California Dairy Sustainability Summit

Increasing Nutrient Use Efficiency for Survival and Profit

Increasing Nutrient Use Efficiency for Survival and Profit

Moderator**: Deanne Meyer, PhD**, Livestock Waste Management Specialist, Department of Animal Science, University of California, Davis and UC ANR

- **Bob Hutmacher, PhD**, UC Cooperative Extension Specialist & Director, West Side Research and Extension Center
- **Blake Alexandre**, Owner, Alexandre Family Farm
- **Michelle Davis**, Environmental Manager, Morning Star Dairy, Inc.
- **Simon Vander Woude**, Owner, Vander Woude Dairy

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Increasing Nutrient Use Efficiency for Survival & Profitability

Panel Discussion

Bob Hutmacher, UCCE / UC-ANR
& UC Davis Plant Sciences Dept

University of California
Agriculture and Natural Resources

Nutrient Stewardship – use Four R's approach to promote concepts of Best Management Practices (BMP's) that:

- Achieve crop / animal production system goals
- Minimize field nutrient losses & negative environmental impacts
- Promote efficient crop nutrient utilization

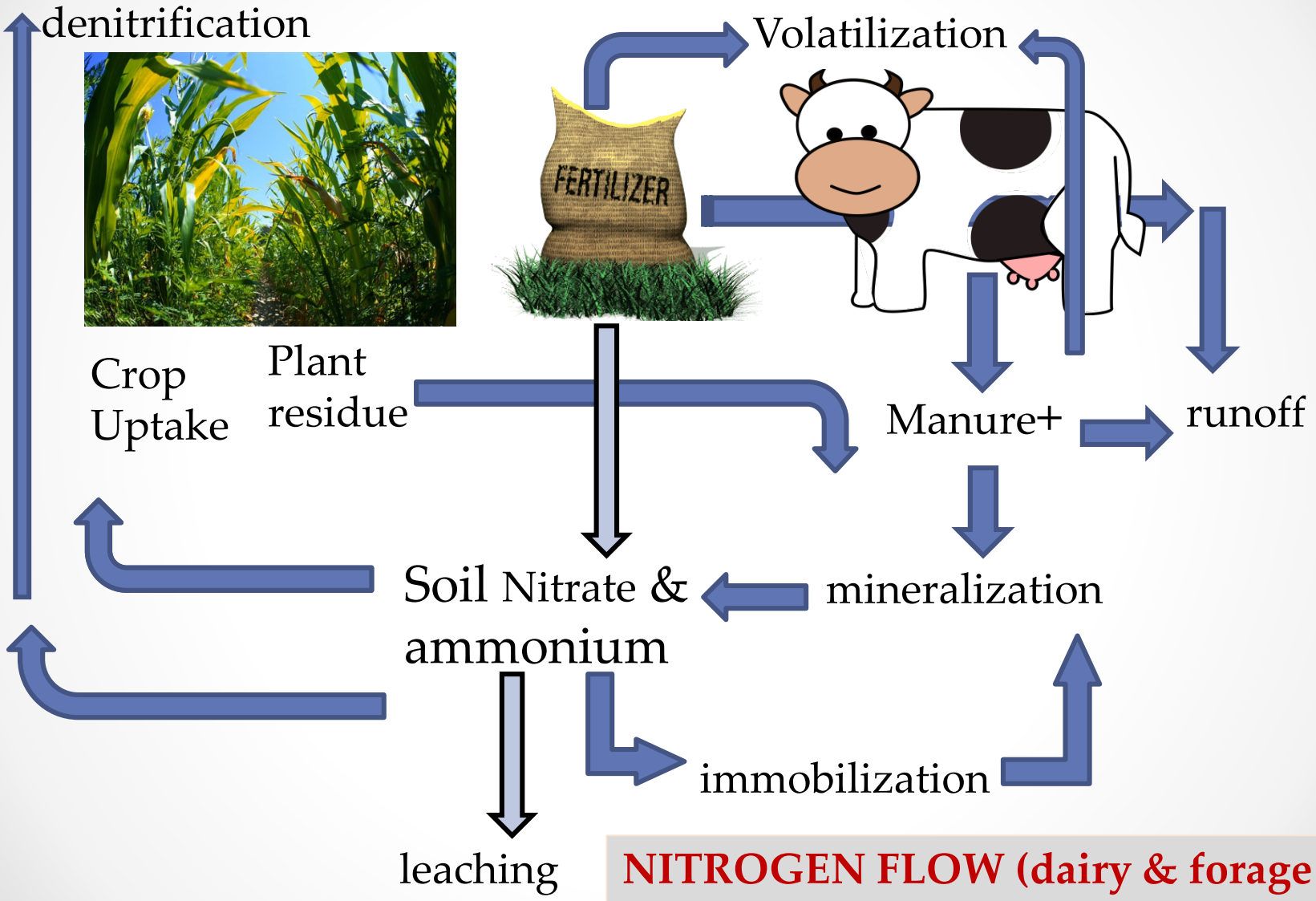
…While using economically sustainable practices that limit financial stress

