libitum*), within six groups. When the animal in the *ad libitum* nutritional level reached 15 kg BW, all animals in the group were slaughtered. In the second trial, kids were fed *ad libitum* and slaughtered at 15, 20, and 25 kg BW. Similar to trial 1, twenty-one animals were allocated to three nutritional levels into seven groups. The animals in a group were slaughtered when the animals in the *ad libitum* nutritional level reached 25 kg BW. The following body parts were used: head plus feet, hide, organs (all viscera, blood and abdominal fat), neck, shoulder, ribs, loin, leg, whole 9 to 11th ribs and right half carcass. The means of chemical composition obtained for each treatment (body and body parts), within slaughter weight and nutritional level, were subjected to principal component and cluster analyses. The whole 9 to 11th ribs and neck had the highest accuracy in predicting the body composition of the kids. The removal of the whole 9 to 11th ribs to measure body composition damaged the retail price of the carcass. Our experiment indicated the composition of the neck was as accurate as the whole 9 to 11th ribs to estimate body composition. Additionally, fat concentration in the neck was accurate to predict the composition of all body nutrients and energy. Therefore, we recommend the use of the neck to estimate the body composition.

Key Words: Indirect method, Multivariate, Neck

W188 Calibration of a respiratory chamber for calorimetry studies. N. Rodriguez*[1], W. Campos[1], and M. Lopez[2], [1]*Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil*, [2]*Consejo Superior de Investigaciones Científicas, Granada, España*.

The influence of CO_2 on O_2 determination by a paramagnetic analyzer was performed using mixtures of O_2, CO_2 and N_2 with the following proportions: 21:0:79; 21:0.5:78.5; 21:1:78 and 21:1:78. These gases were injected in the analyzers for four minutes and thereafter six samples were analyzed. This procedure was performed five times. The effect of CO_2 on O_2 determination was calculated by regression. To calibrate the system (analyzers + acrylic respiration chamber) atmospheric air, CO_2 (99.99%), CH_4(99.99%) and N_2 (99.99%) were injected in the chamber for six h by a rate of 68.51L/min, 0.35L/min, 0.04L/min and 1.10L/min, respectively. These flows reproduce the respiratory exchanges of a lamb of 65 kg (nitrogen was used to reduce the O_2 concentration inside of the system). After the six h, atmospheric air was injected by a rate of 70L/min for more 14 h. The concentrations of gases inside the chambers and of atmospheric air that was inflowing were analyzed every eight minutes during the whole procedure (20 h). The volumes of the injected gases were determined by gravimetric method. The gases cylinders were weighted before and after the injection, then the following densities were considered: 1.964776786g/l for CO_2, 0.716205357g/l for CH_4 and 1.250892857g/l for N_2. The injection of gases mixtures in the oxygen analyzer resulted on the following equation:$[O_2] = [O_2]-(0.0053X_2 + 0.0117X)$. This shows the necessity of using correction factors for the influence of CO_2 on O_2 determination by analyzers that use a paramagnetic principle. The system correction factors were 1.0379, 1.1885 and 1.0009 for determination of the volume of CO_2, CH_4 and O_2, respectively. It shows that the efficiency of gases determination was almost 100% suggesting a good performance of the system. To confirm those results measures of heat production of 12 lambs fed *ad libitum* with hay and concentrate (50%) were determined by open circuit respiratory exchanges. The values recorded varied from 330 to 539kj/kg$^{0.75}$ with an average of 434kj/kg$^{0.75}$ after 20 h of measurements for each animal. These values are similar to those found in the literature which suggest a good operation of the system.

Key Words: Respirometry, Calorimetry, Chamber

W189 Lipe, an external natural marker for digestibility studies. E. Saliba, N. Rodríguez*, and D. Pilo-Veloso, *Universidade Federal de Minas Gerais, Belo Horizone, Minas Gerais, Brazil*.

Lignin from wood of eucalyptus was isolated and purified giving a hydroxyphenyl propane polymer called LIPE. It has been tested as an external marker of fecal production in digestibility trials. In rabbits, sheep and swine, dry matter digestibility, voluntary feed intake and fecal output were compared using LIPE and total fecal collection. Feed intake was not affected by marker, and fecal recuperation for rabbits was 99.3%, for sheep 96.9%, and for swine 102.6%. The LIPE marker was used to test fecal production, digestibility and metabolic energy content (ME) of various feed ingredients, compared with chromic oxide and total fecal production in chikens. Estimates of digestibility and ME content using LIPE were similar than those obtained with total fecal collection ($P>0.05$). An experiment with Nelore esophageal fistulated steers was ran on pasture of Brachiaria brizantha CV. Marandu. Chromic oxide (CO) and LIPE were used to estimate fecal excretion and intake comparing different periods of adaptation to markers, three (CO3 and LIPE3) and 7 d (CO7 and LIPE7). Dry matter intake was estimated to be 2.12%, 2.09%, 2.16% and 2.10% of LBW for treatments CO3, LIPE3, CO7 and LIPE7, respectively, ($P>0.05$) which are normally expected values. Fecal excretion estimated by LIPE was constant after 48 hours of initial dosage. When estimated

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