



Can We Improve Soil “Health” and Orchard Performance With Organic Amendments?

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Theoretically, adding organic matter to the soil is a good thing

- Does it produce meaningful changes that provide economic benefits to a fruit & nut tree grower?

Does Pre-plant Compost Help in the Establishment of New Potted Trees?

Field trial in east Modesto:

- No compost
- 5 tons / acre
- 10 tons / acre
- 20 tons / acre
- 30 tons / acre

Sandy loam soil following removed vineyard





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5 tons / acre
\$130

10 tons / acre
\$265

20 tons / acre
\$530

30 tons / acre
\$800

Compost Nutrient Analysis

- Material: Recology composted green waste & food waste
 - 2.32 % N dried weight (1.25% as delivered)
 - ~ 25 lb N / ton applied
 - ~ 5-20% available first year
 - 10.8 lb K₂O / ton
 - 26 lb P₂O₅ / ton



Slow N release urea:
Assumes 5% of N from
compost available the first year

- 6.3 lb / a
- 12.5 lb / a
- 25.0 lb / a
- 37.5 lb / a

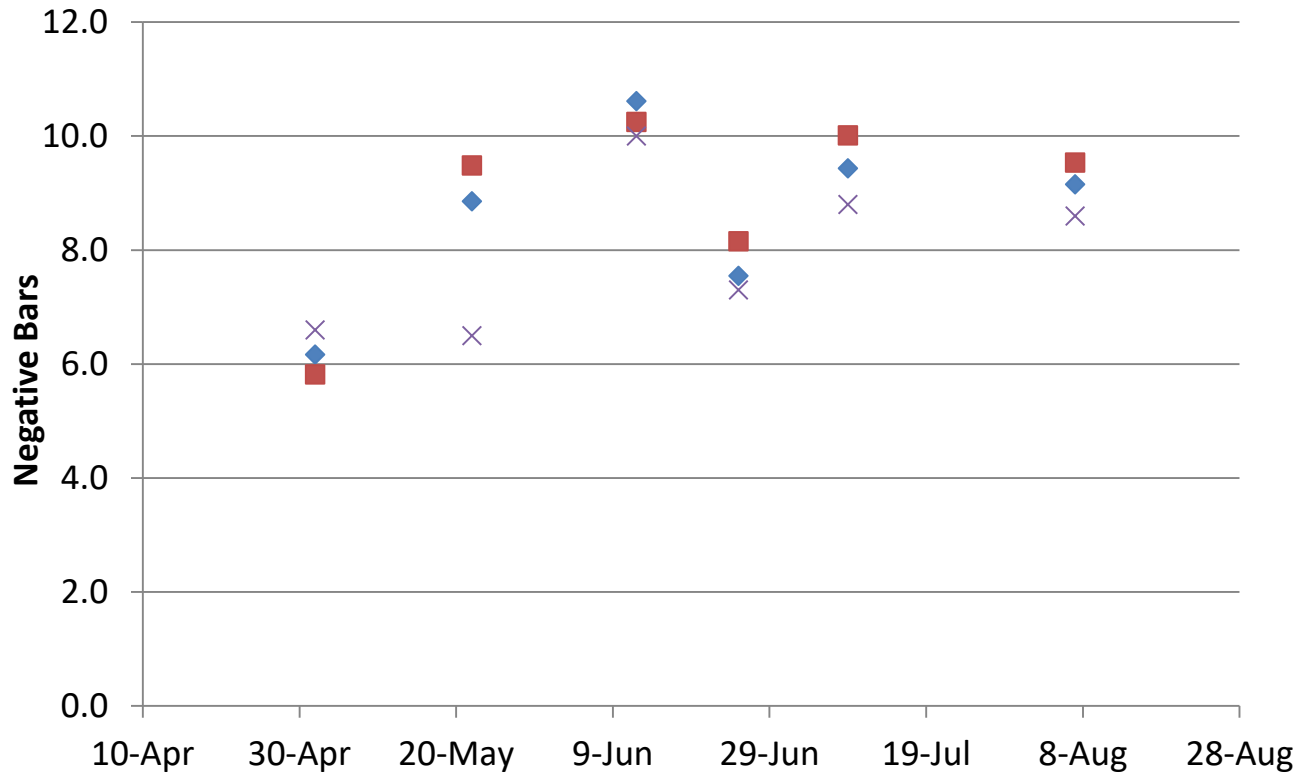




Potted trees planted May 2017



Does Compost Reduce Water Stress?



