169 The impact of genomic selection on A.I. companies, today and tomorrow. K. L. Westaby* and L. H. Kilmer, *Iowa State University*, *Ames*.

Genomic selection may transform the dairy industry by altering the process that A.I. companies use to identify, select, and evaluate new bulls. This advancement in animal genetics involves genotyping animals to ascertain which ones have inherited the best set of alleles responsible for traits desirable to the industry. A.I. companies can use rapid genomic evaluations to genotype more bulls as an initial step to identify those bulls with superior genetics, then progeny test fewer bulls than is done currently. Genomic information is particularly valuable for determining differences among full siblings. Alternatively, A.I. companies now have the option to offer bulls selected from genetic predictions based on genomic information and ancestor performance, without the time consuming process of progeny testing. However, the reliability of these genetic predictions remain to be tested. In the future, the use of genomics can be expanded by selection for traits with low heritability, and testing bulls from families not previously used, to help reduce inbreeding. The positive changes that genomic evaluations have and will continue to make for the A.I. industry are only just being realized. Reliability of genomic estimates will continue to improve as more animals are genotyped, statistical methods are refined, and associations between genotypes and phenotypes are better defined. However, A.I. companies can currently use genomic selection to reduce costs of getting a truly superior new sire into their active line-up, and increase the rate of genetic gain, especially in traits not easily selected for when using parent averages.

Key Words: genomic selection

170 Pre-planning considerations for on-farm dairy processing enterprises. E. A. Chaney*, *University of Kentucky*, *Lexington*.

The current trend toward fewer and larger dairy operations and increasingly volatile milk prices present many challenges for the small dairy business manager. One option that dairy managers searching for a way to maintain a small dairy operation may consider is on-farm processing of a value added dairy product (i.e. cheese, ice cream, or bottled milk). Niche marketing of dairy products, which has increased in recent years, can be a feasible way to maintain family goals and a profitable business simultaneously. The decision to start an on-farm processing business venture should not be taken lightly. Before starting any agribusiness, particularly an on-farm dairy processing enterprise, a considerable amount of thorough research and development must occur. Most existing agribusiness owners started out by going through at least a year of research and travel. Throughout this exploration process, these business managers evaluated the economics of their decision and visited already successful on-site cheese makers, homemade ice cream stores, and milk processing facilities. A complete business plan must be developed before starting an on-farm dairy processing enterprise. Similarly, a comprehensive market research plan should be developed to explore the need and demand for the business and product within the area along with how the business can differentiate itself from potential competitors. With an idea of investment expenditures and projected income from product sales, investment analyses and short and long-term budgeting should be conducted. Local universities, economic development councils, small business management administrations, and the Cooperative Extension Service may be useful resources during this process. On-farm processing facilities are heavily regulated. Consequently, being knowledgeable of and prepared to adhere to all local and regional rules and regulations can help make or break a business. On-farm dairy processing is a hot topic among American dairy farmers. Listening to existing business managers and researching all business and technical considerations will maximize the chances of establishing a successful on-farm processing enterprise.

Key Words: on-farm processing, value added

171 Bovine genomics: Mapping the future of the dairy industry. V. Eubanks*, *Clemson University*, *Clemson, SC*.

Healthy, high producing cows are the foundation of the dairy industry. Although assisted reproductive technologies have made rapid advances in dairy type and production traits, there remains much room for improvement in areas such as milk quality, somatic cell count, productive life, and other economically important traits. Since the initiation of the Bovine Genome Project in 2003 following work on the human genome project, researchers have been granted an additional tool for selecting genetically superior animals. Genomic selection is the process of identifying numerous genetic markers located across an animal's entire genome and using these markers to select elite animals. This bovine genome map can be used to identify more than 40,000 nucleotides on the 30 chromosome pairs. With the help of genome maps, geneticists may now be able to trace valuable traits to individual loci on chromosomes, and then use this knowledge to breed the best individuals. This new technology has enormous potential benefit for the dairy industry. In a world that is currently based on type and production, genomic selection may allow the focus to shift toward health traits such as somatic cell count, reproductive efficiency, and productive life. In addition, the cost of proving bulls may decrease by as much as 92%, and bulls can be proven at a much earlier age, reducing the generation interval and increasing genetic gain. Genomic selection is a very new technology, but as of January 2009 it has become the official standard for genetic evaluations. Genomic selection will be an asset to all facets of the dairy industry by positively influencing the productivity of dairy animals, both cows and sires, as well as enhancing the overall health and longevity of the animals.

