



AGRICULTURE AND
NATURAL RESOURCE
ECONOMICS PROGRAM

Cover Crops in Citrus Production: Grower Costs, Benefits, and Willingness to Pay

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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 citrus production are largely unknown.

Adoption Benefits

- Improve soil microbial activity
- Increase SOC
- Increase total N
- Improve soil aggregation
- Increase soil productivity
- Reduce soil erosion
- Reduce leaching

Adoption Barriers

- 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 Citrus Row Middles

Are cover crops a feasible strategy to help manage trees with HLB symptoms?

Team effort:

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



Cover Crops in Citrus Row Middles: Cost-Benefit Analysis

- Estimate costs and savings from using cover crops in citrus
- Calculate breakeven prices for yield-quality scenarios

Cost of citrus production per acre per year:

- Baseline costs from IFAS budgets for a 10-year-old grove.
- Add additional costs of cover crops obtained from growers.
- Account for savings from using cover crops.
- Separate production costs for Valencia and non-Valencia oranges.

Calculate breakeven prices in \$/box and \$/lb solids:

- Prices calculated for yield (boxes/acre) and quality (lb solids/box) scenarios.
- Scenarios - Quartiles of yield from NASS and quality from FL Department of Citrus (FDOC).

Compare break-even prices to historical prices:

- FDOC Field Box Reports.
- \$/ box
- \$/ lb solids

Cover Crops Cost and Savings

Cover crops cost about \$220/acre/year.

Item	Cost	Description
Seed	\$80/acre/application	50-80 lb/acre for optimum germination
		Mix of legumes (Sunn Hemp & Cowpea) and non-legumes (Daikon Radish & Buckwheat)
		Average cost of the mix: \$1.225/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	\$20/acre/application	Daily rental: \$250
Other:	\$5/acre/application	Unplanned or unforeseen costs

Cover crops savings are about \$75.47/acre/year.

Short-term (1 year) savings from reduced mowing

Citrus Production Costs

Costs	Applications / Year	Material Cost/Acre (\$)	Total Cost/Acre (\$)
Total cost of production (no cover crops)			1,988.74
Additional Cost Items			
Cover Crop cost items			
Seeds	2	80	160
Fuel costs	2	2	4
Labor	2	5.5	11
Drill	2	20	40
Other			5
Total Cover Crops Costs			220
Savings from Cover Crops			
Mowing			75.47
Net cost (Total Costs + Cover Crops costs - Savings)			2,133.27

- Cover crops are 6.77% of total production cost
 - 7.26% increase from the baseline costs
- Static 1-year analysis
- Longer (3–5 years) analysis could include savings from reduced herbicides and yield and quality improvements.
- **Exact costs will depend on specific grove practices.**

Breakeven Prices for Valencia Oranges

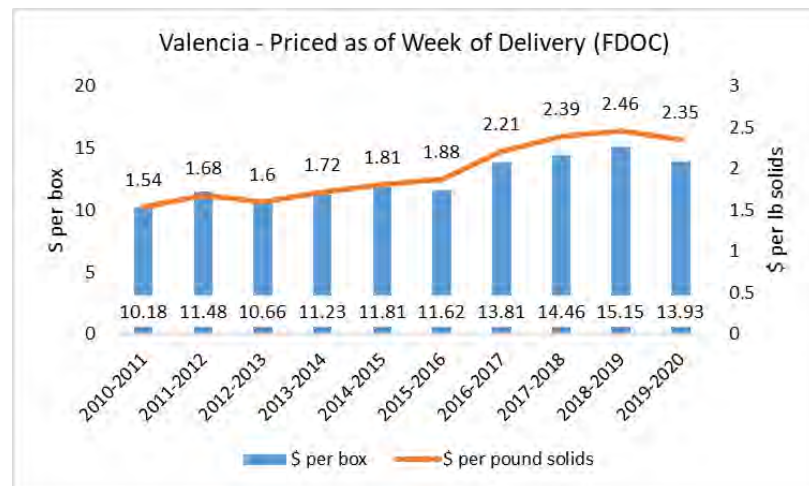
At 200 boxes/acre cover crops can be profitable in Valencia orange production.

Valencia Oranges

Yield quartiles	Min	Quartile 1	Median	Quartile 3	Max		
Yield (boxes/acre)	113.1	172.0	200.4	250.0	285.4	Quality quartiles	
Total Delivered-in Cost (\$/acre)	2523.5	2726.5	2824.7	2995.8	3117.8		
	Break-even prices				lb solids/box		
Delivered-in Price (\$/box)	22.31	15.86	14.09	11.98	10.93		
	3.78	2.69	2.39	2.03	1.85	5.90	Min
	3.68	2.62	2.33	1.98	1.80	6.06	Quartile 1
Delivered-in Price (\$/lb solids)	3.53	2.51	2.23	1.90	1.73	6.32	Median
	3.39	2.41	2.14	1.82	1.66	6.59	Quartile 3
	3.25	2.31	2.05	1.75	1.59	6.86	Max

Values are comparable to recent years:

- At 200 boxes/acre and 6.06 lb solids/box the breakeven price of \$2.33/lb solids is less than 2017-19 prices.
- 200 boxes/acre is comparable to pre-Irma yields.
- 6.06 lb/solids/box is comparable to 2018-19 (6.11 lb/solid/box).

