W173 A mass balance computer model of nutrient flow for a California dairy. H. A. Johnson*, E. J. DePeters, J. G. Fadel, P. L. Price, P. H. Robinson, and D. Meyer, *University of Callifornia*, *Davis*.

Estimating nitrogen (N) and phosphorus (P) output from a dairy production facility is essential to determining the land area necessary for environmentally sustainable nutrient recycling. To understand nutrient partitioning of N and P between liquid and solid waste streams from dairy farms, a dynamic computer model was created using acslXtreme v. 2.4 simulation software. The model consists of four parts: 1. Estimations of manure production and N, P content using regression equations based on milk production (Nennich et al., 2005), 2. Manure collection via scraping, flushing or vacuuming, 3. Manure storage and treatment including sand traps, solids separator, anerobic digestor, and holding ponds, and 4. Output composition of solid waste used for bedding or land application and liquid waste used as recycled flush water or land application i.e., irrigation. Simulations were run for 30 days for 1,500 milking cows at which time the amount and yield of N and P in recycled flush water reached steady state. Model predictions of yield of N and P in manure recycled flush water (N = 8,385 kg, P = 967 kg) were within ranges of data collected over 6 months at the test dairy (N = 8,458 kg, standard deviation (SD) = 1,032 kg; P = 972 kg, SD = 564 kg). Estimated yield of solid waste at 30 days was N = 2684 kg, P = 309 kg and liquid waste was N = 1509 kg and P = 174 kg. These comparisons indicate that this mass balance computer model is useful in predicting the yield of N and P in dairy waste output. However, more data are needed along the waste stream over a longer period of time to fully test the model. Data describing effects of storage and treatment on manure nutrient composition would increase the usefulness of the model by allowing addition of more manure handling technologies to simulate potential strategies to manipulate nutrient waste output.

Key Words: Manure, Waste Stream

W174 Bacteroidales PCR for universal, human, hog, and ruminant fecal pollution markers. B. R. Min*[1,2], G. Giovanni[3], N. Garcia[3], E. Casarez[3], H. Y. Kim[1], M. K. Ho[1], J. Chang[1], L. Chang[1], C. Bae[1], and P. Dyer[2], [1]*Ichthus Education Center*, *La Trinitaria, Chiapas, Mexico*, [2]*Texas AgriLife Research*, *Vernon, TX*, [3]*Texas AgriLife Research*, *El Paso, TX*.

The overall objective is to quantify the effect of fecal contaminated drinking water on bacterial population in four Mayan villages. Raw water samples (7 to 25 ml) were collected from four villages (Comitan, Chiapas) in Mexico and analyzed for the presence of the fecal pollution indicator *Bacteroidales*. Samples were concentrated by membrane filtration and DNA was extracted from the concentrates by way of a commercial DNA kit (Qiagen DNA mini kit). DNA extracts were tested by PCR for the presence of *Bacteroidales* fecal bacteria in general using the universal marker, and *Bacteroidales* host-specific markers (nested PCR) for humans, ruminants, and hogs. Using a universal *Bacteroidales* marker, positive PCR products were detected for fecal contamination obtained from various samples in Mayan villages, indicating a presence of fecal pollution problems. However, *Bacteroidales* host-specific markers for humans, ruminanats, and hogs shown that sample tested positive for the human marker, but negative for ruminants and hogs. This may have been due to the difference in PCR cycling conditions that have been optimized for the individual markers. It should be noted that nested PCR, with its increased sensitivity and detection levels, was able to confirm the presence of the human marker. In conclusion, the sources of the fecal contamination indicated by the universal markers in general shown that the most of Mayan villages have water polution problem from animals or human. However, results in samples analyzed by host-specific markers shown that fecal contamination from humans, hogs and ruminans were identified with the limited markers available, and they may have originated from other animal (e.g. wildlife) or human sources. Further work to increase the sensitivity of the assays is underway. Additional samples are needed to confirm results and to determine if there is a trend in the sources of fecal pollution for the study sites.

Key Words: Water, Fecal Pollution, Bacterial Contamination

W175 Compost: A potential value-added product for dairy operations? E. M. Shane*[1], M. I. Endres[1], D. G. Johnson[2], and C. J. Rosen[1], [1]*University of Minnesota*, *St. Paul*, [2]*University of Minnesota*, *Morris*.

The objective of this descriptive study was to evaluate the composting potential of various bedding materials that were previously used in experimental bedded packs. Each material was placed in windrows (1.83m height × 9.14m length × 2.29m width) from April 2007 to September 2007 and managed as needed to promote composting. Materials included: sawdust (SD), corn cobs (CC), woodchip/sawdust mix (WC/SD), soybean straw (SS), woodchip/soybean straw mix (WC/SS), and soybean straw/sawdust mix (SS/SD). Replicated samples were taken weekly and analyzed for DM, pH and C:N ratio. Temperature was measured twice weekly. Results for initial and final samples of the composting material (mean (SD)) are reported on Table 1. Number of days temperature stayed above 54.4°C (temperature needed to kill pathogens and weed seeds) were: SD, 35; CC, 109; WC/SD, 106; SS, 95; WC/SS, 92, and SS/SD, 95. Initial temperature across materials was 51#\deg;C and final temperature was 39.2°C. Some of the observed C:N ratios were slightly below 20:1, but all materials still composted efficiently.

Table 1.

	Material					
Item	SD	CC	WC/SD	SS	WC/SS	SS/SD
DM (%)						
Initial	38.6 (2.4)	45.7 (4.0)	33.7 (1.6)	37.7 (2.4)	41.6 (0.5)	37.8 (0.8)
Final	51.5 (8.6)	73.9 (3.1)	42.9 (5.6)	63.0 (10.2)	68.1 (1.9)	54.4 (4.0)
pH						
Initial	8.25 (0.26)	8.36 (0.13)	8.69 (0.16)	8.75 (0.06)	8.55 (0.06)	8.78 (0.16)
Final	6.96 (0.22)	7.97 (0.31)	7.38 (0.22)	8.19 (0.31)	6.98 (0.16)	7.05 (0.12)
C:N Ratio						
Initial	34.7 (3.4)	18.2 (0.3)	39.8 (2.2)	17.5 (1.0)	32.0 (2.4)	18.7 (0.8)
Final	27.3 (4.8)	14.3 (1.1)	30.5 (1.2)	13.0 (0.6)	20.9 (0.8)	14.4 (0.6)

Key Words: Housing System, Compost, Value-Added

W176 Associations between non-dietary factors and dairy herd performance. A. Bach*[1,2], N. Valls[3], A. Solans[3], and T. Torrent[4], [1]*ICREA*, *Barcelona, Spain*, [2]*IRTA-Unitat de Remugants*, *Barcelona, Spain*, [3]*CADI*, *Lleida, Spain*, [4]*Pirenaica*, *Lleida, Spain*.

