Barriers to the Adoption of Recommended Nutrient & Water Management Practices

Patrick Brown, Mark Lubell
Sat Darshan Khalsa, Jessica Rudnick, Stephanie Tatge
phbrown@ucdavis.edu
University of California Davis

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Contents

- Research project overview
- Best nitrogen management practices
- Early results: voices from surveys & interviews
- Next phase survey
Research Project Overview
(CDFA-FREP Funded Grant 2017-19)

- Gauging the attitudes and perspectives of the agricultural community toward nitrogen (N) management
  - What N management practices are growers using?
  - What barriers or incentives exist to the adoption of new N management practices?
  - What outreach and educational resources are available and useful on N management?
  - What other resources are needed?
  - How well do growers understand current N management regulations?
Contents

• Research project overview
• Define current best nitrogen management practices.
• Early results: Data and voices from surveys & interviews
• Next phase survey
# Best Nitrogen Management Practices

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<thead>
<tr>
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<th>Soil Practices</th>
<th>Irrigation Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>N Budget</td>
<td>Soil sampling to determine residual soil nitrate</td>
<td>Irrigation water testing to determine N content</td>
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<tr>
<td>Leaf sampling to determine plant-nutrient status</td>
<td>Cover crops</td>
<td>Pressure chamber to measure plant water stress</td>
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<td>Variable rate application using GPS</td>
<td>Compost/ organic matter</td>
<td>Moisture probe or soil sensors</td>
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<td>Slow release fertilizers or nitrification inhibitors</td>
<td>Optimization of soil ‘health’</td>
<td>Use ET to schedule irrigation</td>
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<tr>
<td>Split applications</td>
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<td>Check for distribution uniformity</td>
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<td>Foliar N application</td>
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<td>Fertigation timing</td>
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References for more on practices:
Approach

1: Stakeholder meetings to inform survey design

• In person interviews at 6 Water Coalition Meetings
  • 3 Delta (150 participants)
  • 3ESJWQC (415 Participants)
• 565 Total Responses
• Growers asked about 10 management practices listed on previous slides based on their largest (most important) parcel of land.
• Asked for data on crop grown
• Sources of information and constraints and benefits
• Follow up 20 kitchen table grower interviews
• Review and comments by ‘experts’
Grower Survey on Nitrogen Management
East San Joaquin Water Quality Coalition

About this Survey: This survey is part of a large-scale study across the Central Valley to investigate nutrient management in a variety of crops, administered by UC Davis. All data from this survey will be kept anonymous; your privacy is our priority. Thank you for your participation and helping to improve California agriculture.

1) What crop do you grow on your largest parcel?
- Stone fruits/table grapes
- Wine grapes
- Raisin grapes
- Nuts

2) How many total acres is this single largest parcel?
- 0-50
- 51-100
- 101-250
- >250

3) For this single largest parcel do you... (check all that apply)
- Own this land
- Lease this land
- Manage this land

4) How do you irrigate this parcel?
- Micro-irrigation
- Furrow
- Flood for groundwater recharge
- Solid set sprinklers
- Flood for in-season irrigation

5) What water source do you use to irrigate this parcel?
- Riparian Water
- Groundwater
- District water delivery

6) How frequently do you use the following management practices?

<table>
<thead>
<tr>
<th>Practices</th>
<th>Regularly Use when appropriate</th>
<th>Use irregularly</th>
<th>Tried and Discontinued</th>
<th>Considered but, never tried</th>
<th>Never Considered</th>
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<td>Nitrogen Management</td>
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<td>Use a Nitrogen budget to determine fertilizer rates</td>
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<td>Application of organic matter (compost or manure)</td>
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<td>Use ET-based methods to schedule irrigation</td>
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<td>Measure plant water status to time irrigation</td>
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<td>Soil moisture sensors to track water availability</td>
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<td>Test irrigation system for distribution uniformity</td>
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7) For the same set of practices, please indicate if the listed challenges hinder, discourage or inhibit your implementation of the practice. Check all that apply.

