

CITRUS UNDER PROTECTIVE SCREEN: GRAPEFRUIT YIELD AND ECONOMICS AFTER FOUR YEARS

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INTRODUCTION & OBJECTIVES

- Grapefruit production in Florida has been drastically reduced by HLB: 40.8 million boxes in 2003/04 to 5.4 million boxes in 2018/19 (**87% reduction**) www.nass.usda.gov
- Grow Citrus Under Protective Screen (CUPS) to exclude the Asian Citrus Psyllid and completely block CLas transmission
- Produce asymptomatic, low-seeded, premium grade fresh fruit in HLB-endemic Florida by using CUPS
- CUPS is a complex integrated system with a high establishment cost – citrus grown must be high yielding, high quality, with potential to generate high fruit revenue
- **Hypothesis:** hydroponically-grown grapefruit in containers spaced at high densities can boost sustainable fresh fruit production for a highly profitable CUPS enterprise

CUPS facility at the CREC

1.3 acres (58,000 sq. feet)




CREC CUPS 2018/19 season for two main varieties: 4th year highlights

- ‘Ray Ruby’ grapefruit: December 5, 2018, average 892 boxes/acre, 100% pack-out
- ‘Honey’ murcott: January 23, 2019 average 529 boxes/acre, 100% pack-out

‘Ray Ruby’ grapefruit
426 cartons packed (0.24 acres)
70% US #1
\$25.89 /box net fruit revenue
(\$23,094 /acre /year)

‘Honey’ murcott
326 cartons packed (0.34 acres)
90% US #1
\$42.48 /box net fruit revenue
(\$22,472 /acre /year)



Today we will focus
on ‘Ray Ruby’ grapefruit
grown in containers
with hydroponics

HIGHLIGHTS AFTER 4 HARVESTS:

- Grapefruit thrives in the CUPS, and started production in year 1
- After 5 years, there are no psyllids and no HLB in the CUPS
- Both fruit quantity and quality are high, resulting in high net fruit revenue
- CUPS allows growing a very HLB-susceptible variety (grapefruit) in HLB-endemic conditions, while retaining non-GMO status of the marketed fruit
- Demand for CUPS-grown Florida grapefruit can be high due to the great taste of “fresh-from-Florida” fruit and the 87% reduction in supply from traditional field-grown sources

METHODS

- Citrus Under Protective Screen (CUPS) constructed with 50-mesh HDPE screen and 14' (4.3 m) high roof
- Hydroponically grown 'Ray Ruby' grapefruit in pots, drip fertigation, 871 trees per acre
- Annual hedging, no topping required yet



RESULTS

'Ray Ruby' grapefruit @ 2.5 years, 35 L pots, 871 trees /acre:



January 2018: 'Ray Ruby' grapefruit @ 3.5 years



October 2018: 'Ray Ruby' grapefruit @ 4.1 years



'Ray Ruby' grapefruit @ 4.25 years, 20 L pots, 871 trees /acre:



Fruit harvesting from CUPS at 4.25 years (December 2018)



