gain was higher (P<0.001) on L as were total concentrations of ruminal VFA (P=0.06). Treatment had no effect (P>0.05) on proportion of individual VFA. Treatment had no effect (P>0.05) on daily CH_4 emissions overall or within any individual period. There was a trend (P=0.10) for lower CH_4 emissions per kg ADG for animals on L (143 v. 166 g CH_4/kg ADG). These results show that reducing pre-grazing HM will lead to increased animal performance, and thus may lead to reduced CH_4 emissions in beef production systems where cattle are slaughtered at a target live-weight. A data modelling approach is required to fully quantify these effects.

Key Words: beef cattle, methane, pasture quality

Small Ruminant: Symposium: Organic and Grass-Fed Small Ruminant Challenges and Opportunities

374 Obstacles to organic and grass fed small ruminant production in the U.S. J. M. Burke*, *USDA, Agricultural Research Service*, *Booneville, AR*.

Certified organic and grass fed production systems must align to standards defined by the USDA Agricultural Marketing Service. There is very little research being conducted on organic livestock systems in the U.S. by land grant colleges or federal research agencies. The demand for organic, grass fed, locally-grown, and natural products is strong and there is a desire to increase the sustainability of farming systems, which is perceived to occur by using organic and grass fed management. Obstacles to becoming certified organic include increased record keeping, increased risks, limited awareness of organic farming system practices, lack of processing facilities, lack of certified organic feeds, and inability to capture market share. In many environments, internal parasite control remains a large barrier. Small ruminants must be managed to minimize internal parasite infection. Also, growing animals must only graze certified organic pastures or feed. The latter is limited by availability and may not be sustainable because of dependency on off-farm inputs. These same obstacles do not necessarily apply to grass fed management. Grass fed ruminants are defined as those provided a diet solely from forage with the exception of milk before weaning. This standard applies to animals destined for slaughter, but not necessarily breeding animals. Both management systems are in need of basic and applied research to optimize production and maximize profitability. Research should follow a systems-oriented approach that applies organic or grass fed principles. Priorities have been identified and include development of effective parasiticides, parasite management strategies, development of emergency and preventative health care strategies, development of improved genetics to fit the system, and environmental impact studies. In addition, research is needed on forage management to optimize growth of weaned animals. A case study will be presented.

Key Words: goat, sheep, systems research

375 Ecology as a model for organic dairy production. F. Thicke*, *Radiance Dairy*, *Fairfield, IA*.

Natural ecosystems are characterized by biodiversity, self sufficiency, and the conservation and recycling of nutrients. The diversity of a natural ecosystem precludes off-site pollution because the waste of each species is recycled as substrate for other species. By contrast, industrial crop and livestock systems are characterized by monocultures and requirements for high external inputs. The inability of monoculture systems to efficiently process waste *in situ*, combined with practices that disrupt ecological integrity, result in leakage of materials (e.g., nutrients, pesticide residues and eroded soil) from these systems to become pollutants to off-farm resources. An organic, grass-based dairy mimics the ecosystem of prairie plants and bison which created the highly productive soils of parts of North America. In that prairie ecosystem, prairie grasses and forbs produced massive growth, both above-ground and below-ground. Migrating bison herds periodically grazed off the above-ground plant growth, resulting in the plants sloughing root mass off into the soil to balance their reduced photosynthetic capacity. Repeated growth-and-grazed cycles pulsed organic matter deep into the soil, creating the productive, high-organic-matter soils of the prairies. Similarly, organic grazing systems that are designed and managed in accord with ecological principles can enhance the farm resource base (soil quality, water quality, air quality, and wildlife habitat) as well as promote good animal health, reduce reliance on fossil-fuel energy and other external inputs, and minimize pollution-causing leakages. A case study will be presented of an Iowa monoculture-crop farm that was converted to an organic, grass-based dairy that processes milk on the farm and markets finished dairy products locally. The farm design and management will be discussed as a model of an ecologically based farming system.

Key Words: dairy, organic, graze

376 Successful organic dairy systems. K. J. Soder*, *USDA-ARS, Pasture Systems & Watershed Mgmt. Research Unit*, *University Park, PA*.