Pressure bomb indicated a small but consistent **HIGHER** water stress in compost-treated trees



Trunk Circumference Measurements of Almonds Trees Amended with Compost at Planting Time – Dusty Lane

	End 1 st Leaf (2017) (cm)		End 2 nd Leaf (2018) (cm)	
	Nonpareil	Bennett	Nonpareil	Bennett
Check	8.4	8.5	25.7	26.1
5 tons / acre	8.5	8.1	25.7	30.2
10 tons / acre	8.6	8.3	25.9	25.7
20 tons / acre	8.6	8.7	26.2	26.1
30 tons / acre	8.4	7.9	26.2	25.7
6.3 lb N	8.5	8.7	26.1	26.2
12.5 lb N	8.5	8.4	26.1	26.0
25 lb N	8.5	8.3	25.7	26.2
37.5 lb N	8.5	7.9	25.6	25.4
	n.s.	n.s.	n.s.	n.s.

Does Pre-plant Compost Help in the Establishment of Potted Trees?

After two years, we saw no measurable effect on tree establishment



Preplant & Post-plant Compost on Young Almond Trees – Two Locations

- Riverbank, Hanford Sandy Loam, never been farmed in trees
 - Nonpareil on Nemaguard
- North Modesto, Loamy sand, almond orchard removed previous year
 - Independence on Viking



Preplant & Post-plant Compost on Young Almond Trees

-2015 first leaf

- Composted green waste @ 5.2 tons applied per acre
- Composted dairy manure
- Urea @ 0.2 lb / tree (equivalent to N in composted green waste; assuming 20% available)
- Unamended