Forty seven dairy herds (approximately 3,129 lactating cows) from northeast of Spain that were feeding exactly the same lactating ration were surveyed to determine the effect of non-dietary factors on herd performance. The survey collected information on the profile of the owners (their future intentions, the number of workers, and time devoted to the enterprise), information regarding the animals (reproductive performance, incidence of pathology, culling rate, etc...), information on the facilities (number of feeders, waters, stalls, cleanliness, etc...) and information on management practices (numbers of daily milkings, feed deliveries, feed push-ups, cleaning frequency, etc...). In addition, the chemical quality of drinking water from each dairy enterprise was determined. Also, amount of feed delivered to each herd, daily total milk production, and milk quality were obtained for each herd for a period of 8 months prior the fulfillment of the survey. Mortality rate of calves, tended to be lower in herds that weaned progressively than in those that weaned abruptly. Age at first calving (AFC) was negatively correlated with level of milk production (mainly due to the type of heifer rearing system used). Culling rate tended to be lower in herds that used a close-up ration than in those that did not. Using gloves and paper towels (instead of cloth towels) tended to reduce the somatic cell count in milk. Concentration of calcium in the drinking water tended to be negatively correlated with the number of days open and with the proportion of cows culled due to infertility problems. Despite that the 47 herds fed the same ration and shared a similar genetic base, average milk production per cow ranged from 20.6 to 33.8 kg/d. A positive relationship ($r = 0.57$; $P < 0.05$) between the number of stalls per cow and milk production was found. The most important non-dietary factors that affect milk production in these dairy herds were AFC, presence or absence of feed refusals, ratio of number of free stalls per lactating cow, and whether feed was pushed up in the feed bunk. These factors accounted for more than 50% of the observed variation, not attributable to the diet, in milk yield.

Key Words: Water, Housing, Management

W177 Boric acid and borax treatment of stored swine manure to reduce ammonia and hydrogen sulfide emissions from swine facilities. M. Yokoyama*, S. Hengemuehle, and R. von Bernuth, *Michigan State University*, *East Lansing*.

The objective of this research was to evaluate the efficacy of boric acid and borax in reducing ammonia and hydrogen sulfide emissions from stored swine manure under in vitro and in vivo conditions. Boric acid was reagent grade (J.T.Baker Co.) and borax was commercial grade (20 Mule Team Borax). Swine manure was obtained from the MSU swine facility and incubated (200 ml) with 0.00, 0.0625, 0.125, 0.25, 0.25, 0.50 and 1.0% (w/v) of the borates in 2-L Erlenmeyer flaks for 7 days. Ammonia was measured daily in the headspace gases with Drager ammonia tubes and hydrogen sulfide was measure using a Jerome analyzer. Increasing amounts of borates to swine manure in the incubations delayed hydrolysis of urea to ammonia by 48-144 hours (e.g. 2-6 days). Adding 1% borates almost completed inhibited (95%) ammonia emissions. Borates at 1% almost completely inhibited (99%) hydrogen sulfide emissions. Shallow manure pits under nursery rooms at the MSU swine facility were treated with borax for 4 weeks. Air quality was continuously monitored with a Continuous Emission Photoacoustic Multi-Gas Monitor (CEM) with computer software program. Paired t-test comparisons of treatment means indicated that the control room had significantly higher hydrogen sulfide/carbon dioxide concentrations than the boron treated room. Hydrogen sulfide concentrations in the nursery room when pull plugs were opened, indicated that hydrogen sulfide levels were reduced by at least 80%. Paired t-test comparisons of treatment means indicated that the control room had significantly higher ammonia concentrations than the boron treated room. When normalizing the data for carbon dioxide concentrations, the boron treated room had higher ammonia concentrations than the control room. These results demonstrate that boric acid and borax are effective in controlling hydrogen sulfide emissions from stored swine manure. This project was supported by the National Pork Checkoff.

Key Words: Boric Acid, Ammonia, Stored Swine Manure

W178 Effect of different feed push-up schedule on milk production, feed intake and behavior in Holstein dairy cows. D. V. Armstrong*[1], T. R. Bilby[1], V. Wuthironarith[2], W. Sathonghon[2], and S. Rungruang[2], [1]*The University of Arizona*, *Tucson*, [2]*Charoen Pokphand Foods Public Co. LTD*, *Bangkok, Thailand*.

Primiparous and multiparous Holstein cows in early to mid lactation were divided into 2 groups of 43 based on milk production, days in milk and parity. Both groups were milked 2x daily and fed 3x daily (600, 1300 and 2200 hrs). Milk production and group feed weights and refusals were recorded daily. The feed area was empty for 2 hrs daily for both groups. Feed push-up schedule for the control group was once per hr, every 24 hrs, for a total of 22 push-ups daily. The treatment group was pushed-up every 30 min for the first 2 hrs after each feeding for an additional 9 push-ups totaling 31 push-ups daily. A crossover design was used with treatments being applied for one week then switching treatments between groups for another week with a 2 day interval between weeks. Cows were housed in a tunnel ventilated free stall barn with a feed line soaker. Milk production was increased in the treatment group versus the control (29.7 vs. 28.5 kg, respectively; $P<0.01$). In addition, there was a significant interaction ($P<0.05$) between treatment and parity with treatment moderately increasing milk production for primiparous cows (29.1 and 29.8 kg) but significantly increasing milk production in multiparous cows (27.8 and 29.6 kg). Daily dry matter intakes were not significantly different. Cow behavior was observed every 15 min for 24 hrs on the sixth day. Observations recorded were as follows: number of cows either (1) eating at the feed line, (2) standing at feed line, (3) lying at feed line, (4) standing in free stall, (5) lying in free stall, (6) at the water trough or (7) at the milking barn. Percent of cows at the water trough tended to be increased in treatment versus control groups (5.2 % vs. 4.2 %; $P<0.10$). No significant differences between groups for all other behaviors. In conclusion, increasing feed push-ups at feeding increased milk production with little effects on dairy cow behavior.

