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Cover Crops in Tree Crop Production: Calculating Costs and Benefits

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Cover Crops in Citrus
& Other Tree Crops
Immokalee, FL (Zoom)
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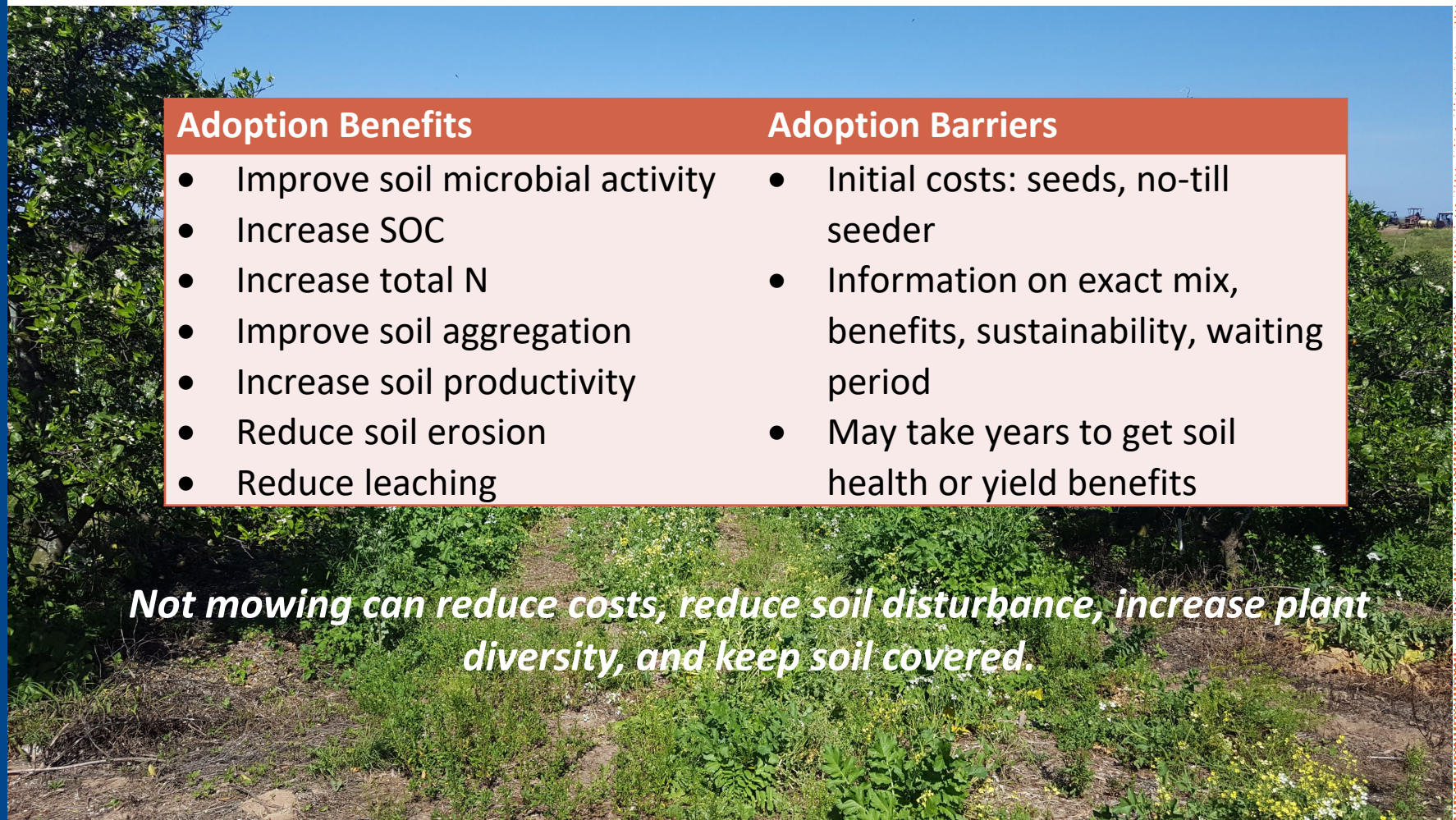
Cover Crops Benefits and Barriers to Adoption

Cover crops are non-cash crops widely used in row-crop production.