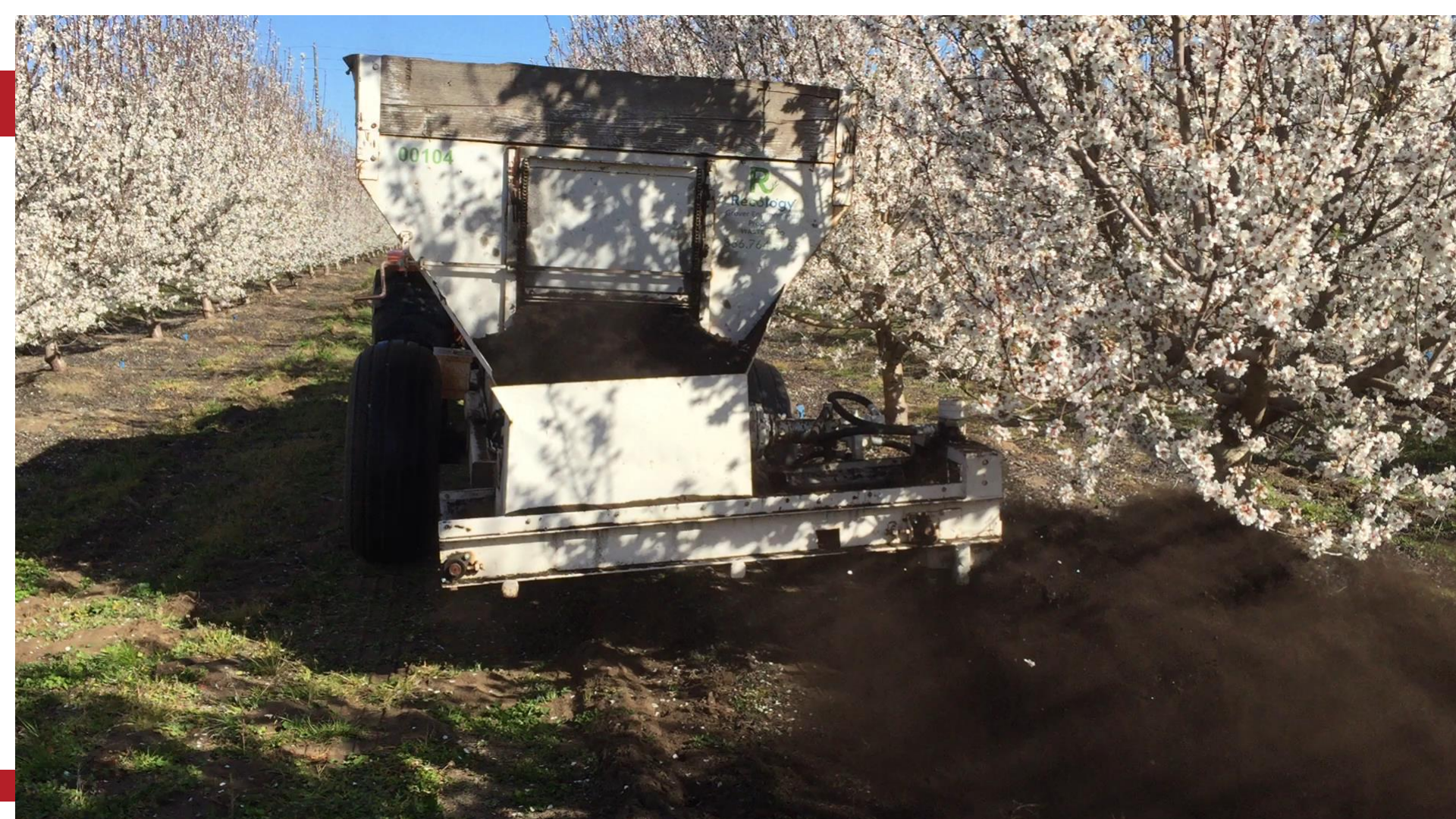


Amendments incorporated at planting time. Additional ½ ton after planting.
- Two locations











