Managing Agricultural Nitrogen Workshop

Managing Nitrogen in Dairy Manure

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Central Valley CA dairies:
-- most complex
-- highest-N-throughput
of any farming system in the world

UC dairy crop field N balance study

2007-2008 San Joaquin Valley

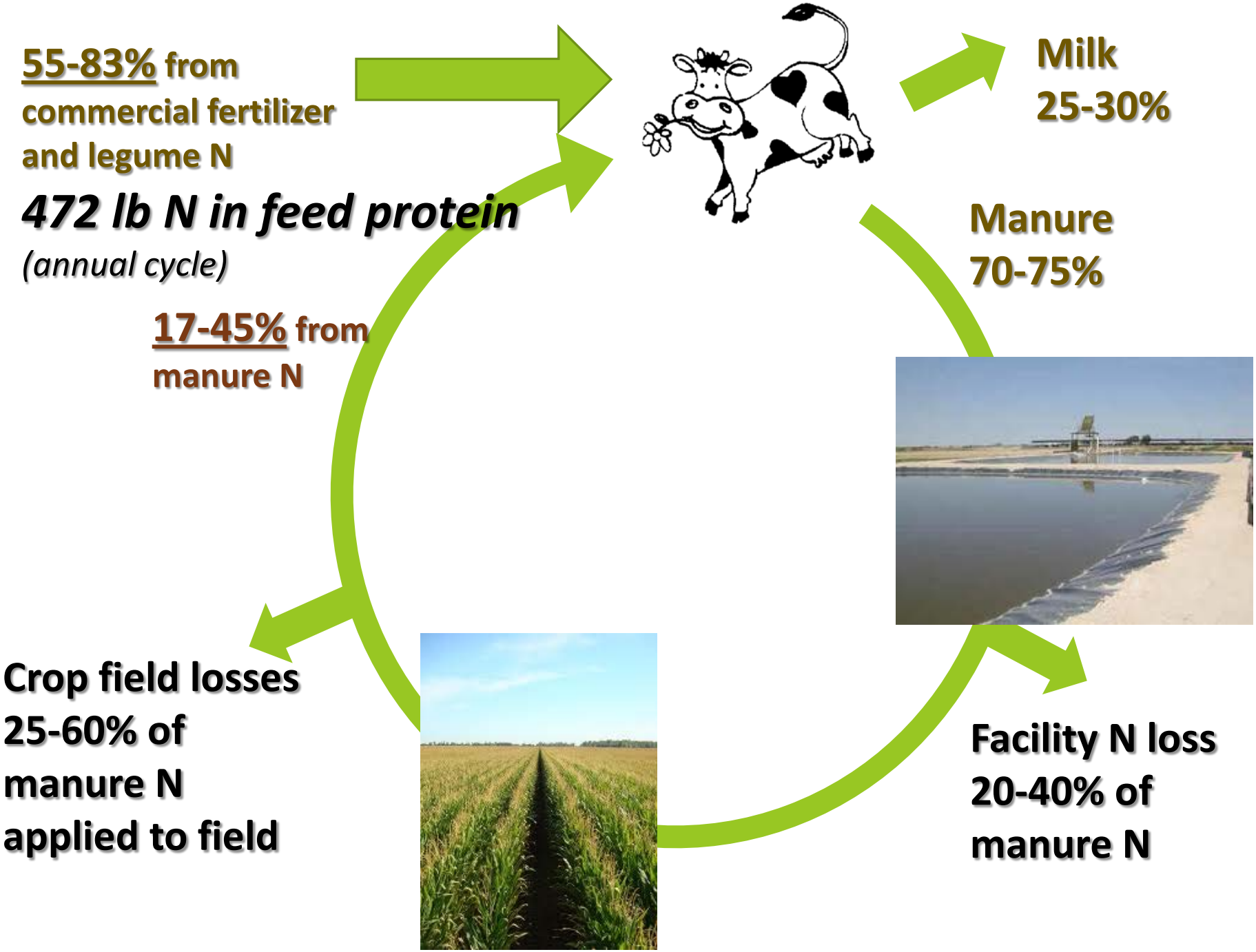
	Soil, %sand	Crops (C=corn, O=oats)	Total N applied	N harvested in crop	NO_3-N leached below 6 ft*
			---------- *lb N/acre* ----------		
Farm 1	80	C-sudangr-triticale-C	1484	821	528
Farm 2	69	C-O-C	1441	678	347
Farm 3	67	C-O-C	714	541	132

*Simulated with RZWQM model

-- from Geisseler et al., 2012. Agronomy Journal

Key System features that present challenges for N use efficiency

- Crops irrigated with gravity systems
- Variety of solid and liquid manure-containing wastes
- Manure storage, treatment and field application on many dairies is still low tech.
- Many dairies not engineered from ground up.