Benefits in tree crop production are largely unknown.



Adoption Benefits	Adoption Barriers
• Improve soil microbial activity • Increase SOC • Increase total N • Improve soil aggregation • Increase soil productivity • Reduce soil erosion • Reduce leaching	• Initial costs: seeds, no-till seeder • Information on exact mix, benefits, sustainability, waiting period • May take years to get soil health or yield benefits

Not mowing can reduce costs, reduce soil disturbance, increase plant diversity, and keep soil covered.

Cover Crops in Tree Crops

Are cover crops a feasible strategy to help improve soil health, tree health, or yield?

Team effort:

- Growers!
- Soil microbiologist
- Water and nutrient scientist
- Weed scientist
- Economist
  - ✓ Budget analysis: Assess cover crops costs and benefits
  - ✓ Survey:
    - Grower perspectives
    - Grower costs

Calculating Costs and Benefits

Things to consider:

Keep records!

- ✓ Start with a production/enterprise budget.
- ✓ Do a multi-year trial:
  - Compare costs with and without cover crops.
  - Cost Tool: Use a tool to help assess costs and benefits.

Costs are expected to increase in the first few years.

Calculating Costs and Benefits

Things to consider:

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✓ **Cover crops cost sheet: Labor and machinery**

Cover Crops Adoption Cost Tool

The cover crop adoption cost plan is designed as a simple guide that growers may use to help compare costs of current practices and equipment to expected costs when incorporating cover crops. Growers can get more precise estimates by conducting a cover crop trial and maintaining records before full adoption. For assistance with using this form contact Tara Wade at tara.wade@ufl.edu or (239) 658-3444.

Date: _____ **Crop:** _____ **Field:** _____ **Acres:** _____

Costs of row middle management	**Existing Practices**		**Practices with cover crop adoption**	
Field Labor and Equipment Time	**Labor Hours**	**Machinery Hours**	**Labor Hours**	**Machinery Hours**
Land preparation before herbicide application (e.g., mowing)			NA	NA
Herbicide application _____ times per year (e.g., summer, winter)				
Mechanical removal of weeds _____times (e.g., disking in summer, winter)				
Broadcasting cover crop seeds _____ times by (e.g., twice per year)	NA	NA		
No-till drill cover crop seeds _____ times using (e.g., twice per year)	NA	NA		
Cover crop termination _____ times (e.g., mowing)	NA	NA		
Hired consultants (e.g., data management and processing)				
Other				
Other				
Other				

Calculating Costs and Benefits

Things to consider:

✓ **Cover crops cost sheet: Seed costs**

Cover crop seeds mix cost.

Legume				Non-legume			
Variety name	Applications/year (#)	Application rate (pound/acre)	Cost ($/acre)	Variety name	Applications/year (#)	Application rate (pound/acre)	Cost ($/acre)
			$				$
			$				$
			$				$
			$				$
			$				$
			$				$
			$				$
Total seed mix cost per acre ($/acre) Legume			$	Total seed mix cost per acre ($/acre) non-legume			

Calculating Costs and Benefits

Things to consider:

- ✓ **Cover crops cost sheet: Cost comparison (conventional vs with cover crops)**

Total Production Labor, Machinery, and Seed Costs.

	Existing Practices	Practices with cover crop adoption
Labor hours		
Wage/labor cost per hour ($/hour)		
Total labor cost ($)		
Machinery hours		
Average cost per hour including fuel ($/hour)		
Total machinery and labor cost ($)		
Total labor and machinery cost ($)		
Cost per acre ($/acre)		
Total seed mix cost (Legume, non-legume cost/acre*total acres) ($)		
Total costs for using cover crops (Labor + Machinery + Seed) ($)		
Total per acre cost of using cover crops (Total cost ÷ Field acres) ($/acre)		

Net benefits are expected to be negative for the first few years.

Calculating Costs and Benefits

Things to consider:

✓ **Estimating net benefits**

Benefits typically take years to accrue.

- You will need multiple years of data.

Simple benefits calculator:

- *All estimates are hypothetical*.
- Create your own cost and yield scenarios.
- Key features:
  - Cost of conventional production
  - Cost of cover crops seeds and management
  - Savings from cover crops
  - Breakeven prices

Calculating Costs and Benefits

Things to consider:

✓ **Estimating net benefits**

An Excel tool to compare production costs, cover crop costs and benefits, yield-quality scenarios, and associated breakeven prices.

