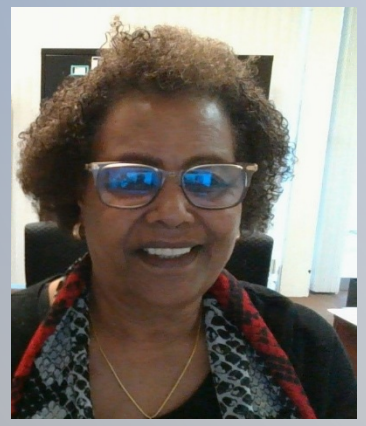
TITLE: PROFIT POTENTIAL INVESTIGATED FOR HIGH DENSITY AVOCADO PLANTING IN CALIFORNIA

A cost returns analysis based on a study of a field trial of a high density avocado planting in San Diego County from 2011-2018



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THE PURPOSE/NEED

- The study's purpose was to address the situation of a declining avocado industry in San Diego county and to find solutions for stabilizing and even reviving the industry.
- The principal investigator Dr. Gary Bender, a California cooperative extension (UCCE) farm advisor in San Diego county, now emeritus (seen on the picture) described the situation as follows:

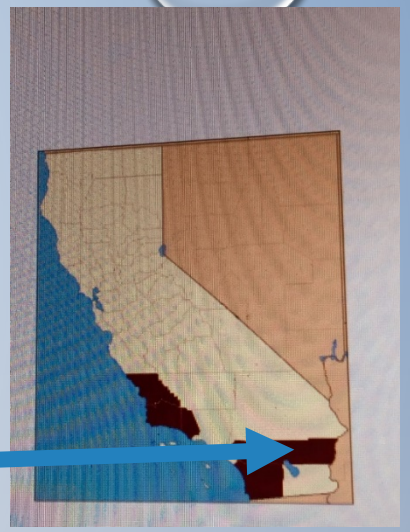
  '*how does a grower in California make a profit when the water prices keep increasing and yet, mostly due to foreign competition, market prices remain fairly static?*'

Showing not sufficiently irrigated grove due to high water cost

Water prices in San Diego county reached to up to $2,000 per acre foot in 2020; that means ~$9,000 per acre for water use only in avocado production, yet

Production or yield per acre and prices remaining static stifling profit led growers pulling out groves that led to the huge decline of the avocado industry in the County.

THE PURPOSE OR NEED



- San Diego County was a leading avocado producer with about 45,800 acres, ~60% of the 76,307 acres in California in 1987/88.
- Now the industry has only 17,741 acres in 2018; a 2% per year decline for the last 30 years.

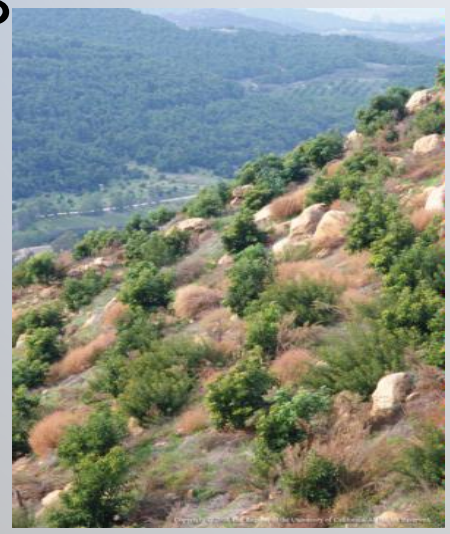
- Therefore the sustainability of the industry being challenged, over the years production improving practices have investigated:
  - nutrition, irrigation, pest and disease management, pruning and even organic production to improve growers profit and the stability of the industry.
  - These improvements, however, could not offset the increasing water costs.
- In the last decade high density production has been getting interest in many of the world avocado producing countries, so was here in California.

THE FIELD TRIAL/HIGH DENSITY PLANTING

A

High Density Planting in Valley Center, San Diego, 2011. (Picture by Dr. Gary Bender, Farm Advisor Emeritus, San Diego County)

B



Avocado planting on a hillside (20'x15'=145 trees per acre

Description of field trial included

- Initiated by Dr. Gary Bender in cooperating with a local grower
- Location at Valley Center, Northern San Diego County
- Gentle slope landscape (figure A),
- Planting space of 10' x10' = 430 trees per acre , **almost 3 times the density** of the traditional planting 20'x15'=145 trees per acre (figure B):
- Hass or lamb Hass varieties,
- Zutano variety pollinizer (1 tree per 8 trees of Hass or Lamb Hass),

THE FIELD TRIAL INVESTIGATED/EVALUATED: FACTORS MEASURED

Yield level?

