

# Barriers to the Adoption of Recommended Nutrient & Water Management Practices

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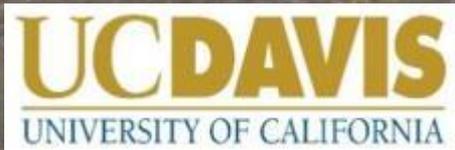
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University of California Davis

California Plant & Soil Conference

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Research support from:



# 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**?



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- Research project overview
- Define current best nitrogen management practices.
- Early results: Data and voices from surveys & interviews
- Next phase survey

# Best Nitrogen Management Practices

Fertilizer Practices	Soil Practices	Irrigation Practices
<ul style="list-style-type: none"> <li>• N Budget</li> <li>• Leaf sampling to determine plant-nutrient status</li> <li>• Variable rate application using GPS</li> <li>• Slow release fertilizers or nitrification inhibitors</li> <li>• Split applications</li> <li>• Foliar N application</li> <li>• Fertigation</li> </ul>	<ul style="list-style-type: none"> <li>• Soil sampling to determine residual soil nitrate</li> <li>• Cover crops</li> <li>• Compost/ organic matter</li> <li>• Optimization of soil 'health'</li> </ul>	<ul style="list-style-type: none"> <li>• Irrigation water testing to determine N content</li> <li>• Pressure chamber to measure plant water stress</li> <li>• Moisture probe or soil sensors</li> <li>• Use ET to schedule irrigation</li> <li>• Check for distribution uniformity</li> <li>• Fertigation timing</li> </ul>

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
- Solid set sprinklers
- Furrow
- Flood for in-season irrigation
- Flood for groundwater recharge

**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?**

Practices	Regularly Use when appropriate	Use irregularly	Tried and Discontinued	Considered but, never Tried	Never Considered
<b>Nitrogen Management</b>					
Use a Nitrogen budget to determine fertilizer rates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Split applications of nitrogen fertilizer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In-season leaf sampling to verify plant-nutrient status	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Soil Fertility Management</b>					
Soil sampling to measure residual soil nitrate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cover cropping between tree/ vine rows or rotations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Application of organic matter (compost or manure)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Irrigation Management</b>					
Use ET-based methods to schedule irrigation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Measure plant water status to time irrigation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Soil moisture sensors to track water availability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Test irrigation system for distribution uniformity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**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.**

Practices	Cost	Labor Intensive	Supplies	Tech. Knowledge	Lack of efficacy	Unsure of challenges	Adopted with no challenges
<b>Nitrogen Management</b>							
Use a Nitrogen budget to determine fertilizer rates	<input type="checkbox"/>						
Split applications of nitrogen fertilizer	<input type="checkbox"/>						
In-season leaf sampling to verify plant-nutrient status	<input type="checkbox"/>						
<b>Soil Fertility Management</b>							
Soil sampling to measure residual soil nitrate	<input type="checkbox"/>						
Cover cropping between tree/vine rows or rotations	<input type="checkbox"/>						
Application of manure, green waste or compost	<input type="checkbox"/>						
<b>Irrigation Management</b>							
Use ET-based methods to schedule irrigation	<input type="checkbox"/>						
Measure plant water status to time irrigation	<input type="checkbox"/>						
Soil moisture sensors to track water availability	<input type="checkbox"/>						
Test irrigation system for distribution uniformity	<input type="checkbox"/>						

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

Practices	N use efficiency	Water savings	Improve soil health	Adapt to drought	Adapt to excessive rainfall	Adapt to extreme temperatures	Meet regulations	Improve crop yield	Improve crop quality
<b>Nitrogen Management</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
<b>Soil Fertility Management</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
<b>Irrigation Management</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

**9) Which county/ counties do you grow in? Check all where you operate.**

- Madera
- Merced
- Stanislaus
- Tuolumne
- Mariposa
- Calaveras

**10) Do you grow other crops in addition to your permanent crops? Please check all that apply.**

- Stone fruits/ grapes
- Nuts
- Vegetables/ melons
- 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

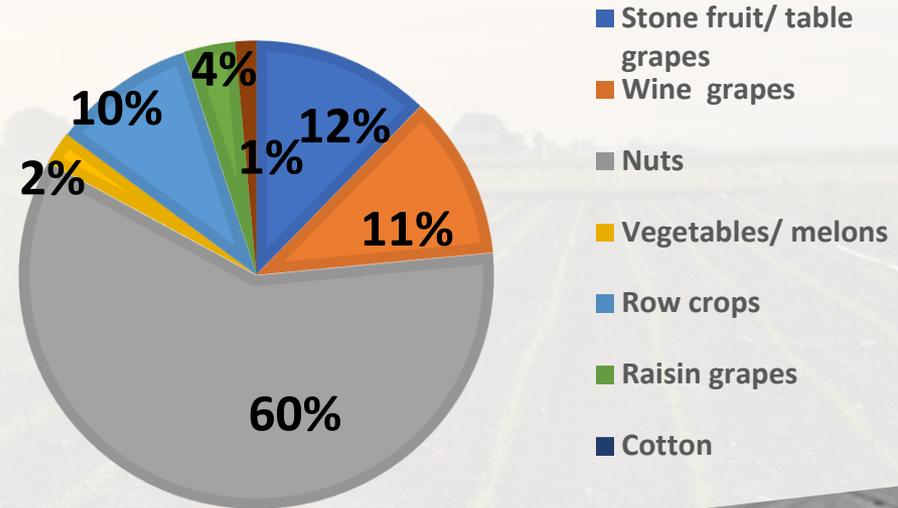
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- Early results: Data and 'opinions' from surveys & interviews
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# Early Results | Winter 2017 Surveys