Loamy Sand After Four Years Annual Application of 10 Tons Composted Green Waste

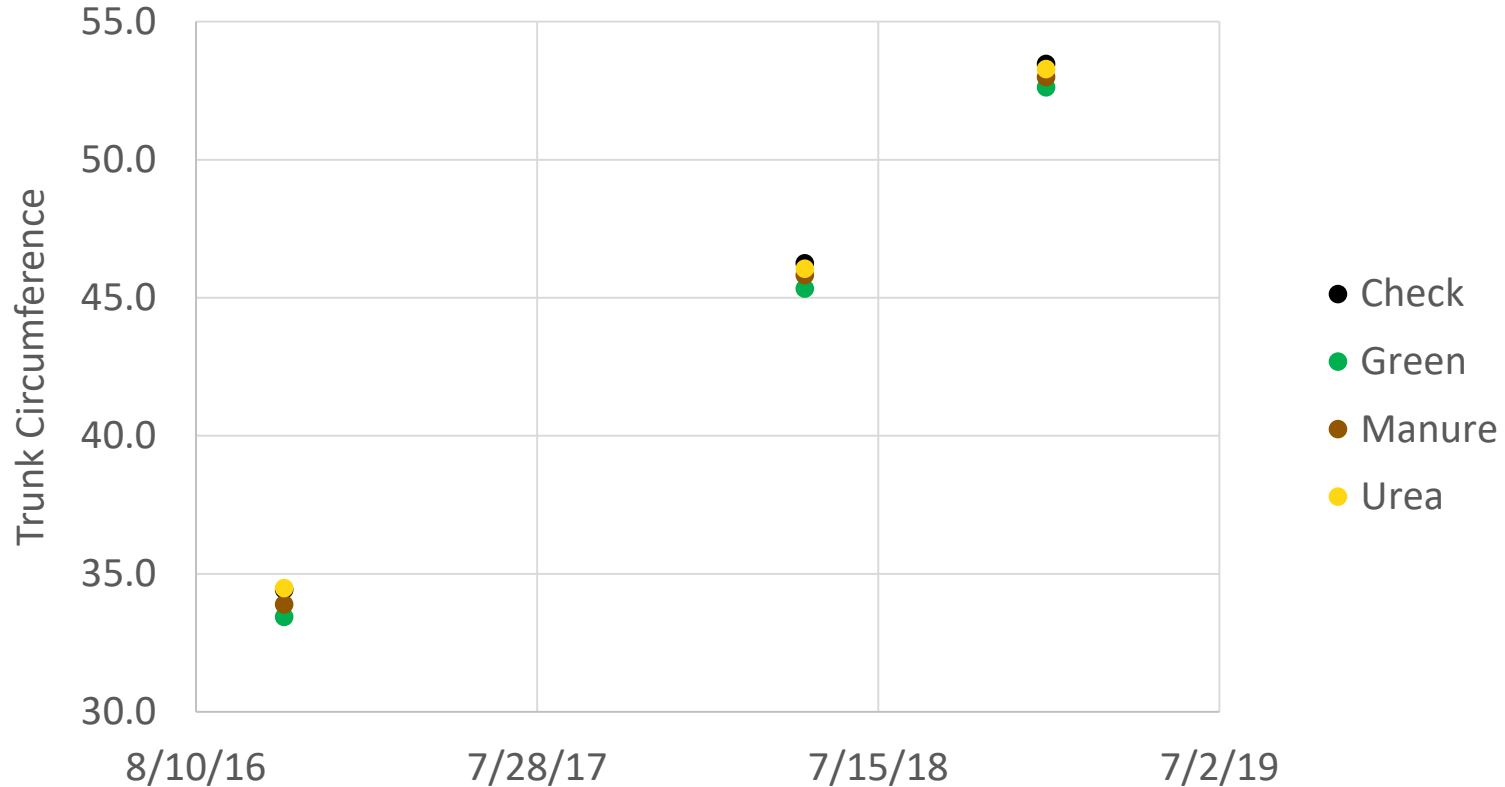


Parameters we are measuring

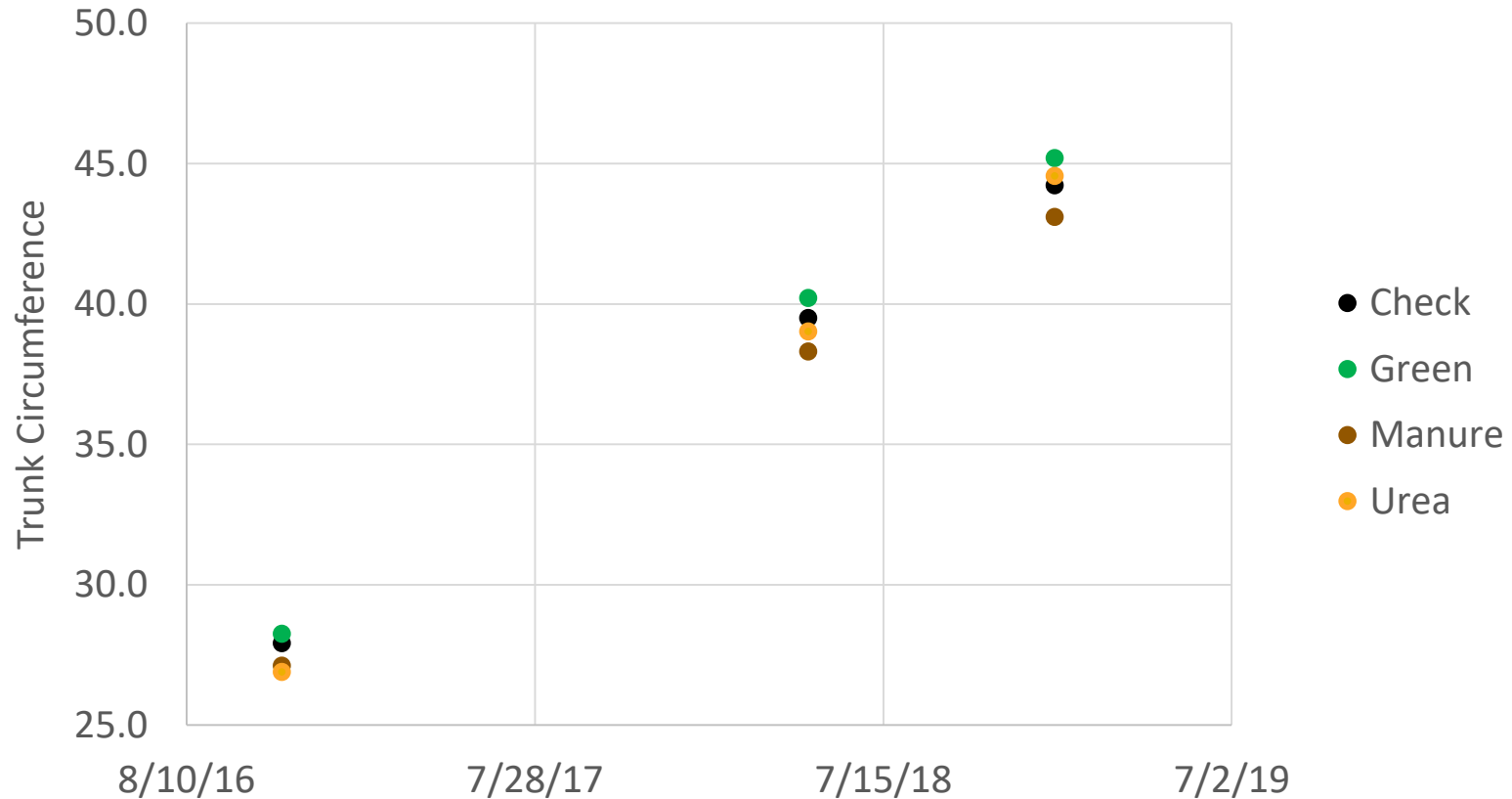
- Trunk circumference annually
- Leaf nutrients
- Nematodes
- Stem Water Potential (pressure bomb)
- Yield
- \$\$



