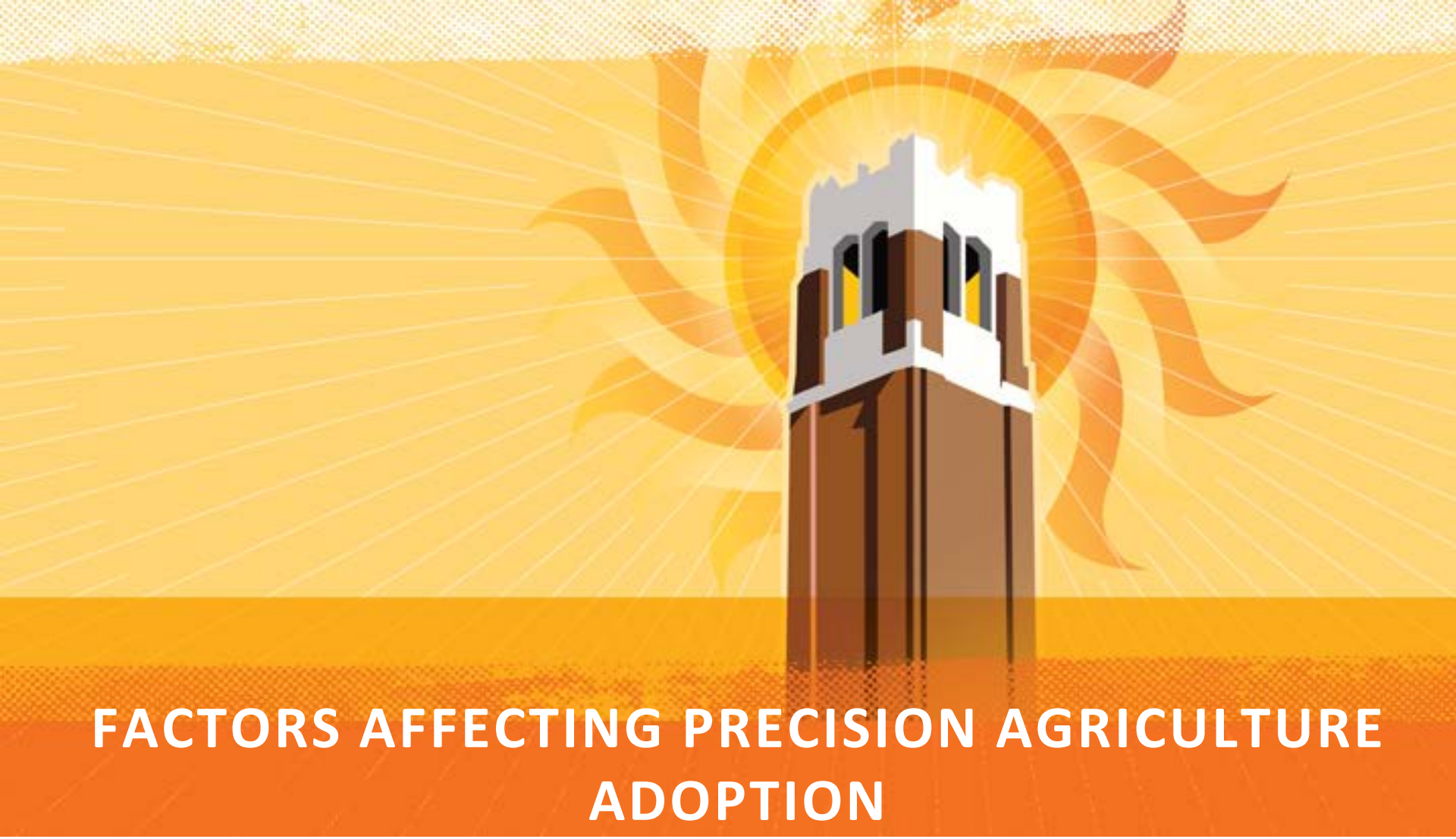


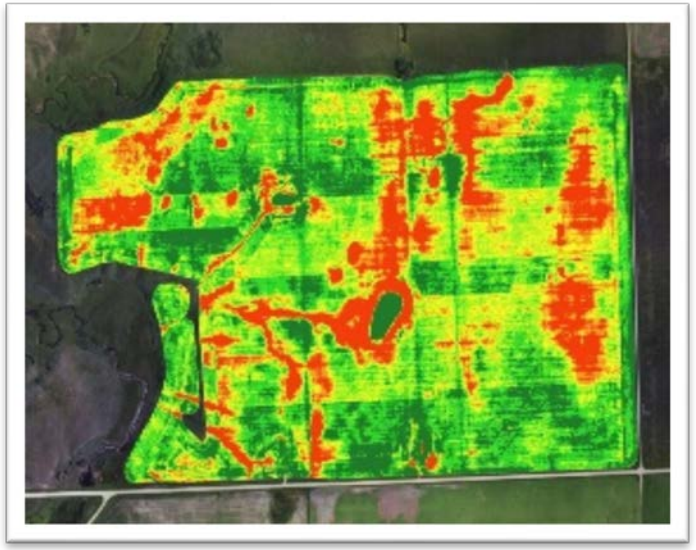
FACTORS AFFECTING PRECISION AGRICULTURE ADOPTION

Tara Wade, PhD
Southwest FL Research and Education Center

Presentation at Smart Agriculture and Smart Technologies IST
March 28, 2019
Immokalee, FL