Key Words: Feeding, Behavior, Dairy

W179 Hydrated lime bedding treatment for mastitis control. T. A. McCaskey*, R. S. Chettri, C. R. McCarthy, M. B. Brady, and L. I. Chiba, *Auburn University*, *Auburn, AL*.

Dairy cow mastitis is the inflammation of the mammary gland, usually caused by microbes, which is estimated to cost the dairy industry over $1 billion annually. The principal remedy is antibiotic therapy, and the major preventive measure is good sanitary practices prior to, during, and after milking, and dry cow antibiotic treatment at time of dry-off. Most mastitis cases are associated with staph, strep and coliform bacteria which are acquired during the milking procedure due to improper milking practices, or acquired from the environment such as the bedding where the cows lie down. Earlier studies have evaluated alkalizing and acidifying agents to reduce microbial loads in cow bedding. Hydrated lime treatment of bedding has been reported to reduce bacterial counts by 100-fold, but the effect diminished in two days. A study was conducted to evaluate the daily application of hydrated lime to free-stall bedding, and to determine its effect on the incidence of mastitis for cows assigned to the stalls. Dairy cows with similar udder health status were allotted to two groups of 16 cows each. Both groups were bedded in free-stalls with peanut hull bedding. The control cow group received no lime, and the treatment group received daily applications of lime (~50grams) to the back 1/3 of the stalls. The assessment of the incidence of mastitis for both groups of cows was determined by the Wisconsin Mastitis Test (WMT) performed monthly for 12 months on quarter, foremilk collected from the cows in the milking parlor prior to milking. A somatic cell count (SCC) of 200,000/ml or more was used as the guideline to indicate an intramammary infection of the mammary quarter. Based on WMT data there was a 38% decrease in the incidence of mastitis for the cow group assigned to stalls with hydrated lime-treated bedding. SCC data taken from DHIA records indicated a 33% decrease in the incidence of mastitis for the lime treatment group. However, when the data for the cow groups were normalized for number of lactations and lactation period these differences were not significant (P>0.05).

Key Words: Dairy Cow, Bedding Treatment, Mastitis

W180 Bedding options for an alternative housing system for dairy cows. E. M. Shane*[1], M. I. Endres[1], D. G. Johnson[2], and J. K. Reneau[1], [1]*University of Minnesota*, *St. Paul*, [2]*University of Minnesota*, *Morris*.

Availability of bedding material for compost bedded pack barns is a concern for dairy producers who use this type of alternative housing system. The material most commonly used in these barns is sawdust. The objective of this descriptive study was to evaluate different types of material that could potentially work for these housing systems. The study was conducted at the West Central Research & Outreach Center in Morris, Minnesota from November 2006 to March 2007. Materials included: sawdust (control) (SD), corn cobs (CC), woodchips, and soybean straw (SS). Some of these materials were evaluated as mixtures on a 2:1 by volume ratio. These mixtures included: wood chips/sawdust (WC/SD), wood chips/soybean straw (WC/SS), and soybean straw/sawdust (SS/SD). Six bedded packs were used, each with one of six different materials, and 16 cows were placed on each pack for the specified time period. Replicated samples of the bedded pack material were collected biweekly and analyzed for dry matter. C:N ratios and pH were analyzed monthly. Temperatures of each pack were measured weekly at various depths (15.24, 30.48, 45.72, and 60.96 cm). Cows were scored for hygiene (1=clean, 5=dirty) biweekly. Dry matter (mean ± SD) of SD was 48.35 ± 21.16; CC, 53.78 ± 9.94; WC/SD, 47.60 ± 21.13; SS/SD, 41.77 ± 10.31; WC/SS, 60.45 ± 28.77; and SS, 63.31 ± 8.94. SD pH was 8.69 ± 0.28; CC, 7.69 ± 0.73; WC/SD, 8.62 ± 0.28; SS/SD, 8.59 ± 0.20; WC/SS, 8.41 ±.37; and SS, 8.64 ± 0.15. C:N ratio of SD was 36.61 ± 9.91; CC, 29.39 ± 6.05; WC/SD, 47.48 ± 11.81; SS/SD, 25.47 ± 4.92; WC/SS, 30.49 ± 4.95; and SS, 21.88 ± 3.11. Temperatures (&DEG;C) were averaged across depths: SD, 31.00 ± 11.35; CC, 40.00 ± 12.22; WC/SD, 22.55 ± 13.93; SS/SD, 26.00 ± 8.83; WC/SS, 20.00 ± 10.54; and SS, 13.00 ± 11.14. Hygiene score of cows on SD was 2.39 ± 0.74; CC, 2.71 ±0.81; WC/SD, 2.46 ± 0.76; SS/SD, 2.90 ± 0.83; WC/SS, 2.63 ± 0.85; and SS, 2.84 ± 0.80. Based on these results and our observations, it appears that any of the materials evaluated in this study would potentially work in this type of housing system if proper bedding management is applied on a consistent basis.

Key Words: Dairy Cow, Housing System, Bedding Material

W181 Effects of corn particle size and feeding management on dry matter intake, ruminal fermentation, chewing activity and nutrient digestibility in midlactation cows. Z. Cao*, S. Li, and M. Ma, *College of Animal Science& Technology, China Agricultural University*, *Beijing, China*.

The objective of the experiment was to estimate the effects of corn particle size and feeding management on dry matter intake, ruminal fermentation, chewing activity and nutrient digestibility in midlactation cows. Four multiparous Holstein cows with ruminal cannulas, averaged 625 kg (SD = 63) of BW and 195 DIM (SD = 21) were assigned randomly to a 4 × 4 Latin square design. Treatments were the effects of 1) corn silage particle size [100% short corn silage (SS, 6.3 mm), 50% short corn silage + 50% long corn silage (SL, 10.7 mm) and 100% long corn silage (LL, 16.4 mm)]in the TMR and 2) feeding TMR compared with SI. Dry matter intake and milk yield were similar for all diets. Cows fed SI spent more time ruminating (445 min/d vs 484 min/d, P = 0.05) and consumed less ADF (3.34 kg/d vs 2.89 kg/d, P = 0.04) than cows fed SS in the TMR With the increasing of corn silage particle size, ruminating time (P = 0.05) and chewing time (P = 0.03) quadratic increased, and digestibility of dry matter (P = 0.03), organic matter (P = 0.03) and nitrogen (P = 0.02) linear increased.

