Could Cover Crops or Whole Orchard Recycling Help with Orchard Management?

california almonds®
Almond Board of California

Session Speakers

Gabriele Ludwig, ABC

Tanya Wood, ABC

Greg Wegis, Wegis & Young

Amelie Gaudin, UC Davis

Brent Holtz, UC ANR

Greg Wegis,

Wegis & Young

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Almond Board of California

Amélie Gaudin
Assistant Professor of Agroecology,
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Implementing cover crop systems in Almond Orchards

J.Mitchell, A.Westphal, M.Yaghmour, C.Zuber, D.Lightle,
B.Hanson, N.Williams, A.Hodson, H.Wilson, S.Solis
C.Creze, S.Haring, A.DeVincentis

Orchards alley are **underutilized**

- Roads
- Floors

Potential to intensify their use to help address

- **Production** challenges/constraints
- **Sustainability** targets

Especially postharvest during the winter

- Tree dormancy
- Precipitation water is available

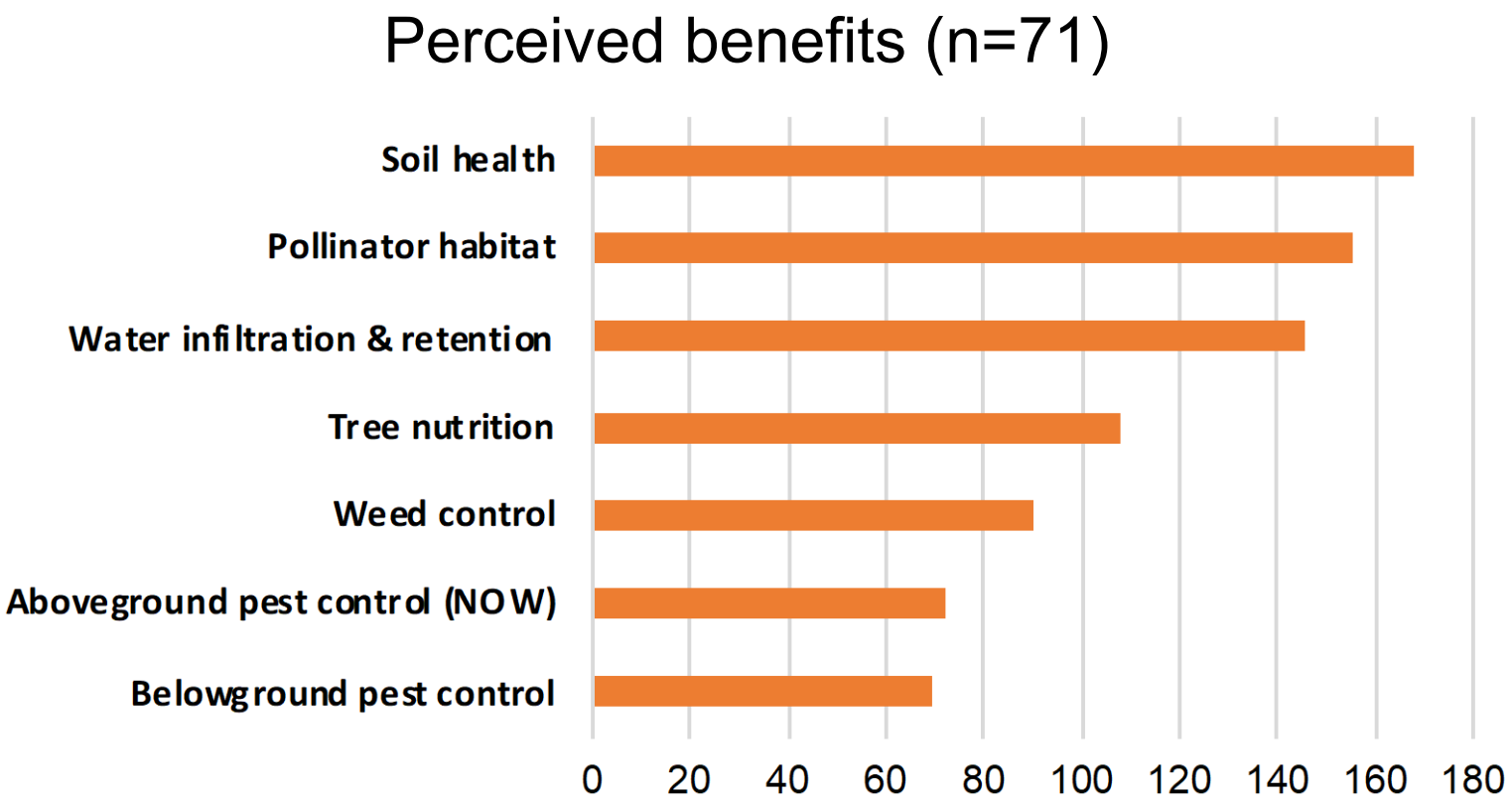




It can take many forms

- Orchard's age and spacing
- Region
  - Precipitation
  - Soil type
  - Temperatures …
- Objectives
- Equipment availability
- Experience and advice

Many growers recognize the potential benefits of winter cover crops but uncertainties remain

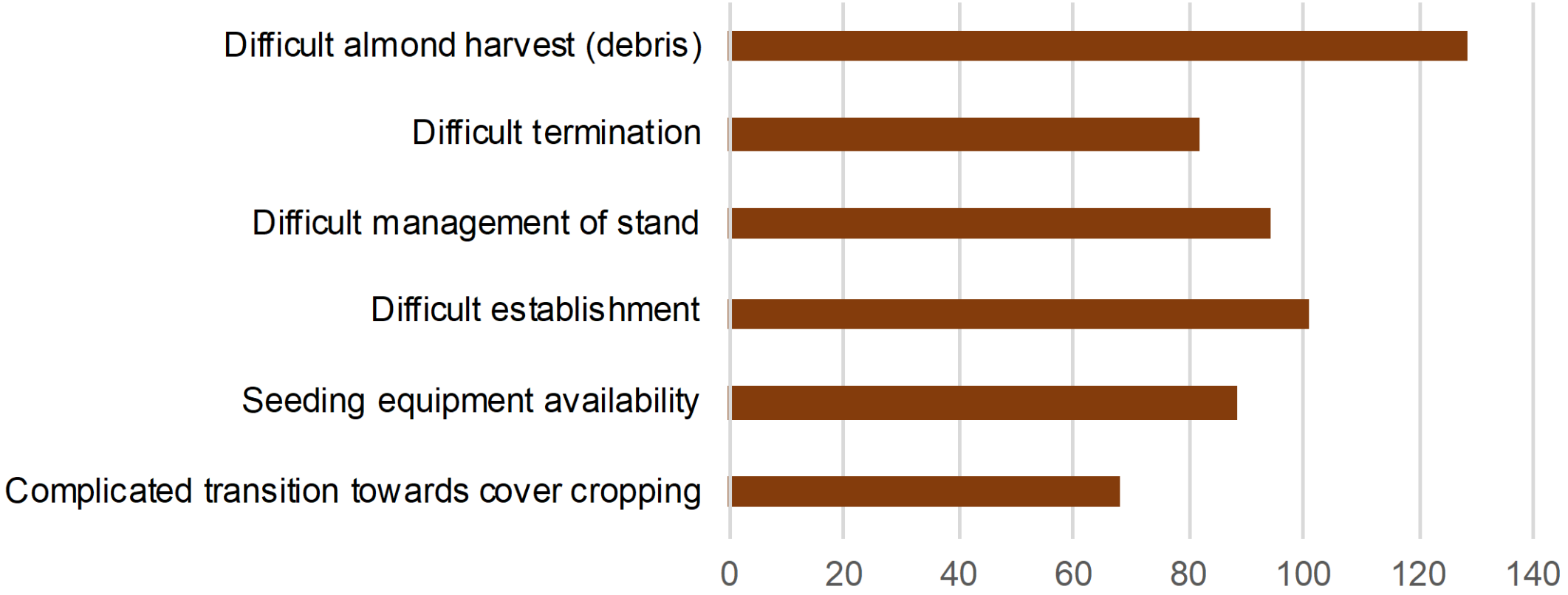


- Water usage?
- Issues at harvest?
- Additional difficulties in management?
  - Weed control
  - Winter sanitation
  - Vertebrate pest management
  - Frost risk
- Cost and uncertainties of economic return

Lack of information on cover crop management

C.Creze, A Gaudin

Perceived operational constraints



C.Creze, A Gaudin

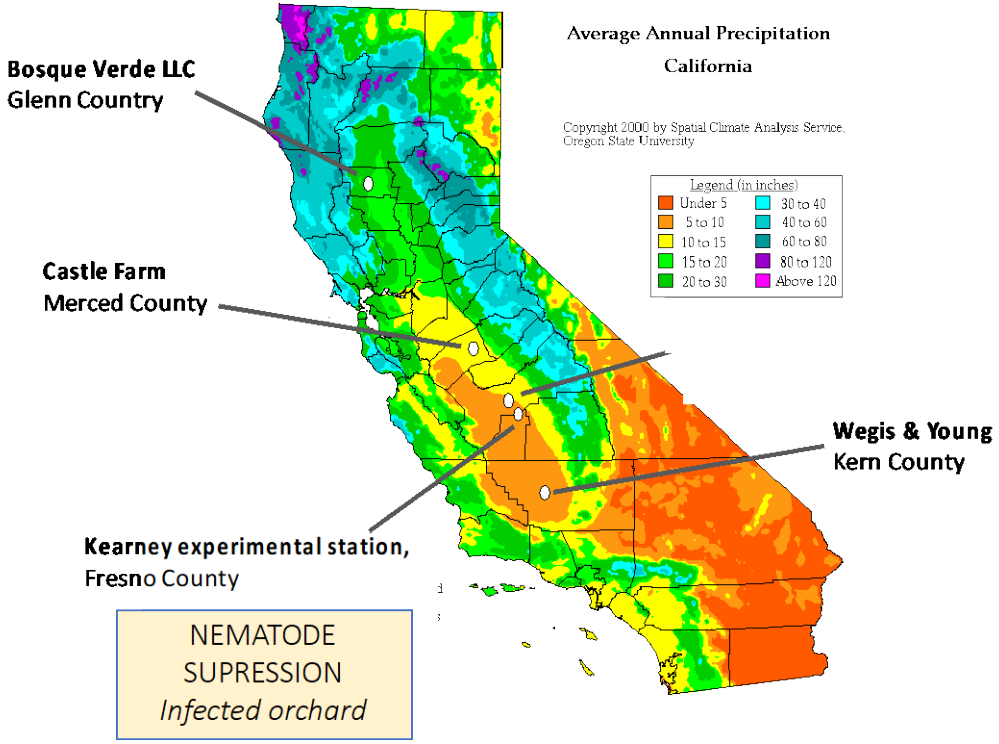
UCCE evaluations of cover crops 1922-1934

Field Peas in Tree Pruning Plot C,P,C Tuttle

Left to right: grown on sand
Mellilotus, Tangier Peas, common vetch, field peas - Atwater

How can it be successfully implemented in our modern intensive systems? What are the benefits? What to watch out for?

Evaluation across our rainfall gradient



1) Soil Mix

(5 species/3 families) at 50 lbs./acre

- ✓ 10% **Bracco White Mustard** (*Brassica hirtum*)
- ✓ 10% **Daikon Radish** (*Raphanus sativus*)
- ✓ 30% **Merced Ryegrass** (*Lolium perenne*)
- ✓ 20% **Berseem Clover** (*Trifolium alexandrinum*)
- ✓ 30% **Common Vetch** (*Vicia sativa*)

2) Pollinator Mix

(5 species/1 family) at 8 lbs./acre

- ✓ 15% **Bracco White Mustard** (*Brassica hirtum*)
- ✓ 20% **Daikon Radish** (*Raphanus sativus*)
- ✓ 15% **Nemfix Yellow Mustard** (*Brassica juncea*)
- ✓ 15% **Common Yellow Mustard** (*Brassica hirtum*)
- ✓ 35% **Canola** (*Brassica napus*)

- **2 popular mixes for different objectives**
- **Perennial resident vegetation, mowed**
- **Bare soil**

Seeded with a no till drill/seeder end of Oct-Nov
1 to 2 or no supplemental irrigation; microsprinklers
2 termination dates (March-April) with herbicide

CALIFORNIA AG CAS SOLUTIONS

Kamprath Seeds

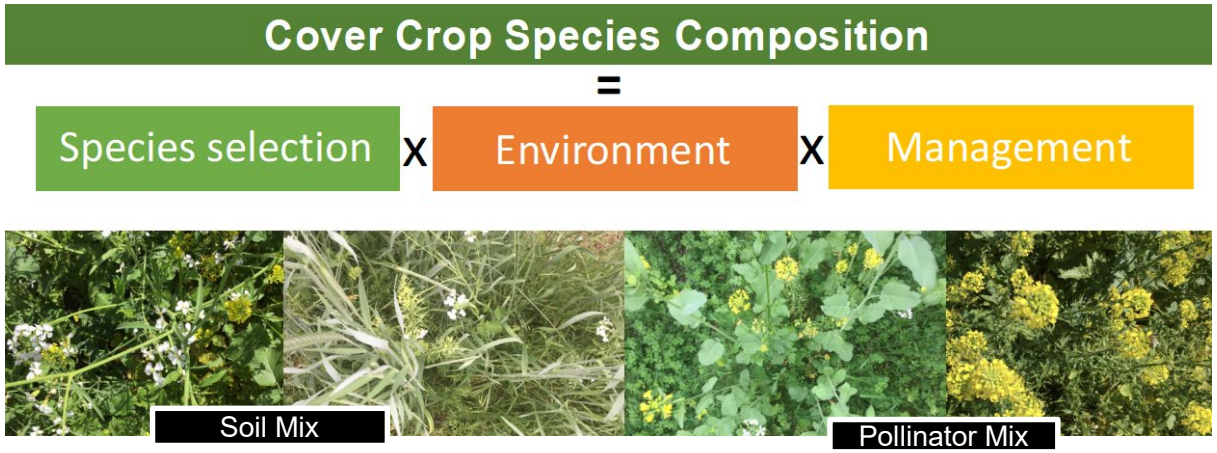
Project *Apis m.*

What have we learned?