565 growers participated in our surveys  
in the northern San Joaquin Valley at  
annual grower water quality coalition  
Meetings

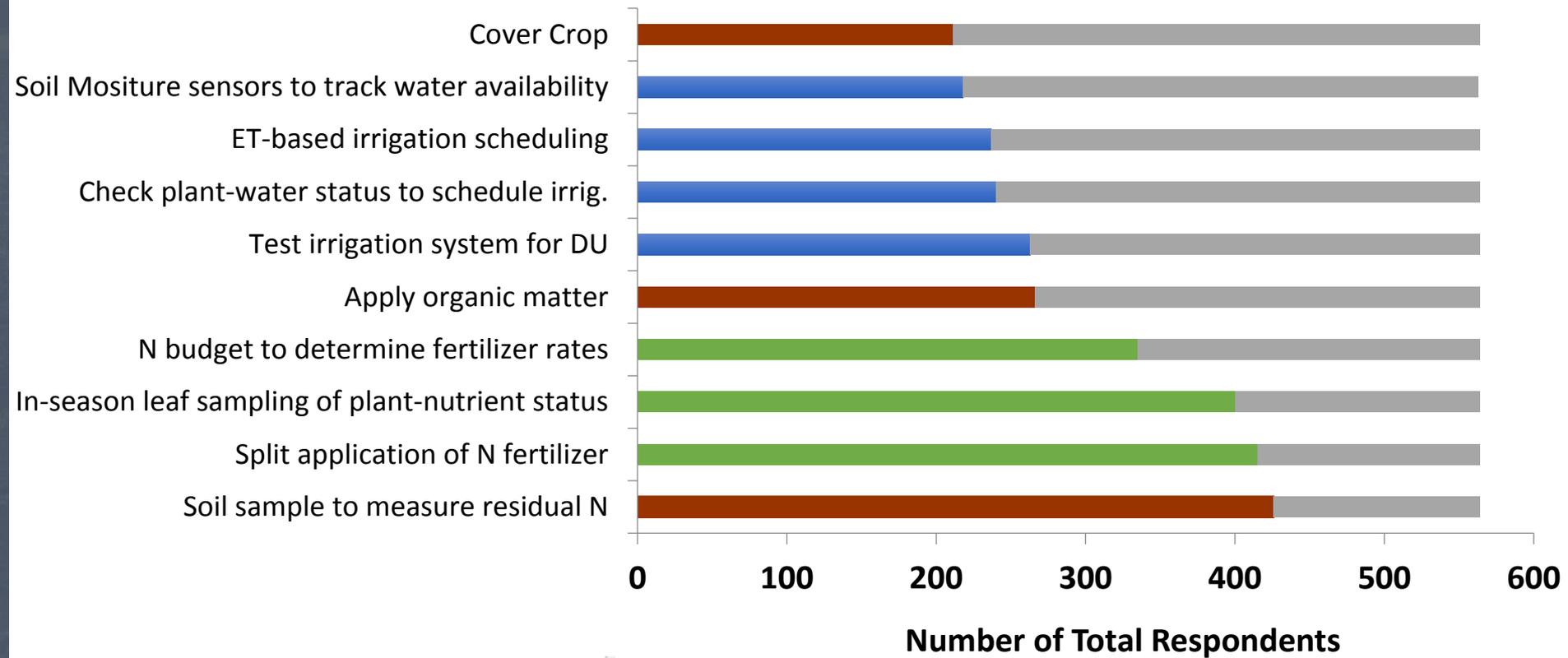
DOMINANT CROP TYPE OF RESPONDENTS



# Early Results | Winter 2017 Surveys (n=565)

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

