

p.m. and a.m. milkings were collected during a 2-wk period (wk 23 and 24 of lactation) from all cows, and blood samples were collected hourly during a 16-h post-feeding interval during wk 27 of lactation from only MP cows. Milk glucose was affected ( $P<0.01$ ) by dietary treatment such that both PP and MP cows fed XPY+P169 had 28% greater ( $P<0.05$ ) milk glucose levels ( $251\pm$  mg/dL) than Control cows and 32% greater milk glucose levels than XPY-fed cows. Diurnal plasma glucose concentration ( $59\pm 1$  mg/dL) was not affected by diet in MP cows. Plasma insulin levels were affected ( $P<0.01$ ) by dietary treatment and time such that plasma insulin levels in MP cows fed XPY+P169 ( $0.86\pm 0.05$  ng/mL) were 34% and 30% greater ( $P<0.01$ ) than in MP cows fed Control and XPY, respectively. Although 16-h post-feeding fluctuations in plasma glucose did not significantly differ among Control, XPY and XPY+P169 groups, the lack of a detectable increase in plasma glucose may be due, in part, to the fact that plasma insulin levels increased faster in XPY+P169 fed cows. Milk glucose and plasma insulin responses to XPY+P169 feeding suggest that XPY+P169 supplementation might have enhanced gluconeogenesis and increased glucose uptake by the mammary gland.

**Key Words:** Yeast Culture, Propionibacteria, Glucose

**M137 Supplemental feeding of propionibacteria to lactating dairy cows: Effects on plasma hormones and metabolites.** M. M. Alemán<sup>\*1</sup>, D. R. Stein<sup>1</sup>, D. T. Allen<sup>1</sup>, K. W. Gates<sup>1</sup>, K. J. Mertz<sup>2</sup>, T. G. Rehberger<sup>2</sup>, D. A. Jones<sup>1</sup>, and L. J. Spicer<sup>1</sup>, <sup>1</sup>Oklahoma State University, Stillwater, <sup>2</sup>Agtech Products, Inc., Waukesha, WI.

From 14 d prepartum to 175 d postpartum, multi- (MP) and primiparous (PP) Holstein cows were fed one of three dietary treatments: 1) Control (n=13), fed a

total mixed ration (TMR); 2) HP169 (n=11), fed TMR plus  $6 \times 10^{11}$ /head/d (high dose) of Propionibacterium Strain P169; or 3) LP169 (n=14), fed TMR plus  $6 \times 10^{10}$ /head/d (low dose) of P169. Blood samples were collected weekly for 25 wk and analyzed for plasma concentrations of glucose, insulin, insulin-like growth factor-I (IGF-I), leptin, nonesterified fatty acids (NEFA) and cholesterol (CHOL). Between wk 25 and 30 bovine somatotropin (bST) was given to all groups every 2 wk. Plasma glucose was affected by diet x parity ( $P<0.001$ ) such that glucose levels in LP169 MP cows ( $59.8\pm 1.1$  mg/dL) were 5.5% lower than in HP169 MP cows; LP169 PP cows ( $67.9\pm 0.9$  mg/dL) had 6% to 9% greater plasma glucose levels than HP169 and Control PP cows. Plasma insulin was affected by diet ( $P<0.001$ ) such that LP169 had less plasma insulin than HP169 and Control cows (during wk 13-25), and HP169 cows had greater insulin than Controls (during wk 1-12). Plasma IGF-I, NEFA and leptin levels did not differ ( $P>0.15$ ) among diet groups between wk 1 and 25, but PP cows had greater ( $P<0.02$ ) IGF-I and lower ( $P<0.01$ ) NEFA levels than MP cows. Plasma CHOL was affected by diet x parity ( $P<0.01$ ) such that LP169 MP cows ( $246\pm 11$  mg/dL) had 25% greater levels than HP169 and Control MP cows; CHOL levels in PP cows did not differ among diet groups. During bST, HP169 MP cows and LP169 PP cows had lower ( $P<0.01$ ) IGF-I levels than their respective Controls. Regardless of parity, LP169 cows had greater ( $P<0.10$ ) leptin levels than Controls cows, and HP169 cows had greater ( $P<0.01$ ) NEFA than Control cows. We conclude that P169 may hold potential as a direct-fed microbial to enhance metabolic efficiency during early and mid-lactation.

**Key Words:** Propionibacteria, Direct-fed Microbial, Hormones

## Production, Management and the Environment: Environment and Economics

**M138 Effects of population density on growth and vermicompost production of earthworms (*Eisenia spp.*).** J. Hernández<sup>\*1</sup>, S. Pietrosevoli<sup>1</sup>, W. Echeverría<sup>2</sup>, R. Palma<sup>2</sup>, A. Faria<sup>1</sup>, C. Contreras<sup>2</sup>, and A. Gomez<sup>1</sup>, <sup>1</sup>La Universidad del Zulia, Maracaibo, Zulia, Venezuela., <sup>2</sup>Proyecto FONACIT PSI-200000792, Maracaibo, Zulia, Venezuela.

During 84 days, in an area classified as dry forest of Zulia state, Venezuela; a medium scale experiment was performed in order to evaluate the effects of three population densities: low, medium and high (1000, 2000 and 4000 earthworm/m<sup>2</sup> respectively) on earthworm biomass and superficial vermicompost production. Initial biomass was  $166.53 \pm 11.34$  mg/earthworm. Experimental design was a completely randomized with five replicates. Earthworms were maintained in concrete bins with a precomposted mixture 50:50 of oil palm fiber and bovine manure. Total substrate offered was  $0.220 \text{ m}^3$  /bin. Every 21 days, biomass of the first 20 earthworms founded in the upper area of the bins was recorded; and free surface vermicompost was collected having its volume measured. Data was analyzed using STATISTIX software. Statistical differences were established among treatments for both earthworm biomass  $327.98 \pm 46.08$ ;  $278.9 \pm 47.8$  and  $198.4 \pm 31.4$  mg/earthworm and total vermicompost production  $0.039 \pm 0.004$ ;  $0.045 \pm 0.002$  and  $0.049 \pm 0.035 \text{ m}^3$  for low, medium and high density respectively. Tukey media test not showed differences between medium and low densities for biomass, and neither between medium and high density for vermicompost production. Population density of earthworms affected biomass and vermicompost production, with the lowest biomass/earthworm with high density treatment, which achieved the best vermicompost production.