- **Potential Benefits**
- **What to watch out for**
- **Best management practices**

Selecting the right mix for your objectives

- Different species or classes of cover crops can target different management goals
- Mixtures: many goals, higher chance of good stand
- Treat it as a crop
- Despite identical seeding rates and mix composition, cover crop composition and biomass will likely be different *every year* and *in your different blocks*



Goals	Grasses	Legumes	Brassicas
Provide Nitrogen		✓	
Scavenge Nitrogen	✓		
Increase Infiltration	✓		✓
Feed Pollinizers		Clover, Vetch	✓
Suppress Weeds	✓	✓	✓
Increase Soil Health	✓	✓	✓

Figure 1. Identify your cover cropping goals, then find the species or group that will meet your goal.

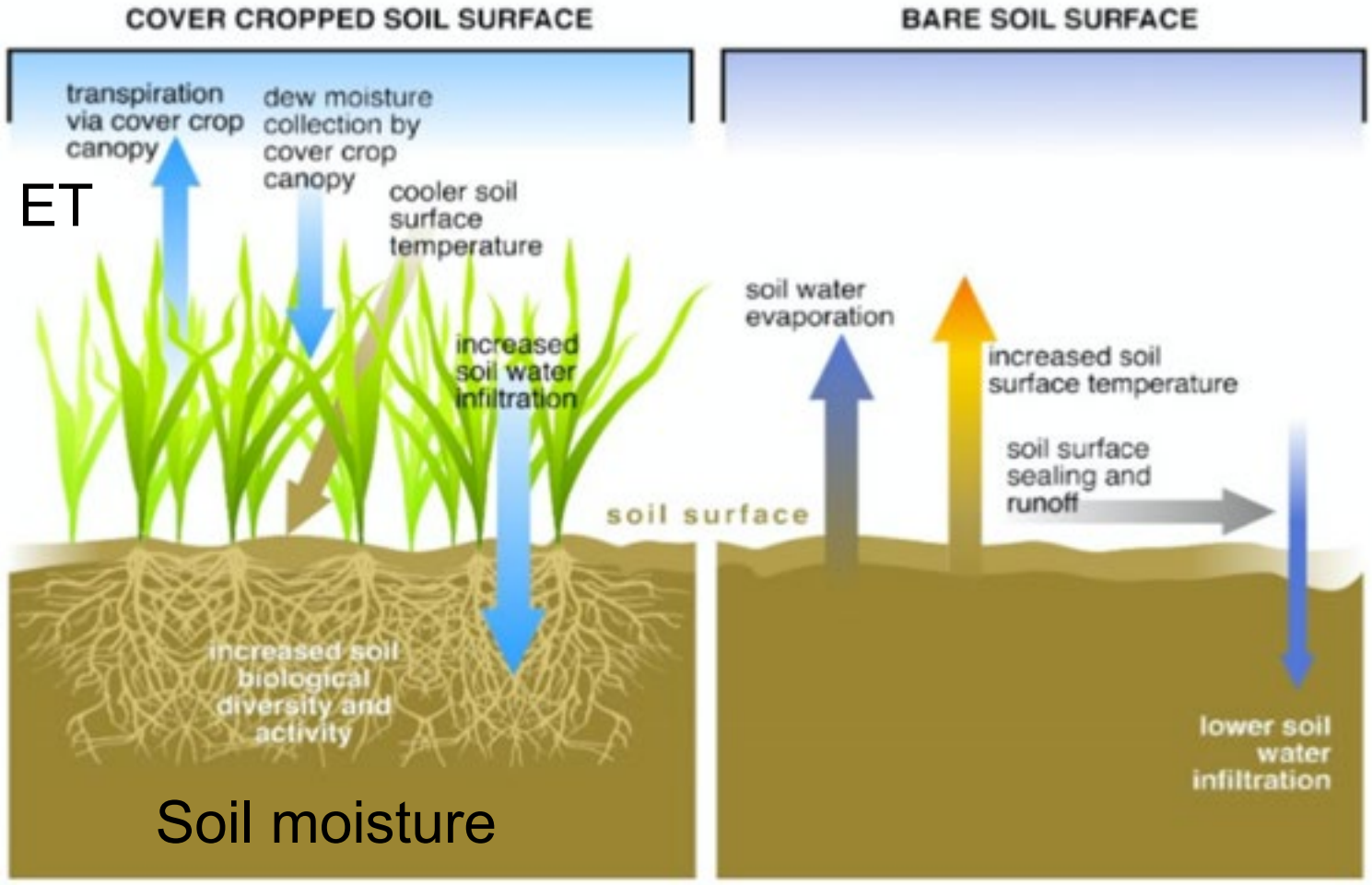
Katherine Jarvis-Shean, UCCE Orchard Advisor
http://www.sacvalleyorchards.com

Guaranteeing optimal harvest conditions and yields

- It is possible to get clean harvest without conditioner
- Species choice: balanced C/N ratio
  - Legumes are faster in decomposing
- Termination: promptly post bloom using mowing and herbicide was effective
- Flail mow: frequency, height, stage
- If you wish to terminate later in the spring, additional mowing in the summer + irrigation could accelerate the break-down of residues.

Keeping water use low: maximize use of rainfall

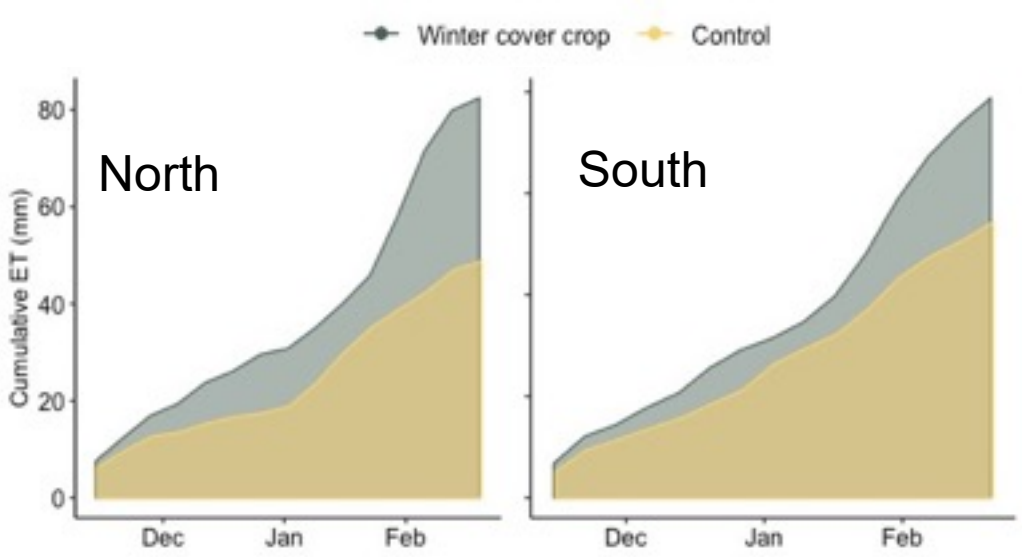
Kc, ET



Jeff Mitchell, Alyssa DeVincentis, Samuel Sandoval

Keeping irrigation water use low

- Seed ahead of the first rain
- No significant differences in soil moisture or tree water status in the spring
- Very close ET values for winter cover crop and bare soils
  - Cumulative difference is approximately 1 inch (25 mm)



- Water is used to create biomass that provides other benefits
- Function of establishment, growth and species

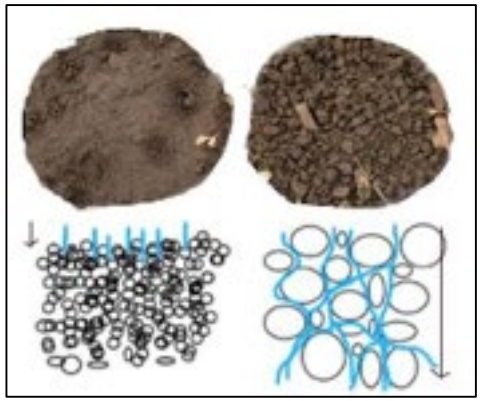
Jeff Mitchell, Alyssa DeVincentis, Samuel Sandoval

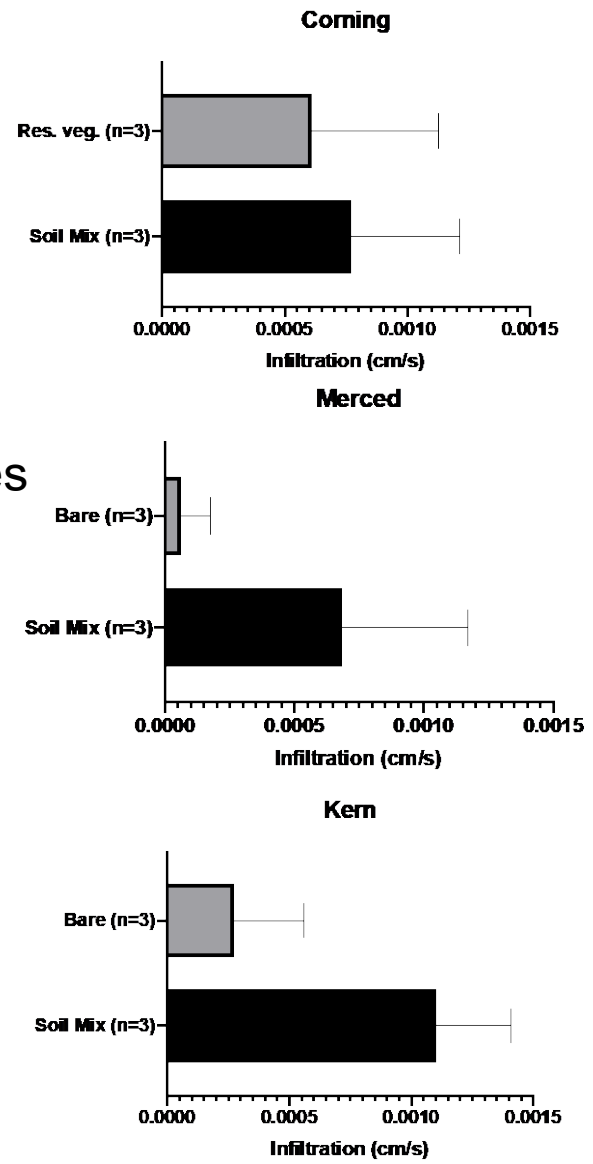
Infiltration and trafficability

Pictures: D.Doll
Merced, February 2017

Infiltration and water retention - 2 years:

- Infiltration: Improved infiltration during the cover crop
- Higher capacity for winter rainfall to penetrate the soil
  - Reduced risks of runoff
  - Water conservation
- Conditions tend to revert back to original infiltration rates post-cover crop: Long term improvements
- Improved aggregation with vegetative covers
  - Water infiltration
  - Dust

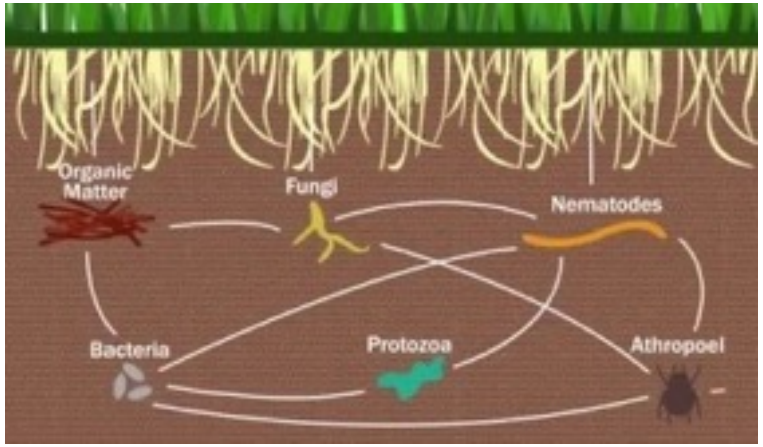




C.Creze, A Gaudin

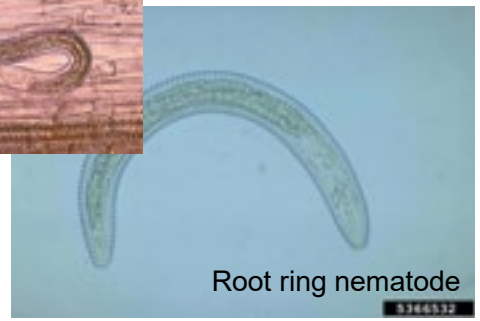
Improvements in soil health take time….

- Cover crop biomass production is a key factor
- Soil biology responds rather quickly, site/mix dependent
  - + Microbial biomass N
  - Carbon cycling enzymes
  - Shifts in soil food web (enrichment in bacterial feeding nematodes)
- Some cover crop species can help limit reproduction of pest nematodes (Greenhouse)
  - Cover crops that suppress RLN do not necessarily suppress RN
  - Large variability between species i.e.: clover types, Rose Clover
- Increases in SOM have not yet been seen



Good guys

Bad guys



C.Creze, Andreas Westphal, Amanda Hodson

NOW: Sanitation effectiveness?

- Trafficability can be improved in the winter to facilitate sanitation
- NOW mortality may increase in mummies in cover crops
- At the same time, cover crops could interfere with sanitation efficacy
  - More difficult to blow/sweep nuts from rows with a dense stand of cover crop
- Offset? We don't know!