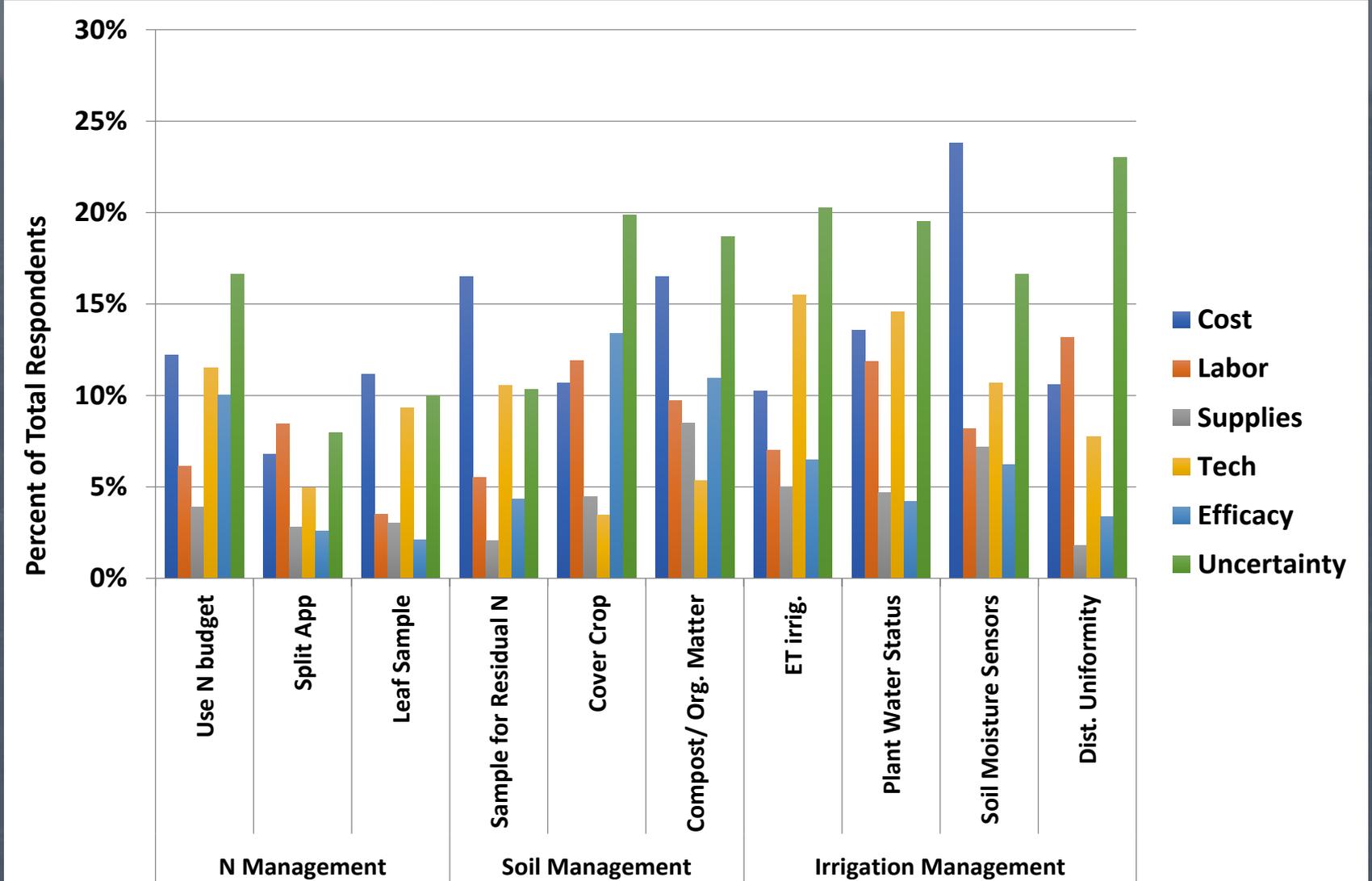
Total number of respondents reporting adoption/ non adoption of each practice (565 Respondents)



Soil Management }  
Irrigation management } Adopted  
Fertilizer management }  
Practice Not Adopted }

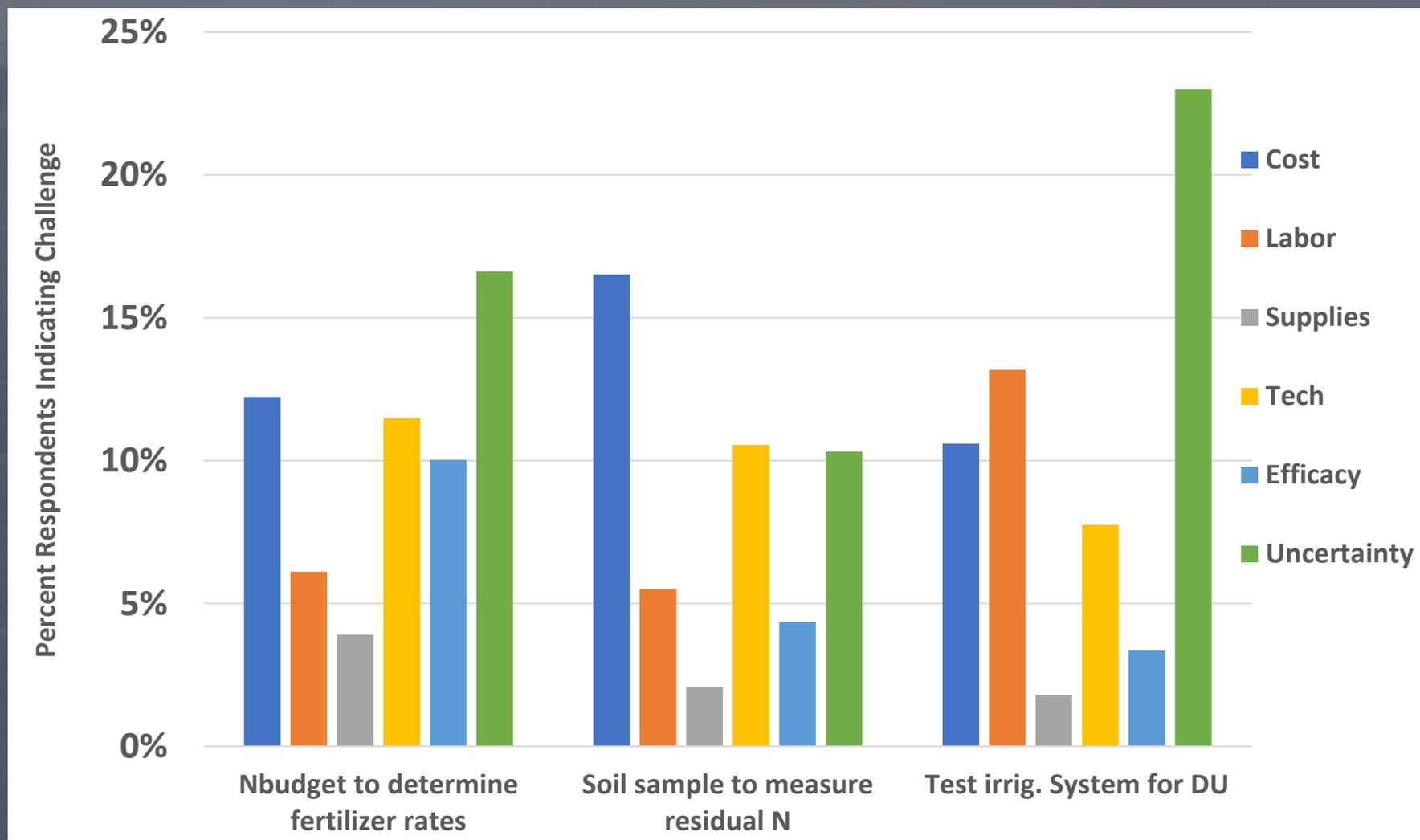
# Early Results | Winter 2017 Surveys (n=565)

