595 Effect of acetate to propionate ratio on clearance of progesterone in the ovid. D. L. Smith*, B. A. Costine, and M. E. Wilson, *West Virginia University, Morgantown*.

The objective of these experiments was to determine if a change in the ratio of acetate to propionate (A:P ratio) in hepatic portal blood, draining the gastrointestinal tract, can alter the metabolism of progesterone by the liver. Experiment 1; 4 crossbred, ewe lambs (BW 45.5 + 2.5 kg) were fed for maintenance and given a once daily oral bolus (0.146 Mcal/d) of acetate (0.7 moles) or propionate (0.4 moles) for 11 d. A portal-vein catheter was inserted 14 d prior to collection. Portal and jugular venous blood were simultaneously collected (-0.17, 0.17, .33, 0.5, .66, .83, 1, 1.17, 1.33, 1.5, 1.66, 1.83, 2, 2.33, 2.66, 3, 4, 5, 6, 7 h with respect to feeding and VFA bolus) and serum was analyzed for concentrations of VFA by GLC. Experiment 2; 30 crossbred ewe-lambs, (BW 45.2 + 1.9 kg) were blocked by BW and fed for maintenance for 11 d. On d 12, each lamb was randomly assigned to one of two treatments, and given an oral bolus (0.146 Mcal/d) of acetate (0.7 moles) or propionate (0.4 moles). Animals received (i.m.) 20 mg progesterone (P_4) in corn oil. Plasma samples were collected (-0.5, 0.5, 1, 2, 3, 4, 5, 6, 8 h relative to feeding, VFA bolus, and P_4 injection) via jugular venipuncture and circulating concentrations of P_4 were determined by P_4-RIA. An oral bolus of acetate or propionate caused a mark change in the A:P ratio for at least 4 h. By 24 h after the oral bolus, the A:P ratio returned to baseline. Plasma concentrations of P_4 after the oral bolus of either acetate or propionate began to diverge as early 0.5 h and were different ($P < 0.05$) by 3-h (1.09 + 0.09 ng/ml vs. 2.04 + 0.48 ng/ml) and 4-h (1.20 + 0.09 ng/ml vs. 1.95 + 0.41 ng/ml) for ewe lambs bolused with acetate and propionate, respectively. By 5 h, coincident with the return to baseline A:P ratios seen in Experiment 1, circulating concentrations of P_4 were not different. Changes in the A:P ratio altered the circulating concentrations of P_4 by reducing the metabolic clearance of P_4 when the A:P ratio was decreased.

Key Words: Acetate, Propionate, Progesterone

Production, Management and the Environment: Heat Stress and Environment

596 Response of heat stressed dairy cattle to low-pressure soaking or high-pressure misting heat abatement systems. M. J. Brouk*[1], J. P. Harner, III[2], J. F. Smith[1], W. F. Miller[1], and B. Cvetkovic[1], [1]*Department of Animal Sciences and Industry, Kansas State University,* [2]*Department of Agricultural and Biological Engineering, Kansas State University*.

Eight lactating Holstein cows (4 primiparous and 4 multiparous) were arranged in a replicated 4x4 Latin square design to evaluate the effect of three different heat abatement systems. Respiration rate and surface temperature (right shoulder, left shoulder and rear udder) were measured and recorded at 5-min intervals during the study. Surface temperatures were measured with an infrared thermometer. Body temperature was recorded with a vaginal probe once per min and averaged by 5 min intervals prior to data analysis. Animals were housed in freestall barns and milked 2x. During testing, cattle were moved to a tiestall barn for a period of 2 hr starting at 14:00 hr on 4 days of intense heat stress. Treatments were control (C), low-pressure soaking applied for 1 min on 5 min intervals (LPS), continuous high-pressure misting with 2 (6.4 L/hr) nozzles (HP-2) or continuous high-pressure misting with 4 (6.4 L/hr) nozzles (HP-4). In addition to water application, all cooling treatments had supplemental airflow (215 m/min). Cows cooled by the LPS or HP-4 system became soaked during the 85 min the cooling treatments were applied. Respiration rates were lowered ($P<0.05$) when cows were cooled (114.4, 98.2, 89.3 and 82.5 breaths per min for C, HP-2, HP-4 and LPS treatments, respectively). Cows cooled with either LPS or HP-4 had lower ($P<0.05$) respiration rates than those cooled by HP-2. Surface temperatures of the right and left shoulders were lower ($P<0.05$) for cooled cows as compared to controls. Cows cooled by HP-4 had lower ($P<0.05$) shoulder surface temperatures than those cooled by HP-2 or LPS. Rear udder surface temperature was also lower ($P<0.05$) for cows cooled by either HP-4 or LPS as compared to controls. Respiration rates were decreased by 14, 37 and 48% for HP-2, HP-4 and LPS cooling systems, respectively, during the 85 min evaluation period. The combination of cooled respiratory air and surface soaking of the HP-4 treatment was more effective in reducing shoulder surface temperature than LPS. These data suggest that soaking of cattle with either the LPS or HP-4 treatment provided superior heat abatement as compared to HP-2 or C.