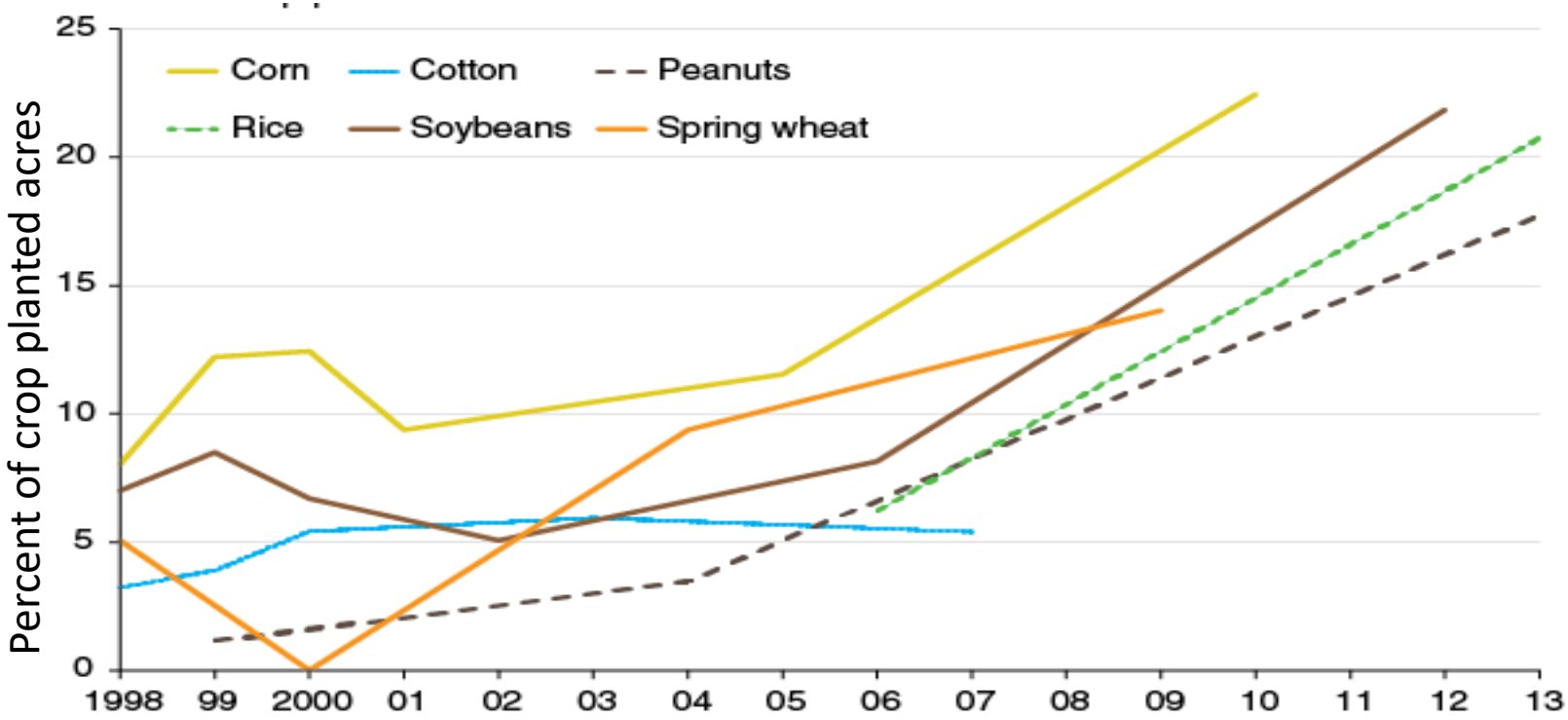
UF IFAS
UNIVERSITY of FLORIDA

Precision Agriculture (PA)



Adoption Trends in Program Crops: VRT

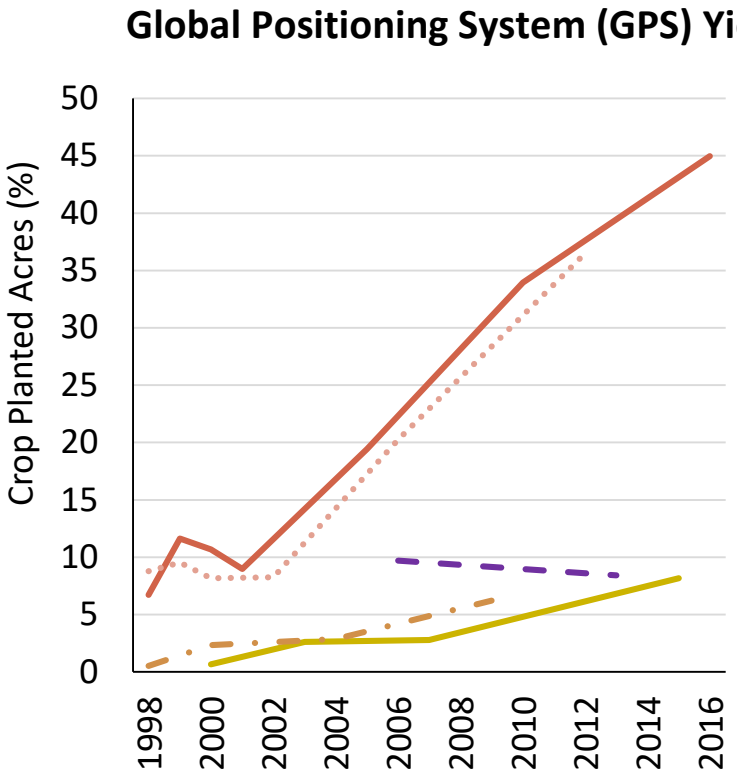
Variable Rate Technology use has risen to about one fifth of planted acres of corn, peanuts, soybeans, and rice

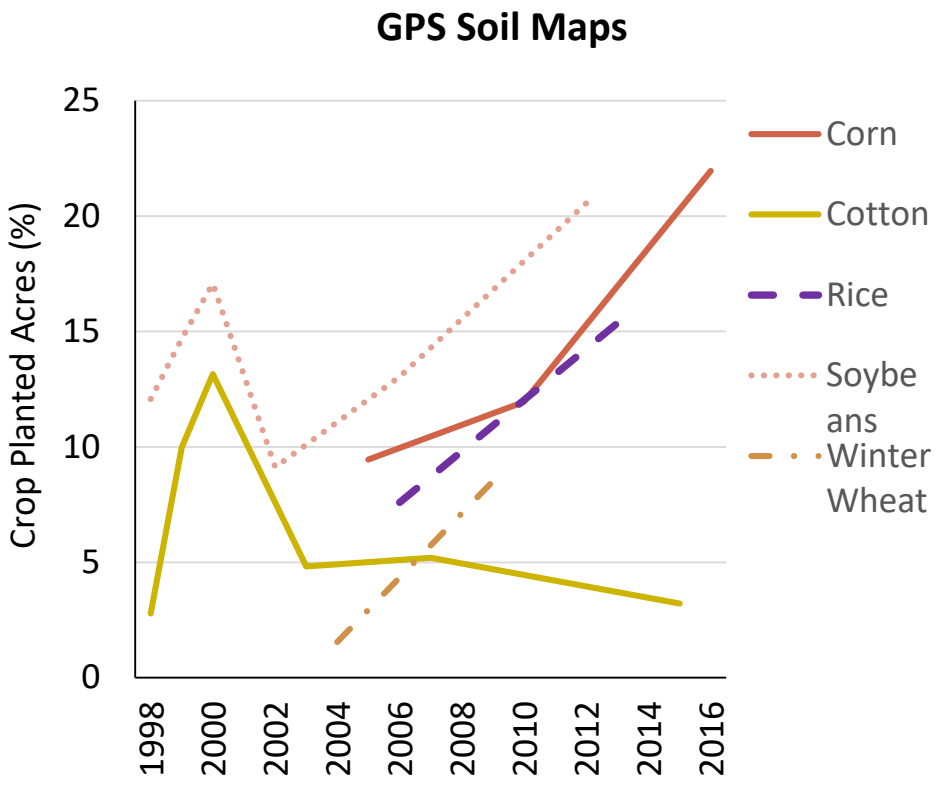


USDA, Economic Research Service using data from USDA's Agricultural Resource Management Survey (ARMS) Phase II.