Key Words: bovine, genome, dairy

172 The effects of genomic predictions in dairy cattle. R. R. Liskey*, B. G. Cassell, and D. R. Winston, *Virginia Polytechnic Institute and State University*, *Blacksburg*.

The world of dairy cattle genetics is about to change the way producers look at their breeding programs with the new innovation of genomics. In January 2009, the Animal Improvement Programs Laboratory in Beltsville, MD published the first genomic PTA's. Genomic PTA's are created using phenotypic, pedigree, and genotypic data that evaluates the accuracies of traits, increases genetic progress, decreases generation interval, and increases the reliability of records. Currently the genomic data is retrieved with the use of Illumina BovineSNP50 BeadChip and semen samples. The use of the chip enables us to reveal the genetic makeup of an individual at about 50,000 locations out of 3,000,000,000. About 38,000 of those 50,000 locations are used to predict genetic merit for 27 different traits: five yield traits, five for health and fitness, 16 conformation traits, and net merit were computed using genomics. Research (VanRaden, et al, 2009) showed increased reliabilities and decreased

generation intervals with the use of genomics. This work revealed that the reliability using genomic predictions and averaged over all 27 traits increase by 23% compared to reliabilities of parent averages. On average, this increase was equivalent to about 11 additional daughter records. The improvement in accuracy of genetic evaluations at an early age provides distinct economic advantages to genomic breeding programs. Annual genetic gain could be increased by 50% per year through the new technology. The genomic breeding programs also provided a higher discounted profit than a conventional progeny testing program and the costs related to bulls in progeny testing were reduced by 92%. Although this research is still in early phases, the ability to increase efficiency and profitability through the use of genomics shows great potential.

Key Words: genomics, dairy cattle

173 Advanced technology in gender selection: Sexed semen. H. Parkins* and S. Washburn, *North Carolina State University*, *Raleigh*.

Genetic improvements of cattle involve selections made through reproduction; purposely mating individuals possessing favorable traits required to improve overall herd performance. In the 1980s it became possible to sort and sex semen to influence the gender of the offspring, primarily increase the ratio of heifer calves born; this sexing procedure is Fluorescence Activated Cell Sorting (FACS). A pioneer in this field, George E. Seidel, refers to this procedure as Flow Cytometry or Cell Sorting; it requires the use of a Flow Cytometric Sorter System, separating the cells based on DNA content. Female Sperm cells bearing X chromosomes have 4% more DNA than Y-bearing sperm cells. Consequently, X cells pick up a higher content of a fluorescent dye, with no negative effects on living cells. A flow Cytometer works by forcing the cells into little droplets with a vibrator making approximately 70,000-80,000 droplets per minute. A special laser then emits light at a specific wavelength to determine dye content. Results go through a detector and are analyzed by a computer. Droplets are assigned a charge depending on results; X are positive and Y are negative; those with multiple, none or damaged sperm cells do not receive a charge. Cells exit the Cytometer at 80Km/H through a nozzle, and then pass through an electric field where the charged droplets are attracted to opposing charges on opposite sides of the unit; droplets with no charge stay in the center. Three exit streams are formed with X and Y output each at about 20%; unknown or damaged at 60%. Debating issues include small doses of semen and how to make it economically viable for industry use, high cost of a Cytometer, slow rate of sorting, lower fertility, loss of value of Y-bearing sperm cells, and lack of incentive to sort high value bulls. One product (Heifer Plus) currently being marketed has been purported to increase heifer ratio to about 70% at a lower cost than the FACS system. However objective research data are lacking. Recent advances in technology for gender selection have been promising, and more advances will be made as technology advances.

174 Blood pregnancy tests as alternatives to transrectal examinations. N. J. Heim*, *The Pennsylvania State University*, *University Park*.