Key Words: Corn Particle Size, Feeding Management

W182 Impact of simulated selection for feed efficiency and length of breeding season on beef life cycle performance. C. Williams* and T. Jenkins, *USDA, ARS, U.S. Meat Animal Research Center*, *Clay Center, NE*.

The Decision Evaluator for the Cattle Industry (DECI) was used to simulate production for a base herd (BA), a herd in which genetically superior sires for feed efficiency were used (SA), and a herd in which genetically superior sires for feed efficiency and lower fertility were used (SB). Within each selection scenario, four breeding season lengths (BSL) were simulated, 90 d, 75 d, 60 d, and 45 d. Eight 15-yr-simulation runs were done for each selection by length of breeding season scenario. Animals were a composite of 50% Angus and 50% Simmental. Exposed females were palpated at weaning and open cows were culled at that

time and replaced with pregnant heifers to maintain herd size at 150 calving females. At weaning all open and excess pregnant heifers were sold, and all steers and non-replacement heifer calves were put on a stocker program for 150 d to gain 0.91 kg/day, then finished on a high-concentrate diet (3.258 Mcal ME/kg DM). In each 15-year simulation, yearly production and financial data were collected and averaged over yr 14 and 15 to measure selection response relative to the BA. Compared to BA, ADG increased by 0.04 kg ($P < 0.05$) and feed efficiency increased by 0.02 ($P < 0.05$) in both SA and SB. Decreasing BSL from 90 to 45 d, required an increase of 15 female replacements to maintain herd size, and resulted in a greater proportion of steers to heifers going into the finishing phase and heavier average slaughter weights. Except for the 90-d breeding season, the impact of lower fertility sires was to increase the number of replacement females needed to maintain herd size by 2 in SB herds. Income over feed costs (IOFC) for the combined cow/calf and post-weaning phases was significantly higher in SA and SB and decreased as BSL decreased. These results show that selection for feed efficiency would increase post-weaning feed efficiency and IOFC by about 10 and 12% respectively, and have a small positive impact on ADG. Shorter BSL increased replacement rate and decreased IOFC.

Key Words: Beef Model, Feed Efficiency, Selection

W183 Agricultural sustainability: The environmental impact of using recombinant bovine somatotropin (rbST) to improve the productive efficiency of one million lactating dairy cows. J. L. Capper*[1], R. A. Cady[2], and D. E. Bauman[1], [1]*Cornell University*, *Ithaca, NY*, [2]*Monsanto Company Animal Agriculture Group*, *St Louis, MO*.

This study modeled the effects of supplementing one million lactating cows with rbST on the environmental impact of dairy production when compared to an equivalent milk production from unsupplemented cows. The model employed 2006 average milk yields (28.9 kg/d) and a 4.54 kg/d response to rbST, a 14 mo calving interval and a 60 d dry period. Use of rbST was assumed to begin at 57 DIM. Each population contained lactating cows, dry cows and replacement heifers, for which rations were formulated according to NRC. Resource inputs included feedstuffs, fertilizers and fossil fuels; waste outputs included manure, N and P excretion and greenhouse gas emissions. Supplementation of one million cows with rbST reduced the total population size required to produce 12.1 billion kg milk by 334,859 animals. In consequence, the quantity of nutrients required to maintain the population was decreased by 6.24 × 109 MJ metabolizable energy and 6.05 × 104 kg crude protein, and land required for feedstuff production was reduced by 2.19 x 105 ha. Total N and P excretion was considerably lower from the rbST-supplemented population, with annual reductions in greenhouse gas emissions of 8.2 million kg CO2, 41 million kg CH4 and 9,600 kg N2O. Non-renewable resource (fossil fuel) requirements for feedstuff production were 7.28 million MJ/y lower in the rbST-supplemented population. Furthermore, both electricity (1.56 million kWh/y) and water (5.43 billion l/y) use were lower for the population supplemented with rbST. The carbon footprint, calculated as total CO-equivalents, was reduced by 1.77 billion kg/y. Reductions in resource inputs and waste outputs conferred by rbST use would considerably lessen the environmental impact of dairy production. Clearly rbST is a valuable dairy management tool that increases the efficiency of milk production, reduces the carbon footprint and improves agricultural sustainability.

Key Words: Recombiant Bovine Somatotropin, Biotechnology, Dairy

W184 Change in natural abundance of ^{15}N and estimation of nitrogen losses from dairy manure during storage by mass balance and nitrogen to phosphorus ratio. M. J. Aguerre*[1], G. A. Broderick[1,2], and M. A. Wattiaux[1], [1]*University of Wisconsin*, *Madison*, [2]*US Dairy Forage Research Center*, *Madison, WI*.

The main objective was to evaluate methodologies to estimate nitrogen (N) losses from stored dairy manure. Manure with high N (HN) and low N (LN) content was obtained from two groups of cows assigned diets of 17 and 15% CP (DM), respectively. Manure collected from the barn floor was diluted with water to 10% DM, loaded in 200 L barrels (186 kg) with or without addition of chopped straw (22 g/kg of undiluted manure) and stored in a partially temperature-controlled environment. Manure samples were collected on days 0 and 136 of storage and analyzed for N, phosphorus (P) and ^{15}N natural abundance (δ15N). Nitrogen loss was estimated by mass balance and changes in N:P ratio. The study was conducted once in May and twice in October. There were no interactions for the reported measurements. Addition of straw had not effect on N loss measured by mass balance or N:P ratio. Nitrogen losses estimated by mass balance were reduced by 36 % on LN relative to HN (see table). Using the N:P ratio there was a trend for a reduction in N loss for LN relative to HN manure, however N loss measured using this technique was on average 44 % lower than estimated by mass balance. Average ^{15}N abundance in manure increased during storage from 4.965 to 5.995‰, probably due to volatilization of ammonia depleted in ^{15}N, but there was no difference in the magnitude of the increase between the LN and HN manures. Abundance in ^{15}N at day 136 was lower when straw was added (5.603 vs. 6.398 ‰, P<0.01), indicating that straw-containing manure may have lost less ammonia N. Results from this study suggested also that N loss was influenced by initial manure N content. Estimates of N losses were substantially lower using the change in N:P ratio compared with the values observed by mass balance.

Table 1.