**Key Words:** Population Density, Earthworms, Biomass and Vermicompost

**M139 Effects of feeding frequency on growth and reproduction of earthworms (*Eisenia spp.*).** J. Hernández<sup>1</sup>, S. Pietrosevoli<sup>\*1</sup>, A. Faria<sup>1</sup>, R. Palma<sup>2</sup>, and R. Canelón<sup>2</sup>, <sup>1</sup>La Universidad del Zulia., Maracaibo, Zulia, Venezuela., <sup>2</sup>Proyecto FONACIT PSI- 200000792, Maracaibo, Zulia, Venezuela.

During 105 days, in an area classified as dry forest of Zulia state, Venezuela; a medium scale experiment was performed in order to evaluate the effects of three feeding frequency: once (100% substrate), three (50, 25 and 25 % substrate) and four times substrate supply (25, 25, 25 and 25 % substrate) on earthworm biomass, total biomass/feeding frequency and cocoons production. Total substrate offered was  $0.220 \text{ m}^3$ /bin. Initial density and biomass were 1000 earthworm/m<sup>2</sup> and  $234.88 \pm 19.93$  mg/earthworm respectively. Experimental design was a completely randomized with five replicates. Earthworms were maintained in concrete bins with a precomposted mixture 50:50 of oil palm fiber and bovine manure. Every 21 days, biomass of three groups of 100 earthworms each was recorded. On day 42, cocoons founded on the upper 10 cm of the bins were collected. At the end of the trial after capturing all the specimens in each bin, total earthworm biomass was registered. Data was analyzed using STATISTIX software. Statistical differences were established among treatments for earthworm biomass  $136.49 \pm 12.29$ ;  $147.95 \pm 11.92$  and  $172.56 \pm 12.46$  mg/earthworm for once, three and four times feed supply respectively. Tukey media test not showed differences between once and three times supply. Cocoons production ( $345 \pm 155.37$ ;  $363.6 \pm 108.47$  and  $168 \pm 66.126$  cocoons for once, three or four time feed supply respectively) and total biomass ( $426.21 \pm 121.26$ ;  $383.51 \pm 59.13$  and  $342.15 \pm 190.32$  g/bin for once, three or four time feed supply respectively) were not influenced by treatments ( $p \leq 0.07$  and  $p \leq 0.06$ ). Feeding frequency affected earthworm biomass. The highest individual biomass was registered when feed was supplied four times. Benefits obtained in increasing feed frequency are not equilibrated with increasing of management task required.

**Key Words:** Feeding Frequency, *Eisenia* Earthworms, Biomass and Cocoons Production

**M140 Evaluation of advanced dairy systems shade tracker fans and korral kool coolers on a commercial dairy in Buckeye, Arizona.** M. VanBaale<sup>1</sup>, D. Ledwith<sup>1</sup>, R. Burgos<sup>\*1</sup>, R. Collier<sup>1</sup>, D. Armstrong<sup>1</sup>, J. Smith<sup>2</sup>, M.

Brouk<sup>2</sup>, and L. Baumgard<sup>1</sup>, <sup>1</sup>University of Arizona, Tucson, <sup>2</sup>Kansas State University, Manhattan.

Multiparous (n=200) and primiparous (n=100) dairy cows balanced for parity, stage of lactation, and milk yield were randomly assigned to one of two cooling treatments (trts). Cows were cooled with Korral Kool (KK) stationary coolers or Advanced Dairy Systems Oscillating Fan plus Misters Shade Tracker (ADS-ST) system. The cooling systems in each pen were attached to a shade structure (121.92 m long by 9.14 m wide by 3.96 m high) oriented north-south. Individual milk yields and pen DMI were collected daily and milk components were obtained monthly. Respiration rates (RR) and body surface temperatures (ST) were obtained weekly at two times during the day and vaginal body temperatures were taken from a sub set (n=6) of cows used in a switch back design over a four day period during wk 13 of the study. BCS and body weights (BW) were observed monthly from a subset (n=20) of both primiparous and multiparous cows throughout the study. Average daily milk production did not differ for multiparous cows housed in ADS-ST or KK (41.8 kg/d) pens. However, daily milk yield for primiparous cows housed under KK conditions (37.8 kg/d) tended to be higher than cows housed under ADS-ST conditions (36.7 kg/d). Weekly DMI were similar between trts (25.0 kg/d) and there was no difference in BW change (6 kg) between multiparous cows, respectively. However, primiparous cows housed under ADS-ST conditions gained less BW (8.6 vs. 39.8 kg) than those cooled with KK. Multiparous cows cooled with ADS-ST had a higher RR (60.5 vs. 58.3 breathes/min), however, RR (59.7 vs. 58.6 breathes/min) in primiparous cows did not differ. There was no trt difference in mean core (vaginal) body temperature (32.6 C) or body surface temperature (32.2 C) respectively. The ADS-ST cooling system used less electricity (526 vs. 723 kwh/d) and water (291 vs. 305 L/d) than the KK coolers. The daily variable costs for the ADS-ST system were lower (\$27.30 vs. \$33.36) and the daily cost/cow (\$0.11 and \$0.15), and per cwt of milk (\$0.10 and \$0.14) was less for ADS-ST compared to the KK coolers.

**Acknowledgements:** We thank United Dairywomen of Arizona, ADS and KK for funding the trial.

**Key Words:** Evaporative Cooling, Heat Stress

**M141 Evaluation of cooling systems to improve lactating Holstein cows comfort in the sub-tropics.** C. N. Lee\* and N. Keala, *University of Hawaii-Manoa, Honolulu.*

Previous studies from various laboratories had demonstrated that summer heat results in lower milk production, depressed fertility, higher respiration rates and increase stress in lactating cows. This study was designed to evaluate various cooling systems in 3 commercial dry-lot dairies located within 1km of each other in the southwestern shores of Oahu. Dairy A (n=200) had only shade, dairy B (n=200) had either shade with fans at the feed alley or shade with foggers at the stanchion and dairy C (n=200) had Korral Kool fans and misters in Saudi pens and pens with oscillating fans with misters. Respiration rates (RR/min.) for summer (Sept.-Oct.) and winter (Feb.-March) for dairy A were 88 and 70, dairy B were 80 and 60 and dairy C were 63 and 52. In dairy B, cows in pens with shade and foggers at stanchion had lower RR than cows with shade and fans over the stanchion (71 vs 89) for the summer months. Similar trend was observed in the winter months. In dairy C, cows in Korral Kool pens had lower RR than cows in pens with oscillating fans with misters; summer 60 vs 65 and winter 47 vs 57. In all dairies, RR were lower in am (0900-1100) vs pm (1300-1500). Korral Kool cows had the lowest RR, followed by oscillating fans then cows under foggers. All these cows had RR below the critical level of 70/min. The THI directly under shade in all dairies were 3-6 units lower than that under the sun. However, all THI during data collection period were above 72; range of 73-78 in winter and 76-82 in summer. Skin temperatures were lowest for cows standing under the foggers followed by cows under Saudi pens but these animals have similar rectal temperatures. The study showed that adequate shade with strong wind speed and misters are most effective in keeping cows cool in the sub-tropics.