Key Words: Heat Stress, Cow Cooling, Facilities

597 Impact of air velocity and direction of flow upon respiration rate, body surface temperature and body temperature of heat stressed dairy cattle. M. J. Brouk*[1], J. P. Harner, III[2], J. F. Smith[1], W. F. Miller[1], and B. Cvetkovic[1], [1]*Department of Animal Sciences and Industry, Kansas State University,* [2]*Department of Agricultural and Biological Engineering, Kansas State University*.

Seven heat stressed, mid-lactation Holstein cows averaging 250 days in milk and producing an average of 38.3 kg of milk were arranged in a 7x7 Latin square design to determine the effects of air velocity and direction of flow on cow cooling. Animals were housed in freestall barns and milked 2x. Cows were moved to a tiestall barn for a period of 2 hr at 14:00 hr each afternoon of testing. Respiration rate and surface temperatures were measured and recorded at 5-min intervals during the 2 hr testing period. Surface temperatures were determined with an infrared thermometer and body temperature was measured and recorded once per min with a data logger and vaginal probe and subsequently averaged by 5-min intervals prior to data analysis. Treatments were control (C) or one of six different cooling treatments. All cooling treatments included a low-pressure soaker system which soaked the cows for 1 min on 5-min intervals. Supplemental airflow was provided by axial flow fans at one of three flow rates; 183 (1), 229 (2) or 275 (3) m/min. Airflow was either from the front to rear (FRT) or from the right side (SIDE) of the animal. Cooling treatments were FRT-1, FRT-2, FRT-3, SIDE-1, SIDE-2 or SIDE-3. Respiration rates were lowered ($P<0.01$) by all cooling treatments as compared to controls. Cows cooled with SIDE-3 had lower ($P<0.01$) respiration rates than cows cooled with FRT-1 or SIDE-2. Rear udder surface temperature was lowered ($P<0.05$) when cows were cooled by FRT-3, SIDE-2 or SIDE-3 as compared to the controls. Right shoulder temperature was reduced more compared to left shoulder temperature when the airflow was from the right side as opposed from the front. The impact of air velocity on surface temperature was variable, but more predictable when from the front as opposed to the side of the animal. These data indicate that the velocity and direction of supplemental airflow elicit different responses from heat stressed dairy cows. Airflow from the front to the rear of the animal may result in greater cooling than air directed at the side of the animal.

Key Words: Heat Abatement, Facilities, Cow Cooling

598 Impact of soaking cows housed in a tunnel ventilated barn equipped with evaporative pads located in Thailand. D. V. Armstrong[1], J. F. Smith*[2], M. J. Brouk[2], V. Wuthironarith[3], and J. P. Harner, III[2], [1]*University of Arizona, Tucson,* [2]*Kansas State University, Manhattan,* [3]*Charoen Pokphanol Group Co., LTD, Bangkok, Thailand*.

Ten lactating Holstein cows (10 multiparous) were arranged in a replicated 5 x 5 Latin Square design to evaluate the effect of soaking frequency and volume of water per soaking on lactating cows housed in tunnel ventilated and evaporative cooled freestall barn. Rectal temperature, respiration rate and body surface temperature (shoulder, thurl and rear udder) were measured every 5 minutes. Treatments were control (C), soaking every 5 min with 1L (5+1) or 2L (5+2), and soaking every 10 min with 1L (10+1) or 2L (10+2). Average ambient temperature and humidity were 30.3°C and 68% and 26.9°C at 86% in the barn. Water was applied manually from the shoulder to the tail and had a temperature of 27°C. Treatments were applied after 3 initial measurements were taken. Seventeen measurements were taken during treatment application and 5 measurements were taken after the treatments were stopped. Air velocity over the shoulder of the cows was 110 m/min. Respiration rate and body surface temperature for all treatments were lower than the control except for rear udder surface temperature of 1+10. Rectal temperature for 1+5, 2+5, and 2+10 were lower than the control. Respiration rate for 1+5 and 2+5 were lower than 1+10. These data suggests that soaking can be used in combination with tunnel ventilation and evaporative pads to reduce heat stress.