Pruning methods efficiency:

(alternate side pruning per year vs whole grove pruning per year-effect on yield)

Irrigation water use

monitored and documented using Watermark soil irrigation Monitors, irrigated when the Watermarks averaged 35-40 centibars (cb). Worked perfectly and trees never had any tip-burn.

Pruning

- Kept trees at 8';
- avoid overcrowding;
- harvesting ease and grove passes; helps keep costs down and
- more light shine into the trees, more fruit borne on the lower branches.

PRODUCTION PRACTICES OBSERVED BUT NOT MEASURED

- Other production practices such as fertilization (applied through the irrigation system), pesticide, herbicides controls and other treatments assumed the same for the high density as the traditional planting because application of those practices depend on field area and not on density of planting.

Example of diseases Avocado disease: stem end rot

Pest management/ control

RESULTS

Yield Per Acre from a High density trial, Valley Center, 2011-2018 And Traditional Planting Growers Interview, 2011						
Hass Variety						
Valley Center Field Trial 430 trees per acre				**Traditional Planting 145 trees per acre**		
Year	*Trial Year*	*Yield: lbs./acre*	*Yield: lbs./tree*	Interview *year*	*Yield: lbs./Acre*	*Yield: lbs./tree*
2012	Planting			2011		
2013	Year 1					
2014	Year 2					
2015	Year 3	13,246	31		700	5
2016	Year 4	25,100	58		2,900	20
2017	Year 5	5,541	13		4,300	30
2018	Year 6	20,992	49		5,300	37
Prod. Year (Avg.)	Year 7+	16,220	38		9,000	62

RESULTS

Water Use Per Acre from a High Density Trial, Valley Center, 2011-2018 And Traditional Planting Growers Interview, 2011				
Hass Variety				
Valley Center Field Trial 430 trees per acre				**Traditional Planting 145 trees per acre**
Year	*Trial Year*	*Water Ac. In/acre*	Interview *year*	*Water Ac. In/acre*
2012	Planting		2011	
2013	Year 1	14.04		6
2014	Year 2	39.60		11
2015	Year 3	34.56		16
2016	Year 4	57.84		21
2017	Year 5	45.48		26
2018	Year 6	~46.00		32
Prod. Year (Avg.)	Year 7+	~46.00		42

RESULTS

Pruning Hours Per Acre and Per Tree, High Density Trial, Valley Center 2022-2018 And Traditional Planting Growers Interview, 2011

Valley Center Field Trial 430 trees per acre					Traditional Planting 145 trees per acre	
Year	*Trial Year*	Hours/ Acre	*Hours/ Tree*	Interview *year*	*Hours/ Acre*	*Hours/ Tree*
2012	Planting			2011		
2013	Year 1	26.89	0.06			
2014	Year 2	43.33	0.10			
2015	Year 3	55.08	0.13			
2016	Year 4	48.56	0.11		14.50	0.10
2017	Year 5	49.10	0.11		16.86	0.12
2018	Year 6	49.50	0.12		21.71	0.15
Prod. Year (Avg.)	Year 7+	49.30	0.11		38.64	0.27

No significant yield differences between the whole grove pruning per year versus alternate side pruning per year. Therefore, alternate side pruning is cost effective

RESULTS

Cost and Profitability Analyses of Traditional and High Density Planting :

Establishment Costs and Returns

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Traditional Production (140 Trees per acre, 2011 study adjusted to inflation to 2020)						
Yield (pounds)			700	2,900	4,300	5,800
Establishment Costs (year 1-6) and production costs year 7+ ($)	15,006	6,556	8,505	9,323	11,063	12,525
Returns ($)			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
Production returns after costs ($)						
Returns during the establishment period offset the cost of establishment by ~28%						
High Density Production (430 Trees Per Acre, 2020 Study)						
Yield (pounds)			13,246	25,100	5,541	20,992
Establishment Costs (year 1-6) and production costs year 7+ ($)	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 ($)	29,712	39,553	33,335	22,777	27,862	17,597
`Production returns after costs ($)						
Returns during the establishment period offset the cost of establishment by ~83%						

RESULTS

Production Costs and Returns	
	Production Year 7+
Traditional Production (140 Trees per acre, 2011 study adjusted to inflation to 2020)	
Yield (pounds)	9,000
Production costs year 7+ ($)	12,980
Gross Returns ($)	12,510
Returns after costs except management ($)	-563
High Density Production (430 Trees Per Acre, 2020 Study)	
Yield (pounds)	16,220
Production costs year 7+ ($)	16,233
Gross Returns ($)	22,494
Returns after costs except management ($)	6,260

