Project/Activity Number:
NC-2040

Project/Activity Title:
Metabolic relationships in supply of nutrients for lactating cows

Period Covered:
01 October, 2019 – 30 September, 2020

Date of This Report:
09 December, 2020

Annual Meeting Date(s):
19-20 October, 2020

Participants:

1. Ranga Appuhamy (chair)	Iowa State University
2. Sebastian Arriola Apelo (secretary)	University of Wisconsin, Madison
3. George Smith (administrator)	Michigan State University
4. Antonio Faciola	University of Florida
5. Heather White	University of Wisconsin, Madison
6. Shawn Donkin	Purdue University
7. Kevin Harvatine	Pennsylvania State University
8. Heidi Rossow	University of California, Davis
9. Agustin Rius	University of Tennessee
10. James Fadel	University of California, Davis
11. Matthias Hess	University of California, Davis
12. Tim Hackmann	University of California, Davis
13. Ermias Kebreab	University of California, Davis
14. Tanya Gressley	University of Delaware
15. Brian Crooker	University of Minnesota
16. Luciano Caixeta	University of Minnesota
17. Jeff Firkins	Ohio State University
18. Johan Osorio	South Dakota State University
19. Isaac Salfer	South Dakota State University
20. Paola Piantoni	Cargill
21. Mike Vandehaar	Michigan State University

Summary of minutes of annual meeting:

George Smith gave an update on the overall project and highlighted the importance of emphasizing collaborations between project members. George also indicated that this year the midterm report is due.

Heidi Rossow and Timothy Hackmann discussed conversion of Molly to C++ and R interface.

Steven Smith discussed the handout previously sent to the group with the following points:

- NIFA relocation, staffing, and impact on grant funding decisions.
- U.S. government continuing resolution budget until December 11, 2020 and its impact on USDA budget.
- Three main competitive programs available for FY 2020, 2021, and 2022, plus other relevant competitive programs.
- Dual purpose with dual benefit funding opportunity.
- AFRI Foundational programs' outcomes.

Station Reports:
University of Delaware (Tanya Gressley)
University of California Davis (Matthias Hess)
University of Minnesota (Luciano Caixeta)
Purdue University (Shawn Donkin)
University of Florida (Antonio Fasciola)
University of Tenesse (Agustin Rius)
Penn State (Kevin Harvatine)
University of California Davis (Ermias Kebreab)
Ohio State (Jeffry Firkins)
Iowa State (Ranga Apuhammy)
University of Wisconsin-Madison (Heather White)
University of California Davis (Heidi Rossow)
University of Minnesota (Brian Crooker)
University of California Davis (Timothy Hackmann)
University of Wisconsin-Madison (Sebastian Arriola Apelo)
University of California Davis (James Fadel)

The group discussed 2021 meeting location in Chicago with an online version for participants that cannot attend in person. Sebastian Arriola Apelo volunteered to chair that meeting.

Accomplishments and impacts pertaining to each objective:

OBJECTIVE 1: *To quantify supply, availability, and interaction of nutrients and bioactive compounds utilized for efficient milk production while reducing environmental impact.*

- Michigan (VandeHaar) and Virginia (Hanigan) stations are collaborating in a project titled: Importance of body gain in evaluating responses to dietary protein.

OBJECTIVE 2*: To identify and quantify molecular, cellular, and organismal signals that regulate intake, partitioning and efficient utilization of nutrients.*

- Wisconsin (White) and Cornell (McFadden) are collaborating on Interactions between fatty acids and methyl donors using cell culture and cow models.
- Wisconsin (White) and Minnesota (Caixeta) are starting a collaboration applying a bio marker panel to samples with defined phenotypes previously collected by White's lab.
- Michigan (VandeHaar) and Wisconsin (White) stations are collaborating in a project titled: Genomic and metabolic control of feed efficiency.
- Michigan (VandeHaar) and Maryland (Erdman) stations are collaborating on systems for evaluating energy requirements.
- Michigan (VandeHaar), Maryland (Erdman), Ohio (Firkins), California (Kebreab), and Virginia (Hanigan) stations are collaborating on updating dairy cow requirements for NRC.
- Ohio (Firkins) and Pennsylvania (Harvatine) stations plan to collaborate on the evaluation of shifts in bacterial lipids from continuous cultures administered different forage:concentrate ratios, presence of unsaturated fat, and BCVFA.

