

Question those assumptions: *Success with modern orchard systems demands attention to the details*

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NEW ENGLAND VEGETABLE AND FRUIT MEETINGS
DECEMBER 14, 2022

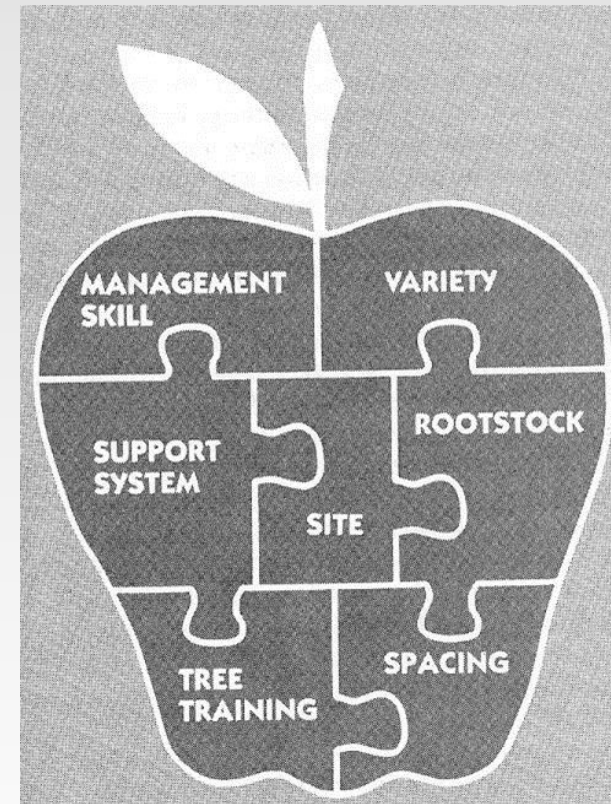
Evolution of Orchard Layout and Design

High Density Systems evolved immediately with advent of dwarfing stocks

Tree densities

- 50/ acre 1920
- 200/acre 1950
- 400/acre 1970
- 1000+/acre 1990
- 2000+ /acre?.....

How do you put it together?





‘Standard’ Orchards



Semidwarf orchard



Iconic, traditional orchards



Increased intensification



Net present value

- Method used for comparing two investment options over time

- ‘Time value of money’

@6%, ‘Discount rate’ =

0.940 Year 2 - 0.309 Year 20

- Considered different production scenarios

Net Present Value (NPV)

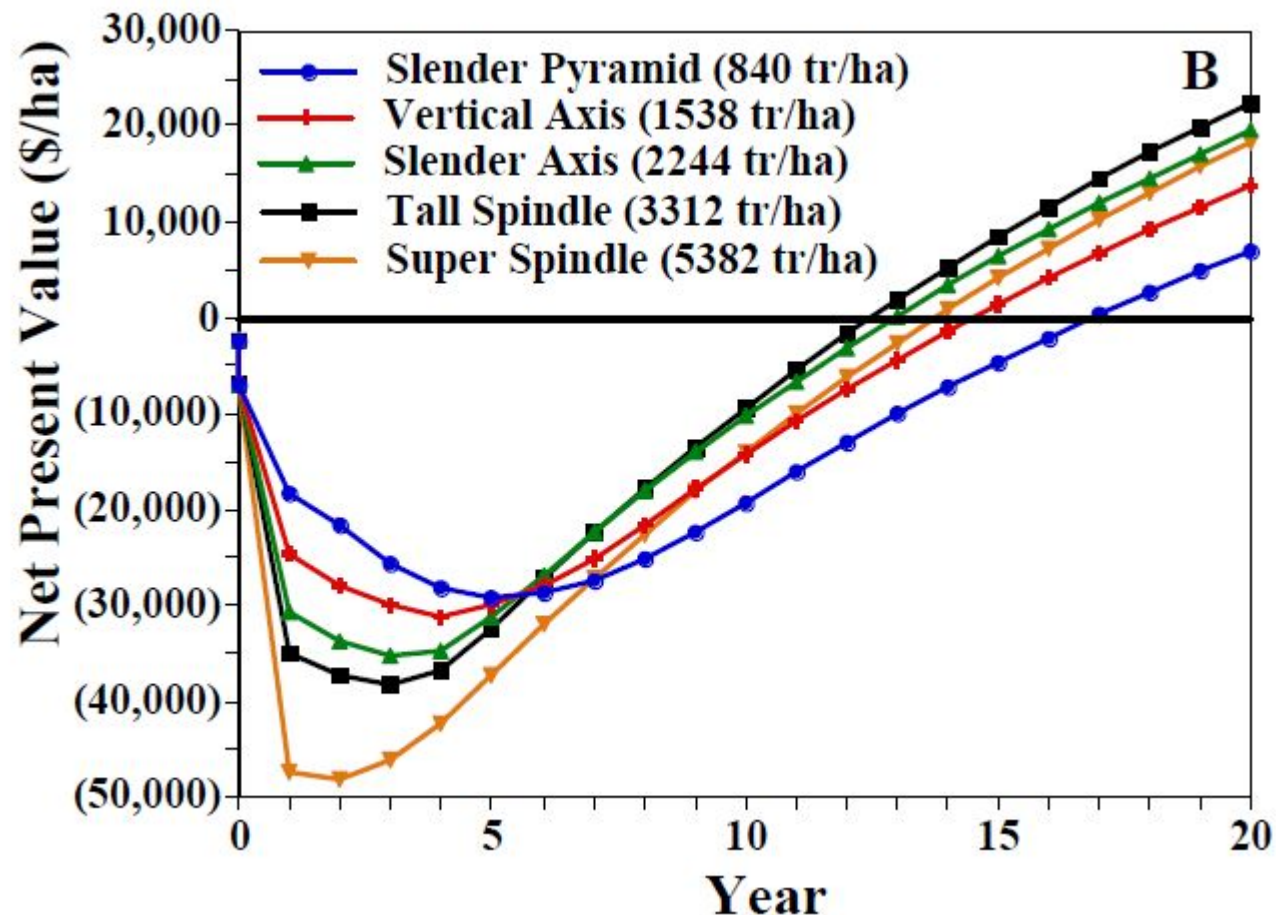
$$NPV = \sum_{t=1}^T \frac{\text{Cash Flow}_t}{(1+i)^t} - \text{Initial Cash Investment}$$

t = Cash Flow Period
i = Interest Rate Assumption

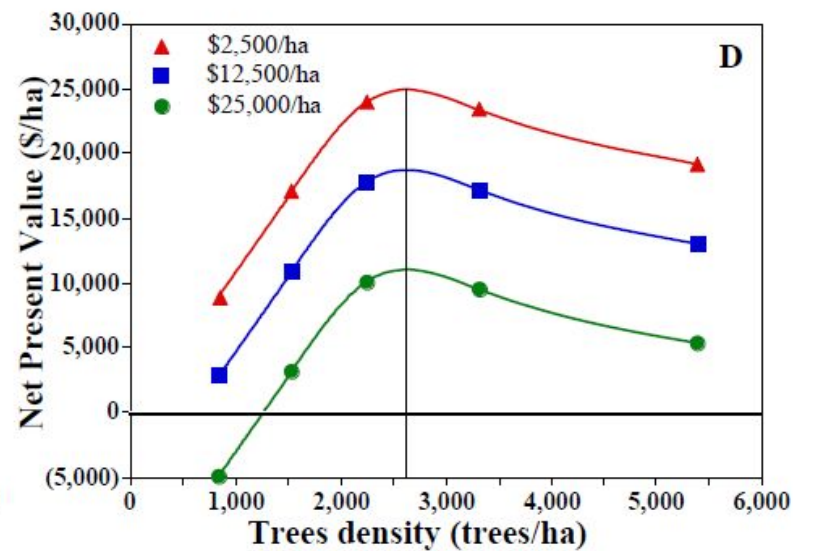
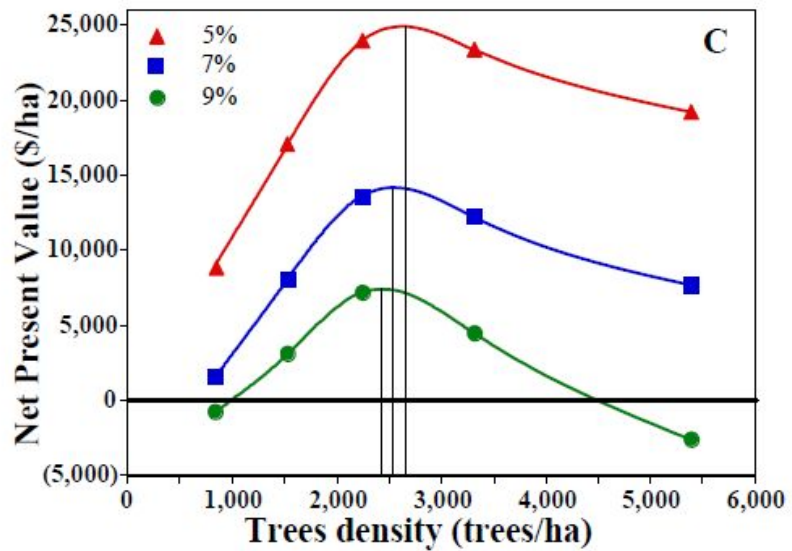
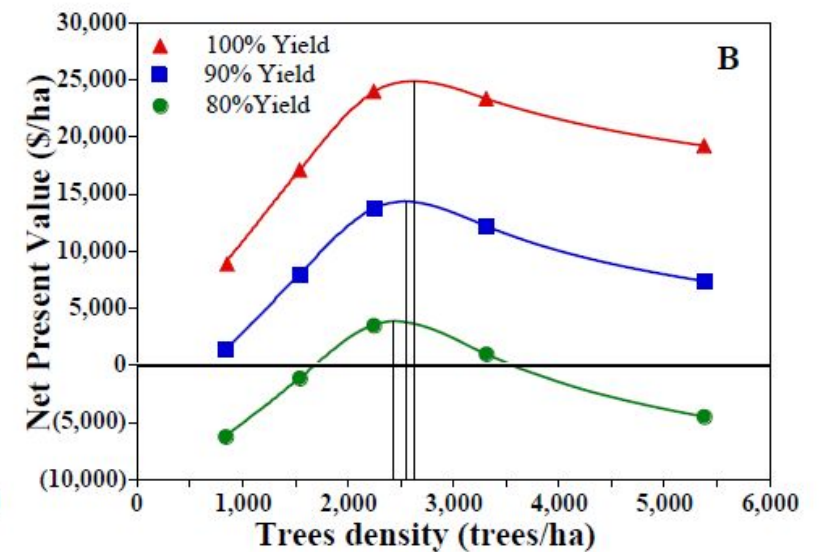
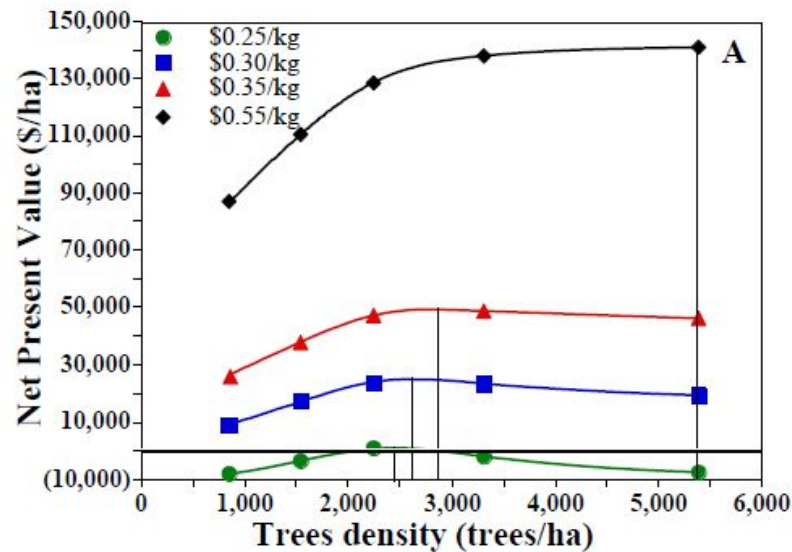
<http://www.mysmp.com/fundamental-analysis/net-present-value.html>

What convinced us all...

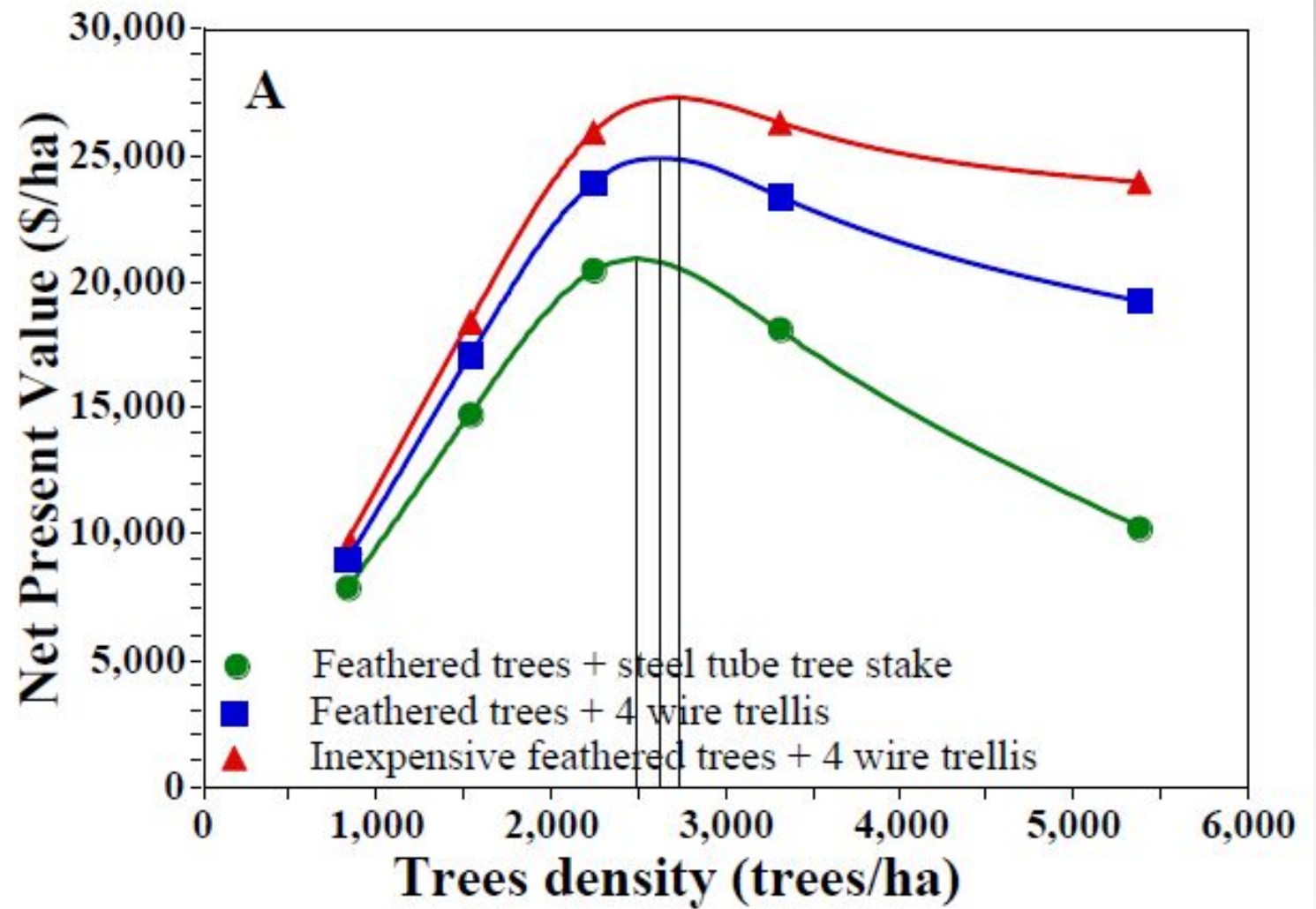
Robinson, T., DeMarree, A., & Hoying, S. (2007). An economic comparison of five high density apple planting systems. *Acta Hort*, 732, 481-489.



