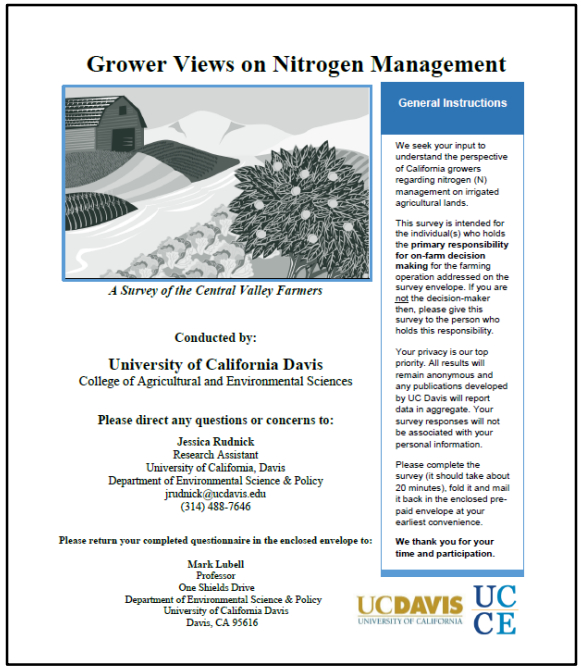
ESJWQC Nitrogen Management Practice Adoption Trends & Reported Barriers

PIs: Patrick Brown and Mark Lubell
Dr. Sat Darshan S. Khalsa, Jessica Rudnick,
Stephanie Tatge, Molly Sears,
& Liza Wood

CDFA FREP Final Research Report

Tailored results: East San Joaquin Water Quality Coalition (ESJWQC)

January 2020



Grower Views on Nitrogen Management

A Survey of the Central Valley Farmers

Conducted by:

University of California Davis
College of Agricultural and Environmental Sciences

Please direct any questions or concerns to:

Jessica Rudnick
Research Assistant
University of California, Davis
Department of Environmental Science & Policy
jrudnick@ucdavis.edu
(314) 488-7646

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

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 individual(s) who holds the **primary responsibility for on-farm decision making** for the farming operation addressed on the survey envelope. If you are not the 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), fold it and mail it back in the enclosed pre-paid envelope at your earliest convenience.

We thank you for your time and participation.

UCDAVIS UNIVERSITY OF CALIFORNIA UC CE

University of California
Agriculture and Natural Resources

FERTILIZER RESEARCH AND EDUCATION PROGRAM FREP

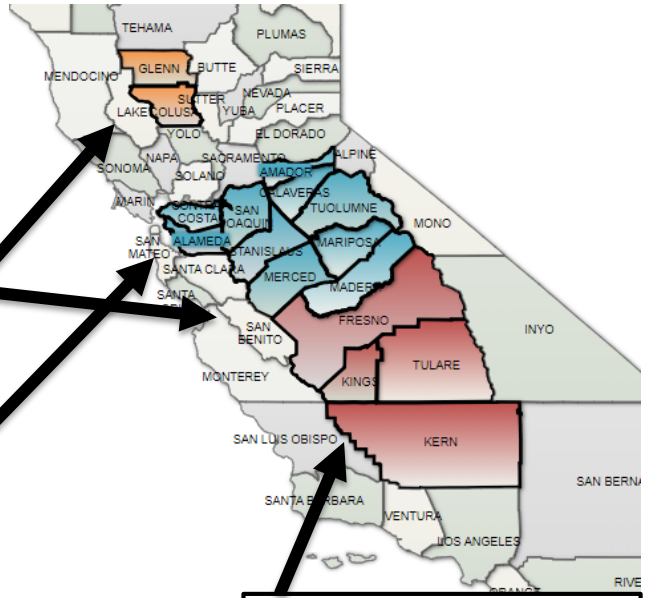
Project Team & Research Goals

1. **Characterize adoption patterns of important N management practices, across multiple farm operation and grower characteristics**
   - Understand adoption differences across different farm types and in different regions of the state
2. **Improve UC Cooperative Extension, Water Quality Coalitions, and other information sources' outreach and extension by addressing grower-identified needs:**
   - Identify, understand and overcome barriers to adoption and expand factors that enable/ motivate adoption
   - Improve access & reliability of information about nitrogen management practices and regulations
3. **Provide grower perspective on the Irrigated Lands Regulatory Program (ILRP)**
   - Understand growers' perceptions of nitrate water quality challenges in California, the ILRP Water Quality Coalitions, and ILRP required reporting elements

Survey Data: *Grower Views on Nitrogen Management*

2018: Mail Survey sent to 5,000 growers in 3 Water Quality Coalitions

- 966 responses total (~19% response rate)
  - **183 responses from East San Joaquin Coalition (14% response rate)**
  - 377 response from Colusa-Glenn Subwatershed Program (31% response rate)
  - 312 responses from San Joaquin County & Delta Coalition (15% response rate)



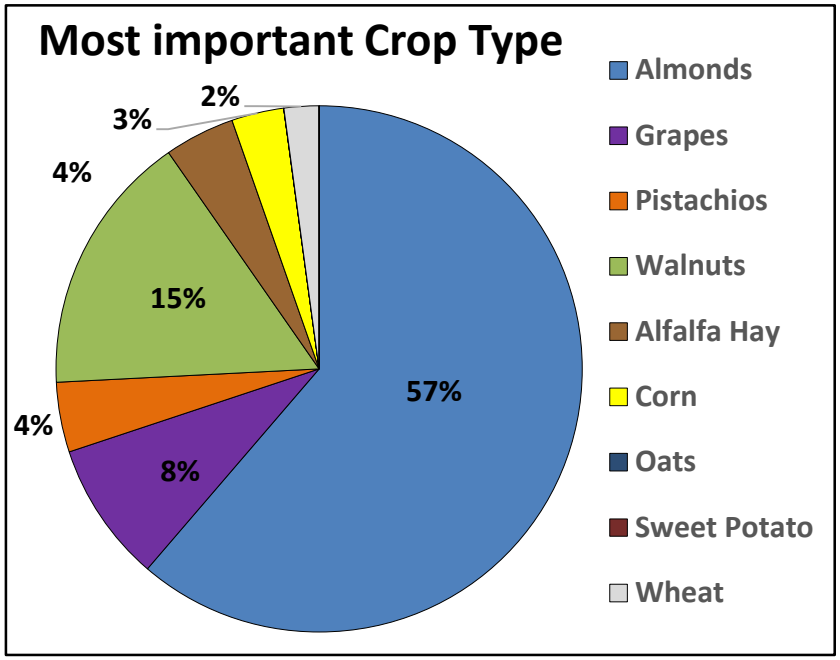
****Coming Spring 2020: mailing survey to 5,000 growers in South San Joaquin Valley Coalitions**

- Survey measured:
  - Adoption of 11 practices N management practices
  - Farm operation characteristics & grower demographics
  - Grower attitudes toward N management, motivations & barriers to practice adoption, information & technical knowledge access, opinions on the ILRP & Coalitions

ESJWQC Survey Respondents

Characteristics of respondents (n=183):

- **Average farm size**: 467 acres
  (smallest= 2 acres, largest 9,300 acres)
- **Number of crops:** average respondent reported 2 different crops
  (max. reported 5 different crops)
- **Water source access**: 25% groundwater only, 44% surface water only, 31% mix of surface and groundwater
- **Land tenure:** 89% land owners & operators, 7% lease land where they operate, 2.2% in-house consultants/ managers