Adoption Trends in Program Crops: Maps

GPS Yield Maps (left) are twice as popular as GPS Soil Maps (right) for corn and soybeans



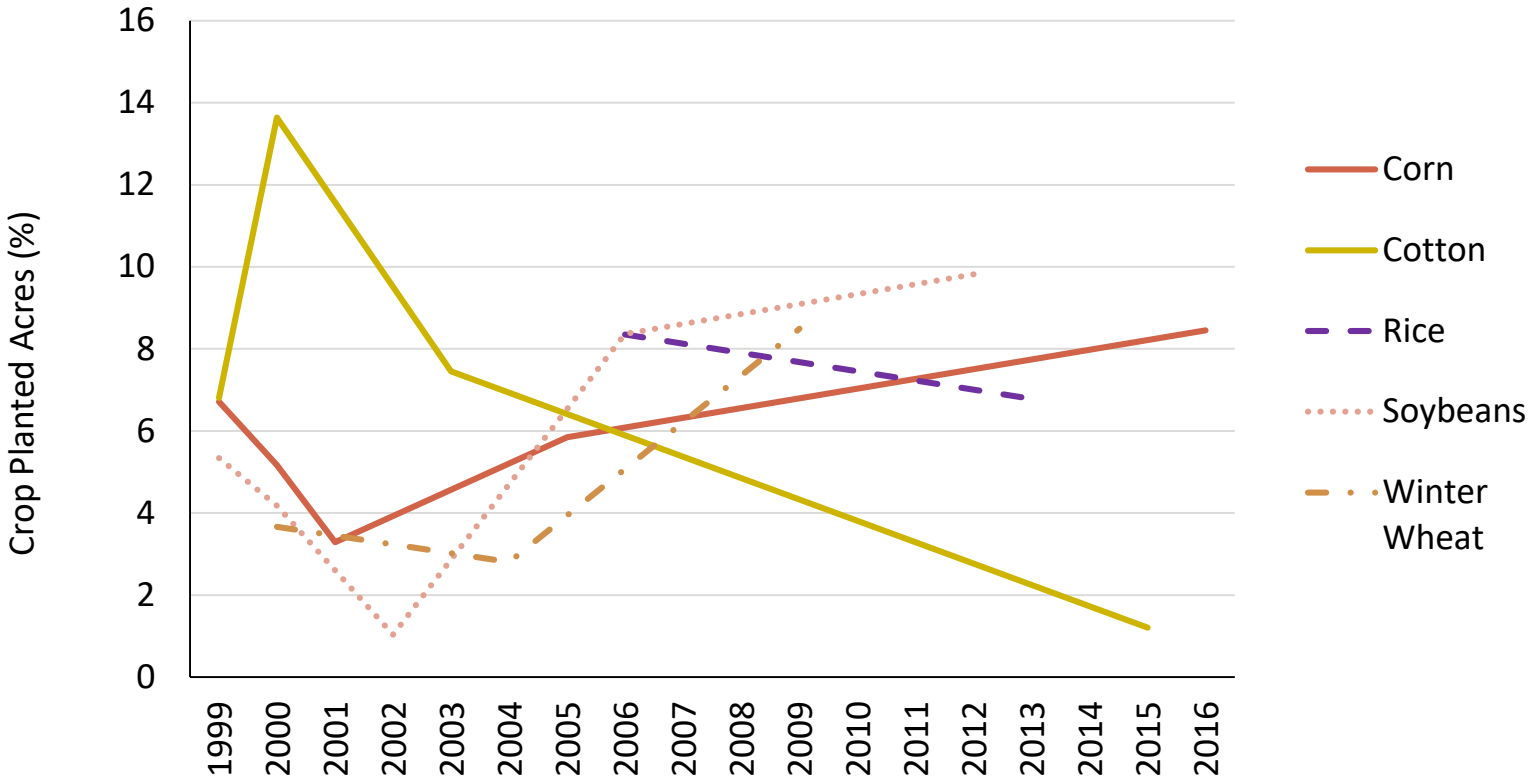


Source: USDA Economic Research Service estimates using data from the agricultural Resource Management Survey Phase II.

Cite: Land-grant University Research Group NC-1034 pre-conference for the 22nd International Consortium on Applied Bioeconomy Research (ICABR) hosted by the World Bank in Washington, DC, June 12, 2018.

Adoption Trends in Program Crops: GPS and Drones

Only 10% of planted acres have GPS maps created from aerial data (drones, light aircraft, or satellites)

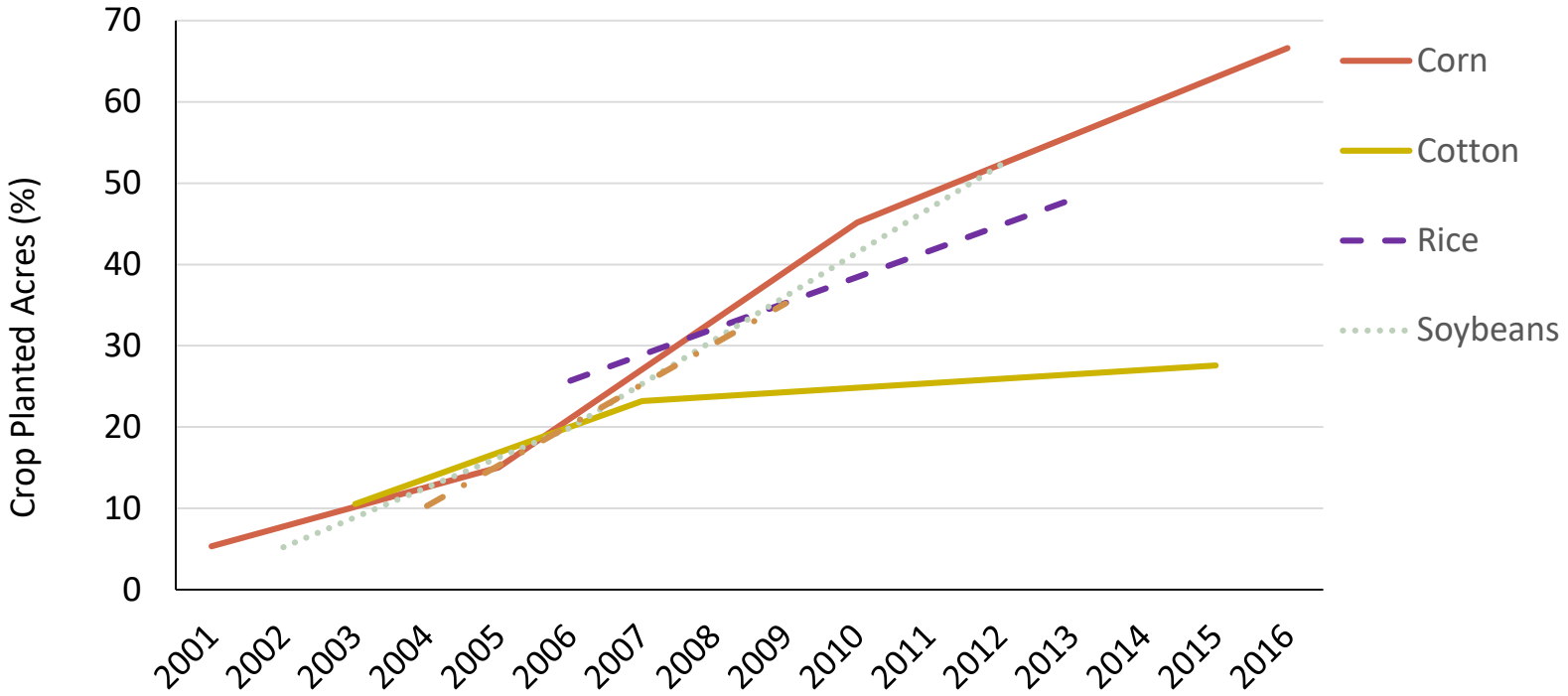


Source: USDA Economic Research Service estimates using data from the agricultural Resource Management Survey Phase II.