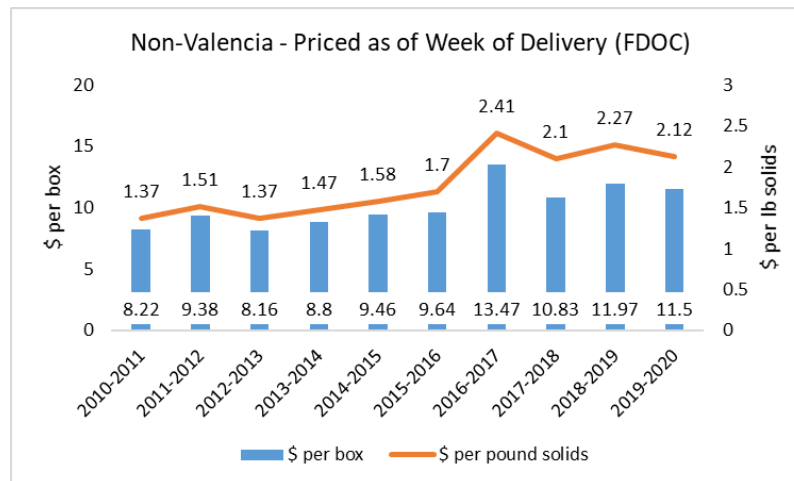


Breakeven Prices for Non-Valencia Oranges

Cover crops are less profitable in non-Valencia oranges than Valencia oranges.

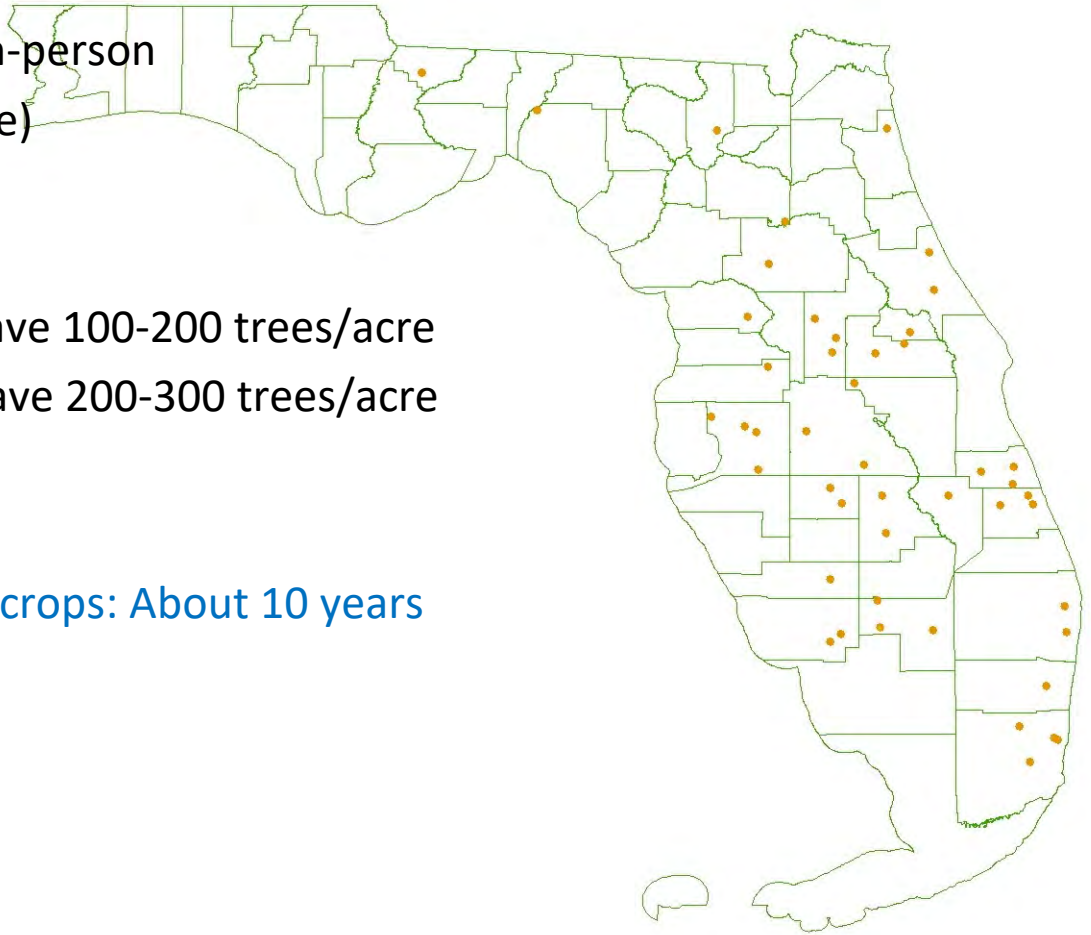
Non-Valencia/Early and Mid-Season Oranges