Trunk Circumference of Nonpareil on Nemaguard – Virgin Sandy Loam



Trunk Circumference of Independence on Viking - Replant Loamy Sand



Green Waste vs. Unamended.
Begin 5th leaf, Jan. 2019



Nematode Numbers in Compost-Amended and Non-Amended Soil End 4th Leaf (January 2019)

	Sandy Loam Virgin soil Nemaguard root		Loamy Sand Replant Site Viking root	
	Ring	Root Lesion	Ring	Root Lesion
Check	0	0	73	118
Green Waste	0	0	180	136
Manure	0	38	316	137
Urea	0	0	44	162
	n.s.	n.s.	n.s.	n.s.



per 250 cc soil

Leaf Nutrients in July-Sampled Leaves from Trees in Compost Amended and Non-Amended Soil

Independence on Viking (4th Leaf)
July, 2018



	N	P	K	Ca	Cl
Check	2.58 b	0.16 a	2.89 b	5.31 a	0.39 c
Green Waste	2.76 a	0.16 a	3.06 b	4.73 b	0.56 ab
Manure	2.74 a	0.17 a	3.37 a	4.44 b	0.63 a
Urea	2.58 b	0.15 a	3.12 b	5.33 a	0.39 bc

Higher N,& Cl; higher K in manure. Lower Ca

Leaf Nutrients in July-Sampled Leaves from Trees in Compost Amended and Non-Amended Soil

Nonpareil on Nemaguard (4th Leaf)
July, 2018



	N	K	Ca	Cl
Check	2.51 a	3.21 ab	5.52 a	0.18 b
Green Waste	2.55 a	3.34 ab	5.09 b	0.24 a
Manure	2.53 a	3.51 a	5.07 b	0.24 a
Urea	2.48 a	3.15 b	5.55 a	0.20 ab

Yield Comparison of Almonds in Compost-Amended or Non-Amended Soil

	Loamy Sand Replant Independence / Viking		Sandy Loam Nonpareil / Nemaguard	
	3 rd leaf	4 th leaf	3 rd leaf	4 th leaf
Check	--	1988 a	568 a	2148 a
Green Waste	--	2256 a	559 a	1992 a
Manure	--	1991 a	602 a	1977 a
Urea	--	2018 a	600 a	2121 a