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**Key Words:** Respiration Rate, THI, Dairy Cows

**M142 A comparison of methods for determining body temperature of Holstein cows during hot weather.** C. Wildman\*, J. West, and J. Bernard, *The University of Georgia, Tifton.*

Eight lactating Holstein cows were used in a randomized complete block trial to compare methods for body temperature measurement over a 4 d period during hot weather. Temperature measures were taken intra-vaginally using the HOBO Water Temp Pro® and at the tympanic membrane using a Stowaway XTI Temperature Logger®. Cows were blocked by environment; four cows were located outdoors with shade cloth only and four cows were housed in a free-stall barn with high velocity fans and high-pressure misters for cooling. Body temperatures were recorded at 6 min intervals for calculation of an hourly mean. Ambient temperature and relative humidity were recorded in both environments for calculation of temperature-humidity index (THI). Days were divided into 3 h intervals and hourly data was analyzed for each interval across days. No differences were observed for measurement method during any interval and no significant interactions with measurement method occurred. Mean intra-vaginal and tympanic temperature during the 15:00-18:00 h interval, the time during which environmental temperature was highest, were 39.8 and 39.7°C respectively. Two of the cows in the study also had ruminal cannulae and were used to compare ruminal temperature with intra-vaginal and tympanic membrane measures. Body temperature and weather data were recorded and calculated similarly as for study one. Ruminal temperature was higher than tympanic and vaginal temperature for the 0:00-3:00 h interval (40.2, 38.9, 38.9°C,  $P=0.0085$ ), 3:00-6:00 h interval (40.4, 38.9, 38.9°C,  $P=0.0047$ ), and 6:00-9:00 h interval (40.3, 38.7, 38.8°C,  $P=0.0177$ ). No differences were observed for the other intervals. No differences were noted between tympanic and vaginal temperature at any interval. Results of this research indicate that tympanic and vaginal temperature are similar measures of cow body temperature, while rumen temperatures are elevated at times and may not accurately reflect body temperature.

**Key Words:** Intra-vaginal Temperature, Tympanic Temperature, Heat Stress

**M143 Influence of high temperatures on productive performance of sows.** L. M. Ramírez<sup>1</sup>, M. Aparicio<sup>1</sup>, J. Morales<sup>1</sup>, R. Lázaro<sup>2</sup>, and C. Piñero<sup>1</sup>, <sup>1</sup>PigCHAMP Pro Europa, S.A., Segovia, Spain, <sup>2</sup>U. P. Madrid, Spain.

The influence that hot summer weather conditions have on reproductive performance of sows, especially during lactation, has been described thoroughly in the literature but few papers have quantified the effects. Heat affects fertility and prolificacy, and increases sow and piglet mortality. August of 2003 was the warmest month in Spain for the last 50 years and an increase of failures in reproduction was observed. We assessed the influence of the high temperatures (often above 40°C) occurring during this month in 58 commercial farms. In the study the reproduction data for the whole year was provided by database PigCHAMP® and included farrowing rate (FR), pre-weaning mortality (PWM), percentage of dead piglets born (DPB), repeat mating rate (RMR), total weaned piglets per sow (WP), sows mortality rate (MR), and weaning to service interval (WSI). The MR observed in August was the highest of the year and was twice as high as the average for 2003 (12.4 vs 6.0%;  $P=0.0001$ , respectively). Most of the mortality occurred suddenly and close to the farrowing indicating that sows are very sensitive to extreme weather conditions. The DPB (10.8 vs 8.4%;  $P=0.0001$ ) and PWM (11.9 vs 10.8%;  $P=0.06$ ) indexes also increased in August, affecting total WP (9.3 vs 9.1;  $P<0.01$ ). Reproductive parameters were also affected by hot weather conditions and the RMR increased from 14.0 to 15.8% ( $P=0.07$ ) during August. Probably the increase observed in RMR in August affected FR in December (three months later; 73.8 vs 81.9%, the average of the year;  $P<0.001$ ). The WSI increased in August, although the differences with respect to the average of 2003 did not reach significance (7.3 vs 6.8 d;  $P>0.10$ ). We conclude that high temperatures negatively impacted mortality and reproductive and productive performance of sows.

**Key Words:** Heat Shock, Sows, Reproductive Performance

**M144 Component and factor analysis of pork farm odor using neural networks.** K. Janes, S. Yang, and R. Hacker\*, *University of Guelph, Guelph, Ontario, Canada.*

The pork industry in many countries has suffered declining and stagnate growth due to public concerns regarding various quality of life issues. Non-farming residents living in close proximity to pork farms (PF) are concerned that the odor emissions originating from PF are a health threat and reduce their enjoyment of the rural outdoors. There has been numerous research studies on modelling of PF odor using single-component analysis, to gain understanding of the odor and to allow a convenient method for measurement. However, PF odor is complex with over 200 different components that interact and a variety of factors that contribute such as humidity. It is proposed that multiple-component, multiple-factor analysis of PF odor using neural networks, will yield more accurate intensity predictions. A data set was compiled from 26 PF with 131 samples for air-phase concentrations of ammonia, hydrogen sulphide, time, date, temperature, humidity and ventilation. Three models were developed using the data sets, one linear multiple regression model (LMR1) and two neural network models (NN1 & NN2). The NN models were constructed using neural network-based structural-learning-with-forgetting method. This method is based solely on data, without initial theories and pre-processing. The results were analysed using mean absolute error, standard deviation and coefficient of determination. A model's precision in predicting PF odor intensity is greater the lower the standard deviation. LMR1 and NN1 realised an  $E_a$  of 64.9% & 31.2% a s of 67.7% & 20.5% and an  $R^2$  of 0.48 & 0.83 respectively. These results indicated that LMR1 is far less accurate than NN1. NN2 considered time and temperature in addition to the parameters in NN1. NN2 realized a performance gain in  $E_a$  of 11.9% over NN1. Standard deviation decreased from 20.7% to 12.7% for NN1 and NN2 respectively.  $R^2$  remained approximately the same for both NN1 and NN2. These performance gains indicate that factors other than odorants are very relevant to the analysis of PF odor. An enhanced electronic nose that utilized NN2 could greatly assist the pork industry to enhance its public image in an economic manner.