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



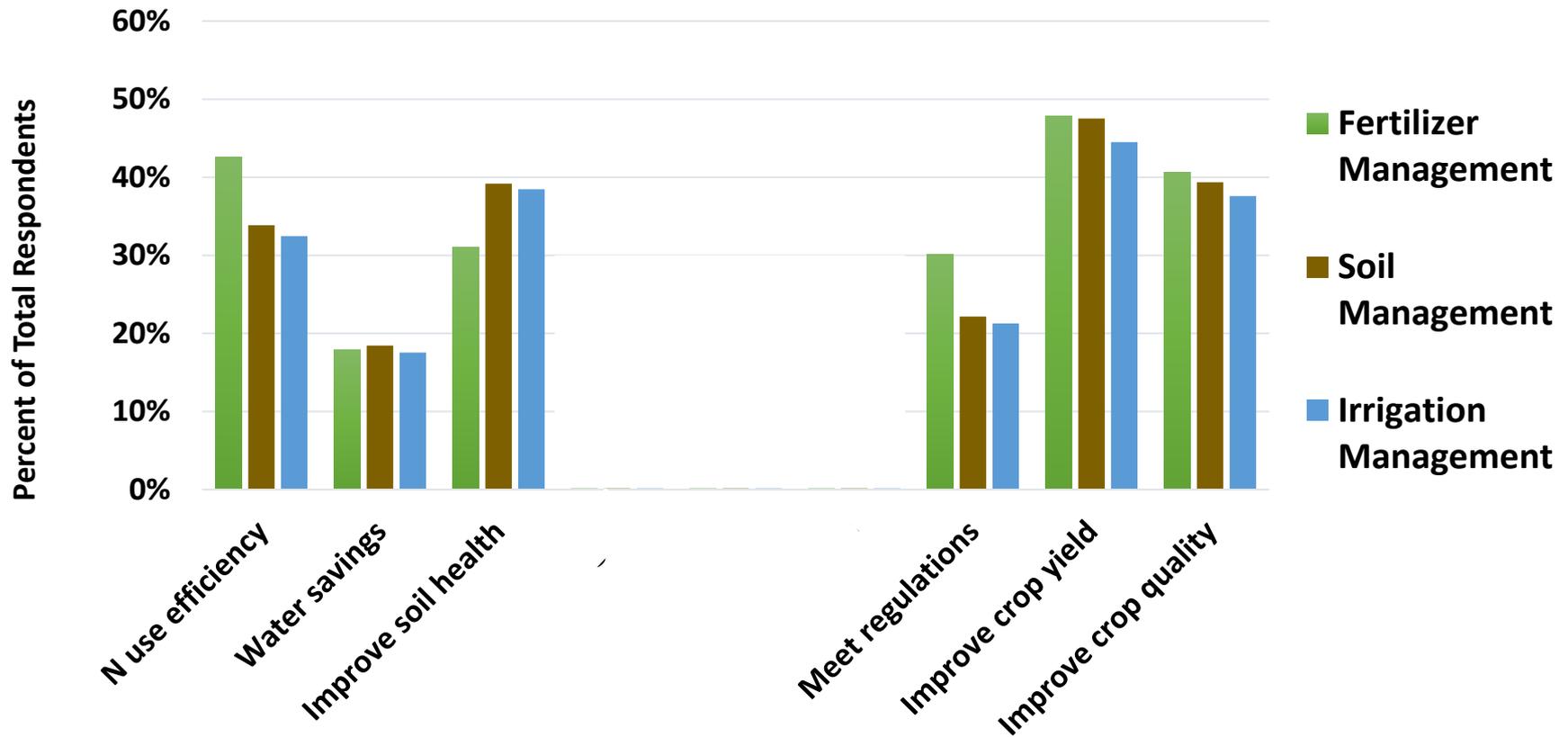
# Early Results | Winter 2017 Surveys (n=565)

