

The following report contains a summary of the dairy cattle protein formulation survey that was answered by 30 nutritionists who feed cattle within the Northeast SARE region. A brief recommendation is provided at the conclusion of this report, outlining the next steps that our groups plans to take to assist these industry professionals.

Question 1: For participants in this survey, the median start year for dietary formulation was 1993, ranging from 1970 to 2023.

Table 1. Demographics for herd numbers and average herd size for survey participants in the Northeast SARE region.

State	Number of Herds Represented	Average Herd Size
Connecticut	2	60
Delaware	1	80
Maine	1	700
Massachusetts	10	134
Maryland	12	125
New Hampshire	2	775
New Jersey	2	60
New York	249	882
Pennsylvania	69	167
Rhode Island	1	80
West Virginia	0	Not determined
Vermont	71	565
NE SARE Region	420	659

Table 2. Summarized response of nutritionists asked what their top five preferred forms of continuing education.

Educational Form	Priority Number (Respondent Count)					
	1	2	3	4	5	Total
Conferences or Meetings	10	8	4	1	4	27
Company sponsored training	8	2	2	2	3	17
Working/Consulting with peers	5	8	7	2	2	24
Published literature	2	5	4	5	6	22
University led workshops/training sessions	2	3	7	6	4	22
Field training and/or self-experience	2	3	3	10	5	23
Online research (including articles and videos)	0	0	2	3	4	9
One on one conversations with academia/researchers	0	0	0	0	1	1
Magazine or editorial publications	0	0	0	0	0	0

Table 3. Summarized response to general dietary formulation technique of metabolizable energy (ME) and protein (MP) in lactating cattle diets.

Diet Balancing Technique	Count
I balance diets to keep ME and MP allowable milk as close to each other as possible.	17
I typically balance diets to have more MP than ME allowable milk described.	8
I typically balance diets to have more ME than MP allowable milk described.	4

Table 4. Summarized response of nutritionists asked to list the top five constraints which may require them to feed more protein in their client's herd.

Constraint which may increase protein feeding to cattle.	Priority Number (Respondent Count)					Total
	1	2	3	4	5	
Purchased cost make the use of preferred ingredients undesirable.	8	3	10	3	1	25
Inventory is too low to allow for the desired inclusion rate of an ingredient.	4	5	7	3	5	24
Desired ingredients are not available on farm or at the mill.	1	8	0	7	3	19
Feeding management is not adequately trained/experienced to handle precision feeding techniques.	3	3	6	1	3	16
Owners not receptive to paying for precision products, such as rumen protected amino acids, as it may not align with their current business strategy.	2	2	2	3	6	15
Ingredients are too variable in nutrient specifications to provide a stable dietary nutrient supply.	1	2	1	6	7	17
Pen grouping decisions do not allow for the formulation of a more targeted nutrient supply relative to the animal being fed.	2	3	2	5	1	13
Other	7	1	1	0	1	10

Other constraints listed by participants, in order of priority:

- Not enough required tools to easily aggregate enough data (from multiple sources) to make precision formulation decisions.
- Protein quality in forage is not optimal.
- General forage quality is limiting.
- Milk production is not where the producer wants. We push the diets harder and lead the cows more on milk with higher protein and then higher starch.
- I've been trained to lead with MP to avoid limiting performance.
- Clear recommendations have not been shared yet on how we should formulate based on new research, so I am probably overfeeding protein while we wait to learn how to balance more precisely?
- Milk market price doesn't support additional cost.
- Novel ingredients, such as Plenish soybeans, are not where the desired inclusion rate should be.

Table 5. Summarized responses of nutritionists asked what nutritional parameters they prioritize when considering optimization of protein feeding for lactating dairy cattle.