**Key Words:** Odor, Modelling, Pig Farm

**M145 Chemical and environmental treatment of whole tree juniper bedding to lower fecal coliform counts.** M. Gamroth\*<sup>1</sup> and L. Swan<sup>2</sup>, <sup>1</sup>*Oregon State University, Corvallis*, <sup>2</sup>*U.S. Forest Service, Klamath Falls, OR.*

Byproducts of wood processing are an important source of organic bedding on dairy farms. Unfortunately, organic beddings can be contaminated with mastitis-causing bacteria, especially those made from external bark or whole trees. Samples of fresh chipped whole tree juniper showed high counts of fecal coliform bacteria, including *E. coli* and *Klebsiella* species. The objective of this study was to evaluate alternative chemical and environmental treatments to limit the fecal coliform contamination of whole-tree green chipped juniper and dry chipped juniper. Four chemical/environmental treatments were tested on two types of chipped juniper. Whole juniper trees with needles (GREEN) and without needles (DRY) were chipped to about 2.5 to 4.0 cm (1 to 1-1/2 inch) in size. Approximately 1 kg (2.2 lb) portions of the chips were poured into 40 cm x 60 cm (16" x 24") aluminum pans prior to treatment. Treatments to control bacteria were: 50 ppm iodophor solution sprayed over the surface of the panned chips (GERMICIDE), powdered calcium hydroxide, hydrated lime, at 120 ml (4 oz) /cubic foot of chips mixed into panned chips (LIME), open air drying of chips in the dairy barn (AIR DRY), and composting chips held in 19 liter (5 gal) buckets and turned every 5 days (COMPOSTED). Chips treated with lime and germicide were sampled after 14 hours. Air dry and composted were sampled at 7 days and 15 days. Air drying and composting had little effect on bacteria counts. Levels of fecal coliform never reached acceptable levels. The sprayed-on germicide had no effect on bacteria counts in the DRY chips and reduced the count to 600 CFU/g in the GREEN chips. Hydrated lime dusted on the chips reduced bacteria counts after 14 hours of contact time. GREEN chips showed no growth and DRY chips were 100 CFU/g. Lime was the only treatment that helped reduce bacteria counts to acceptable levels.

**Key Words:** Bedding, Mastitis, Juniper

**M146 Effect of season on ammonia volatilization from urine and beef and dairy feces on pasture.** P. Tyler\*, K. Cummins, C. Wood, and B. Wood, *Auburn University, Auburn University, AL.*

An experiment was done to evaluate the effect of season of the year and diet on ammonia volatilization from cattle urine or beef or dairy feces when applied to pasture. Dairy cows were fed corn, soybean, and corn silage diets. Beef cows were grazing annual pastures in fall and winter and bermuda grass in spring and summer. Feces and urine were collected fresh and applied to 1 m plots on typical Piedmont soils in 5 replicates. In equal numbers of control plots no feces or urine was applied. Feces and urine were each mixed, sub-sampled, and weighed amounts placed in the plot. The ring was removed after the urine soaked into the soil or after fecal application. One L of urine or approximately 1 kg of feces was placed in each plot. Ammonia loss was measured by trapping ammonia inside a 15.9 L plastic bucket placed over each urine patch or fecal pile, and flush to the soil, at 0, 6, 12, 24, 36, 48, 60, 72, 84, and 96 h after start of the experiment. Ammonia concentration was measured inside the trap after two hours using an electrochemical ammonia measuring device. Mass of ammonia in the trap was calculated. At the end of the experiment, soil samples were taken from each plot to measure concentrations of nitrate, ammonia, and carbon at depths to 20 cm. There was a significant effect of season on ammonia loss to the atmosphere from urine ( $P < .01$ ). Air temperatures had means of 28.3, 24.4, 4.6, and 19.3 degrees C for summer, fall, winter, and spring, respectively. Loss of nitrogen to the atmosphere was 0.33, 0.07, 0.029, and 0.109 % of applied total N for summer, fall, winter and spring, respectively ( $P < .01$ ). Little or no ammonia N was detected volatilizing from plots with feces. In soil, after the experiment, total carbon and N was higher in plots with feces, ( $P < .05$ ) from 0 to 5 cm depth. Ammonia and nitrate-N increased in plots where urine was applied, at the 10-20 cm depth, compared to control or feces plots ( $P < .05$ ), consistent with the small atmospheric loss of ammonia N. Cows on pasture where urine and feces are not mixed in waste management systems may lose relatively small amounts of N to the environment.

**Key Words:** Ammonia, Environment, Cattle

**M147 Validating N to P ratio for estimating N volatilization from dairy manure.** V. Moreira\* and C. Cox, *LSU AgCenter SERS, Franklinton, LA.*