Effect of Compost on Soil Chemistry

- West Modesto Orchard after 7 Years of Composted Green Waste

	Sampling Depth	Saturation Percentage	pH	CEC (meq/100g)	% Organic Matter
Compost	0 - 4"	36	6.8	12.8	2.68
	4"-12"	25	6.9	7.0	0.97
	12"-18"	27	7.2	7.3	0.77
No Compost	0 - 4"	29	6.7	7.6	1.12
	4"-12"	29	6.2	7.9	0.87
	12"-18"	27	6.0	8.6	0.83



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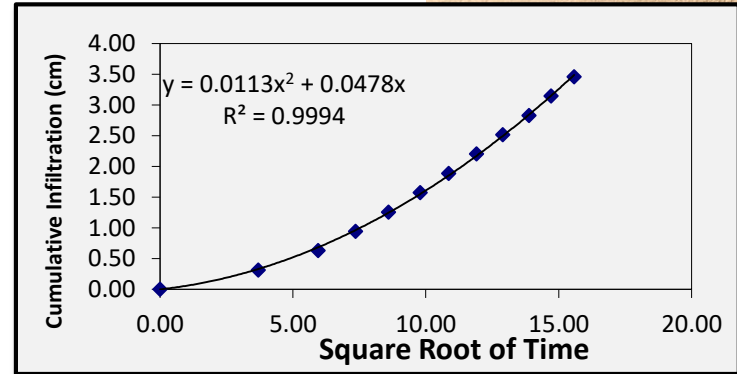
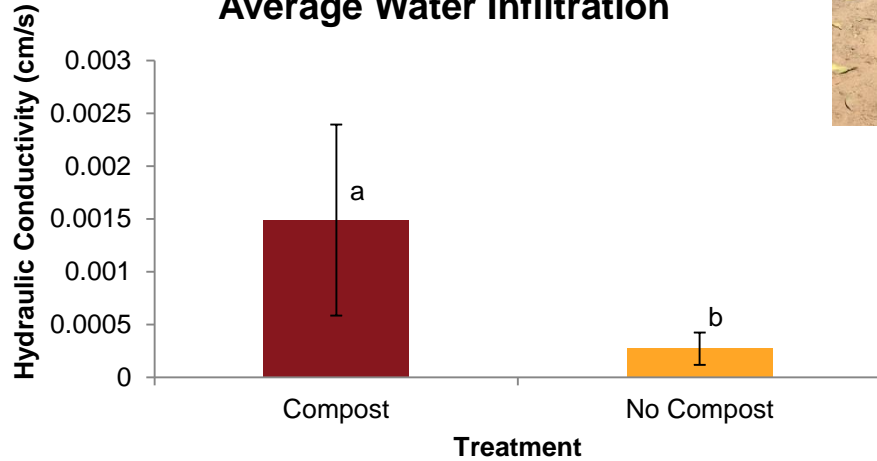


Water Infiltration Test

-Vivian Lopez, UCCE Merced



Average Water Infiltration



Surface infiltration was better in compost area

Cost of Compost Application

- \$10 / ton composted green waste
- Freight costs = \$275 / 25 ton load
 - = \$21 / ton delivered
 - Roughly \$5.50 / ton application cost



Total cost = \$26.50 / ton composted green waste applied

= \$265 / acre for 10 tons applied

Conclusions

- Increased cation exchange capacity (top few inches only)
- Increased in organic matter in top few inches
- Increased soil carbon
- Increased microbiological activity
- Increasing trend for higher K, N in soil & leaves
- Improved water penetration at soil surface
- Increase in leaf chloride
- Decrease in leaf calcium
- More negative stem water potential??
- No difference in tree size or yield after 4 years... YET!

Conclusions

- Building soil “health” may take many years using compost
- Will it be economically feasible?
- May see most difference in replant or sandy sites

Many Questions to answer:

- What is the carbon footprint of producing, hauling and applying compost?
- Is there a better way to increase OM in California orchards?



Thank You to:

John Duarte
Robert & Brandon Longstreth

Brian Dugo
Art Bowman

Daniel Green
Dan Rivers

 **University of California**
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