

THE EFFECT ON PRODUCTIVITY AND PROFIT OF HIGH DENSITY PLANTING OF AVOCADOS

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https://ucanr.edu/sites/Farm_Management/

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References

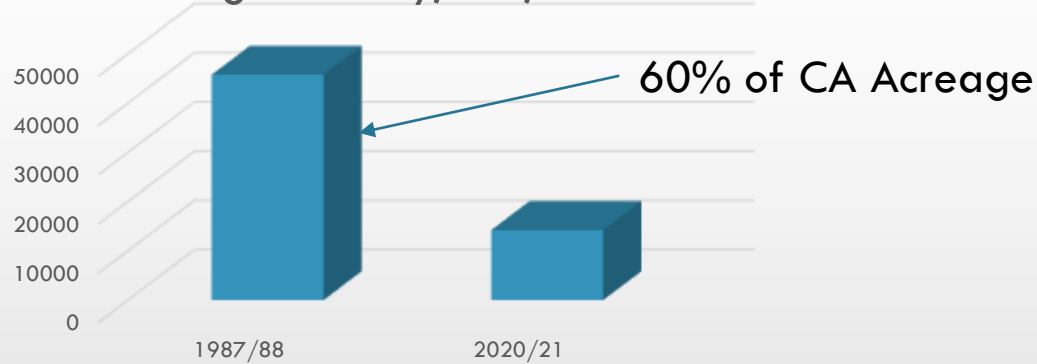
For details of the field trial and economic/cost analyses

- Better growing: *Gary Bender*, farm advisor emeritus, UC cooperative extension, San Diego County, High density avocado production, A method to improve yield per acre, winter 2018 / from the grove / 35, [HTTPS://WWW.CALIFORNIAAVOCADOGROWERS.COM/SITES/DEFAULT/FILES/DOCUMENTS/11-HIGH-DENSITY-AVOCADO-PRODUCTION-WINTER-18.PDF](https://www.californiaavocadogrowers.com/sites/default/files/documents/11-High-Density-Avocado-Production-Winter-18.pdf).
- Takele Etaferahu, Donald Stewart and Daniel A. Sumner, 2021. 2020 Avocado Establishment And Production Costs And Profitability Analysis In High Density Planting, University Of California Agricultural And Natural Resources Cooperative Extension, Agricultural Issues Center, UC Davis Department Of Agricultural And Resources Economic [HTTPS://COSTSTUDYFILES.UCDAVIS.EDU/UPLOADS/CS_PUBLIC/B4/3D/B43D58D9-1E91-4A3E-80F9-A2EDB14958B0/2020AVOCADOHIGHDENSITYSANDieGOCOUNTY.PDF](https://coststudyfiles.ucdavis.edu/uploads/cs_public/B4/3D/B43D58D9-1E91-4A3E-80F9-A2EDB14958B0/2020AVOCADOHIGHDENSITYSANDieGOCOUNTY.PDF)
- *Takele, Etaferahu, G. Bender, M. Vue, 2011*. Avocado Sample Establishment And Production Costs And Profitability Analysis For San Diego And Riverside Counties, 201, Conventional Production Practice [https://COSTSTUDYFILES.UCDAVIS.EDU/UPLOADS/CS_PUBLIC/5A/87/5A87BB11-59B3-4056-A2D6-A6E14507DD84/AVOCADOCONVENTIONALSDR2011.PDF](https://coststudyfiles.ucdavis.edu/uploads/cs_public/5A/87/5A87BB11-59B3-4056-A2D6-A6E14507DD84/AVOCADOCONVENTIONALSDR2011.PDF)

