PROJECT 17
AGRICULTURAL TECHNOLOGY CLUSTER

MEASURING AND EXTRACTING NITRATES IN SOIL: CONSIDERING INNOVATIVE SOLUTIONS WHILE DEFINING AGRICULTURE'S NEEDS

THINK TANK SESSION
AUGUST 19, 2011

SESSION NOTES

On August 19, 2011, Project 17, in collaboration with the Grower-Shipper Association of Central California and Hartnell College, convened an invitation-only think tank session to delineate the This session focused on:

- real-time measurements of nitrates in the soil;
- moisture-sensing instruments; and
- solutions to clean nitrates out of soil.

This session, as part of an on-going series sponsored by the federally-funded Project 17, continued to identify the needs of the agricultural industry around the issue of nitrates in the soil, especially in irrigation waters and tile waters. The session included a review of current research in this area from California State University, Monterey Bay and University of California, Davis. Additionally, several commercial solution providers highlighted their approaches to measuring nitrates in water and in soil, as well as how best to execute de-nitrification processes. Beyond assessing the viability of these particular solutions, participants continued to define their "wish list" for improved products to deploy on their farms.

These notes summarize key findings in research around nitrate measurement and de-nitrification; and the pros and cons of the commercial solutions presented at this session. Of particular interest is the delineation of key points on the "Commercial Wish List" as articulated by the agricultural participants.

PARTICIPATING COMPANIES AND ORGANIZATIONS

- Crop Production Services
- Driscoll Strawberry Associates, Inc.
- Duda Farm Fresh Foods, Inc.
- Fresh Express / Chiquita
- Gills Onions
- Monterey County Farm Bureau
- Ocean Mist Farms
- Paraiso Vineyards
- Rio Farms
- Rose Royal Radicchio
- Tanimura & Antle
- Taylor Farms California
- Grower-Shipper Association of Central California
- AMEC Geomatrix
- APT Water, Inc.
- BioVantage Resources, Inc.
- California State University, Monterey Bay
- Hartnell College
- John Deere Water
- Project 17
- Monterey County Water Resources Agency
- Smart World Center
- University of California, Davis
- Wilbur-Ellis Company

OBJECTIVES OF THE OVERALL SESSION

- Create a wish list regarding solutions to nitrate issues
- Continue to define the nitrate-oriented problems
- Outline needs/pros and concerns / cons of potential and current solutions

WHAT'S ON OUR RESEARCH WISH LIST?

- Find out rate of nitrate penetration (Get a baseline on nitrates)
  - Speed
  - How it's traveling
  - Direction
- How much are we experiencing now of nitrates from the past?
- How long does it take to revert?

RESEARCH QUESTIONS

- How to protect potable water?
- Surface water contamination by nitrates
- Could growers use wood cuttings from their farmers for de-nitrification?
  (e.g., wood chips; straw -good in this area)
  (e.g., molasses – per Tim Hartz)
- Wood chips – cons/consideration
- Wood silt overwhelm the Chips?

ADDITIONAL IDEAS ON RESEARCH QUESTIONS

- Tulare versus Salinas Valley: Are the nitrate problems the same? If so, is there a mechanism in place to share data? e.g.,, how do we leverage lessons learned?
- Within the leafy greens, what commodity or soil type tends to leach more nitrates?
- What de-nitrification systems are sustainable and economical (i.e., Hartz digester, etc.)?
- What are the barriers that prevent public agencies and scientists from sharing data with other agencies? How can we remove these barriers to provide the best data for analysis and modeling (e.g.,, MCWRA and U.C. Davis)?
- De-nitrification of ground water has been ignored by staff (RWQB) as negligible. Is that a good assumption? Can the de-nitrification of NO_3 in leached water be counted to increase allowable applied NO_3 (assuming surface water problems are separated)?

- We talk about the size of fields as an impediment to variable rate technologies and precision agriculture methodologies. But people walk fields almost every day (weeding, watering, etc.) and tractors are in very frequently. So, why is it hard? They're there.
- Needs:
  - Advancements in nitrate soil plant testing
  - Need shallow narrow drain. Wells to monitor improvements in best management practices
- Reducing NO_3 in file – how to do economically and efficiently?
- How fast does Keldahl Nitrate turn into NO_3N?
- Need for entire region (RB3)
  - Contaminant susceptibility map based on soil, geology, lithology and proximity to highly beneficial use areas (community water systems with high nitrate)
  - Vulnerability Map for Leaching
- Need utility 4-wheel drive truck
- Mobile WQ Laboratory to perform immediate WQ testing for surface and ground water quality such as nitrate / conductivity / pH and physical tests such as pefiole (sp?) and soil nitrate testing.

CONSIDERING COMMERCIAL SOLUTIONS

AMEX Geomatrix: Wood Chip Bio Reactors

Pros:

- High profile demonstration project near Elkhorn Slough
- Most local woods are useable
- Immediate, measurable reduction in pollution
- Lasts for 20 years
- Financially feasible

Cons:

- Consideration: trench burial: need for erosion
- Control so wood chips are not "buried" by storm or flood waters
- Do we need special permits?
- How about its impact on shallow ground water?
- Is this technology nitrate-only specific (or applicable to other contaminants) (multi-use: research is on-going)?

John Deere Water: CropSense: Soil Moisture Management

Pros:

- Mitigation of nitrate leeching
- Ability to probe at different levels
- To use tools on comparable soil types. This is a management tool not a management decision-maker
- Manage how much water gets down into the tile system (has proven to us that we are over-irrigating)
- Web-based for monitoring and sharing data

Cons or Considerations:

- Very expensive to use versus reduction of nitrate use – and cost
- Expensive to use
- Question: how many to put in a field? Challenge: how does this work on different soils and with different crops?
- Can this system integrate with a different kind of sensor (e.g.,, for measurement of nitrates outside of individual farms)?
    - Want an EC sensor (total salts)

REFINING OUR COMMERCIAL WISH LIST

- Conduct more research on water and fertilizer management
- Get technology to reduce nitrates early on – before it gets into public waterways
- Look at profile of water dispersion of a particular bed / timing on stress of crop
- Question: what are the implications for crop choices relative to the introduction of new technologies?
- Develop a nitrate quick test: e.g.,, strip test or a probe
- Develop a mobile irrigation water quality lab
- Create environmental sensors
- We have a need to establish a baseline in growers' soil
    - Build up the growers' database
- We need an integrated approach re: needs as well as the solutions
- Create demand for Ag-Tech grads among growers
- Establish an agricultural innovation and technology clearinghouse
- Develop slow-release fertilizers (?)
- Create knowledge management systems

- Create GMOs doing nutrient modification
- We need to develop a tool to measure and executive on-demand release of
    - Water
    - Fertilizer
      (not a probe for one place; but a “map” of the bed)
    - Develop a tool to drag behind a tractor and get information, real-time, from the soil

Data Collection and Data Management

- For a grower
- For a region
- Address issues of confidentiality
- Real-time collection
- Ease of use to collect data