Cite: Land-grant University Research Group NC-1034 pre-conference for the 22nd International Consortium on Applied Bioeconomy Research (ICABR) hosted by the World Bank in Washington, DC, June 12, 2018.

Adoption Trends in Program Crops: Guidance Systems

Guidance Systems are the most popular precision technology for all these field crops
(over 50% of corn and soybeans planted acres in the U.S.)



Source: USDA Economic Research Service estimates using data from the Agricultural Resource Management Survey

What We Know From The Literature

Farm size has a positive effect on PA adoption

- E.g., Kutter et al., 2011; Walton et al., 2010; Isgin et al., 2008; Alvarez and Nuthall, 2006

Income or capital expenditure is positively correlated with PA adoption

- E.g., Asare and Segarra, 2018; Watcharaanantapong et al., 2014

Education has a positive effect on PA adoption

- E.g., Jenkins et al., 2011; ; Banerjee et al., 2008; Isgin et al., 2008; Alvarez and Nuthall, 2006

Age has a negative effect on PA adoption

- E.g., Castle, Lubben and Luck, 2016; Jenkins et al., 2011; Paxton et al., 2011; Isgin et al., 2008; Fernandez-Cornejo, Daberkow and McBride, 2001

What We Know From The Literature cont'd

Computer literacy has a positive effect on adoption

- E.g., Castle, Lubben and Luck, 2016; Watcharaanantapong et al., 2014; Paxton et al., 2011; Walton et al., 2010

Yield or profit increase has a positive effect on PA adoption

- E.g., Watcharaanantapong et al., 2014; Mooney et al., 2010; Walton et al., 2010; Roberts et al., 2004; Daberkow and McBride, 2003

Cost share program enrollment has a positive effect on PA adoption

- E.g., Asare and Segarra, 2018; Roberts et al., 2004

Precision Agriculture (PA) Pros and Cons

One size does not fit all

Pros:

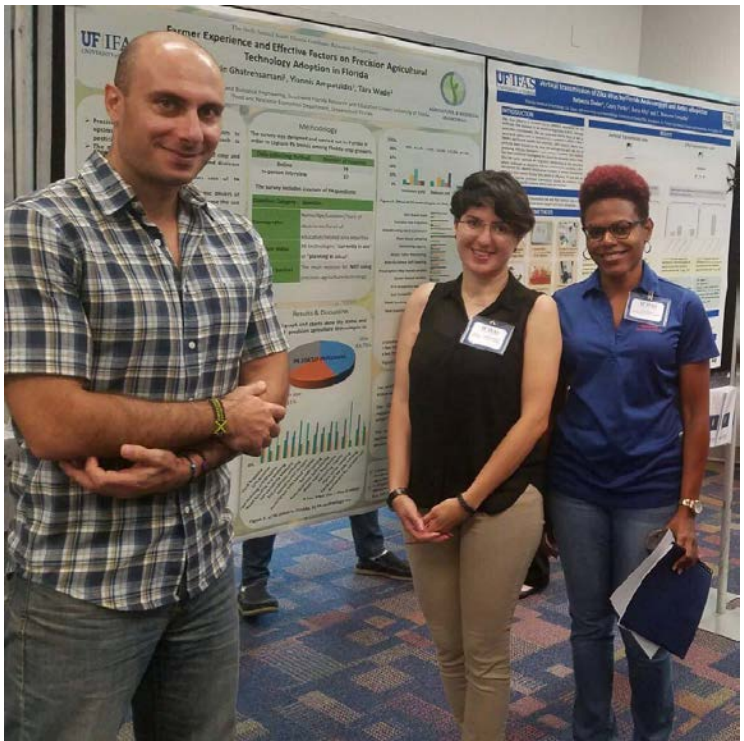
1. Reduce costs and/or inputs
   (labor, fuel, water, pesticides, nutrients, seed)
2. Increase farm efficiency and productivity
   (soil quality and fertility, pest management, decision aids, uniform fields)
3. Minimize environmental risks

Cons:

1. Require system upgrades
2. Require significant capital investment
3. Increase specialty labor
4. May collect data you don't need/use
5. Can be crop specific

Specialty crop growers' adoption of precision agriculture technologies: preliminary data from Florida surveys

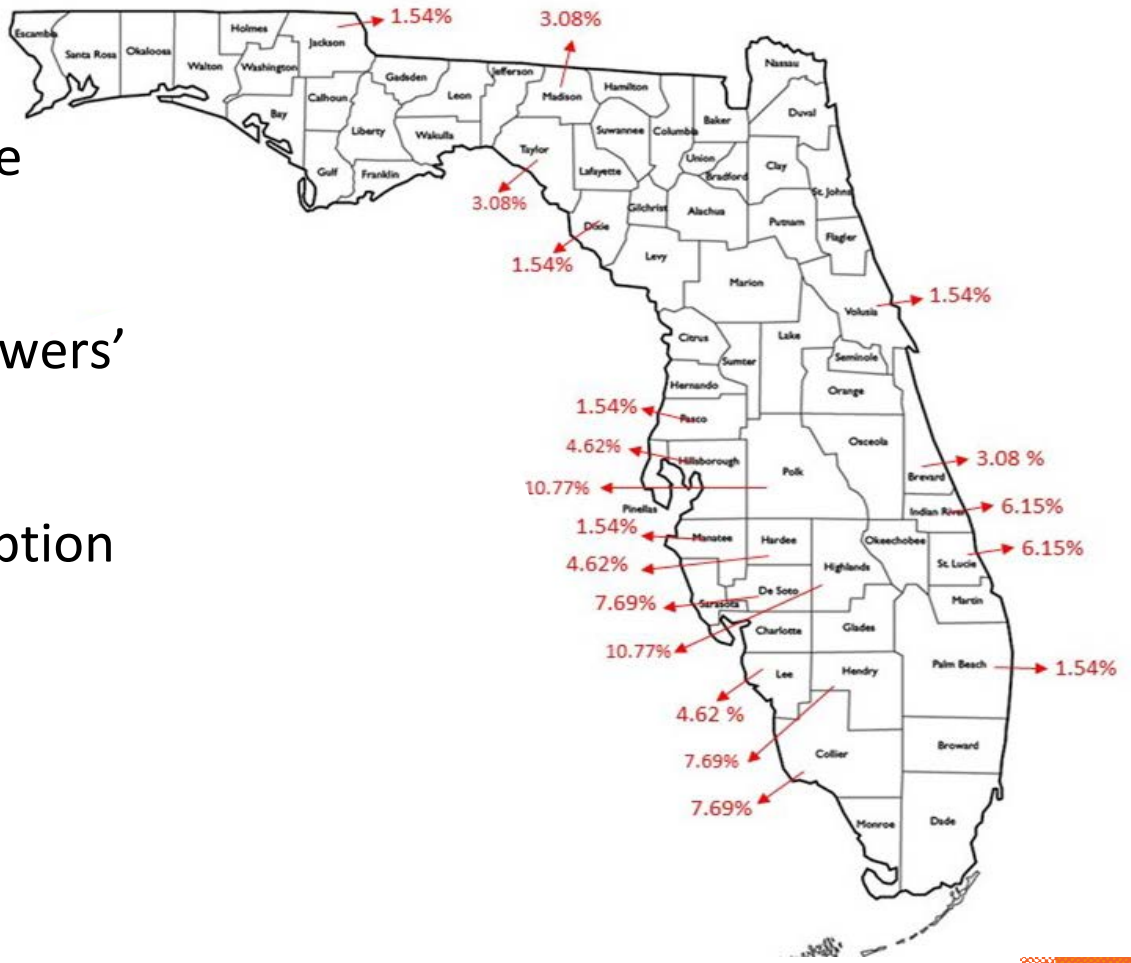
Work with Shirin Ghatrehsamani (Student) & Yiannis Ampatzidis