Treatments	C	1 + 5	2 + 5	1 + 10	2 + 10	SE
Respiration rate, Breaths/min.	72.8[a]	51.0[c]	51.6[c]	59.3[b]	55.6[bc]	2.03
Rectal Temperature, °C	38.5[a]	38.2[b]	38.2[b]	38.3[ab]	38.2[b]	0.12
Body Surface Temperature, °C						
Thurl	34.4[a]	32.0[c]	31.8[c]	32.6[b]	32.3[b]	0.38
Rear Udder	35.3[a]	34.6[b]	34.7[b]	35.0[ab]	34.8[b]	0.25
Shoulder	34.3[a]	32.1[bc]	31.9[c]	32.9[b]	32.7[b]	0.50

[abc]Means within a row that have different superscripts are different P<0.05.

Key Words: Heat Stress, Cooling Systems, Facilities

599 Effects of shade, sprinklers, and stocking density on performance, behavior, physiology, and environmental impact of Holstein heifers in drylot pens. N. M. Marcillac*, P. H. Robinson, J. G. Fadel, and F. M. Mitloehner, *University of California, Davis*.

The objective of the study was to measure the effects of shade, sprinklers, and stocking density on performance, behavior, physiology, and environmental impact of 40 Holstein heifers, housed in dirt-floored drylot pens during summer. Experimental design was a 4 x 4 Latin square, using 21-d periods and treatments: 1) shade, no sprinklers, normal (100%) stocking density; 2) no shade, sprinklers, normal stocking density; 3) shade, no sprinklers, increased (130%) stocking density; and 4) no shade, sprinklers, increased stocking density. Performance measures included DMI, ADG, and gain:feed. Ethologic measures were laying, standing, walking, feeding, drinking, bulling, agonistic, urination, and defecation behavior. Physiological measures were rectal temperature, respiration rate, urinary urea nitrogen (UUN), blood urea nitrogen (BUN), fecal carbon and energy. Environmental measures were manure composition, surface temperature, surface moisture, particulate matter #8804 10 or 2.5 μm (PM10 and PM2.5, respectively), and surface flux chamber ammonia concentrations. Shaded vs sprinkled heifers tended to have increased DMI (P = 0.07), decreased gain:feed (P < 0.05), but similar ADG, while stocking density had no effect on performance. Heifers spent most time and showed highest frequency of daytime elimination behaviors in either the shaded (P < 0.05) or sprinkled areas (P < 0.05) of their pens. Heifers in pens with normal vs increased stocking density showed increased bulling and standing behavior (P < 0.05). Respiration rate was decreased (P < 0.01) in shaded vs sprinkled heifers, but rectal temperature, BUN, UUN, and fecal carbon was similar across treatments. Shaded or sprinkled areas within each pen had highest surface moisture (P < 0.05), and lowest surface temperature (P < 0.05). Shaded vs sprinkled pens showed decreased ammonia (P < 0.05), increased PM10 (P < 0.05) and similar PM2.5 concentrations. In conclusion, only shade improved heifer performance, and both shade and sprinkling inversely affected ammonia and PM10 emissions from drylot pens.

Key Words: Heat Stress, Environment, Cattle

600 The effect of fiber characteristics on production, physiological and behavioral traits in heat stressed dairy cows. A. Arieli*[1], A. Rubinstein[1], Y. Ahroni[2], U. Moallem[2], and I. Halachmi[2], [1]*Fac. of Agric., Hebrew University of Jerusalem, rehovot, Israel,* [2]*Agricultural Research Organization, The Volcani Center, Bet Dagan, Israel*.

