

Production, Management and the Environment: Young Stock, Environment and Management

313 Supplements for replacement beef heifers grazing dry summer California foothills annual range. R. D. Sainz^{*1}, L. F. B. Carvalho^{1,2}, L. R. A. Sodr ^{1,3}, G. D. Cruz¹, D. M. Myers¹, J. W. Oltjen¹, and M. Arana⁴, ¹University of California, Davis, ²Federal Rural University of Pernambuco, Recife, PE, Brazil, ³University of S o Paulo, Pirassununga, SP, Brazil, ⁴A. L. Gilbert Company, Oakdale, CA.

California beef producers depend upon foothill rangelands forage, but due to the Mediterranean climate there are marked seasonal variations in forage availability and quality. Low forage quality during summer requires costly feed supplementation to maintain adequate performance. A previous study showed benefits from use of a high protein supplement for replacement heifers in the summer (Monteiro et al., 2007, J. Anim. Sci. 85 (Suppl. 1):257). This study evaluated two low-cost supplements for 60 weaned Angus-Hereford heifers grazing dry summer range: a dry high protein/energy/mineral mix (UCD-DR; 58% CP) and a home-made low-moisture molasses-based tub supplement (UCD-TUB; 48% CP). Heifers (222 ± 2.2 kg BW) were stratified by BW and allocated randomly to six groups of 10: two supplement types, with three replicates (pastures) each. Heifers were allowed free-choice access to both supplements (using self-feeders for UCD-DR) at all times. Supplement intakes and daily costs averaged 441 and 425 g/d (± 29, P = 0.55) and \$0.229 and \$0.173 (± 0.015, P = 0.01) for the UCD-DR and UCD-TUB groups, respectively. Heifers' ADG were 434 and 284 g/d (± 7.5, P = 0.07) for the UCD-DR and UCD-TUB groups, respectively. Supplementation with high protein, plus energy and minerals for heifers grazing dry summer range maintained ADG as expected. The dry mix tended to produce greater ADG, despite being consumed at a similar rate to the molasses-based tubs. On the other hand, the cost of the tub supplement (\$369/ton) was lower than the dry mix (\$471/ton), and the labor requirement was lower for the tubs as well. Producers can maintain performance and reduce costs of production on California annual range by formulating and mixing their own feed supplements.

Key Words: Cattle, Range, Supplementation

314 Feed intake, gain and feed efficiency of Suffolk ram lambs from a flock emphasizing performance traits. M. E. Benson^{*2}, A. B. Culham¹, and G. M. Hill¹, ¹Michigan State University, East Lansing, ²Washington State University, Pullman.

There is little data available on the feed intake and conversion of feed to gain associated with sheep selected for and attaining high levels of growth performance. This study was conducted to identify animal variation in daily feed intake (DFI), average daily gain (ADG), feed conversion ratio (FCR) and feeding behavior. Thirty Suffolk ram lambs born from January 27 to March 6, 2007 were used in this 42-44 d growing study. Rams were creep fed from birth, weaned at approximately 60 d of age (DOA), and fed a corn, soybean meal based diet from weaning throughout the test period. The diet was offered ad libitum and met or exceeded all NRC (1985) requirements for early weaned lambs with rapid growth potential. An Osborne FIRE electronic feed intake monitoring system was used to measure individual feed intakes and lamb weights, and to record intake behavior. Each ram was fitted with a RFID eartag transponder and was randomly allocated to a pen,

each with one electronic feeder resulting in 7 or 8 rams/feeder. Over the growth period, rams gained an average of 23.7 kg resulting in ADG of .55 ± 0.02 kg/d. ADG ranged from .13 to .77 kg/d. Rams consumed an average of 1.9 ± 1.0 kg of feed/d. Rams that grew faster consumed more feed. ADG and DFI were positively related with an r² of .66, P < .0001. Very efficient feed conversion ratios (FCR) were attained by rams with an average FCR of 3.6 ± .20. FCR was negatively and most highly correlated with ADG (r² = -.44, P = .02) which resulted in the cost of gain being most economical in some of the fastest gaining rams. The r² of FCR with DFI was .33; P = .08. Rams visited the feeders an average of 16.1 (± 8.0) times/d and spent 55.6 (± 4.1) minutes /d in the feeders. Rams were identified in this study that had similar rates of high ADG yet widely different feed conversion ratios. This variation within a flock selected for high growth rates indicates the potential to improve growth performance and nutrient utilization simultaneously.