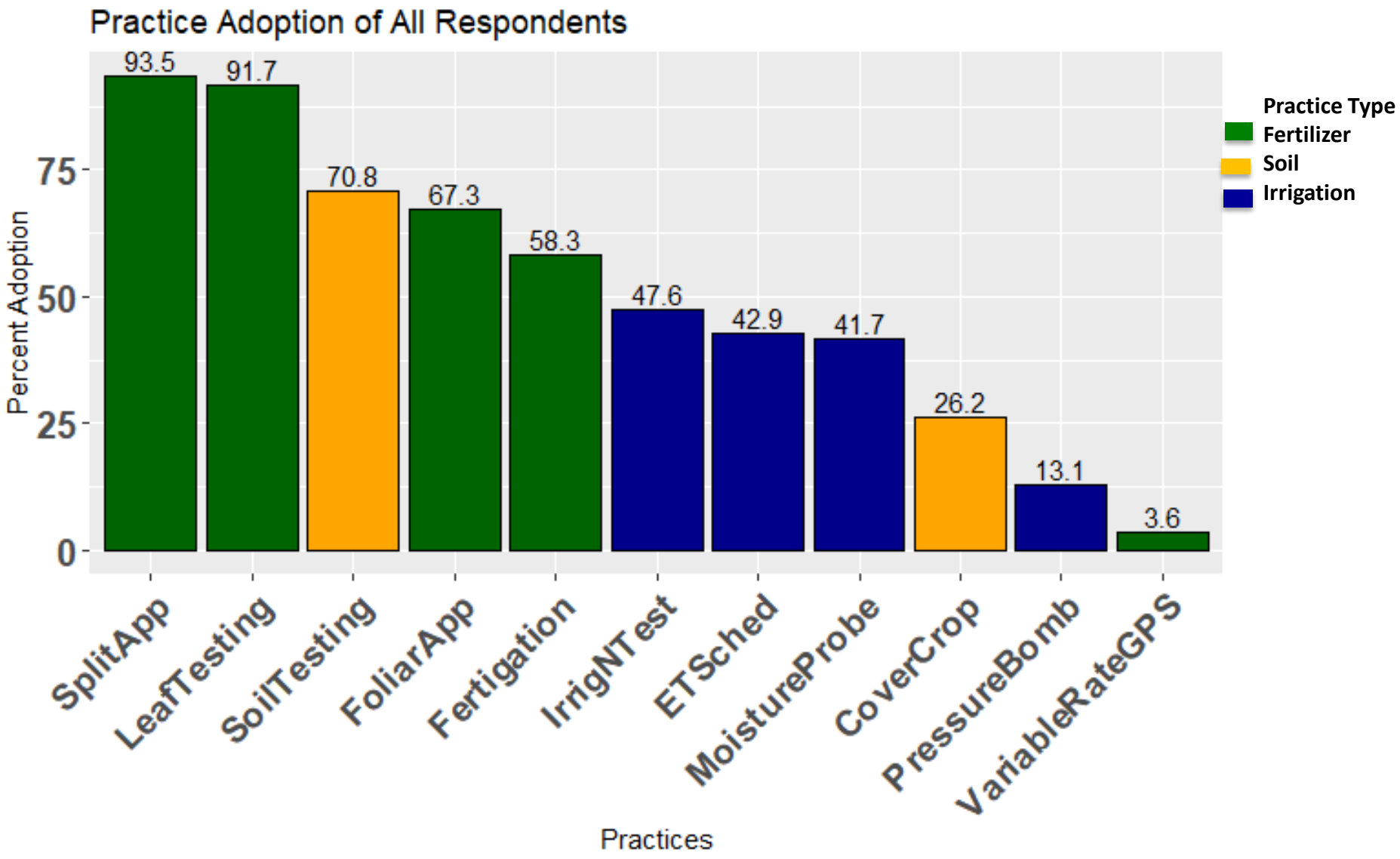
***Respondents were determined fairly representative of region based on crop type and farm size, with slight over-representation of almonds (see Table 1 in extra slides); it is possible other factors influenced differential response rate by ESJWQC subpopulations.*

4R's Nitrogen Management Practices

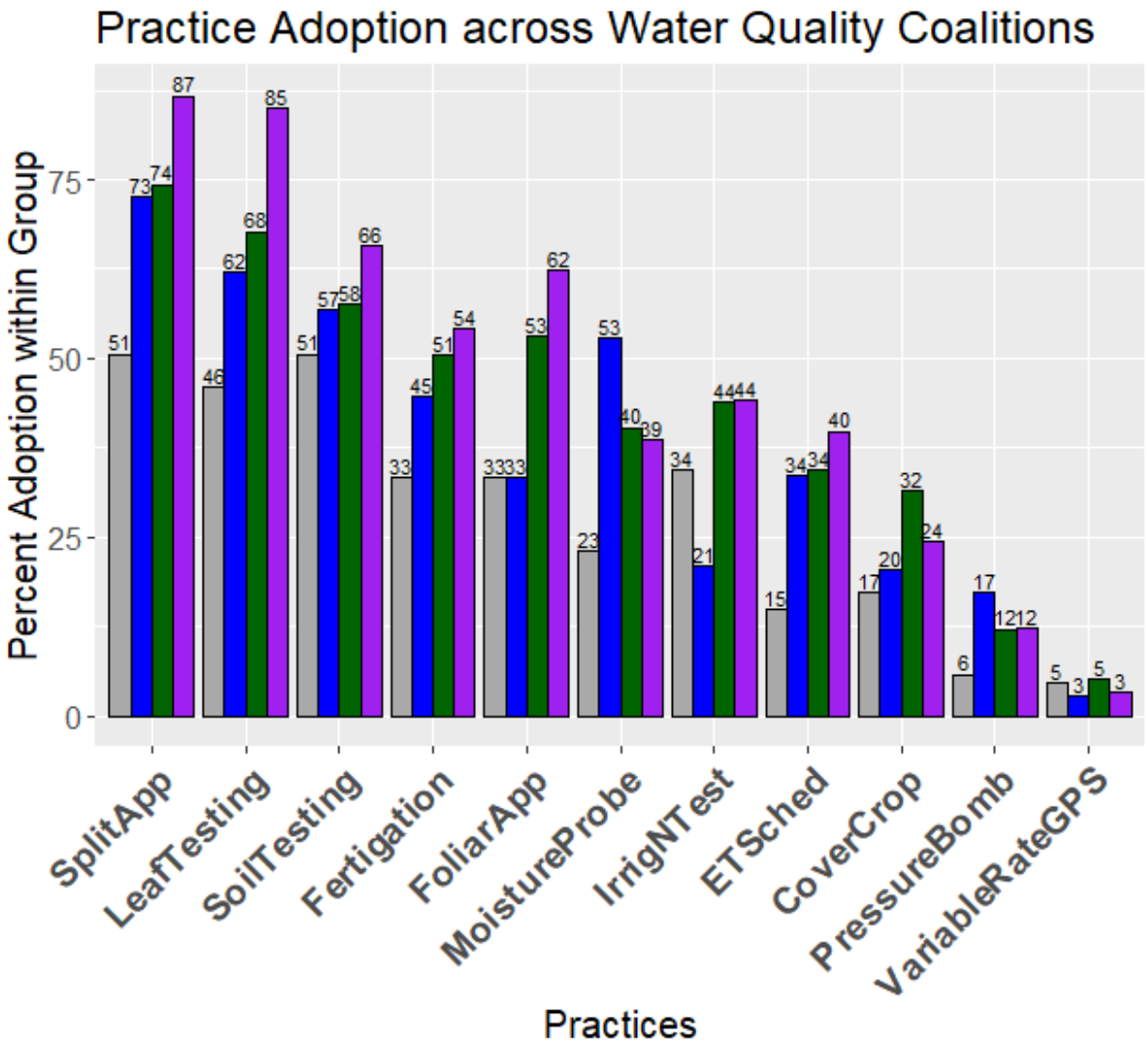
4 R Principles	Fertilizer Practices 	Soil Practices 	Irrigation Practices 
Right source	• Appropriate form of N	• Appropriate C:N ratio of fertilizer	
Right Rate	• Nitrogen Budget • **Leaf sampling to determine plant-nutrient status** • **Variable rate application using GPS** • Slow release fertilizers or nitrification inhibitors	• **Soil sampling to determine residual soil nitrate** • **Cover crops** • **Compost/ organic matter**	• **Irrigation water testing to determine N** • **Pressure chamber to measure plant water stress** • **Moisture probe or soil sensors**
Right time	• **Split fertilizer applications**	• Time of field mechanics (tillage, disk, etc.)	• **Use ET to schedule irrigation**
Right place	• **Foliar N application** • **Fertigation**	• Soil type	• Check for distribution uniformity

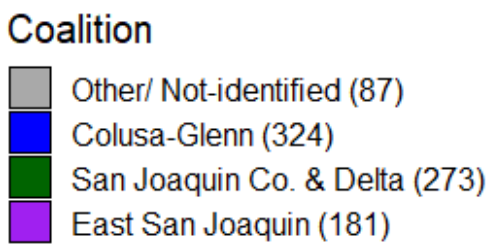
***practices in bold were measured on survey**

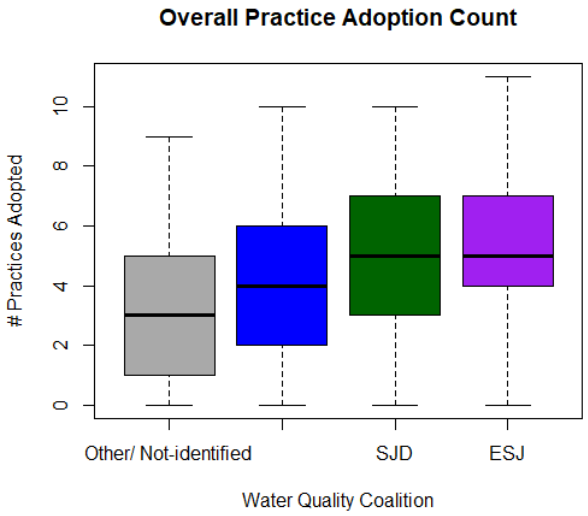
Nitrogen Management Practice Adoption Rates Overall