Valencia oranges

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	Y-to-Y inflation rate		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cost of production per acre without cover crops ($/acre)		1871.17	1889.88	1908.78	1927.87	1947.15	1966.62	1986.28	2006.15	2026.21	2046.47
	Proportion of cover crop cost	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Cover crop cost ($/acre)		248.00	250.48	252.98	255.51	258.07	260.65	263.26	265.89	268.55	271.23
Yield (boxes/acre)		119.00	119.00	119.00	119.00	119.00	119.00	119.00	119.00	119.00	119.00
Quality (lb solids/box)		5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21
Total Delivered-in Cost per acre with cover crops ($/acre)		2281.72	2300.43	2319.33	2338.42	2357.70	2377.17	2396.83	2416.70	2436.76	2457.02
	Proportion saved from reduced mowing	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Savings from reduced mowing ($/acre)		102.70	103.73	104.76	105.81	106.87	107.94	109.02	110.11	111.21	112.32
Savings from herbicides (%)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Savings from fertilizer (%)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total savings ($/acre)		102.70	103.73	104.76	105.81	106.87	107.94	109.02	110.11	111.21	112.32
Total Delivered-in Cost per acre with cover crops net of savings ($/acre)		2179.02	2196.70	2214.57	2232.61	2250.83	2269.23	2287.82	2306.59	2325.55	2344.70
Breakeven delivered-in price net of savings ($/box)		18.31	18.46	18.61	18.76	18.91	19.07	19.23	19.38	19.54	19.70
Break-even delivered-in price per lb solids net of savings ($/lb solids)		3.51	3.54	3.57	3.60	3.63	3.66	3.69	3.72	3.75	3.78

Calculating Costs and Benefits

Sample scenario

Valencia oranges

		Year 1	Year 2	Year 3	Year 4	Year 5
	Y-to-Y inflation rate		0.02	0.02	0.02	**0.02**
Cost of production per acre without cover crops ($/acre)		1871.17	1908.59	1946.77	1985.70	**2025.41**
	Proportion of cover crop cost	1.00	1.00	1.00	1.00	**0.90**
Cover crop cost ($/acre)		248.00	252.96	258.02	263.18	**241.60**
Yield (boxes/acre)		119.00	119.00	119.00	119.00	**124.95**
Quality (lb solids/box)		5.21	5.21	5.21	5.21	**5.47**
Total Delivered-in Cost per acre with cover crops ($/acre)		2281.72	2319.14	2357.32	2396.25	**2456.49**
	Proportion saved from reduced mowing	1.00	1.00	1.00	1.00	**1.00**
Savings from reduced mowing ($/acre)		102.70	104.75	106.85	108.99	**111.17**
Savings from herbicides (%)		0.00	0.00	0.00	0.00	**0.10**
Savings from fertilizer (%)		0.00	0.00	0.00	0.00	**0.05**
Total savings ($/acre)		102.70	104.75	106.85	108.99	**159.78**
Total Delivered-in Cost per acre with cover crops net of savings ($/acre)		2179.02	2214.39	2250.47	2287.26	**2296.72**
Breakeven delivered-in price net of savings ($/box)		18.31	18.61	18.91	19.22	**18.38**
Break-even delivered-in price per lb solids net of savings ($/lb solids)		3.51	3.57	3.63	3.69	**3.36**

Cover crops seed costs

The mix of legume and non-legume cover crops is based on the objectives of the grower.

Price of cover crop seeds for 65lb/acre seed requirement.

