Considerations for Sustainable Animal Production

July 14, 2010

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Achieving Sustainable Animal Production
Defining Terms

- **All food production has an environmental impact!**
- Consumers want a food industry that delivers wholesome nutrition while safeguarding our natural resources.
  - While **some** recognize that there is no true sustainability without long-term economic viability for the production facility,
  - **Everyone** agrees that sustainability must be built on a rigorous environmental component.
- Unfortunately there is no universal definition nor is there agreement on how to measure it.
- The common “pastoral” picture of sustainability typically has a few cattle on pasture with a gabled-roof barn in the background.
- But this “picture” just doesn’t work because it doesn’t address either the fundamental economic or environmental challenges associated with animal production!

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The Economic Challenge for Sustainable Beef Production

- A recent paper published by Cornell University press* points out:
  - "Total food requirements will increase by 100% as a function of both the 50% increase in population (by 2050) and the additional global demand for animal protein…"
  - "The resources available for agricultural production are likely to decrease concurrently…"
  - The authors conclude: "…it is essential to use a standardized assessment tool,… one that reflects impact per functional unit of food…"
  - Reflecting their realization that "in the end, the purpose of agricultural activity is to produce food for consumption and it must meet the volume needs of the marketplace."

- Regarding organic milk production, the authors point out: "When differences in productivity are accounted for, organic dairy production requires considerably more resources (feed, land, water etc) per unit of milk produced and has a greater environmental impact."

* "Demystifying the Environmental Sustainability of Food Production", Washington State University, Elanco Animal Health, Cornell University.

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Sustainability and Scale of Operation- Environment and Economics

- Large and small livestock operations generate similar environmental impacts on a per head basis given similar practices, rations, etc.

- There are just two ways to improve sustainability and neither is directly related to the size of the operation:
  - Decrease environmental impacts through implementation of waste treatment and other developing technologies and practices; or
  - Increase productivity through more sophisticated feeding, shelter and other operational approaches.

- Larger operations however have the resources to improve sustainability:
  - Tend to have greater per head productivity;
  - Are more visible and operate under greater scrutiny,
  - Have greater resources to lower environmental impacts, and
  - Face a greater economic and environmental imperative to do both!

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Productivity as a Drivers of Sustainability

- Stanford University earth scientists have released a study to be published by the Proceedings of the National Academy of Sciences.
- Improvements in farm productivity since the Industrial Revolution in 1850's are responsible for avoiding GHG emissions from additional land clearing equal to about one-third of total global GHG's.
- Advances in high-yield agriculture have prevented the equivalent of 590 billion metric tons of carbon dioxide from entering the atmosphere.
- "Our results dispel the notion that modern intensive agriculture is inherently worse for the environment than a more "old-fashioned" way of doing things…" –Jennifer Burney, lead author & post doctoral researcher with the Program on Food Security and the Environment.

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An Example of Low Input / High Environmental Impact: NYT 6/6/10

- "Manure that accumulates on Amish farms easily washes into nearby streams, then into the troubled Chesapeake Bay. The federal government's work with Amish farmers is part of an initiative intended to restore the bay to good health."

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Environmental Impacts per Dairy Cow: Traditional Management

- American Society of Agricultural Engineers (ASAE) data:

	Milker	Beef Cow
– Manure solids per day d.b.	20 lb	15 lb
– Nitrogen (N) per day d.b.	0.99 lb	0.42 lb
– Phosphorus (P) per day d.b.	0.17 lb	0.10 lb

- Every dairy cow voids approximately 360 lb of nitrogen and 60 lb of phosphorus per year to the environment (cattle on feed produce about 100 lb N and 25 lb P per year).
- For a typical free stall dairy with storage lagoon, half or more of the annual 360 lb/yr of N are lost as ammonia emissions prior to accounting for N by the farm's nutrient management plan (NMP).
- Loss of N via volatilization of ammonia from pasture fed milker manure is similar.
- The180 lb/yr of N lost as ammonia is redeposited to the environment with no accounting but with a burden (including the cost to treat) transferred to the public!

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Implications of Traditional Manure Management

- Of the approximately 180 lb of N spread on cropland for fertilizer under a typical NMP, about 40% on average is available to the crop.
- Assuming the majority of N available to the crop under a nutrient management plan is actually used by the crop, somewhere less than 70 lb of N per year per milker will be removed from the environment in crop production.
- The remaining N of greater than 290 lb per milker per year is lost in one form or another to the environment.
- Placing dairy cows on pasture only makes the environmental impacts less controllable –**and lowers overall productivity making the enterprise significantly less sustainable!**