Nutritional Parameter	Surveyor Count	Priority Number	Preferred Target
Metabolizable protein supply	24	2.13	At, or slightly greater than, 100% of model predicted requirements.
Dietary sugar and starch	20	3.50	Target starch between 25-30% DM depending on fermentability. Target sugar greater than 5% DM.
Rumen degradable protein (RDP) content	17	3.71	Between 9.5 and 10.5% DM. Optimize for fermentable protein where Protein A1 fraction=0.5 - 1.0% DM, Protein A2>=3.0% DM or >17% of fermentable CHO B1 (whichever is greater), Protein B1 > 4.75% DM, and Protein B2 >0.5% DM.
Methionine, Lysine, and/or EAA supply	26	4.00	Amino acid supplementation is related to energy, according to CNCPS requirements. Feeding at 1.07-1.15 g metabolizable methionine per Mcal of metabolizable energy. Methionine:lysine 2.62-2.70. More supplementation of amino acid occurs in fresh period.
Rumen degradable starch	17	4.06	Target between 18 and 22% DM.
Potentially degradable NDF	12	4.58	Maximize content, targeting uNDF content between 7 and 8.5% DM.
Dietary NDF	13	5.00	Target greater than 26% DM, with range typically at 28-30% DM.
Total fermentable CHO content	12	5.00	Target greater than 42% CHO intake, with target at 44-46%.
Rumen ammonia content	18	5.33	Range varies widely, observing 115-160% of predicted requirements.
Microbial protein supply	9	6.33	Targeting greater than 50% of total MP supply.
Rumen peptide content	8	8.00	Some tie peptide content with rumen fermentable CHO.
Crude protein content	11	8.36	Targeted for 15.5-17% DM depending on ingredient availability.
Soluble protein supply	8	9.43	No targets mentioned.
Rumen undegradable protein (RUP) content	6	9.50	No targets mentioned.
Nutritional Parameter Listed by Surveyors	Surveyor Count	Priority Number	Preferred Target
uNDF Intake	5	4.40	Intake at 7.5-9.0% of DM or 0.30-0.38% BW. Intake of 30-hour uNDF at 1% BW or 5-6 pounds. Physically effective uNDF intake at 4-6 pounds.
Metabolizable Energy Predictions	1	1.00	No targets mentioned.

Fatty Acid Feeding	1	10.00	Oleic acid and palmitic acid fed at 0.9 and 2.1 g absorbed per pound of milk, respectively.
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Table 6. Summarized responses of nutritionists asked what the average range of key animal characteristics are on their average herd, stratified by animal type. Surveyor count is also included to provide context.

Animal Type	Average Range (Survey Count)				
	Dry Matter Intake	Milk Production	Days in Milk	Body Weight	Target Refusal Rate
Pre-weaned Calves	7.0 to 9.0 (3)	Not Applicable	Not Applicable	152 to 263 (3)	Not Stated
Weaned Calves	8.4 to 12.9 (11)	Not Applicable	Not Applicable	270 to 973 (11)	Not Stated
Grower Calves	10.7 to 15.4 (12)	Not Applicable	Not Applicable	375 to 713 (11)	1.0 to 3.0 (10)
Breeding Heifer	16.0 to 20.3 (19)	Not Applicable	Not Applicable	668 to 965 (17)	Not Stated
Pregnant Heifer	19.9 to 24.1 (17)	Not Applicable	Not Applicable	903 to 1305 (15)	Not Stated
Springing Heifer	21.5 to 24.5 (2)	Not Applicable	Not Applicable	1110 to 1440 (2)	Not Stated
Close-up Heifer	22.0 to 26.0 (1)	Not Applicable	Not Applicable	1250 to 1500 (1)	Not Stated
Far-off Dry Cow	25.9 to 31.6 (23)	Not Applicable	-60 to 25 (14)	1404 to 1662 (22)	1.0 to 30 (22)
Close-up Dry Cow	26.2 to 31.3 (21)	Not Applicable	-28 to 0 (14)	1408 to 1702 (19)	3.5 to 5.5 (21)
Fresh Cow	39.7 to 46.0 (21)	62.3 to 91.7 (21)	3 to 27 (21)	1353 to 1643 (18)	4.5 to 6.5 (21)
High Lactating Heifer	50.0 to 55.0 (2)	77.5 to 117.5 (2)	60 to 140 (2)	1400 to 1550 (2)	Not Stated
High Lactating Cow	53.8 to 61.2 (25)	91.6 to 123.6 (25)	54 to 186 (25)	1472 to 1679 (22)	1.7 to 3.4 (25)
Mid Lactating Cow	52.0 to 55.5 (2)	60.0 to 90.0 (2)	175 to 250 (2)	1600 to 1800 (2)	2.0 to 5.0 (2)
Low Lactating Cow	47.0 to 52.2 (21)	65.8 to 82.8 (20)	205 to 340 (21)	1495 to 1702 (18)	1.3 to 3.0 (21)
First Lactation Heifer	48.7 to 53.3 (15)	74.9 to 92.7 (15)	62 to 223 (15)	1287 to 1450 (14)	1.3 to 2.7 (15)
Grower Beef	15.0 to 20.0 (1)	Not Applicable	Not Applicable	700 to 900 (1)	Not Stated
Finishing Beef	20.0 to 26.0 (1)	Not Applicable	Not Applicable	900 to 1400 (1)	Not Stated

Table 7. Summarized responses of nutritionists asked what animal they target when formulating diets for different animal types.