Variety	$/lb	$/50 lb bag
Sunn hemp	$1.54	$76.99
Sunflower	$0.76	$37.99
Daikon radish	$2.00	$99.99
Buckwheat	$1.80	$89.99
Average cost ($/lb)	**$1.52**	
Total cost (65lb/acre)	**$99.10**	

Source: Hancock Seed Co

Seed Cost Sources

Online:

Southern States: http://www.southernstates.com/storelocations/index.aspx
Hancock Seed Company: https://hancockseed.com/collections/cover-crop-seed

Florida retailers: EDIS

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IFAS Extension

HS 1142

Annual Cover Crops in Florida Vegetable Systems Part 3. Buying and Sourcing[1]

Danielle Treadwell, Waldemar Klassen, Michael Alligood and Stephanie Shewey[2]

C. M. Payne and Sons, Inc.: “Forage legumes” 9410 Payne Rd Sebring, FL 33875-9716 Phone (863) 385-4642

Diamond R Fertilizer: “Treated seed Untreated seed” 321 N. Hennis Rd. P.O. Box 12489Winter Garden, FL 34787Phone (407) 656-3007Fax (407) 656-3903http://www.diamond-r.com/locations.htm

Haile-Dean Seed Co. :“Treated seed “501 N. Hennis Rd. Winter Garden, FL 34787-2407Phone (407) 877-3333 or (800) 423-7333

Wise Seed Company, Inc.: “All Untreated seed” 930 Highway 630 West Frostproof, FL 33843-9771Phone (863) 635-4473Fax (863) 635- 4880http://wiseseed.net/

Other Cover Crops Cost

Cover crops cost about $248/acre/year.

Item	Cost	Description
Seed	$99/acre/application	50-80 lb/acre for optimum germination
		Mix of legumes (Sunn Hemp) and non-legumes (Daikon Radish, Sunflower & Buckwheat)
		Average cost of the mix: $1.525/lb (Hancock Seed Co.)
		2 applications per year
Fuel	$2/acre/application	
Labor	$20/hour	$5.50/acre per application (2 applications per year)
No-till Drill	$15/acre/application	Daily rental: $250
Other:	$5/acre/application	Unplanned or unforeseen costs

Citrus: Cover crops savings are about $102.70/acre/year.
Net cover crop cost about $145.30/acre/year
Short-term (1 year) savings from reduced mowing

Cover Crops Payment Programs

Cover crops have environmental (or public benefits). Some federal and state agencies offer partial payments for cover crops use.

- USDA-Natural Resources Conservation Service (NRCS)
  - ✓ Environmental Quality Incentives Program (EQUIP)
  - ✓ Conservation Stewardship Program (CSP)
  - ▪ Climate smart practice
- Florida Department of Agriculture and Consumer Services (FDACS)
- Water Management Districts
- Carbon market (not yet)

USDA-NRCS Enrollment Process: EQUIP & CSP

Participant objective

Purpose of enrolling in the cost-share program examples:

- Nitrogen fixation.
- Erosion control.
- Soil organic matter.
- Weed control.

NRCS planning process

- Information from grower on objective, seeding rate, seed costs, length of time, etc.
- NRCS plans the project based on above information and on various NRCS scenarios.
- Plans optimum program enrolment participation mix and timeline. E.g., 3 years in EQUIP & 2 years in CSP.
- NRCS calculates input indicators, models outcomes, verifies, and certifies practice.

Payments

- New adopters can enroll for up to 5 years for each practice.
- Current cover crop adopters can enroll in CSP for practice payments.
- Up to 75% cost share, 90% for HU growers.
- Repayment in case of reimplementation due to adverse weather events.

Additional points

- Partial enrolment of farm possible. (Important for trialing.)
- Total time from application to implementation: 1.5 years on average.
- Maximum payment limit: $450,000 for a farm.
- NRCS can also support in planning for adoption for growers that do not seek payments.
- Currently no provision for enrolling into additional benefits from using no-till seeder. Future provisions possible.

USDA-NRCS Enrollment Process: EQUIP & CSP

Florida Enrollement Contacts:

Santos Colberg
District Conservationist, USDA-NRCS
Fort Myers, FL Service Center
(239) 214-3114
santos.colberg@usda.gov

Roberto Luciano Semidey
State Agronomist
352-338-9544
roberto.luciano@usda.gov

Other Florida Contacts:

NRCS Local Working Groups
https://www.nrcs.usda.gov/conservation-basics/conservation-by-state/florida/local-working-groups

Florida - Brooksville Plant Materials Center
https://www.nrcs.usda.gov/plant-materials/flpmc

USDA-NRCS Resources

NRCS EQUIP Florida

https://www.nrcs.usda.gov/programs-initiatives/eqip-environmental-quality-incentives/florida/environmental-quality-incentives