Low 21-day pregnancy rates are among the largest challenges dairy producers face today. Timely pregnancy diagnosis is key to reducing the inter-service interval. Currently the most widely used method to diagnose pregnancy is transrectal palpation. However, palpation can cause a 2-6% embryonic loss, and this is particularly a problem when palpation occurs before day 35 after insemination. To improve accuracy and timeliness, scientists have developed new technologies, beginning with ultrasonography and followed by blood pregnancy tests. These technologies have benefits over transrectal palpation. In addition, they can be conducted earlier after insemination. BioPRYN® (Pregnancy Ruminant Yes/No; BioTracking LLC) is a commercially available blood test that checks for the presence of pregnancy specific protein-B (PSPB), a protein only produced by the placenta. This technology allows a cow to be checked for pregnancy as early as 30 days after insemination and has an overall 97% accuracy. Test administration does not require a high level of training and is convenient for the producer. Additionally, the blood is tested accurately by participating labs using an enzyme linked immunosorbent assay (ELISA) test. Another blood test is being developed by AspenBio Pharma, Inc. called SurBred™. This is a cow-side test which will determine if a cow is open at days 18-21 after insemination. When a cow is pregnant, specific proteins are increased in her blood during early pregnancy. SurBred™ will test the blood for these specific proteins. This test has potential advantages because it can be performed on the farm and can detect failed inseminations 8-10 days earlier than ultrasonography or BioPRYN®. Blood pregnancy tests provide a safe, accurate and economical management tool for producers to determine pregnancy status earlier and reduce the inter-service interval compared to transrectal examinations.

Key Words: pregnancy, palpation, pregnancy specific protein-B (PSPB)

175 Contracted tendons in calves. M. Reed*, *Louisiana State University*, *Baton Rouge*.

Contracted tendons are the most common congenital abnormality in calves. This condition is not considered directly fatal as it does not interfere with vital organs of the body. The two most commonly affected tendons are the deep digital flexor and the superficial flexor. There is no definitive cause of the syndrome although it is thought that nutrition, intrauterine positioning, and genetics may play a role in the development of this condition. Research has also shown that a manganese deficiency in the dam may cause contracted tendons in the calf. Ingestion of toxic plants such as Lupine alkaloids, locoweed, and poison vetch has also been reported to cause the syndrome. Calf nutrition is equally important in tendon development. Vitamins D and E as well as selenium have been shown to play a key role in muscle and tendon growth in the infantile calf. It is also believed that insufficient room in the uterus for extension and grow of tendons will lead to development of the condition. Autosomal recessive genes have been discovered to cause musculoskeletal defects in infant calves. There are several conditions and diseases that correspond with contracted tendons. The main concern is malnutrition, as calves who cannot walk cannot obtain the nutrients needed for maintenance and growth. Calves may also develop secondary infections from wounds caused by knuckled walking. If calves remain untreated for long periods of time they risk the possibility of tearing the common digital flexor. There are three classifications of the deformity which range from walking on the toes to walking on the dorsal aspect of the lower limb. Treatments for tendon contracture are stretches and exercising, soft splints and plaster cast as well as surgery. Splints are normally used in moderate to severe cases, leaving the toes out to help force the tendon to extend and stretch. Casts are more often used when there is twisting involved as well as the contracture. In conclusion, contracted tendons are a serious condition in calves, but with balanced nutrition and proper treatments it is a correctable problem.

Key Words: contracted tendons, calves, congenital deformity

176 The effects of breeding for increased milk production in dairy cattle on other productive traits. G. A. Carpenter* and E. L. Karcher, *Michigan State University*, *East Lansing*.

The economic model of milk production in the United States gives incentive to dairy farms that produce large amounts of milk. As a result, there is a movement to genetically select cows for superior production. Unfortunately, breeding cattle based on volume of milk produced may affect other traits, such as survival, milk composition, disease, and reproduction. Current research suggests that the stress associated with higher production may lead to increased mortality in these animals. A study by Castillo-Juarex et al. (2000) suggested an adverse correlation between mature equivalent milk and somatic cell score over the entire lactation. Additionally, cows that are genetically superior in milk production are genetically inferior in fertility (Dematawewa and Berger,1998). Although, high production can have antagonistic genetic effects on other productive traits, these effects can be reduced with a combination of breeding selection and sound management practices. Low heritability and repeatability estimates for survival indicate that management can reduce cow mortalities. Moreover, positive error correlations between survival and other traits suggest that producers may be providing better management for high-producing cows than low-producing cows. These management practices may include more meticulous udder preparation and more vigilant estrous detection. Combined, these have the potential to effectively lower the mortality rates for high-producing cows. It can be deduced from these studies that while breeding cattle for increased production can harmfully affect some traits, with proper management, these consequences can be minimized while still achieving a greater profit.