Animal Type	Count of preferred target for diet formulation within a given group			
	The 10% below the average animal	The average animal	The 10% above the average animal	Top 10% of animals
Pre-weaned Calves	0	3	1	0
Weaned calves	1	6	3	2
Grower calves	0	10	3	0
Breeding heifers	0	17	2	1
Pregnant heifers	0	14	3	1
Springing heifers	0	1	1	0
Close-up Heifer	0	0	1	0
Far-off Dry Cow	0	23	1	1
Close-up Dry Cow	1	19	2	1
Fresh Cow	0	4	11	6
High Lactating Heifer	0	0	1	1
High Lactating Cow	2	5	15	3
Mid Lactating Cow	0	2	0	0
Low Lactating Cow	0	13	6	1
First Lactation Heifer	1	5	7	1
Grower Beef	0	1	0	0
Finishing Beef	0	1	0	0

Table 8. Summarized responses of nutritionists asked how often they meet with key farm employees, their preference of meeting them, and the difference between them.

Enterprise member	Every visit	Every other visit	Quarterly	Bi-annually	Annually	As needed	I do/prefer not to meet with them.
<u>Farm owner</u>							
Current Frequency	17	6	2	0	0	2	0
Preferred Frequency	15	5	3	0	0	0	0
Difference	2	1	-1	0	0	2	0
<u>Feeder</u>							
Current Frequency	19	7	0	0	0	1	0
Preferred Frequency	17	5	0	0	0	0	0
Difference	2	2	0	0	0	1	0
<u>Herd manager</u>							
Current Frequency	22	5	0	0	0	0	0
Preferred Frequency	19	4	0	0	0	0	0
Difference	3	1	0	0	0	0	0
<u>Crop manager</u>							
Current Frequency	0	1	15	6	0	5	0
Preferred Frequency	0	1	14	6	2	0	0
Difference	0	0	1	0	-2	5	0
<u>Agronomist</u>							
Current Frequency	0	0	1	6	4	13	2
Preferred Frequency	0	0	2	6	7	0	4
Difference	0	0	-1	0	-3	13	-2
<u>Veterinarian</u>							
Current Frequency	1	3	7	4	0	11	1
Preferred Frequency	1	3	11	5	1	0	0
Difference	0	0	-4	-1	-1	11	1
<u>Financial lender</u>							
Current Frequency	0	0	5	4	2	9	7
Preferred Frequency	0	1	7	5	6	0	3
Difference	0	-1	-2	-1	-4	9	4
<u>Another member</u>							
Current Frequency	0	1	1	0	0	2	1
Preferred Frequency	0	1	0	0	0	0	1
Difference	0	0	1	0	0	2	0

Calf manager and other family members were listed as ‘Another member’.

Table 9. Summarized responses of nutritionists asked if predicted nutrient excretion affects their formulation decisions and, if so, which nutrients affect their decision making.

Formulation around excretion questions	Count
I observe the nutrient excretion measurements provided; however, I rarely make any changes to my diet if the excretion of certain nutrients is too high.	11
I typically do not view any excretion measurements provided by diet formulation software.	10
I observe the nutrient excretion measurements provided and will make changes to my diets if emission/excretion are not preferable.	8
Prioritization of excretion parameters	
Decisions are made based on nitrogen excretion.	13
Excretion/emission predictions are not used in formulation decisions	11
Decisions are made based on phosphorus excretion.	7
Decisions are made based on methane emission.	3

Table 10. Summarized responses of nutritionists asked how often forage and non-forage ingredients are collected, who collects them, and what analyses are performed by commercial labs.

Parameter	Forage Ingredients	Non-forage Ingredients
Average weeks of sampling	2.9	7
Who collects these samples?		
Nutritionist	16	22
Feeder	6	4
Producer	2	0
Other	1	1
What analysis are typically requested?		
Basic NIR analysis, including measurements for protein, carbohydrates, and fiber.	1	3
Basic NIR analysis plus NIR predictions of digestibility (Fiber, starch, etc.).	24	10
Basic NIR analysis plus in vitro analysis of digestibility (Fiber, starch, etc.).	2	1
Wet chemistry analysis for protein, carbohydrate, and fiber.	0	10
Wet chemistry analysis for protein, carbohydrate, fiber, and digestibility.	0	4

Comments regarding forage sample collection and analysis.

- Duplicate samples are sent for corn silage to understand variability.
- Frequency of sampling is higher when opening a new bunk, where wet chemistry is often used to understand nutrient supply. NIR is more frequently used when a stable pile is achieved.
- Dry matter is monitored 2x a week and big changes in dry matter trigger a forage sample.
- Minerals are estimated using wet chemistry for forages.
- My sample interval would depend on farm size. A thousand cow farm will be sampled at least twice a week.

Comments regarding non-forage sample collection and analysis:

- We do not sample enough of these samples.
- Corn grain is sometimes analyzed via NIR, given available predictions.
- Non-forage ingredients are typically collected semi-annually if that. Most farms feed through concentrates too fast to adjust diets based on results.
- Dry matter content will dictate frequency of analysis.