The objective of this study was to compare mass balance (MB) and nitrogen to phosphorus ratio (N:P) methods for estimating N volatilization (NV). A secondary objective was to evaluate the pattern of NV from manure containing two proportions of urine and feces. Urine and feces were collected separately in 8 buckets from 1 to 4 cows. Immediately after collection, feces and urine were mixed to give ratios of 60:40 (HU, n = 2) and 66:34 (LU, n = 2). Two 150-g sub-samples were incubated on 9-1/4" x 6-1/2" x 1-1/2" aluminum pans for each time. Incubations occurred from 0600 to 1300 h on June 10, 2004. Two sub-samples per time per bucket were acidified with 2 mL of 66% H<sub>2</sub>SO<sub>4</sub> at 0, 2, 3 and 6-h of incubation and immediately stored in a freezer. The pH was measured upon manure pouring. Dry matter, N and P (Kjeldahl method), NDF, and ADF were analyzed after samples were lyophilized. Ambient temperature averaged 28.2° C (22.8 to 31.1° C) and relative humidity was 73.8% (51 to 100%). Manure nutrient contents averaged 10.3% DM, 4.05% N, 0.69% P, 34.3% NDF, and 22.1% ADF at 0-h. The pH slowly increased ( $P \leq 0.08$ ) for LU in the first 16 minutes, but treatments were similar at 2, 3 and 6 h. Nitrogen volatilization (grams) increased with time similarly ( $P \geq 0.10$ ) for both treatments (LU and HU). Volatilization estimated by MB and N:P reached respectively 12.8% and 13.8% after 6 h of incubation. A linear regression equation of NV (grams) was estimated as  $N:P = 0.006 + 1.051 \times MB$  ( $P \leq 0.001$ ;  $R^2 = 0.84$ ;  $RMSE = 0.021$ ) and the slope was not significantly different from 1 ( $P \geq 0.10$ ). Urine:feces ratios used in this trial had minimum effect on N volatilization, particularly after 6 h of incubation. Method of estimation did not significantly affect NV ( $P \geq 0.10$ ). The results of this preliminary study indicate that N:P ratio can estimate N volatilization from manure as well as MB, when manure is collected from and stored in confined areas.

**Key Words:** N Volatilization, Nitrogen to Phosphorus Ratio, Mass Balance

**M148 Effects of selected environmental factors on feed intake of three breeds of beef bulls during feedlot performance tests.** G. T. Tabler, Jr.\*<sup>1</sup>, A. H. Brown, Jr., E. E. Gbur, Jr., I. L. Berry, Z. B. Johnson, D. W. Kellogg, and K. C. Thompson, *University of Arkansas, Fayetteville*.

Selected environmental data were analyzed to more precisely define the relationship between climate and feed intake of three breeds of performance-tested beef bulls during feedlot performance tests. Intake data originated from Angus, Polled Hereford and Simmental bulls in University of Arkansas Cooperative Bull Tests at Fayetteville, Hope and Monticello from 1978 through 1990. Bulls were given a 21-d adjustment period, then individually full-fed a total mixed ration twice daily in the same stall for 140 d. As formulated, diet contained 1.6 Mcal NE<sub>m</sub>, 0.9 Mcal NE<sub>g</sub> and 12% CP per kg DM. Initial age and weight were recorded at start of each test with weights taken at 28-d intervals. Data were pooled, divided into five 28-d periods, with data from each period and breed analyzed separately. Since environmental variables tended to be highly collinear, regression of feed intake on them would be problematic. Therefore, principal components (PCs) were calculated and feed intake was then regressed on a subset of PC values for each animal using standard regression techniques. The PCs associated with initial weight and age had the dominant effect ( $P < 0.001$ ) on intake for Polled Hereford and Simmental breeds, followed by temperature-related PCs ( $P < 0.001$ ). That order was reversed in Angus cattle with environmental PCs having the dominant effect on intake ( $P < 0.001$ ) with weight and age secondary ( $P < 0.001$ ). Numerous PCs affected ( $P < 0.001$ ) feed intake throughout the study. The R-squares ranged from 0.25 to 0.53 depending on breed and period. Results indicate environment has strong, differing effects among individual breeds and effects on intake differ as a feeding period progresses. Evidence further indicates temperature alone is inadequate to represent effects of weather on feed intake.

**Key Words:** Beef, Climate, Feed Intake

**M149 Effect of dietary nitrogen on estimates of nitrogen emission during manure collection in a freestall barn.** M. Aguerre\*<sup>1</sup>, T. Hunt<sup>2</sup>, C. Weigel<sup>2</sup>, and M. Wattiaux<sup>1</sup>, <sup>1</sup>*University of Wisconsin, Madison*, <sup>2</sup>*University of Wisconsin, Platteville*.

The objective was to measure the effect of dietary CP on estimates of N emission during collection of manure excreted by lactating cows housed in a freestall barn. At the beginning of the trial, 73 cows averaging 170 DIM (SD = 117) were randomly divided in two groups and assigned to two dietary treatments: a recommended diet (REC) formulated to meet the requirements (NRC, 2001) for rumen degradable protein (RDP) and rumen undegradable protein (RUP), or an excess diet (EXC) formulated to supply 10 % excess of RDP and RUP for a production of 36 kg/d of milk. Diets were fed during 4 monthly periods (January to May 2004, except April). Dry matter intake and milk yield were recorded daily. Feed and milk samples were collected at the end of each period. Manure produced in 24 hrs was recorded and sampled after scrapping the alleys in 6 4-hr periods staggered over 3 consecutive days. Dietary CP was 15.9 and 17.1 % (DM basis) for the REC and the EXC diets, respectively, and milk production was 33.8 kg/d/cow for both dietary treatments. Assuming no net gain or loss of body N over the course of the trial, expected manure N was calculated as N intake minus milk N. Observed manure N was the total amount collected from the alleys. Unaccounted N was calculated as expected manure N not recovered from the alleys. Intake of N was lower, but milk N (kg/d/cow) and manure N (%) were the same when cows were fed the REC diet compared with EXC diet. Expected manure N was 0.05 kg/d/cow lower in the REC than the EXC diet. Observed manure N was lower than expected manure N and averaged 0.38 kg/d/cow for both diets. Using unaccounted N as an indicator of N emission, results suggest that losses during collection were influenced strongly by the level of dietary N with higher emission when cows were fed excess dietary N relative to NRC recommendations.

	Rec. Avg	Diet SD	Exc. Avg	Diet SD
N intake, kg/d/cow	0.61	0.04	0.66	0.03
Milk N, kg/d/cow	0.17	0.01	0.17	0.01
Expected manure N, kg/d/cow	0.44	0.04	0.49	0.04
Manure N, % manure DM	3.49	0.3	3.47	0.2
Observed manure N, kg/d/cow	0.38	0.05	0.38	0.03
Unaccounted N, %	14	11.4	21	8.2

**Key Words:** Air Quality, Manure, Nitrogen

**M150 The use of bioaugmentation to reduce odor and enhance nutrient profile in stored dairy manure.** C. Ballard\*<sup>1</sup>, K. Cotanch<sup>1</sup>, J. Darrah<sup>1</sup>, E. Thomas<sup>1</sup>, S. Kramer<sup>1</sup>, W. Donohue<sup>2</sup>, and W. Champion<sup>2</sup>, <sup>1</sup>*W.H. Miner Agricultural Research Institute, Chazy, NY*, <sup>2</sup>*Pro-Act Microbial, Inc., Portsmouth, RI*.