  – Shaking and sanitation is still necessary and feasible
  – Sanitation before planting the cover crop is an option
  – Combine cover crop mowing with flail-mowing of the mummies

H.Wilson

Regrowth? Maximizing weed control

- Competition for resources
- Found weed suppression when the cover crop emerges early and is really abundant
  - Decrease weed diversity
  - Weed germination and emergence are not affected
  - Suppress growth
- No differences between mixes thus far
- Early seeding of a mixture ahead of winter rain

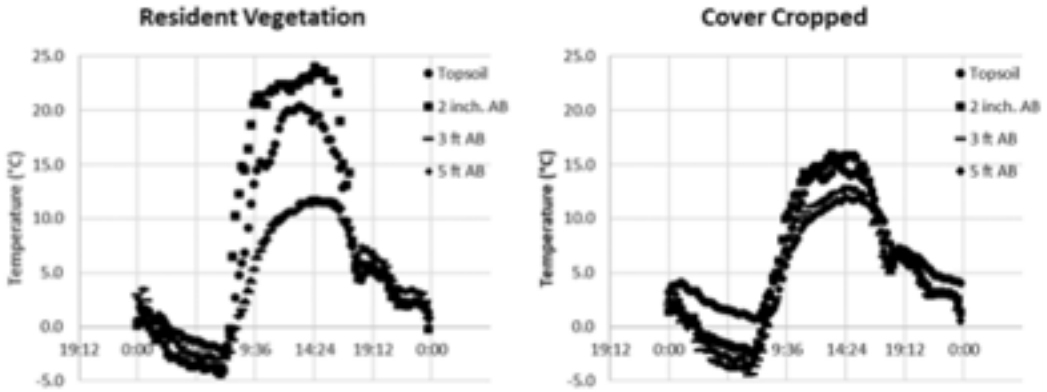
Mowing
Herbicide
Dry conditions

S.Haring, B.Hanson

Avoiding increases in frost risks

- Cover crops can reduce soil-to-tree heat transfer and therefore, increase damage during sensitive frost nights
- Topsoil temperatures were cooler under cover crops
- We observed no ambient air temperature differences at 3 and 5 feet :
  - Suggests that cover cropped orchards may not experience higher frost risks

One year data

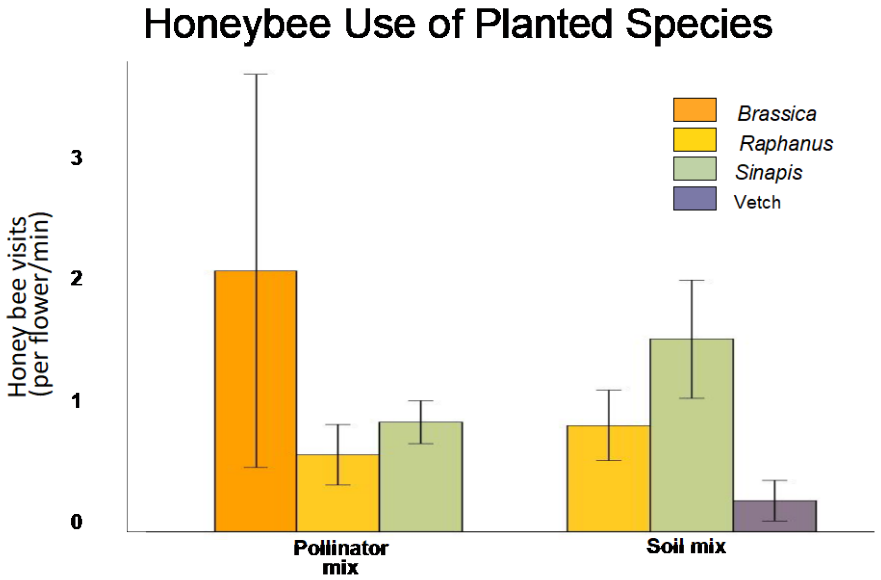


- Mowing and irrigating for frost control can be done anytime
- Consider a low-growing cover such as sub-clover for instance

C.Creze, Dani Lightle

Feeding pollinators

- Both mixes tested provided forage resources to bees during and after almond bloom
- Brassica appears more attractive than other species in these mixes.

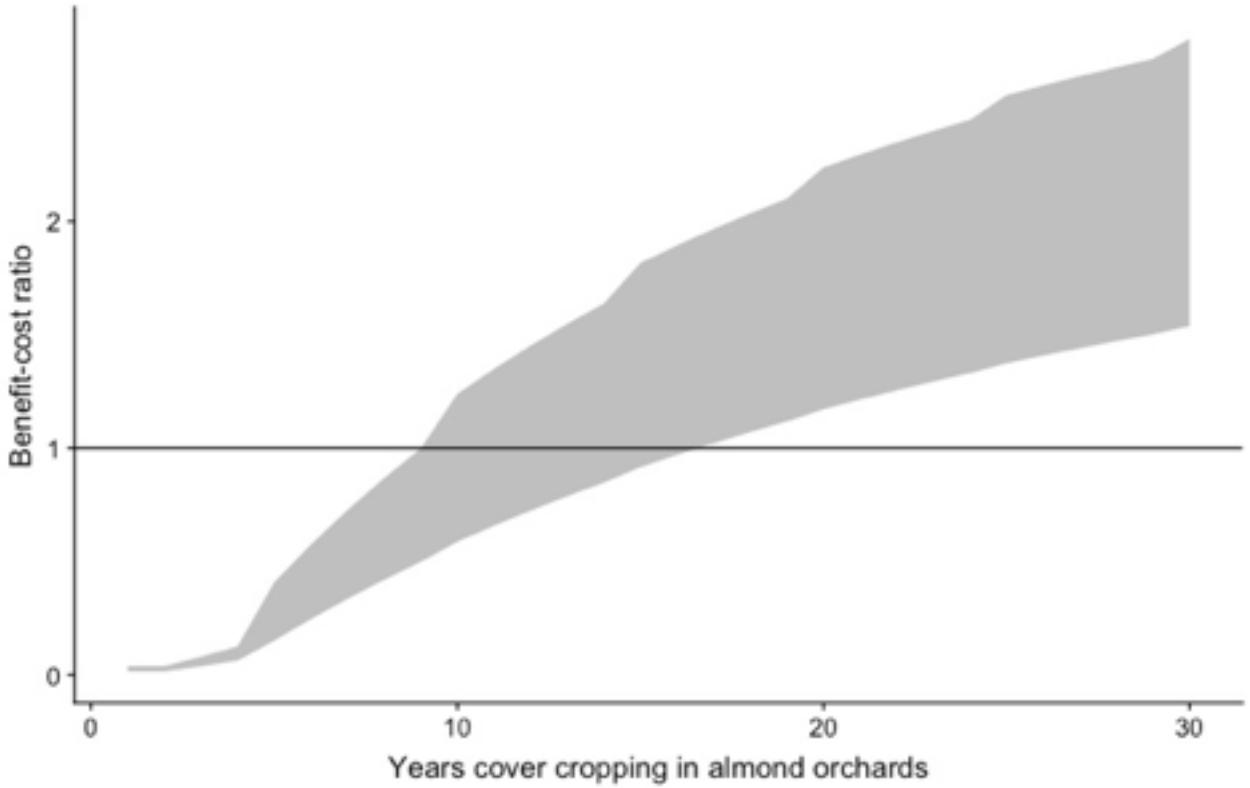


- Achieving blooming synchrony is not trivial – early planting, mowing strategy (sanitation..)
- Little to no competition for pollination with Almond while having the potential to provide useful habitat to improve bee health

Neal Williams, Elina Lastro Niño

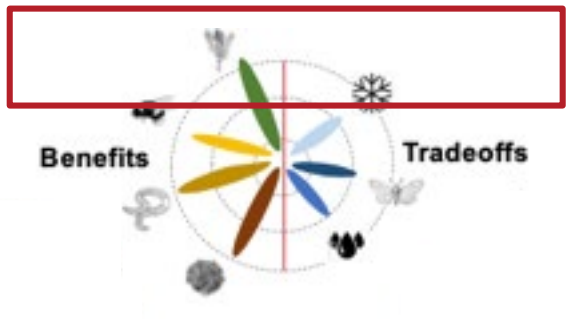
Economic feasibility

Costs	Benefits
Seed	Increased Yield
Planting (labor)	Soil erosion control
Termination (labor)	Nutrient cycling
Depreciation of machinery	Weed control
Opportunity cost of time spent learning to grow cover crops	Increased soil organic matter
	Reduced surface water runoff
	Soil-carbon storage
	Discounted beehives (almonds only)



Alyssa DeVincentis, Samuel Sandoval

Last thoughts



- Many interacting factors – there are opportunities for optimization according to your objective(s)

- High flexibility in its implementation
- Start small, learn from trial and error
- Every year will be different

- Inform yourself
  - Other growers
  - Farm advisors and UCCE resources
  - NRCS

Be patient, it's a medium/long term investment (so are your trees)

Thanks to the research team, growers, industry partners and funding agencies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Dr. Andreas Westphal (PI)


Dr. Amélie Gaudin (PI)


Dr. Dani Lightle, UCCE Glenn


Dr. Mohammad Yaghmour, UCCE Kern


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Cynthia Crézé, PhD Student


Steve Haring, PhD Student


Alyssa DeVincentis, PhD student


Dr. Sam Sandoval


Cameron A.T. Zuber

Kamprath Seeds

California Climate Investments
Cap and Trade Dollars at Work

California Ag CAS Solutions

cdfa
California Department of Food & Agriculture

California Almonds
Almond Board of California

Western SARE
Sustainable Agriculture Research & Education

California Almonds
Almond Board of California

Check out our posters
Pollinators: POLL20, POLL13
NOW: ENTO22
Soil: STEWCROP7
Weeds: HRT12

Thank you

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Whole Orchard Recycling - Update

by

Brent A. Holtz, Ph.D.

UC Farm Advisor in San Joaquin County

Sponsored by the Almond Board of California and
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University of California
Agriculture and Natural Resources

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Burning before the clean air act of 2002

Grinding orchards for co-generation plants

Can whole orchards be incorporated into the soil when they are removed and not burned in the field or in a co-generation plant?

Can we return this organic matter to our orchard soils without negatively effecting the next orchard that will be planted?

When we remove an orchard we grind up 25-30 years worth of photosynthesis and carbon and nutrient accumulation and haul it away. 25-30 years of organic matter is lost from our system, estimated at 60 tons per acre for an almond orchard.

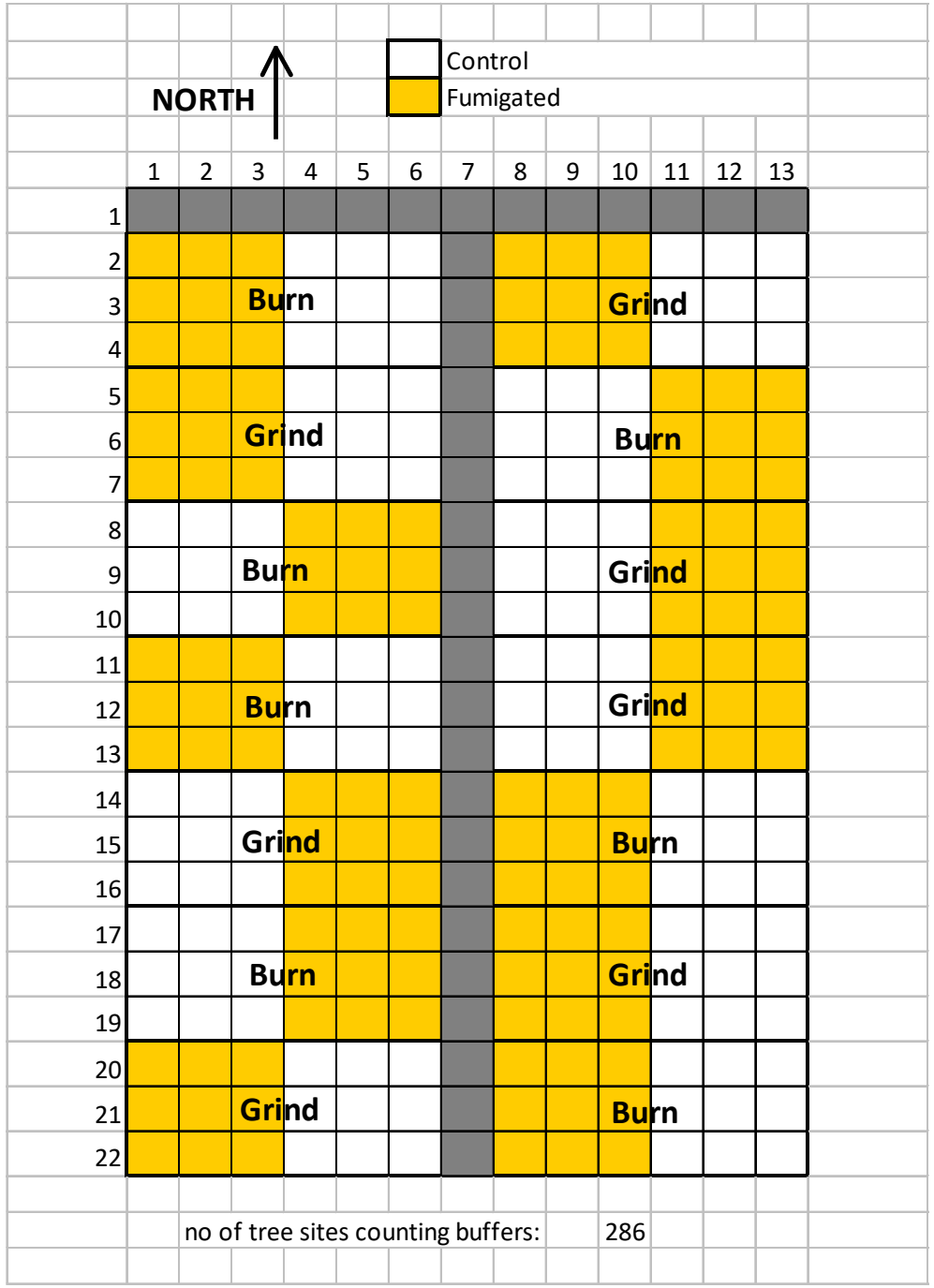

The Iron Wolf

http://ucanr.edu/?blogpost=16603&blogasset=74534

The Iron Wolf
a 100,000 lb (45,000 kg) rototiller

Two Treatments:
Orchard Grinding with Iron Wolf
Pushing and Burning Trees

In a natural forest system– Tree nutrients come from either decomposing logs or ashes from forest fires.