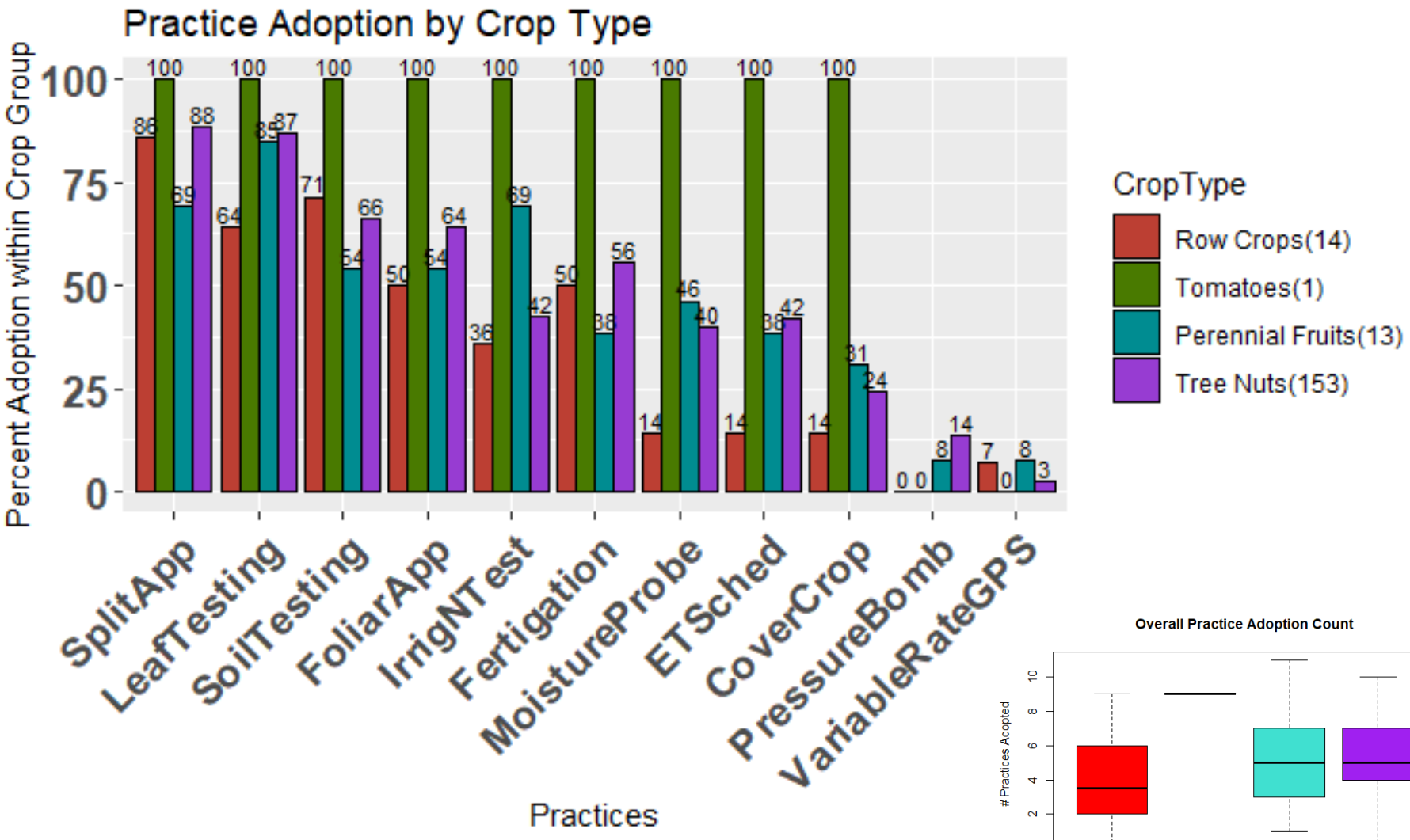
Adoption Rates by Water Quality Coalition



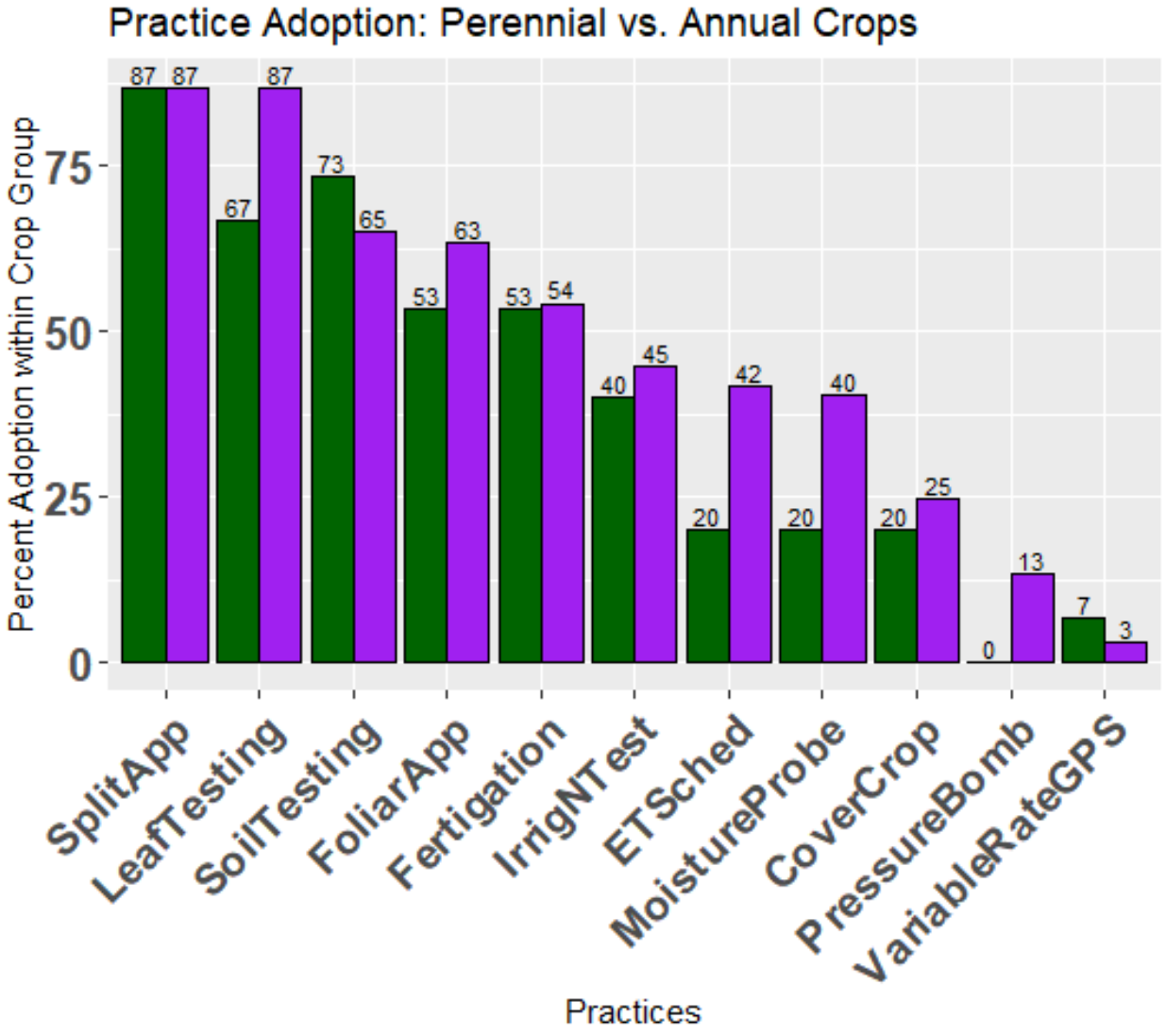


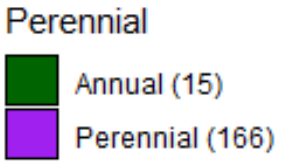


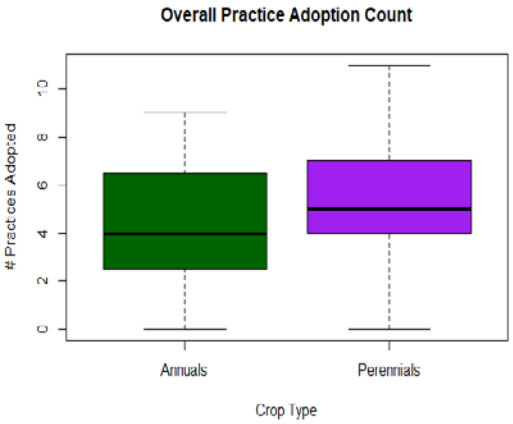
Practice adoption rates differ by crop type