SUMMARY:
HIGH DENSITY COMPARED TO TRADITIONAL PLANTING

Almost double yield in production

16,620 lbs per acre

Pruning cost per tree reduced by over 50%

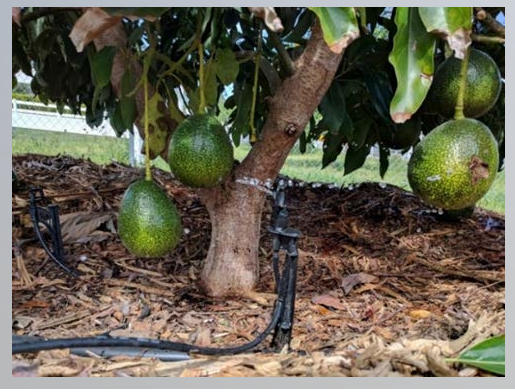
0.11 hours per tree

Significantly lower establishment cost (cumulative of 6 years):$17,600/Acre

~Double gross returns: $22,500/Acre

Significant gain in net returns: $6,200/Acre

Efficiency in water use:



46 acre inches per acre

APPLICATION OF A HIGH DENSITY TO A LARGER SCALE

In Conclusion

High density planting shows to be profitable and may be a way to go for maintaining the avocado industry and even may reverse the trend to induce new plantings and revive the industry in San Diego County.

However, the big question is can high density be done in very steep slope groves? In the trial, high density planting was done in moderately sloped landscape (picture A) and several of the groves in San Diego County are on hill side as seen in picture B.

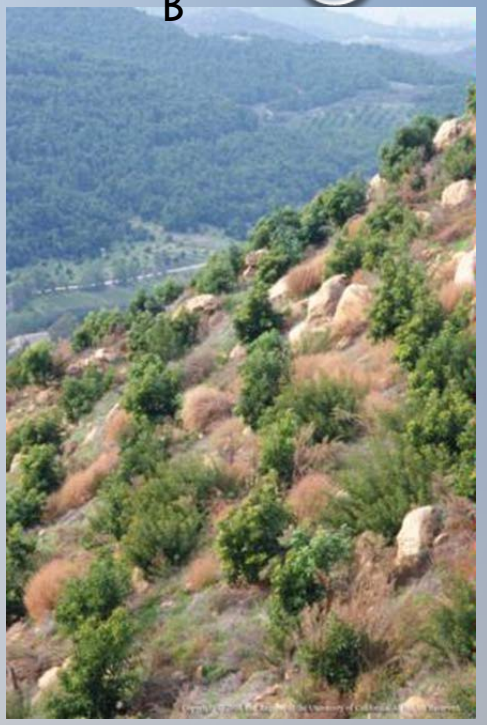
A

High density in moderately sloped landscape

Future work will involve to answer the following questions:

- Is it feasible to assume the same density of planting for steep slope groves as the moderately slope landscape?
- what will be the density that would fit the high slope planting?
- Would planting at a lower density be profitable?
- Would the costs of pruning on a steep slope be as low as the density of moderate slope landscape?
- These and other questions would need further investigation.

B



Most groves in San Diego County

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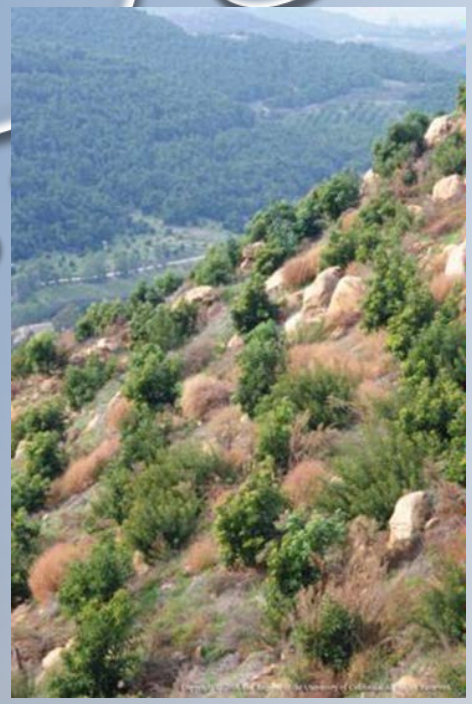

Thank you