Key Words: Sheep, Growth, Feed Conversion

315 Variation in total mixed rations on farms utilizing feed management software. B. House^{*}, L. Holden, and G. Varga, Pennsylvania State University, University Park.

Providing a consistent and adequate supply of nutrients is an important factor in optimizing health and production of dairy cattle. The total mixed ration feeding system is widely utilized as a tool to provide a consistent supply of nutrients; however nutrient variability is still a concern. The objective of this study was to quantify nutrient variation as it compares to balanced rations on five Pennsylvania dairies. Herd size averaged 650 (327) cows with an average production of 33.1 (.98) kg/d. Twelve weekly samples were taken from May through July 2007 for twelve different rations. Samples were analyzed for DM, CP, ADF, NDF, and some minerals. The sampled rations were checked for mixing accuracy using feed management software. Using paired t-tests, the mean composition of formulated rations were compared with actual ration analyses. Across all herds, analyzed rations differed significantly (P < .01) from formulated rations with less CP, and more ADF and NDF. Analysis within herds showed a difference (P < .05) in DM% between formulation and analysis in three farms. The average nutrient coefficient of variation ranged from 5 to 10%. Using the average variation and average sample analysis, resulting average variation expected in rations were calculated. Variation in ration composition between actual analyses and formulation is due to several different sources. Values for CP, ADF, and NDF differed for analyzed compared to formulated rations in herds using feeding management software.

Table 1. Nutrient deviations and variation for 12 rations across five herds

Across All Rations (%)	DM	CP	ADF	NDF	P
Avg. Formulation –					
Avg. Analysis	-0.52	1.14	-2.97	-3.58	-0.006
P-value	0.0521	<.0001	<.0001	<.0001	0.2369
Std. Dev. of Difference	3.03	1.00	2.18	2.77	0.026
n	130	130	130	111	29

Coefficient of Variation within a Ration					
Avg.	0.047	0.054	0.093	0.074	0.068
Max	0.084	0.066	0.133	0.091	0.127
Min	0.024	0.026	0.074	0.050	0.041
Avg. Sample Analysis	48.98	16.51	22.34	33.62	0.37
Avg. Variation	2.31	0.89	2.09	2.48	0.025

Key Words: Ration Variation, Feeding Management

316 Residual feed intake of pre- and post-pubertal heifers of diverse breed types. A. N. Loyd*, A. W. Lewis, R. D. Randel, and C. R. Long, *Texas AgriLife Research, Overton, TX.*

With the rising costs of feedstuffs, reducing feed expenses is important for livestock producers. Residual feed intake (RFI) is a measure of feed efficiency developed to identify animals which may require less feed to achieve the same performance as their cohorts. This retrospective analysis of RFI used data collected during 1973 and 1974 from the McGregor location of the Texas Agricultural Experiment Station. Heifers were obtained from a large crossbreeding program involving a five-breed diallel of Angus, Brahman, Hereford, Holstein and Jersey. Breed groups were Dairy (D; n = 16) comprised of Holstein, Jersey, and their crosses, English (E; n = 16) comprised of Angus, Hereford, and their crosses, D x E crosses (n = 19), D x Brahman (B) crosses (n = 12), E x B crosses (n = 9), and B (n = 5). At approximately six months of age, pre-pubertal heifers (n = 77) were individually penned and received ad libitum access to a balanced ration. Feed intake and body weight data collected 84 days prior to puberty and 90 days post-puberty were utilized for this study. The ration was changed at puberty to provide a lower energy density. Considering all females as cohorts, RFI was calculated for each heifer for each period. A moderate, positive correlation ($r = 0.48$; $P < 0.0001$) was found between pre-pubertal and post-pubertal RFI. A difference in RFI among breed types was also detected ($P = 0.11$ for pre-pubertal and $P < 0.0001$ for post-pubertal). This implies that RFI may not be an accurate method to compare feed efficiency of individuals of diverse breed types. When RFI was covaried with the breed type specific NEm, differences in RFI among breed groups, both pre- and post-pubertal, were no longer significant ($P > 0.05$). This implies that a portion of the variation in RFI is accounted for by NEm, thus supporting the argument that RFI may not be a good method to compare cattle of diverse breed types. It is possible that RFI determined during the post-weaning period is only a moderate predictor of variation in RFI during the post-pubertal period.