Fruit harvesting from CUPS at 4.25 years



Fruit harvesting from CUPS at 4.25 years



Fruit harvesting from CUPS at 4.25 years



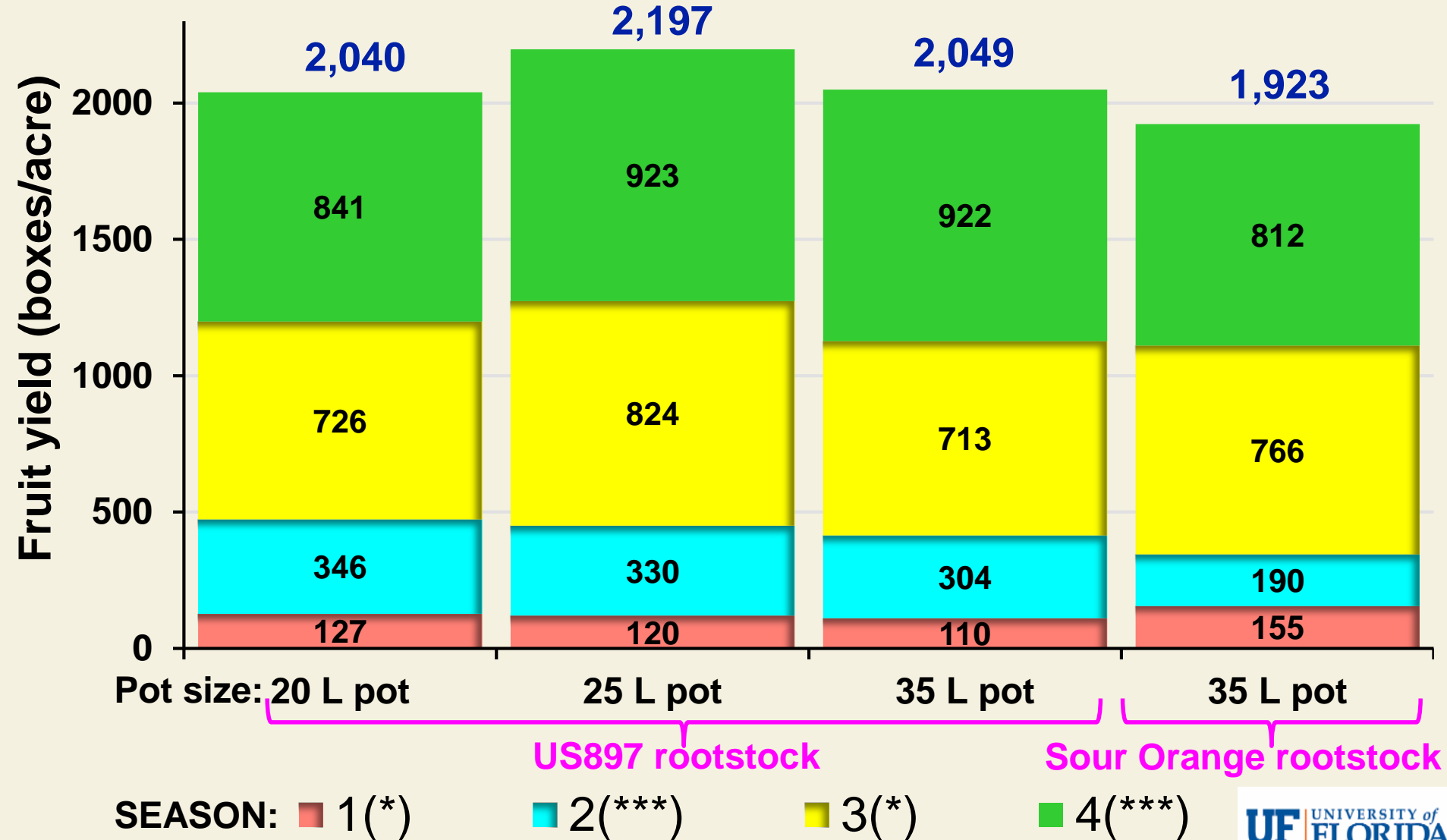
Florida

Classic

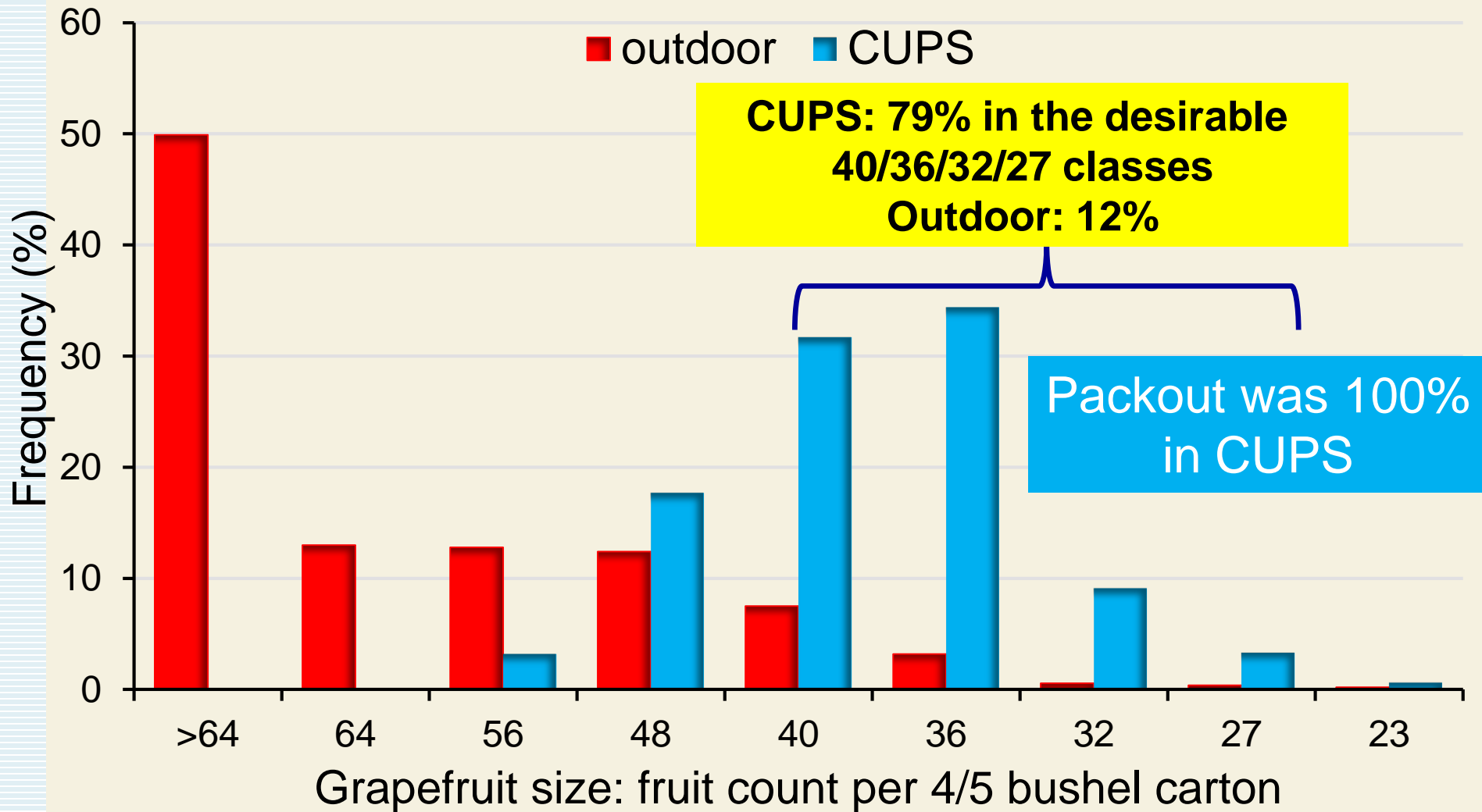


'Ray Ruby' grapefruit yields in CUPS: (US897, Sour Orange rootstock, 871 trees/acre)

Cumulative yields (divide boxes/acre by 10 to get approx. tonnes/ha)



CREC 'Ray Ruby' fruit size: 2018 plot harvest



CONCLUSIONS

- CUPS is an attractive non-GMO fresh fruit solution to HLB
- Economic viability of CUPS technology can be maximized by early high yields of premium grade fruit & high pack-out, 100%
- Ariel Singerman will elaborate in the following slides
- Hydroponic cultivation of grapefruit in containers is an attractive option for boosting planting densities, early yields and quality of fresh fruit in CUPS, but is more complicated
- With hydroponics, an average 892 boxes /acre of grapefruit were grown with 205 lb /acre nitrogen fertilizer. The conversion efficiency of **4.35 boxes /lb N is high** (370 kg fruit /kg N)
- Notable disadvantages of hydroponic citrus include higher establishment costs, more management, trellises required for support, and more difficult weed control. However robotic fruit harvesting is more feasible with trellised trees

**Other systems? 'W murcott' in commercial CUPS @ 2.5 years:
KLM Farms, where the 2018 CUPS field day was held**



- 'W murcott' in commercial CUPS @ 2.5 years
- Trees are planted in the ground, not in pots
- 'W murcott' fruit is **seedless** in CUPS



FINAL

✓ Fresh citrus in CUPS > \$20,000 /acre /year net

THOUGHT: • Try papayas in CUPS: > \$70,000 /acre /year?