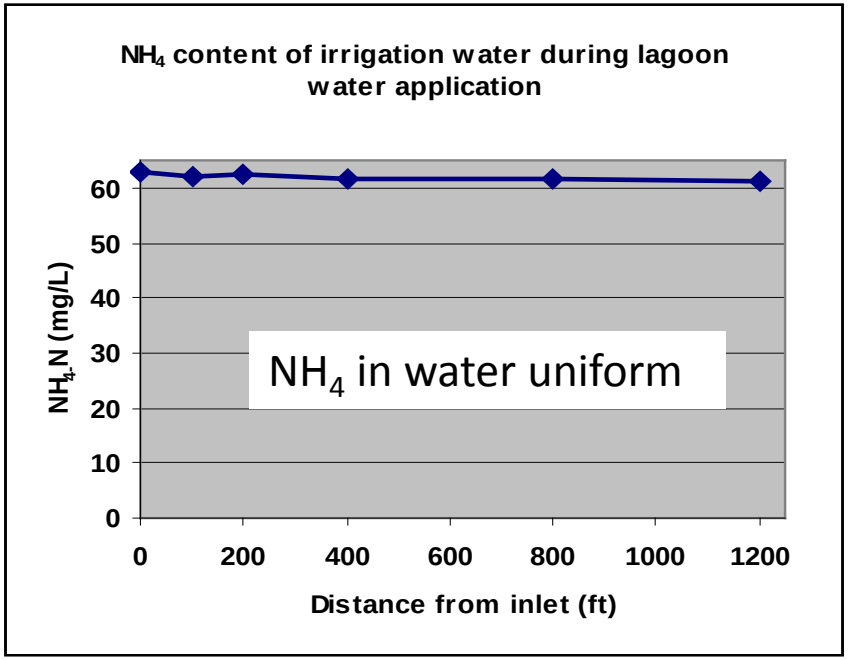

55-83% from commercial fertilizer and legume N
472 lb N in feed protein
(annual cycle)
17-45% from manure N
Milk 25-30%
Manure 70-75%
Facility N loss 20-40% of manure N
Crop field losses 25-60% of manure N applied to field

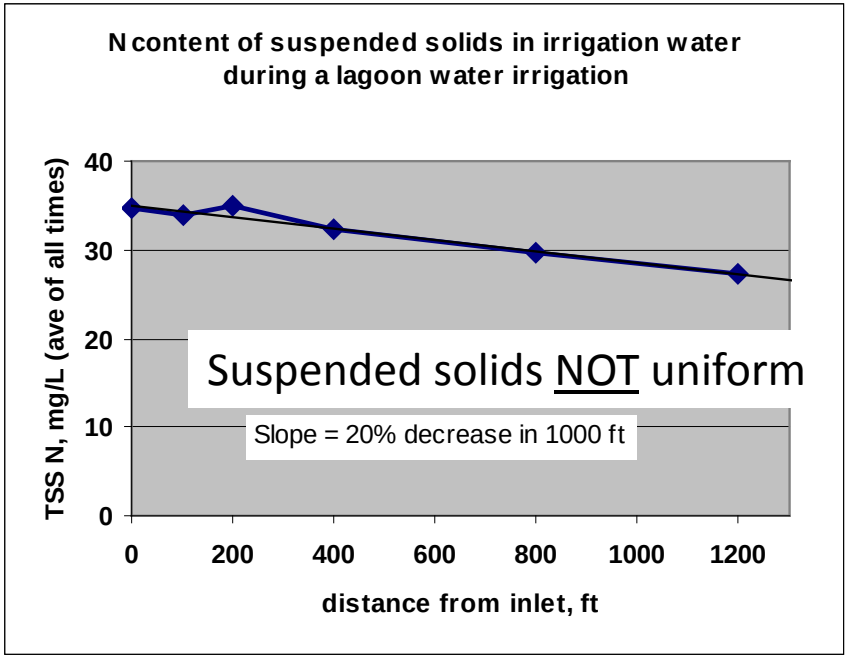
In this scenario, manure N from one milk cow recycled and eventually harvested in forage could be

-- as low as **79 lb N**

-- as high as **212 lb N**

a range of 17 to 83% of excreta N





Gravity irrigation systems

PROBLEM:

- Potentially low efficiency, non-uniform
- Additionally, poor distribution of lagoon water solids

SOLUTIONS?

- Faster advance, shorter fields
- Delay lagoon water injection during irrigation
- Convert to pressure irrig system

R&D needs to improve N use efficiency on fields receiving dairy manure

- Adapt low-leaching irrigation methods to highly permeable soils
- Adapt plant tissue and soil nitrate testing for dairy forage cropping systems
- Establish field-scale research site(s) for testing combinations of practices

Other R&D needs

- **Adaptive management tools**
  - *N budgeting and associated recordkeeping*
  - *Corn stalk nitrate test (end of season)*
  - *Develop system for farmer crop strip trials?*
- **Determine gaseous N losses from manured fields**
- **Convert manure sludge/solids to organic fertilizers usable on a wider range of crops**
  - *Determine agronomic performance of biodigester residues, vacuum-collected manure, etc.*
- **Determine alfalfa N credits**
- **Better field-based measurements of N mineralization of organic sources**