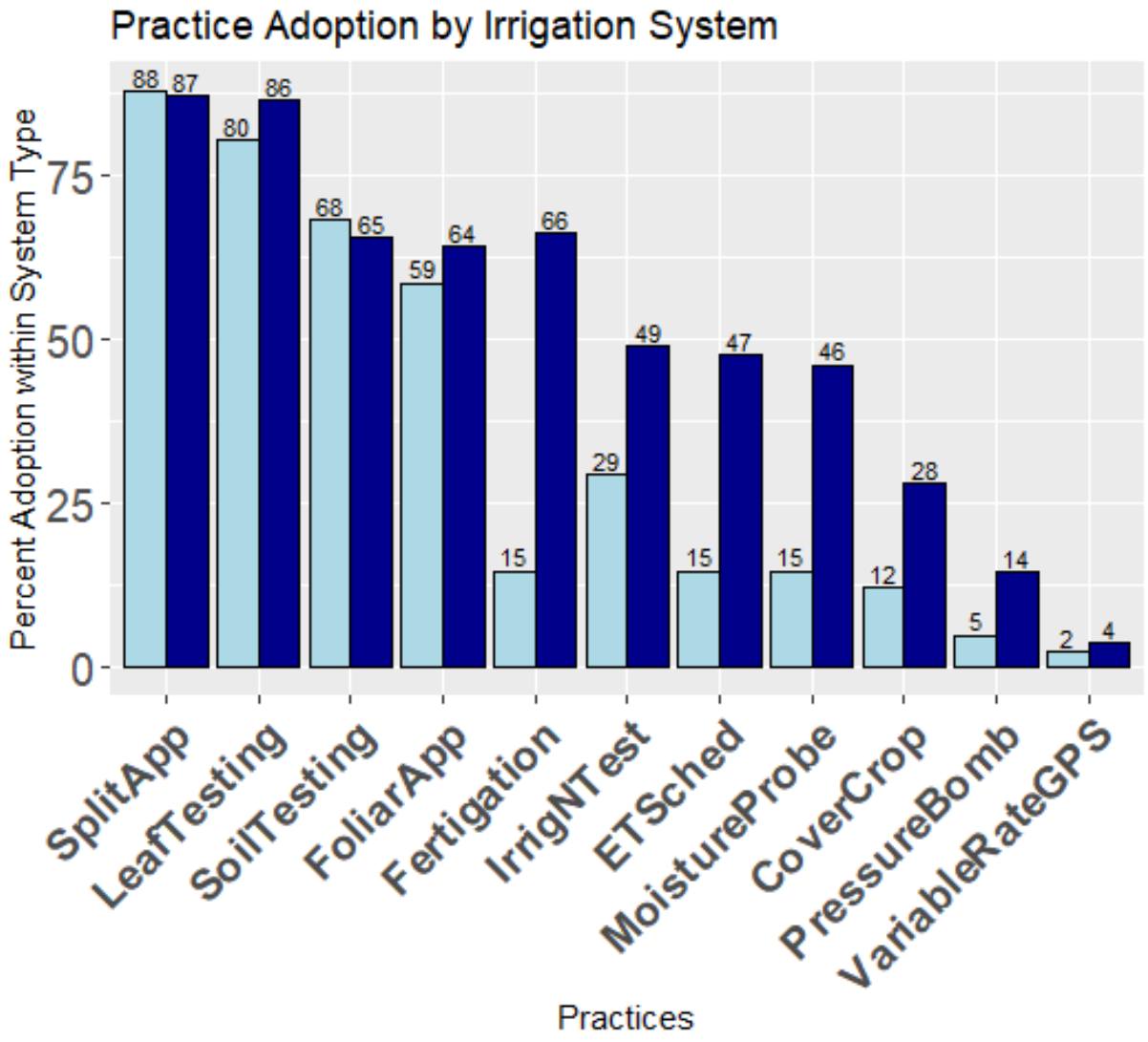
Practice adoption rates differ between annuals and perennials

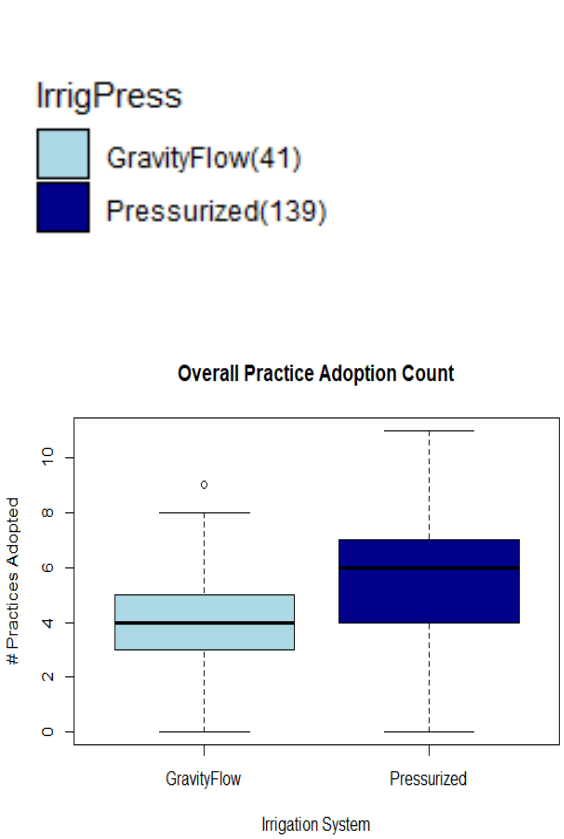




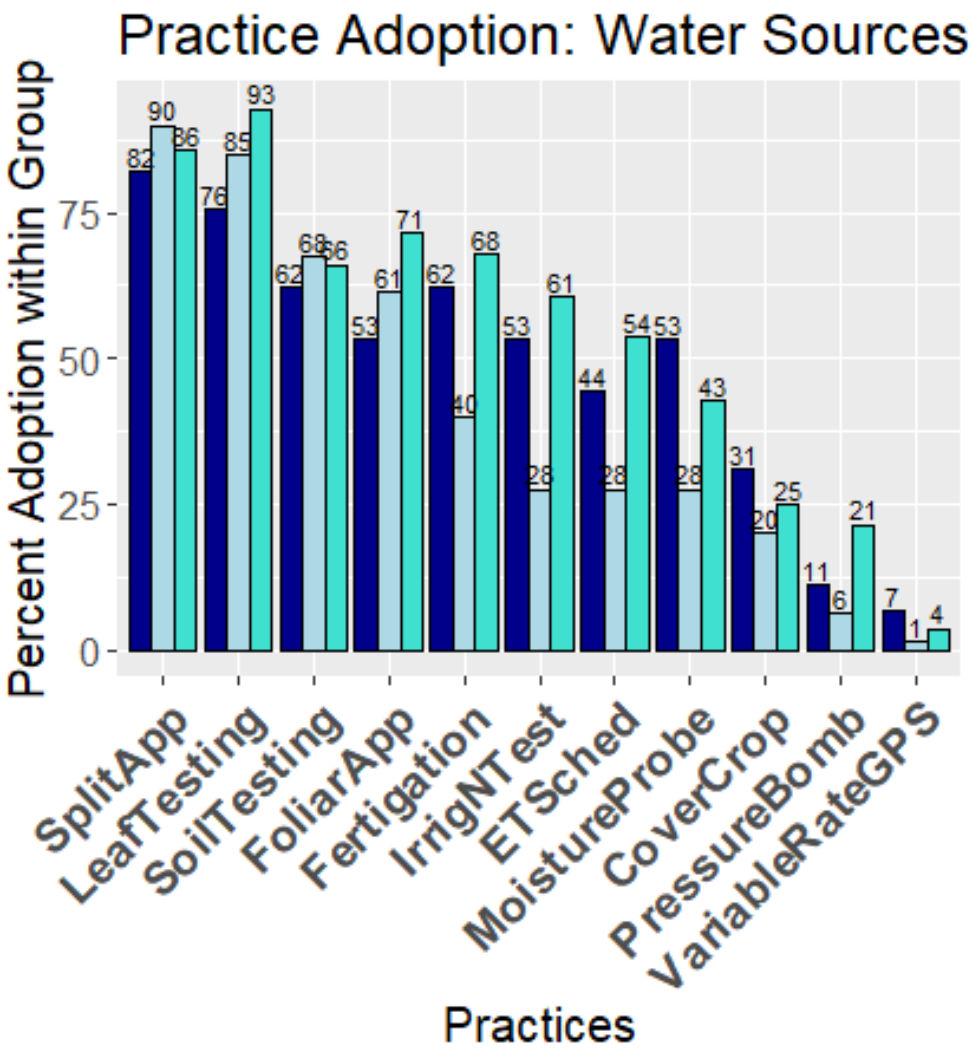


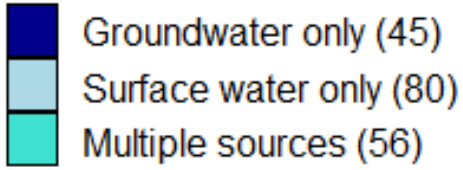
Practice adoption rates differ by irrigation system