Item	LN	HN	SEM	P-value
Total N Day 0, g	546	642	17.3	<0.01
Total N Day 136,g	447	490	13.8	0.06
N loss, g	98	153	16.3	0.04
N:P Day 0	6.03	6.98	0.5	0.23
N:P Day 136	5.20	5.94	0.4	0.18
N loss, g	54	85	10.0	0.07
$\delta^{15}N$ Day 0, ‰	4.95	4.98	0.4	0.96
$\delta^{15}N$ Day 136,‰	6.01	5.98	0.2	0.93

Key Words: Nitrogen Loss, Manure

W185 Performance and selenium incorporation in beef heifers grazing pastures growing in saline soils containing high levels of trace minerals. S. O. Juchem*[1,2], S. E. Benes[2], P. H. Robinson[1], P. Vasquez[2], M. Brito[2], G. Getachew[3], and P. Chilibroste[4], [1]*University of California*, *Davis*, [2]*California State University*, *Fresno, CA*, [3]*University of California*, *Davis, CA*, [4]*Instituto Nacional de Investigació Agropecuaria*, *Montevideo, Uruguay*.

Salinification of soils in parts of the San Joaquin valley of California has led to the need to grow salt tolerant forages as a means of evapotranspiring water in order to concentrate salts in drainage water. Our objective

was to determine tissue selenium (Se) concentrations and performance of beef heifers grazing forages with high (>3 mg/ kg DM) of Se, being 'Jose' tall wheatgrass (TWG) (*Thinopyrum ponticum* var. 'Jose') and creeping wildrye (CWR) (*Leymus triticoides* var. 'Rio'). Twenty 6 m old Angus heifers were allocated to two grazing areas, where each ~9 ha TWG or CWR area was divided into two subplots, with each subdivided into 4 paddocks that were rotationally grazed at 14 d intervals. Heifers grazed the TWG and CWR pastures for 190 d from May to November (2007). Blood and liver were sampled before grazing and at 190 d of grazing. At ~45 d intervals during grazing, additional samples of blood were collected and BW was recorded before grazing and at 135, 150 and 190 d of grazing. Concentrations of minerals in whole blood or serum, and in liver tissue, were determined. Data sampled over time were analyzed as repeated measures with the experimental unit (heifers) nested within subplots. Preliminary data (n=16) on chemical composition indicates that TWG had higher ME (7.7 vs. 6.6 MJ/kg DM) and CP (12.2 vs. 11.0% DM), whereas Se did not differ (4.7 vs. 3.9 mg/kg DM). Heifers grazing TWG gained more BW (0.59 vs. 0.27 kg/d; $P<0.01$), and these BW gains were higher than expected. Accumulation of Se in blood occurred quickly, with Se increasing by more than 300% by 45 d of grazing, with TWG heifers having higher concentrations of Se (0.67 vs. 0.48 ppm; $P<0.05$) at 45 d of grazing than did CWR heifers. However by 190 d, Se concentrations in blood were similar (0.87 vs. 0.94 ppm). Concentrations of Se in liver increased with time, but heifers grazing CWR had higher concentrations of Se (3.9 vs. 2.1 mg/kg) at 190 d of grazing than did TWG heifers. Use of TWG and CWR are viable options to increase the value to soils with low agronomic potential due to salinity, in spite of the high concentrations of Se in the plant tissue.

W186 Factors affecting milk component levels in Northern New York dairy herds. L. E. Chase*, W. C. Stone, C. M. Ryan, J. P. Tauzel, and T. R. Overton, *Cornell University*, *Ithaca, NY*.

Milk components are key determinants of the price received for milk on dairy farms. The objective of this field study was to investigate nutritional and management factors that may be related to differences in milk fat and true protein (TP) in cooperating dairy herds. Dairy herds (n=52) in 6 Northern NY counties were used in this study. All herds had to be on DHI test, feed total mixed rations and average > 29.5 kg/d of milk per cow. Milk fat percent was the main factor used to select herds. Visits were made to each herd and feed, forage, TMR, water and bulk tank milk samples were collected. Ration and grain mix composition was obtained from the feed representative. Regression analysis was used to identify factors that were related to variations in milk component levels across herds. Average milk production was 34.4 kg (SD ± 9.7). Average milk fat % was 3.47 (SD ± 0.29, range = 2.7 to 4.2%). Milk TP mean was 3.0 (SD ± 0.1, range = 2.8 to 3.3%). Seventeen herds were housed in tie-stall barns and 35 herds were housed in free-stall barns. Twenty-four herds milked twice a day and 28 herds milked 3 times per day. There were no significant relationships between number of cows per herd or herd average milk production and milk fat or TP percent in this study. There were only a few factors that had a significant ($P<0.05$) relationship with either milk fat or TP content. These were corn silage particle size, as determined using the Z-box, and milk fat %. Corn silage starch, NDF and nonfiber carbohydrate (NFC) levels also had significant relationships with milk fat %. The only significant relationships detected with milk TP % were ration starch and NFC levels. None of these factors accounted for > 10% of the variation observed in milk component levels. Herds with lower milk fat levels had significantly ($P<0.05$) higher levels of trans-10 C18:1 in bulk tank milk samples. The results of this study identified some nutritional parameters that appear to be associated with milk component levels in these herds.

Key Words: Milk Fat, Milk Protein

W187 Survival curves and reproductive risk factors for culling in dairy herds. A. De Vries*[1] and J. Olson[2], [1]*University of Florida*, *Gainesville*, [2]*Pfizer Animal Health*, *Fort Collins, Co*.

Objective of this study was to quantify dairy cow survival by stage of lactation and parity and reproductive risk factors for culling in Holstein herds. Data were DHI lactation records from 38 states primarily from the eastern US. After editing, the final data set contained 2.2 million records in 707 herds with at least 200 cows in each of the years from 2001 to 2006. For each herd-year, the breeding program was characterized as unlikely, possibly, probably or most likely synchronized. Synchronized breeding occurred mostly on Thursday (48%) or Friday (30%). Daily risk of culling was expressed per 100,000 days at risk. Daily risks of culling at 5, 30, 60, 120, 200, 300, 400, and 500 d after calving were 73, 124, 150, 145, 146, 275, 381, and 446 for open cows, respectively. For pregnant cows, daily risk of culling was -, -, 4, 35, 43, 46, 66, and 79. At day 5, the risk of culling was 132 for first parity cows, but increased from 32 to 64 for cows in parity 2 to 6 respectively. At day 30, cows in the second parity had the lowest risk. At day 60 and later, greater parity cows had higher daily risks of culling. At day 30, the primary reason for leaving the herd was death (35%) followed by injury/other (23%). By 400 DIM, primary reasons were repro problems (36%), followed by death (24%) and low production (15%). Hazard ratios of culling for parities 2 and 3+ were 2.2 and 4.2, respectively compared to parity 1. Breeding program did not affect the hazard of culling. The hazard ratio for cows with milk yields < 5 kg at 70 DIM compared to average herd mates was 3. For average cows it was 1.3 compared to cows with relative milk yields > 5 kg. Longer herd average days to first service only marginally increased the hazard ratio of culling. Herds with pregnancy rates < 12% had hazard ratios of 1.3 compared to herds with > 16% pregnancy rates. Of the first parity cows not pregnant at 150 DIM, 9% were culled by 365 DIM. For second and greater parity cows, results were 19 and 30%, respectively. Quantification of survival curves and reproductive risk factors for culling is useful for identification of opportunities to reduce forced culling losses.

