Optimizing the Use of Groundwater Nitrogen (NO_3^-): Efficacy of the Pump and Fertilize Approach for Almond

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PROJECT SUMMARY

Objectives:

- Our primary objective during 2014-15 was to work with grower-cooperators to establish seasonal data for the pump and fertilize (P&F) approach for nitrogen (N) management in almond and pistachio orchards.
- We have gathered two seasons of data to validate recent developments in nutrient budget N management (early season sampling and yield estimation), and two seasons of data for efficacy for P&F,
- Describe P&F, as contrasted with conventional grower practice and high frequency N applications ("spoon feed").
- Characterize key biological and physical parameters relevant to P&F (seasonal plant-soil N balance, soil NO_3^- movement),
- Establish proof of concept for use of stable isotopes of $^{15}NO_3^-$ in tracing N under P&F,
- Validate decision support models to assist growers with management of groundwater (GW) N (mainly nitrate, NO_3^-), and.
- Demonstrate and proactively extend results and developed technologies of self-assessment and BMP's to growers.

Background and Discussion:

The loss of reactive N to air and water is currently one of the key challenges to environmental agricultural sustainability. One of the most recent alerts involved the UC Davis coordinated report (http://groundwaternitrate.ucdavis.edu/) where the involvement of agricultural fertilizers in GW NO_3^- contamination was assessed. Nitrate is present in well waters in varying concentrations and is believed to be "overwhelmingly the result of crop and animal agricultural activities".

The report proposed the use of GW NO_3^- using P&F practice on a mass equivalent basis to reduce NO_3^- loading into GW. The goal of this project is to test the efficacy of the P&F practice as a realistic alternative to the use of fertilizers. Information is needed to inform and meet regulatory demands and provide growers with improved management tools on the efficacy of current fertilizer management practices as well.

We used modern, modifiable fertigation systems in a region of the Central Valley classified as a hydrogeologically vulnerable area (HVA: DWR, 2000). Appropriate sites were established - those with soil type and water table levels indicative of 'high risk' for nitrate (NO_3^-) leaching.

Multidisciplinary approaches are being used to assess how P&F will impact economic and environmental sustainability. This project will gather mass balance and yield information on an orchard level to assess P&F GW NO_3^- as a potential source of N for crop use on a mass equivalent basis. The P&F approach can potentially reduce fertilizer costs and reduce N concentrations in GW over the long-term. However, harmful consequences like presence of toxic concentrations of other salts in well waters with NO_3^- need to be understood. Pump and fertilize was compared with current grower practices for integrated N management in almonds and pistachio.

Project Cooperators and Personnel: Shahar Baram, Matt Read, Sharon DeBach and Christine M. Stockert, University of California, Davis; Gurreet Brar, UCCE – Fresno/Madera Counties; ATB Growers; CDFA FREP.

For More Details, Visit

- Poster location 64, Exhibit A + B during the Almond Conference; or on the web (after January 2016) at Almonds.com/ResearchDatabase
- 2014 - 2015 Annual Reports CD (14-PREC6-Smart); or on the web (after January 2016) at Almonds.com/ResearchDatabase
- Related projects: 15-AIR2-Smart; 14-PREC4-Hopmans, 13-PREC2-Brown; 15-PREC7-Brown