A trial was conducted using 40 mid-lactating (141 DIM) cows to evaluate the effect of fiber characteristics on production, physiological and behavioral traits in heat stressed dairy cows. The trial was conducted during summer 2003, in Bet Dagan, Israel. The mean, and maximal ambient temperature, relative humidity and thermal humidity index prevailing throughout the trial were: 26 and 31oC, 63 and 92%, and 75 and 82, respectively. Cows had 3 showers/d in the milking waiting yard; each lasting for 20 min. Cows were individually fed, receiving a low CP diet (15% CP), 33% RUP (% of CP), 33% NDF. The cows were blocked into 2 dietary treatments: Control (CON) and treatment (TRT) groups received 18% and 12% NDF in the DM from forage sources. In the TRT group 2 kg of wheat hay was replaced by the same amount of soyhulls. Milk yield and composition were measured daily, and every 2 wks. Feed intake was measured continuously by a computerized system. The heart rate was measured in ten cows per group during a 3 d period, and energy expenditure was estimated by calibrating heart rate with oxygen consumption by applying the open mask method. In both groups the initial DM intake was 25 kg/d, and decreased by 80 g/d. Mean meal size was 1.7 kg of DM/meal in both groups, but feeding time was higher (14 min) in CON than in TRT (12 min, P<0.001). Initial milk yield was 37 kg/d in both groups; milk yield decreased by 120 g/d in both groups. Concentrations of milk protein and lactose were 3.08 and 4.80% in both groups, whereas fat concentration was 3.30% in TRT and 3.02% in CON (P<0.05). Mean energy expenditure was 1025 kJ/MBW-d in both groups. Energy expenditure varied during the day, being highest at 1900h (1063 and kJ/MBW-d) and lowest at 0800h (996 and kJ/MBW-d, P<0.05). It was concluded that replacing forage NDF with NDF from non forage source, like soyhulls, is not an efficient means to reduce metabolic heat production in heat stressed cows.

Key Words: Dietary Fiber, Heat Stress, Feeding Behavior

601 Changes in the diurnal rhythm of rectal temperature of cattle exposed to prolonged heat stress, and cooled with warm salt water. J. Gaughan*[1] and S. Holt[2], [1]*The University of Queensland, Gatton, Australia,* [2]*South Dakota State University, Brookings*.

This study was undertaken in a controlled climate facility using 6 Angus steers in individual stalls. This study investigated changes in rectal temperature (RT) in cattle exposed to thermoneutral conditions (TN) for 4 d and hot conditions (HOT) for 11 d. During HOT cattle were wetted for approximately 60 s when RR equalled or exceeded 120 breath per minute using a hose. Warm (30 °C) salt water (3% NaCl) was used. Individual RT was measured every 60 s. Dry bulb temperature, wet bulb temperature, relative humidity and air movement were recorded every 10 min. For all steers mean daily RT were lower (P<0.01) on days 1 to 4 than for 5 to 15. During HOT, individual mean daily RT on day 5 were lower than mean daily RT for days 6 to 15. Rectal temperatures increased over the first 4 d and then decreased slightly. Individual rectal temperatures varied over a 24-hour period, but remained fairly constant (± 0.1 °C variation) for up to 6 h each day. During HOT, small incremental rises in RT were additive. There was no consistency in the rise, with daily increases of 0.5 °C followed the next day with a 0.01 °C increase. Decreases in RT also occurred but at no time did RT return to levels of TN. Minimum RT is an important measure. Clear diurnal patterns were seen for RT over the first 8 to 9 d of HOT but not on days 10 and 11. There is also evidence of reduced diurnal movement (day 8, 10 and 11) suggesting that the cattle were not dumping their heat load, and may be an indicator of failure to cope. Diurnal patterns seen in previous studies were usually associated with significant diurnal changes in climatic conditions. It is possible that cattle accumulate heat during the hotter parts of the day and then dissipate this heat when conditions are cooler. These data suggest that cattle will use this mechanism even where diurnal variations in climatic conditions are small or non-existent but will reach a point were the mechanism fails largely because the ambient conditions do not alleviate.

Key Words: Heat Stress, Rectal Temperature, Beef Cattle

602 Emissions of atmospheric ammonia and a nitrogen mass balance for a dairy. B. P. Rumburg*[1], G. H. Mount[1], J. M. Filipy[1], B. K. Lamb[1], R. L. Kincaid[2], and K. A. Johnson[2], [1]*Laboratory for Atmospheric Research, Department of Civil & Environmental Engineering, Washington State University, Pullman,* [2]*Department of Animal Sciences, Washington State University, Pullman*.