Robinson, T., DeMarree, A., & Hoying, S. (2007). An economic comparison of five high density apple planting systems. *Acta Hort*, 732, 481-489.



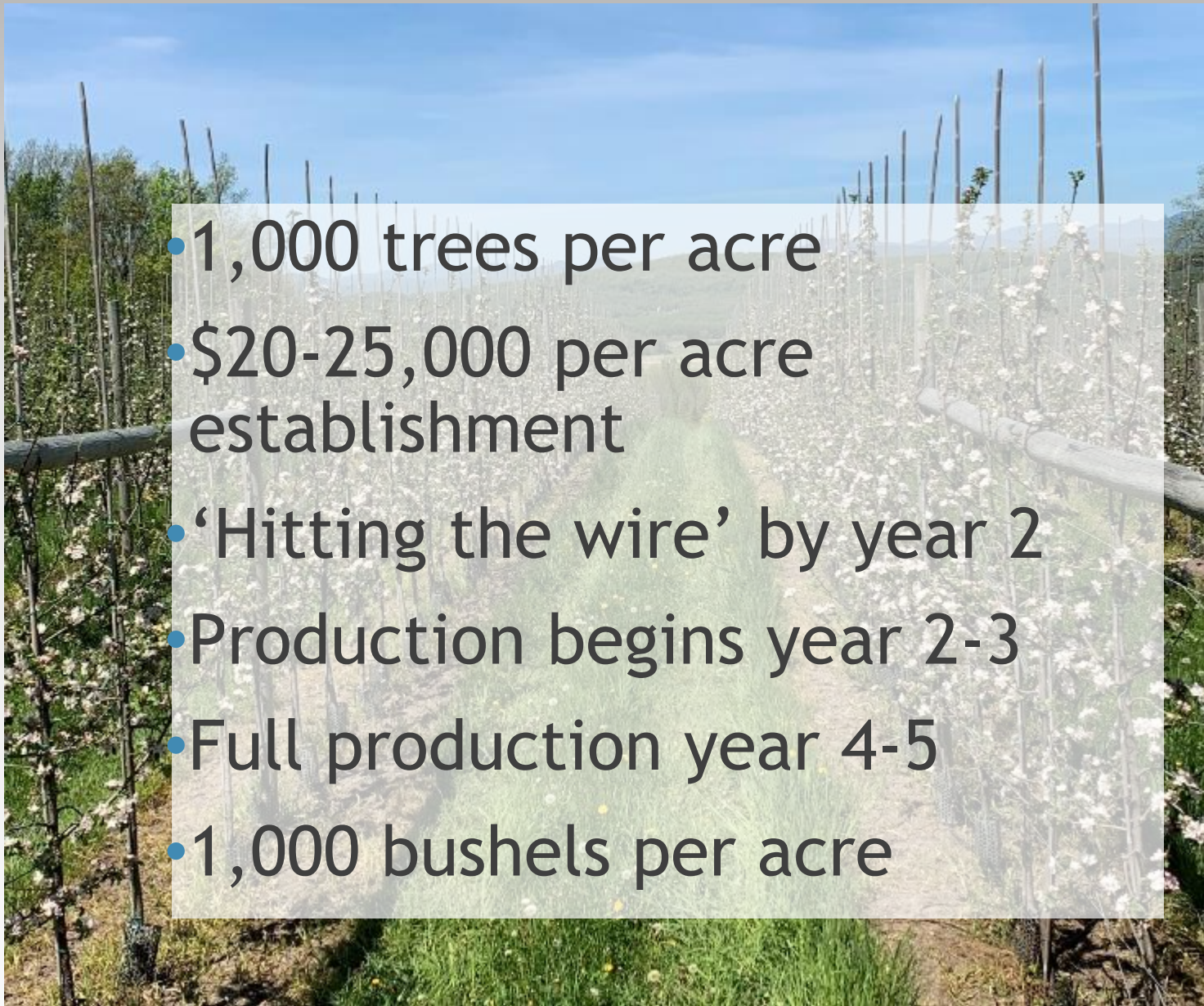
Robinson, T., DeMarree, A., & Hoying, S. (2007). An economic comparison of five high density apple planting systems. *Acta Hort*, 732, 481-489.



Modern
conventional
wisdom of
tall spindle
orchards:

*The
assumptions*

- 1,000 trees per acre
- \$20-25,000 per acre establishment
- ‘Hitting the wire’ by year 2
- Production begins year 2-3
- Full production year 4-5
- 1,000 bushels per acre

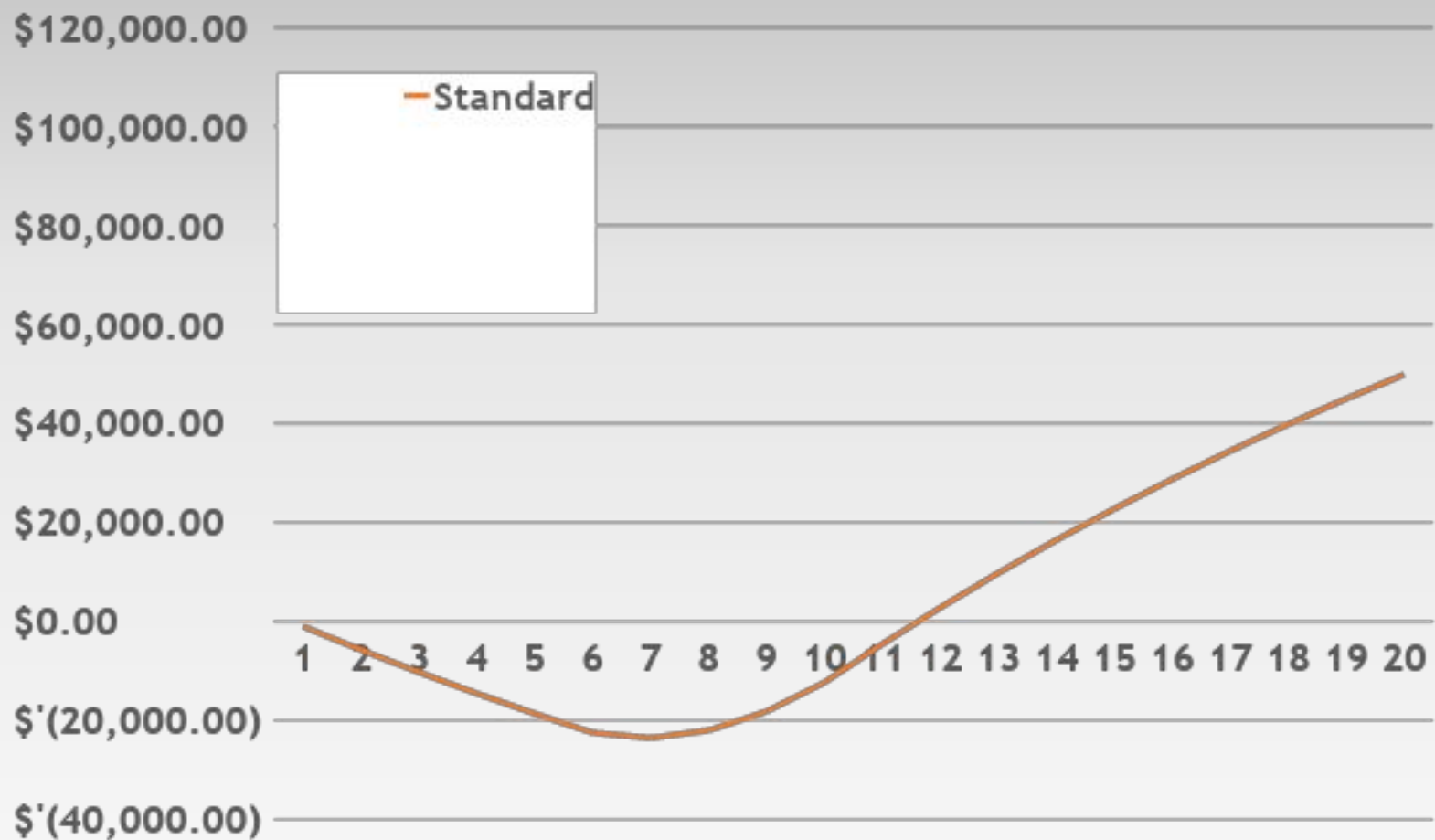


TB's NPV calculations

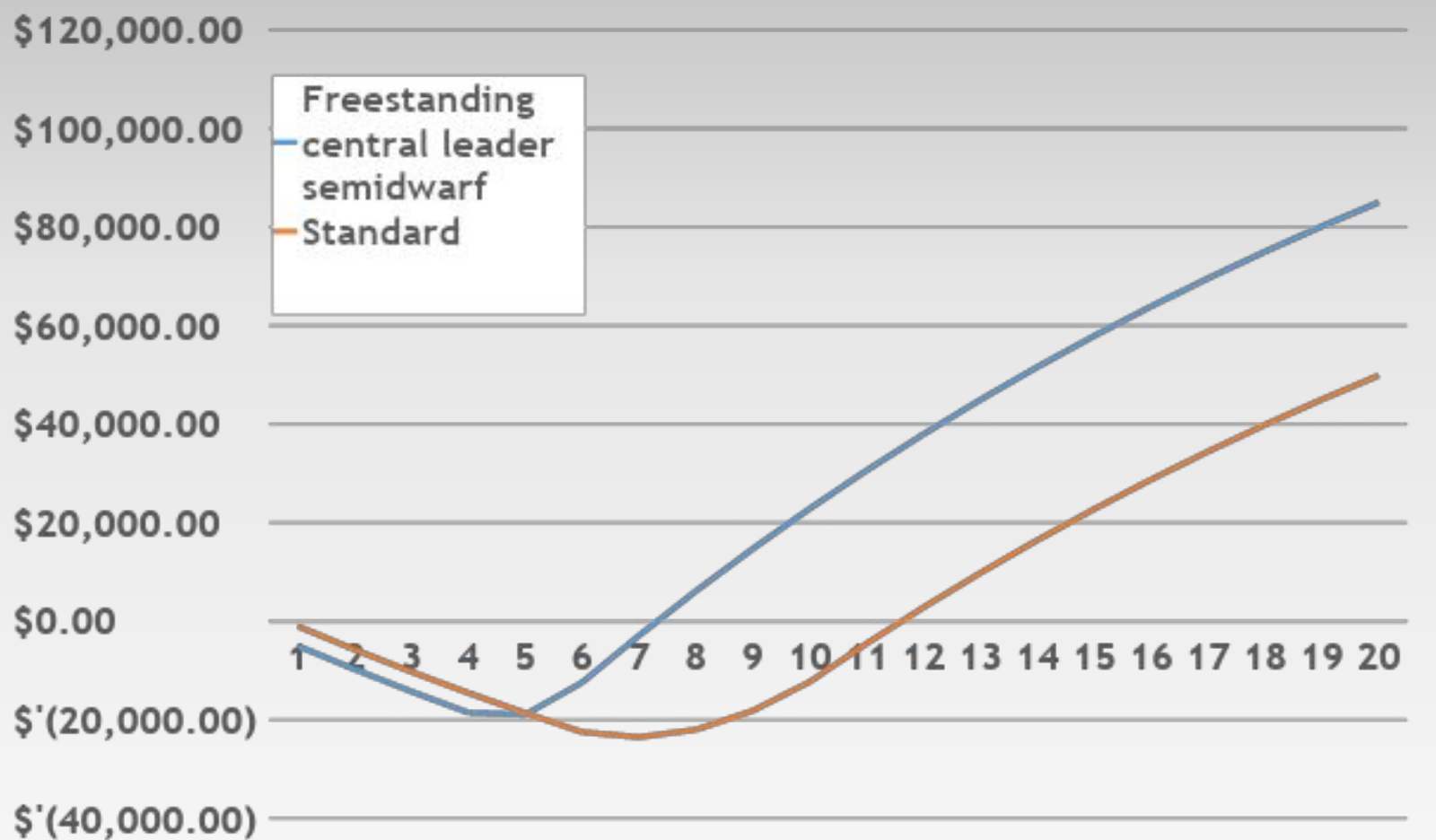
Assumptions:

- \$28/bushel fresh market
- \$6/bushel cider
- Tall spindle full production year 5
 - 15% Y2, 40% Y3, 75% Y4
- FS central leader full production year 8
 - Zero production until Y5
- 1,000 bu/ac TS
- 800 bu/ac FSCL