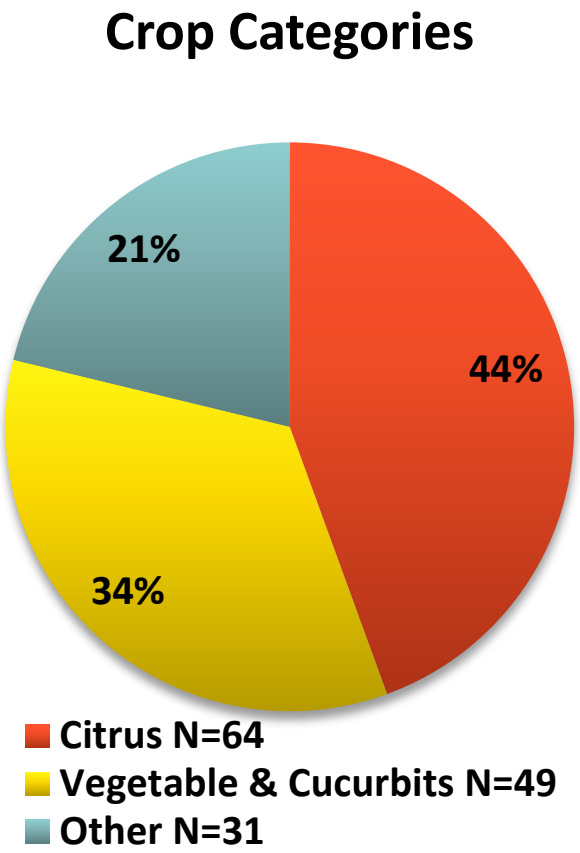
Florida PA Technology Adoption Survey

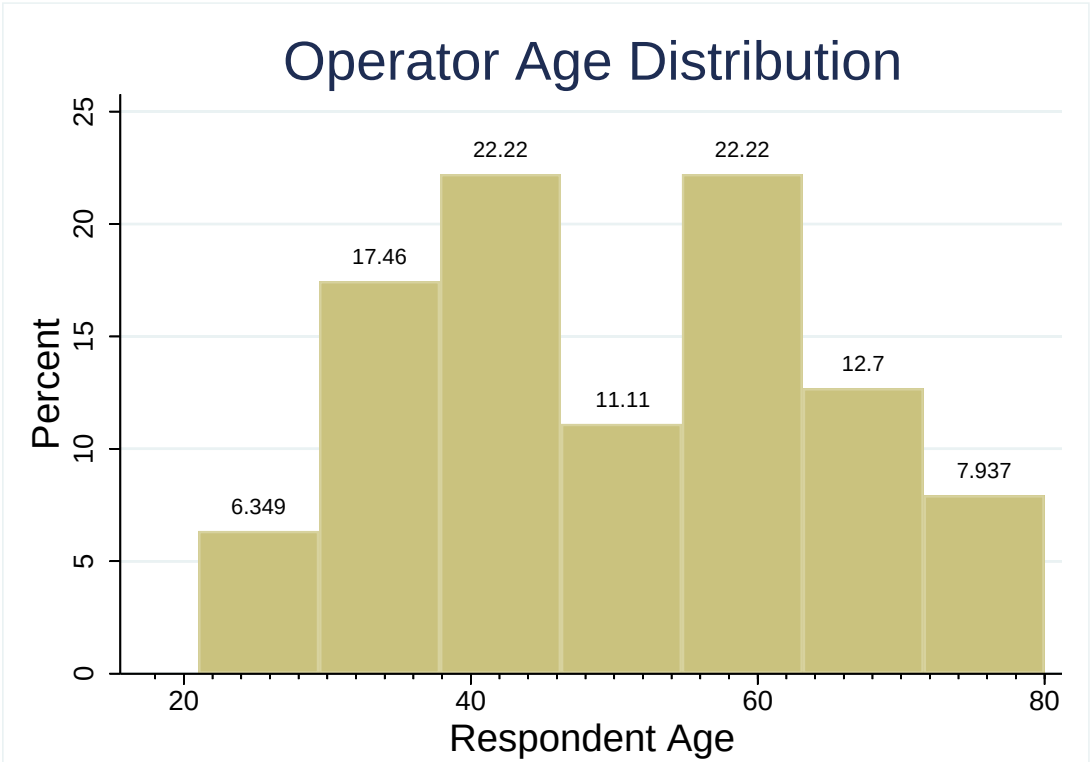
- Statewide electronic and in-person survey
- Provides a comprehensive overview of PA adoption
- Provides insights into growers' attitudes towards PA
- Examines barriers to adoption