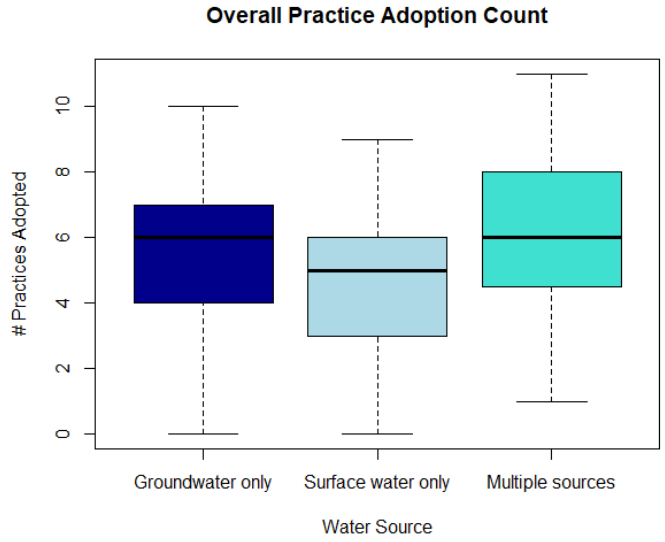




Practice adoption rates differ by water source

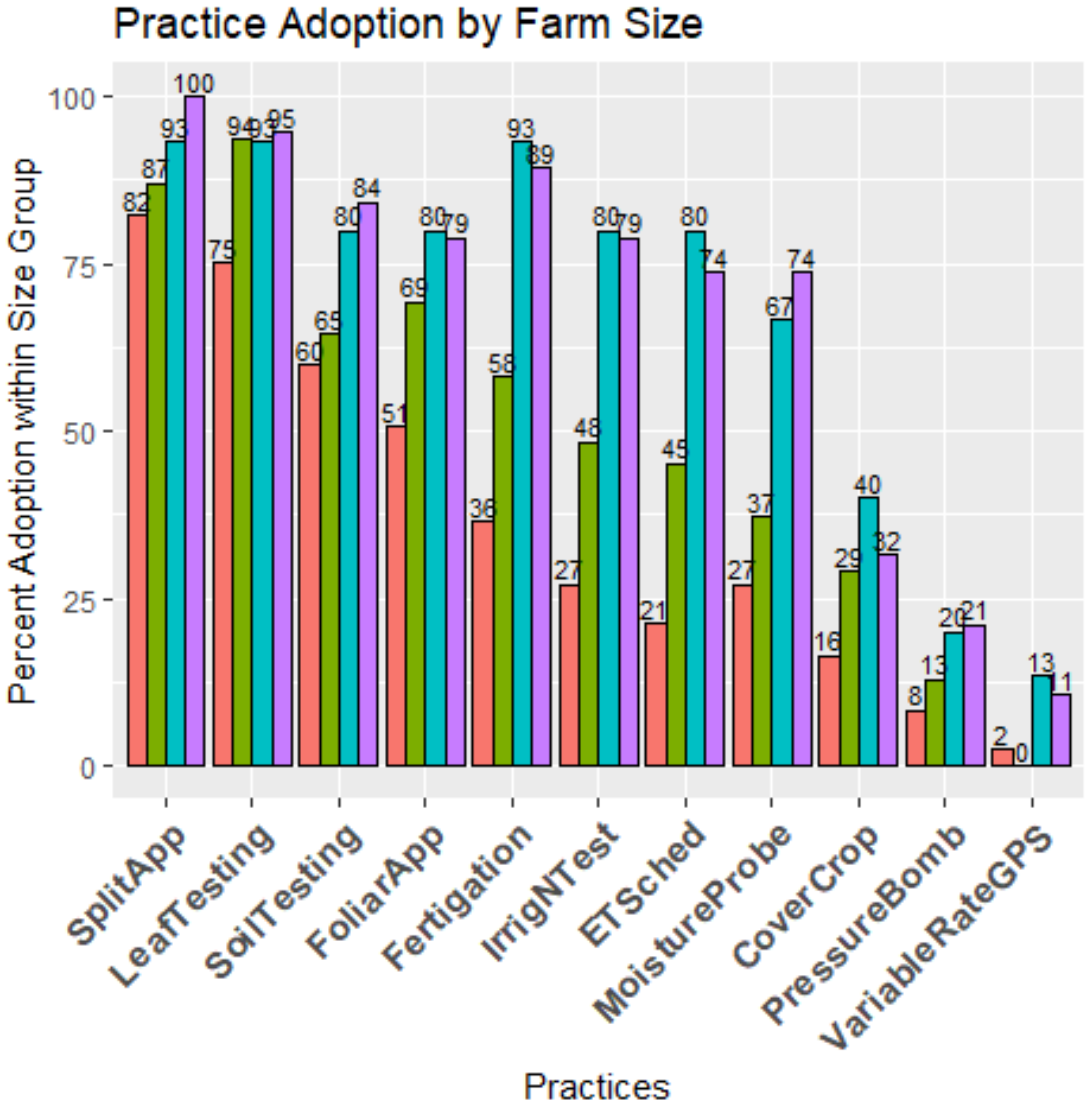


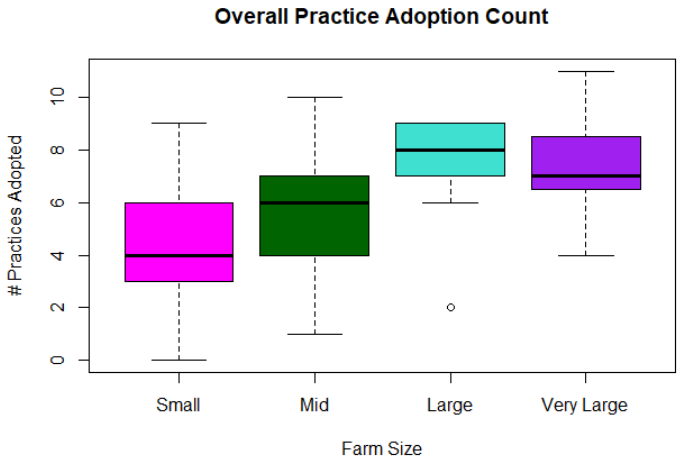




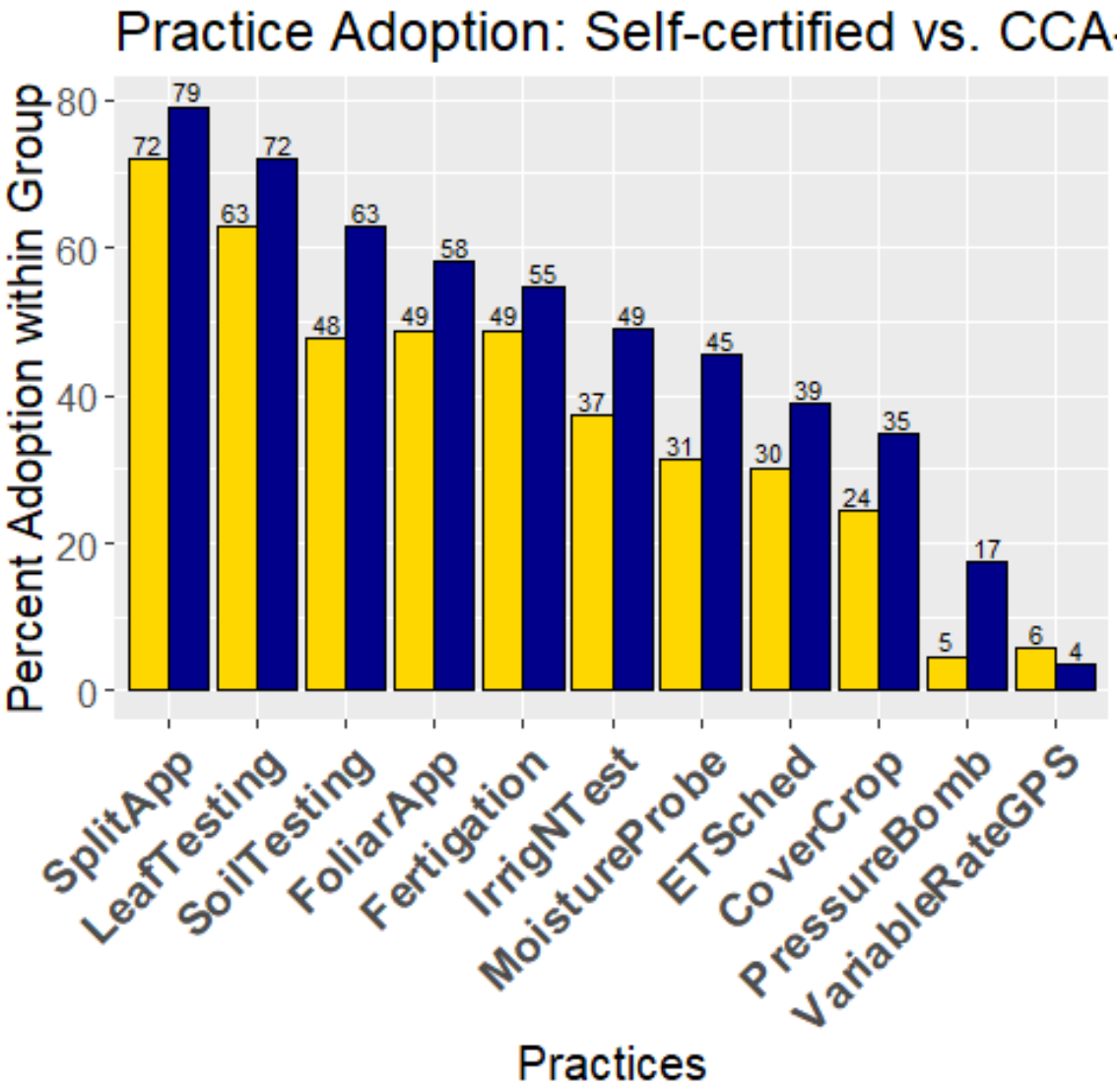
***"Multiple sources" indicate growers with access to both surface (riparian rights or district water) and groundwater**