Key Words: Cattle, Residual Feed Intake, Puberty

317 Effect of feeding method and temperament on measures of feed efficiency and age at puberty in Brahman bulls. N. D. Ramirez*¹, D. A. Neuendorff³, A. W. Lewis³, S. T. Willard⁴, R. C. Vann⁷, S. Bowers⁴, T. H. Welsh, Jr⁵, T. D. A. Forbes⁶, R. L. Stanko^{1,2}, and R. D. Randel³, ¹Texas A&M University, Kingsville, ²Texas AgriLife Research Station, Beeville, TX, ³Texas AgriLife Research and Extension Center, Overton, TX, ⁴Mississippi State University, Starkville, ⁵Texas

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The objective of this study was to determine the effect of feeding method, limited (LF) or ad libitum (AL), and temperament on measures of efficiency in spring-born Brahman bulls. Bulls (n=32) were randomly allocated to either be LF or AL fed for 70 d (P1). Following a 7-d rest, treatments were exchanged in a cross-over design and bulls were fed an additional 70 d (P2). Bulls were blocked by BW and assigned to pens (n=11, 2 to 5 bulls/pen). Pen score (PS) and exit velocity (EV: m/s) were used to qualify temperament. Mean (\pm SEM) age and BW at the beginning of the trial were 343 ± 4 d and 327 ± 8 kg. Bulls were individually fed twice daily a 12% CP (NEm=0.291 Mcal/kg and NEg=0.272 Mcal/kg) pelleted ration. Bull BW was recorded and amounts fed were adjusted daily during AL and weekly during LF. RFI was calculated as the residual from the linear regression of DMI on mid-test BW^{0.75} and ADG. Feeding method did not effect ($P > 0.1$) RFI, ADG, DMI, and feed efficiency (FE; G:F, g of ADG/kg of DM). However, feeding period influenced ($P < 0.06$) ADG (1.06 ± 0.04 and 0.95 ± 0.04 kg/d) and DMI (8.4 ± 0.2 and 9.4 ± 0.4 kg). Order of feeding treatment influenced ($P = 0.06$) FE. Overall, RFI was correlated ($P < 0.001$) with FE in LF (-0.56) and AL (-0.65) bulls, and PUB was correlated ($P < 0.05$) with DMI (-0.37) in LF bulls only. Mean (\pm SEM) RFI and ADG in LF and AL were -0.52 ± 0.3 and 0.54 ± 0.8 , and 1.00 ± 0.04 and 1.01 ± 0.04 kg/d, respectively. Treatment influenced RFI in P1, but not in P2, LF (RFI=-0.62 \pm 0.42) were more efficient ($P < 0.01$) than AL (RFI=0.66 \pm 0.1) bulls. In P1, RFI was correlated ($P < 0.05$) with FE (-0.56) in LF but not AL bulls; ADG was correlated ($P < 0.05$) with DMI (0.71), and EV was correlated ($P < 0.05$) with PS (0.56) in LF but not AL bulls. In P2, RFI was correlated ($P < 0.01$) with FE in LF (-0.65) and AL (-0.74) bulls. These data suggest that there may be a relationship between method of feeding and measures of feed efficiency and thus selection for efficiency (low RFI). Limit feeding spring-born Brahman bulls may be more appropriate than AL feeding to establish accurate measures of efficiency.