Yield potential:

160 lb /tree/year, 871 trees/acre

\$70,000 /acre @\$0.5 /lb



Thank you for your support

Grower stakeholders & cooperators

UF/IFAS Extension Agents

Laboratory and Support Staff

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FDACS SCBG 2014-17

UF/IFAS Citrus Initiative 2013-18

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NEXT: Economic analysis of 4 years and projections: A. Singerman

IFAS Research

Florida Agricultural Experiment Station

(Mark McLellan,
previous Dean for
Research)



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Updated Economic Assessment of CUPS

Citrus Expo
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Ft. Myers, FL

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Costs of Establishment and Production

Assumptions

- Land is already owned. Spacing is 5 x 10 ft. (871 trees per acre)

- Investment for Fresh Ruby Grapefruit planted in pots

- Yields by year (boxes/acre):

Year									
1	2	3	4	5	6	7	8	9	10
145	287	797	892	892	892	892	892	892	892

- Assumed Packout: 100%

- Production costs are assumed to be constant from year 4 through year 10

- For most Machinery and Irrigation: assuming a 20-acre operation

- Annual cost of insuring structure per acre: \$2,200

- Real increase in land value per acre after 10 years: \$1,245

Caveats

- Production and input data available for first 4 years only

- Use of retail chemical prices (growers may get up to 20% discount for large volumes)

- Amount invested in Machinery and Irrigation will depend on whether it is a new operation or switching from another crop

Investment in Machinery and Fixed Costs Calculations

Item	Purchase Price
Sprayer, herbicide*	290
Sprayer, air-blast*	475
Wagon (3)*	171
Tractor (40-50 HP)*	1,956
Hedger handheld (1 unit)	396
Golf Cart *	350
Hand-sprayer (1 units)	250
* based on a 20-acre operation	
Total Investment per acre	\$3,888
Annual Fixed Costs per Acre	\$688.87