Key Words: Culling, Reproduction, Hazard

W188 Effect of concentrations of progesterone during a timed AI protocol on fertility of lactating dairy cows. J. R. Lima[1], J. E. Santos[2], F. Rivera*[1], C. D. Narciso[1], R. A. Oliveira[1], and R. C. Chebel[1], [1]*University of California Davis*, *Tulare, CA*, [2]*University of Florida*, *Gainesville, FL*.

Objective was to evaluate the effect of progesterone (P4) concentrations during a timed AI protocol on pregnancy risk (PR). Lactating dairy cows, from 2 dairy herds, were presynchronized with 2 injections of prostaglandin F2α (PGF), 14 d apart (Presynch), and cows observed in estrus were inseminated (EST = 1,301). Cows not inseminated by 11 d after the end of the Presynch were submitted to the Heatsynch (d 0 GnRH, d 7 PGF2α, d 8 estradiol cypionate, and d 10 TAI). At the beginning of the Heatsynch, cows were randomly assigned to receive

no exogenous P4 (CON = 432), one CIDR insert (CIDR1 = 440), or two CIDR inserts (CIDR2 = 440) from d 0 to 7. Blood was sampled at the end of the Presynch and at the beginning of the Heatsynch for determination of P4 concentrations. Cows with P4 concentration < 1.0 ng/mL in both samples were considered anovular and those with at least one sample > 1.0 ng/mL were considered cyclic. From a subgroup of cows, blood was sampled on d 3 and 7 of the Heatsynch. Pregnancy was diagnosed at 38 and 66 d after AI. Data were analyzed including all cows or only cows randomly assigned to treatments. During the Heatsynch, CIDR2 cows had the greatest (P < 0.01) P4 concentration (CON = 3.7 ± 0.3, CIDR1 = 4.6 ± 0.3, CIDR2 = 5.5 ± 0.3 g/mL). Proportion of cows classified as anovular was similar (P = 0.67) among treatments (CON = 20.2, CIDR1 = 17.8, CDIR2 = 19.3%), but it was different (P < 0.01) between sites (11.1 and 20.6%). When all cows were evaluated, treatment did not affect PR at 38 d (CON = 35.9, CIDR1 = 39.1, CIDR2 = 37.1, EST = 40.9%; P = 0.43) or 66 d (CON = 32.4, CIDR1 = 35.8, CIDR2 = 34.4, EST = 37.8; P = 0.62). When only cows randomly assigned to treatments were evaluated, treatment and the interaction between treatment and cyclicity did not affect PR at 38 (P = 0.61 and P = 0.28, respectively) and 62 (P = 0.59 and P = 0.42, respectively) d after AI. Anovular cows, however, tended to have smaller PR at 38 (31.2 and 38.9%; P = 0.07) and 62 (28.0 and 35.8%; P = 0.06) d. Treatment with 2 CIDR inserts increased P4 during a timed AI protocol but did not improve PR.

Key Words: Dairy Cow, Progesterone, Synchronization

W189 Effect of change in body condition score during the dry period on incidence of diseases and lactational and reproductive performance of Holstein cows. L. Lima[1], J. E. Santos[2], and R. C. Chebel*[1], [1]*University of California Davis*, *Tulare*, [2]*University of Florida*, *Gainesville*.

Objectives were to evaluate the association between body condition score (BCS) change during the dry period and health, lactation, and reproductive performances of Holstein cows. Data from 2,089 multiparous cows and 3,451 lactations were collected. Cows received a BCS at dry off and at parturition and were classified according to change in BCS during the dry period as no change (NC), lost BCS (LB), and gained BCS (GB). Postparturient diseases were diagnosed by farm personnel. Milk yield and fat and true protein concentrations were recorded monthly. Productive and reproductive data were collected up to 305 d postpartum (DIM). The length of the dry period was longest (P < 0.01) for GB cows (NC = 63.9 ± 1.0, LB = 64.6 ± 1.0, GB = 67.5 ± 1.1 d). Change in BCS in the dry period tended (P = 0.07) to affect incidence of ketosis (NC = 2.3, LB = 4.3, GB = 2.5%). Milk yield (NC = 37.7 ± 0.4, LB = 36.1 ± 0.4, GB = 38.7 ± 0.4 Kg/d) and yield of 3.5%-fat corrected milk (NC = 40.2 ± 0.5, LB = 38.6 ± 0.5, GB = 41.4 ± 0.5 Kg/d) were (P < 0.01) greatest for GB cows. Milk fat concentration tended (P = 0.06) to be affected by BCS change (NC = 3.56 ± 0.03, LB = 3.55 ± 0.03, GB = 3.60 ± 0.03%) and GB cows had (P < 0.01) the greatest yield of fat (NC = 1.41 ± 0.02, LB = 1.35 ± 0.02, GB = 1.45 ± 0.02 Kg/d). Change in BCS was not (P = 0.71) associated with true protein concentration, but it was associated (P < 0.01) with yield of true protein (NC = 1.18 ± 0.01, LB = 1.14 ± 0.01, GB = 1.20 ± 0.01 Kg/d). Interval from parturition to pregnancy (NC = 186.7 ± 2.8, LB = 182.1 ± 2.7, and GB = 175.6 ± 3.8 d) and from parturition to the time cows left the herd (NC = 256.5 ± 2.5, LB = 255.6 ± 2. 6, and GB = 272.4 ± 3.0 d) were (P < 0.01) associated with BCS change. Greater (P < 0.01) proportion of GB cows remained in the herd after 305 DIM (NC = 73.9, LB = 72.9, and GB = 79.1%). Increase in BCS during the dry period was associated with improved health, reproductive, and productive performance of multiparous lactating dairy cows.