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



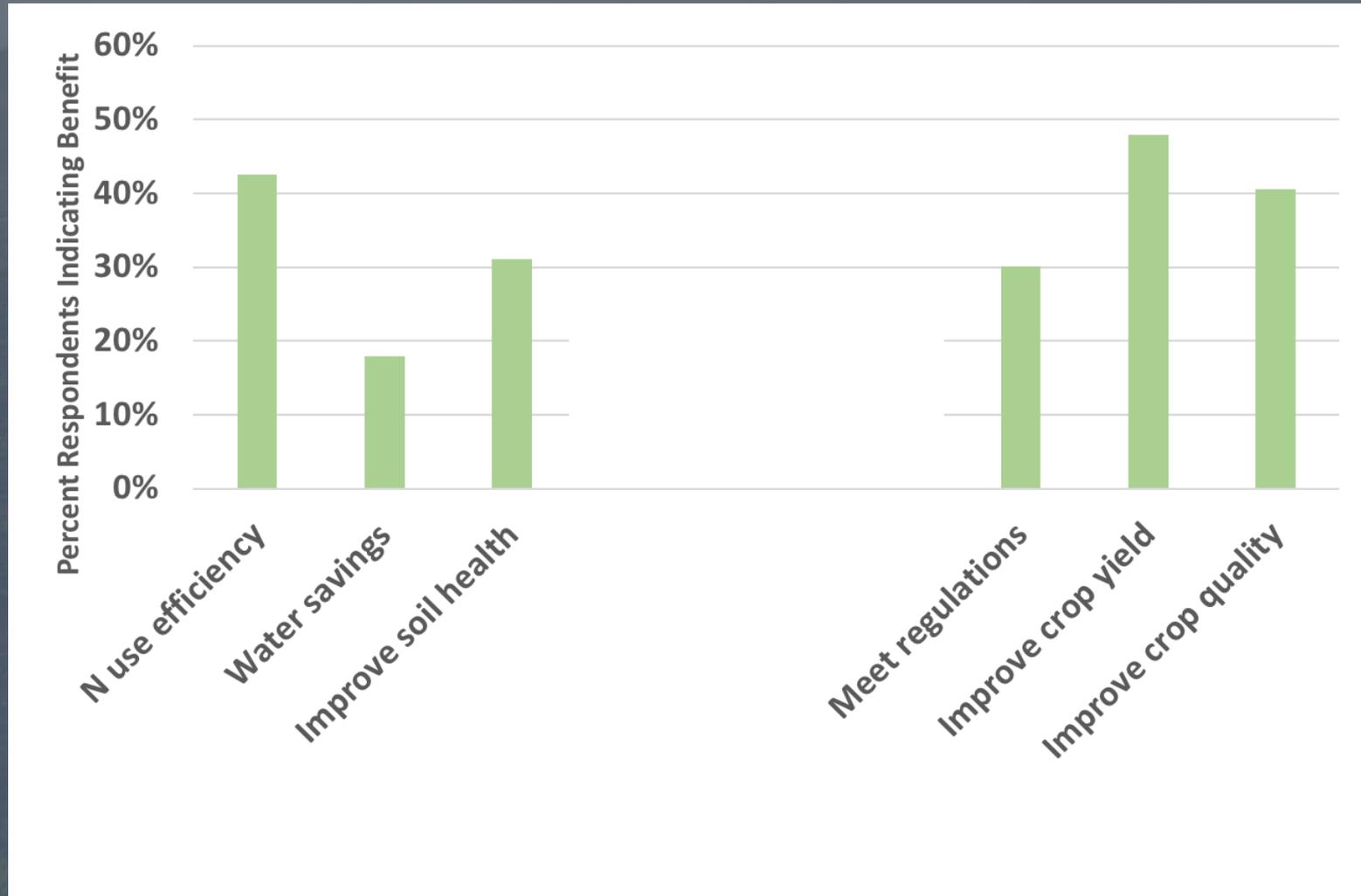
# Early Results | Winter 2017 Surveys (n=565)