NRCS Payment Schedules

https://www.nrcs.usda.gov/getting-assistance/payment-schedules

FL EQUIP Payment Schedules

https://www.nrcs.usda.gov/sites/default/files/2022-11/Florida-EQIP-23-payment-rates.pdf

FL EQUIP Scenarios

https://www.nrcs.usda.gov/sites/default/files/2022-11/Florida-Scenarios-23-payment-rates.pdf

NRCS, Conservation Practice Standard, Cover Crop

https://efotg.sc.egov.usda.gov/api/CPSFile/23444/340_NC_CPS_Cover_Crop_2020

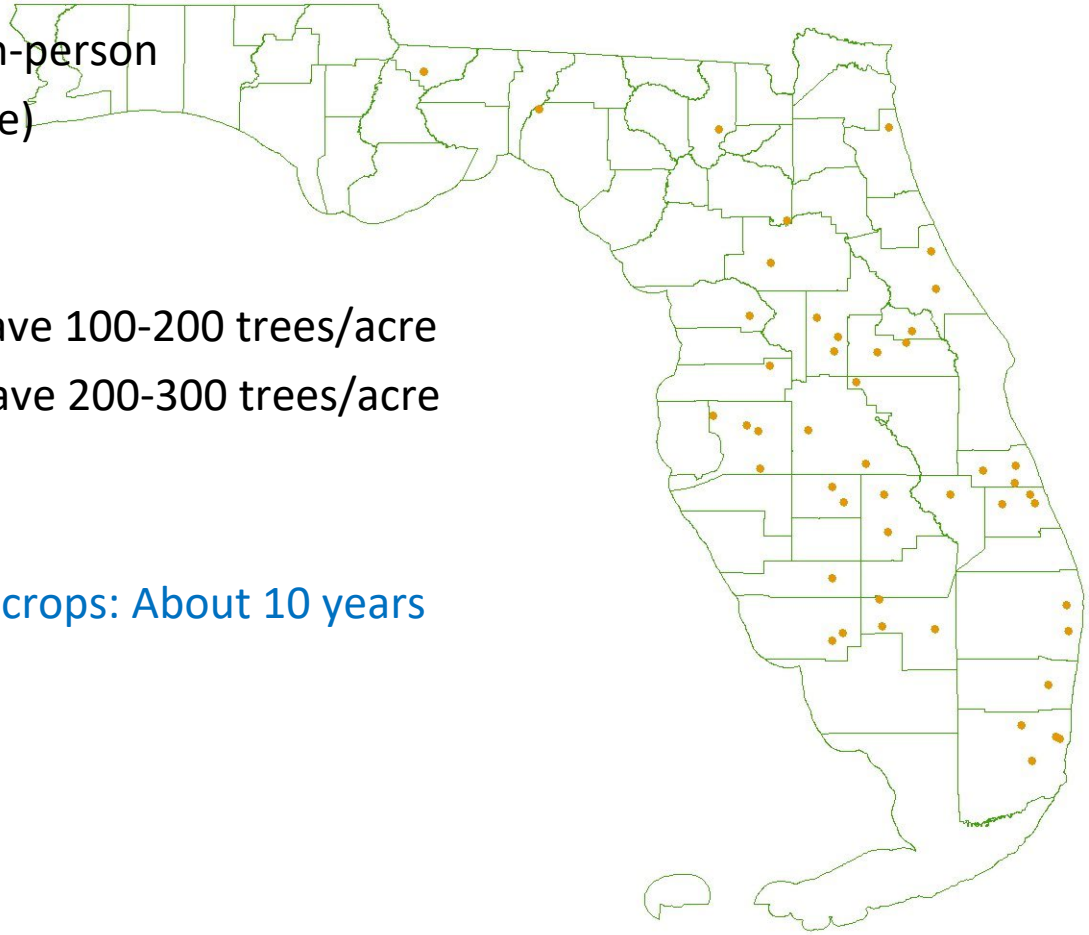
Steps for assistance