Key Words: breeding, genetics, production

ADSA-SAD (Student Affiliate Division) Undergraduate Competition: Original Research

177 Feeding brown midrib forage sorghum silage and wet corn gluten feed to lactating dairy cows. C. S. Heine*[1], P. J. Kononoff[1], J. F. Pedersen[2], A. G. Geis[1], and A. M. Gehman[1], [1]*University of Nebraska, Lincoln*, [2]*USDA-ARS Grain, Forage, and Bioenergy Research Unit, Lincoln, NE*.

Brown midrib (BMR) forage sorghum contains less lignin, resulting in increased NDF digestibility compared to conventional sorghum. An experiment was conducted to evaluate the effects of BMR sorghum silage in diets containing wet corn gluten feed (WCGF). The objective was to determine the effect of diet on milk production, composition, and total tract digestibility. Twenty Holstein cows weighing 729.8 ± 3.27 kg and averaging 124 ± 29.0 DIM were assigned one of the four dietary treatments: 1) conventional sorghum and 0% WCGF, 2) conventional sorghum and 30% WCGF, 3) BMR sorghum and 0% WCGF, and 4) BMR sorghum and 30% WCGF. The experimental design was a 4 × 4 Latin square in which each cow received each diet during 4 21-d periods. In diets containing no WCGF, 27% DM consisted of sorghum compared to diets containing WCGF, in which 17% DM consisted of sorghum. Ruminal NDF digestibility of sorghum silages was evaluated *in vitro* by incubating approximately 0.3 g of sample in rumen fluid for 48 h. The proportion of NDF digested after 48 h was higher ($P < 0.01$) for the BMR sorghum (53.0 ± 1.7%) compared to the conventional sorghum (39.0 ± 0.78%). Compared to the conventional sorghum, DMI tended ($P = 0.07$) to be higher when cows consumed BMR sorghum silage (24.6 vs. 26.0 ± 1.11 kg/d). In contrast, total tract NDF digestibility was lower when animals consumed diets containing BMR sorghum silage (54.5 vs. 57.0 ± 0.70%). The inclusion of WCGF did not affect DMI or total tract NDF digestibility, and no interactions between silage type and WCGF were observed. Although cows consumed more of the rations containing BMR sorghum silage, no differences were observed in milk production or composition. Similarly, the inclusion of WCGF did not affect milk yield or composition. Across treatments, milk yield averaged 30.5 ± 1.63 kg/d and fat and protein yield averaged 1.08 ± 0.06 kg/d and 0.90 ± 0.05 kg/d respectively. In spite of increased *in vitro* NDF digestibility and DMI, increases in milk production were not observed in cows consuming BMR sorghum silage and no interactions with WCGF were observed.

Key Words: brown midrib, sorghum, wet corn gluten feed

178 Measuring the citrate content in milk, mammary epithelial cells, and blood using capillary electrophoresis. M. J. Howell* and R. Jimenez-Flores, *California Polytechnic State University*, *San Luis Obispo*.

Citrate is an important regulator of calcium in milk and is indirectly related to de novo fatty acid synthesis in milk synthesis by providing NADPH. In this research our objective was to find if there was a correlation between citrate and milk productivity in the two commercial breeds of dairy cows. Levels of citrate were compared in raw milk, mammary epithelial cells, and blood of 12 cows (6 Holstein and 6 Jersey) . Based on productivity records of the Cal Poly Dairy Farm, the cows were classified as high or low producers; they were selected among a herd of 200 cows and chosen at same age and parity. All cows were fed mixed rations and were fed ad libitum. Raw milk was collected by hand, mammary epithelial cells were extracted from the raw milk using Wisteria Fioribunda-A lectin bound to magnetic beads (Dynabeads of 10 micron diameter), and blood was collected via tail vein. Experiments were run in triplicate, and all samples were compared to a standard citrate curve using capillary electrophoresis. While there was a similar trend in citrate content between groups in blood and milk, differences citrate levels were only statistically significant in the blood. Jersey high producing cows had an average of 3.7mM greater concentration of citrate in milk samples compared to low producers of the same breed as well as to the high producers of the Holstein breed, where there was an average of 3.9mM greater concentration of citrate. In blood, the citrate content of Jersey high producing cows was statistically significant when compared with lower producing Jerseys (p=0.078) as well as compared with high producing Holstein cows (p=0.007). Holsteins had no significant difference in citrate levels in the milk or the blood within the breed. Citrate was non-detectible in mammary epithelial cells, as citrate levels in the cells were too low to measure. This data shows there is a difference in citrate concentration between breeds which will have a significant impact on milk composition, like heat stability.

Key Words: citrate, productivity, milk