Demand for organic dairy products has continually increased and at times outpaced supply for a number of years, creating favorable milk pricing for certified organic dairy farmers. This stability in organic milk prices has provided organic dairy farmers with a security not found in the conventional milk marketing system. Many organic dairy farmers transitioned organic production to implement philosophies of the organic production system. Others transitioned in an effort to increase profitability. However, even with relatively high premiums paid for organic milk, transitioning to organic production does not guarantee profitability. There are many challenges unique to organic milk production, including accessing markets for milk pickup, sourcing organic feeds and veterinary care. Additionally, the recently volatile input prices have significantly challenged the sustainability of organic dairies. While organic dairy systems are primarily forage-based systems, emphasizing high-quality pasture, supplementation is still an important component for many farms. Organic feed prices have increased at a greater rate than conventional feed prices, in part due to demand outpacing supply as an increasing number of dairies transitioned to organic production in recent years. Some organic farmers have opted to decrease, eliminate, or find alternative supplementation strategies to decrease feed costs. Others produce more of their feeds on-farm. This presentation will provide an overview of the organic dairy industry. Data will be presented showing recent trends in organic dairy production, including recent growth of the

industry, current statistics and economics of organic milk production. A summary of strategies used by organic dairies to adapt to current industry challenges will be discussed including those mentioned above as well as changing herd genetics, putting even more emphasis on cropping and pasture fertility, and exiting the industry. Finally, a brief review of changes to the organic pasture standard currently being proposed and revised by the National Organic Program will be presented.

Key Words: dairy, organic, systems

377 Grass-fed management systems for profitable livestock production. S. K. Duckett* and J. G. Andrae, *Clemson University, Clemson, SC.*

Consumer markets for natural, forage-finished livestock products are expanding in the U.S. As a result of this demand, some livestock producers are electing to finish animals on forages and market products directly to consumers. Agricultural Marketing Service has established a voluntary standard for a grass (forage) fed marketing claim for ruminant livestock. The grass (forage) fed claim standard is that grass (annual and perennial), forbs, browse, forage, or stockpiled forages, and post-harvest crop residue without separated grain shall be at least 99% of the energy source for the lifetime of the ruminant specie, with the exception of milk consumed prior to weaning. Producers can now request a grass fed claim be verified by USDA. Results from our research show that forage-finishing decreases LM lipid content and increases fat-soluble and water-soluble vitamin contents. Forage-finishing also increases concentrations of cis-9 trans-11 CLA, trans-11 vaccenic acid, and all n-3 fatty acids (linolenic acid, EPA, DPA, DHA). One of the greatest challenges facing livestock producers is the consistent supply of high quality forages for finishing. Forage nutritive and fatty acid content are variable among species, variety, harvest time, and growing season. These differences in forage fatty acid content influence meat and milk fatty acids produced in grazing animals. Forage systems that optimize stocking rates and nutritive density and minimize input costs are needed. Evaluation of alternate forages is of considerable interest to fill gaps in perennial forage production and/or promote high rates of gain. Forages we have evaluated for finishing include: alfalfa, chicory, cowpea, pearl millet, non-toxic tall fescue, and bermudagrass. Alternative fertilizers, legumes, and supplements should be evaluated to determine their effects on forage production, animal performance (including parasite load) and product quality.

Key Words: livestock, forage, fatty acid

Animal Behavior and Well-Being: Animal Behavior and Well-Being 1

378 Enriched colony cage for laying hens and the effects on behavioural and physiological parameters. N. J. Cook*[1], J. Feddes[2], D. Korver[2], D. B . Haley[2], and J. S. Church[3], [1]*Alberta Agriculture and Rural Development, Lacombe Research Centre, Lacombe, Alberta, Canada*, [2]*University of Alberta, Edmonton, Alberta, Canada*, [3]*Thompson Rivers University, Kelowna, British Columbia, Canada*.