Impacts / Outcomes

There are no impacts to report, however, NC2040 will pay increased attention to documenting impacts of collaborative work in subsequent years.

GRANTS

- Hackmann TJ (PI), Daley VE. The NANP Nutrition Models Workshop: Training a new generation of scientists in mathematical modeling. USDA-NIFA Foundational Program Grant 2019-67015-29841. ($40,878). For this workshop, several members of NC2040 (PN, VI, CA) are invited to present.
- Rossow, H, Hanigan MD, et al. Fact: Database analytics to evaluate overall dairy production efficiency using benchmarking techniques. USDA-NIFA. Not funded (CA, VI)

PUBLICATIONS (peer-reviewed articles only)

1. Van Lingen, H.J., M. Niu, E. Kebreab, S.C. Valadares Filho, J.A. Rooke, C. Duthie, A. Schwarm, M. Kreuzer, P. I. Hynd, M. Caetano, M. Eug.ne, C. Martin, M. McGee, P. O'Kiely, M. Hünerberg, T.A. McAllister, T.T. Berchielli, J.D. Messana, N. Peiren, A.V. Chaves, E. Charmley, N.A. Cole, K.E. Hales, S. Lee, A. Berndt, C.K. Reynolds, L.A. Crompton, A.-R Bayat, D.R. Yez-Ruiz, Z. Yu, A. Bannink, J. Dijkstra, D.P. Casper, A.N. Hristov. 2019. Prediction of enteric methane production, yield and intensity of beef cattle using an intercontinental database. Agric. Ecosyst. Environ. 283:106575. https://doi.org/10.1016/j.agee.2019.106575. (CA, PN)
2. Benaouda, M., C. Martin, X. Li, E. Kebreab, A. N. Hristov, Z. Yu, D. R. Y..ez-Ruiz, C. K. Reynolds, L. A. Crompton, J. Dijkstra, A. Bannink, A. Schwarm, M. Kreuzer, M. McGeek, P. Lundl, Anne L. F. Hellwingl, M. R. Weisbjerg, P. J. Moate, A. R. Bayat, K. J. Shingfield, N. Peiren, and M. Eugne. Evaluation of the performance of existing mathematical models predicting enteric methane emissions from ruminants: Animal categories and dietary mitigation strategies. Anim Feed Sci. Technol. 255:114207. https://doi.org/10.1016/j.anifeedsci.2019.114207. (CA, PN)
3. Hristov, A.N., A. Bannink, L.A. Crompton, P. Huhtanen, M. Kreuzer, M. McGee, P. Nozi.re, C.K. Reynolds, A. R. Bayat, D. R. Y..ez-Ruiz, J. Dijkstra, E. Kebreab, A. Schwarm, K. J. Shingfield, and Z. Yu. 2019. Invited review: Nitrogen in ruminant nutrition: A review of measurement techniques. J. Dairy Sci., 102:5811–5852. (CA, PN)

4. Kennedy, K M., S. S. Donkin and M. S. Allen. 2020. Effects of propionate concentration on short-term metabolism in liver explants from dairy cows in the postpartum period. J. Dairy Sci. (accepted). (IN, MI)
5. Vijn, S., D. P. Compart, N. Dutta, A. Foukis, M. Hess, A. N. Hristov, K. Kalscheur, E. Kebreab, S. V. Nuzhdin, N. N. Price, Y. Sun, J. M. Tricarico, A. Turzillo, M. R. Weisbjerg, C. Yarish, and T. Kurt. 2020. Key Considerations for the Use of Seaweed to Reduce Enteric Methane Emissions from Cattle. *Frontiers in Veterinary Science, section Animal Nutrition and Metabolism (accepted)*. (CA, PN)
6. Matamoros, C., R. Klopp, L.E. Moraes, and K.J. Harvatine. 2020. Meta-analysis of the relationship between milk trans-10 C18:1, milk fatty acids < 16 C, and milk fat production. J. Dairy Sci. In Press. (OH, PN)
7. J. W. McFadden, C. L. Gerard, S. Tao, Z. Zheng, J. K. Bernard, M. Duplessis, and H. M. White. 2020. Symposium review: One-carbon metabolism and methyl donor nutrition in the dairy cow. J. Dairy Sci. 103:5668-5683. https://doi.org/10.3168/jds.2019-17319 (NY, WI)