

NC-2042 Accomplishments Report

Project/Activity Number: NC-2042

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

Period Covered: 10/01/2020 – 09/30/2021

Date of This Report: 11/15/2021

Annual Meeting Dates: 10/07/2021 – 10/09/2021

Participants: Cardoso, Phil (cardoso2@illinois.edu) - University of Illinois; Boerman, Jackie (jboerma@purdue.edu) - Purdue University; Schutz, Michael (mschutz@umn.edu) - University of Minnesota and NCRA Administrative Advisor; Heins, Brad (hein0106@umn.edu) - University of Minnesota; Titgemeyer, Evan (etitgeme@k-state.edu) - Kansas State University; Aguerre, Matias (maguerr@clermson.edu) - Clemson University; Chahine, Mireille (mchahine@uidaho.edu) - University of Idaho; de Haro-Martí, Mario (mdeharo@uidaho.edu) - University of Idaho; Endres, Marcia (miendres@umn.edu) - University of Minnesota; Ferreira, Gonzalo (gongf@vt.edu) - Virginia Tech; Cabrera, Victor (vcabrera@wisc.edu) - University of Wisconsin; McArt, Jessica (jmcart@cornell.edu) - Cornell University; Overton, Tom (tro2@cornell.edu) - Cornell University; De Vries, Albert (devries@ufl.edu) - University of Florida; Brito, Andre (Andre.Brito@unh.edu) - University of New Hampshire; Erickson, Peter (Peter.Erickson@unh.edu) - University of New Hampshire; Costa, Joao (costa@uky.edu) - University of Kentucky.

Brief Summary of Minutes of Annual Meeting:

- Welcome, introductions and review of the agenda: the meeting was called to order and the agenda for the following days was reviewed. Introductions were done from all in attendance from NC-2042 and 1 post-doc in attendance.
- Administrative advisor update: Michael Schutz provided an overview of the goals for Multi-State groups as well as the expectations for the upcoming re-write that will need to be submitted in 2022.
- Upcoming meeting: Peter Erickson contacted the Atlantic Veterinary College on Prince Edward Island and they are willing to host next year. If we have travel restrictions in place, UC Davis also expressed willingness to host in 2022 or 2023.
- USDA – NIFA update: Andres Cibils provided an update on competitive grants that are available through USDA.
- Elections: Joao Costa was nominated for secretary for the upcoming year.
- Grant opportunities: discussion of working on a SAS grant related to sustainability across different regions of the country.
- Station presentations: All stations represented presented their work related to the Multi-State objectives.

Accomplishments: Sustainable dairy production remains the focus of our research group. We are organized around three objectives: 1) optimize calf and heifer growth and development by improving feeding strategies, management systems, well-being, new technologies, and environmental impacts for productivity and profitability; 2) optimize dairy cow performance and well-being by improving nutrition, forage utilization, technology, and management; and 3) evaluate whole farm system components and integrate information and technology to improve

efficiency, profitability, environmental sustainability and social responsibility. The NC-2042 group has focused research and Extension activities around meeting these objectives to improve the sustainable production of milk.

Short-term Outcomes: None to report at this time.

Outputs: There were 109 peer-reviewed publications reported by members within the NC-2042 group for 2020 – 2021. We would like to emphasize several review articles that were written through collaborations between NC-2042 members.

Activities:

- Risk management workshops
- Investment in automated milking system workshops
- Development and demonstration of dairy decision support tools

Milestones: In year 4 of this 5-year project, we are focused on building collaborations within our group to conduct complementary research. We will be conducting a re-write in the next year which allows us to evaluate the objectives and goals of this Multi-State group.

Impacts:

Objective 1: We have conducted research and published results on the role of supplementing rumen protected amino acids to the dry cow on performance of their offspring. We have evaluated the amino acid requirements of growing animals, and we have evaluated the role of nutraceuticals to reduce the use of antibiotics in dairy calves. We have evaluated the growth, health and, most importantly, the economic performance of dairy calves in individual housing, group housing, pair housing, and raising calves with cows on pasture in the context of calf health, behavior, and welfare. The impacts of this work are a more comprehensive understanding of dairy calf growth, health, economic performance, and management systems to share with dairy stakeholders.