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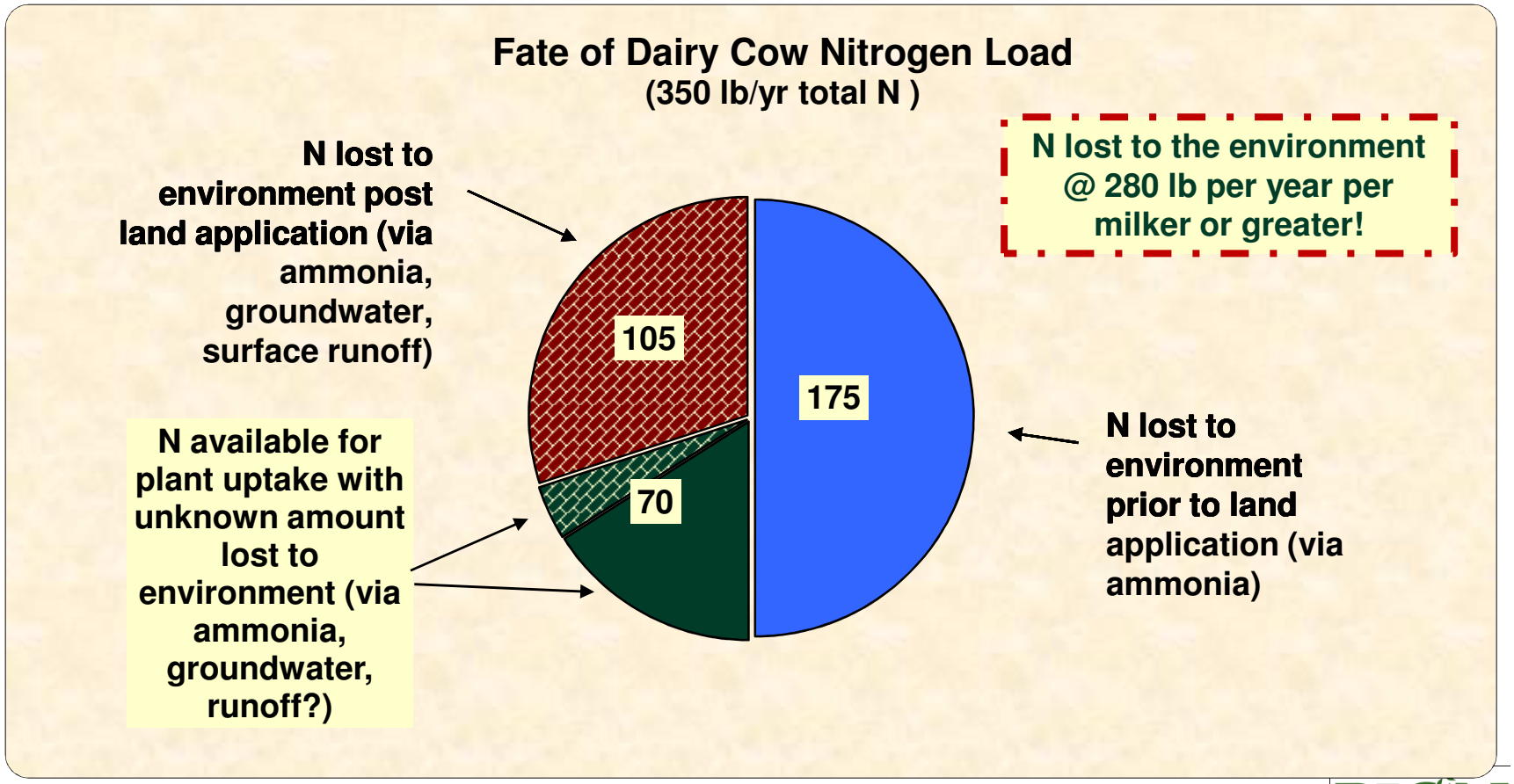
Implications of Traditional Manure Management

- **Dairies with lagoon storage on an NMP and using BMP's lose 80% or more of the milker manure N to the environment!**



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Impact of Bion's Waste Treatment Technology on Nitrogen (N) Loss

- PA DEP has certified the generation of nutrient credits from operation of a Bion waste treatment system on an existing commercial dairy – based on a substantial reduction in nitrogen lost to the environment.
- More specifically, a substantial majority of the traditional nitrogen loss through ammonia volatilization is eliminated through use of the Bion system while it converts most of the remaining nutrients to harmless nitrogen gas and organic, less soluble forms.
- The result avoids release of approximately 80% of the total voided nitrogen –as compared with loss to the environment of over 80% of voided nitrogen using a nutrient management plan with standard best management practices (as detailed on the previous slides).
- Supplemental implementation of a constructed wetland following treatment will further capture the vast majority of remaining nutrients in the effluent stream (approaching drinking water standards).

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Bion's Improved Sustainability is Significant

- Improved sustainability through lower impacts AND higher productivity.
- Environmental impacts following Bion waste treatment w/ wetlands:
  - Residual N and P to the environment will be insignificant;
  - Substantial reductions of air emissions (VOC's, NOx, GGE's, NH_4);
  - System pathogen reductions of 6-log or greater can be expected;
  - Near drinking water standards at groundwater with crop application after wetlands treatment.
- Productivity:
  - Shelter significantly improves cattle finishing efficiencies
    - Increased average daily gain
    - Improved feed conversion efficiencies
  - Protection through confinement has also been shown to cut mortality rates by more than half.

Significantly lower environmental impacts and increased productivity means high sustainability!

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