Avocado Production Areas in California, USA



Avocado Acreage Trend in San Diego County, CA, USA



Reason for decline

In Dr. Gary Bender's words,

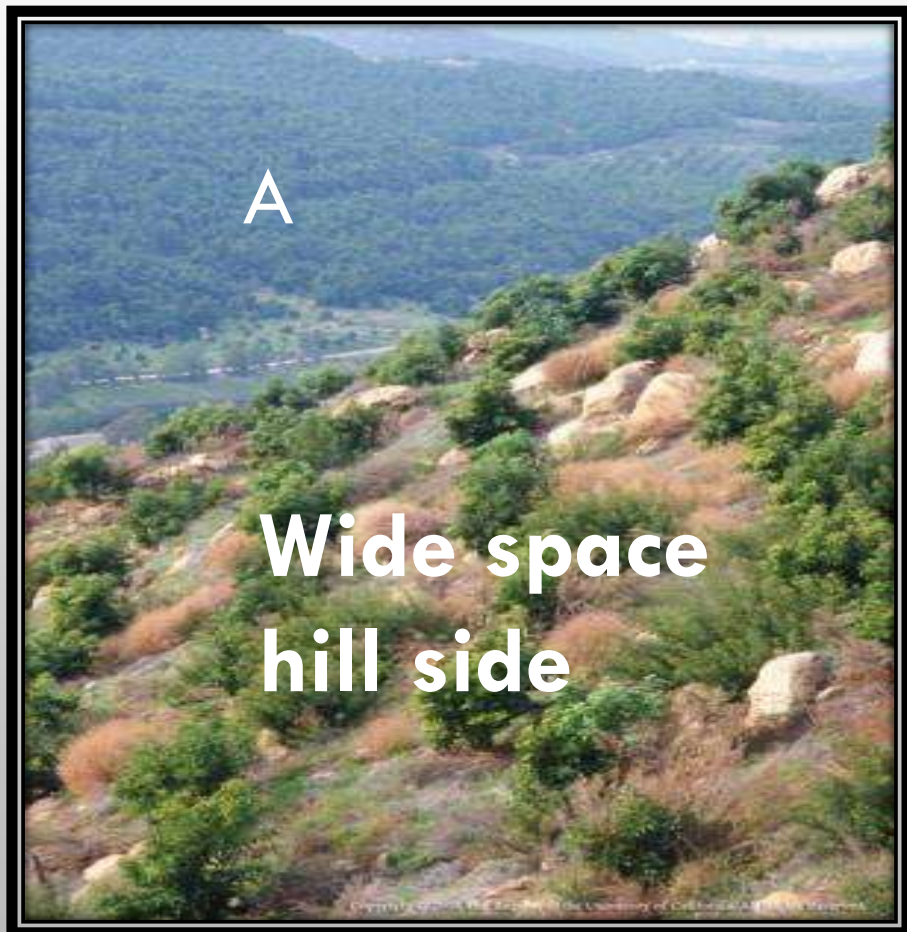
'how does a grower in California make a profit when the water prices keep increasing and yet, mostly due to foreign competition, market prices remain fairly static?'



Dr. Gary Bender, Subtropical Horticulture Farm Advisor, now emeritus, visiting a grove with water cutoff in 2010

Water cost reaching \$1900-\$2,000/ac. Ft in 2020

Plantings in San Diego County, CA, USA



High Density Field Trial

Purpose: Seeking a method of practice that would increase returns and minimize costs for sustainability/viability of producing avocados in San Diego County.

on a hillside

Objectives: Conduct a field trial of high density planting and investigate if the method will effect:

1. Yield/return increases?
2. Efficiency in irrigation/cost minimization?
3. Pruning cost?
4. Profitability increase?

The Trial



Location: Valley Center,
San Diego, CA, Grower
Cooperator

Varieties: Hass and Lamb
Hass Varieties

Zutano pollinizer

2011-2018

Results #1: Yield-Hass* Variety

Yield Per Acre, High density trial, Valley Center, 2011-2018				
430 trees per acre				
<i>Year</i>	<i>Trial Year</i>	<i>Yield:</i> <i>lbs./acre</i>	<i>Yield:</i> <i>lbs./tree</i>	
2012	Planting			
2013	Year 1			
2014	Year 2			
2015	Year 3	13,246		31
2016	Year 4	25,100		58
2017	Year 5	5,541		13
2018	Year 6	20,992		49
Prod. Year (2019-2020)	Year 7+	16,220		38

Traditional planting: 9,000
(84% more in high density)

Results #2: Irrigation Water Use

Water Use Per Acre, High Density Planting

HASS VARIETY, 430 trees per acre
Valley Center Field Trial

<i>Year</i>	<i>Trial Year</i>	<i>Water Ac. In/acre</i>
2012	Planting	
2013	Year 1	14.04
2014	Year 2	39.60
2015	Year 3	34.56
2016	Year 4	57.84
2017	Year 5	45.48
2018	Year 6	46.00
Prod. Year (2019-2020)	Year 7+	~46.00-47.00

Traditional planting: 42.00

Results #3: Pruning

Pruning Hours Per Acre, High Density 2012-2018

Using Alternate Side Pruning*

430 trees per acre

<i>Year</i>	<i>Trial Year</i>	Hours/ Acre
2012	Planting	
2013	Year 1	26.89
2014	Year 2	43.33
2015	Year 3	55.08
2016	Year 4	48.56
2017	Year 5	49.10
2018	Year 6	49.50
Prod. Year (2019-2020)	Year 7+	49.30

Traditional planting ~38.64

Economic Analysis



Full Enterprise Budget Analyses:

1. *Estimate establishment investments:*

$$TC_{\text{Investment}} = \sum VC + \sum FC + \sum OC - GR \text{ (years 1-6)}$$

2. *Production cost and return budget:*

$$TC_{\text{Production}} = \sum VC + \sum FC + \sum OC + \text{Amortized Investment Capital}$$

3. *Profit:*

$$\Pi = GR_{\text{Production}} - TC_{\text{Production}}$$

Data:

- From the field trial: planting, yield, water use, pruning
- Grower interview of all production practices

Results #1. Establishment Investment Costs Per Acre (2020)

High Density Planting						
(430 Trees Per Acre, 2020 Study)						
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Yield (pounds)			13,246	25,100	5,541	20,992
Establishment Costs (year 1-6) (\$)	29,712	9,841	10,969	18,633	14,895	16,804
Returns (\$)			17,187	29,191	9,810	27,069
Establishment cost after returns (\$)	29,712	9,841	6,218	10,558	-5,085	-10,265
Cumulative Establishment Costs (\$)	29,712	39,553	33,335	22,777	27,862	17,597

Establishment Investment Costs Comparison (2020)

High Density and Traditional Planting Establishment Costs

(430 Trees Per Acre)

	Year1	Year 2	Year 3	Year 4	Year 5	Year 6
Yield (pounds)			13,246	25,100	5,541	20,992
Establishment Costs (year 1-6) (\$)	29,712	9,841	10,969	18,633	14,895	16,804
Returns (\$)			17,187	29,191	9,810	27,069
Establishment cost after returns (\$)	29,712	9,841	6,218	10,558	-5,085	-10,265
Cumulative Establishment Costs (\$)	29,712	39,553	33,335	22,777	27,862	17,597

2.58 times less than the traditional establishment; 85% of the cumulative establishment cost offset by returns (year 3-6).

Establishment Years Costs and Returns

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Traditional Production (145 Trees per acre, 2011 study adjusted for inflation to 2020)						
Yield (pounds)			700	2,900	4,300	5,800
Establishment Costs (year 1-6) (\$)	15,006	6,556	8,505	9,323	11,063	12,525
Returns (\$)			897	3,615	5,515	7,429
Establishment costs after returns (\$)	15,006	6,556	7,608	5,608	5,615	5096
Cumulative Establishment Costs (\$)	15,006	21,562	29,171	34,780	40,228	45,324

28% of the cumulative establishment cost offset by returns during establishment

Results #II. Production Costs And Returns Per Acre

High Density (430 Trees Per Acre, 2020 Study)	
Yield (pounds)	16,220
Production costs year 7+ (\$)	16,233
Gross Returns (\$)	22,494
Returns after costs before management (\$)	6,260

Gross returns higher than production costs by 38% = Profit before paying management

High Density And Traditional Planting Production Costs, And Profit Comparison (2020)

High Density (430 Trees Per Acre)	
Yield (pounds)	16,220
Production costs year 7+ (\$)	16,233
Gross Returns (\$)	22,494
Returns after costs except management (\$)	6,260
<hr style="width: 50%; margin: 0 auto;"/> Traditional Production (145 Trees per acre, 2011 study adjusted for inflation to 2020)	
Yield (pounds)	9,000
Production costs year 7+ (\$)	12,980
Gross Returns (\$)	12,510
Returns after costs except management (\$)	-563

Summary: High Density Planting:

