ADSA-SAD UNDERGRADUATE STUDENT PAPER COMPETITION: ADSA-SAD UNDERGRADUATE PRESENTATIONS—DAIRY PRODUCTION

0018 Dairy cow welfare: Bridging the gap.
E. A. Morabito* and J. M. Bewley, *University of Kentucky, Lexington.*

Most consumers are unaware of dairy production practices and generally rely on information from print, television, and social media to obtain information. Animal welfare is 1 consumer concern that often creates a gap between consumers and dairy producers. Differing values and ethics increase the complexity of animal welfare as an ethical issue. Current dairy welfare research includes objective physiological, behavioral, preference, and motivational research. Objective research observes measureable variables to determine whether the welfare of a dairy cow is compromised. These measures may not be useful indicators of psychology or natural behaviors, but are helpful in other types of welfare research. Cow comfort research examines cow behavior with different facilities and management practices. This research demonstrates how cow comfort is beneficial for welfare and production. Preference research includes observing dairy cow choices among alternative situations. This indicates cow inclinations and helps redefine natural behaviors. Motivational research is similar to preference research where an obstacle is used to get to 1 of the situations. An obstacle could include a physical barrier or longer walk to get to the destination. This demonstrates how motivated a cow is to choose 1 situation over another. All of these current research areas are allowing scientists to understand more about animal behavior and psychology. Knowledge of dairy cow emotions is still lacking and difficult to measure. Animal welfare models have been created to understand the broader definition of welfare. These models go beyond the traditional measures of welfare and include less measureable traits, such as emotions and an animal's need for a natural environment. Before applying these models to improve the definition of animal welfare, research must be conducted to understand more about emotion, psychology, physiology, and natural behavior. Some studies on both lab and livestock species have been conducted to measure emotions. Translating these studies into dairy research may be beneficial in the future. Publicizing information about current and future research is important for public education. Education, along with the implementation of welfare models, may help bridge the gap between consumers and dairy producers. Improving animal welfare will improve dairy cow well-being, public perception, and overall dairy production.

Key Words: dairy, ethics, welfare

0019 The effects of overcrowding on the behavior of lactating dairy cows in freestall housing systems.
S. F. Templeton*, R. A. Black, and P. D. Krawczel, *University of Tennessee, Knoxville.*

Overcrowding is commonly seen among freestall dairy operations to increase herd size without altering facilities. Overcrowding occurs at stocking densities > 100%. Overcrowding at the feedbunk is defined as > 1 cow per headlock or < 0.6 m of linear feedbunk space per cow. Overcrowding at the resting space is defined as providing < 1 stall per cow. At maximum capacity, 48.5% of freestall farms in the United States provided < 1 stall and 67.9% provided < 0.6 m of feedbunk space per animal (USDA, 2010). These crowded environments interfere with time budgets of cows by disrupting lying and feeding behaviors. A normal behavior time budget for a lactating dairy cow includes 3 to 5 h of eating per day (Grant & Albright, 2001). As stocking density increased, time cows spent feeding decreased, whereas feeding rate increased. This may alter intake during these feeding bouts. Increased feeding rate may increase the risk for ruminal acidosis and displaced abomasums after calving. Aggressive interactions among animals resulting in displacements from the feedbunk also occur more frequently in overcrowded pens (DeVries et al., 2004). Providing 0.5 m of feeding space as opposed to 0.1 m of feeding space resulted in 60% less space between animals and 57% more aggressive interactions while feeding. Subordinate animals are most affected, as they will often be displaced from the bunk by a dominant animal. Feed quality tends to decline throughout the day as TMR is sorted and submissive cows will ultimately consume a poorer quality diet after waiting for feedbunk access. A typical lactating dairy cow will rest for 12 to 14 h/d to meet her daily time budget (Grant & Albright, 2001). Cows prioritize rest and will choose to rest rather than eat when both lying time and feeding time are limited (Munksgaard et al., 2005). At stocking densities of 150%, cows spent 1.7 h/d less lying relative to those housed at 100% (Fregonosi et al., 2007). These data may help explain the positive relationship between milk production and freestall availability described by Bach et al. (2008). Krawczel et al. (2008) reported average time standing idly in the alley also increases at stocking densities > 110%, which is associated with an increased risk for lameness.

Key Words: freestalls, overcrowding, stocking density

0020 A Polled Future.
M. Richard*[1] and C. C. Williams[2], *[1]Louisiana State University, Baton Rouge, [2]Louisiana State University AgCenter, Baton Rouge.*

The horn is an adaptation of the skin, characterized by hardened keratin in the epidermis. Dairy cattle have used their horns as a defense mechanism since the beginning of their existence. However, since dairy cattle no longer need to ward off predators in the wild, their horns do not serve a purpose. Addi-

tionally, horns can cause injury to handlers and other cows in the herd. Thus, disbudding or dehorning is necessary to lower risk associated with the horns of dairy cattle. Disbudding and dehorning techniques differ; however, they both have disadvantages associated with the procedure relating to cost, health, and animal welfare. The solution presents itself in polled genetics. Animals born without horns carry 1 or 2 polled alleles. German researchers found that this genetic marker was associated with certain mutations, such as a hairy eyelid. Since the polled gene is dominant, genetic selection can improve rapidly. An animal with 2 polled alleles will produce 100% polled offspring, whereas an animal with only 1 polled allele will still have 50% of its offspring polled. Polled genetics are also more cost efficient than dehorning, as a farmer can spend an additional $7.50 for polled genetics. Other advantages of polled genetics include eliminating the risk of infection and reduced labor required. However, limited genetic selection is a major reason dairy farmers are hesitant to embrace polled genetics. Although still a minority, polled dairy cattle are increasing in generic merit and polled bulls are beginning to rank in the top of genetic evaluations. In conclusion, using polled genetics provided a more cost efficient and less labor intensive alternative to traditional dehorning methods.