Manure management is becoming an increasingly complex issue with regulatory pressures on livestock producers to minimize odor emissions. Pro-Act Microbial, Inc. (PM) has developed a bioaugmentation process, which works as a three-stage digester in manure lagoons and pits. The objectives of this study were to determine the efficacy of the PM system to reduce solids content of stored slurry manure, the effect of the PM system on the nutrient composition of manure at the upper and lower depths of stored dairy manure slurry, and the efficacy of the PM system to reduce objectionable odor and volatile ammonia and hydrogen sulfide in slurry manure. Eight 3785-liter vertical poly tanks were stored above ground and filled with 3200 liters dairy manure slurry averaging 4.16% solids. Tanks were blocked by fill order from spreader and assigned to either control or PM. Microbes, growth accelerator and cycle additive were added to the PM tanks ½ hour after filling. One aquarium pump was installed on each PM tank to serve as a surface aerator. Manure from each tank was sampled at filling and from the top 15-30 cm and bottom 15-30 cm after 67 d of storage. Samples were analyzed for DM, pH, total N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O, P, ammonia and hydrogen sulfide emissions and odor panel evaluation. No difference in solids content, total N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O, or P was found. Hydrogen sulfide emissions were significantly less for the PM-treated manure at both depths of manure sampled. Ammonia levels at the bottom of the tanks were also lower for PM. These findings were confirmed by a sensory panel, with 88.89% of panelists finding the PM-treated manure obtained from the top 15-30 cm less offensive while no differences in odor were found for manure from the bottom of the tanks. Manure treated with PM appears to reduce odor gas emissions after 67 d of storage.

**Time required for odor gas levels to reach 20 mg/L.**

Item	Control	PM	SE	P
Ammonia	Time	(seconds)		
Top	388.50	480.25	51.16	0.294
Bottom	474.00	630.00	18.66	0.010
Hydrogen Sulfide				
Top	451.50	1848.50	61.69	<0.001
Bottom	430.00	1217.75	22.21	<0.001

**Key Words:** Manure, Odor, Additives

**M151 Using nonlactating cattle to improve the transition of lactating cows into a new freestall barn.** C. Hill\*, M. Greenwood, C. Ballard, and R. Grant, *W.H. Miner Agricultural Research Institute, Chazy, NY.*

The objective of this study was to determine if conditioning a new freestall barn with heifers and dry cows would improve the rate of adaptation of lactating cows to the new facility. Two pens of 68 stalls each in a new, four-row freestall barn were used in this experiment. The first pen was divided into two halves of 32 stalls each. To condition the pens, pre-breeding heifers were housed in one section and dry cows were housed in the second for 4 weeks prior to introduction of lactating cows to the barn. The second pen was left vacant and unconditioned during this period. Ten primi- and ten multiparous lactating Holsteins between 52 and 182 DIM were blocked according to lactation, mature equivalent milk, and body weight prior to the study and randomly assigned to one of two treatments: conditioned pen (Cond) or unconditioned pen (Uncond). The 20 cows were observed for 24 h and behavioral observations were recorded at 15-min intervals. Observations were performed at -46 d, +2 d, and +17 d relative to moving into the new barn. The -46-d observation was performed in the old barn and used as a covariate in the analysis. Cows moved into either Cond or Uncond pen showed no difference in resting times at +2 d. There was a numerical, but nonsignificant increase in % of day spent resting for cows in the Uncond pen at +17 d (51.5 vs. 56.1%). Time spent feeding and number of meals were also similar for both treatment pens. Rumination decreased slightly at +2 d and +17 d for Cond cows after moving to the new facility, but remained constant for cows in the Uncond pen. Both groups showed a decrease in milk yields after moving into the new facility, with the Uncond pen showing a larger numerical decrease. Housing cattle in a new barn before introducing lactating animals did not seem to affect the adaptation rates of the lactating cows to the new facility. Although the Uncond pen was left empty and clean prior to moving lactating animals, it was not possible to prevent the aroma of the animals in the other pens from diffusing throughout the barn. Therefore, the olfactory stimulus may have eased the adjustment of these cows to the new facility.

**Key Words:** Adaptation, Cattle Behavior

**M152 An adjustment of the empirical Bayes prediction of milk production.** J. Villagómez-Cortés\* and A. de Vries, *University of Florida, Gainesville.*

Objective of this study was to improve the empirical Bayes prediction of future milk weights. The Bayes prediction method was proposed as a means to extend a partial lactation record to obtain estimates of milk weights in the remainder of the lactation. Prediction of future milk production of a cow is important for optimal culling decisions. The originally proposed empirical Bayes prediction method produced better predictions than those produced with the DHIA extension factors. The original method consists of fitting Wood's incomplete gamma function to a reference set of completed lactation milk weights. The reference set of completed lactations should come from cows that are similar to the cow for which predictions are sought. The milk weights from a cow's partial lactation are weighted with the estimated milk weights from the Wood's functions fitted on the reference data set to obtain a realistic, cow-specific Wood's function that can be used to predict future milk weights. However, when few milk weights are available, the resulting Wood's function tends to be near the average of the reference data set. This function may not be realistic for a cow that produced significantly less or more milk in the early part of the lactation. The proposed adjustment consists of regressing a cow's available milk weights on her predicted milk weights from the original method and then adding the intercept to those predicted future milk weights. To test this adjustment, test day milk weights of 386 first lactation cows from a Florida dairy herd were used as the reference set. The first 4 milk weights of 10 randomly selected first lactation cows were used to obtain cow-specific Wood's functions. The average prediction error (actual minus predicted milk weights) for the remainder of the lactation was calculated with and without the addition of the intercept. Average prediction errors were  $1.2 \pm 4.1$  kg and  $6.0 \pm 4.8$  kg, respectively. These results indicate that the adjustment may predict future milk weights better than the original Bayes method.

**Key Words:** Bayesian, Prediction, Lactation Curve

**M153 Economic evaluation of pre-synchronization and re-synchronization protocols in lactating dairy cows.** R. C. Chebel\*<sup>1</sup>, H. M. Rutigliano<sup>2</sup>, R. L. A. Cerri<sup>2</sup>, R. Bruno<sup>2</sup>, and J. E. P. Santos<sup>2</sup>, <sup>1</sup>University of Idaho, Caldwell, <sup>2</sup>University of California-Davis, Tulare.