Right **SOURCE**	Right **RATE**	Right **TIME**	Right **PLACE**
• Balanced nutrients • Types of materials with good characteristics amenable to improved management	• Application amount better matched to crop needs • Consider split applications & methods to reduce losses • Adjust for irrigation, OM N sources	• Application timing better matched to crop needs • Timing of availability of nutrients (mineralized nutrients, time release mat'ls)	• Better match placement of manures, fert. to active root zone • Consider impacts of soil & irrigation on active part of root zone

Consider potential for interactions of modified practices when employing Four R's in developing improved management tools

Can be many components of efforts to improve nutrient mgmt practices:

Even just looking at nitrogen transformations, can focus on many things …



NITROGEN FLOW (dairy & forage system) – Clemson Univ LF09-2015

For example: **In trying to reduce N Losses** Associated with leaching, denitrification, volatilization and runoff ….

- **Leaching** losses reduced by:
  - Since NO3 highly soluble, avoid large applications just prior to conditions that would saturate upper soil profile/root zones (rain, non-uniform large irrigations)
  - Improved match of timing of N containing fertilizers, manures to plant uptake; and improved and less variable delivery methods
- **Denitrification** losses reduced by:
  - Avoiding extended saturated soil conditions; improve drainage
- **Volatilization** losses reduced by:
  - Better incorporation of manures or ammonium-N fertilizers into soil (especially pre-plant); reduce surface applications to high pH soils under warm, moist conditions; use urease inhibitors with urea fertilizers
- **Runoff** losses reduced by:
  - Fewer/lower rate applications prior to expected rainfall; improved irrigation scheduling & methods; practices improving soil infiltration

Management Practice BMP implementation can be challenging in dairy / forage operations

Examples: determining acceptable manure application rates can involve:

- Variable N content of manures & other applied materials across times/sites (need to test routinely so can adjust application recommendations)
- Ratio of N:P:K in manure applications typically is not a match to crop nutrient needs for N:P:K (ex: consider setting upper limits for loading based on P since most likely to exceed plant needs)
- Nutrients in manures are not all immediately plant-available (lagoon water, dry or wet manures differ in lag time for availability)

Examples of improved practices linked to the Four R's approach:

SOURCE – consider interactions between N nutrient source/composition and other nutrients (P, K, salts); consider effects of soil conditions (pH, infiltration & aeration) on nutrient availability & losses; utility of inhibitors, slow-release mat'ls

RATE – consider all nutrient sources (manure, fertilizer, water, etc.); use split applications when appropriate to avoid mismatch of timing & plant use; use soil/plant/sensor data to evaluate rate & utility of variable rate applications

TIMING - adjust based on knowledge of plant uptake patterns, time required for transformation of organic nutrient sources; observed signs of deficiencies

PLACE – determine zones of highest nutrient uptake , improvements in delivery methods (that may be related to changes in irrigation practices/systems)