Atmospheric ammonia (NH_3) emissions have many impacts on the environment and human health. The global emissions of NH_3 are estimated to be 45 Tg N yr^{-1} (Dentener and Crutzen, 1994). Most emissions come from domestic animals with the largest per animal emission coming from dairy cows at 3 times the beef cow rate. The main sources of emission from US dairies are the cow stalls where urea and manure react to form NH_3, the storage lagoons where NH_3 is the end product of microbial degradation and waste disposal. Numerous studies of NH_3 emissions performed in Europe do not apply to the US due to differences in farming practices. We have been studying the NH_3 emissions from the WSU

dairy for four years to develop a detailed emission model from each dairy source for use in a Pacific Northwest regional air quality model. NH_3 concentrations are measured using open path differential optical absorption spectroscopy in the mid- ultraviolet where NH_3 photoabsorbs near 220 nm. The instrument consists of a Xe lamp, a sending and receiving telescope, retro reflectors and a multiplexing spectrograph and data acquisition hardware (Mount et al., 2002). The method is self calibrating and avoids inlet wall adherence which is a major source of error in NH_3 measurements. An SF_6 tracer technique has been used to convert measured NH_3 concentrations to fluxes from the three main dairy emission sources. The SF_6 is released at a measured rate upwind of the source and both the tracer and NH_3 are measured downwind. A ratio of the SF_6 and NH_3 concentrations and the SF_6 flux along with a stability and area factor gives the NH_3 flux.
NH_3 fluxes from the dairy cow stalls area average 0.4 mg m^{-2} s^{-1} and the flux from the dairy lagoon averages 50 ug m^{-2} s^{-1}. Waste application with a "Big Gun" sprinkler resulted in 17% volatilization from the sprinkler alone. Total NH_3 emissions from the WSU dairy are 170 $\pm$ 50 kg cow^{-1} yr^{-1} while current EPA estimates are 40 kg cow^{-1} yr^{-1}. Emission rates will be compared in detail to a nitrogen mass balance of the feed inputs and milk and animal outputs at the dairy.

Key Words: Ammonia, Dairy, Emission

603 Effects of dietary crude protein level on nitrogen balance and emissions.

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Two studies were conducted; one in dynamic air flow chambers (DAFC; exposure zone 64 ft^3), the other using metabolic crates, to determine amounts of N losses and evaluate N digestibility and excretion using growing pigs fed either 14.5 (LCP) or 18.5% (HCP) CP diets (similar levels of digestible lysine-0.83%). In *Study 1*, 8 barrows (initial mean BW 17.9±0.97 kg) were randomly assigned in pairs to 4 DAFC and diets; with 3 replicates over time. Air in chambers was kept under positive static pressure at 0.32 inches H_2O with constant ventilation rate of 30 cfm. Feed and water were provided *ad libitum*. Pigs were acclimatized for 7 d, followed by a 2-wk sampling period. Pigs and feeders were weighed weekly. In *Study 2*, twelve barrows/diet (initial mean BW 17.7±1.32 kg) were randomly assigned to individual crates and diets, and were fed at 90 % of *ad libitum* intake. Acclimation for 5-d was followed by 5-d collection of feces and urine (analyzed for N). In *Study 1*, BW, ADFI, ADG, gain:feed, water usage, odor threshold, and hydrogen sulfide levels did not differ between diets ($P>0.05$); however, slurry pH (6.1 vs. 6.8, SEM=0.05) and ammonia concentrations (0.4 vs. 1.8 ppm; 0.03) as well as ammonia emission rate ($2.8x10^{-4}$ vs. $1.2x10^{-3}$ g/min; $1.73x10^{-5}$) were higher ($P<0.05$) for HCP than LCP diet. In *Study 2*, there were no differences in BW, ADG, ADFI, or urine output due to diet. Nitrogen in feed, feces, and urine and N intake were higher ($P<0.05$) for HCP than LCP diet (2.3 vs. 3.5%, 0.02; 3.0 vs. 3.7%, 0.16; 0.1 vs. 0.2 g/100 ml, 0.01; and 16.0 vs. 24.5%, 0.25, respectively). Total N excreted, retained, and balance also were higher ($P<0.05$) for HCP than LCP (6.7 vs. 12.0 g/d, 0.25; 41.8 vs. 49.2%, 1.28; 9.4 vs. 12.5 g/d, 0.31, respectively); however net protein utilization and biological value were greater ($P<0.05$) for LCP than HCP diet (58.2 vs. 50.9%, 1.29 and 71.8 vs. 59.7%, 1.33, respectively). Results indicate that CP level in diet influences N excretion, retention, utilization as well as slurry pH and N emissions.

Key Words: Crude Protein, Nitrogen Balance, Ammonia Emission

604 Calcium clinoptilolite zeolite added to the diet to reduce nitrogen losses from feedlot lagoons and composted manure.