https://www.nrcs.usda.gov/sites/default/files/2022-09/how-to-get-assistance.pdf

Citrus Growers' Adoption and Willingness-to-Pay Survey

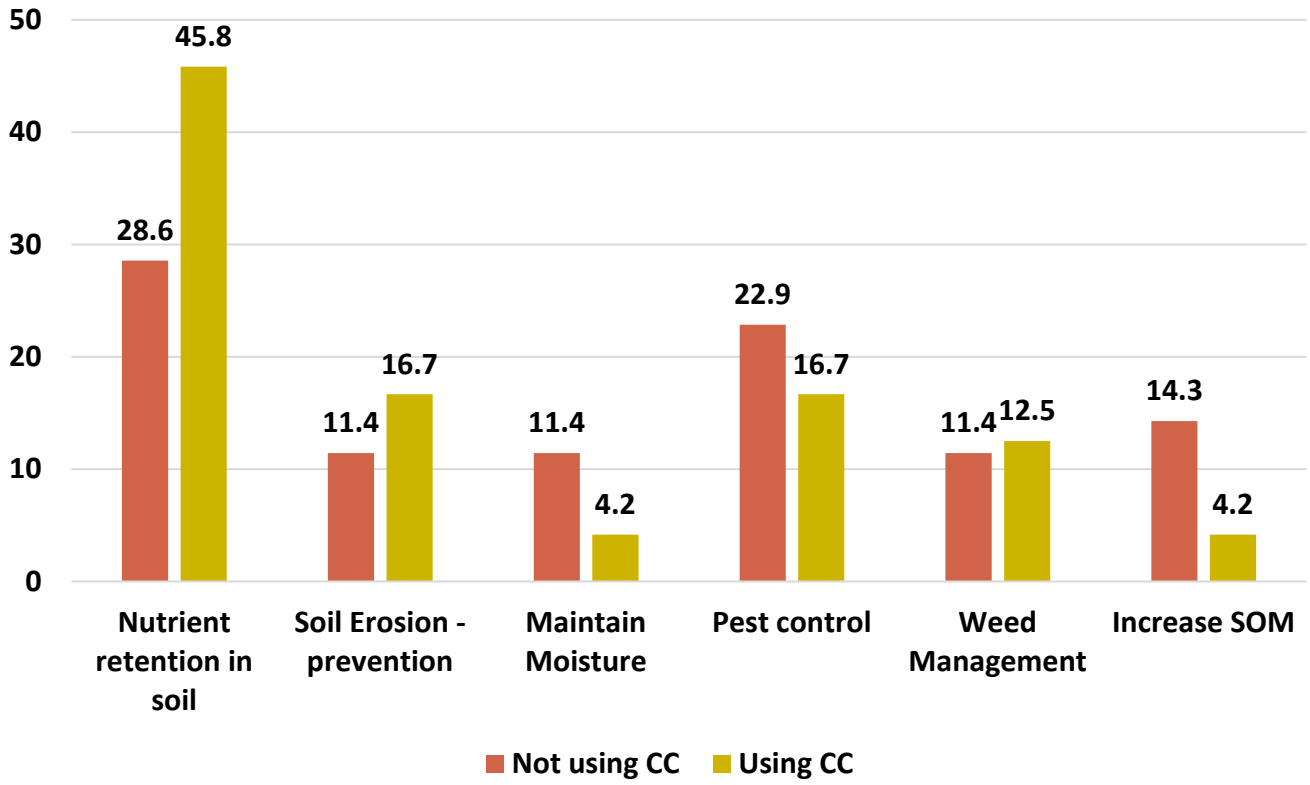
- Survey Method: Online and in-person
- Total N = 59 (1 acre and above)
- Total Acres: 179,018.5
- Average Acres: 3,064.2
- Average Tree Density: 54% have 100-200 trees/acre
  32% have 200-300 trees/acre

- ❑ Cover Crop Adoption: 41%
- ❑ Cover Crops Awareness: 47%
- ❑ Years experience using cover crops: About 10 years