Table 11. Summarized responses of nutritionists asked how often they submit their samples for more descriptive analysis of protein digestibility and amino acid composition.

Frequency of analysis	Intestinal digestibility of protein	Amino acid composition
I do not submit samples.	12	18
I will submit only when troubleshooting formulation issues.	9	6
I will spot check my samples.	9	4
I always ask for when submitting samples for analysis.	0	2
I will check when a new batch of feed arrives on farm and/or starts to be fed.	0	1

Preliminary outcomes from the survey:

- Four hundred and twenty herds, primarily located in New York (249), Vermont (71), and Pennsylvania (69), are represented, with an average herd size of 659 cattle.
- Conferences, meetings, and company sponsored trainings are the primary setting where participants receive their continuing education. Consulting with peers, published research, and university led workshops are secondary forms that participants make use of.
 - Those working on this grant can disseminate information on updated protein feeding techniques through these platforms, particularly in conference and university led workshops.
- Most participants balance metabolizable energy and protein predictions in their diet formulation software, reducing the opportunity of overfeeding protein.
 - Secondly, a subset of participants balance metabolizable protein slightly higher than energy. Comments regarding this technique suggest that this technique was taught to participants to avoid any depression in lactation performance. The level at which protein is balanced over energy varies, with many expressing only a marginal percentage of overfeeding protein.
- The cost of preferred feed ingredients is the top constraint when trying to optimize protein feeding. Inventory constraints are stated as the secondary constraint which leads to overfeeding protein. These two constraints present an opportunity where work from this grant could present profitability calculators for certain ingredients which may appear cost prohibitive. Further, there may be opportunity to collaborate with agronomist to create educational material on the importance of planning for the desired inclusion rate of ingredients, particularly forages, and back calculating the needed yield within a season and number of acres needed to produce this biomass.
 - Feeding management also appears to be a considerable constraint leading to the overfeeding of protein. Published materials and the dissemination of that information to feeders and other key farm employees should be prioritized to reduce this constraint.
- Not surprisingly, metabolizable protein supply is the top nutritional parameter when optimizing protein feeding in lactating dairy cattle, with over 80% of participants considering it a priority.
 - Dietary non-structural carbohydrates (i.e. starch and sugar) content was considered secondarily important, with parameters that consider their fermentability (i.e. Rumen degradable starch and total fermentable carbohydrates) also considered a priority.

- Rumen degradable protein content was also highly considered when optimizing protein feeding, highlighting the importance of a healthy rumen and supply of microbial protein which would be synthesized from this protein.
- Individual amino acid supply was stated as priority, but only after the previously stated parameters are considered. Most prefer relating amino acid supply to energy content of the diet.
- Dietary and potentially degradable NDF was also considered a priority, after the above were stated. Preferred targets suggest maximizing potentially degradable NDF in diets.
- Predicted rumen ammonia content ranged widely from participants, with a range of 115 to 160% of requirements. This range should be investigated further to understand differences in perceptions.
- Crude protein, soluble protein, and rumen peptide content were not rated highly as a priority in optimizing protein feeding, highlighting that participants are likely using more discrete parameters to estimate protein nutrition.
- Most participants formulate their diets for the average animal for all animal types, except for most participants target feeding ten percent over the average animal for the fresh and high lactating cow group.
 - A small group of participants target the top ten percent of animals in the fresh cow group, highlighting the need to maximize nutrient availability for this group of animals.
- Participants believe they are meeting with the farm owner, feeder, and herd manager at their preferred frequency, with most participants meeting with these members every time they visit the farm.
 - Crop managers are met quarterly and are in close agreement with participants preferred frequency.
 - Agronomists are met with more often than preferred; however, there is likely a missed opportunity to collaborate on planning for forage inventory based on desired inclusion rates.
 - Participants prefer to meet with veterinarians and financial lenders more frequently than they currently do, suggesting the need to advocate for more collaborative meetings.
- Most participants either do not view or make little changes to their diets when considering predicted excretion measurements. Nitrogen and phosphorus excretion measurements are considered in diet decision making whereas methane excretion measurements are considered by the minority.
- Forage and non-forage sample collection occurs every 3 and 7 weeks, respectively. Most sampling occurs from the nutritionist, with the feeders secondarily collecting samples. Most forage samples are submitted for NIR analysis while non-forage ingredients are split between wet chemistry analysis and NIR. This is likely due to some ingredients not having robust NIR equations for accurate predictions. Advocacy of these equations may help to rectify this situation.
- Many participants do not submit their samples for more discrete measurements, including protein digestibility and amino acid profiles. If these analyses are considered, it appears to be only for troubleshooting needs. More education and a cost-benefit analysis on these analyses may help elucidate the need to regularly perform these at a commercial lab.