Objective 2: We have evaluated the feeding value of by-products and co-products in dairy cattle diets. We have conducted research to develop the best management practices for forages including alternative forages in Southeastern conditions. We have evaluated the effect of drought stress on the digestibility of forages. We have evaluated combinations of nutritional strategies to formulate diets fed to dry cows on subsequent performance during lactation. Finally, we have evaluated the effect of circadian rhythms on dairy cattle health and productivity. The impacts of this research are improvements in nutrition and management of dairy cattle to continue to have sustainable dairy production.

Objective 3: We have developed equations to predict associations of dry period length with milk production, culling, and reproduction in subsequent lactations for economic studies. We have developed infographics describing the different revenue programs available to dairy farmers in the United States. We have developed decision support tools on the use of precision technologies utilized on farms. We have utilized multi-year modeling of dairy farms to maximize the use of manure and harvesting of high-quality forages. Finally, we have developed multiple systems to collect and integrate data generated on dairy farms. The impacts of this work are to assist dairy farmers by identifying the complex relationships that exist and giving them tools to utilize the data to aid in decision making on their farms.

Across all three objectives, the impact of the NC-2042 group is seen through the research and dissemination of that research to dairy stakeholders to improve the sustainability of dairy production.

Publications: Below are an example of the collaborative publications from NC-2042 with a comprehensive list of publications from 2020 – 2021 found at the link below:

<https://app.box.com/s/ukz26j1yud0daivgazndydd45g7w4j93>

1. Erickson, P.S., J.L. Anderson, K.L. Kalscheur, G.J. Lascano, M. Akins, and A.J. Heinrichs . 2020. Review: Strategies to improve efficiency and profitability of heifer raising. *J. Dairy Sci.* 103:5700-5708.
2. Ferreira, G., C. Teets, J. Huffard, and M. J. Aguerre. 2020. Effects of planting population, genotype, and nitrogen fertilization on nutrient composition, ruminal in vitro neutral detergent fiber disappearance, and nutrient output of corn for silage. *Anim. Feed Sci. and Tech.* 268: 114615.
3. Ferreira, G., A. Burch, L. L. Martin, S. L. Hines, G. E. Shewmaker, and M. Chahine. 2021. Effect of drought stress on in situ ruminal starch digestion kinetics of corn for silage. *Animal Feed Science and Technology.* *Animal Feed Science and Technology* 279 (115027).
4. Ferreira, G., L. L. Martin, C. L. Teets, B. A. Corl, S. L. Hines, G. E. Shewmaker, M. E. de Haro-Marti, and M. Chahine. 2021. Effect of drought stress on ruminal neutral detergent fiber digestibility of corn for silage. *Animal Feed Science and Technology* 273 (114803).
5. Cardoso, F.C., K.F. Kalscheur, and J.K. Drackley (2020). Review: Nutrition strategies for improved health, production, and fertility during the transition period. *Journal of Dairy Science.* 103:5685-5693.
6. Heinrichs, A. J., C. M. Jones, P. S. Erickson, H. Chester-Jones, and J. L. Anderson. 2020. Symposium review: Colostrum management and calf nutrition for profitable and sustainable dairy farms. *J. Dairy Sci.* 103:5694-5699.
7. Tejada, H., G. Ferreira, M. Chahine, and M. de Haro-Marti. 2020. Risk assessment and decision-making guidelines for dairy risk management: Part 3. University of Idaho Extension; Bul 954.
8. Tejada, H., G. Ferreira, M. Chahine, and M. de Haro-Marti. 2020. Risk assessment and decision-making guidelines for dairy risk management: Part 2. University of Idaho Extension; Bul 953.
9. Tejada, H., G. Ferreira, M. Chahine, and M. de Haro-Marti. 2020. Risk assessment and decision-making guidelines for dairy risk management: Part 1. University of Idaho Extension; Bul 952.
10. Baldin, M., T. Breunig, R. Cue, A. De Vries, M. Doornink, J. Drevenak, R. Fourdraine, R. George, R. Goodling, R. Greenfield, M. W. Jorgensen, A. Lenkaitis, D. Reinemann, A. Saha, C. Sankaraiyah, S. Shahinfar, C. Siberski, K. Wade, F. Zhang, L. Fadul-Pacheco, S. Wangen, T. E. da Silva, V. E. Cabrera. 2021. Integrated decision support systems (IDSS) for dairy farming: A discussion on how to improve their sustained adoption. *Animals* 11:2025. <https://doi.org/10.3390/ani11072025>.