**Project/Activity Number:** NC-2042

**Project/Activity Title:** Management Systems to Improve the Economic and Environmental Sustainability of Dairy Enterprises

**Period Covered:** October 1, 2019 – September 30, 2020

**Date of This Report:** 12/07/2020

**Annual Meeting Date:** 10/09/2020

**Participants:** The meeting minutes can be accessed at: <https://uofi.box.com/s/4x5k7dao11za9pb1wktce28vf1edyw2a>

**Brief summary of minutes of annual meeting:** Victor C. moved to approve the minutes from previous meeting. Marcia E. second. Nobody opposed. Minutes were approved. Cornell University was selected for the business meeting in 2021 to happen on October 7, 8, 9 (THU, FRI, SAT). Marcia E. moved a motion to approve Jackie B. as the new Secretary. Gonzalo F. seconds. Nobody opposed. Jackie B. is the new Secretary. Victor C. moves to adjourn the meeting (11 AM). Gonzalo F. seconds. Nobody opposed. Meeting adjourned.

**Accomplishments:** UNIVERSITY OF CALIFORNIA AT DAVIS. Objective 2: Completed studies on the nutritive value of almond hulls for dairy cattle. California is the world’s leading producer of almonds. Field weight yields of almonds at harvest are 23% nuts, 13% debris, 14% shells, and 50% hulls. Almond hulls are high in sugar and low in protein, with a high fiber composition. CLEMSON UNIVERSITY. Work was completed looking at weaning strategies and milk replacer (MR) regime effect on ruminal and fecal microbiome after weaning to improve the adaptation. Two in-vivo projects were conducted with the objective to determine if a treatment process applied to protein capsules containing fish oil slowed protein disintegration time in rumen buffer and prevented biohydrogenation of internal omega fatty acids in lactating dairy cows. We are on the 3rd-year of evaluation on the impact of cutting schedule (28, 35, and 42 d interval) on reduced lignin alfalfa under southeastern conditions. CORNELL UNIVERSITY. We continued to focus on evaluating biomarkers of health in transition dairy cattle and their relationships to outcomes. Using a sample set and data assembled from 72 commercial dairy farms in New York and Vermont, we determined cow- and herd-level alarm thresholds for circulating haptoglobin and its relationships with disease, milk yield, and reproductive performance. In work led by collaborator Dr. Sabine Mann, relationships between supplemental amino acids administered by intravenous infusion to cows during the first week of lactation and metabolism and immune response were evaluated. UNIVERSITY OF IDAHO. Results from a project that was conducted in 2019 as a collaboration between two NC2042 stations (Virginia Tech and the University of Idaho) were summarized and have been submitted and presented nationwide as well as internationally. The research has examined the effect of irrigation on fiber concentration and digestibility of corn plant tissues. A lot of effort was also spent in addressing the effect of COVID-19 on dairies. UNIVERSITY OF ILLINOIS. Feeding cows with RPL prepartum reduced medicated events in their male offspring. Additionally, male calves from cows supplemented with RPL tended to have increased plasma alanine and glutamic acid concentrations than calves from cows not treated with RPL. LOUISIANA STATE UNIVERSITY. Six male Holstein calves were used to assess glucose responses to insulin to develop an on-farm method of measuring insulin sensitivity with 4 blood samples. Results indicated that mean insulin concentrations of 13, 33, and 36 mU/kg BW at 3, 6, and 9 weeks, respectively, were determined to result in a 50% decline in blood glucose post infusion using only 4 blood samples (-10, 0, 40, and 60 min post insulin). UNIVERSITY OF MINNESOTA. The objective of this study was to evaluate the taste preference of calves fed Chlorella sp. microalgae produced from dairy lagoon wastewater. Results indicated that microalgae maybe added to calf starter grains without any adverse effects; however, calves preferred calf starter grains without microalgae. Marcia Endres’ lab conducted analysis of a robotic milking dataset from 36 farms in Minnesota and Wisconsin. Results showed that some farm level factors were positively associated with milk production, such as the use of automatic manure scraper and provision of more than one type of concentrate feed in the robot box. UNIVERSITY OF MISSOURI. Developed a modelling framework that allows one to measure simultaneously how efficient are dairy farmers in producing outputs from a given set of inputs and maintaining animal health and welfare. We identified targets for production and udder health management improvement efforts. MISSISSIPI STATE UNIVERSITY. Animal welfare, reproduction, and milk production can be negatively affected when dairy cattle experience heat stress. Pegbovigrastim injection (IMR) represents a new approach in overcoming mastitis. On-farm bacteriologic culturing (OFBC) provides quick and inexpensive mastitis diagnosis, but commercial adoption of this innovation has been low in Mississippi. UNIVERSITY OF NEW HAMPSHIRE. Results indicated that adding salt to the WBG reduced spoilage resulting in less loss to mold. Apparent total tract digestibility was reduced for dry matter, organic matter, and non-fiber carbohydrates as salt inclusion increased. This could be due to the slight increase in dry matter intake as salt inclusion increased. NORTH CAROLINA STATE UNIVERSITY. The objective of the project was to determine if enrichments would allow heifers to overcome negative stereotypes often seen with limit feeding. PENNSYLVANIA STATE UNIVERSITY. We compared feeding high quality maternal colostrum, low quality maternal colostrum supplemented with whey-based colostrum replacer, or 2 levels of IgG intake from whey-based colostrum replacer. Calves (80 Holsteins) were randomly assigned to colostrum treatment and fed within 1.5 h of birth. All treatments resulted in acceptable serum IgG values at 24 h, and efficiency of IgG absorption was greater in calves fed colostrum replacer. No differences in growth or health were observed through 7 wk of age. Our results suggest this whey-based product is a viable alternative for providing critical protection to calves when adequate maternal colostrum is unavailable. PURDUE UNIVERSITY. We have deeveloped a video based system that will identify a cow and several anatomical points on that cow from a machine learning video analytics system. Any observation that we currently do manually on farm, may be moved to an automated process. We have focused on predicting body weight and will move to other applications that may have use on commercial dairy farms; examples of this may be disease detection or behavior changes. We have published one journal manuscript with more currently being written. USDA-ARS, U.S. DAIRY FORAGE RESEARCH CENTER. A project was conducted to determine how much high-quality alfalfa silage (AS) could be utilized in a high-producing dairy cow diet to replace concentrate feedstuffs without lowering milk production. Substitution of protein and non-forage fiber feedstuffs up to 18% of the diet (DM basis) with high quality AS did not reduce milk production and increased milk fat yield, milk fat % and FE. VIRGINIA TECH. In collaboration with University of Idaho, we delivered educational workshops to farmers. In these workshops, we showed how to prepared a projected financial budget. UNIVERSITY OF WISCONSIN-MADISON. A model application to systematize nutritional grouping (NG) management in commercial dairy farms was perormed. The model has 4 sub-sections: (1) real-time data stream integration, (2) calculation of nutritional parameters, (3) grouping algorithm, and (4) output reports. The average diet cost was $3,250/cow per year for current farm management and $3,219/cow per year for NG, which resulted in a theoretical $31/cow per year diet cost savings. We completed the second of three projects evaluating the use of an antibody to interleukin-10 to control coccidiosis and improve heifer health and growth. This project evaluated feeding the antibody from 14-28 days after arrival to correspond more closely with incidence of coccidiosis. The antibody did not reduce the incidence of digestive or respiratory disease nor improve heifer growth compared to continuous feeding of an ionophore/coccidiocide (sodium monensin).