Yield quartiles	Min	Quartile 1	Median	Quartile 3	Max	Quality quartiles	
Yield (boxes/acre)	109.2	184.7	211.8	307.4	351.3		
Total Delivered-in Cost (\$/acre)	2497.9	2750.1	2840.6	3160.0	3306.6		
Break-even prices						lb solids/box	Quartile
Delivered-in Price (\$/box)	22.88	14.89	13.41	10.28	9.41		
	4.44	2.89	2.60	2.00	1.83	5.15	Min
	4.19	2.73	2.46	1.88	1.72	5.46	Quartile 1
	4.00	2.60	2.34	1.80	1.64	5.73	Median
Delivered-in Price (\$/lb solids)	3.83	2.49	2.24	1.72	1.57	5.98	Quartile 3
	3.68	2.40	2.16	1.66	1.52	6.21	Max



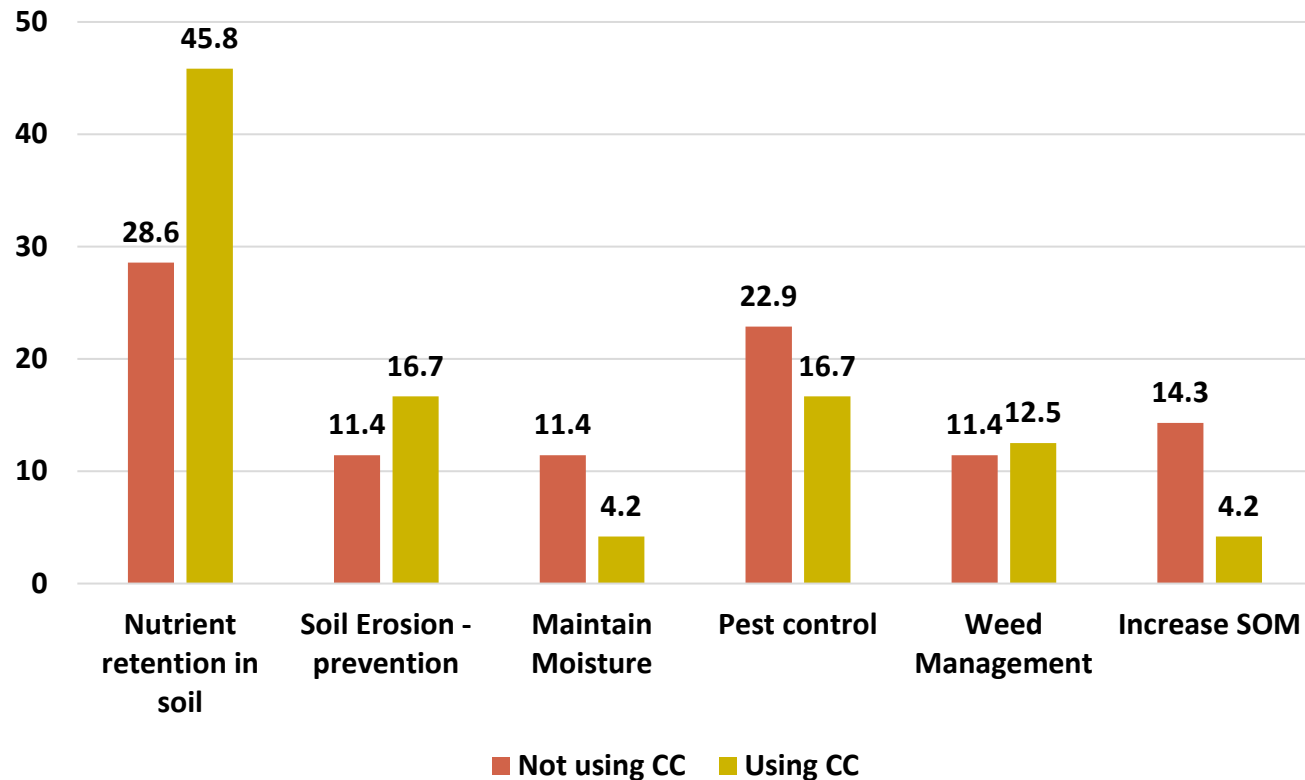
Grower Adoption and Willingness-to-Pay Survey