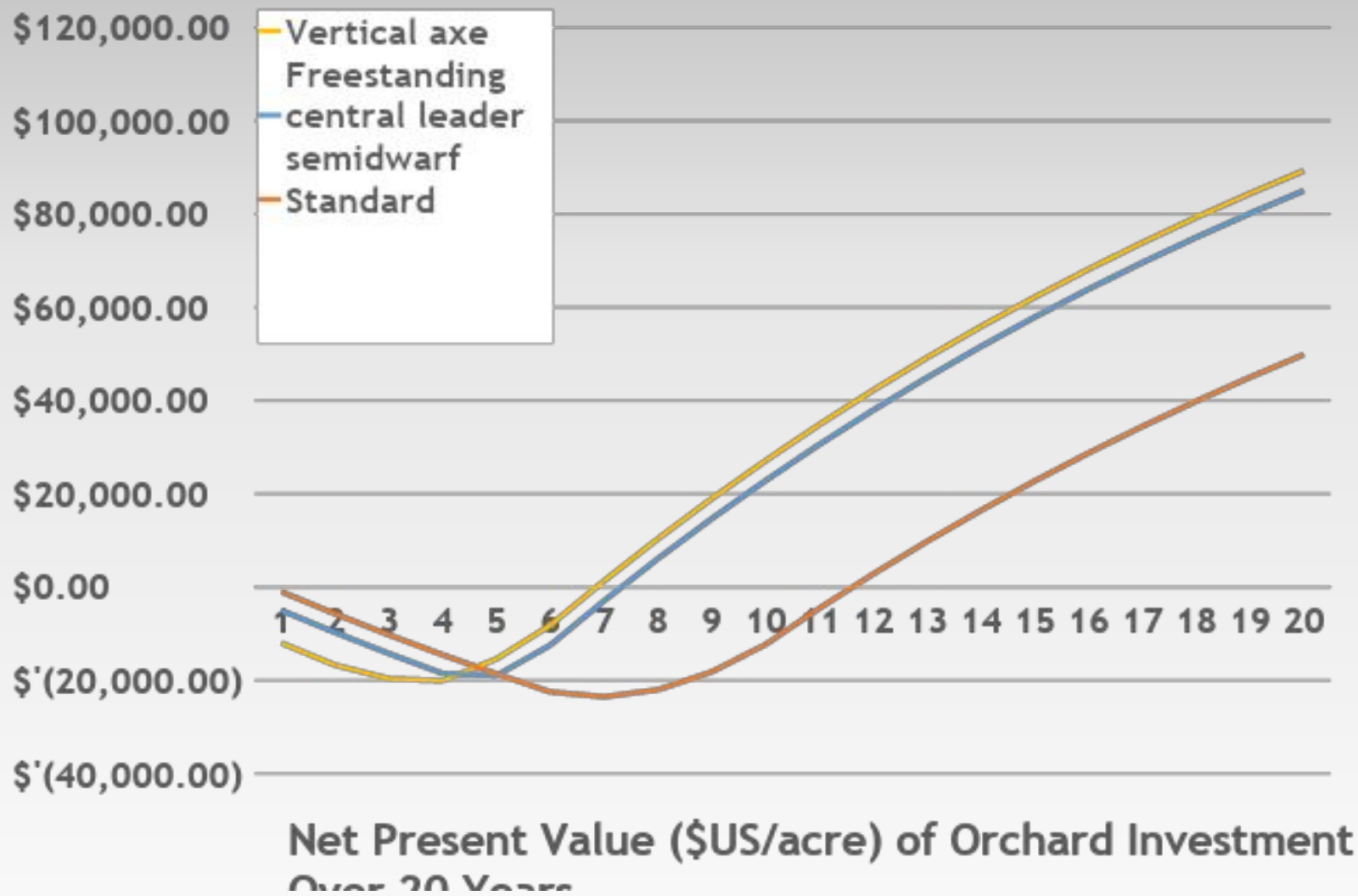
- 5% discount rate in NPV calculation

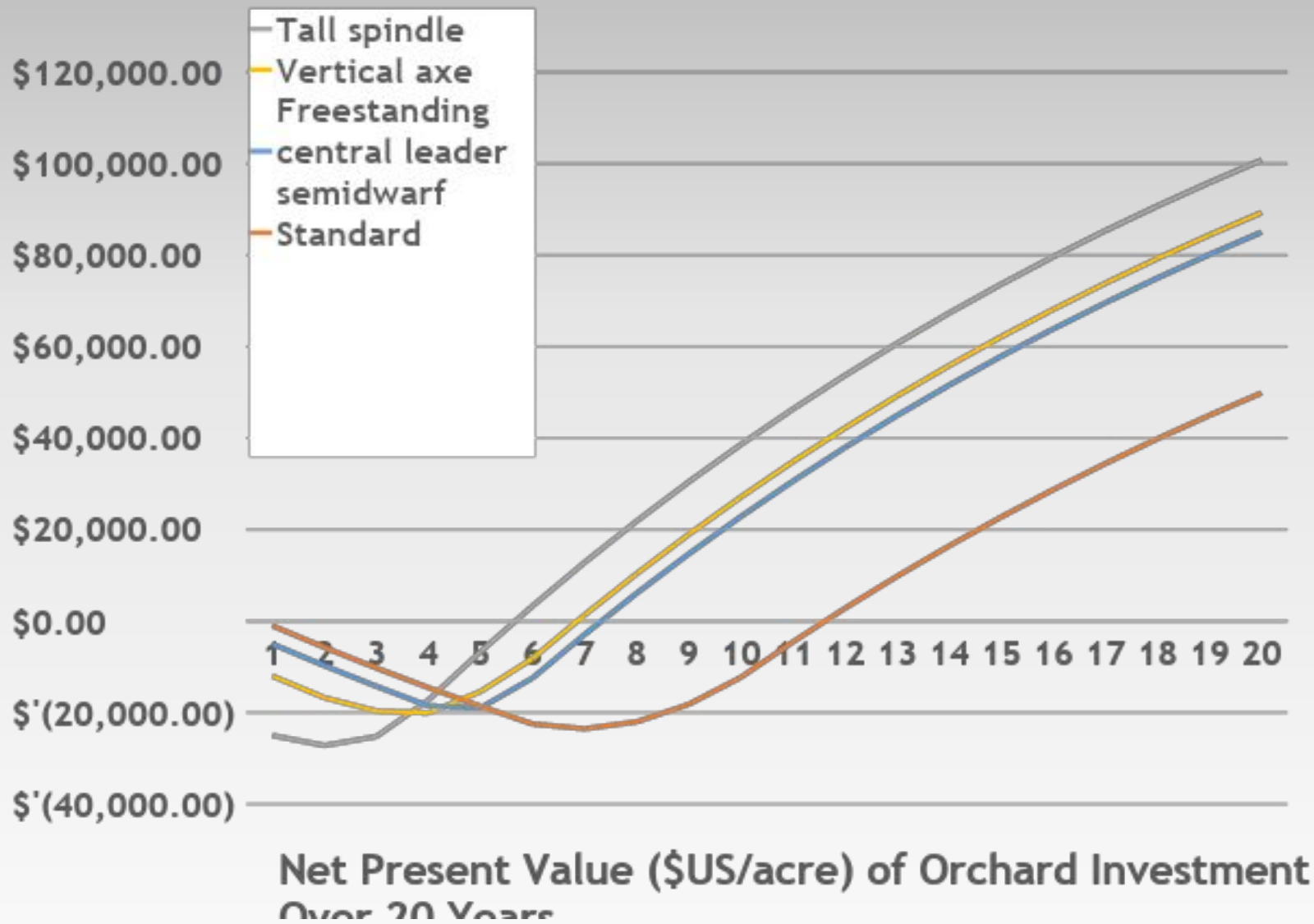


**Net Present Value (\$US/acre) of Orchard Investment
Over 20 Years**



Net Present Value (\$US/acre) of Orchard Investment Over 20 Years





Costs...

Robinson, T., DeMarree, A., & Hoying, S. (2007). An economic comparison of five high density apple planting systems. *Acta Hort*, 732, 481-489.

Table 2. Costs and returns used in the economic analysis.

Annual Fixed Costs	Cost
Operators Management Fee	\$360/ha
Overhead Expenses	\$460/ha
Machinery Investment	\$506/ha
Total Fixed Costs	\$1,326/ha
Annual Variable Costs	
Annual Machinery Expense	\$507/ha
Unskilled Labor (Including Indirect Costs)	\$8.24/hour
Semi-skilled Labor (Including Indirect Costs)	\$10.89/hour
Skilled Labor (Including Indirect Costs)	\$14.95/hour
Feathered Tree Price	\$5.30
Interest Rate (Discount Rate)	5%
Land Cost	\$2,500/ha
Fruit Price (Farm gate price which excludes packing	\$0.30/kg

2023 REGULAR INVENTORY PRICING

TREE SIZE	50+	100+	200+	500+	1000+	5,000+
Feathered	\$12.48	\$11.76	\$11.04	\$10.33	\$9.61	\$8.89
5/8"	\$11.85	\$11.13	\$10.41	\$9.69	\$8.98	\$8.26
1/2"	\$11.33	\$10.61	\$9.88	\$9.16	\$8.44	\$7.73
7/16"	\$10.80	\$10.08	\$9.36	\$8.64	\$7.92	\$7.21
3/8"	\$10.26	\$9.55	\$8.83	\$8.11	7.39	\$6.68
1/4"	\$9.05	\$8.33	\$7.61	\$6.90	\$6.18	\$5.46

<https://waflernursery.com/pricing/>

APPLE ROYALTIES

Prices per tree and must be added to the base price.

- Bakers Delight® / \$1.50
- Blondee™ / \$1.00
- Brookfield® / Gala\$.60
- Buckeye Gala® / \$1.00
- Buckeye® Prime Gala / \$1.00
- Cameron Select® / \$.25
- Chrisolyn® Jonathan / \$1.00
- Crimson® Gala / \$1.50
- CrimsonCrisp® / \$1.35
- Dandee Red™ / \$1.00
- MAIA 1- EVERCRISP® / \$1.00
- Franklin / \$2.00
- Fuji Supreme® / \$1.25
- Galarina™ / \$1.15
- Goldrush® / \$.75
- Jonastar® / \$1.00
- Kumeu Crimson® / \$.80
- Kindercrisp / \$1.25
- MAIA-L Ludacrisp® / \$1.00
- Pacific Gala® / \$.75
- Pink Lady® Barnsby / \$2.00
- Pixie Crunch™ / \$1.25
- Pristine™ / \$.75
- Rising Sun® Fuji / \$1.00
- MAIA11 Rosalee® / \$1.00
- RedRidge™ Gala / \$1.00
- Roseland Red™ Honeycrisp / \$1.00
- Royal Court™ / \$.60
- Royal Red Honeycrisp® / \$2.00
- Ruby Mac® / \$1.25
- Rubinstar® Jonagold / \$.75
- September Wonder® Fuji / \$1.25