The benefits to laying hens of colony cages of 40, 20 and 10-birds/cage, and enrichment with perches, nest boxes and scratch pads, were assessed by behavioural and physiological parameters. Non-enriched, "conventional" cages of 5-birds/cage were included for comparison. Laying hens were Brown (n = 360) and White (n = 360) Leghorns over an egg laying period of 65wks. Behavioural and physiological parameters were the % perch use for roosting at 57, 61 and 62 weeks, claw length (n = 288) for use of scratch pads at week 65, and the comparative numbers of eggs laid within nest boxes at 35 and 60 weeks. Feather cover was assessed by infrared thermography of 144 birds at 35 and 60 weeks. Densities and areas of the humerus and femur (n = 60) were assessed by quantitative computer tomography at week 65. Time-integrated adrenocortical activity was assessed by egg yolk and albumin levels of corticosterone in 20% of the eggs from each cage type during weeks 35 and 60. Data were analyzed by mixed models using JMP v6. The majority of eggs (72.6%) were laid in nest boxes. Nest use was highest in Brown hens ($P < 0.03$). Perch use was >80% but was significantly less in the 10-bird cages ($P < 0.0001$) due to a shorter perch length. Claw length was longer in the 5-bird cages compared to enriched cages ($P < 0.0001$). Bone densities and areas were not associated with cage type or enrichment. Densities and areas of the humerus and femur were highest in Brown birds ($P < 0.005$). White birds exhibited better feather cover than Brown ($P < 0.0001$). Feather cover declined from 35 to 60wks for breast and back areas ($P < 0.0001$). Feather losses were highest in 20 and 40-bird cages and lowest in the 5-bird cages. Egg albumin corticosterone was significantly lower at 60wks compared to 35wks ($P < 0.001$). Yolk corticosterone was significantly lower at 60wks in 5-bird cages ($P < 0.05$). The findings indicated a preference for the use of nest boxes, perches and scratch pads. However, the materials and size of the enrichment amenities had implications for feather cover.

Key Words: laying hens, colony cages, environmental enrichment

379 Animal welfare indicators of Holstein bulls ring-castrated at three months of age. S. Marti*[1,2], A. Velarde[2], J. L. de la Torre[1,3], A. Bach[2,4], X. Manteca[1,3], A. Aris[2], A. Serrano[2], and M. Devant[1,3], [1]*Animal Nutrition, Management, and Welfare Group, Barcelona, Spain*, [2]*IRTA, Barcelona, Spain*, [3]*UAB, Barcelona, Spain*, [4]*ICREA, Barcelona, Spain*.

Ring castration at 3 mo of age is an effective and low-time consuming procedure, however it has been questioned from the welfare point of view. Forty-seven bulls (130 ± 3.43 kg BW and 95 ± 1.5 d of age) individually housed were randomly assigned to 2 treatments (control, CTR, n = 23 or castrated, CAS, n = 24) to evaluate the effect of ring castration at 3 mo of age in Holstein bulls on welfare indicators. Castration was performed with local anesthesia (lidocaine 2%, 3 mL in each testis and 2 mL in the scrotum) and analgesia (flunixin meglumine, 3 mg/kg BW) treatment, no local anesthesia and analgesia were used in CTR bulls. Serum cortisol concentration was determined at -120, 0, 30, 60, 90, and 180 min after castration. At days 1, 3, and weekly thereafter during 2 mo serum haptoglobin concentration, rectal temperature, lesions at the castration site, and behavior of 12 CTR and 12 CAS bulls recorded continuously for 24 h, BW and concentrate and straw intake were analyzed. Serum antibody titers against ovoalbumin were determined at 14 and 35 d. At day 49, bulls were i.v. injected with ACTH and serum cortisol concentration at 0, 1, 2, and 4 h thereafter, and serum testosterone concentration were determined. The statistical model included initial BW as a covariate, castration, time, and the interaction between castration and time, as fixed effects, and animal as a random effect. Gain was greater ($P < 0.001$) in CTR than CAS bulls (1.36 vs 1.16 ± 0.038 kg/d, respectively). Area under the curve of serum cortisol at day 0 was smaller ($P <$