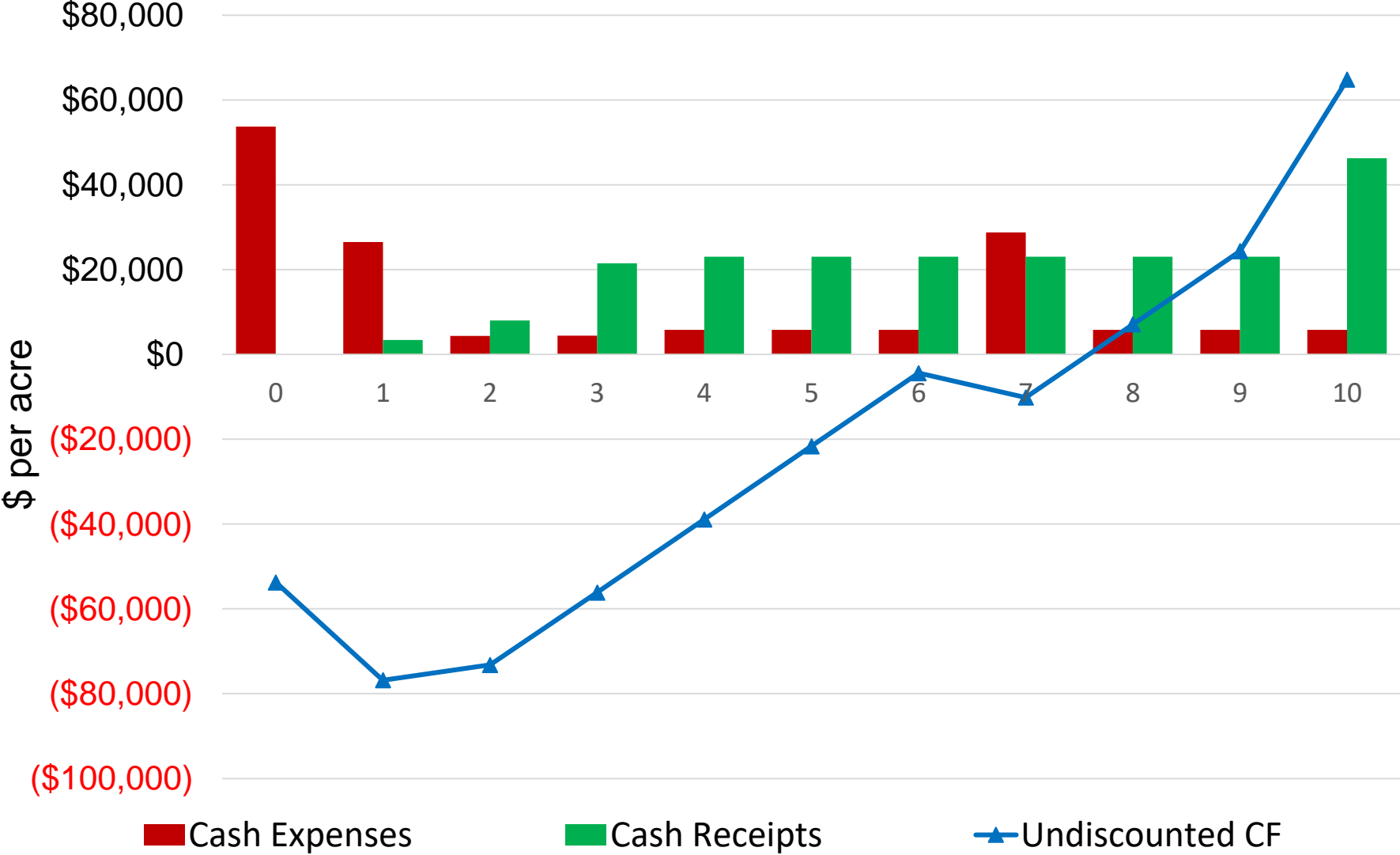
Investment in Irrigation and Fixed Costs Calculations