PLUS ROYALTIES

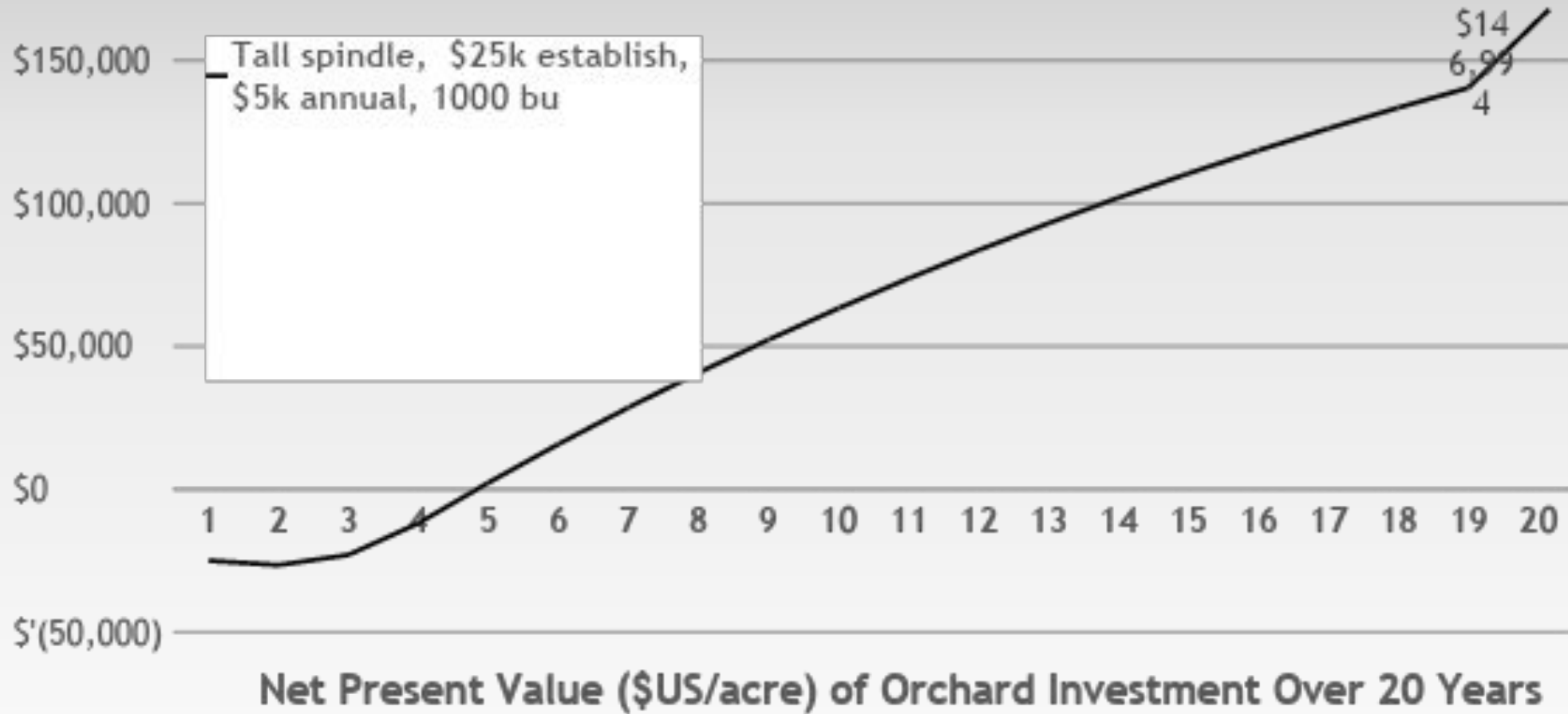
ALL PRICES F.O.B. WOLCOTT, NY

ADDENDUM

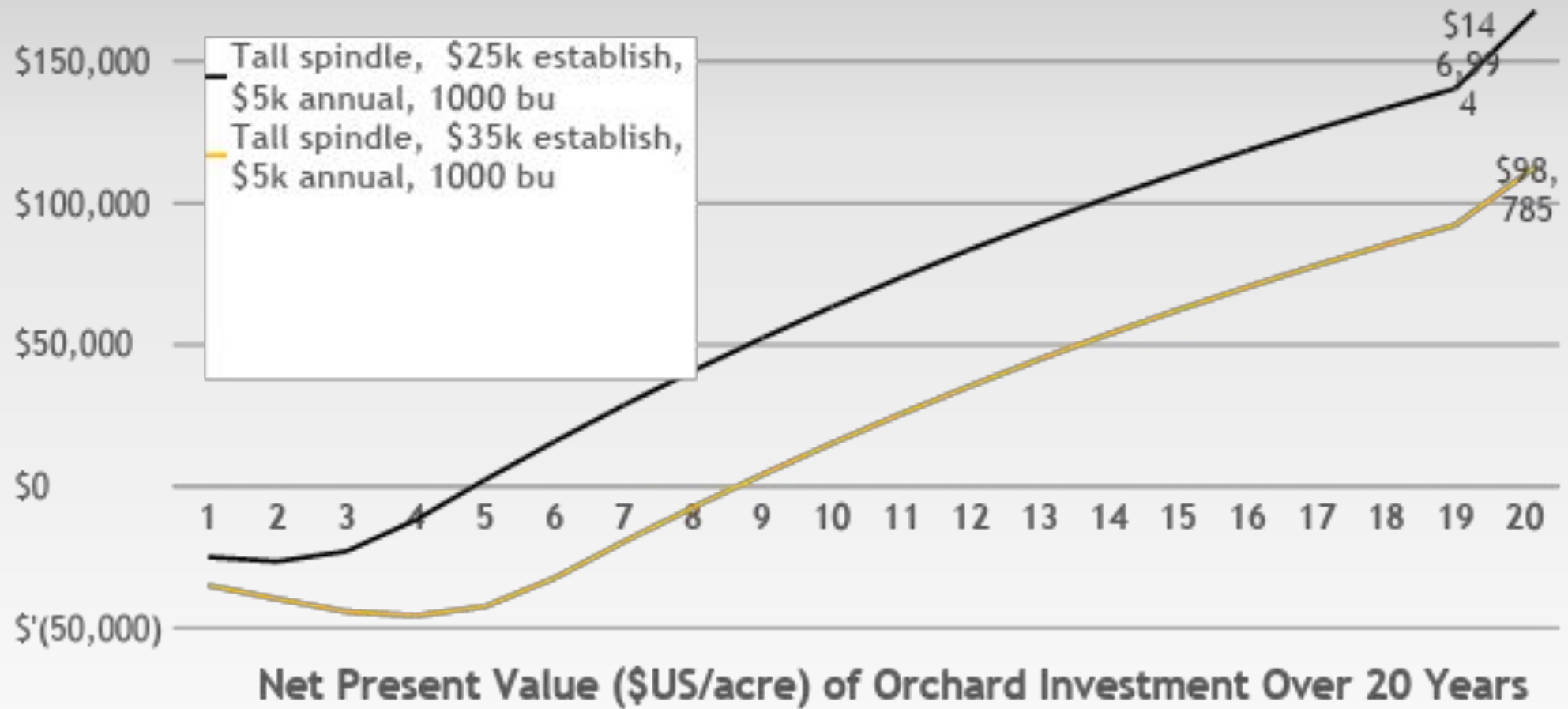
- Geneva® G.11, G.30, G.935, and G.969: add \$1.00/tree
- Geneva® G.41: add \$2.00/tree
- BiBaum® Trees (Double Leader Trees): add \$1.70/tree

<https://waflernursery.com/pricing/>

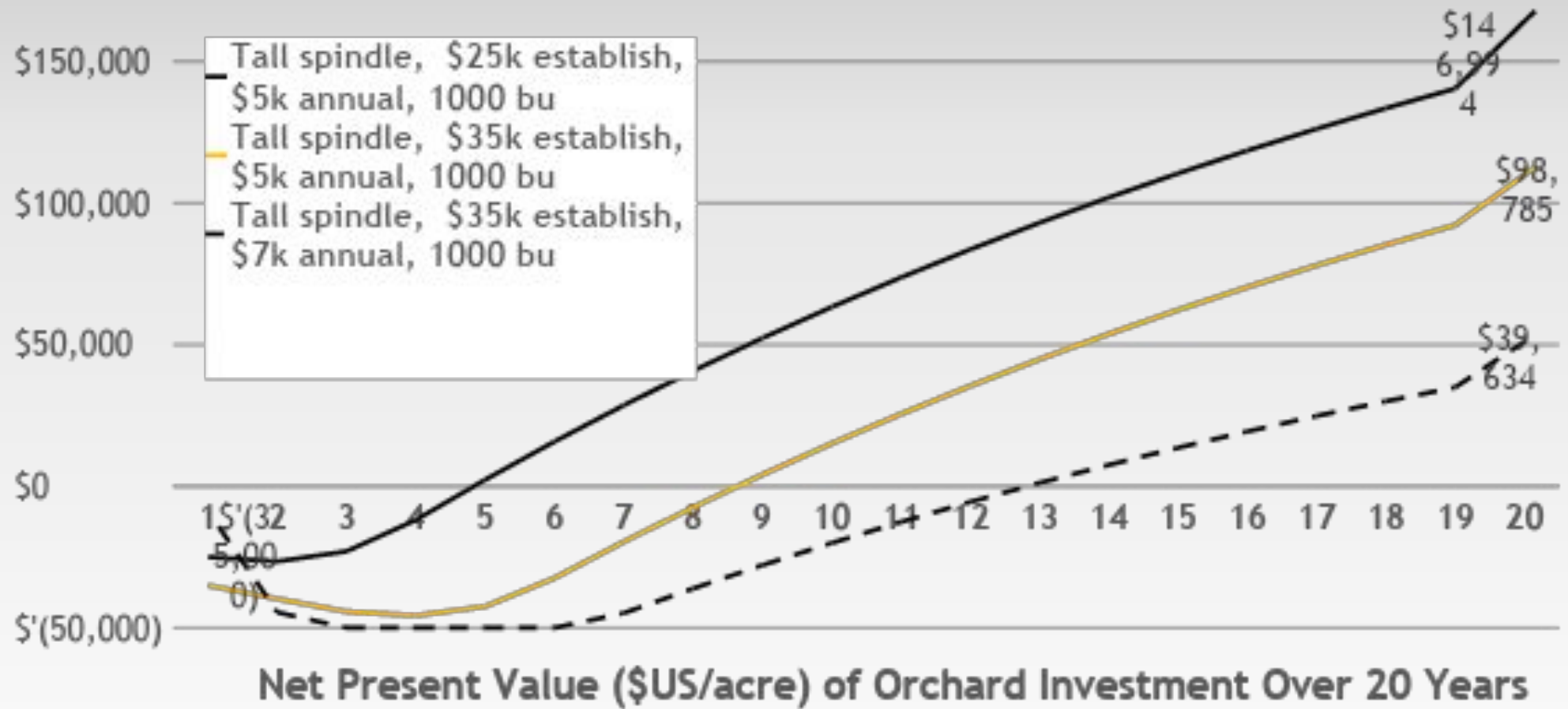
Costs matter



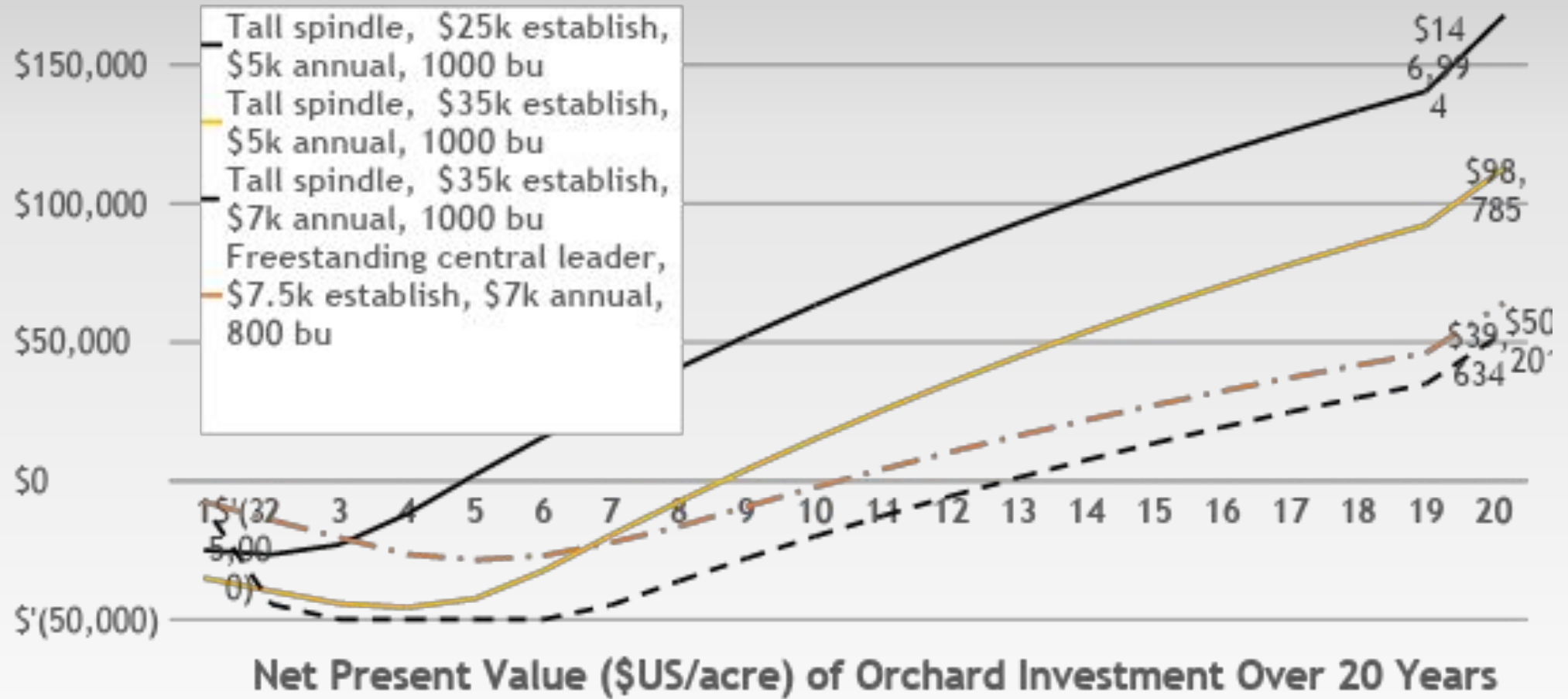
Costs matter



Costs matter



Costs matter



Watch for
conditions
that affect
precocity





Bud 9 and Bud 10 work well when growing bitter pit-susceptible varieties such as Honeycrisp, Mattson said.

The key is not allowing those trees to produce a big crop early on. **The fruit should be stripped off for the first three to four years in order to allow the tree to fill its space.**

“If you’re going to grow Honeycrisp on a Bud 9, just be ready to be patient,” Mattson said.

FRUIT GROWERS NEWS

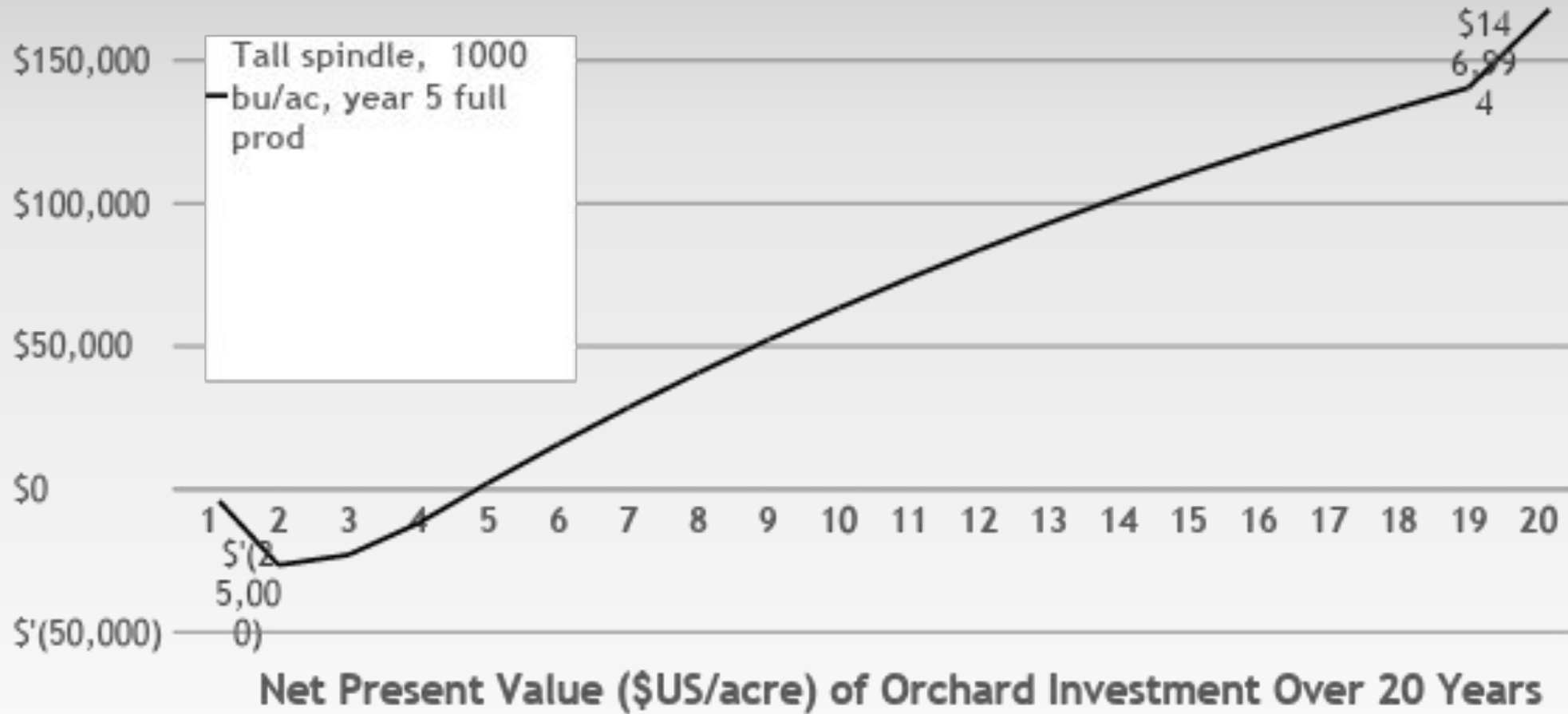
BY REGION | FRUITS | LABOR | CROP PROTECTION | CROP MANAGEMENT | TECHNOLOGY | FOOD SAFETY