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



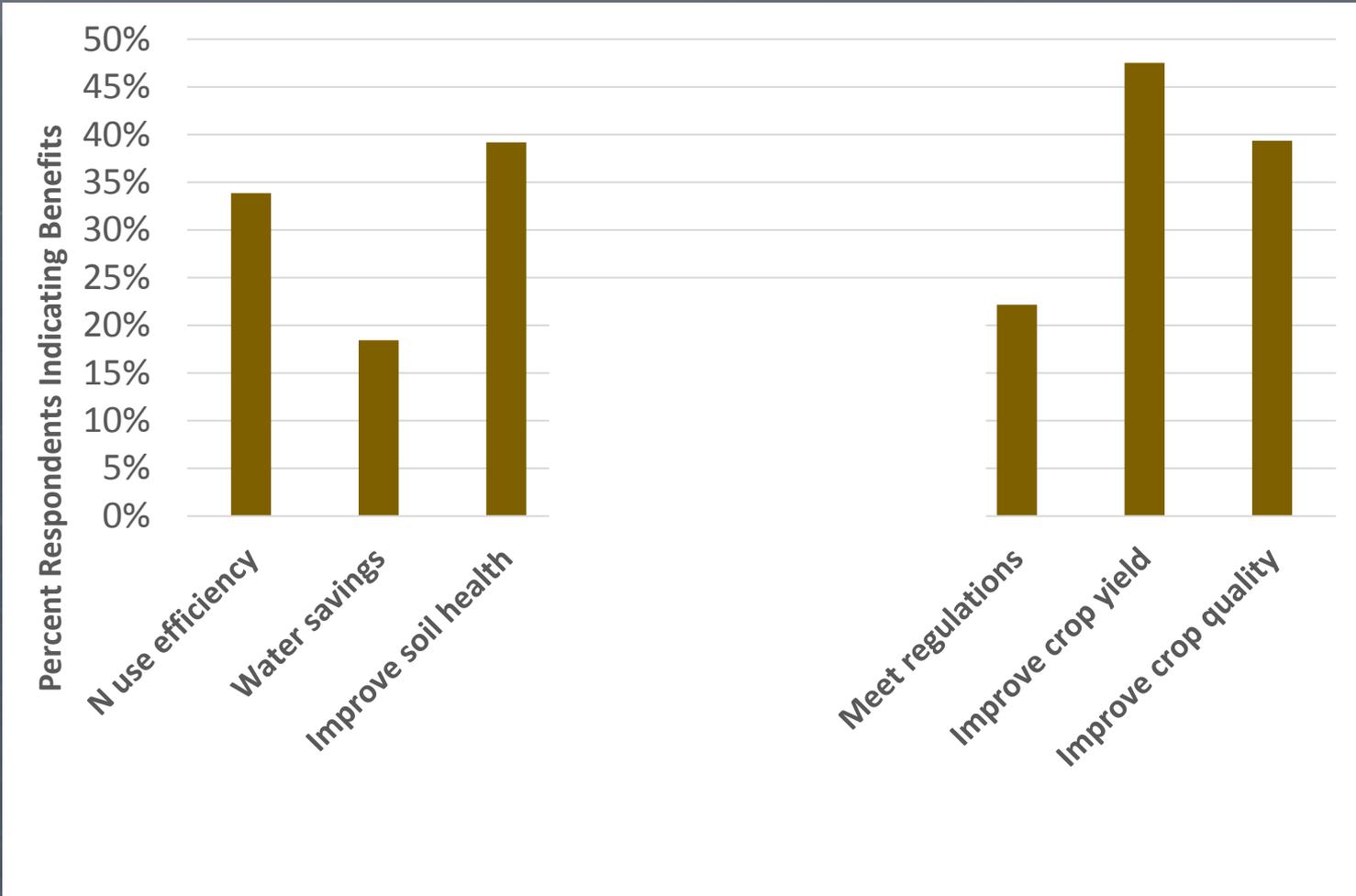
# Early Results | Winter 2017 Surveys (n=565)

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



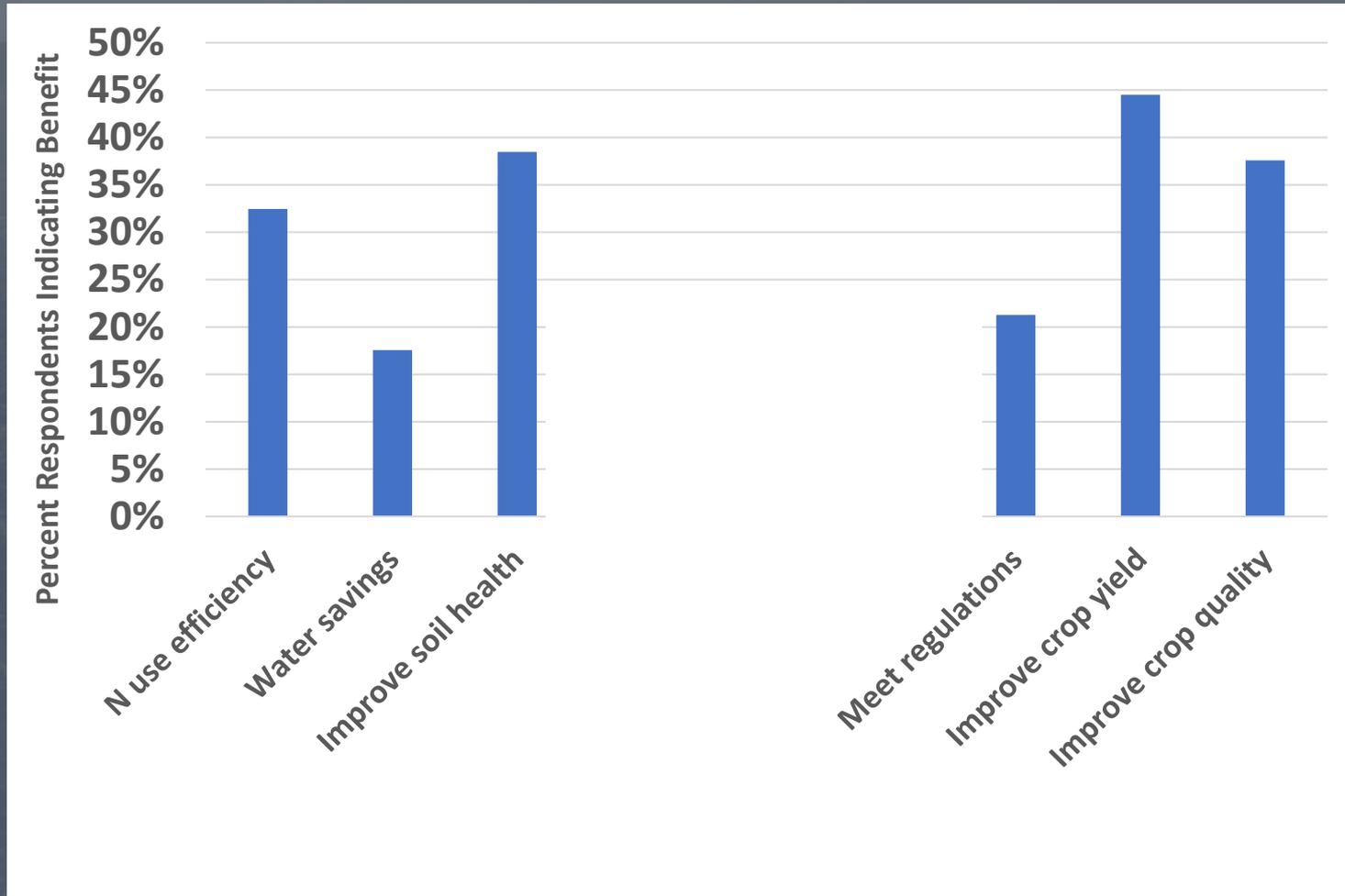
# Early Results | Winter 2017 Surveys (n=565)