Holstein cows (1,019) were assigned to a pre-synchronization with PGF<sub>2α</sub> (CON) or PGF<sub>2α</sub> and CIDR (CTAI and CED). All cows received 2 injections of PGF<sub>2α</sub> on d 35±7 and 49±7. Cows in CTAI and CED received a CIDR on d 42±7. After the 2nd PGF<sub>2α</sub> and CIDR removal on d 49±7, cows were observed for estrus, but only CON and CED were inseminated. On d 62±7 cows not inseminated began the Ovsynch and were timed AI on d 72±7. Blood samples were analyzed for progesterone (P4) on d 35±7, 49±7, and 62±7 and cows were classified as anovulatory (ANV) if P4 < 1.0 ng/mL on d 35 and 49, or otherwise ovulatory (OVL). On d 14±1 after the 1st AI cows were assigned to a resynchronization with CIDR for 7 d (RES) or no resynchronization (RCON). Economic analysis was performed for the first 305 d in milk and included values for: drugs, treatment, semen, estrous detection, AI, milk revenue, feed, cost of days open (DOPN), and value of the cow at the end of the study. Costs were calculated using actual on farm values. Cost of DOPN was calculated as described by French et al. (2003) for a milk price of U \$0.30/kg. Cow value was determined according to pregnancy status (pregnant vs open) and if it was marketed or dead by 305 d in milk. The net revenue (NR) for each cow was then calculated and included the cow value at the end of the study period. Data were analyzed using the GLM procedures of SAS (2001). Pre-synchronization protocol had no effect on DOPN, cost of DOPN, cow value, and milk income, but AI cost of cows in the CTAI group was in average U \$6.81 higher than CED and ED (P < 0.01); however, net revenue was also not affected. Re-synchronization protocol affected DOPN (RES = 157 vs. RCON = 171, P=0.03), but it did not affect cost of DOPN, cow value, milk income, AI cost, and NR. The average cow value for cows receiving CED+RES protocols tended to be \$92 higher than the other treatment interactions (P = 0.09) and the NR from cows receiving CED+RES was \$214 higher (P = 0.03). Ovulatory cows had lower cost of DOPN (OVL = \$221 vs. ANV = \$323, P<0.01) and higher NR (OVL = \$3,723 vs. ANV = \$3,364, P < 0.01). Pre-synchronization and re-synchronization did not affect NR, but interaction of CED+RES improved NR. Ovulatory cows had improved NR when compared to ANV cows.

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**Key Words:** Pre-synchronization, Re-synchronization, Economics

**M154 Prediction of profitability using milking center data in dairy farms.** E. Zimmerman\*, J. Delahoy, L. Holden, J. Hyde, B. Hilty, and C. Dechow, *Penn State University, University Park.*

Management and use of assets in the milking center impacts overall farm profitability. Return on assets (ROA) is an important indicator of overall profitability, accurately measuring returns as a percentage of total assets invested in the business, regardless of how those assets are financed. The objective of this study was to predict ROA using management and production characteristics associated with the milking center. Appropriate explanatory variables were determined using multivariate analysis in SAS. Data was collected in 2001 from 88 Pennsylvania dairy farms with a subset of 37 farms providing complete financial data for analysis. The average herd size of the dairies was 316 (± 256) cows. The average milk production was 71.3 (± 7.10) pounds per cow in 2001. The average farm size of the dairies was 400 (± 285.8) acres. Average ROA of the dairy farms was 6.89% (± 4.77%). In this dataset, ROA was best explained by herd size (SE: 0.0058), use of the California Mastitis Test (CMT) to detect mastitis (SE: 1.332), and use of bulk tank mastitis cultures (SE: 1.247). The ROA was negatively affected by somatic cell count (SCC) (SE: 1.287) and individual culturing for mastitis detection (SE: 1.363). Groups of production and management factors associated with milking center management can be effectively used to predict return on assets.

**Key Words:** Profitability, Milking Center

**M155 A partial budget for change in milking frequency and cow numbers with constrained parlor use.** B. Carr<sup>1</sup>, M. McGilliard\*<sup>1</sup>, W. White<sup>1</sup>, G. Bethard<sup>2</sup>, and R. Pearson<sup>1</sup>, <sup>1</sup>Virginia Polytechnic Institute and State University, Blacksburg, <sup>2</sup>G&R Dairy Consulting, Inc., Wytheville, VA.

A computer spreadsheet was developed to determine the economic advantage of changing cow numbers and milking frequency while maintaining constant hours of parlor use. Input characteristics of the farm included number of milking stalls, employees, and hours of operation for each parlor. Cows in milk were described by number of groups of different sizes, milk yield, body weight, parlor turns per hour, and milking frequency per day. Economic parameters included prices for milk, feed, parlor labor, milking supplies, replacement cows, cull cows, dry cow care, and other marginal costs per cow. Investment costs were included for additional housing facilities and cows purchased for expansion, amortized over 5 and 3 yr (1/cull rate) respectively. A base herd situation can be entered and changes made to it, mostly in terms of number and sizes of

cow groups, milking frequency, parlor throughput, and expected milk yield of each group. Scenarios were compared by expected change in net operating income, adjusted for amortized change in capital investment for cows and additional facilities. Expansion costs included cows, housing facilities (priced per cow), and a complement of dry cows. An example herd of 1200 cows in milk, grouped in 5 groups of 240 cows each, was milked twice daily with 4 turns/h in a D-20 parlor in 15 h. To evaluate the consequences of partial 3x milking, one group was reduced to 200 cows (to maintain 15 h/d parlor use) and milked three times daily (+10% milk) with 5 turns/h. Annual milk income decreased by \$77,000 while operating expenses decreased by \$50,000, replacement cost decreased by \$20,000, and amortized cow sales increased by \$32,000, for an annual increase of \$25,000 in net cash income. Results were particularly sensitive to estimates of milk response and parlor turns per hour from an increase in milking frequency, and were sensitive to cow prices when herd size changed.

**Key Words:** Management, Milking Frequency, Parlor Throughput

## Ruminant Nutrition: Beef Cattle

**M156 Effects of replacing corn grain and urea with condensed corn distillers solubles in diets for finishing steers.** D. Pingel\* and A. Trenkle, Iowa State University, Ames.