Key Words: Residual Feed Intake, Reproduction, Brahman Bulls

318 Effect of reflective insulation on calves in polyethylene hutches. B. H. Carter*, T. H. Friend, J. H. Matis, J. E. Sawyer, and M. A. Tomaszewski, *Texas A&M University, College Station.*

Radiant heat load on calf hutches may add to heat stress by increasing interior hutch temperature. A summer trial was conducted on a Texas Panhandle dairy to determine if covering polyethylene hutches with reflective insulation would reduce heat load on individually housed Holstein-Friesian calves. Twenty of 38 hutches were covered with a 2.5 x 2.2 m sheet of reflective aluminum and polyethylene double bubble film insulation (8 mm thick) over the top and two sides of hutches. Interior hutch temperature was recorded for 72 h at 10-min intervals. Body (ear canal) temperature (BT) was measured for two 72-h periods at 10-min intervals when calves averaged 35 and 56 d of age. Respiration rate was recorded by observation at 2-h intervals for 48 h of each period. Results for the two periods were pooled. Effects of ambient thermal heat index (THI) on the rate of body and hutch temperature change were modeled for each calf and hutch using linear regression. The slopes for body and hutch temperature were compared for insulation effect using 2-sample t-tests. Estimated mean respiration rate, calf

BT and interior hutch temperature were calculated for each calf at high (> 72) and moderate (< 72) THI. Effects of insulation on respiration rate, BT and hutch temperature were tested at high and moderate THI using 2-sample t-tests. Calf BT was similar ($P=0.16$) among insulation treatments at high THI, but was higher ($P=0.05$) for calves in insulated hutches at moderate THI. Insulation had minimal effect on the rate of BT change ($P=0.11$). Respiration rates were lower ($P=0.04$) for calves in insulated hutches at high THI, and tended to be lower at moderate THI ($P=0.17$). Covering hutches reduced ($P<0.01$) interior temperatures by $1.4 \pm 0.14^\circ\text{C}$ at high THI but increased ($P<0.01$) interior temperatures by $0.58 \pm 0.09^\circ\text{C}$ at moderate THI. The rate of temperature change for insulated hutches was lower than control hutches ($P<0.01$). Covering polyethylene hutches with reflective insulation moderated temperature and its change within hutches, reduced respiration rate of calves, and may benefit calves by retaining heat in cooler temperatures.

Key Words: Dairy, Hutch, Reflective

319 Changes in newborn calf and colostrum management on U.S. dairy operations 1991-2007. J. E. Lombard*, C. A. Kopral, B. A. Wagner, and G. W. Hill, *USDA:APHIS:VS:Centers for Epidemiology and Animal Health, Fort Collins, CO.*

The National Animal Health Monitoring System has conducted 4 studies evaluating the dairy industry – 1991, 1996, 2002 and 2007. One objective of this study was to evaluate changes in newborn calf and colostrum management over this time period. States were selected in each of the study years to represent at least 75% of dairy operations and dairy cows with responses statistically weighted to make inferences back to the population from which the sample was selected. The percentage of operations where newborn calves were separated from their dam immediately after birth increased from 28.0% in 1991 to 55.9% in 2007. For operations that hand-fed colostrum, the percentage of operations that evaluated the quality of colostrum has increased from 5.2% in 2002 to 13.0% in 2007 and its use increased as herd size increased. The practice of pooling colostrum has decreased from 27.0% in 2002 to 21.0% in 2007. More operations are storing colostrum in a refrigerator in 2007 (11.1%) compared to 7.8% in 2002; however, most operations that hand-fed colostrum, did so without storing it. Colostrum was primarily hand-fed from a bucket or bottle from 1991 to 2007. There have been no changes in the percentage of operations by the method of delivering the first feeding of colostrum. Approximately one-third of operations allowed calves to obtain colostrum at first nursing. The percent of operations by quantity of colostrum fed during the first 24 hours has not changed since 1991 with about 30% providing 4 or more quarts. Two or less quarts were normally fed on approximately one-quarter of operations from 1991–2007. Although more operations are removing calves from their dams immediately after birth, the quantity of colostrum administered on dairy operations hasn't changed since 1991. The importance of feeding 4 quarts of high quality colostrum to every calf is an opportunity for continued producer education.