NORTH
Control
Fumigated
1 2 3 4 5 6 7 8 9 10 11 12 13
1
2
3 Burn Grind
4
5
6 Grind Burn
7
8
9 Burn Grind
10
11
12 Burn Grind
13
14
15 Grind Burn
16
17
18 Burn Grind
19
20
21 Grind Burn
22
no of tree sites counting buffers: 286

2009 First leaf trees growing in grinding plot

2010 Second leaf trees

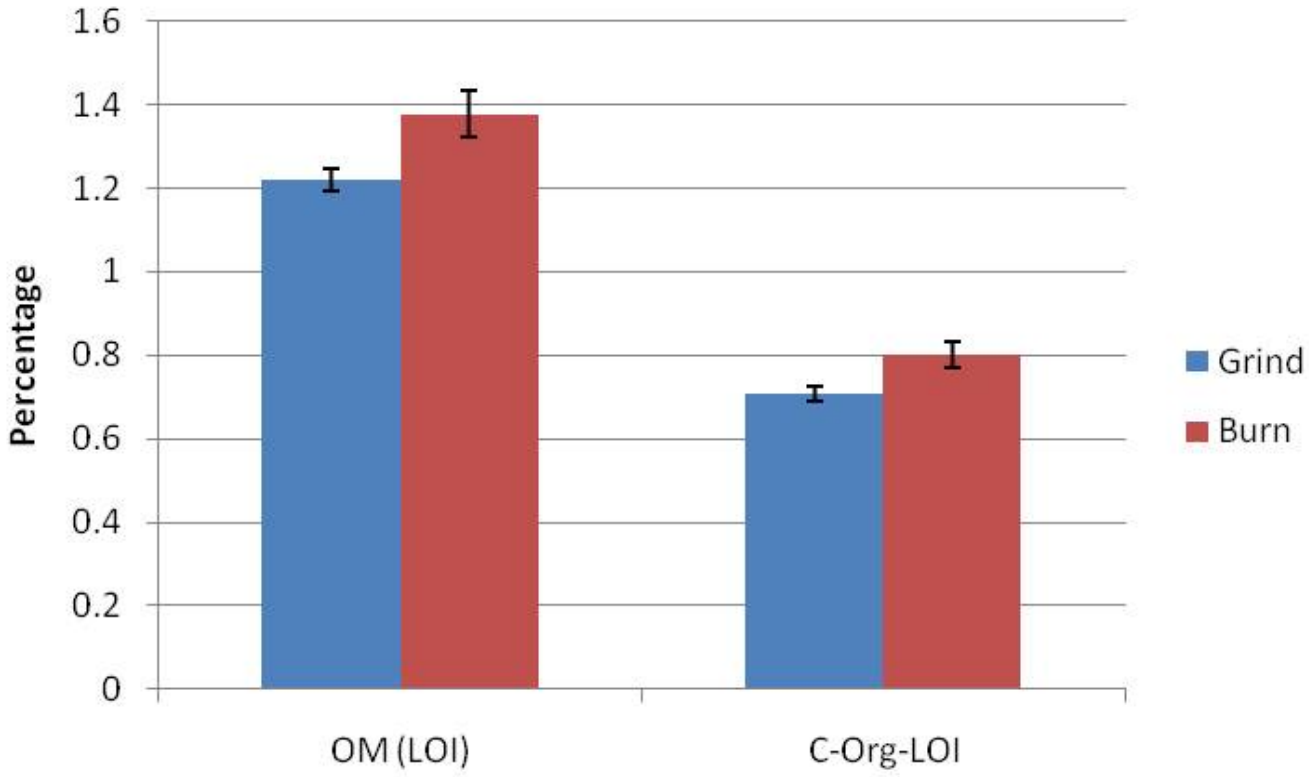
No difference in tree circumference

The grinding did not stunt the second generation orchard

2011 Third leaf trees growing in grinding plot

2012 Fourth leaf trees growing in grinding plot

In 2010, Burn treatments had significantly more organic matter (OM), carbon (C), and Cation Exchange Capacity (CEC) in the top 10-15 cm of soil.



Burning appears to release nutrients back into the orchard soil more rapidly than decomposition.

Soil Analysis

	2010		2011		2012	
	Grind	Burn	Grind	Burn	Grind	Burn
Ca (meq/L)	4.06 a	4.40 b	2.93 a	3.82 b	4.27 a	3.17 b
Na (ppm)	19.43 a	28.14 b	13.00 a	11.33 b	11.67 a	12.67 a
Mn (ppm)	11.83 a	8.86 b	12.78 a	9.19 b	29.82 a	15.82 b
Fe (ppm)	32.47 a	26.59 b	27.78 a	22.82 b	62.48 a	36.17 b
Mg (ppm)	0.76 a	1.52 b	1.34 a	1.66 a	2.05 a	1.46 b
B (mg/L)	0.08 a	0.07 a	0.08 a	0.08 a	0.08 a	0.05 b
NO_3-N (ppm)	3.90 a	14.34 b	8.99 a	11.60 a	19.97 a	10.80 b
NH_4-N (ppm)	1.03 a	1.06 a	2.68 a	2.28 a	1.09 a	1.06 a
pH	7.41	7.36	6.96 a	7.15 b	6.78 a	7.12 b
EC (dS/m)	0.33 a	0.64 b	0.53	0.64	0.82 a	0.59 b
CEC(meq/100g)	7.40 a	8.47 b	8.04	7.88	5.34	5.32
OM %	1.22 a	1.38 b	1.24	1.20	1.50 a	1.18 b
C (total) %	0.73 a	0.81 a	0.79 a	0.73 a	0.81 a	0.63 b
C-Org-LOI	0.71 a	0.80 b	0.72	0.70	0.87 a	0.68 b
Cu (ppm)	6.94 a	6.99 a	7.94 a	7.54 a	8.87 a	7.92 b

Blue Pair = grinding significantly less than burning

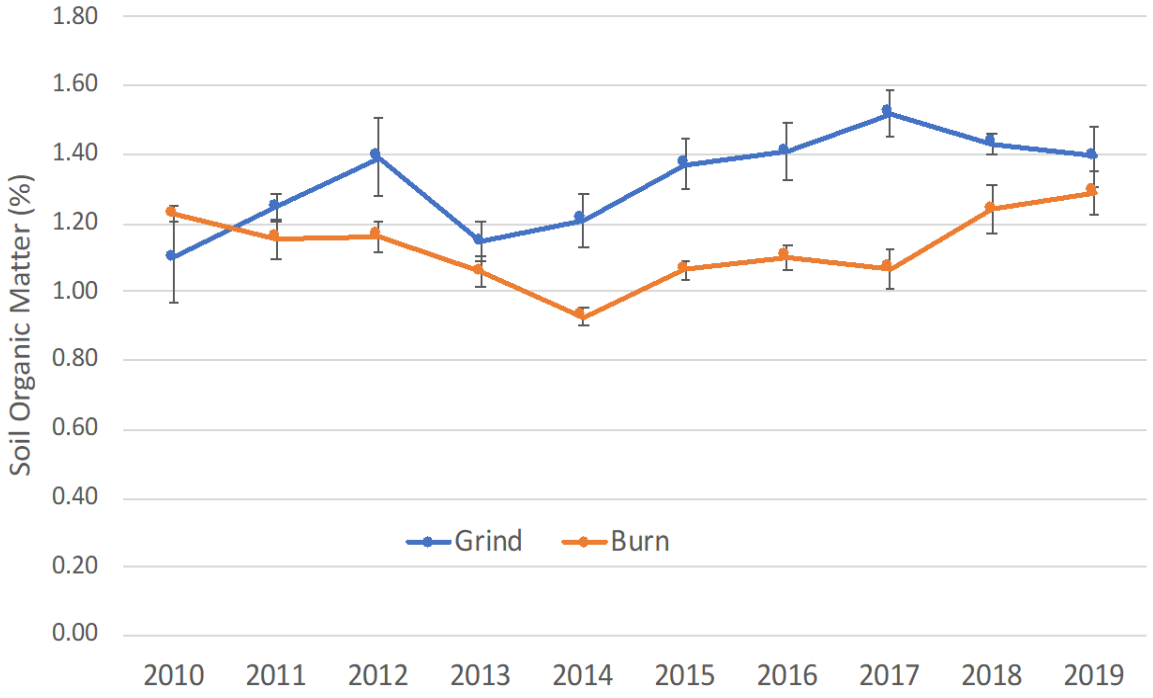
Yellow pair = grinding significantly greater than burning

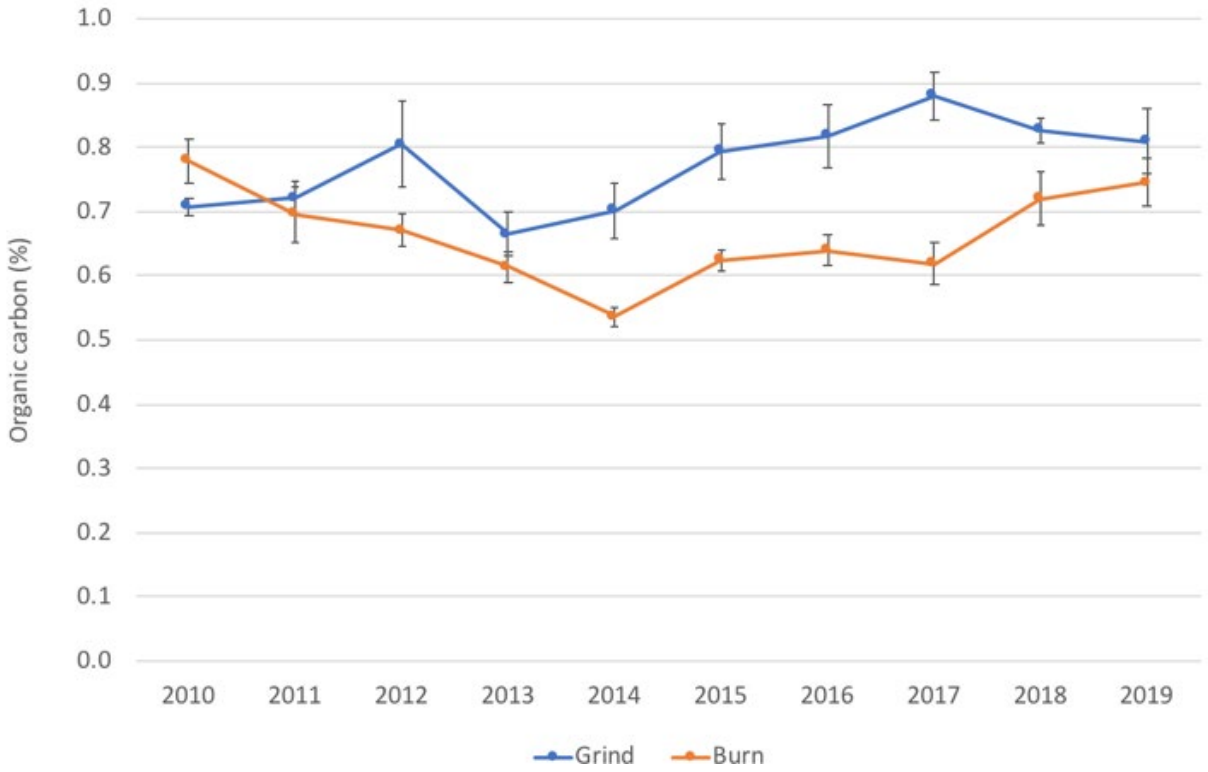
Soil Analysis

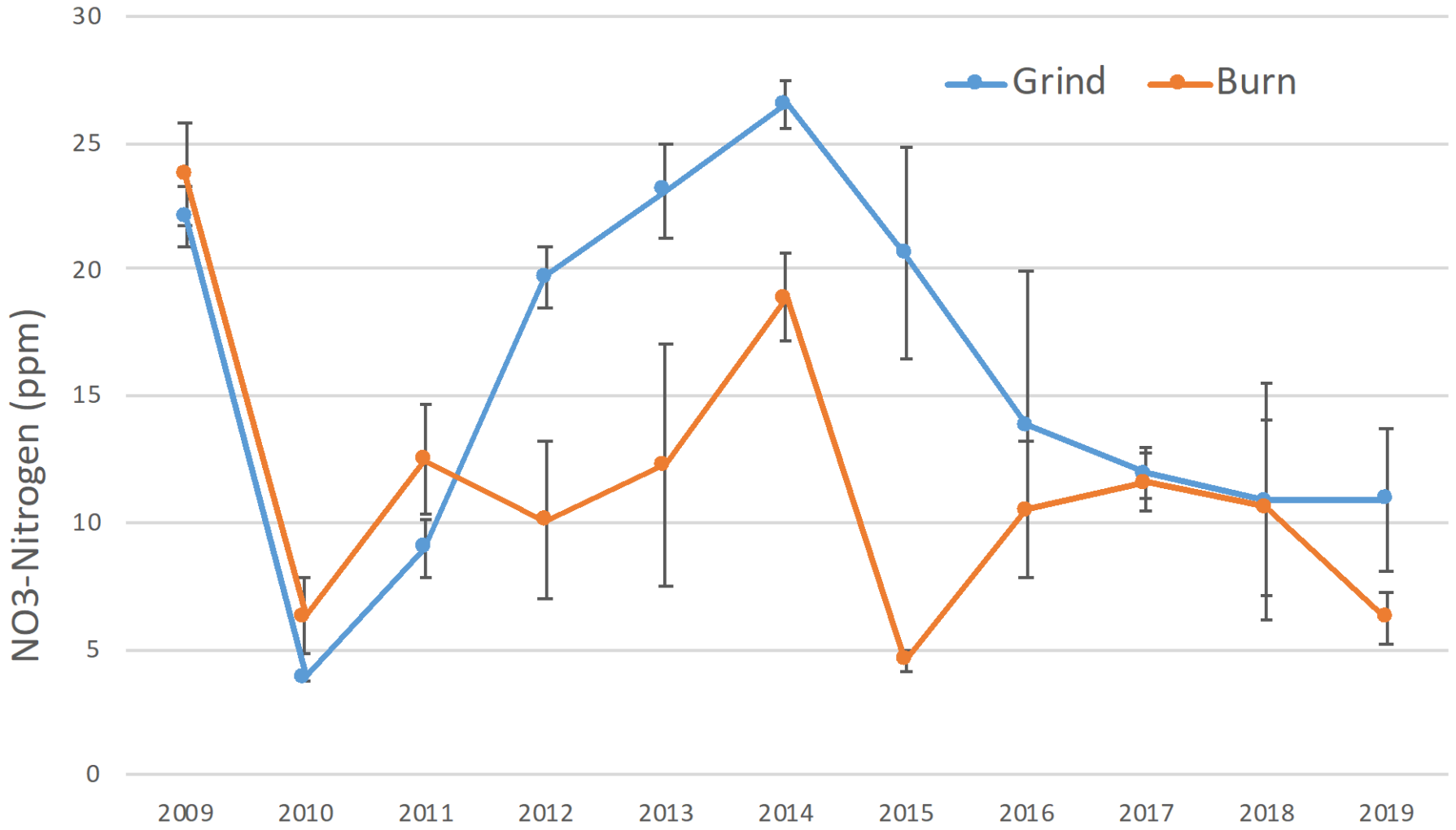
	2013		2014		2015	
	Grind	Burn	Grind	Burn	Grind	Burn
Ca (meq/L)	3.78 a	3.25 b	7.55 a	5.45 b	4.02 a	1.36 b
Na (ppm)	2.74 a	1.90 b	3.41 a	2.34 b	2.32 a	1.21 b
Mn (ppm)	26.35 a	5.71 b	14.46 a	10.65 b	7.31 a	4.67 b
Fe (ppm)	32.56 a	20.38 b	38.58 a	29.30 b	24.29 a	17.21 b
Mg (ppm)	2.15 a	1.20 b	3.61 a	2.57 b	2.01 a	0.68 b
B (mg/L)	0.06	0.07	0.07 a	0.10 b	0.05 a	0.07 b
NO_3-N (ppm)	20.11	12.27	26.53 a	18.89 b	20.64 a	5.23 b
NH_4-N (ppm)	0.37	0.33	1.59 a	1.36 b	0.89 a	0.65 b
K (mg/L)	94.50	84.88	28.50 a	13.60 b	19.76 a	16.97 b
pH	7.39 a	7.53 b	6.95	7.06	7.27 a	7.60 b
EC (dS/m)	0.91 a	0.68 b	1.54 a	1.08 b	0.90 a	0.38 b
CEC(meq/100g)	9.54	10.16	7.78	8.30	5.16	5.14
OM %	1.55 a	1.06 b	1.21 a	0.93 b	1.37 a	1.08 b
C (total) %	0.87 a	0.51 b	0.71 a	0.54 b	0.66 a	0.50 b
C-Org-LOI	0.87 a	0.61 b	0.70 a	0.54 b	0.79 a	0.62 b
Cu (ppm)	8.26 a	7.11 b	8.03	7.73	7.51 a	7.03 b