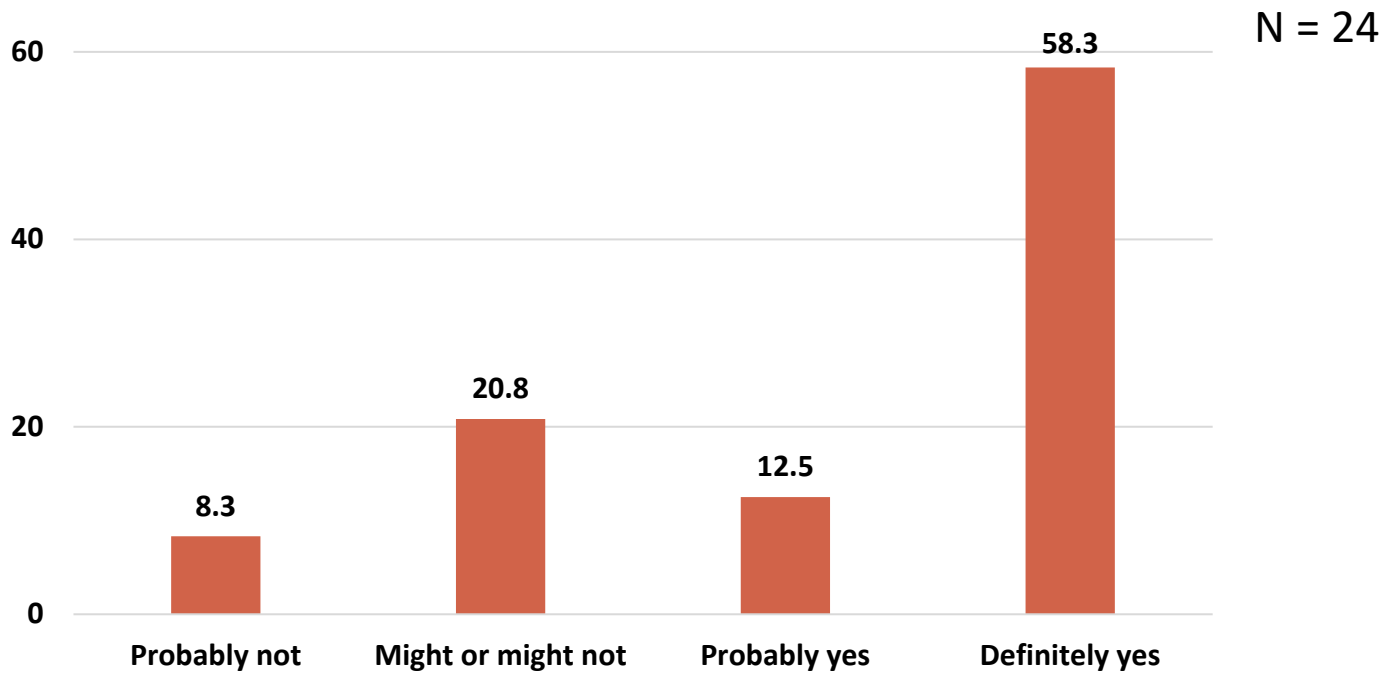
Grower Survey Insights: Cover Crops Attributes Ranked Number 1

Growers rank nutrient retention as the most useful cover crop attribute.



Grower Survey Insights: Observed Changes in Soil Health

58% of growers said they "definitely" saw changes to in soil health after using cover crops.



Grower Survey Insights: No-Till Planter Ownership

62.5% of those who use cover crops own a no-till planter.