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Rapid nitrogen (N) loss and ammonia emissions from feedlot manure and lagoons represent a loss in fertilizer value and a potential environmental problem. Composting feedlot manure may reduce odors, but additional N is lost during the composting process. Previous research has shown that Biolite (BLT) a specific calcium clinoptilolite zeolite (CZ) added to feedlot diets can reduce manure N losses. The study was designed to compare a high concentrate steam flaked corn-wet gluten corn silage finishing diet with or without 1.2% CZ (DMB) fed to feedlot steers on concrete floors. The CZ was added in place of an equivalent amount of grain. In the lagoon study 20 gallons of fresh liquid manure adjusted to a 10% dry matter content was added to 100 gallon sealed vertical plastic containers. Ammonia content of the trapped air was measured each day, after which the air was evacuated and the container re-sealed. No additional manure was added to the system. The ammonia concentration measured would be daily not accumulated ammonia production. Ammonia production was greater and increased more rapidly in the control compared to the CZ treatment. In both treatments, ammonia production peaked at nine days and was 110 and 57 ppm for the control and CZ treatments, respectively. Ammonia production for each treatment appeared to increase with increasing ambient temperatures. Composted treatments consisted of wet manure collect for four days from the control and CZ diets, mixed with 1/3 sawdust and composted for ten weeks. Samples from each treatment were obtained on day one and at one to two week intervals thereafter and analyzed for moisture, N and phosphorus (P). N loss from the compost was reduced in the CZ treatment and the N: P ratio increased. Compost N loss at weeks 6 and 7 was 27.3% for the control compared to 14.7% for the CZ treatment. The results indicate 1.2% CZ added to a feedlot finishing diet significantly reduces lagoon ammonia and composted manure N losses, Table1.

Treatment	Time	Dry Matter %	N	% Lost	P	N:P
Control	Day 1	35.1	2.05		1.00	2.05
Control	Week 2-3	37.8	1.95	-4.88	0.95	2.05
Control	Week 4-5	51.3	1.59	-22.44	.96	1.66
Control	Week 6-7	51.5	1.49	-27.32	.89	1.67
Control	Week 9-10	48.2	1.50	-26.83	.88	1.70
CZ	DAY 1	35.3	2.11		1.04	2.03
CZ	Week 2-3	49.6	1.93	-8.53	1.02	1.89
CZ	Week 4-5	49.8	1.8	-14.69	.93	1.94
CZ	Week 6-7	50.3	1.8	-14.69	1.00	1.80
CZ	Week 9-10	47.6	1.87	-11.37	.98	1.91

Key Words: Ammonia, Zeolite, Feedlot

605 Combination of a urease inhibitor and a plant essential oil for control of fecal coliforms and emissions of odor and ammonia from cattle waste.

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A 2002 report from the National Research Council of the National Academies ranked ammonia and odor as their highest concerns for emissions from confined animal feeding operations. Most of the ammonia emissions in livestock wastes originates from hydrolysis of urea, whereas odor emissions originate from microbial production of VFA from waste organic matter. The objectives of this work were to evaluate urea hydrolysis, VFA production (odor), and fecal coliforms in cattle waste slurries after a urease inhibitor N-(n-butyl) thiophosphoric triamide (NBPT) and a plant oil (thymol) were added. Feces, urine and distilled water in the ratio 50:35:15 were blended for 1 min. Triplicate aliquots of 750 ml were amended with chemical additives and reblended for 1 min, and were poured into 1.6 L wide-mouth jars covered 90% with a lid. After 56 days, thymol (2000 mg/kg waste) in combination with NBPT (80 mg/kg waste) retained 5.2 g of an initial 8 g of urea in cattle waste slurries, compared to less than 1 g of urea retained when NBPT was the only additive ($P < 0.05$). Thymol by itself had no inhibitory effect ($P > 0.05$) on urea disappearance. However, thymol or thymol in combination with NBPT reduced VFA production ($P < 0.01$), but NBPT had no effect ($P < 0.05$) on VFA production. Thymol and thymol with NBPT also eliminated all fecal coliforms after one day. Fecal coliforms disappeared in the no addition treatment after 8 days; however, they were viable at 6.6×10^4 cfu/g waste beyond 35 days in the NBPT treatment. These results indicate thymol has an additive effect to NBPT by further inhibiting hydrolysis of urea in cattle waste slurries and increasing nitrogen retention in the waste. Also NBPT appears to interfere with the normal eradication of fecal coliforms in cattle waste slurries.