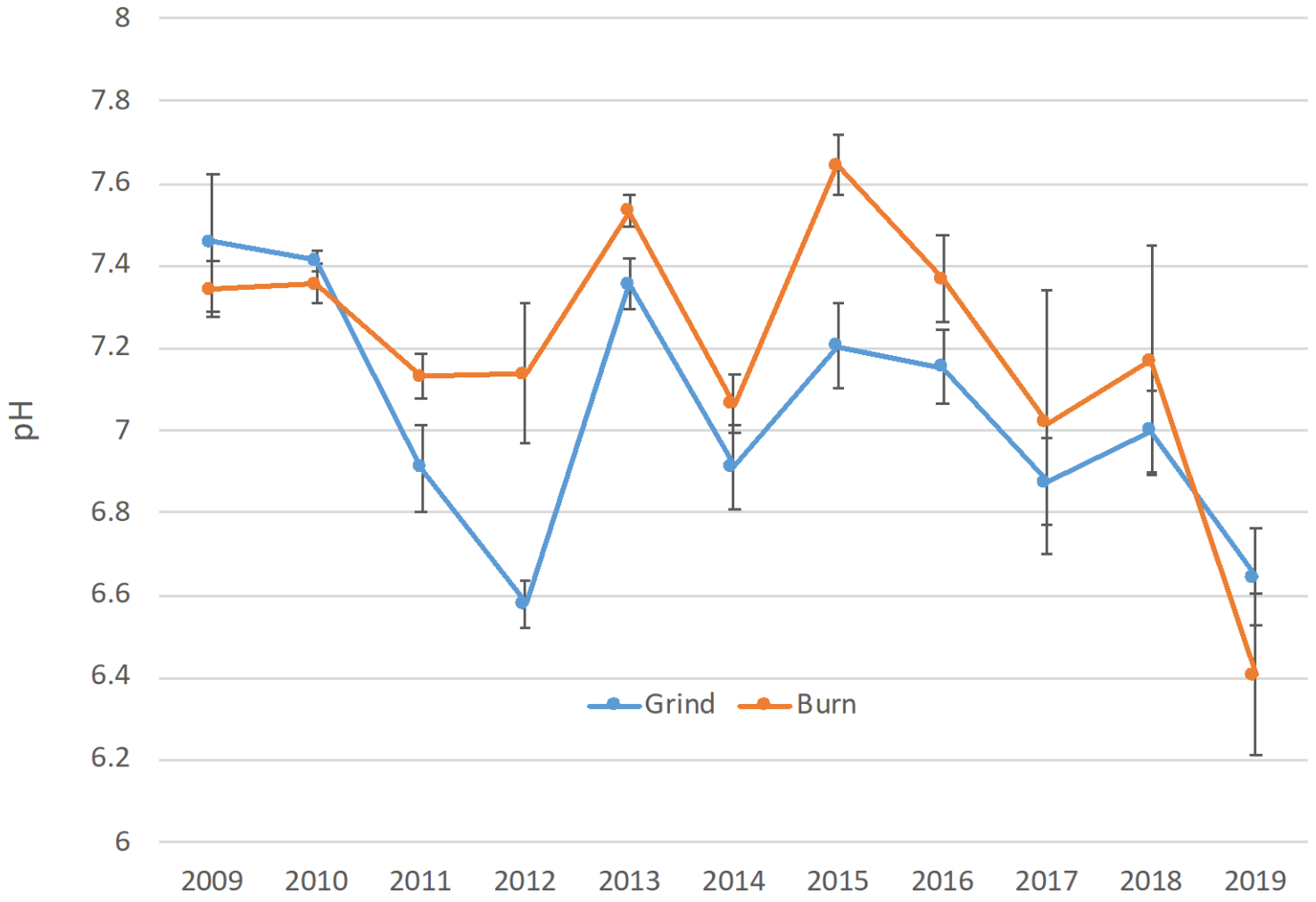
Blue Pair = grinding significantly less than burning

Yellow pair = grinding significantly greater than burning


Soil Organic Matter (%)
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Grind
Burn


Organic carbon (%)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Grind
Burn


30
25
20
15
10
5
0
NO3-Nitrogen (ppm)
Grind
Burn
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019


8
7.8
7.6
7.4
7.2
7
6.8
6.6
6.4
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6
pH
2009
2010
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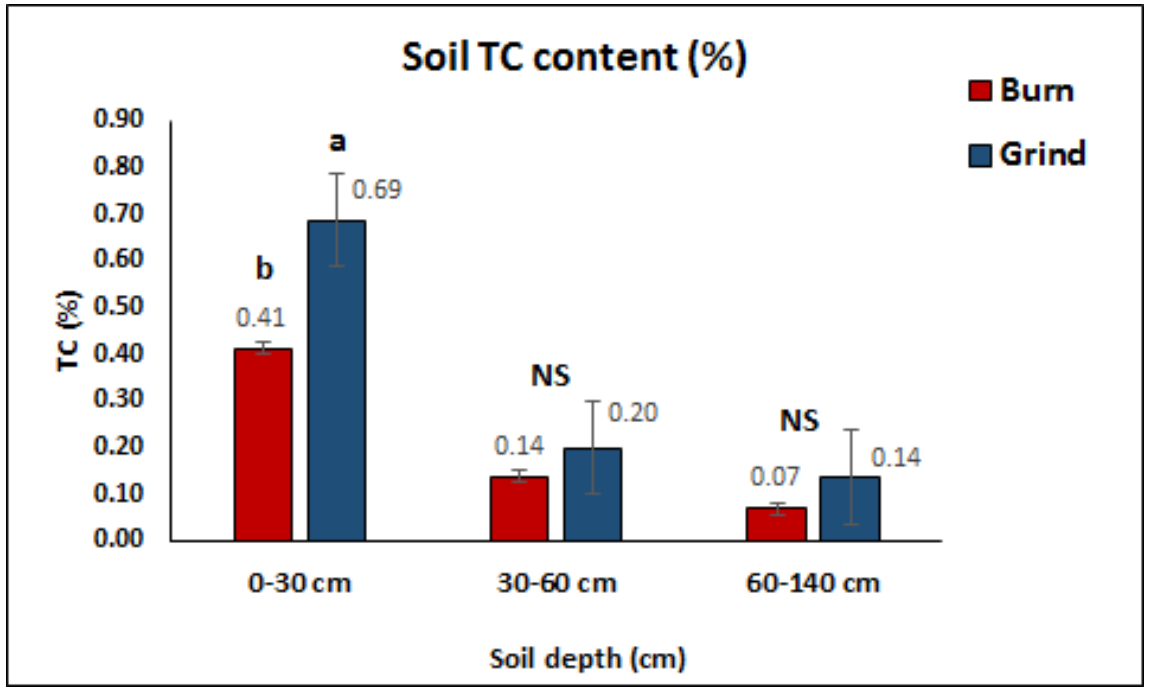
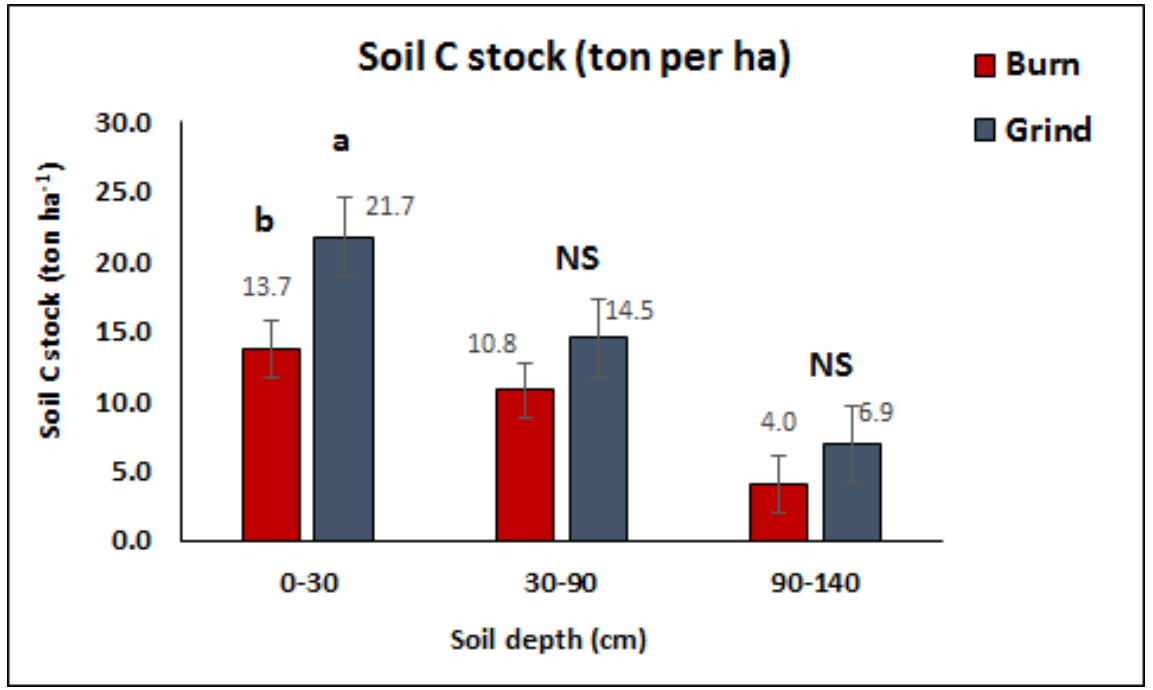
2019
Grind
Burn





WOR increased soil C content by 68% (0-30 cm) compared to the Burn treatment

WOR lead to + 8 tons per ha of C sequestered compared to the burn treatment, 9 years after recycling

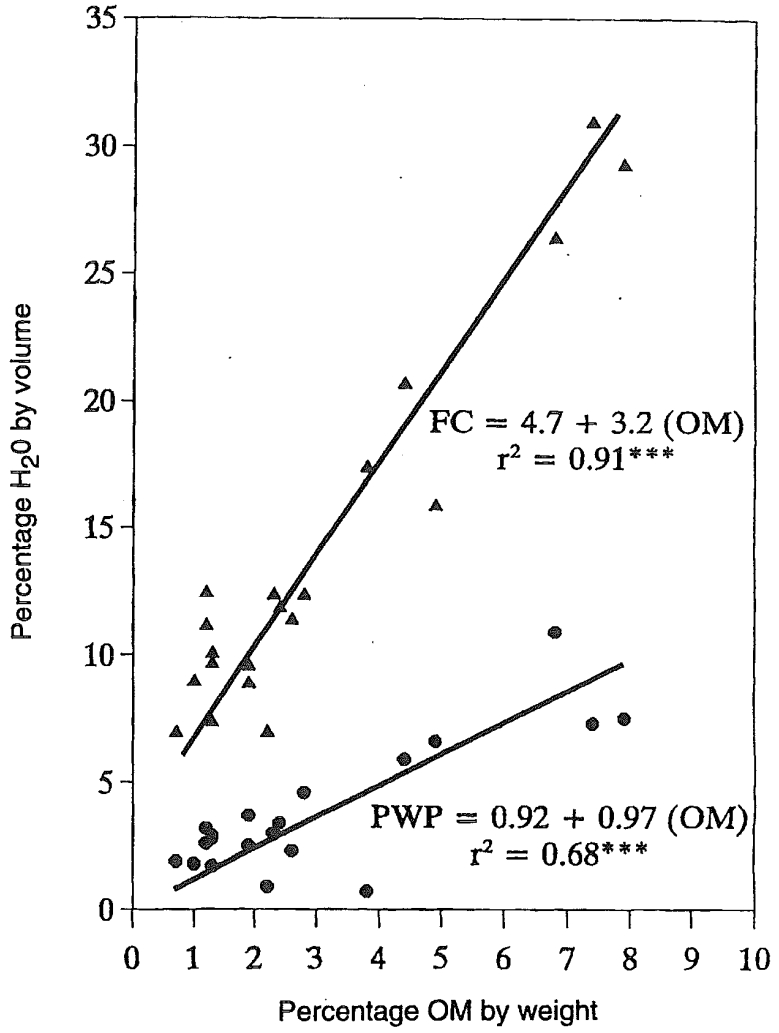


Figure 1. Water content at FC and PWP versus OM content of sand surface horizons.