Key Words: Colostrum, Calves

320 Relationship between temperament and chute exit velocity of Senepol calves after weaning. R. W. Godfrey* and R. C. Ketring, *University of the Virgin Islands, Agricultural Experiment Station, Kingshill, VI.*

The objective of this study was to evaluate the relationship between temperament and growth in weaned Senepol calves. Bull ($n=22$) and heifer ($n=31$) calves were evaluated at weaning (211 ± 3 d of age), 90 d post-weaning (302 ± 2 d of age) and as yearlings (374 ± 3 d of age) using chute score (CS) and exit velocity (EV) as indicators of temperament. Calves were weighed at each evaluation and scrotal circumference (SC) was measured for bulls as yearlings. The CS was determined on a 1 to 5 scale with 1 being calm and 5 being extremely agitated and EV, reported in m/sec, was measured as the animals exited the chute using an electric timing system. None of the calves received a CS greater than 4 at any time. At weaning there was no difference ($P>0.10$) in CS between bulls and heifers (1.6 ± 0.2 vs. 1.9 ± 0.1 , respectively). At 90 d and as yearlings heifers had higher ($P<0.002$) CS than bulls (2.4 ± 0.1 and 2.5 ± 0.2 vs. 1.7 ± 0.2 and 1.7 ± 0.2 , respectively). The CS increased ($P<0.004$) over time in heifers but not in bulls. Heifers had greater ($P<0.0001$) EV than bulls at weaning, 90 d and as yearlings (3.2 ± 0.1 , 3.2 ± 0.1 and 2.9 ± 0.2 vs. 2.7 ± 0.2 , 2.6 ± 0.2 and 2.4 ± 0.2 m/sec, respectively). The EV did not change over time in either bulls or heifers ($P>0.10$). In bulls with a CS of 3 ADG from weaning to 90 d was greater ($P<0.04$) than ADG from weaning to yearling. There was no difference ($P>0.10$) in ADG from weaning to 90 d and weaning to yearling in bulls with a CS of 1 or 2. In heifers there was no difference ($P>0.10$) in ADG during any time period among any of the CS groups. Overall CS and EV had a moderate correlation ($P<0.001$, $r=0.424$). The CS and EV had a moderate correlation at weaning ($P<0.0001$, $r=0.518$), 90 d ($P<0.005$, $r=0.383$) and at yearling ($P<0.005$, $r=0.446$). Weight and EV were correlated at 90 d ($P<0.001$, $r=-0.434$) but not at any other time and CS was not correlated with weight at any time ($P>0.10$). These results show that the temperament of Senepol calves does not change over time after weaning and heifers are more temperamental than bulls.

Key Words: Temperament, Cattle, Behavior

321 The effect of severe winter weather on net energy required for maintenance by yearling steers. P. T. Grubb*, J. J. Wagner, and T. L. Engle, *Colorado State University, Fort Collins.*