- Surveys: 82
- Crops: 35
- Response rate: 15%



Data

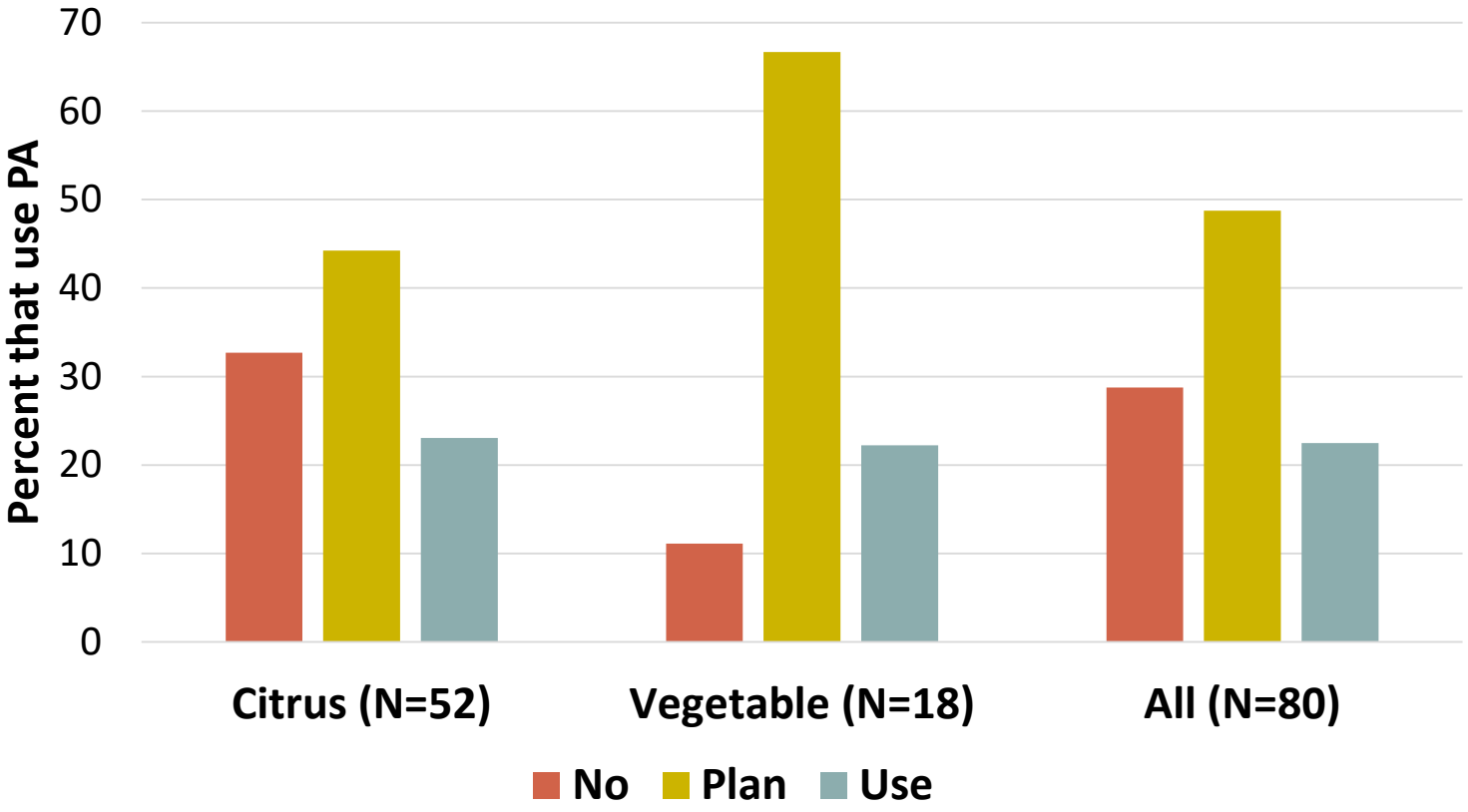




Number of Crops	Number of Growers	Percent of Growers
1	50	61%
2	16	20%
3	9	11%
4	5	6%
7	1	1%
8	1	1%