Soil Organic Matter and Available Water Capacity

by

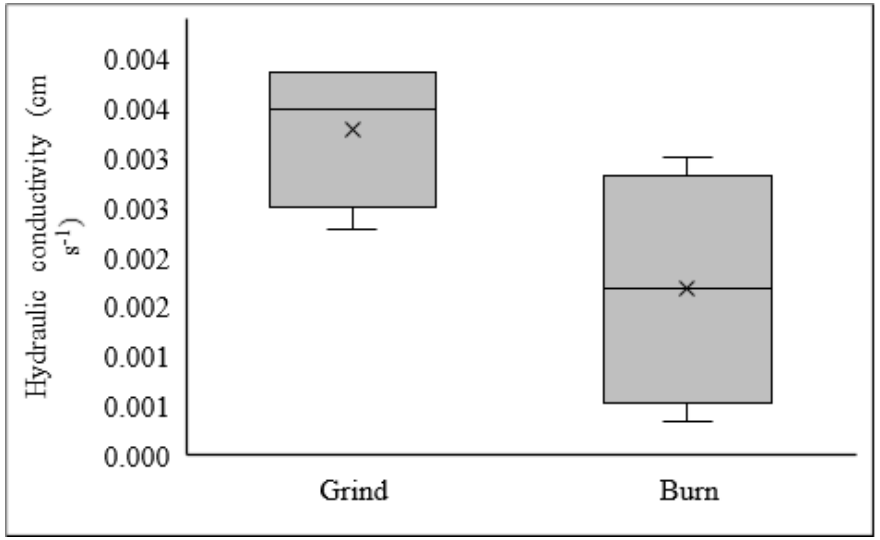
Berman D. Hudson

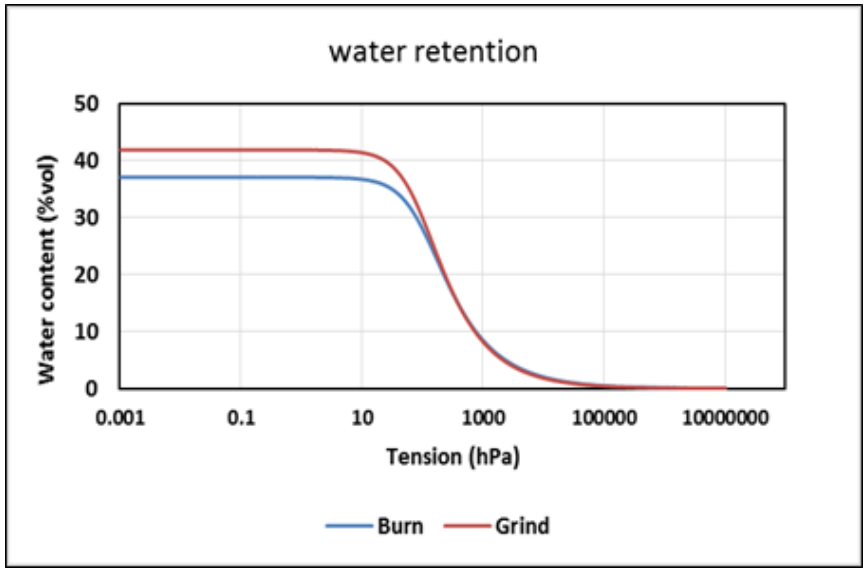
J. Soil and Water Cons. 49(2):189-194.

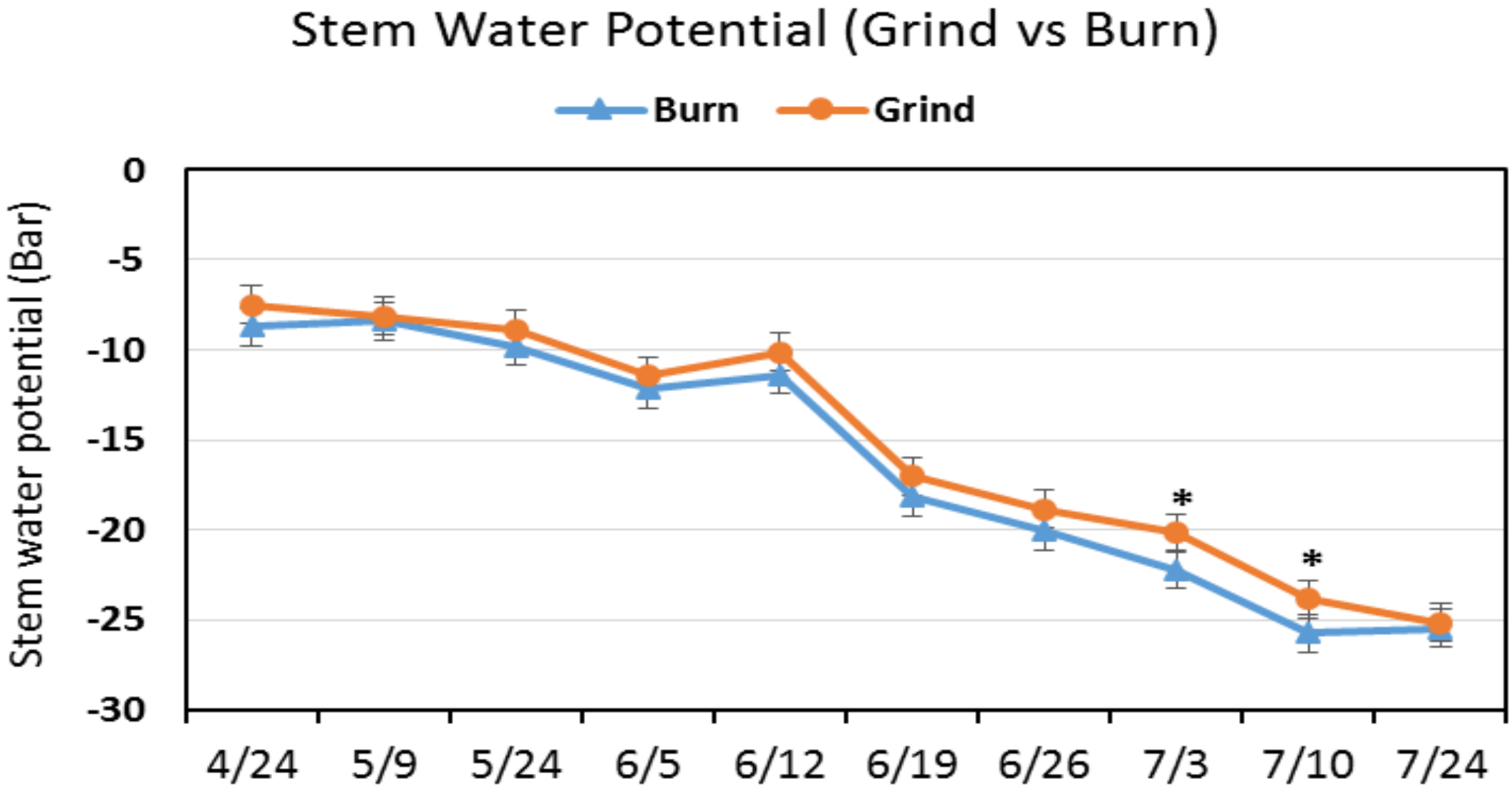
We estimate that Whole Orchard recycling has increased the water holding capacity of our soil by 15% based on this curve and that SOM has increased from in 1.07 (burn) to 1.52 (grind) (2017 results).

Impacts on soil hydraulic properties?

- Improved soil aggregation (significant higher Mean Weight Diameter in the Grind treatment (610 vs 534)
- Compaction was reduced in the Grind plots (- 27%)
- Higher infiltration rate in the Grind treatment (0.003 vs 0.001 cm/s)
- Increased water retention (+ 13% at FC) in the Grind plots