Available options for improvements not likely to be "one size fits all", so best approaches likely to vary some with factors including soil conditions, crop species in forage systems, rooting zone depth, tillage practices & irrigation method

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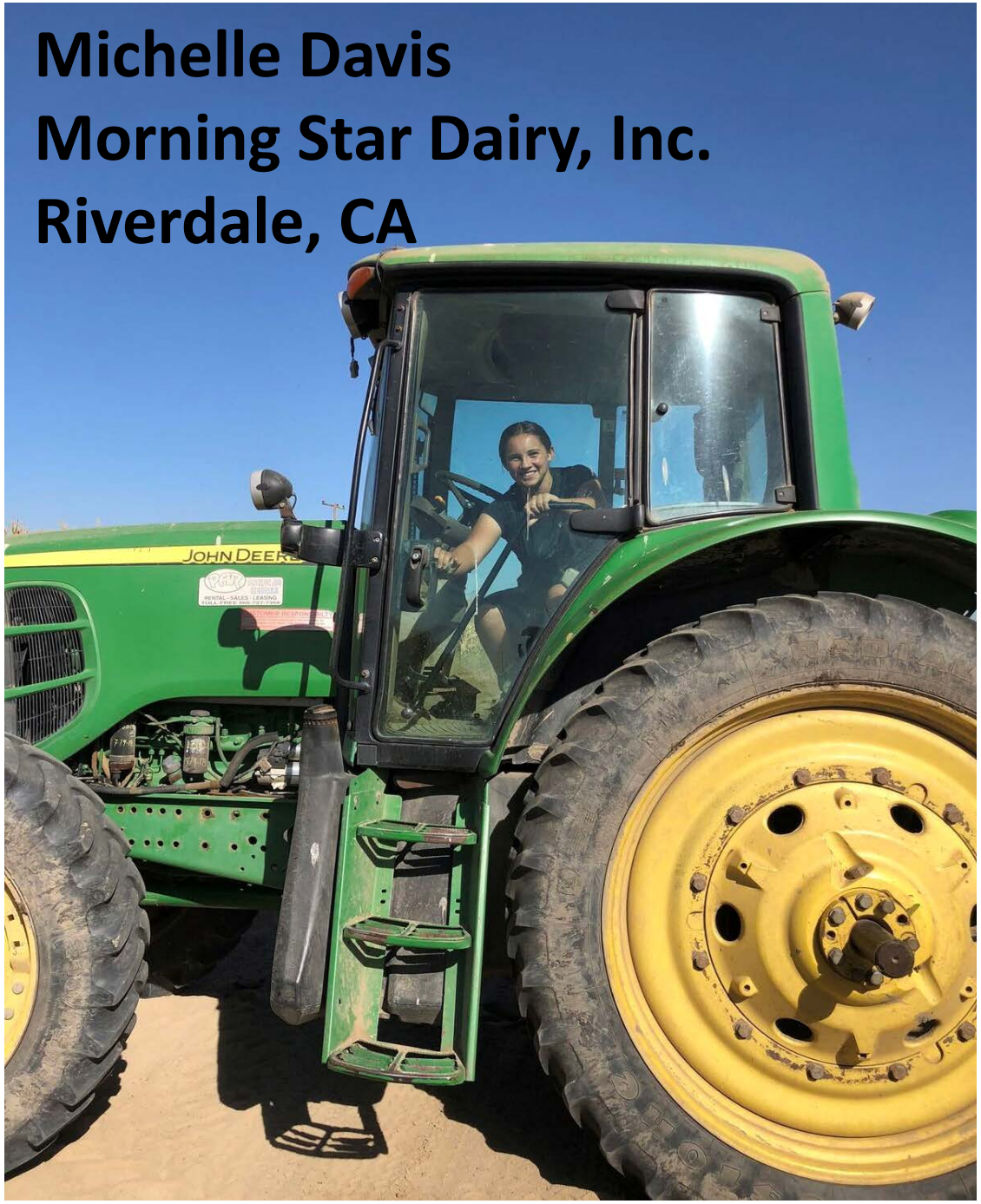

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