Key Words: Plant Oils, Urease Inhibitor, Cattle Waste

606 Evaluation of factors affecting phosphorus solubility in feces of lactating cows. T. D. Nennich*[1], J. H. Harrison[1], Z. Dou[2], L. Johnson VanWieringen[1], R. L. Kincaid[3], and D. L. Davidson[1], [1]*Washington State University, Puyallup,* [2]*University of Pennsylvania, Kennet Square,* [3]*Washington State University, Pullman.*

Solubility of fecal P is associated with potential movement of P to surface waters after field application. The objective of this study was to evaluate factors affecting total and soluble P excretion by lactating dairy cows. Fecal samples (n = 121) were from total collection metabolism studies that used multiparous Holstein cows. These samples were analyzed for water soluble P by extraction (0.3 g + 100 ml deionized water) and P soluble in dilute acid (0.3 g + 100 ml 0.1% HCl). Variables evaluated in regression equations included P intake, dietary P concentration, Ca:P ratio, Ca intake, and other animal and dietary factors. Regression analysis performed using the PROC MIXED procedure of SAS included study as a random variable. Total P and HCl soluble P excretion were predicted using dietary P concentration, whereas dietary P concentration was not a significant variable for predicting water soluble P. Water-soluble P in the feces was affected by P intake and the concentration of Ca in the diet. Increased ratios of dietary Ca:P decreased soluble and total P excretion. Equations developed to predict water or HCl soluble fecal P (g/kg) using Ca:P ratio as the independent variable were y = -0.75 (±0.16) x Ca:P (g) + 4.32(±0.40) and y = -0.51(±0.40) x Ca:P (g) + 7.56 (±1.07), respectively. Dietary or animal factors in several of the studies evaluated affected total and soluble P excretion. In one study on maturity of corn silage, cow diets that contained 37% corn silage (DM basis) resulted in an average P balance of -32 g and had greater total P and HCl-soluble P excretion than other studies at similar dietary P concentrations. A better understanding of dietary factors that contribute to greater soluble P excretion in feces will aid in formulating diets to help lower the excretion of soluble P in feces.

Key Words: Phosphorus, Calcium, Feces

607 Separated drinking water from liquid manure for swine. J. Morris*, R. Fleming, and M. MacAlpine, *Ridgetown College, University of Guelph, Guelph, ON, Canada.*

The efficacy of separated clean water from liquid swine manure as a source of drinking water for starter pigs was completed. The objectives of the study were to evaluate the impact of separated clean water as a source of drinking water on the quality of water, the growth performance and the health status of starter pigs. Water was recovered from liquid manure using the Vibratory Shearing Enhanced Processing (VSEP) unit which was fitted with an reverse osmosis (RO) filter pack. The quality of the recovered water (permeate) was assessed and provided for drinking water to young pigs. Three water treatments (A-regular barn water, B-half barn water and VSEP permeate, and C-VSEP permeate) were prepared and given to the pigs. A total of 54 pigs were allocated to 9 pens of 6 pigs each (3 barrows and 3 gilts). All pigs were fed ad libitum a pelleted corn-soybean meal based pig starter ration. The pigs were subjected to the water treatments for 28 days (12 - 26 Kg liveweight). Performance data was subjected to statistical analysis using the GLM procedure of SAS. Results showed that the VSEP unit produced permeate (separated water) from liquid manure at a quality level acceptable to pigs. No significant treatment effects were found for ADFI - 1.20, 1.18, and 1.23kg/d; se = 0.04; p=0.755, ADG - 0.50, 0.52 and 0.51kg/d; se=0.009; p=0.579, Feed-to-Gain conversion - 2.38, 2.20, and 2.40; se=0.095 and daily water intake - 5.2, 4.3, and 6.1 l/d; se=0.492; p=0.099, for water treatments A, B and C respectively. There were no negative health effects resulting from the treatments during the study. It appeared that the recovered water from liquid manure under the conditions of this study was satisfactory as a source of drinking water for starter pigs.