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



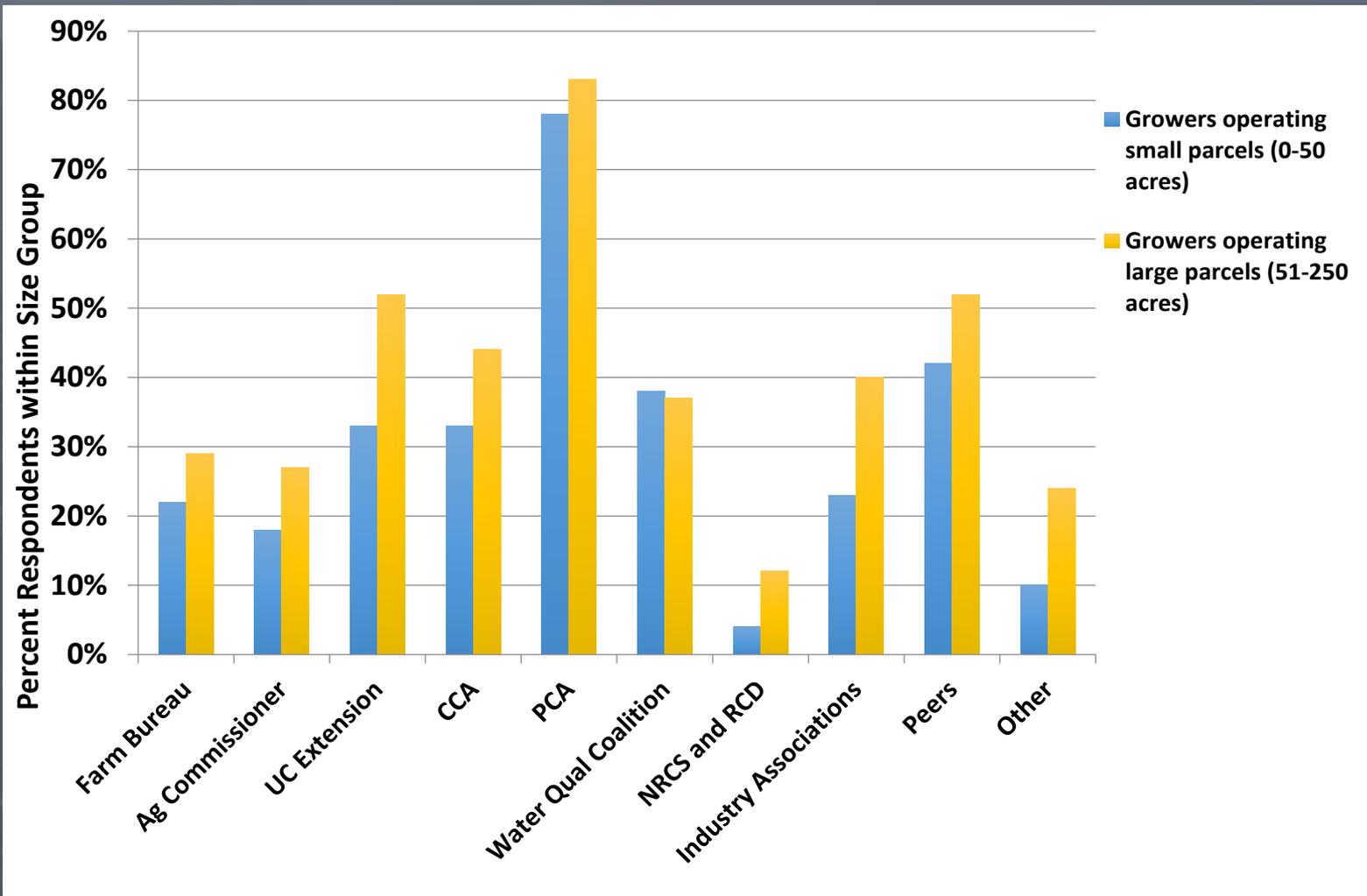
# Early Results | Winter 2017 Surveys (n=565)