Key Words: Dairy Cow, Dry Period, Body Condition Score

W190 Comparison of pregnancy diagnosis strategies by stochastic simulation. A. H. Sanders* and A. De Vries, *University of Florida*, *Gainesville*.

Recent emphasis has been on earlier pregnancy diagnosis (PD) in dairy cattle. Combining earlier PD with an estrous control plan (SYNC, e.g. Ovsynch®) to minimize time to re-breeding, could decrease days open, but the success of a re-breeding plan is also influenced by pregnancy losses which occur after PD, accuracy of PD, and success in re-breeding. The economic efficiency of these strategies is less clear, being influenced by costs and returns from cows. Stochastic simulation is a useful way to compare different strategies while controlling influential factors over a long time span. In this study, PD by ultrasound (US) at 27 days post breeding was compared to PD by rectal palpation (RP) at 35 days post breeding. A 100 cow herd with production based culling for bred heifer replacements was modeled. Stochastic elements included gestation length, cyclicity, estrus detection (ED), fertilization, pregnancy loss, and milk production. Daily risk of resuming cyclicity was LogN~(19,11). Probability of ED were 0.30, 0.50, or 0.70. Probability of fertilization when breeding at estrus was 0.90, with daily risk of embryo loss before 42d Exp~(60) and fixed after 42d so overall probability of a late abortion was 0.03. Cows observed in estrus >60 days in milk (DIM) were bred by artificial insemination (AI). Open cows were bred by timed AI (TAI) at 75 DIM following SYNC. Cows open at PD were enrolled in SYNC for re-breeding. Cows open after 250 DIM were not rebred. Sample size was selected for >80% power using GLMPOWER (SAS®). Data were yearly milk yield (MY), live calves (LC), SYNC enrollments, AIs, PDs, and culls, in steady state, from 700 replicates of each PD x ED combination. Improving ED from 0.3 to 0.7 increased yearly MY (103.3kg) and LC (0.04), and decreased culls (0.04) and inputs (0.35, 0.28, and 0.14 for TAI, PD, and AI) per cow-slot. Yearly SYNC enrollments and PDs were 0.037±0.003 and 0.177±0.003 greater per slot with US than RP, and MY was 10.33±3.09kg less. Culls, LC and AI differed only slightly. This suggests that US may not be an efficient PD strategy because costs are generally greater than RP without improved returns from milk or cow turnover.

Key Words: Pregnancy Diagnosis, Simulation

W191 Supplementation of progesterone via CIDR inserts during ovulation synchronization protocols in lactating dairy cows. R. C. Chebel*[1], M. J. Al-Hassan[2], P. M. Fricke[2], J. E. Santos[3], C. A. Martel[4], J. S. Stevenson[4], R. Garcia[5], R. L. Ax[5], and F. Moreira[6], [1]*University of California Davis*, *Tulare*, [2]*University of Wisconsin*, *Madison*, [3]*University of Florida*, *Gainesville*, [4]*Kansas State University*, *Manhattan*, [5]*University of Arizona*, *Tucson*, [6]*Pfizer Animal Health*, *New York, NY*.

Our objective was to determine the effect of exogenous progesterone (P4) during timed AI protocols on pregnancy risk (PR) in dairy cows not previously observed in estrus. Lactating cows, from 6 dairy herds, were submitted to a Presynch protocol (2 injections of PGF2α [PGF] 14 d apart), and cows in estrus after the second PGF received AI (EDAI, n

= 1366). Cows not inseminated by 12-14 d after the end of the Presynch received a timed AI (TAI) protocol (GnRH [d 0], PGF [d 7], GnRH [48-72 h after PGF], TAI [0-24 h after GnRH]). At onset of the TAI protocol cows were blocked by parity and DIM and randomly assigned to receive no exogenous P4 (CON, n = 721) or a CIDR insert (CIDR, n = 770). Blood was sampled at the second PGF injection of Presynch and at onset of the TAI protocol for P4 determination. Cows with 2 samples in which P4 < 1.0 ng/mL were classified as anovular and those with 1 or 2 samples in which P4 > 1.0 ng/mL were classified as cyclic. Pregnancy was diagnosed at 38 and 62 d after AI. Data were analyzed including all cows or only cows randomly allocated into treatments. Proportion of cows inseminated following the Presynch was different among sites (P < 0.01). Proportion of anovular cows at the onset of the TAI protocol was affected (P < 0.01) by site (range 13.7 to 33.5%), but it was similar (P = 0.88) between treatments (CON = 25.7, CIDR = 26.0%). When all cows were considered, treatment did not (P = 0.12) affect PR at 38 d (CON = 33.7, CIDR = 37.9, EDAI = 38.5%), but it tended (P = 0.08) to affect PR at 62 d (CON = 30.0, CIDR = 34.9, EDAI = 34.9%). When only cows randomly assigned to treatments were considered (model 2), PR at 38 and 62 d tended to be (CON = 33.7, CIDR = 37.9%; P = 0.10) and was (CON = 30.0, CIDR = 34.9%; P = 0.05) improved by exogenous P4, respectively. Cyclic cows had greater (P < 0.01) PR at 38 (38.4 vs. 29.1%) and 62 (34.9 vs. 25.7%) d than anovular cows, but PR did not differ (P > 0.15) among sites at 38 (range 31.9 to 42.4%) and 62 (range 28.6 to 37.5%) d. Use of exogenous P4 during TAI protocols improved fertility of lactating dairy cows not previously observed in estrus.

Key Words: CIDR Insert, Dairy Cow, Synchronization

W192 Characterization of postpartum estrous behavior in lactating cows using radiotelemetry in a large dairy. C. R. Johnson*[1], M. W. Ayers[2], A. Ahmadzadeh[3], S. Etter[4], R. C. Chebel[5], and J. C. Dalton[1], [1]*Caldwell Research and Extension Center*, *Caldwell, ID*, [2]*Caine Veterinary Teaching Center*, *Caldwell, ID*, [3]*University of Idaho*, *Moscow*, [4]*Canyon County Extension*, *Caldwell, ID*, [5]*University of California*, *Tulare*.