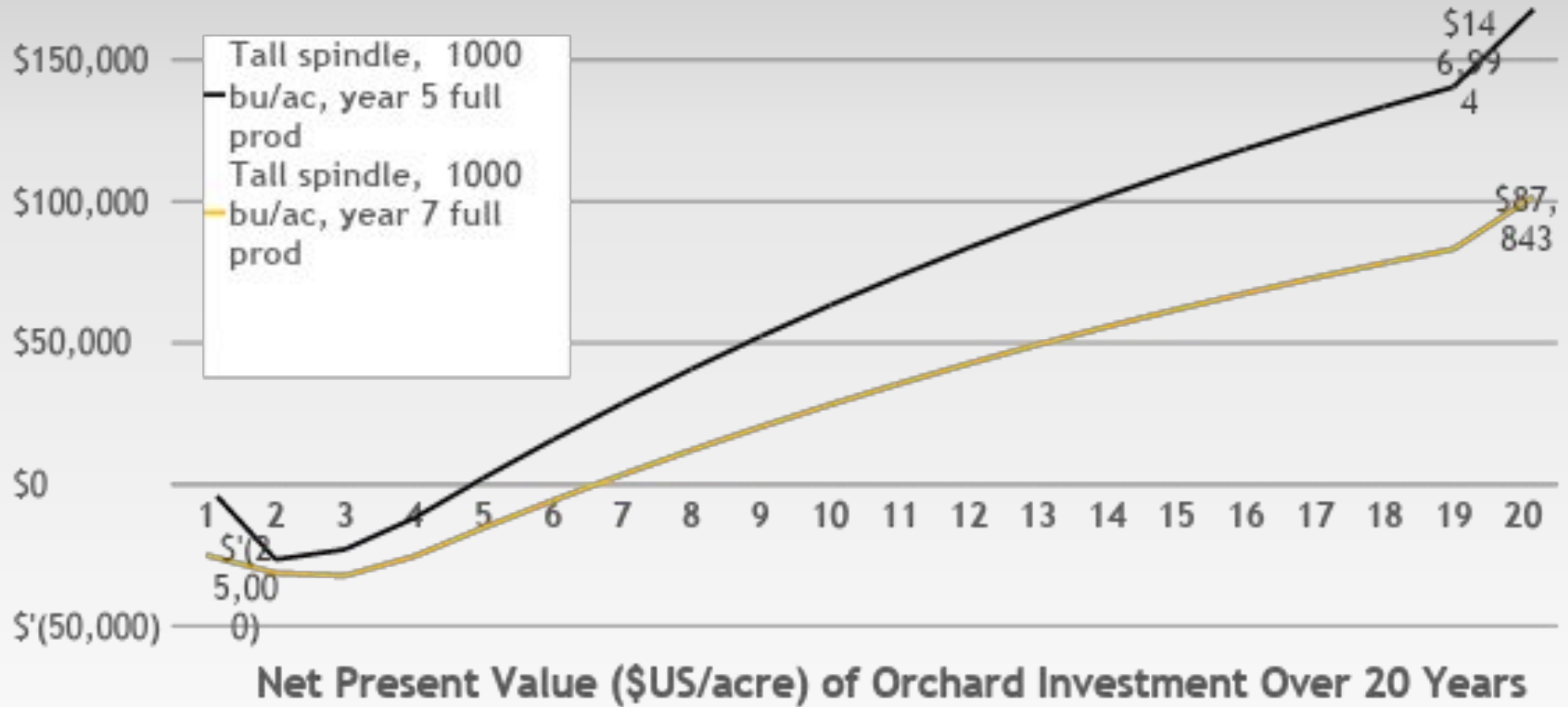
MAR 10, 2022

Modern apple rootstocks evaluated in Mid-Atlantic

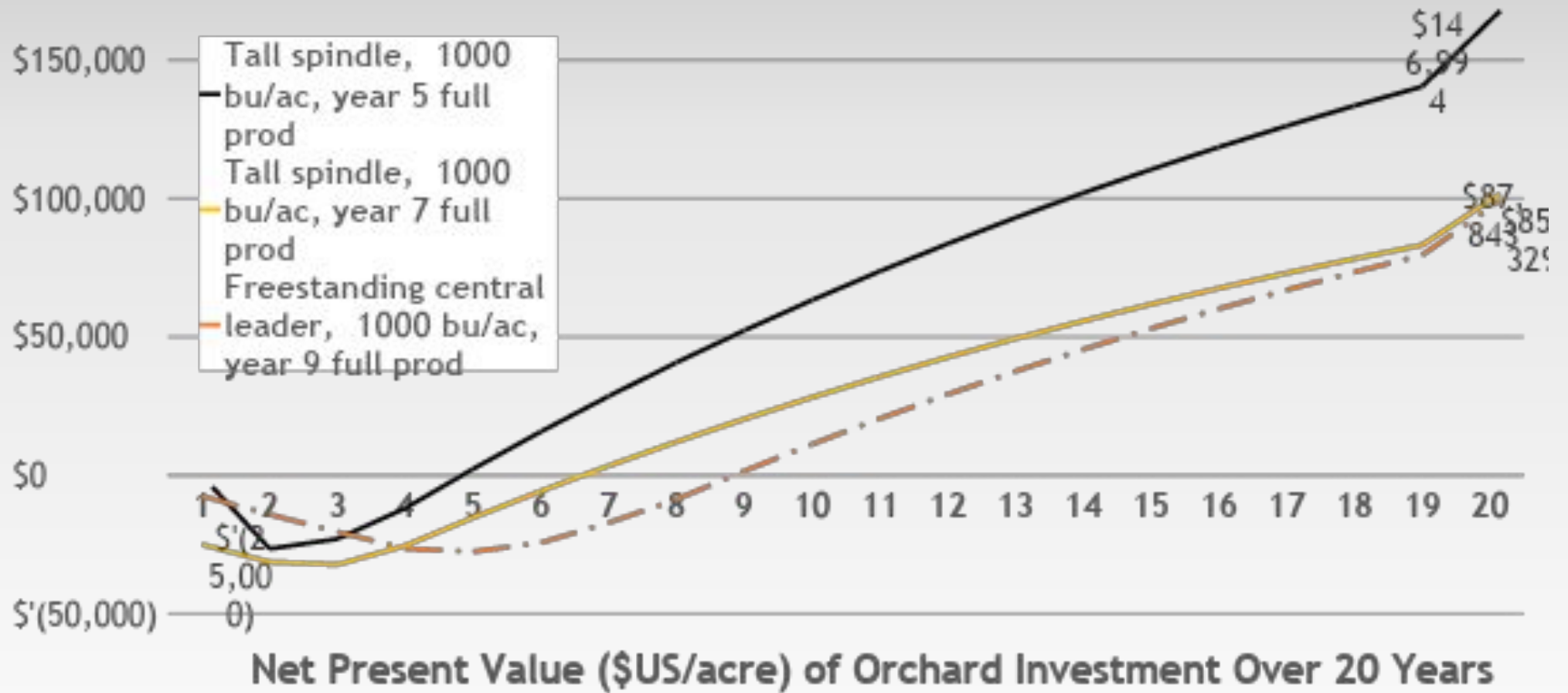
Precocity matters



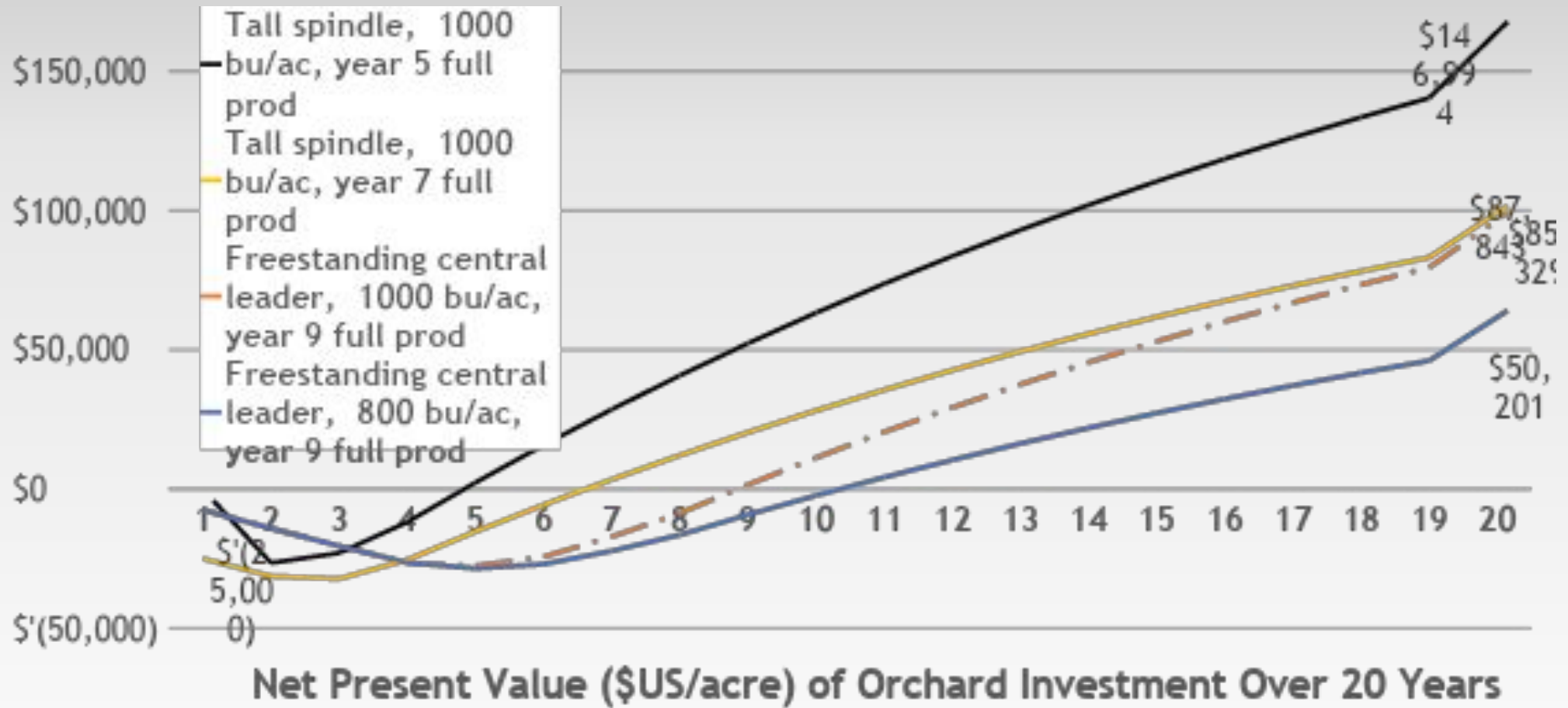
Precocity matters



Precocity matters



Precocity matters



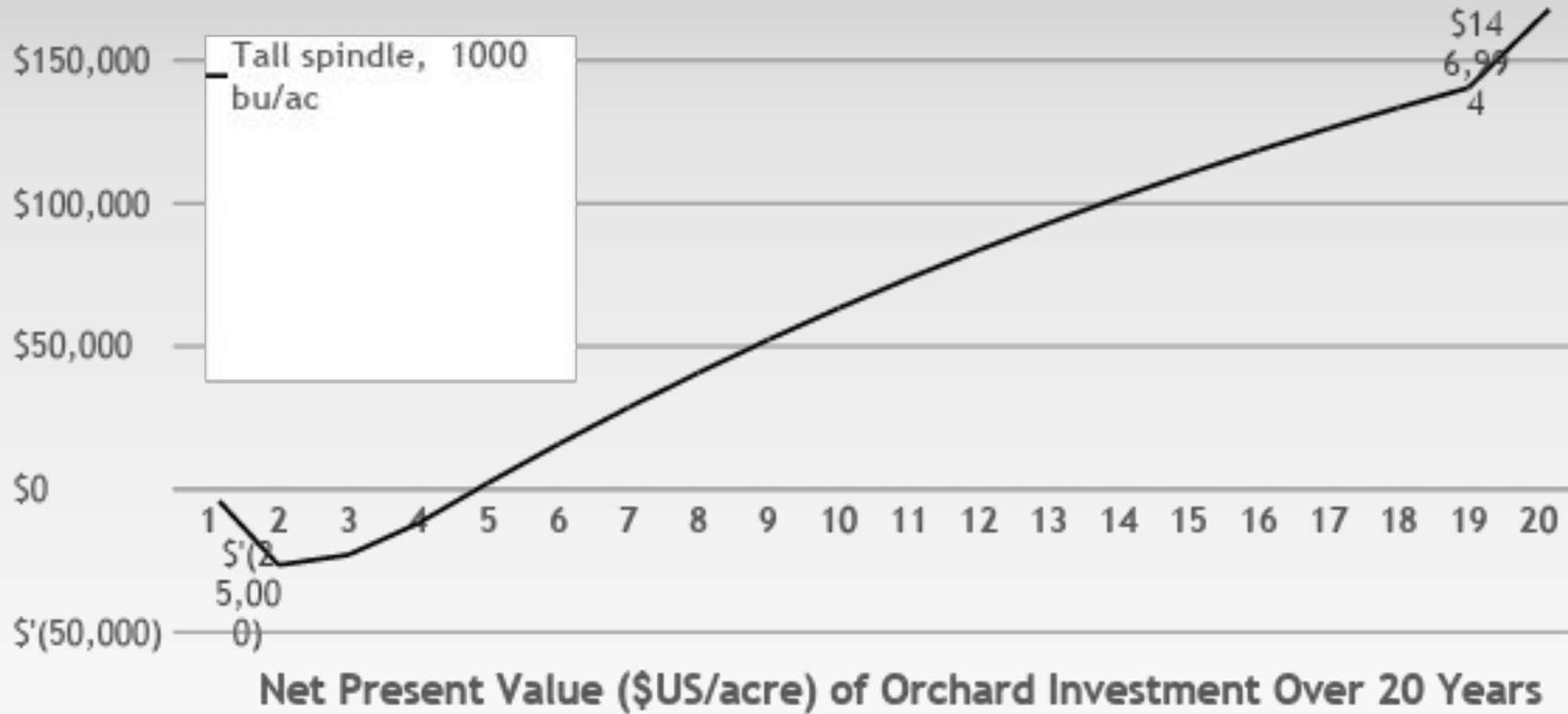
Replant matters



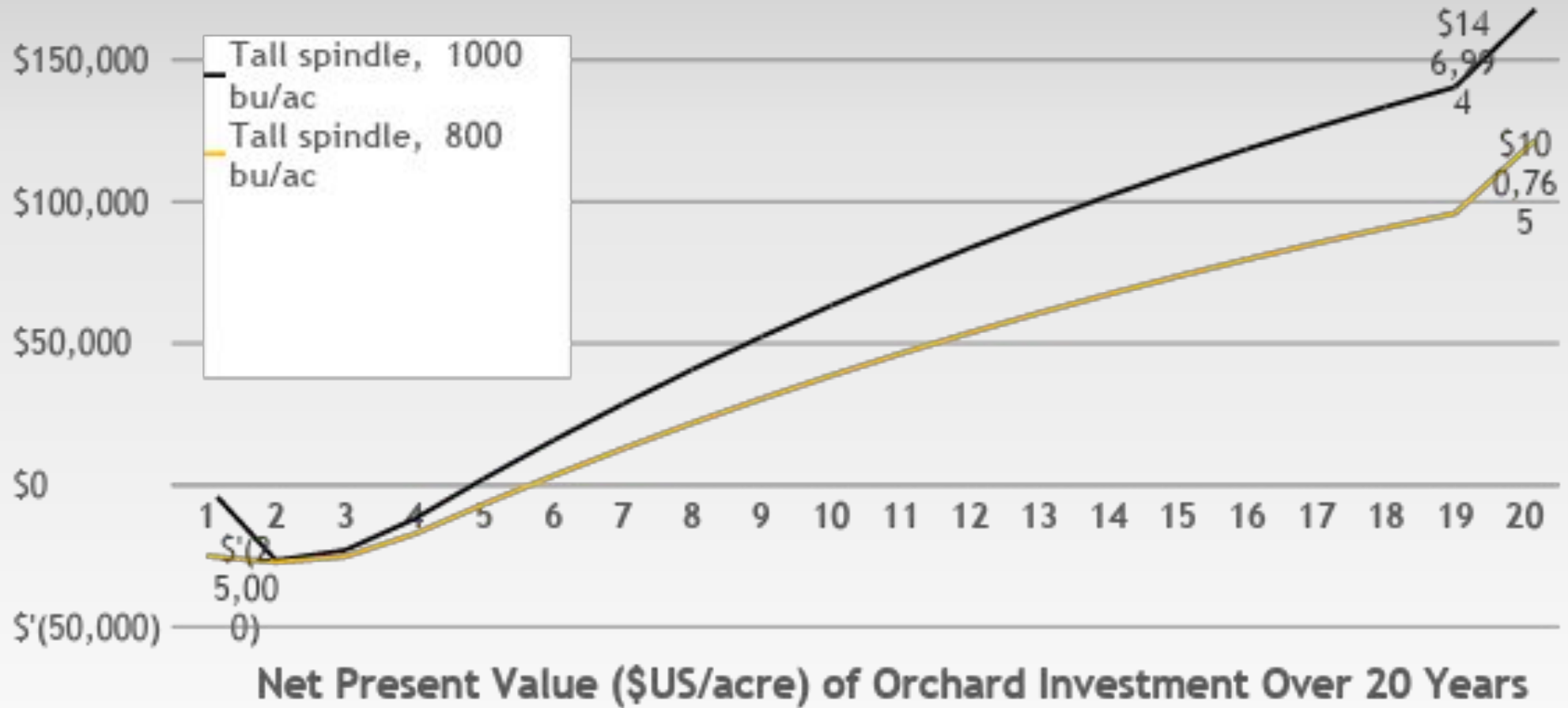
MOLLERUSSA