**Impacts:** Evaluating rumen protection technology resulted in proper chemical protection at the rumen level but did not provide protection against chewing and other physical effects of rumination. Work from our group continues to improve performance and well-being of dairy cattle through focus on transition cow metabolism and nutrition. Research conducted on the effect of irrigation on fiber concentration and fiber digestibility allows us to understand the effect of drought con corn silage forage and fiber quality parameters. Dietary formulation and feeding management during the dry period, peripartal period, and early postpartum (fresh) period may facilitate or interrupt many of the steps for metabolic adaptation before pregnancy is established and maintained. Allowing cows to have adequate nutritional status is paramount for improved health, milk production, and fertility. The method for assessing insulin sensitivity with fewer blood samples and no laboratory analyses will benefit researchers in quickly generating research data in dairy calf projects. Benchmarks have been developed for calf performance parameters that have been used for on-farm comparisons. Goals for calf performance in the nursery have been attained by both conventional, moderate intensive or intensive programs. Results of the robotic milking study indicate that feeding practices and cow visit behavior can influence cow productivity in robotic milking systems. A study resulted in a new tool to assess heat stress in dairy cattle as well as a novel way to abate heat on pastured dairy cattle. Double cropping systems, when managed well, can provide good yields of high quality feed that not only utilize nutrients from fall and spring manure spreading, but also provide a positive economic benefit to the farm. Dairy farming is a decision-intensive enterprise where profitable decisions cannot be made without the use of data-driven decision aids. The dynamics of dairy farm systems warrants the utilization of data integration and sophisticated analytical techniques to assess the impacts of management strategies to farm economics, which at the same time need to be user-friendly and ready to be applied at the farm level.

**Publications:** Publications can be accessed in the link: <https://uofi.box.com/s/xhouajq6818idg5t2fwohmkxkkki0enc>