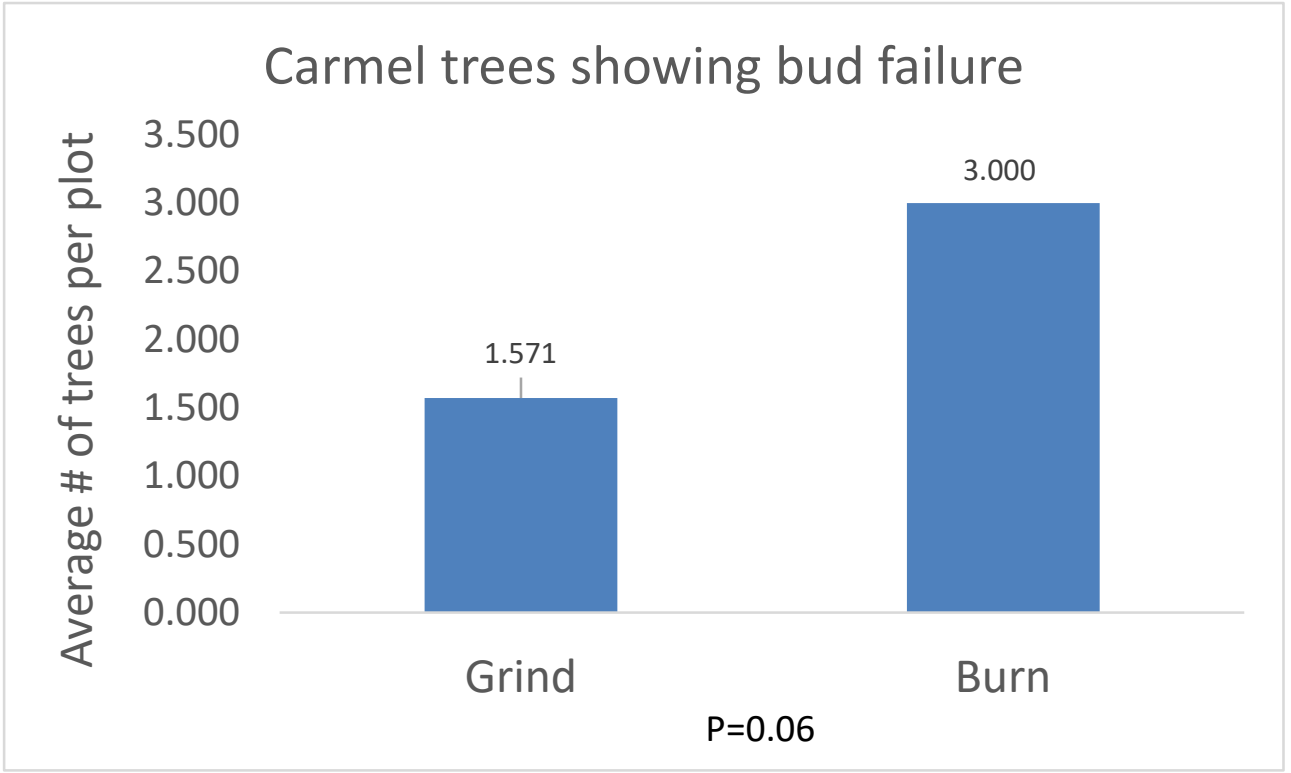


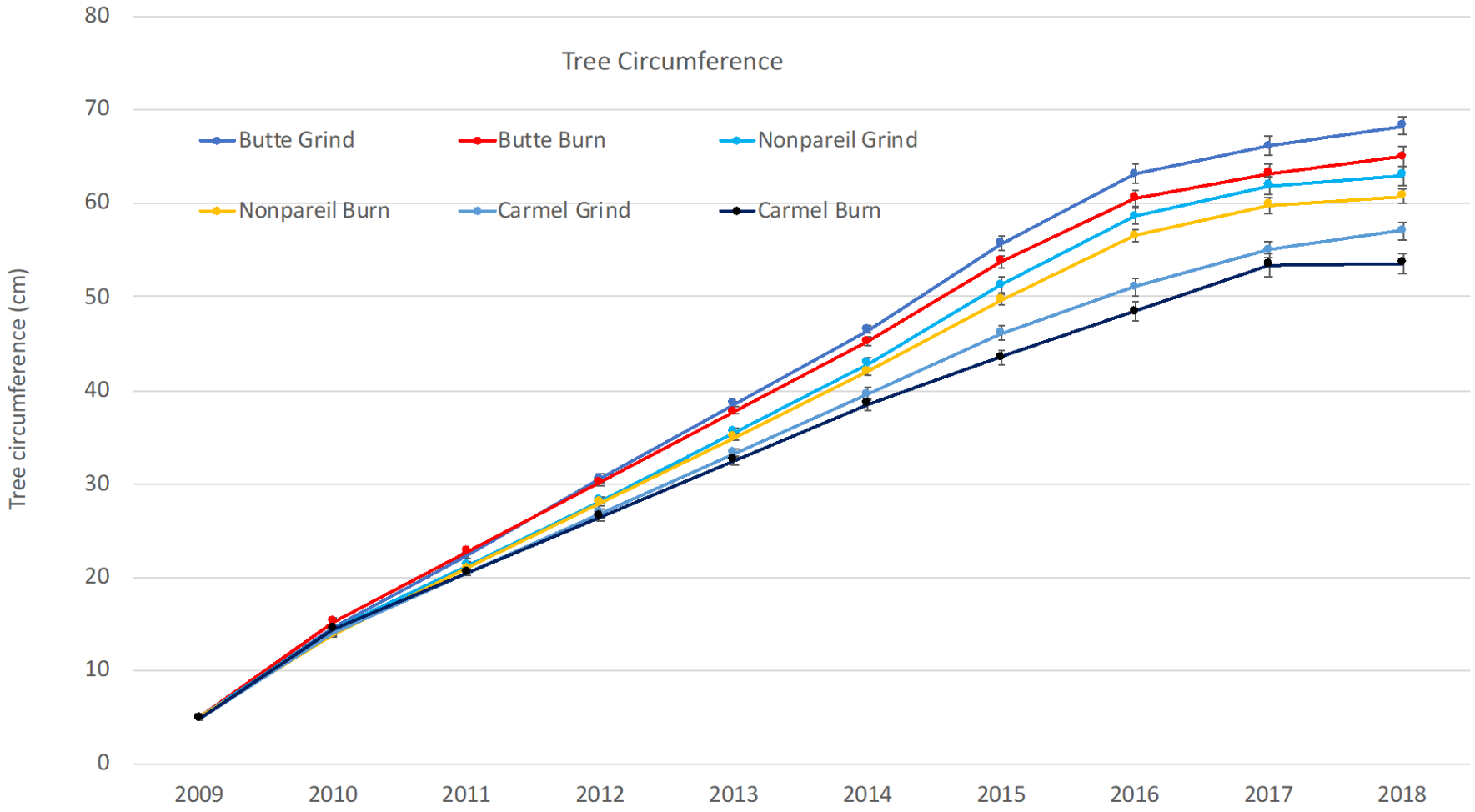


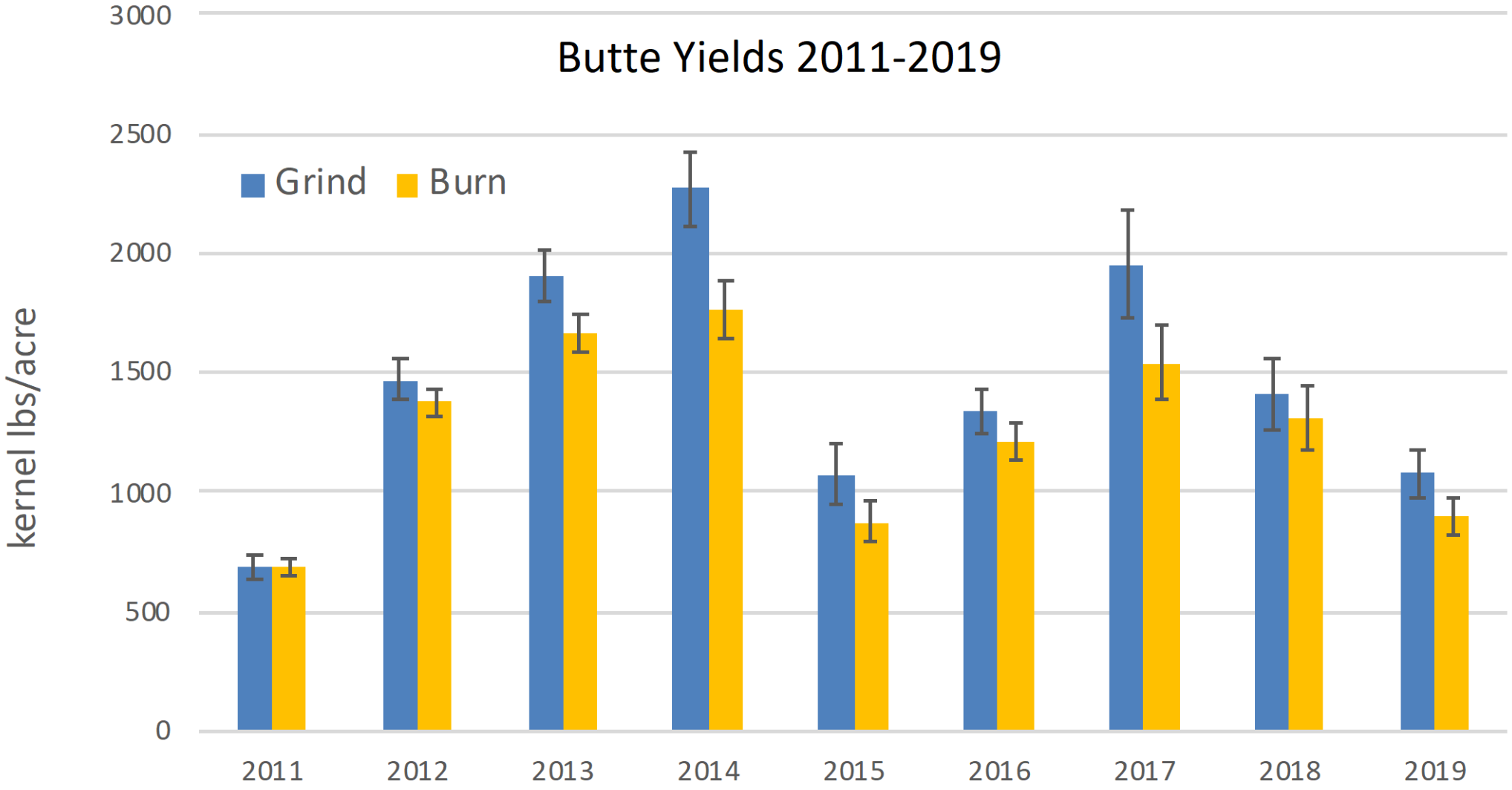

Stem Water Potential (Grind vs Burn)
Burn
Grind
Stem water potential (Bar)
0
-5
-10
-15
-20
-25
-30
4/24
5/9
5/24
6/5
6/12
6/19
6/26
7/3
7/10
7/24
*
*

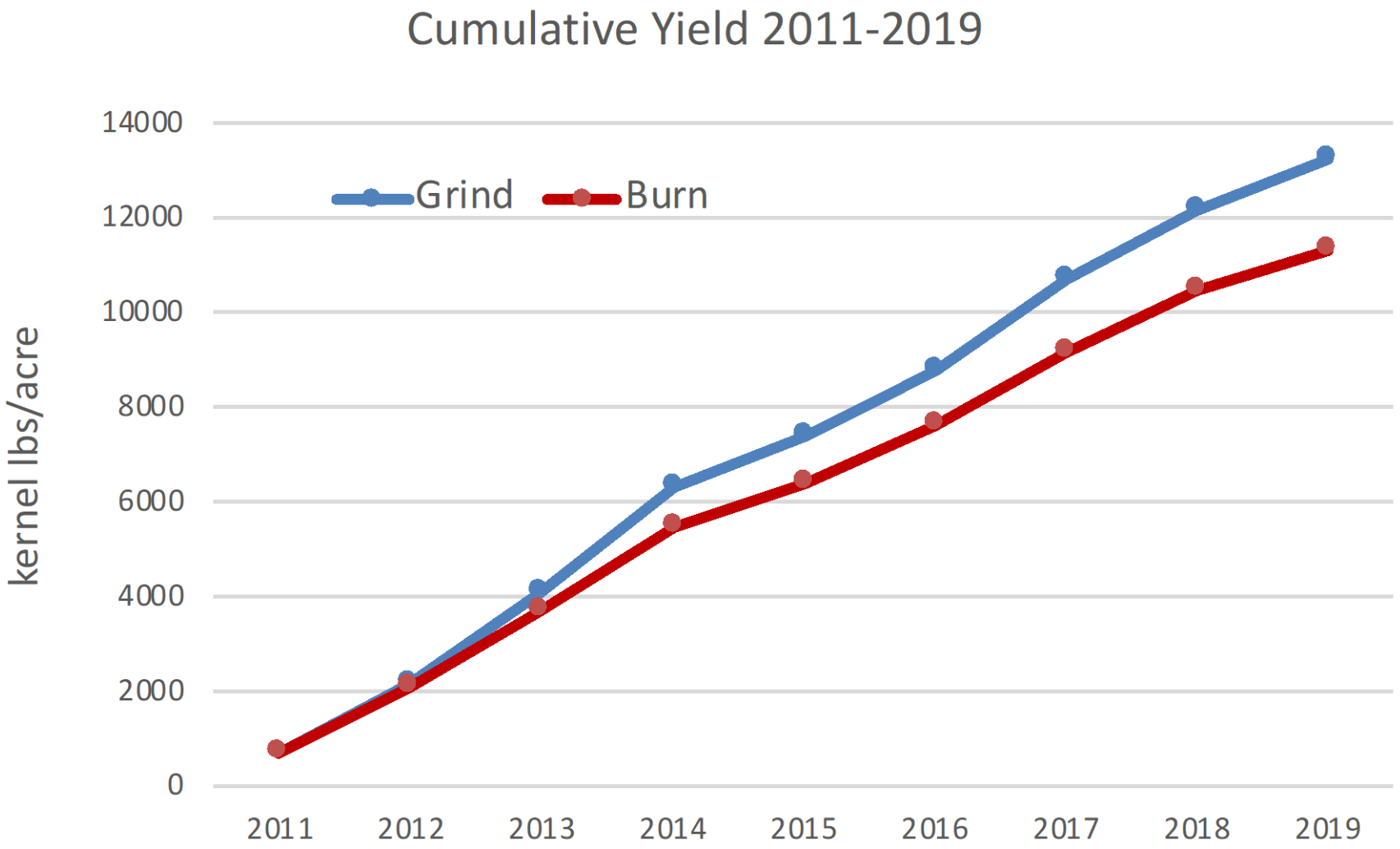
Carmel trees were rated for bud failure symptoms

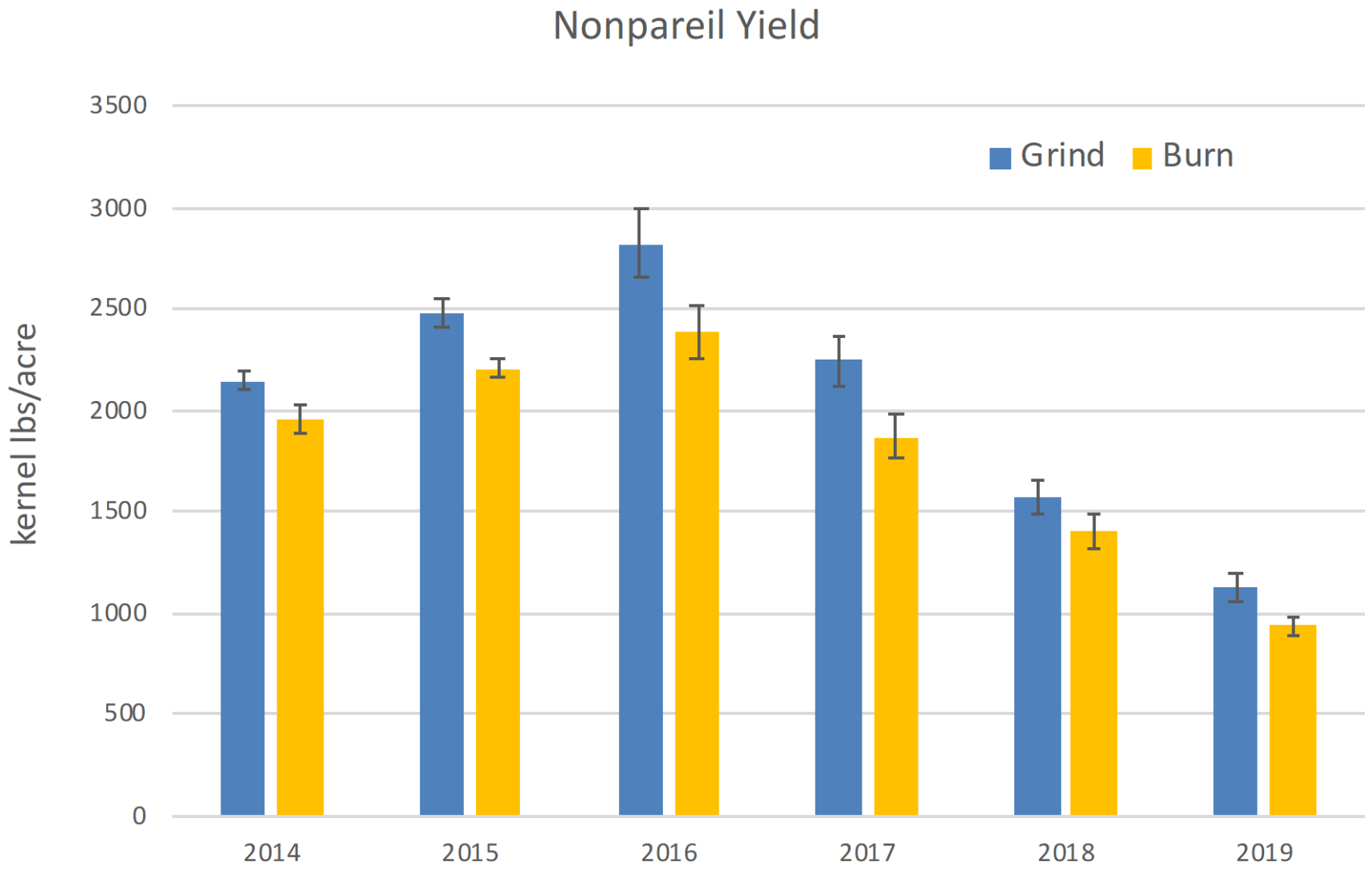
Trees growing in the grind plots had less bud failure

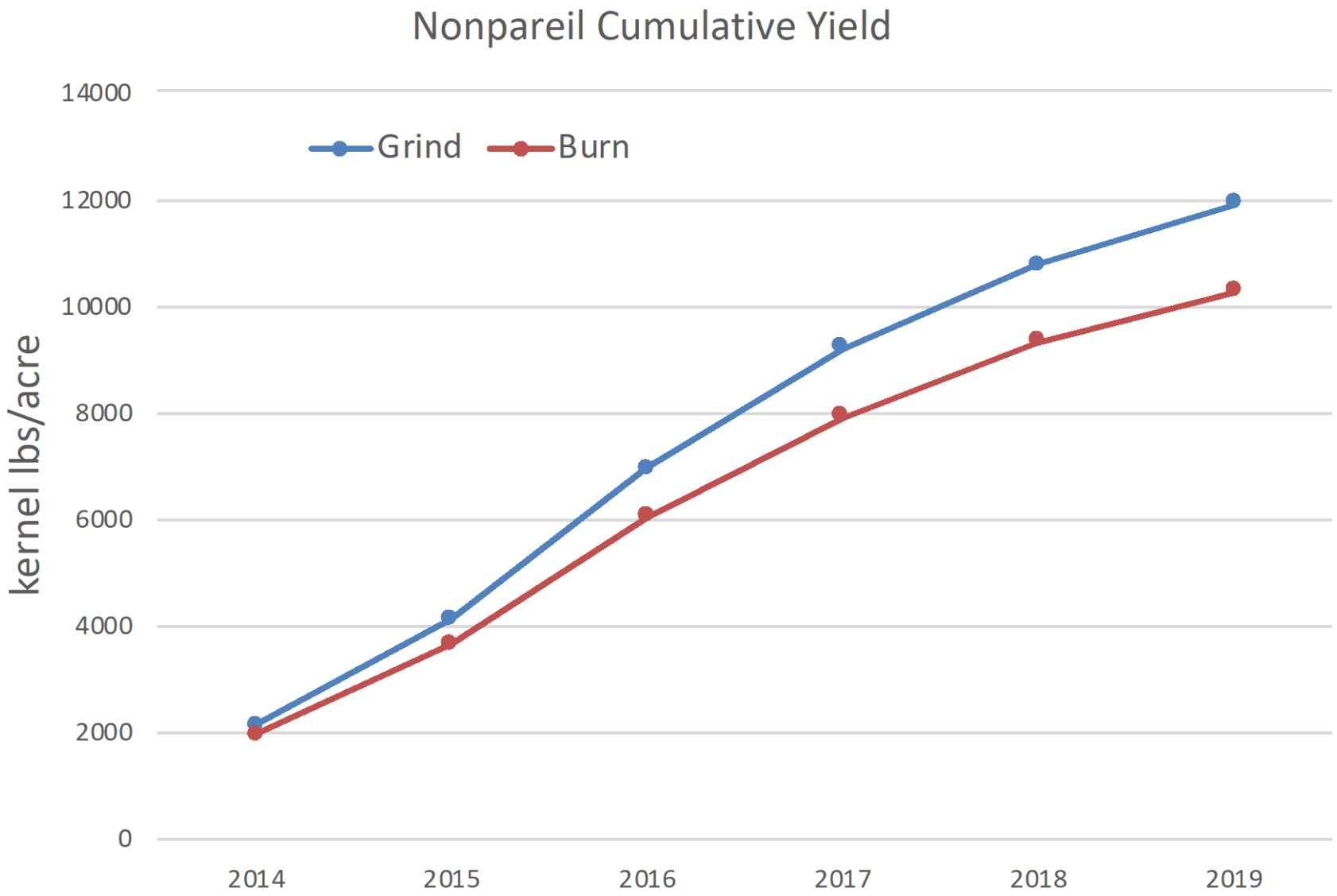



Tree Circumference
Butte Grind
Butte Burn
Nonpareil Grind
Nonpareil Burn
Carmel Grind
Carmel Burn
Tree circumference (cm)
80
70
60
50
40
30
20
10
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018


Butte Yields 2011-2019
kernel lbs/acre
3000
2500
2000
1500
1000
500
0
Grind
Burn
2011
2012
2013
2014
2015
2016
2017
2018
2019


Cumulative Yield 2011-2019
kernel lbs/acre
14000
12000
10000
8000
6000
4000
2000
0
Grind
Burn
2011
2012
2013
2014
2015
2016
2017
2018
2019


Nonpareil Yield
Grind
Burn
kernel lbs/acre
3500
3000
2500
2000
1500
1000
500
0
2014
2015
2016
2017
2018
2019


Nonpareil Cumulative Yield
14000
12000
10000
8000
6000
4000
2000
0
kernel lbs/acre
Grind
Burn
2014
2015
2016
2017
2018
2019

Whole Orchard Recycling has:

- Increased soil organic matter
- Increased soil organic carbon
- Increased soil nutrients
- Increase soil microbial diversity
- Increased orchard productivity

Closure of more biomass plants reduces options

By Christine Souza

The closure or threatened closure of more California biomass power plants leaves farmers with fewer options for disposing of tree prunings or of trees uprooted during planned orchard removals.