ROOTSTOCKS apple tree in replant situations

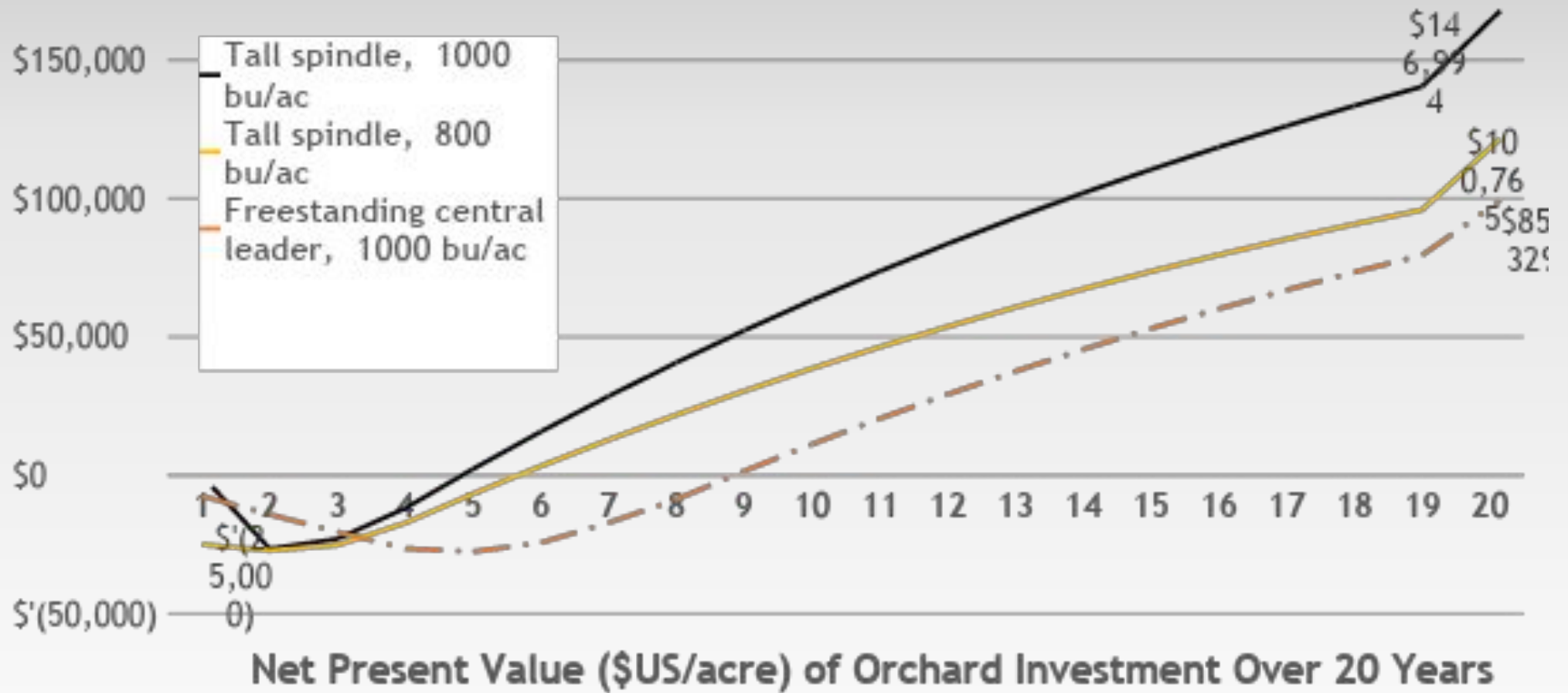
Yield matters



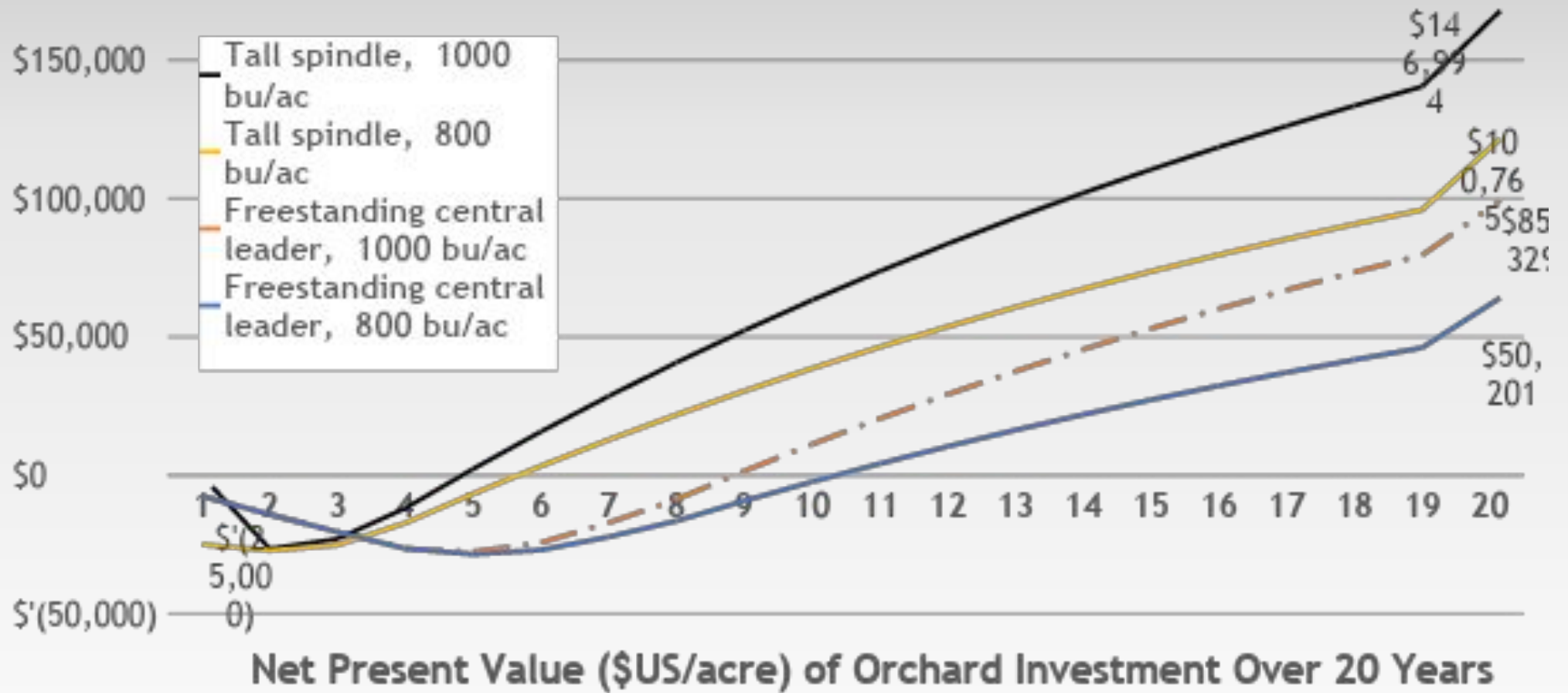
Yield matters

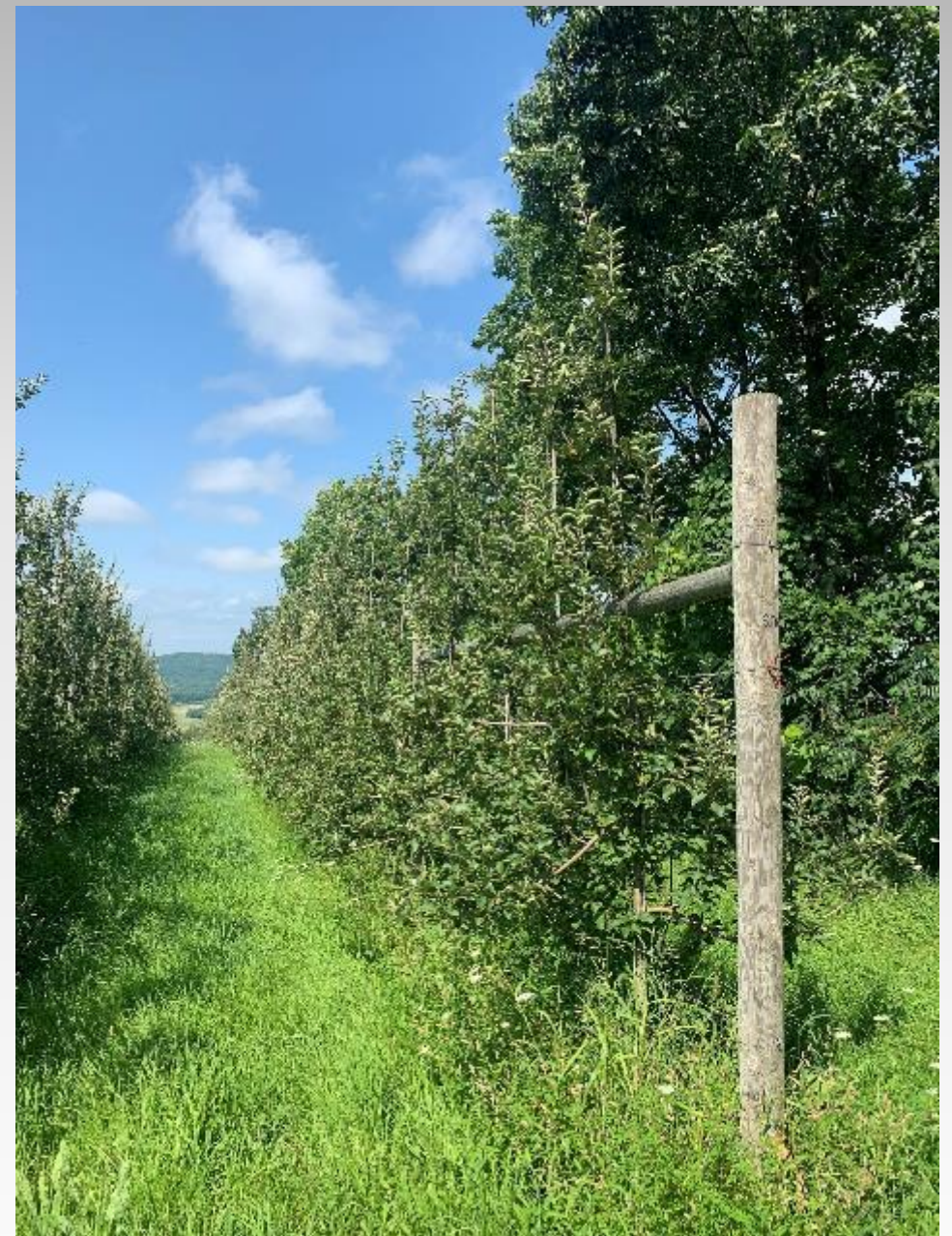


Yield matters

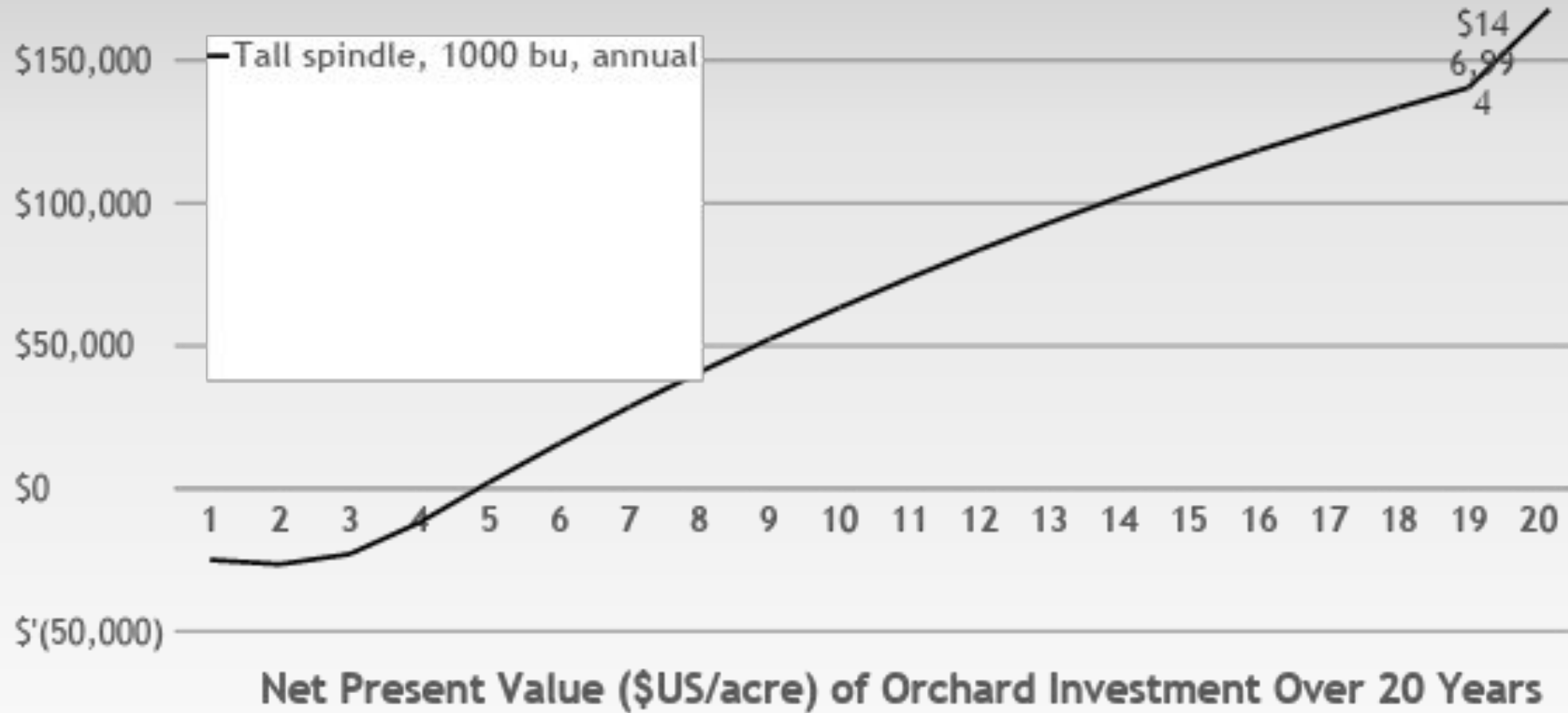


Yield matters

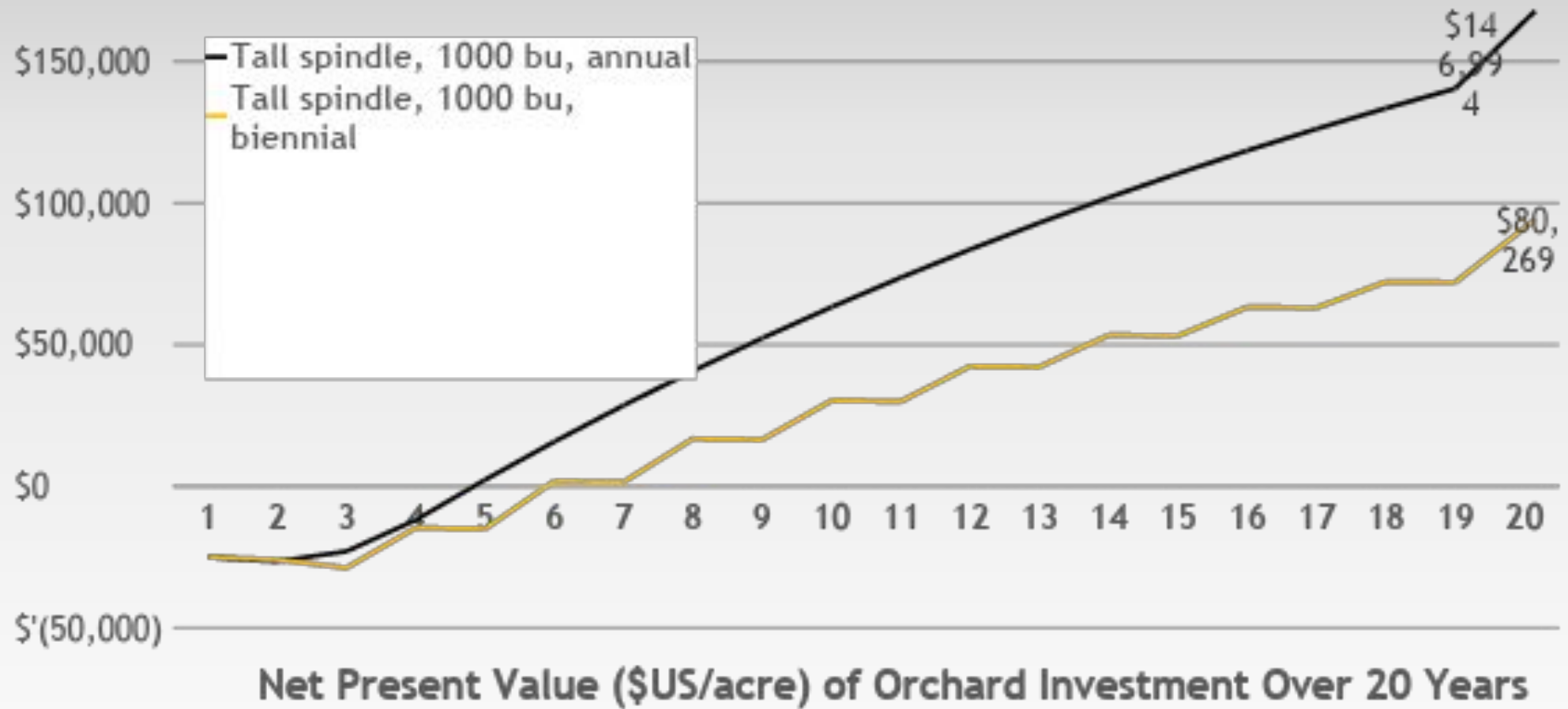




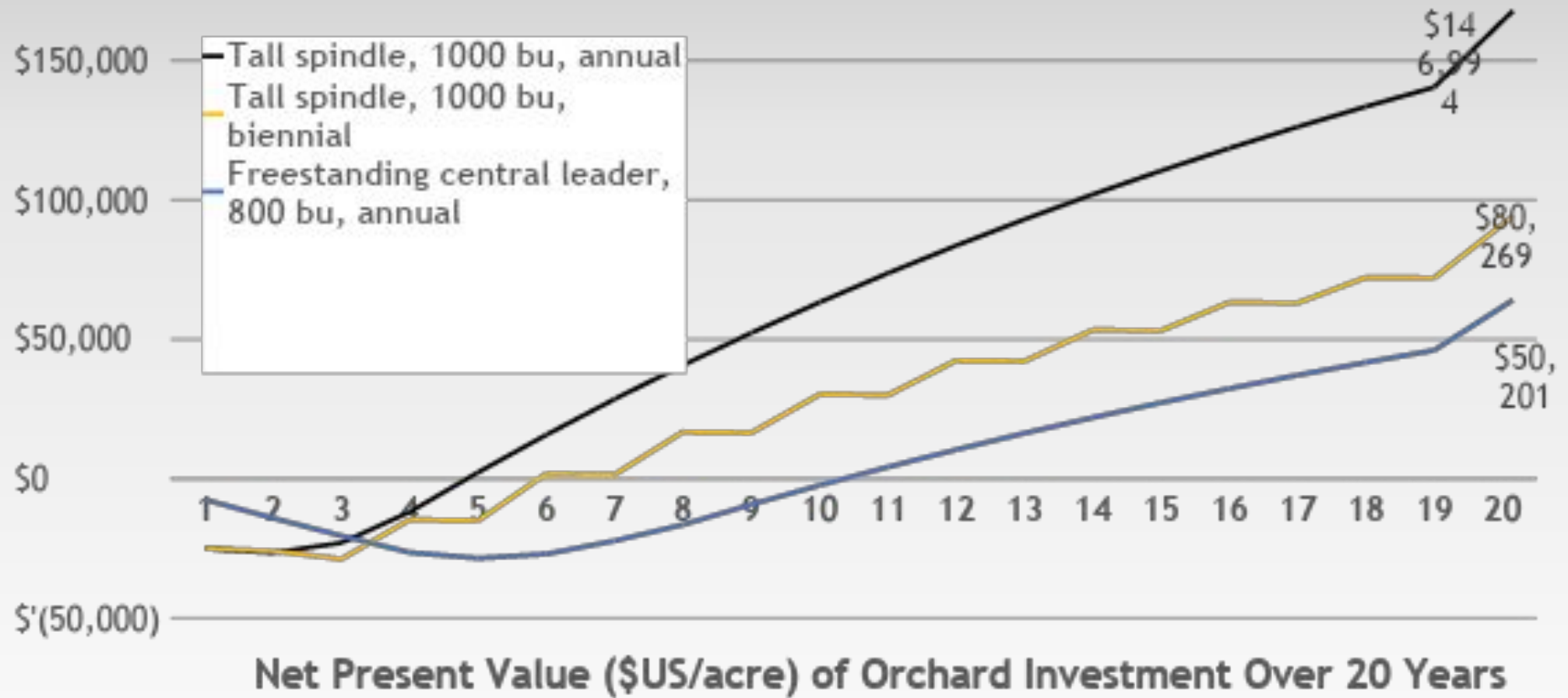
Annual bearing matters