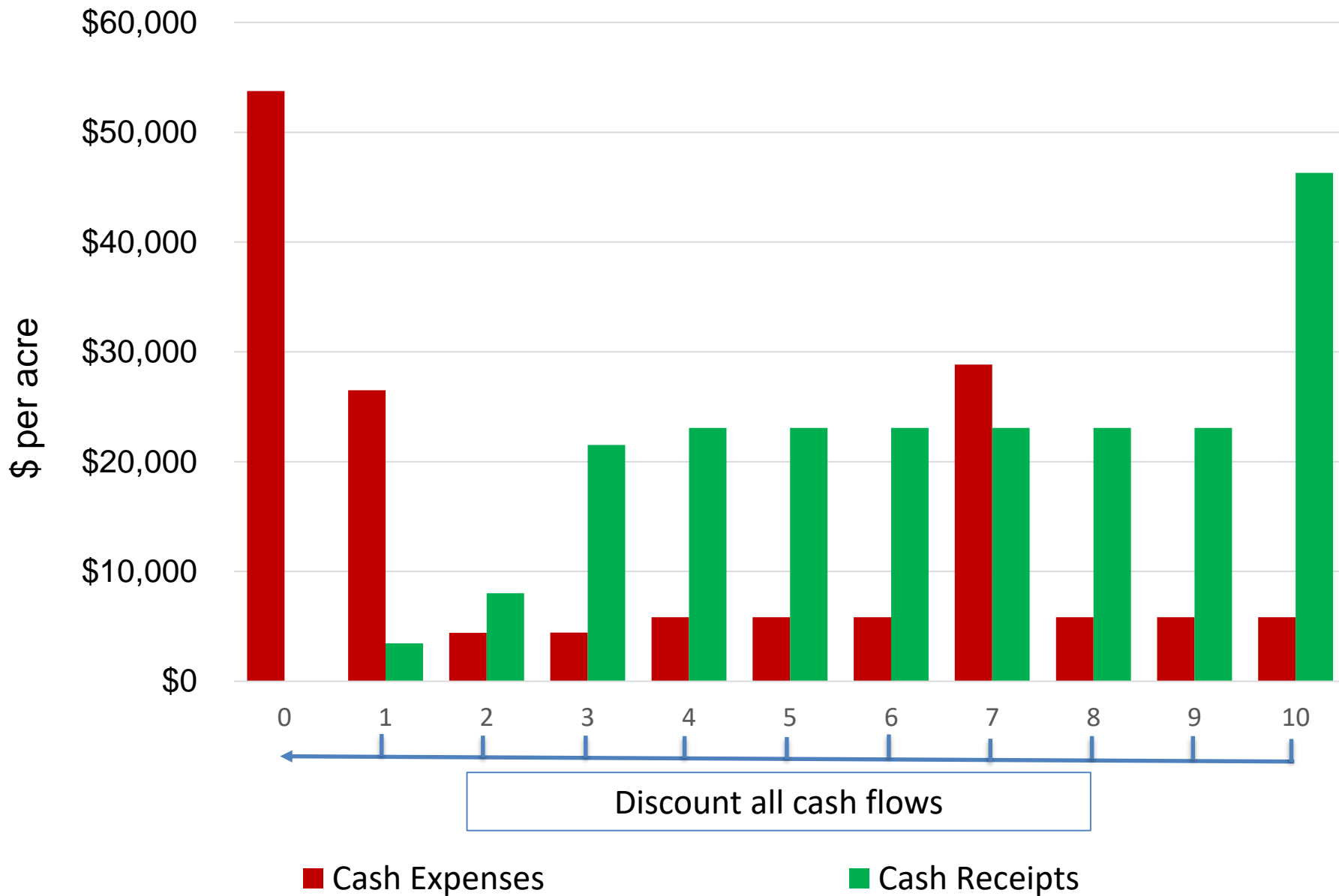
Item	Price (\$)
Well 8" *	1,575
Pump & Motor & Pump House*	2,048
Pump Discharge & Filter Station*	750
Irrigation	2,000
Injection System*	500
* based on a 20-acre operation	
Total Investment per acre	\$6,873
Annual Fixed Costs	\$885

Enterprise Budget

Item	Applications / Year	Rate application	Unit	Price / Unit	Total Cost per acre (\$)
Variable Costs					
Insecticides					
Admire Pro	3	15	oz	1.33	\$59.85
Actara	1	4	oz	3.55	\$14.20
Agriflex	2	6.60	oz	4.50	\$59.40
Danitol 2.4 EC	1	21.33	oz	1.35	\$28.83
Dibrom	1	1.00	pt	15.59	\$15.59
Entrust	3	10.00	oz	12.34	\$370.27
Induce	3	4.30	oz	0.21	\$2.68
Mustang Maxx	1	4.20	oz	1.12	\$4.72
Nexter	2	6.60	oz	4.05	\$53.46
Pyronil	14	4.00	oz	2.83	\$158.47
435 Petroleum Oil	22	1.00	gal	4.25	\$93.50
Total Insecticides					\$860.97
Fungicides					
Headline	3	10.00	oz	3.13	\$93.75
Headline	1	12.00	oz	3.13	\$37.50
K-Phite	17	2.00	qt	6.75	\$229.50
Magnabon	16	10.00	oz	0.38	\$60.00
Ridomil	1	22.00	oz	6.46	\$142.08
Total Fungicides					\$562.83