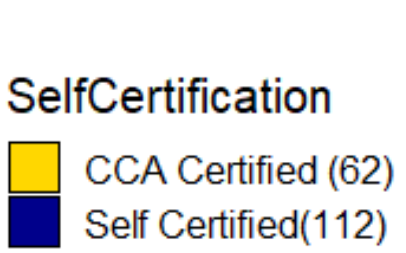
Practice adoption rates differ across farm size

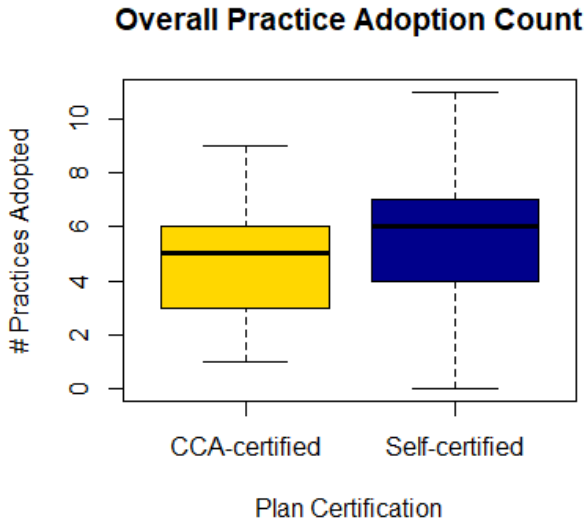




Practice adoption rates by Self Certification course participation

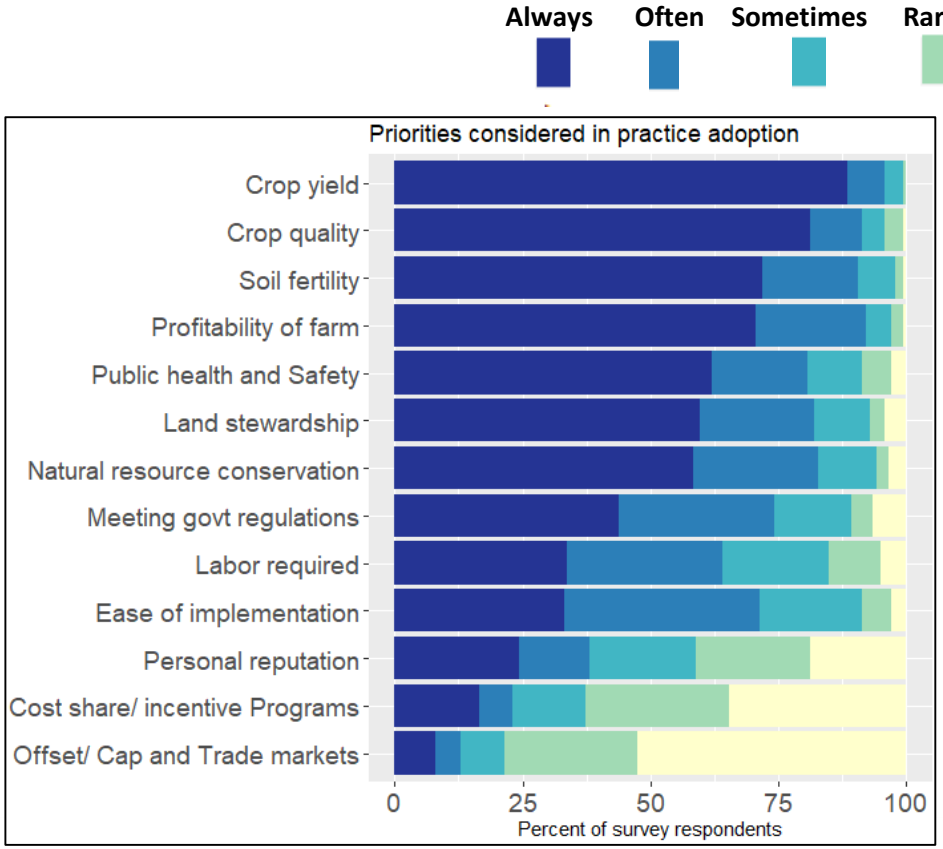


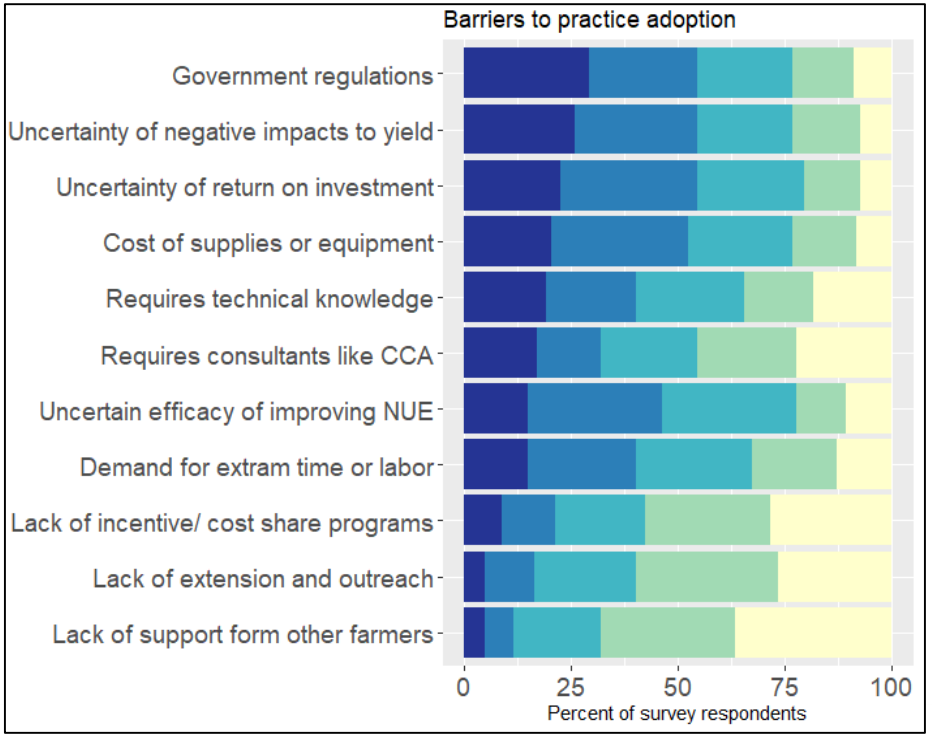




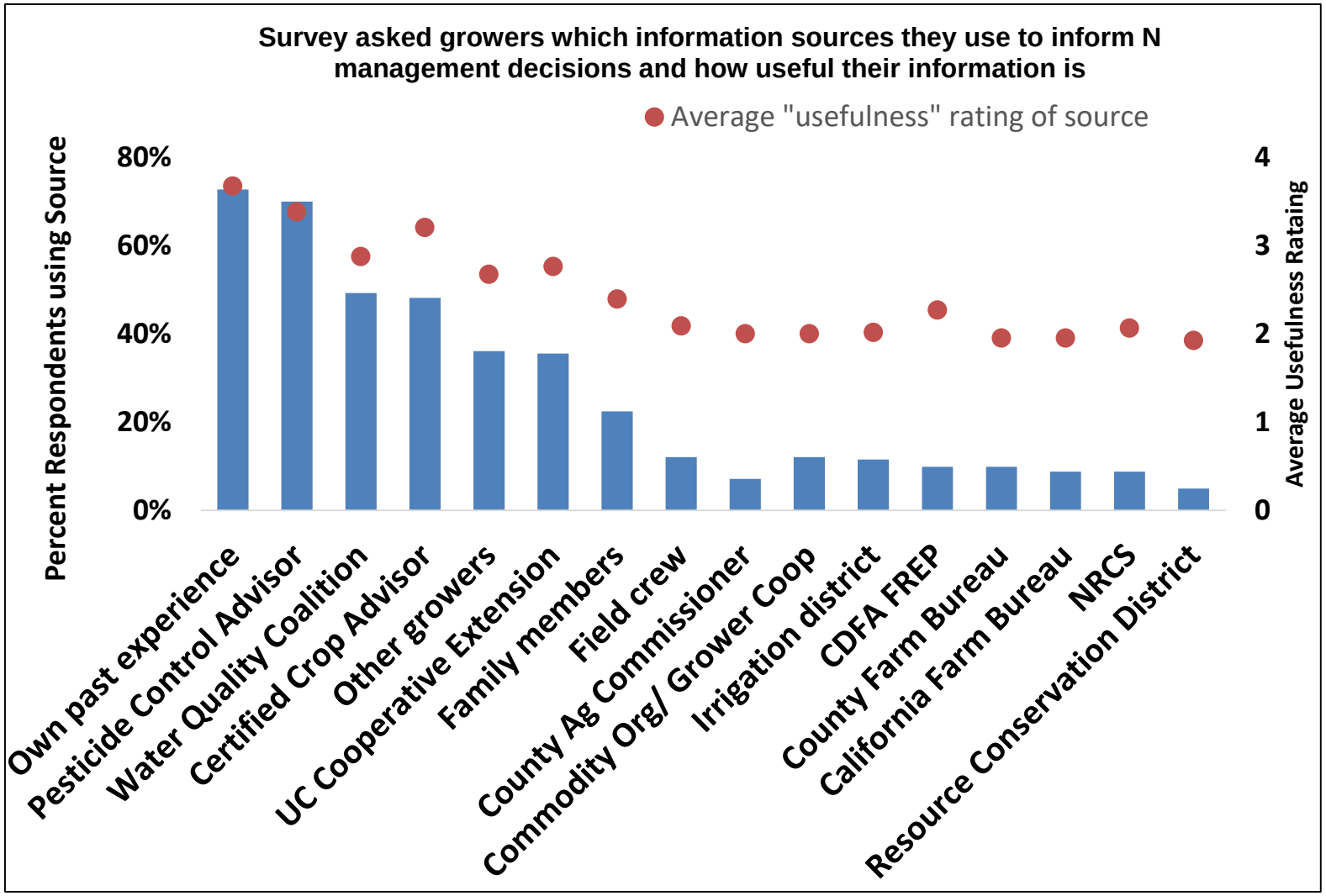