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8) When making decisions regarding the above management practices, what benefits do you consider? Check all that apply.

<table>
<thead>
<tr>
<th>Practices</th>
<th>N use efficiency</th>
<th>Water savings</th>
<th>Improve soil health</th>
<th>Adapt to drought</th>
<th>Adapt to excessive rainfall</th>
<th>Adapt to extreme temperatures</th>
<th>Meet regulations</th>
<th>Improve crop yield</th>
<th>Improve crop quality</th>
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9) Which county/ counties do you grow in? Check all where you operate.
- Madera
- Stanislaus
- Tuolumne
- Mariposa
- Merced
- Colusa
- Colusa

10) Do you grow other crops in addition to your permanent crops? Please check all that apply.
- Stone fruits/grapes
- Vegetables/melons
- Nuts
- Field/row crops

11) From what sources do you seek information on fertility management practices?
- Farm Bureau
- Ag. Commissioner
- UC Extension
- CCA
- PCA
- Water Quality Coalition
- NRCS/RCD
- Industry/Grower assoc.
- Other growers/peers
Contents

• Research project overview
• Best nitrogen management practices
• Early results: Data and ‘opinions’ from surveys & interviews
• Next phase survey
565 growers participated in our surveys in the northern San Joaquin Valley at annual grower water quality coalition Meetings.
Early Results | Winter 2017 Surveys (n=565)

“Do you use any of the following fertilizer, soil or irrigation practices?”

Total number of respondents reporting adoption/ non adoption of each practice
(565 Respondents)

- Cover Crop
- Soil Mositure sensors to track water availability
- ET-based irrigation scheduling
- Check plant-water status to schedule irrig.
- Test irrigation system for DU
- Apply organic matter
- N budget to determine fertilizer rates
- In-season leaf sampling of plant-nutrient status
- Split application of N fertilizer
- Soil sample to measure residual N

Number of Total Respondents
Early Results | Winter 2017 Surveys (n=565)

“Do any of the following challenges hinder, discourage or inhibit your implementation of these practices?”

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**Percent of Total Respondents**

<table>
<thead>
<tr>
<th>Practice</th>
<th>Cost</th>
<th>Labor</th>
<th>Supplies</th>
<th>Tech</th>
<th>Efficacy</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use N budget</td>
<td></td>
<td>0%</td>
<td>0%</td>
<td>10%</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>Split App</td>
<td></td>
<td>0%</td>
<td>0%</td>
<td>10%</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>Leaf Sample</td>
<td></td>
<td>0%</td>
<td>0%</td>
<td>15%</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>Sample for Residual N</td>
<td></td>
<td>0%</td>
<td>0%</td>
<td>20%</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>Cover Crop</td>
<td></td>
<td>0%</td>
<td>0%</td>
<td>15%</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>Compost/Org. Matter</td>
<td></td>
<td>0%</td>
<td>0%</td>
<td>20%</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>ET irrig.</td>
<td></td>
<td>0%</td>
<td>0%</td>
<td>20%</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>Plant Water Status</td>
<td></td>
<td>0%</td>
<td>0%</td>
<td>20%</td>
<td>0%</td>
<td>20%</td>
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<tr>
<td>Soil Moisture Sensors</td>
<td></td>
<td>0%</td>
<td>0%</td>
<td>20%</td>
<td>0%</td>
<td>20%</td>
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<tr>
<td>Dist. Uniformity</td>
<td></td>
<td>0%</td>
<td>0%</td>
<td>20%</td>
<td>0%</td>
<td>20%</td>
</tr>
</tbody>
</table>

**Categories:**

- N Management
- Soil Management
- Irrigation Management
“Do any of the following challenges hinder, discourage or inhibit your implementation of these practices?”