Key Words: Swine, Water, Liquid Manure

608 Environmental impact of integrating crop and sylvan systems with swine. C. W. Talbott*[1], G. B. Reddy[1], C. Raczkowski[1], T. Barrios[1], M. Matlapudi[1], A. Coffee[2], and J. Andrews[2], [1]*North Carolina A&T State University, Greensboro,* [2]*USDA/CSREES Forestry, NC Division of Forest Resources, Raleigh, NC.*

Many species of swine evolved in sylvan environments where natural canopies provide cooler temperatures and thereby aid in thermoregulation during the warm seasons. During cooler seasons, farmers may be able to develop organic soils by utilizing the rooting behavior of the hogs to incorporate manure and mulch into compost. Forty-eight gestating sows were randomly assigned to one of six 25m x 90m wooded plots or one of four 40m x 30m dirt-lots for warm season application (April through September). Five, 10 m radius areas were surveyed (inches diameter breast high, basal area, % canopy) for species variation and prevalence after two, six-month seasons with swine; timber growth response was adjusted for animal stocking rate. During the cool season (October through March), animals were rotated to eight, 20m x 20m lots with or without leaf mulch. Soil samples were collected in years 2000 and 2001 at planting and at harvest at depth increments of 0-15 cm, 15-30 cm and 30-60 cm. Samples were analyzed for soil NO3–N, inorganic N, PO4, total P, organic matter, total C, total N, C:N, and CEC. Integrated plots with pigs had significant increases in NO3–N, inorganic N and PO4 concentrations. Results suggest that sylvo-pastoral systems with swine may improve hardwood stands by reducing softwood competition.

Key Words: Integrated Systems, Sylvo-Pastoral, Swine

Ruminant Nutrition: Dairy - Additives, Vitamins & Models

609 Effects of Aspergillus oryzae (Amaferm®) on production and metabolic parameters in Holstein cattle during the transition period. L. H. Baumgard*[1], M. E. Dwyer[1], C. Davis[1], C. E. Moore[1], H. C. Hafliger III[1], O. B. Mendivil[1], H. Jensen[2], B. Christie[2], and M. J. VanBaale[1], [1]*The University of Arizona, Tucson,* [2]*BioZyme Inc., St. Joseph, MO.*

Holstein cattle (n=33; 22 multiparous and 11 primiparous) were assigned to a TMR with or without an Aspergillus oryzae (AO) extract (Amaferm®; BioZyme Inc., St. Joseph, MO) from -21 to 60 d relative to calving. Alfalfa hay was the main forage source and steam-flaked corn the primary concentrate. AO (15 g/cow/d) was top-dressed daily at 0600 h. Cows were balanced by previous 305 ME and heifers randomly assigned to treatment, all animals were blocked by calving date and milked at 0600 and 1800 h, yield was recorded daily, and milk and blood samples were obtained 1, 7, 14, 21, 28 and 35 DIM. Body weights (BW) were recorded weekly until 60 DIM. There was no overall effect of treatment or treatment by week interaction on DMI prepartum (18.3 kg/d) or postpartum (39.7 kg/d), and this was independent of parity. BW loss did not differ between treatments (51.9 kg), but AO tended (P<0.1) to reduce week of BW nadir (5.0 vs. 6.2 wk). There were no interactions between parity and treatment on BW change, but overall, heifers lost less BW (31.8 vs. 71.8 kg) and tended (P<0.1) to reach BW nadir earlier than cows (4.9 vs. 6.2 wk). Feeding AO through the transition increased (P<0.05) milk yield (35.0 vs. 37.7 kg/d). The overall treatment effect was attributed to the enhanced milk yield of cows (40.8 vs. 44.7 kg/d) as heifers had similar milk yields between treatments. Peak yield was achieved earlier (wk 3) in AO compared to control fed cows (wk 5-6) and this resulted in a milk differential of 4.5 kg during wks 3 and 4 of lactation. AO tended (P<0.15) to increase milk fat content (6%) and decrease milk lactose percentage (3%). Plasma glucose concentrations were not altered by treatment. Despite increased milk yield without a corresponding increase in feed intake, plasma NEFA levels tended (P<0.12) to be reduced (14%) by AO. Feeding an AO extract through the transition appeared to increase dietary energy availability and improve production.

610 The effects of feeding yeast culture during the transition from cool to hot weather to Holstein cows on animal performance. J. D. Ward*[1], T. R. Smith[2], L. Zeringue[1], R. J. Williams[2], J. Crouch[2], R. Walz[1], T. Nueefch[2], and H. M. Wilson[2], [1]*LSU AgCenter, Southeast Research Station, Franklinton, LA,* [2]*Department of Animal and Dairy Sciences, Mississippi State University, Mississippi State.*

Forty-two mid to late lactation Holstein cows at two locations were used to determine the effects of feeding yeast culture during the transition from cool to hot weather on dry matter intake (DMI), milk production (MP), blood glucose, body condition score (BCS) and body weight