Priorities and barriers affecting practice adoption

Survey asked growers how often the following priorities or barriers affected their decisions to adopt N management practices

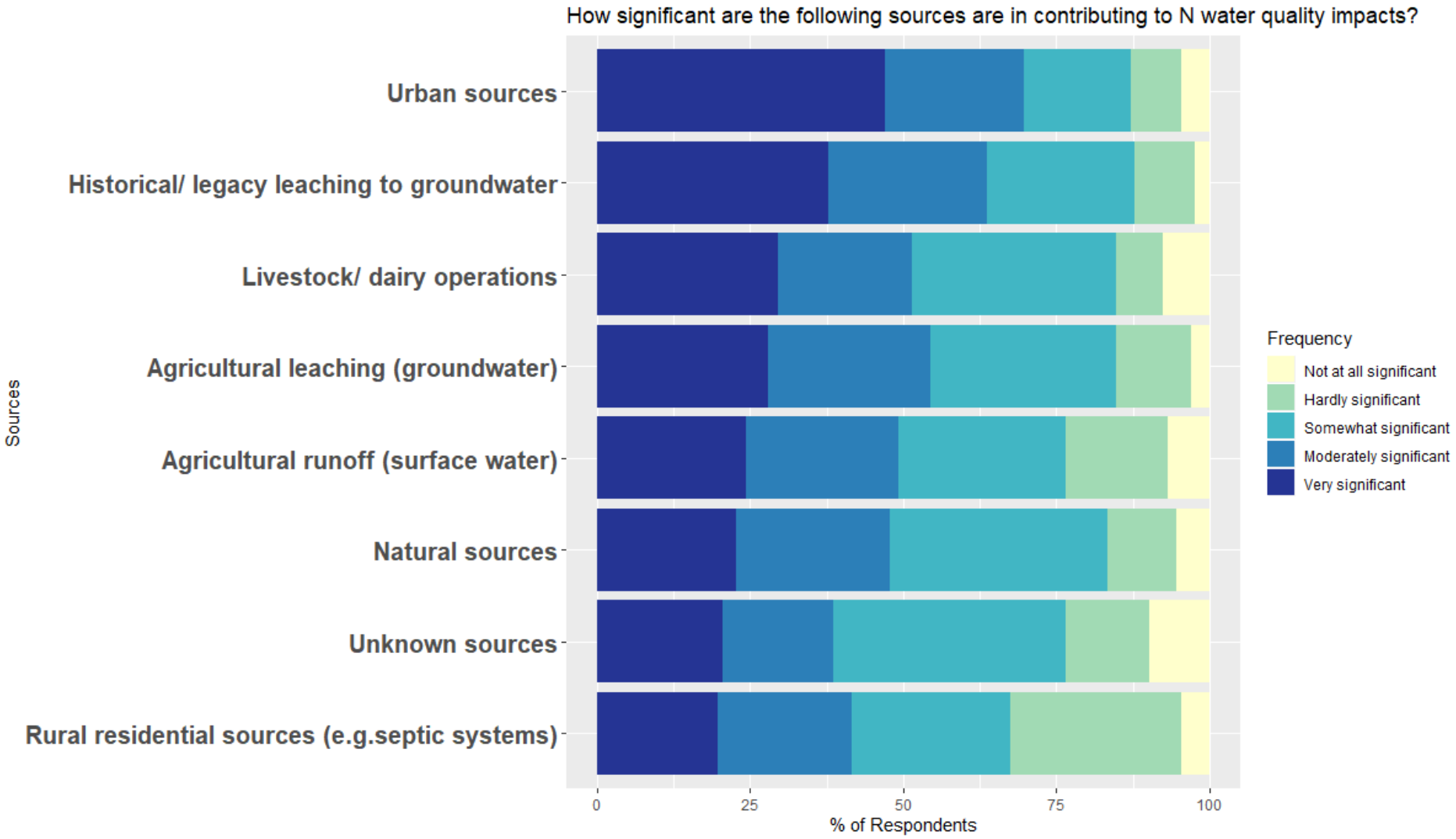




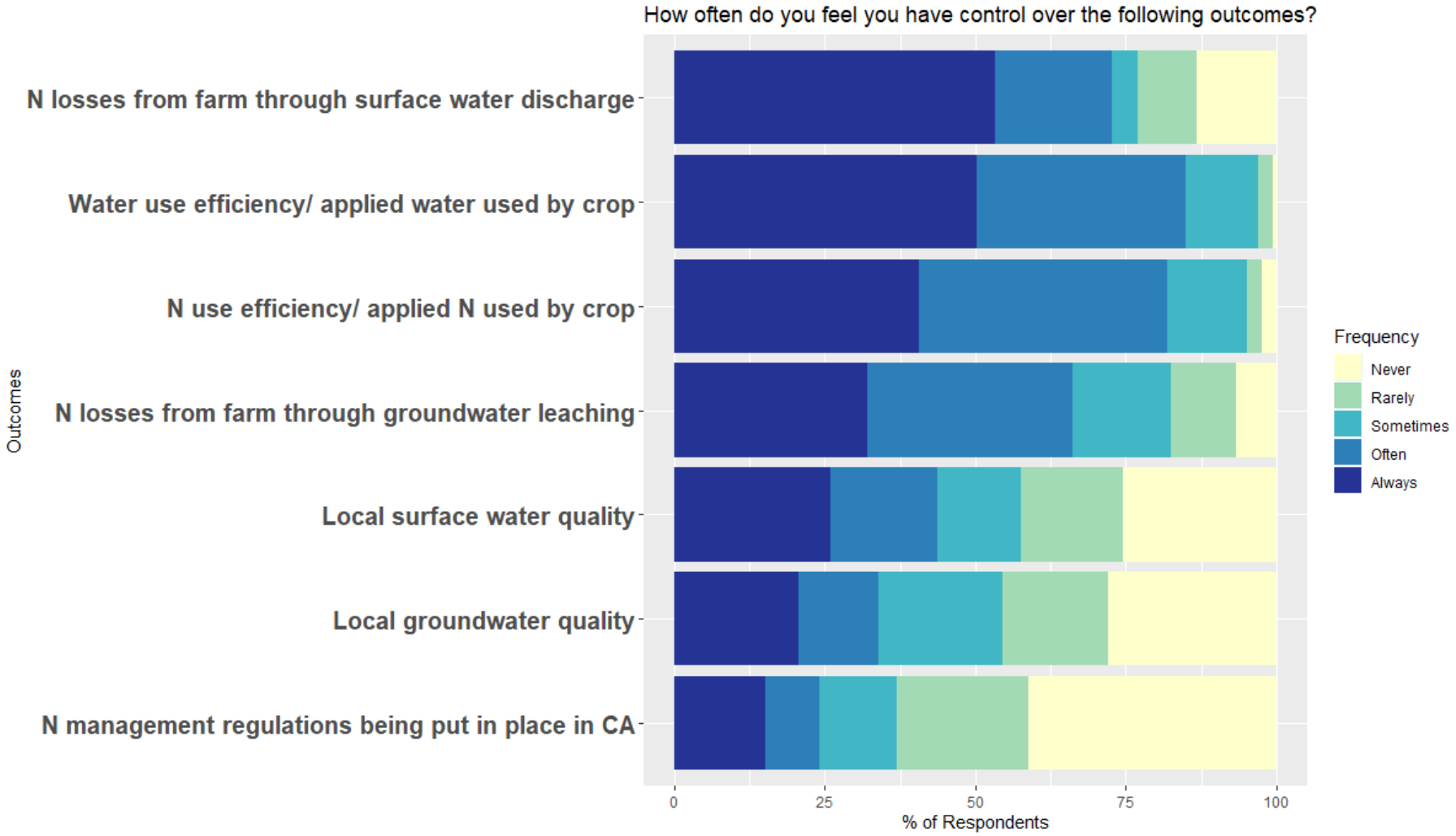
Information sources growers seek N management info from