- N budget to determine fertilizer rates
- Soil sample to measure residual N
- Test irrig. System for DU

Percent Respondents Indicating Challenge:
- Cost
- Labor
- Supplies
- Tech
- Efficacy
- Uncertainty
Early Results | Winter 2017 Surveys (n=565)

“Do you consider any of the following benefits when making decisions about fertilizer, soil and irrigation practices?”

- 

![Bar Chart](image-url)
Early Results | Winter 2017 Surveys (n=565)

“Do you consider any of the following benefits when making decisions about fertilizer management practices?”

- N use efficiency
- Water savings
- Improve soil health
- Meet regulations
- Improve crop yield
- Improve crop quality
Early Results | Winter 2017 Surveys (n=565)

“Do you consider any of the following benefits when making decisions about soil management practices?”

- N use efficiency
- Water savings
- Improve soil health
- Meet regulations
- Improve crop yield
- Improve crop quality
Early Results | Winter 2017 Surveys (n=565)

“Do you consider any of the following benefits when making decisions about irrigation management practices?”

- N use efficiency: 35% respondents indicating benefit
- Water savings: 10% respondents indicating benefit
- Improve soil health: 40% respondents indicating benefit
- Meet regulations: 50% respondents indicating benefit
- Improve crop yield: 45% respondents indicating benefit
- Improve crop quality: 30% respondents indicating benefit
Early Results | Winter 2017 Surveys (n=565)

“Do you seek information on fertility management practices from any of the following sources?”

![Bar chart showing percent respondents within size group for various sources.]

- Growers operating small parcels (0-50 acres)
- Growers operating large parcels (51-250 acres)
Early Results | Thoughts from Interviews…

On irrigation & nitrogen…

“After the drought, we’re not irrigating anywhere near the same amount which changes how the nitrogen moves through the soil… we’re also learning that we don’t need as much nitrogen as we thought we did.”

Madera County Grower

On extension and outreach…

“Demo farms are the best tool to teach and convince others… If you want people to comply, we need to provide reasons that resonate and show the monetary benefit of better nitrogen management”

San Joaquin County Grower

On nitrogen regulations & policy…

“There’s some of that stuff that bothers me or scares me a little bit and it’s just one more piece of paperwork to fill out… I get frustrated because it’s always a moving target”.

Merced County Grower

“So much of that the nitrogen focus seems like they want to have a silver bullet for the whole state or for a whole region and we have variability throughout our individual fields and crops… There’s no silver bullet that will work for all”

Stanislaus County Grower

“Nitrogen budgets are a great learning tool for certain growers that have been doing the same thing the same way for 50 years... but there’s a lot of others that are past that point and have the nitrogen dialed in”

SJ County Grower
• Connection between irrigation practices and N management is important and needs more attention

• Demand exists for outreach and extension around N management practices, especially with emphasis on their on-farm benefits

• Uncertainty around practices is a significant barrier to adoption that needs to be better understood

• Purpose, extent and goal of nitrogen regulations/policies are unclear or not well-communicated
Contents

• Research project overview
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• Next phase survey
Next Phase Survey

“This survey is a great opportunity to learn about why there is resistance to nitrogen reporting & regulations, what would change the resistance and who should be involved in affecting that change.”

San Joaquin County Grower
Next Phase Survey

Colusa – Glenn Subwatershed
February 2018

Delta and San Joaquin County and East San Joaquin Water Quality Coalitions
June 2018
Research Project Overview

Motivations

In the context of new N management requirements:

• Maximize on-farm **efficiency**

• Increase farm **profitability**

• Reducing **N losses** into surface and groundwater drinking supplies

• Meet **regulations**

• Efficiently utilize available N and minimize supplemental N

• Understand the constraints growers face that limit their ability to meet these goals
Any Questions?

Patrick Brown
phbrown@ucdavis.edu

This work is a collaborative effort by an interdisciplinary team at UC Davis including:
Dr. Mark Lubell, Dr. Sat Darshan S. Khalsa, Jessica Rudnick & Stephanie Tatge