Key Words: dairy cattle, polled genetics

0021 The future role of metabolomics in dairy science.
A. E. Kraus*, K. J. Harvatine, and D. R. Olver, *Pennsylvania State University, University Park.*

Metabolomics is an emerging field used to investigate chemical fingerprints left behind by biological and pathological processes. Although research in this discipline far predates its modern name, metabolomics studies are now conducted in a more global, non-targeted manner because of technological advancements. Metabolites in tissues and biofluids are identified using chromatography coupled with mass spectrometry platforms. Metabolites can then be identified by matching their unique masses and fragmentation patterns with standards in metabolome databases. Changes in metabolite fingerprints can differentiate between healthy cows and those with subacute diseases. For example, the metabolites in rumen fluid and milk can be used to gain insight into the mechanisms behind subacute diseases such as acidosis, ketosis, and mastitis. By examining these global changes in metabolite expression, researchers can investigate perturbations to biochemical pathways and eventually use these novel biomarkers to develop metabolite monitoring systems. An increasing number of metabolomics studies are being conducted to better understand the health-disease continuum in humans and model organisms. However, the potential for this tool in dairy science research remains largely unrealized as endogenous and exogenous metabolites continue to be characterized. Recent investigations published in the *Journal of Dairy Science* demonstrate the potential for metabolomics to help increase feed efficiency and reduce production losses in the dairy industry. In the future, metabolomics will be influential in revealing the complex mechanisms behind costly subacute metabolic disorders and pathogen-induced diseases in dairy cattle.

Key Words: mass spectrometry, metabolomics, subacute disease

0022 Polled genetics: Benefits, detriments, and identification of polled dairy cattle.
A. L. Patch*, R. R. Cockrum, and D. R. Winston, *Virginia Polytechnic Institute, State University, Blacksburg.*

The polled trait demonstrates autosomal complete dominance that results in horn growth suppression. Selection for polled cattle has become increasingly popular and can be identified phenotypically by observation and/or genotypically through genomic testing. Dairy cattle are classified with 3 identifiers: observed polled (PO), heterozygous polled (P), and homozygous polled (PP). Observed polled cattle are visually identified by the producer, whereas genomic testing requires analysis of the DNA. Animals identified through genotyping can be determined with a high density SNP chip. A genome-wide association analysis in beef and dairy cattle revealed a 1 Mb region within chromosome 1 associated ($P \leq 0.002$) with P and PP. Further analyses determined a SNP (AC000158:G1390292G > A) located within intron 3 of Interferon γ receptor 2 gene (IFNGR2) and an immune gene was co-segregated with polled in Holsteins. The SNP, AC000158:G1390292G > A, can be used as a genetic marker when testing for polled in dairy cattle. The benefits of polled cattle include: increased docility, decreased labor requirements, improved public perception, and eliminating the necessity of dehorning the animal. Polled genetics allow the producer to realize a profit of $7.50/animal. Conversely, the disadvantages of selecting for polled genetics include: decreased genomic total production index (GTPI), reduced net merit value (NM$), and an increased risk of inbreeding, due to a smaller available gene pool. One possible solution to incorporate polled genetics into the herd is to breed for heterozygous polled cattle by crossing genetically superior cows with polled bulls or breeding polled cows with superior bulls.

Key Words: dairy cattle, polled, single nucleotide polymorphism

---

0023 Crossbreeding—Is it a good option?
R. J. Yarbrough* and S. Washburn, *North Carolina State University, Raleigh.*

Long-term selection of dairy cattle for increased production has resulted in a decline in various functional traits, including reduced fertility, as well as concerns about soundness of feet and legs, resistance to disease, and overall shorter productive life. Some of those effects may be related to increased inbreeding and others due to unfavorable correlations of production traits to fitness traits. Crossbreeding is 1 way to

eliminate inbreeding and bring heterosis into a herd, which could result in improved functional traits in that herd. There has been renewed interest in crossbreeding worldwide with use of both traditional and non-traditional dairy breeds. Some studies have documented up to a 10% economic gain in the F_1 crosses. Holstein and Jersey crosses are popular, due to the commonality of these 2 breeds. Those crosses generally have advantages in fertility, calving ease, neonatal survival, maintenance of body condition score, and are still competitive for milk yield and milk components. Holsteins have a higher milk yield, but Holstein × Jersey crosses produce milk with higher fat and protein content. Across time, 2-breed crosses maintain 67% of the heterosis of the original F_1, whereas 3-breed crosses maintain ~86% of the initial heterosis. Cows that have lower fertility or lack functionality otherwise lead to lost revenue, greater cow turnover, and simply do not last long term on a farm. Selection for improved fitness within breed is a good approach, but crossbreeding may also be a strategy to improve the bottom line in some herds.

Key Words: functionality, heterosis, inbreeding