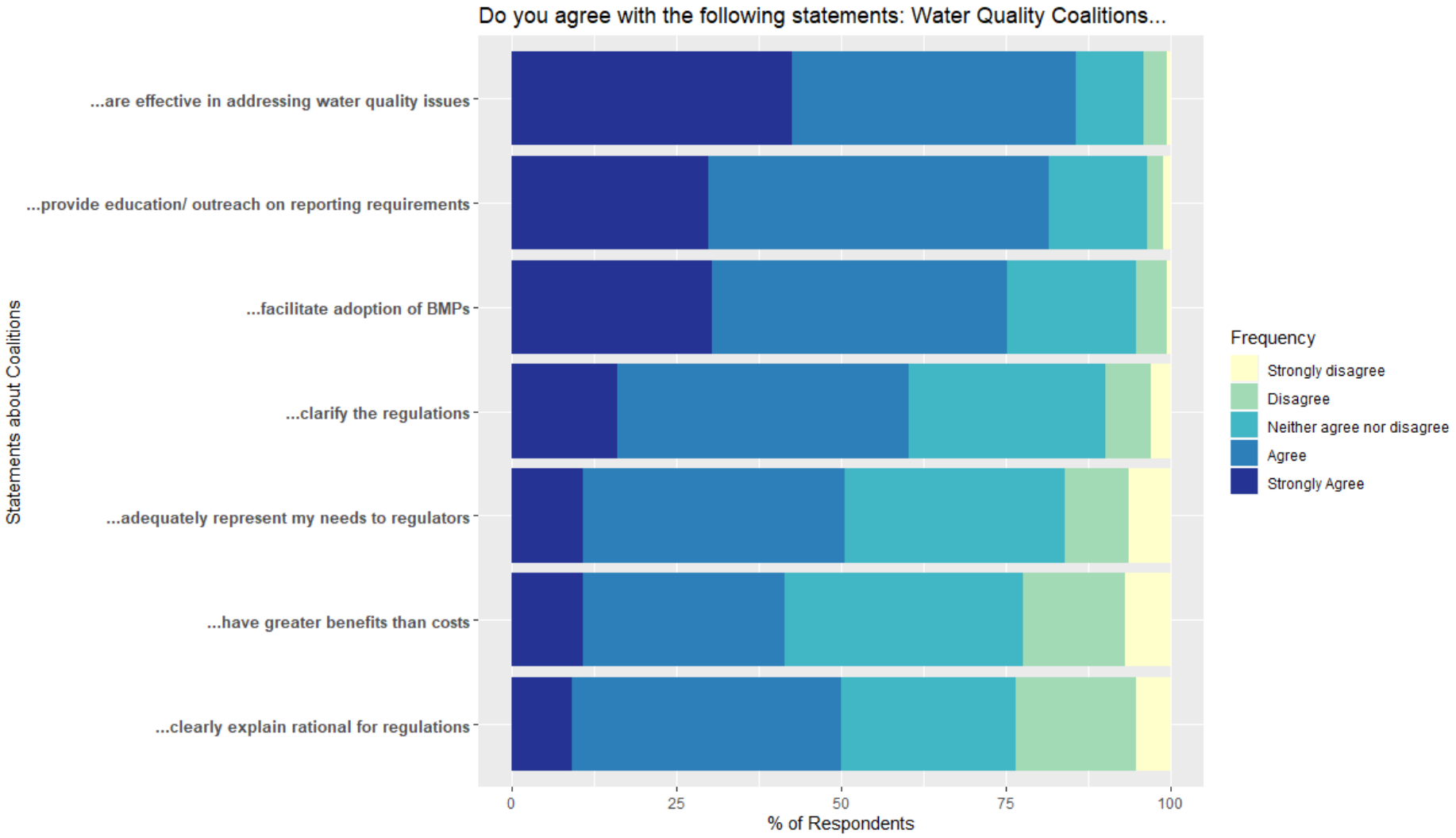
Perceptions of sources of nitrate contributing to water quality impacts



Perceptions of control and self-efficacy over water & nitrogen locally and in California



Perceptions of ESJWQC:



Summary of Findings

- Key findings on adoption in ESJWQC:
  - The most highly adopted practices include **split fertilizer application** (93.5%), **leaf testing** (91.7%), **soil testing** (70.8%), **foliar N application** (67.3%), and **fertigation** (58.3%)
  - **Perennial crop** parcels & **larger farms** tend to **adopt more** practices overall and have higher rates of adoption for nearly all individual practices
  - **Pressurized irrigation systems** and access to **multiple water sources** facilitate practice adoption
  - Growers who have completed the **Self-Certification** course are more likely to adopt practices
- Barriers and motivations to adoption in ESJWQC:
  - **On-farm benefits** of N management practices are most important **priorities**
  - **Uncertainty**, **cost** of practices, **and technical knowledge** required are greatest **barriers** to adoption
- Social & behavioral drivers in ESJWQC:
  - The most commonly referenced sources for N management **information** after one's own experience include **PCAs, the ESJWQC and CCAs**
  - The majority (>50%) of growers believe that **urban sources, legacy leaching, livestock/ dairy, and agricultural (cropland) leaching** are important contributors to nitrate water quality issues
  - The majority (>50%) of growers agree or strongly agree that they have **control over their own N use and N losses from their farm**, yet they **do not feel that they have strong influence over local surface or groundwater quality outcomes**
  - The majority (>50%) of growers agree or strongly agree that the **Water Quality Coalitions are an effective way of addressing water quality issues,** though there is less consensus on their costs and how well they explain the rationale for the ILRP

THANK YOU!

Thank you to all who have offered their support throughout this project!

This work was completed by an interdisciplinary team at the UC Davis Department of Plant Sciences and Department of Environmental Science and Policy, funded through a research grant provided by California Department of Food and Agriculture's Fertilizer Research and Education Program (# 16-0621-SA)

Please direct questions or comments to
jrudnick@ucdavis.edu or sdkhalsa@ucdavis.edu

Extra Slides

Table 1: Survey sample representativeness

	Full Farming Population				UCD Survey Sample		
	A) USDA Census: Madera, Mariposa, Merced, Tuolumne, Stanislaus counties		B) East San Joaquin Coalition (NMP Summary Report 2016 CY)		C) Survey Responses for Q2 (All crops grown in 2017 with acreage)		
Acreage	1,285,452 acres in agriculture (includes pasture & dairies)		464,955 acres (enrolled in Coalition)		84,628 acres (sum of total acreage for all respondents)		
Crop Type (Top 10 acreage crops in Coalition)	**Acres**	**% of total acres**	**Acres**	**% of total acres**	**# Respondents growing crop** (respondents can indicate >1 crop)	**% Respondents growing crop** (% based off of 183 total respondents; will not add to 100%)	**% Total "crop fields" reported on with crop** (% based off of all crops named by all respondents; will not add to 100%)
Almonds	435,972	34%	201,108	48%	143	78%	57%
Grapes (table, wine, & raisin)	141,978	11%	51,033	12%	20	11%	8%
Pistachios	70,416	5%	34,217	8%	10	5%	4%
Walnuts	54,532	4%	20,023	5%	38	21%	15%
Alfalfa Hay	163,991	13%	14,539	3.5%	9	5%	4%
Corn	31,892	2%	14,469	3.5%	8	4%	3%
Oats	27,437	2%	10,108	2%	2	1%	<1%
Sweet Potato	7,170	<1%	8,724	2%	2	1%	<1%
Wheat	83,422	6%	5,939	1%	5	3%	2%
Citrus	3,198	<1%	5,582	1%	2	1%	<1%
Average Farm size	403 acres		Average farm size	No Coalition data available	Mean farm size	470 acres	
Farm size classes	**% farms in size class**		**% farms in size class**		**# respondents in farm size class**	**% respondents in farm size class**	
1-9 acres	18%		No Coalition data available		13	7%	
10-49 acres	38%				71	39%	
50-179 acres	22%				47	26%	
180-499 acers	12%				23	13%	
500-999 acres	5%				8	4%	
>1000 acres	7%				21	11%	