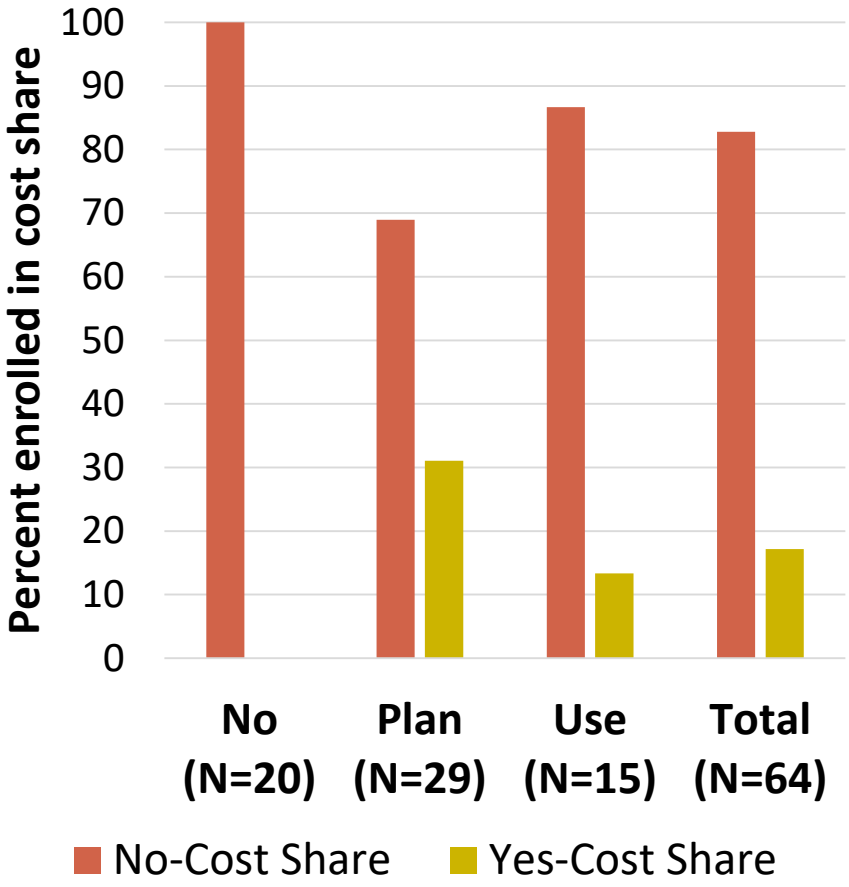
Precision Agriculture Adoption

The majority of vegetable and cucurbit growers plan to use PA



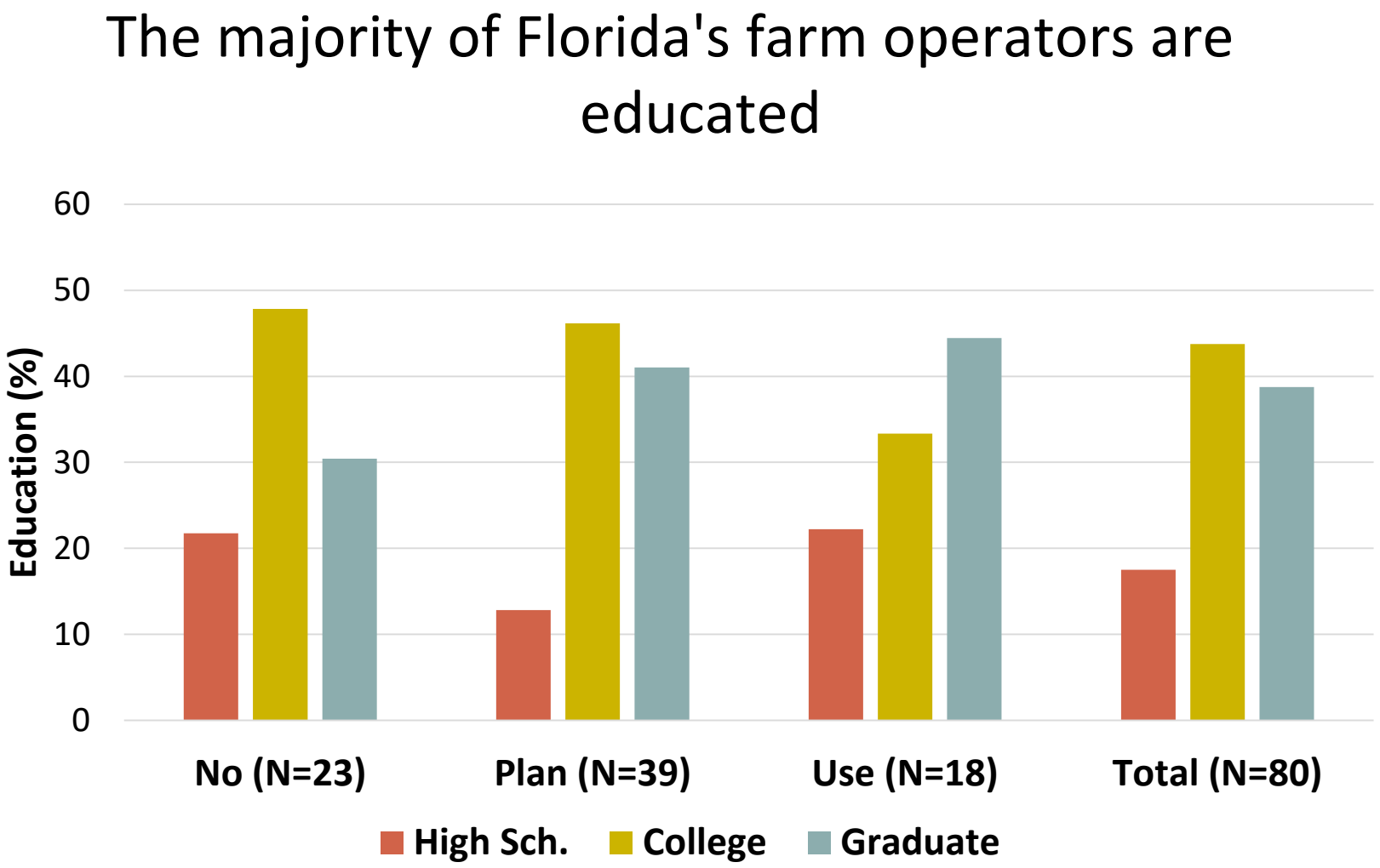
Cost-Share Programs

About half of those who plan to use PA are enrolled in cost share programs



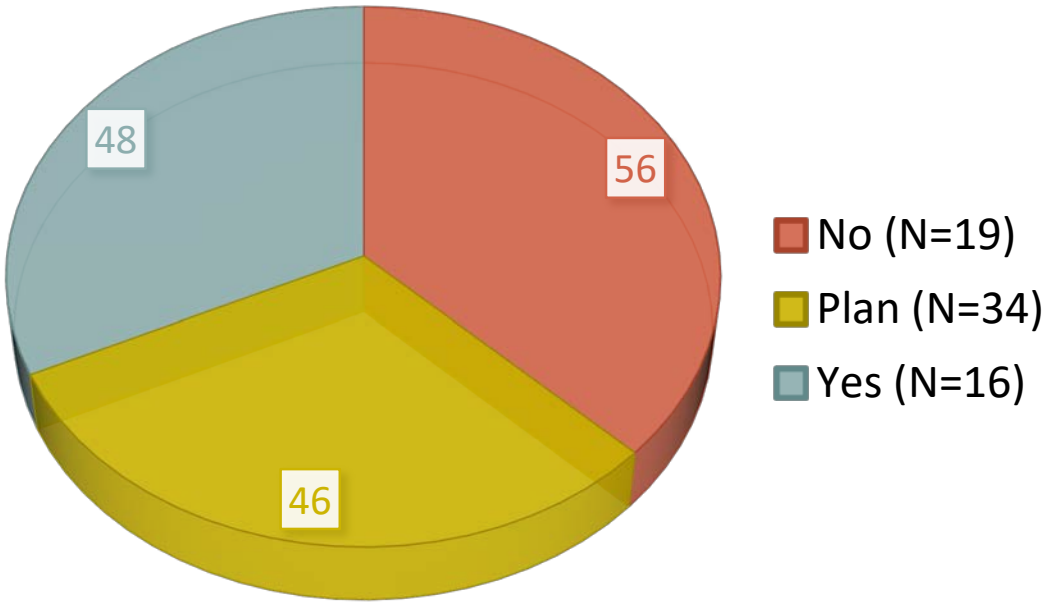
Percent in Cost Share (ρ = 0.4292)			
Total Acres	**No (%)**	**Yes (%)**	**N**
< 50	100	0	18
50-100	100	0	7
100-200	100	0	2
200-500	80	20	5
500-1000	40	60	5
1000-2000	83	17	6
> 2000	54	54	13
Total	**82%**	**18%**	**56**

Education


The majority of Florida's farm operators are educated
Education (%)
60
50
40
30
20
10
0
No (N=23)
Plan (N=39)
Use (N=18)
Total (N=80)
High Sch.
College
Graduate

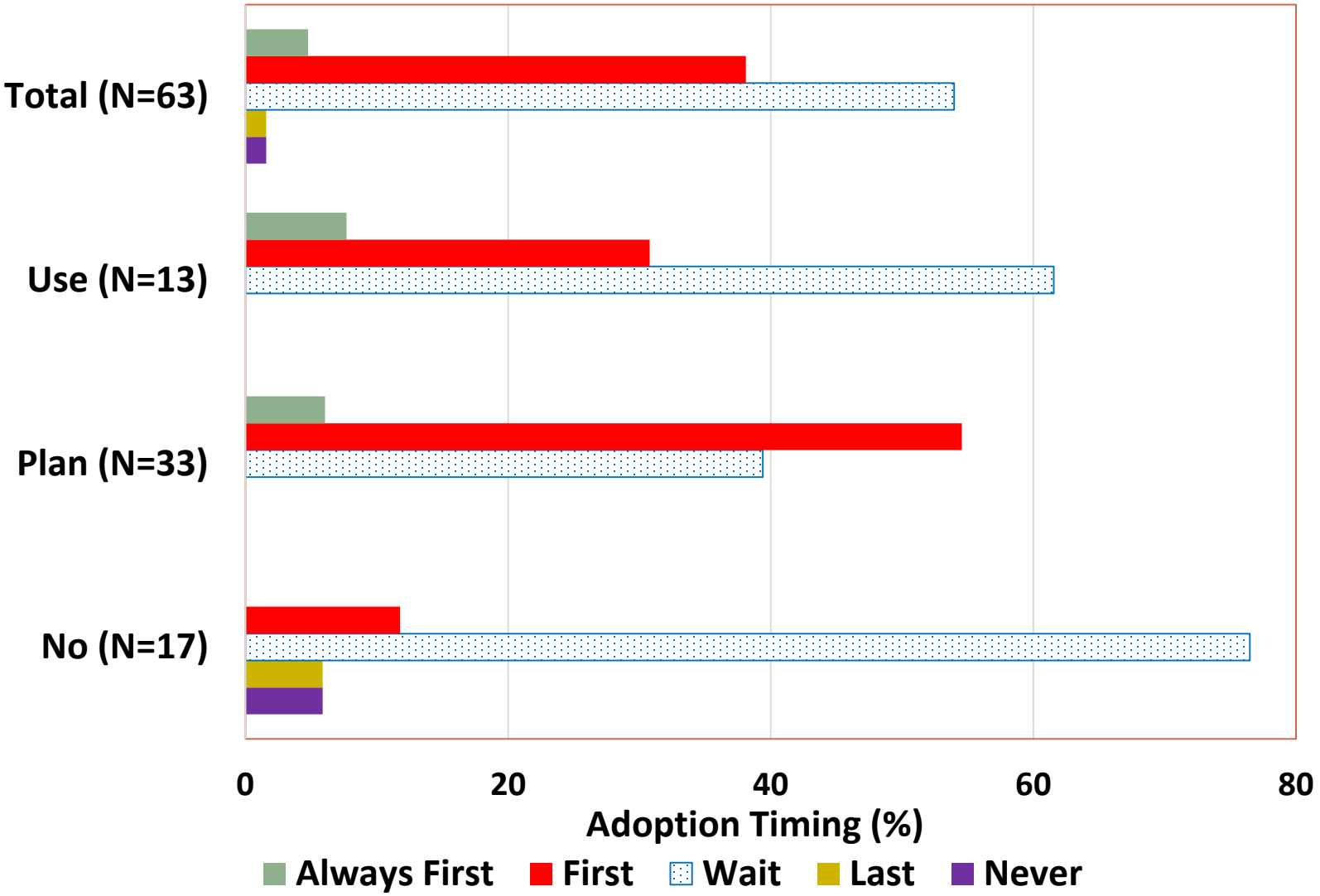
Age

Farm operators who use or plan to use PA are on average 9 years younger than operators who do not use PA