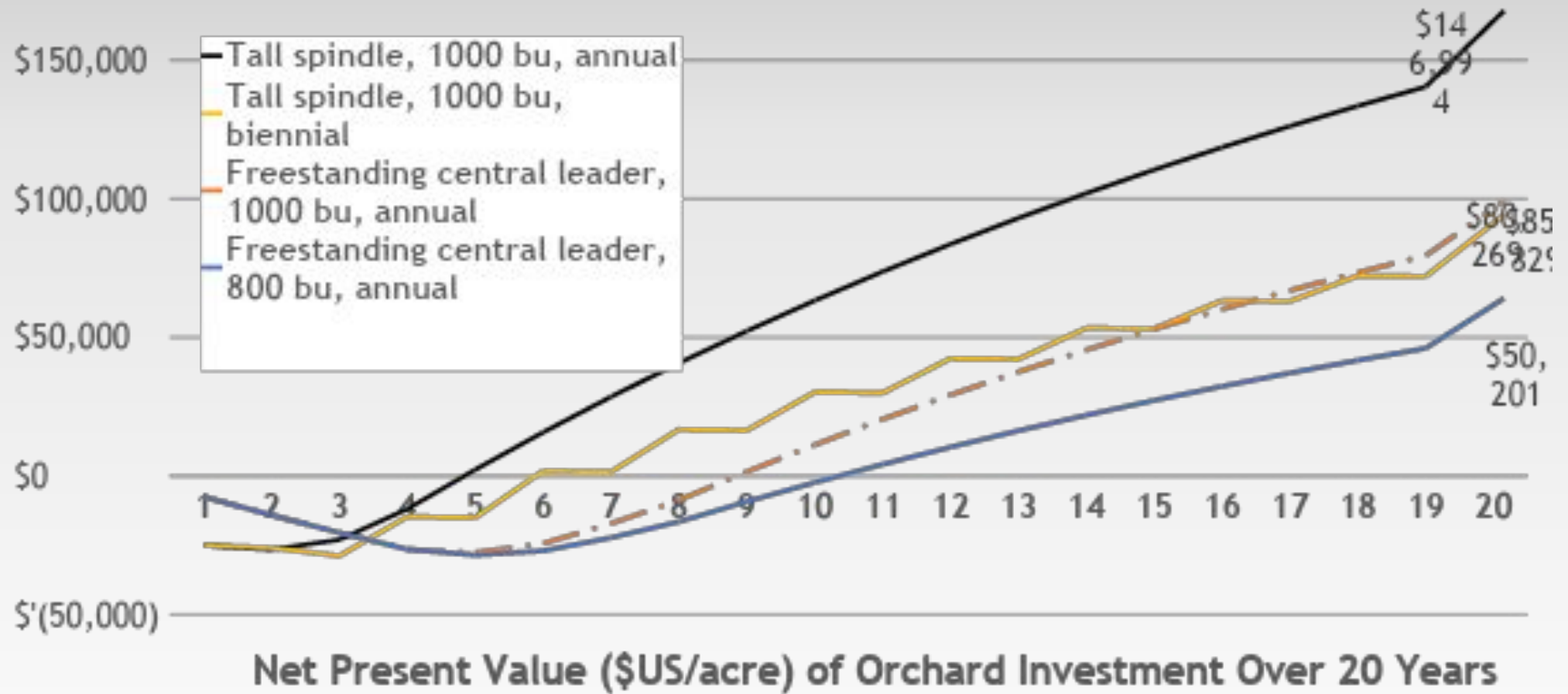
Annual bearing matters



Annual bearing matters



Annual bearing matters



Topgrafted freestanding central leader orchard, 290 trees/acre

Bradshaw, T., et al. (2016). Long-term economic evaluation of five cultivars in two organic apple orchard systems in Vermont, USA, 2006-2013. *Acta Hort*, 1137, 315-322.
doi:10.17660/ActaHortic.2016.1137.44