- 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: No-Till Planter Ownership

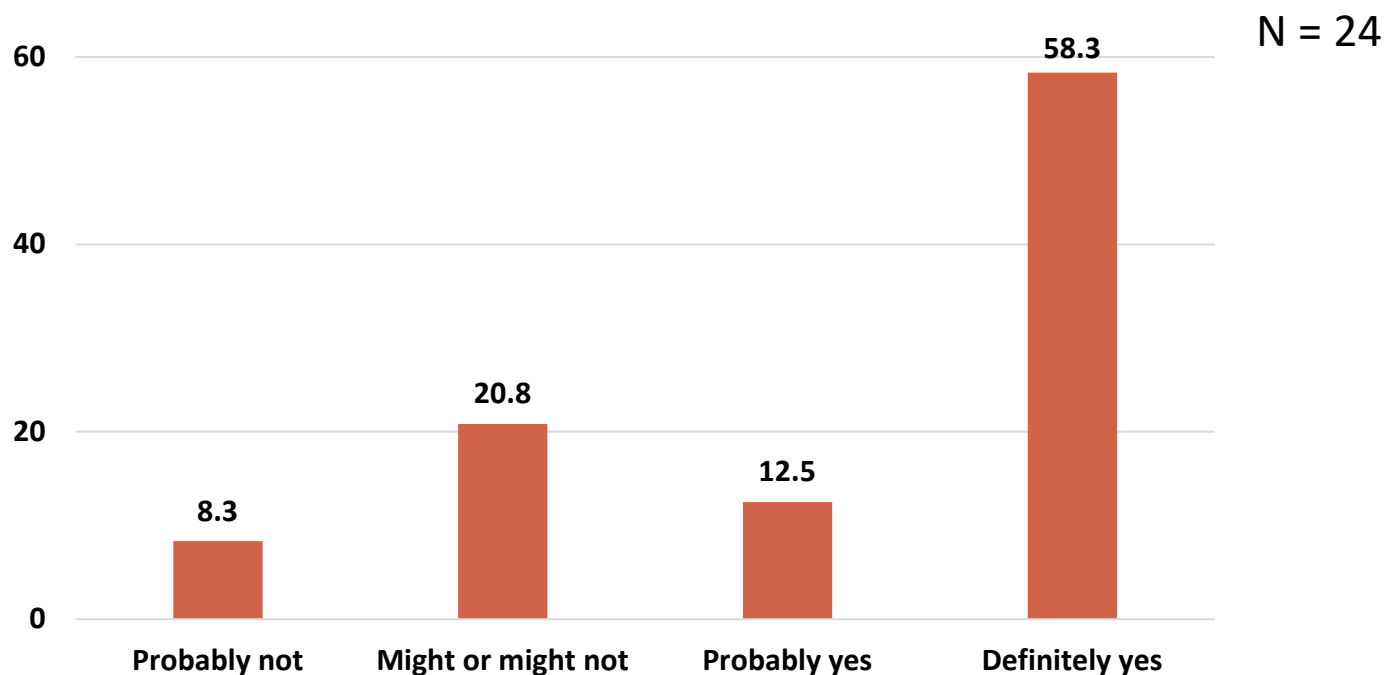
62.5% of those who use cover crops own a no-till planter.

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

Own a no till planter?	Uses cover crops?		
	No	Yes	Total
No	29	9	38
Yes	6	15	21
Total	35	24	59

Grower Survey Insights: Observed Changes in Soil Health

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



Growers' Willingness to Pay for Cover Crops

Growers' WTP estimate for cover crops range from \$416-\$537 per acre.

- Contingent Valuation method for estimating WTP (Carson and Hanemann, 2005; Hanemann and Kanninen, 1996).
- Double bounded dichotomous choice approach:
 - Part 1: The respondent is asked a simple dichotomous choice question
The respondent is asked whether they are willing to pay a randomly generated (middle) price.
 - Part 2: Respondent is asked a follow-up question contingent upon the response to earlier question.

Median and mean WTP's with Normal dist based 95% CI				
	Median WTP	95% CI	Mean WTP	95% CI
Main specification	400.57*** [48.68]	[305.16 495.98]	509.51*** [27.89]	[454.82 564.19]
With geospatial variables	449.49*** [30.6]	[389.51 509.46]	476.27*** [30.76]	[415.98 536.56]

Summary

- Cover crops can be profitable in Valencia oranges with pre-Irma yields and quality comparable to recent years.
- Cover crops are less likely to be profitable in non-Valencia oranges.
- Survey results likely include selection bias.
- Our willingness-to-pay estimates are greater than cover crops costs.



THANK YOU!
QUESTIONS?

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