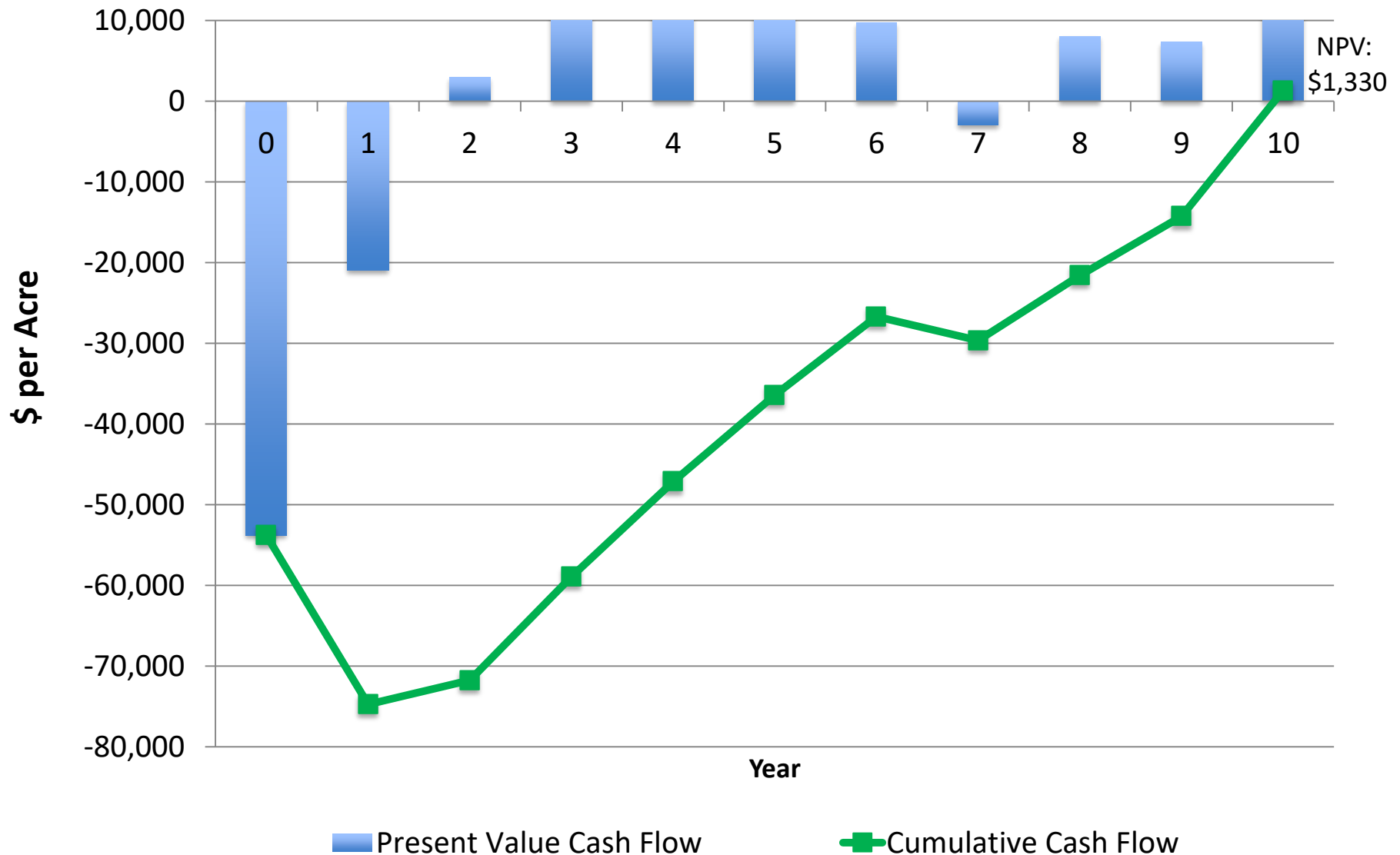
Cash Receipts, Expenses, and Undiscounted Cumulative Cash Flows by Year





Net Present Value:

Self-insured; No increase land value; Discount rate: 10%



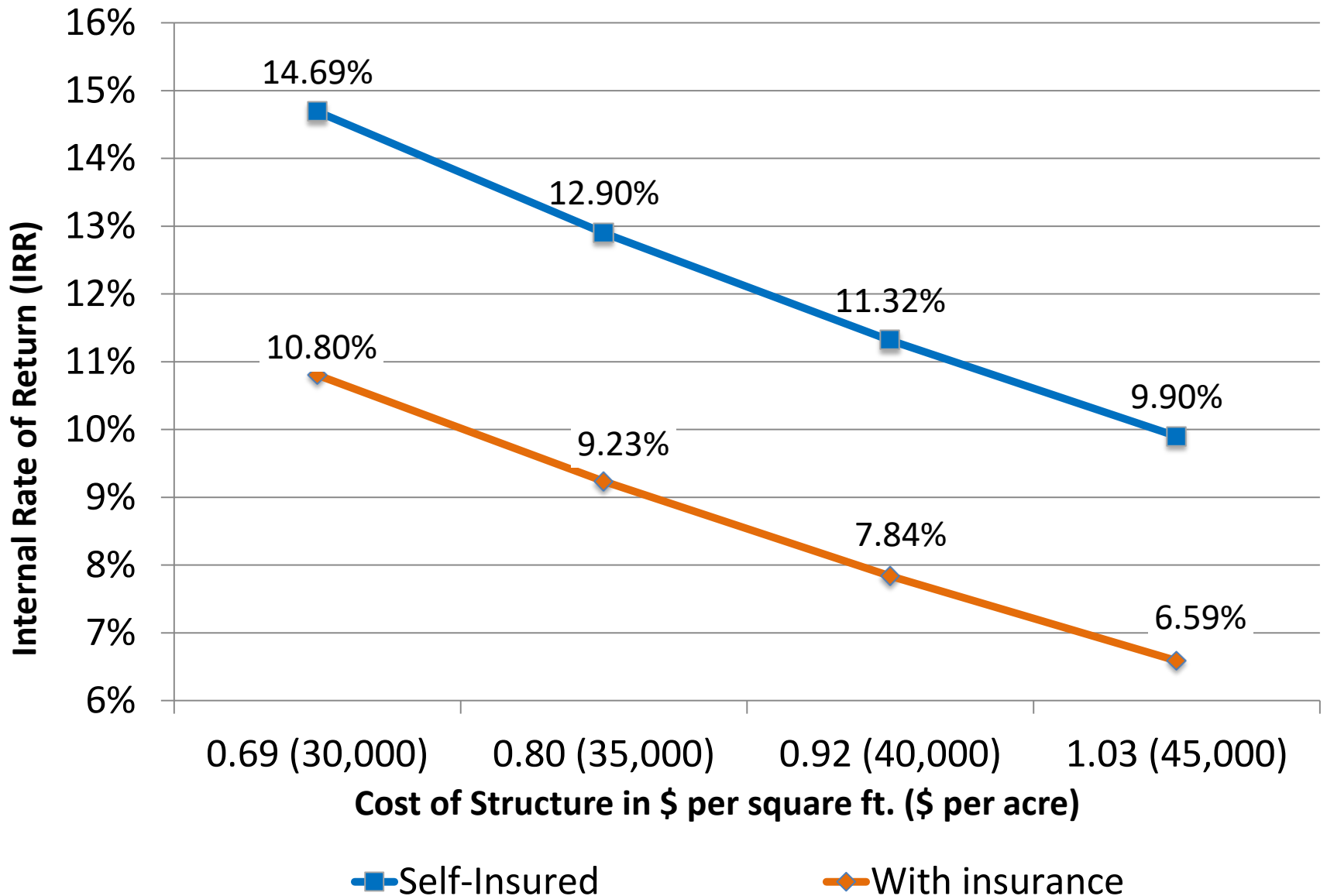
Profitability Analysis

The Internal Rate of Return (IRR) is the actual rate of return on the investment

	IRR
Baseline: self-insured; no increase land value	10.33%
With increase in land value	10.45%
With increase in land value and insurance for structure	7.07%

Internal Rate of Return for Different Structure Cost

With residual land value



Thank you for attention

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