Compared to traditional planting and given assumptions in the Study : Results

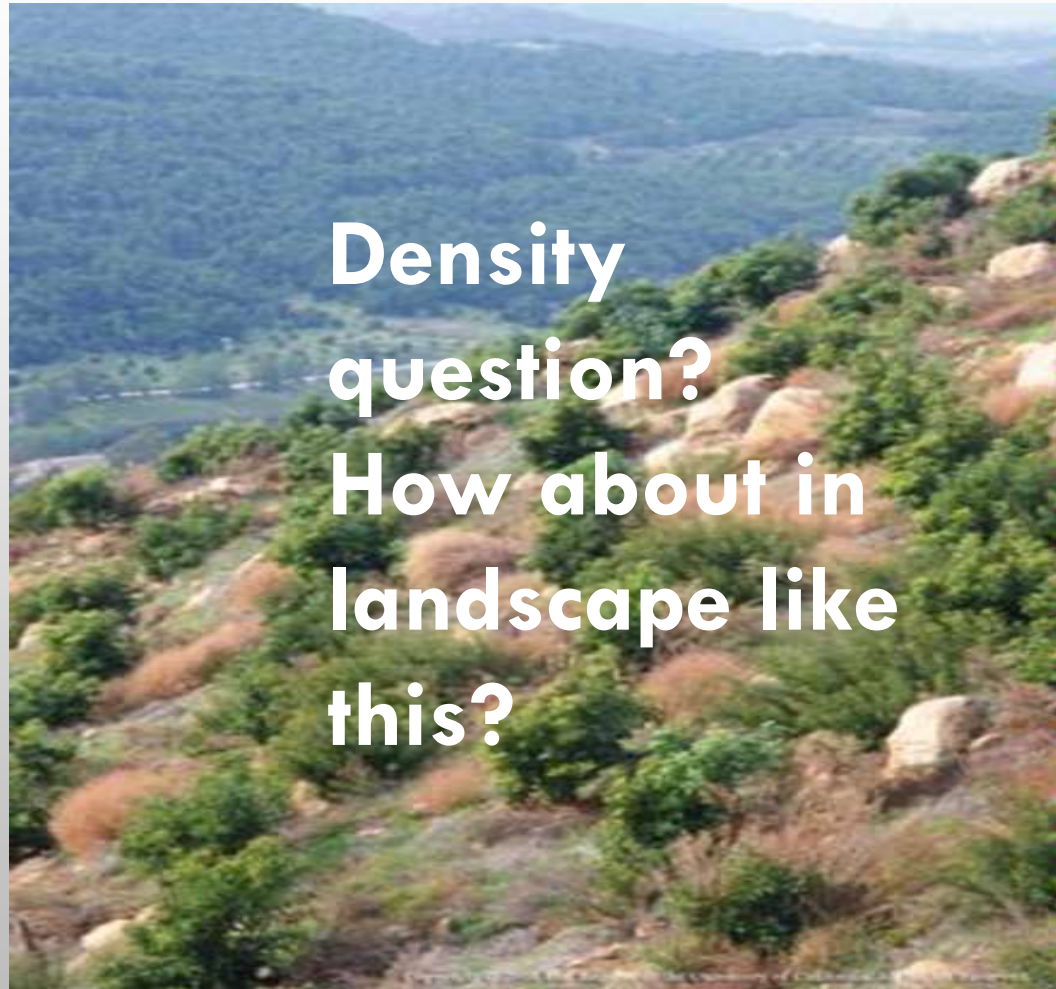
1. Yield: ~80% more on average;
2. Irrigation efficiency:
 - Can grow high density with ~same amount;
3. Alternate pruning method kept pruning cost manageable;
4. Establishment investment costs
 - 3x lower; because
 - more yield/returns (years 3-6) offset 82% of the costs.
5. Positive profit in production.

Conclusion:

- Reflects potential/feasibility for investment considerations;
- Reflects potential for sustainability/and future viability of the industry.

More detail in the study: gross margin, break even prices and yield and price variation analyses

Application of High Density Planting to a Larger Scale



- Is it feasible to assume the same density in hill sides?
- What will be the appropriate density?
- Would planting a lower density be profitable?
- Would the cost of pruning be as low in the moderate slope?
- Etc.?
- Future research opportunities!

*Acknowledgements: Cooperators and Reviewers:
Dr. Daniel Sumner and Don Stewart of Agricultural
Economics Dept. Davis; Dr. Gary Bender, UCCE farm
advisor emeritus, San Diego County and
the Grower Cooperator.*



Additional Notes:

Regarding prices:

- Price used in this study is an average of 2014-2017 from the county agricultural commissioner report: \$1.37/lb
- Total cost break even price for this trial is \$1.00
- Price in 2021 \$1.55/lb
- Price in 2020 \$1.59/lb
- In the US price in 2023 \$1.18-1.19/lb

Regarding High density Plant:

In 2020 Fall brook high density (spacing not specified) on a 10 acre Ventura 22' x10'= 180 trees in 2011 study

Expansion question:

Up to now:

- COVID impact on investment interest
- COVID impact on labor
- It is from here on we would watch what will happen? The information both the trial details and the economic analyses are widely disseminated. It has got good mass media coverage.

Additional Notes: #2

Labor:

Machinery \$26

Manual \$19.00

New regulation: 1.5X for overtime after 40 hours

California prices: California avocado commission

2016-2021 average \$1.35/lb

More insights from the full report: Break even price analyses, Cash Flow analyses, price and yield variation impacts on profit.

A Little Bit More Insight Into The High Density Economics

Components of Production Costs and Returns Per Acre

Type of Cost or Revenue	\$/Acre	Returns above costs (\$/Acre)	Interpretation
Gross Returns	22,494		
Total Operating Costs/Variable Costs	11,920	10,573	
Cash Overhead costs	716	9,857	Gross margin
Non Cash Overhead/Fixed Costs including investment amortization	3,596 (1955)	6,260	