Corn distillers solubles (CDS) a co-product from the dry mill corn ethanol plants is often available at a low cost. Two experiments were conducted to evaluate CDS when fed to finishing steers replacing a portion of the corn and urea. In Exp I, 96 steers (Angus and Charolais crossbred, 386 kg) were stratified by weight and randomly allotted to 16 pens. The steers were fed dry rolled corn and 5% silage and 5% hay with 0%, 4%, 8%, and 12% CDS (DM basis) for 109 d. Daily feed, gain and feed/gain were 9.1, 9.6, 9.7, and 9.4 (kg/d); 1.75, 1.78, 1.75, and 1.79 (kg/d); 5.21, 5.40, 5.51, and 5.27; for 0, 4, 8, and 12% CDS respectively, and were not statistically different ( $P>0.05$ ). Carcass traits were not statically different ( $P>0.05$ ). In Exp II ten beef steers were used in two simultaneous 5x5 Latin squares to evaluate replacing dry rolled corn and urea with 4 and 8% CDS, or 10 and 20% wet corn distillers grain with solubles (WDGS). The steers were placed in digestion crates for total collection of feces and urine during a 5 d period following 14 d of diet adaptation. Dry matter intake, DM digestibility, NDF digestibility, and ADF digestibility were 7.99, 8.73, 8.62 and 8.41, 7.96 (kg/d); 79, 78, 76 and 77, 76%; 53, 52, 44 and 52, 55%; 41, 44, 34, and 48, 48%; for 0, 4 and 8% CDS, and 10 and 20% WDGS, respectively. Replacing corn and urea with distillers co-products did not affect digestibility of the corn-based finishing diet ( $P>0.05$ ). The results of these studies suggest that corn distillers solubles can replace a portion of the diet in finishing beef steers without affecting digestion, performance or carcass value.

**Key Words:** Cattle, Distiller's Co-products, Digestibility

**M157 Effect of clinoptilolite zeolite on cattle performance and manure nitrogen.** D. Sherwood\*, G. Erickson, T. Klopfenstein, and D. Schulte, University of Nebraska, Lincoln.

Zeolite clay may be effective in reducing N losses from feedlots. A summer feedlot trial was conducted from May to September using 96 crossbred yearling steers ( $382 \pm 7$  kg) to evaluate effects of adding clinoptilolite zeolite at 1.2% of the diet on steer performance and N removed in manure. Steers were stratified by weight and assigned randomly to 12 pens and one of two treatments. Treatments were 1) control diet with 0% zeolite clay (CON) or 2) treatment diet with 1.2% clinoptilolite zeolite clay (CZ). Diets consisted of 62.5% dry rolled corn, 25% wet corn gluten feed, 7.5% alfalfa hay and 5% supplement. Nitrogen intake was calculated using analyzed dietary N concentration for each feedstuff and total DMI. Individual steer N retention was calculated using the NRC (1996) net protein and net energy equations. Nitrogen excretion was determined by the difference between N intake and individual steer N retention. Manure N was calculated from the weight of manure hauled and N composition. The percent

N recovered was calculated by dividing manure by excreted N. Ammonia emissions were measured weekly during the last six weeks of the feeding period using wind tunnels and an acid trap for 30 minutes in each pen. There were no statistical differences in steer performance between CON and CZ. There was no difference ( $P=0.61$ ) in ADG between the CON and CZ steers (1.82 vs. 1.79 kg). Gain to feed was not significant ( $P=0.33$ ) with the CON and CZ steers at 0.145 and 0.138. Nitrogen in manure was not affected ( $P=0.62$ ) by treatment with 18.2% recovered for CON and 17.2% recovered for CZ. Ammonia emissions were not different ( $P=0.58$ ) between the CON and CZ pen treatments (53.7 and 59.3 g/h/d). This trial indicates that feeding clinoptilolite zeolite does not have a negative effect on steer performance. However, N recovery in manure and ammonia emissions was not affected by feeding clinoptilolite zeolite.

**Key Words:** Cattle, Nitrogen, Emissions

**M158 Variation in digestibility of undegradable intake protein among feedstuffs.** J. MacDonald\*, T. Klopfenstein, and G. Erickson, University of Nebraska, Lincoln.

Two ruminally and duodenally cannulated steers fed smooth bromegrass hay (IVDMD=58.4%) were used in a mobile bag analysis to determine undegradable intake protein (UIP), total tract indigestible protein (TTIDP) and UIP digestibility (UIPDIG) values for ingredients used in four growing trials. Three of the trials were grazing studies in which at least two ruminally cannulated heifers were used to collect diet samples of the grazed forage throughout the grazing season. Animals on these studies rotationally grazed smooth bromegrass pastures. Diet samples were collected at two times for trial 1 (T1), three times for trial 2 (T2) and eight times for trial 3 (T3). Other samples used in this analysis were: a commercially available methionine source (MET), corn cobs (COB), bloodmeal (BM), corn gluten meal (CGM), SoyPass® (SP), feathermeal (FM), two sources of dry distillers grains (DDGA and DDGB), sorghum silage (SS) and corn bran ruminally incubated for 21 or 30 hours (Bran21 and Bran30). Other samples were ruminally incubated for 16 hours except for forage samples (COB, SS, and grazed diet samples) which were ruminally incubated for 75% of their mean retention time (20 to 30 hours) as determined by their IVDMD. The UIP (% CP) content for grazed diet samples tended to be different ( $P=0.07$ ) for samples collected in T1 (18.8 vs.  $13.9 \pm 1.00$ ), increased quadratically ( $P=0.02$ ) with time in T2 (8.10, 19.2, and  $17.5 \pm 1.11$ ) and were not different across time ( $P=0.17$ ) in T3 (mean= $10.7 \pm 0.94$ ). The TTIDP (%CP) content of grazed diet samples were different ( $P=0.04$ ) in T1 (9.05 vs.  $6.02 \pm 0.81$ ) increased linearly with time ( $P=0.01$ ) from 3.30 to  $10.2 \pm 0.94$  in T2, and increased linearly with time ( $P<0.01$ ) from 4.65 to  $6.80 \pm 0.65$  in T3. The UIPDIG (%UIP) did not change with time in any of the three trials ( $P>0.18$ ) and averaged  $51.7 \pm 1.82$ ,  $49.2 \pm 5.40$ , and  $45.1 \pm 4.75$  for T1, T2, and T3, respectively.