1. Introduction and Project (ENE16-143)

- Sustainable solutions for agriculture and environmental management on dairy farms require improved nutrient use efficiencies across the entire farm (animals and cropland).
- In an adaptive approach for whole-farm nutrient management, the nutrient status of the whole farm is assessed, pinpointing areas where improvements can be made, and tracking progress from year to year. A whole-farm nutrient mass balance (NMB) assessment is a tool that can help farmers and advisors do this effectively and efficiently.
- A NMB is the difference between the amounts of N, P, and K imported onto dairy farms as feed, fertilizer, animals, and bedding, and exported via milk, animals, crops, and manure. We express a NMB per tillable acre to indicate the potential for recycling nutrients in the land base (environmental indicator) and per cwt milk (milk production efficiency indicator).
- Large positive NMBs per acre suggest high risk of nutrient losses to the environment, while large positive NMBs per cwt reflect low nutrient use efficiencies, and potential economic loss for the farm as well. Negative NMBs (resulting from exports exceeding imports) reflect mining of soil P and K and will eventually reduce crop yields.
- Farms that manage nutrients in the optimum operational zone (Green Box) recycle nutrients on their land base and produce milk efficiently.
- With NESARE ENE16-143, we developed curriculum and teach farm advisors (crop consultants, nutritionists, extension) the ins and outs of the NMB assessment.
- Performance target: 20 farm advisors will learn to conduct NMBs for dairy farms and 8 will adopt use of NMB assessments, conduct balances, and discuss results with two dairy farmers each. Ten farmers will conduct the NMB a second year and show intent to continue beyond the project.

2. Whole-Farm Nutrient Mass Balances - Concept

The NMB (Figure 1) is a tool to assess farm nutrient sustainability and efficiency. A farm balance for N, P, and K is calculated by subtracting nutrients in farm exports (milk/crop sales/manure exports), from those in imports (fertilizer/feed purchases). The balances are then expressed per tillable acre and per cwt of milk sold, to allow for comparison among farms in New York.

3. Accomplishments ENE16-143 to Date

- We developed two 45 min training sessions, in addition to factsheets that were made available on NMB assessment and feasible balances.
- Training sessions were held with farmers in the Caring Dairy program of Ben & Jerry’s (two events: web-based) and in-class training sessions were held with all collaborating crop consulting firms, extension offices and Soil and Water Conservation districts in New York (across the state).
- In New York itself, we were able to complete 18 NMBs in 2017 (Figure 3), plus 40 balances in collaboration with Ben & Jerry’s. This year, we expect another 15-20 NMBs in New York, plus ~80 balances for the Ben and Jerry’s Caring Dairy Program.
- In collaboration with Agricultural Consulting Service (ACS), we evaluated integration of mass balance assessment with record keeping, which resulted in the NMB being built into their fields and crops record keeping system.
- We collaborate with partners in the Pennsylvania, the New England states and Virginia where NMB assessments are now ongoing as well.

3. Statewide Trends

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>New York State</th>
<th>Upper Susquehanna Watershed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>66.0 (24)</td>
<td>60.0 (30)</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>6.6 (19)</td>
<td>6.0 (20)</td>
</tr>
</tbody>
</table>

4. Farmer Feedback

- Farmer and farm advisor impact stories:
  - Nutrient Mass Balance Tool Helps Table Rock Farm Achieve Their Goals.
  - Table Rock Farm Reaps Many Benefits Through On-Farm Research Partnership.
  - Spruce Haven Dairy’s Managing Member Applies Whole Farm Nutrient Balance Beyond the Farm.
  - Managing Farm Nutrient Efficiencies: EZ Acres Journey.
  - Howland Dairy Benefits from Whole Farm Analysis Project.
  - Cornell’s Mass Nutrient Balance is a Valued Monitoring Tool for the Hardie Farm.

“We included the whole-farm nutrient mass balance in the Caring Dairy program so farmers take a look at their current management. With the results, farmers are more able to determine if they can and should reduce their nutrient balance for improved profitability and stewardship.” Caring Dairy Program of Ben & Jerry’s

http://nmsp.cals.cornell.edu/NYOnFarmResearchPartnership/MassBalances.html

Contact Information
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