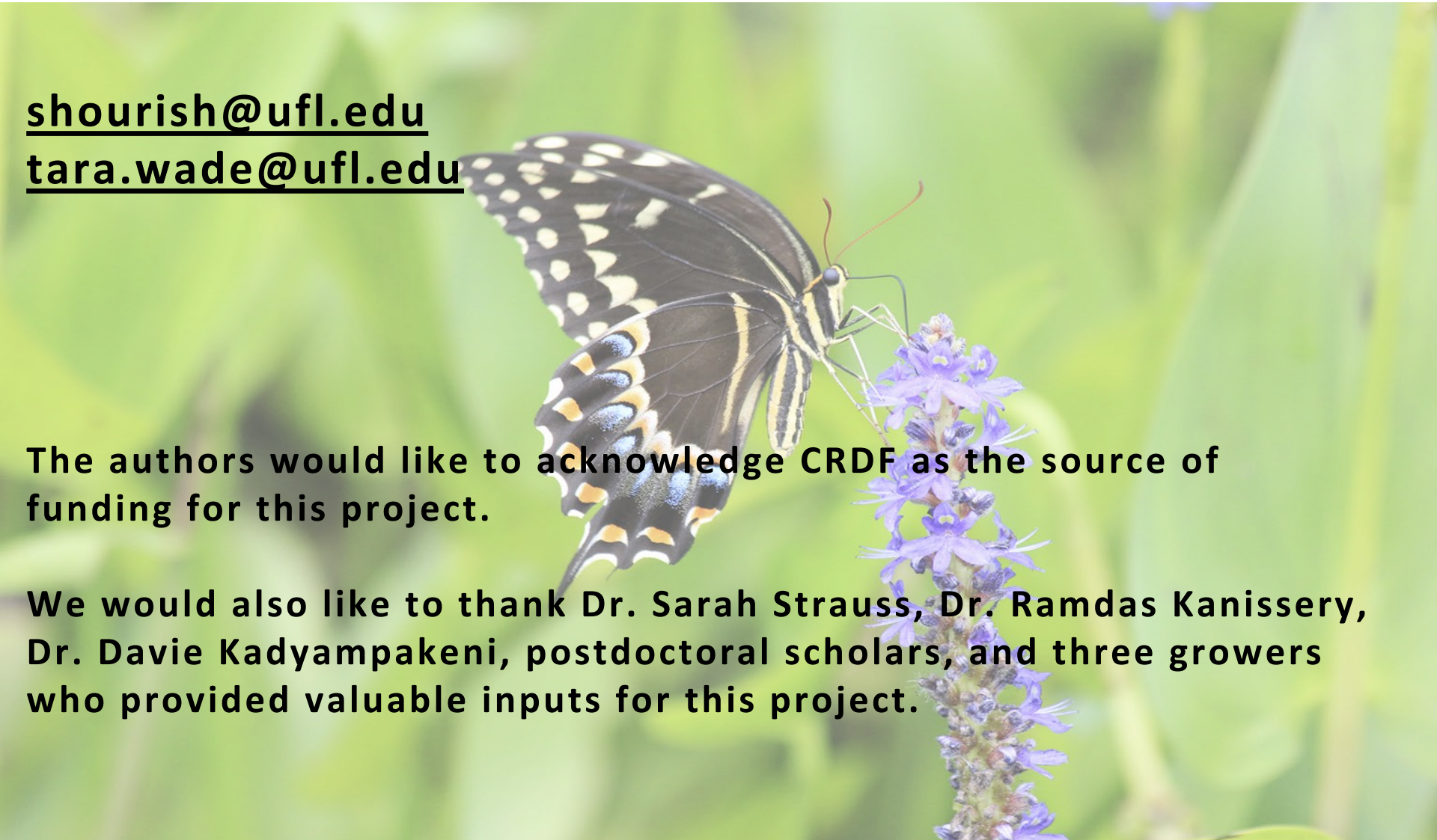
83% of those who do not use cover crops do not own a no-till planter.

No-till planter	Uses cover crops		
	No	Yes	Total
No	29	9	38
Yes	6	15	21
Total	35	24	59

Summary

- Cover crops can be a valuable addition to perennial fruit production systems.
- Cover crops can be profitable depending on savings and effective management practices. Savings accrue over time.
- Majority of cover crop adopters have seen improved soil health from cover crops.
- Cost-share programs from NRCS and FDACS are available to finance and assist growers in implement cover crop practices.

THANK YOU!
QUESTIONS?



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Citrus Production Costs

Costs	Applications/ Year	Materials Cost/Acre ($)	Total Cost/Acre ($)
Total cost of production (no cover crops)			1871.17
Cover crop cost items			
Seeds	2	99	198
Fuel costs	2	2	4
Labor	2	5.5	11
Drill	2	15	30
Other			5
Total cost of cover crops			248
Total production costs + cover crops costs			2119.17
Savings from cover crops (no mowing)			102.7
Net cost (Total production costs + cover crops costs - savings)			2016.47

- Cover crops are 11.7% of total production cost
  - 7.2% when savings are considered.
- Static 1-year analysis
- Longer (3–5 years) analysis could include savings from reduced herbicides and yield and quality improvements. The Excel Cover crops Support tool can be used to compare different scenarios.
- **Exact costs will depend on specific grove practices.**