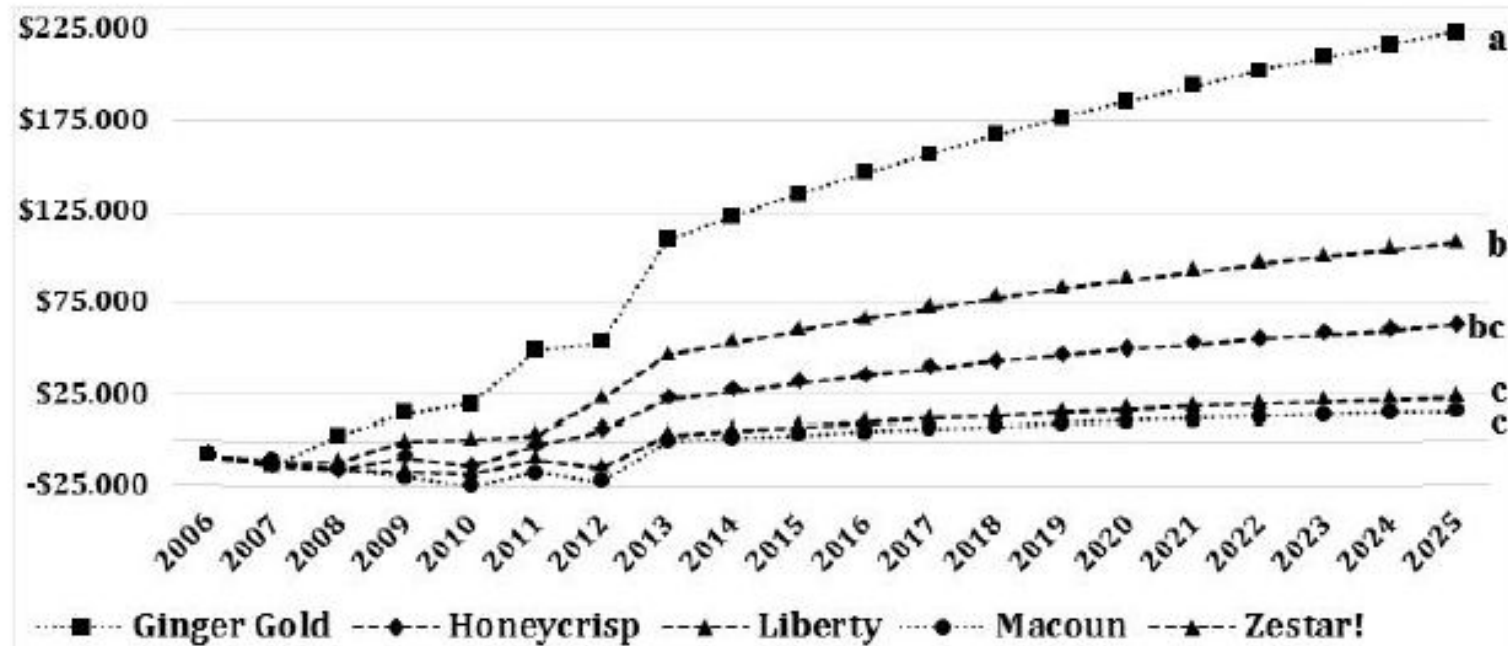


Figure 2. NPV of accumulated cash flow (US\$ ha⁻¹), Orchard 2, 2006-2025.

Newly planted Vertical axis orchard, 580 trees/acre

Bradshaw, T., et al. (2016).
Long-term economic evaluation of
five cultivars in two organic apple
orchard systems in Vermont, USA,
2006-2013. *Acta Hort*, 1137, 315-322.
doi:10.17660/ActaHortic.2016.1137.4
4

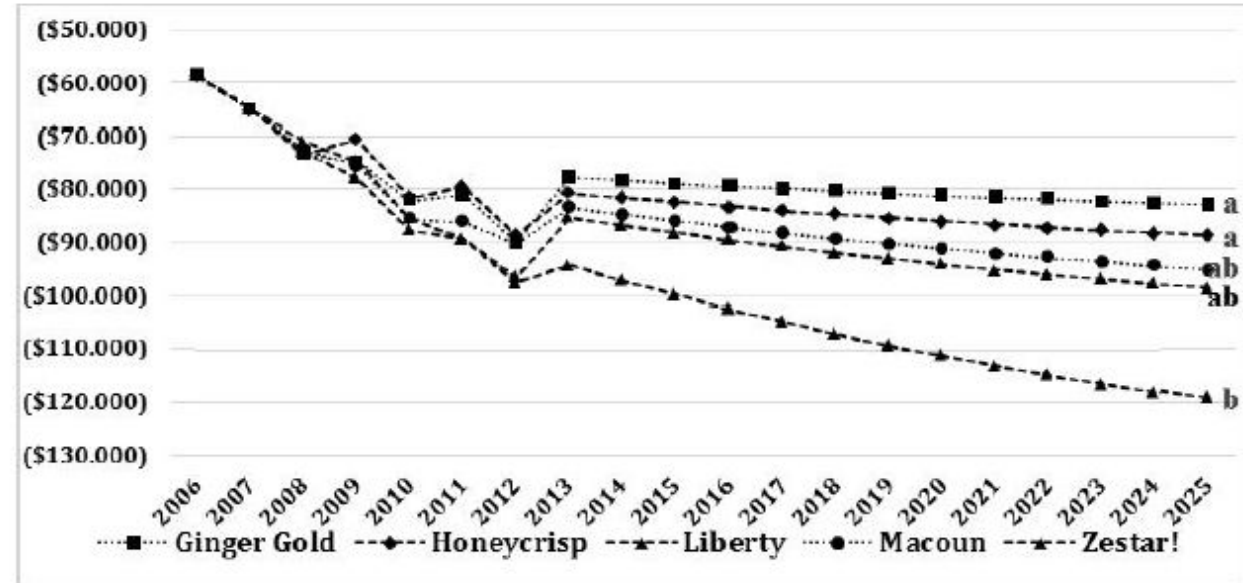


Figure 1. Net present value (NPV) of accumulated cash flow (US\$ ha⁻¹), Orchard 1, 2006-2025.

An update from New York: 20 year systems analysis

Lordan, J., Gomez, M., Francescatto, P., & Robinson, T. L. (2019). Long-term effects of tree density and tree shape on apple orchard performance, a 20 year study—part 2, economic analysis. *Scientia Horticulturae*, 244, 435-444.

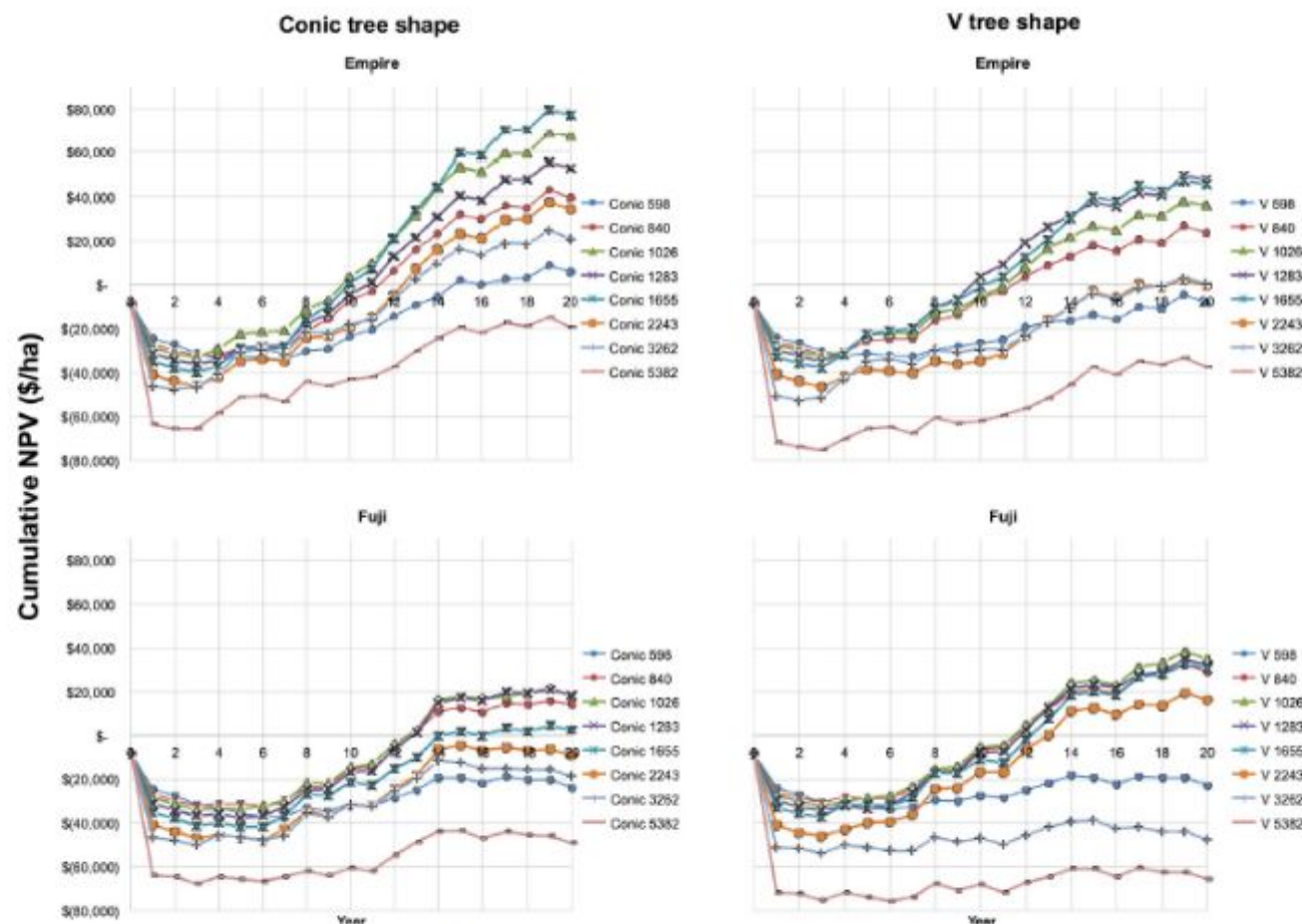


Fig. 1. Net Present Value (NPV) for each plant density (598, 840, 1026, 1283, 1655, 2243, 3262, and 5382 trees/ha), tree shape (conic and V), and cultivar ('Empire' and 'Fuji') at Geneva NY.

Low-density plantings have **poor yields per hectare, so even though investment costs were low, approximately \$23,000/ha in our study, it took a several years (15–16 years) to recoup the investment.** In cases such as ‘McIntosh’, with **lower yields and fruit prices, the orchard never recouped the investment.**

Lordan, J., Gomez, M., Francescatto, P., & Robinson, T. L. (2019). Long-term effects of tree density and tree shape on apple orchard performance, a 20 year study—part 2, economic analysis. *Scientia Horticulturae*, 244, 435-444.

High-density systems require substantially greater investments and thus have greater risk than moderate density systems. **In scenarios with high fruit prices, repayment of the entire initial investment can be achieved in a very short time period (8–9 years).**

Lordan, J., Gomez, M., Francescato, P., & Robinson, T. L. (2019). Long-term effects of tree density and tree shape on apple orchard performance, a 20 year study—part 2, economic analysis. *Scientia Horticulturae*, 244, 435-444.

However, under poor price conditions, lower than expected yield, and expensive trees, orchard life would have to be 20+years to be profitable. Therefore, high-density systems can be the most profitable systems, but only with good yields and high fruit prices.

Lordan, J., Gomez, M., Francescato, P., & Robinson, T. L. (2019). Long-term effects of tree density and tree shape on apple orchard performance, a 20 year study—part 2, economic analysis. *Scientia Horticulturae*, 244, 435-444.

Any factor, such as frost, hail, poor tree growth, or poor pollination, that reduces yield in the early years will dramatically reduce the profitability of high-density plantings.

Lordan, J., Gomez, M., Francescato, P., & Robinson, T. L. (2019). Long-term effects of tree density and tree shape on apple orchard performance, a 20 year study—part 2, economic analysis. *Scientia Horticulturae*, 244, 435-444.

Next steps

Please fill out applicable answers for Block 1

	Variety 1	Variety 2	Variety 3	Variety 4
	Answer 1	Answer 1	Answer 1	Answer 1
Variety				
acreage				
price of tree				
rootstock				
price / pound received				
year planted				

Survey winter 2023

- Joseph Leahy, UVM Graduate Research Assistant
- Calculation of regionally-relevant costs and returns by orchard size and type
- Intent: update ‘conventional wisdom’ models with local data

Thank you!
Dr. Terence Bradshaw
Joseph Leahy
Bethany Pelletier
Eli Wilson