The objective of this study was to describe postpartum estrous behavior in lactating cows using radiotelemetry in a large dairy (n = 1,315 cows). Average annual milk production was 12,310 kg. Cows (n = 30) were continuously monitored for behavioral estrus by HeatWatch II (CowChips LLC, Denver, CO) from 14 to 49 d postpartum. Blood collection (for analysis of progesterone, P_4) and ovarian ultrasonography were performed once weekly. Based on increased concentration of P_4, 25 cows exhibited first ovulation without behavioral estrus. First ovulation was estimated to have occurred within four days before evidence of increased P_4 concentration (Appl. Anim. Behav. Sci. 66; 2000; 153-159). Estimated first ovulation occurred at 23.3±10.2 d (range 10-45 d) for 25 animals without evidence of behavioral estrus. A corpus luteum was visualized by ultrasonography in 22 of 25 cows. First ovulation was associated with behavioral estrus in 3 cows and occurred at 28±10.1 d (range 17-37 d). The average duration of estrus was 7.5±3.6 h (range 3-10.5 h), and average number of mounts were 19±1.7 (range 17-20). The interval postpartum to estimated first ovulation and first ovulation associated with behavioral estrus was not different. Cows that showed evidence of first ovulation with or without behavioral estrus (n = 28) were placed into two milk production groups, >47.3 kg (n = 12) and <47.3 kg (n = 16), based on first milk test weights. Level of milk production did not affect the interval to estimated first ovulation without estrus or first ovulation associated with estrus. The remaining two animals did not show evidence of ovulation based on P_4 concentration. The majority of first ovulations (25/28; 89.3%) were not associated with behavioral estrus.

Key Words: Radiotelemetry, Estrous Behavior, Dairy Cattle

W193 Effect of overnight pasture on metritis and milk production of transition cows. C. Goldhawk*[1], N. Chapinal[1,2], D. M. Veira[2], J. Rushen[2], A. M. de Passillé[2], D. M. Weary[1], and M. A. G. von Keyserlingk[1], [1]*University of British Columbia*, *Vancouver, BC, Canada*, [2]*Pacific Agri-Food Research Centre*, *Agassiz, BC, Canada*.

Transition dairy cows are highly susceptible to disease, and thus require management practices which reduce the occurrence of disease. Continuous access to pasture has shown improvements in udder health, however, it is unclear if this benefit can be extended to other health issues, such as metritis. This study tested the effect of housing transition cows on pasture overnight on dry matter intake, milk production and incidence of metritis. Forty-four multiparous and 26 primiparous Holstein dairy animals were monitored for 3wk prior to calving and 3wk post calving. All animals were housed in freestall pens (n=6) with 12 stalls at densities of 8-12 animals. Control cows (n=35) remained indoors 24 hr/d. Pasture cows (n=35) were housed in the same pens as controls but remained indoors from 0700-2000 and on pasture from 2000-0700. Detailed feeding behaviour of 20 pasture and 20 control cows was monitored from 2 wk pre to 3 wk post-calving in one pre-partum and two post-partum pens. After calving, body temperature and milk production were collected daily, and vaginal discharge was examined for detection of metritis at +3, +5, +7, +14 and +21 d. Following data collection, cows were classified as healthy (metritis score 0 or 1, no fever) or metritic (one mertitis score ≥2). Cows with confounding health issues were removed, leaving 26 cows in the pasture group and 25 cows in the control group. We found no difference in the number of cases of metritis between treatment groups (11 pasture vs. 9 control, P>0.1). DMI of TMR, which was provided indoors, was similar between control and pasture cows for the duration of the transition period (12.8kg/d±0.95 vs. 11.62kg/d±0.67, P>0.1), except during week -2 when DMI was higher for control cows (13.7kg/d±0.73 vs. 11.8kg/d±0.60, P<0.05). Milk yields were also similar between groups (pasture=32.0kg/d±1.20, control=32.2kg/d±1.17) during the first 21 DIM. The results of this study indicate that overnight pasture access does not reduce TMR intake nor milk yield and has no effect on the prevalence of metritis.

Key Words: Transition, Pasture, Metritis

W194 Influence of hen's age on some productive indices of broilers in the hot humid southwestern Nigeria. O. T. F. Abanikannda[1], A. O. Leigh[1], O. Akinsola[1], I. S. Okoya*[1], O. N. Coker[2], I. O. Ola-Gbadamosi[1], and A. L. Dare[3], [1]*Lagos State University*, *Ojo, Lagos State, Nigeria*, [2]*S & D Farms Nigeria Limited*, *Odeda, Ogun State, Nigeria*, [3]*Obasanjo Farms Nigeria Limited*, *Igboora, Ogun State, Nigeria*.

The relatively high meat yield and fast growth rate in broilers provides for an economical source of animal protein, which has been widely accepted by consumers. This study examined the effect of hen's age on some productivity indices (egg weight, fertility, hatchability, egg weight at candling and chick weight) within four flocks of the same breed that

originated from the same line, albeit at different ages. The hens were kept under similar management and environmental conditions and were all derived from the same line. The 607 hatchable eggs used in this study were sampled from the a single line of Anak broiler breeders at 39, 43, 66 and 106 weeks of age, comprising 34.60, 11.53, 34.10 and 19.77 percent respectively. Egg weight at 18 days consistently increased with age, aside from a slight drop observed at 43 weeks, which may have been attributed to a small sample size. However, the chick weight progressively increased as the hen's age increases. Fertility of the eggs was least at 66 weeks, while hatchability was least at 106 weeks. Hatchability after the initial rise at 43 weeks consistently decreased afterwards. A test of independence of fertility and hatchability of eggs on hen's age was highly significant ($P<0.001$), with X^2 values of 24.79 and 29.53 respectively. It was observed that for a profitable and successful hatchery operations, breeder hens are better kept for optimal productivity up to about one year old and should be disposed thereafter.

Table 1. Some productive indices of Anak broiler breed at different ages

Age (Weeks)	N	Egg Weight (g)	Fertility (%)	Hatchability (%)	‡Weight at Candling (g)	Chick Weight (g)
39	210	56.94±0.33^{b}	88.10	79.46	49.28±0.33^{b}	37.72±0.33^{c}
43	70	56.17±0.59^{b}	90.00	82.54	48.36±0.58^{b}	37.79±0.59^{bc}
66	207	60.84±0.43^{a}	71.50	70.27	51.83±0.47^{a}	39.50±0.39^{b}
106	120	61.23±0.63^{a}	74.17	65.17	52.94±0.69^{a}	43.60±0.61^{a}
Combined	607	59.03±0.25	79.90	74.43	50.61±0.25	39.19±0.24

†Means differ significantly ($P<0.05$) ‡Candling done at 18th day

Key Words: Egg Weight, Fertility, Chick Weight