Severe winter storms in southeast Colorado resulted in 38 cm snow accumulation over Christmas weekend in 2006 and an additional 96 cm snow accumulation over New Years weekend in 2007. This snow was accompanied by strong winds which caused excessive drifting. Economic losses suffered by the cattle feeding industry were severe and several research trials were lost at SECRC. Enough data from one of the studies were salvaged to provide an interesting look into the effect of severe winter weather on net energy requirements for maintenance. A set of 214 steers were weighed on December 26, 2006 and average weight (minus four percent pencil shrink) was $558 \text{ kg} \pm 21.7$. Over the following 58 day period there was a 7.0% death loss and average daily gain was $-0.13 \text{ kg} \pm 0.21$ for these steers. Average steer weight (minus four percent pencil shrink) was $550 \text{ kg} \pm 18.7$ on February 22, 2007. During the worst days of the storms, pen feed delivery records were not maintained. However, for accounting purposes, records of total feed delivered to each lot of cattle at SECRC were maintained. This allowed for calculations of net energy required for maintenance based on overall performance and total feed delivered. Total DM delivered to these steers was 53,436.7 kg and average NEM concentration in the diet was 2.263 mcal/kg DM. Daily dry matter intake averaged 9.67 kg/hd/d. Net energy equations published by the National Research Council (1996) were used to calculate average empty body weight (EBW, 497.7 kg), empty body

gain (EBG, -0.00686 kg/d), and retained energy (RE, -0.038 mcal/d). The negative RE value showed that the steers were not recovering enough energy from the diet to meet maintenance requirements. Net energy required for maintenance was 21.927 mcal/hd/d or 0.208 mcal per kg EBW^{0.75}. Statistical analyses of these results were not possible due to the inability to recover pen dry matter intake estimates. However, these data indicate that NEm required during and in the aftermath of a major winter weather event may be 2.7 fold higher than NEm required (0.077*EBW^{0.75}) under thermal neutral conditions.

Key Words: Net Energy for Maintenance, Cold Stress, Retained Energy

322 Hoop buildings vs. conventional feedlots for steers: Effects on growth and performance. P. Lammers*¹, A. Johnson¹, S. Lonergan¹, J. Harmon¹, R. Baker¹, S. Shouse², W. Busby², and M. Honeyman¹, ¹Iowa State University, Ames, ²Iowa State University Extension, Ames.

As the cattle feeding industry focuses on environmental management, there is increasing interest in facilities that minimize runoff such as deep-bedded hoop barns. The objective of this study was to compare the performance of yearling steers between housing treatments: pens inside a deep-bedded hoop barn with a partial concrete floor (HP) vs. pens in a conventional, outside feedlot with shelter (FD). Results are from 2

complete yr. Each yr, 2 groups of yearling steers were fed. Summer/fall groups were put on test in August and marketed in November. Winter/spring groups were put on test in December and marketed in April/May. Steers (422 kg) were randomly allotted to 3 pens within each housing treatment with approximately 40 hd per pen (HP = 4.65 m²/steer; FD = 14.7m²/steer). A description of the hoop barn is reported in Hoop Barns for Beef Cattle 2004, MidWest Plan Service AED-50. All steers were fed a complete and balanced ration and had ad libitum water access from 1 drinker/pen. Cattle in HP received corn stalks for bedding year-round (2-3 kg/d) and FD cattle were supplied bedding only during the winter/spring season (0.5-1 kg/d). Cattle weights and feed disappearance were recorded and used to calculate performance. Carcass data were recorded at the time of harvest (608 kg). Gain-to-feed (kg gain/kg feed) was more for steers in FD than HP (0.15 vs 0.14; *P* = 0.04). There were also trends for FD cattle to have greater ADG (1.90 vs 1.83 kg/d; *P* = 0.05) and larger total gains on test (190.4 vs 182.2 kg; *P* = 0.06). Housing did not affect ADFI, hot carcass wt, marbling, or carcass grade. Summer/fall steers were heavier, had greater ADG and G:F, and produced larger carcasses than winter/spring steers. There were no differences in marbling score or carcass grade between the 2 seasonal periods. There were no housing × season interactions for any measure examined. The difference in G:F and trend for lower ADG for steers fed in hoop barns warrants additional study. Overall the cattle performed similarly with similar carcass data for both housing systems.

Key Words: Deep-Bedded Hoop Barns, Feedlot Beef Cattle