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



# Early Results | Winter 2017 Surveys (n=565)

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





## 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**

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

**Merced County Grower**

### On nitrogen regulations & policy ...

*“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**

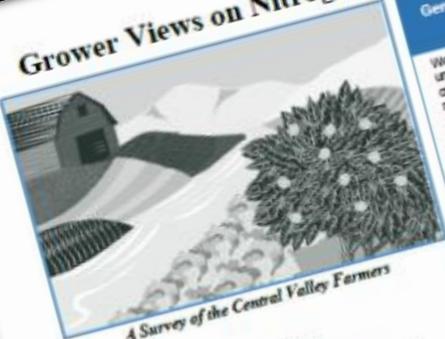
## Early Results | What we have learned so far

- 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

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# Next Phase Survey



**Grower Views on Nitrogen Management**

*A Survey of the Central Valley Farmers*

Conducted by:  
**University of California Davis**  
College of Agriculture and Environmental Sciences

Please direct any questions or concerns to:  
**Sot Dursban S. Khalifa**  
Assistant Project Scientist  
University of California, Davis  
Department of Plant Sciences  
dskhal@ucdavis.edu  
(707) 205-7007

Please return your completed questionnaire in the enclosed envelope to:  
**Mark Lubell**  
Professor  
One Shields Drive  
Department of Environmental Science & Policy  
University of California Davis  
Davis, CA 95616

**UC DAVIS**  
UNIVERSITY OF CALIFORNIA

**UC CE**

**General Instructions**

We seek your input to understand the perspective of California growers regarding nitrogen (N) management on irrigated agricultural lands.

This survey is intended for the individuals who hold the primary responsibility for on-farm decision making for the farming operation addressed on the survey envelope. If you are not this decision-maker then, please give this survey to the person who holds this responsibility.

Your privacy is our top priority. All results will remain anonymous and any publications developed by UC Davis will report data in aggregate. Your survey responses will not be associated with your personal information.

Please complete the survey (it should take about 20 minutes) and mail it back in the enclosed pre-paid envelope at your earliest convenience.

We thank you for your time and participation.

*“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.”*

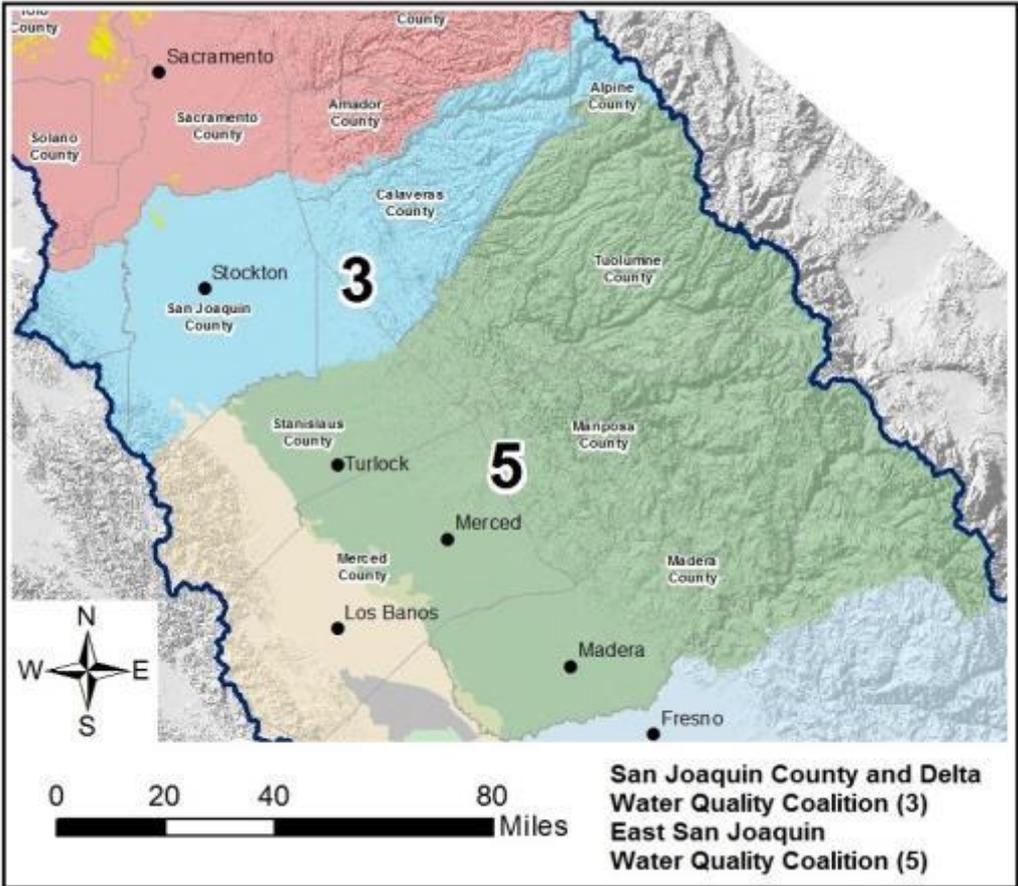
**San Joaquin County Grower**

# 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?

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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