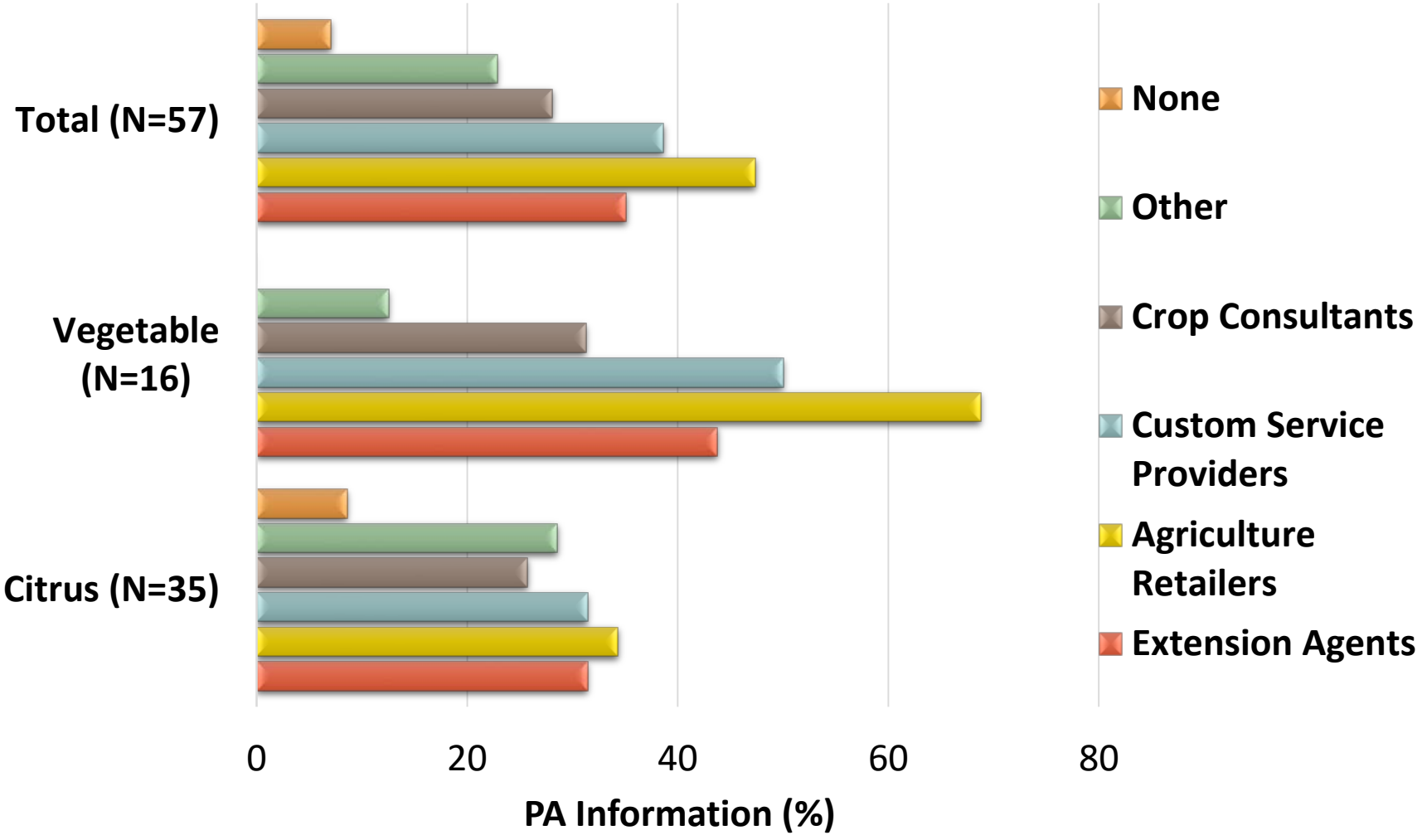
Adoption Timing

The majority of PA users wait before adopting



Information Sources

Producers who use or plan to use PA primarily get information from agriculture retailers and consultants



Discussion

- Increasing PA use requires a better understanding of the economic drivers of adoption.
- We are missing a clear connection between PA adoption and environmental (or public) benefits.
- Policy questions to consider:
  - *Are current state programs encouraging the use of PA technologies?*
  - *What level of payments are needed to increase PA use?*
  - *Is the public willing to pay for agriculture incentive programs for technology adoption?*
  - *Could incentive programs have small farms, beginning farmers, and socially disadvantage farmers welfare effects?*

Conclusion

- Trends in program crops show increased use in PA technology over time.
- There is interest in PA among FL producers: more than 50% use or plan to use PA.
  - There are significant data gaps: with more data we can report specific technologies producers are interested in.
- Social factors, such as education and age, are important determinants in the decision to adopt PA.
- It is unclear if cost share is an important driver for PA adoption in FL.
- Cost-share program design may lend itself nicely to larger growers.
- Extension information plays an important role in delivering PA information to growers.

Acknowledgements

David Schimmelpfennig
Senior Agricultural Economist
USDA, Economic Research Service

SOUTHERN EXTENSION RISK MANAGEMENT EDUCATION

USDA

This material is partially based upon work supported by USDA/NIFA under Award Number 2015-49200-24228.

Questions/Comments

Feel free to contact us.

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Source: www4.swfwmd.state.fl.us/alafia/birds.php

Citrus	Vegetable and Cucurbits	Other
N = 64	N = 49	N = 21
Oranges	Beans	Blueberries
Grapefruit	Cucumber	Chestnuts
Satsuma	Green beans	Lychee Fruit
Luna	Onions	Macadamia nuts
	Pepper	Mics
	Sweet corn	Olives
	Tomato	Pecans
	Vegetable	Pomegranate
	Watermelon	Sod/Turf
	Squash	Stone Fruit
	Cantaloupe	Timber
	Cabbage & Broccoli	Tropical Fruit
		Avocado

PA Survey Technology List

Yield Mapping (e.g., GOAT yield monitoring system)
GPS Receiver (e.g., boundary mapping)
Pest Scouting and Mapping (e.g., “EntoNet”)
Weed Scouting and Mapping
Soil Variability Mapping (e.g., Veris mapping)
Soil properties mapping (for N, P, K or soil organic matter, using e.g., precision soil sampling)
Sensor based variable applicator (e.g., “Tree-See”)
Prescription Map based variable applicator (e.g., variable rate fertilization)
Remote Sensing (e.g., UAV-drones, aerial of satellite imagery)
Machinery Auto-Guidance Self-Steering
Water Table Monitoring (e.g., moisture sensor used to automate irrigation scheduling)
Harvesting Logistic (e.g., mapping brix, acid and sugar levels to determine peak harvest time)
Plant tissue sampling
Equipment for side dressing input applications
Equipment for variable rate irrigation