"The last few projects that we've done,

AgAlert®

THE WEEKLY NEWSPAPER FOR CALIFORNIA AGRICULTURE

Growers started using manure spreaders to spread wood chips back on the soil surface

Orchard removal typically involves five machines and costs between $600-700 acre. Horizontal grinders can chip up 15-20 acres per day. Two inch screen sizes are recommended rather than four inch screens to reduce chip size.

The Morbark horizontal chipper can chip up 15-20 acres per day.

Screens can be used to limit chip size to 2 inches or less.

Wood chips are spread uniformly over entire field surface

Kuhn & Knight manure spreaders were modified to spread wood chips.

Keeping the chips and having them spread back onto your orchard floor will cost and additional $400 acre.

When 64 tons of wood chips are returned to the soil per acre:

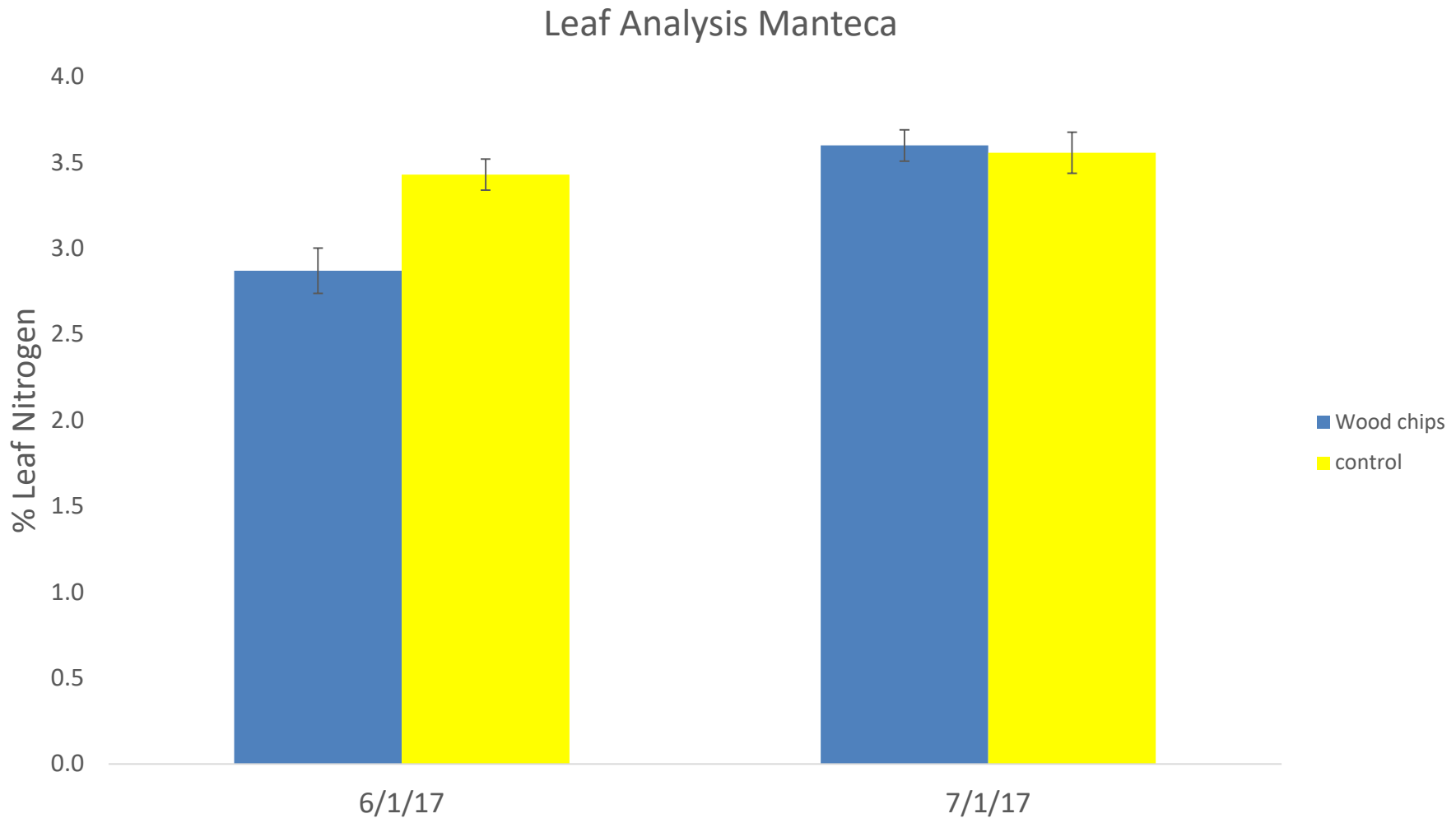
N= 0.31 %, 396 lbs/ac
K= 0.20 %, 256 lbs/ac
Ca= 0.60 %, 768 lbs/ac
C= 50 %, 64,000 lbs/ac

The nutrients will be released gradually and naturally

After spreading the woodchips growers can proceed with typical land preparation practices for the next orchard: ripping, disking, fumigation….

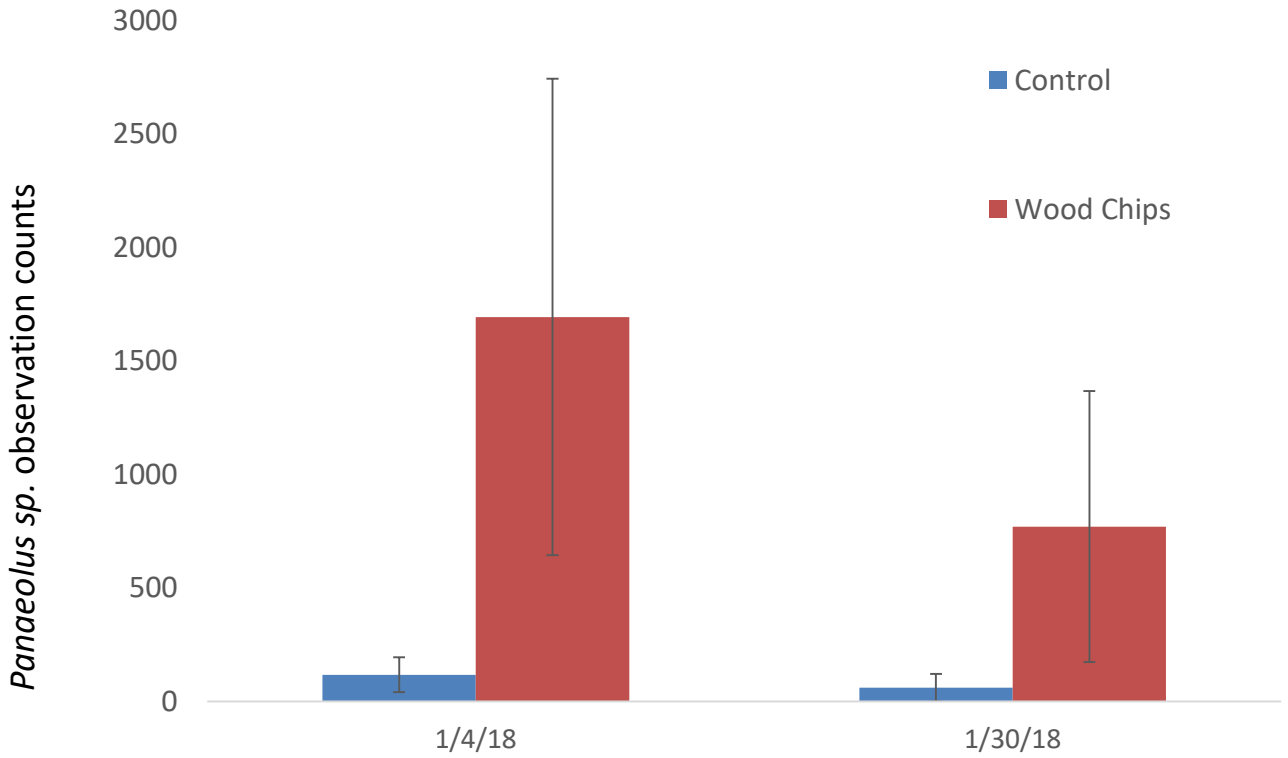
64 tons per acre caused initial tree stunting and total weed suppression. The C:N ratio was out of balance.

We doubled our nitrogen applications through fertigation in order to get the desired growth.


Leaf Analysis Manteca
% Leaf Nitrogen
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
6/1/17
7/1/17
Wood chips
control

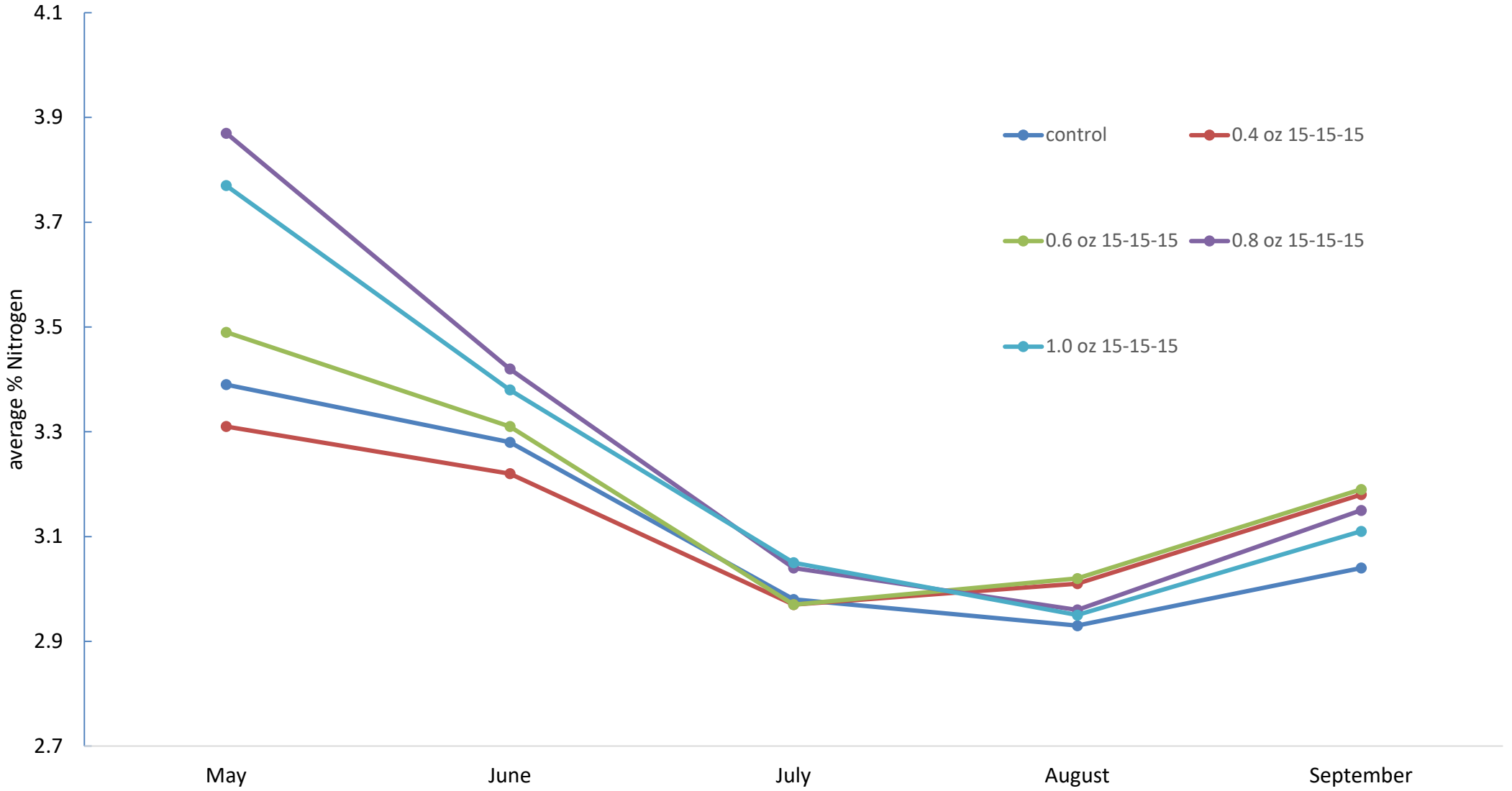
Northwest Tiller:
can till, level, and roll in one pass

After WOR, you have 3 years to incorporate the wood chips and prepare the orchard floor for harvest.


3000
2500
2000
1500
1000
500
0
Panaeolus sp. observation counts
Control
Wood Chips
1/4/18
1/30/18

Control

0.8 oz of N applied in March


4.1
3.9
3.7
3.5
3.3
3.1
2.9
2.7
average % Nitrogen
May
June
July
August
September
control
0.4 oz 15-15-15
0.6 oz 15-15-15
0.8 oz 15-15-15
1.0 oz 15-15-15

Control

70 tons per acre rate

Control

70 tons per acre rate

University of California
Agriculture and Natural Resources

Both treatments received 45 lbs N/acre

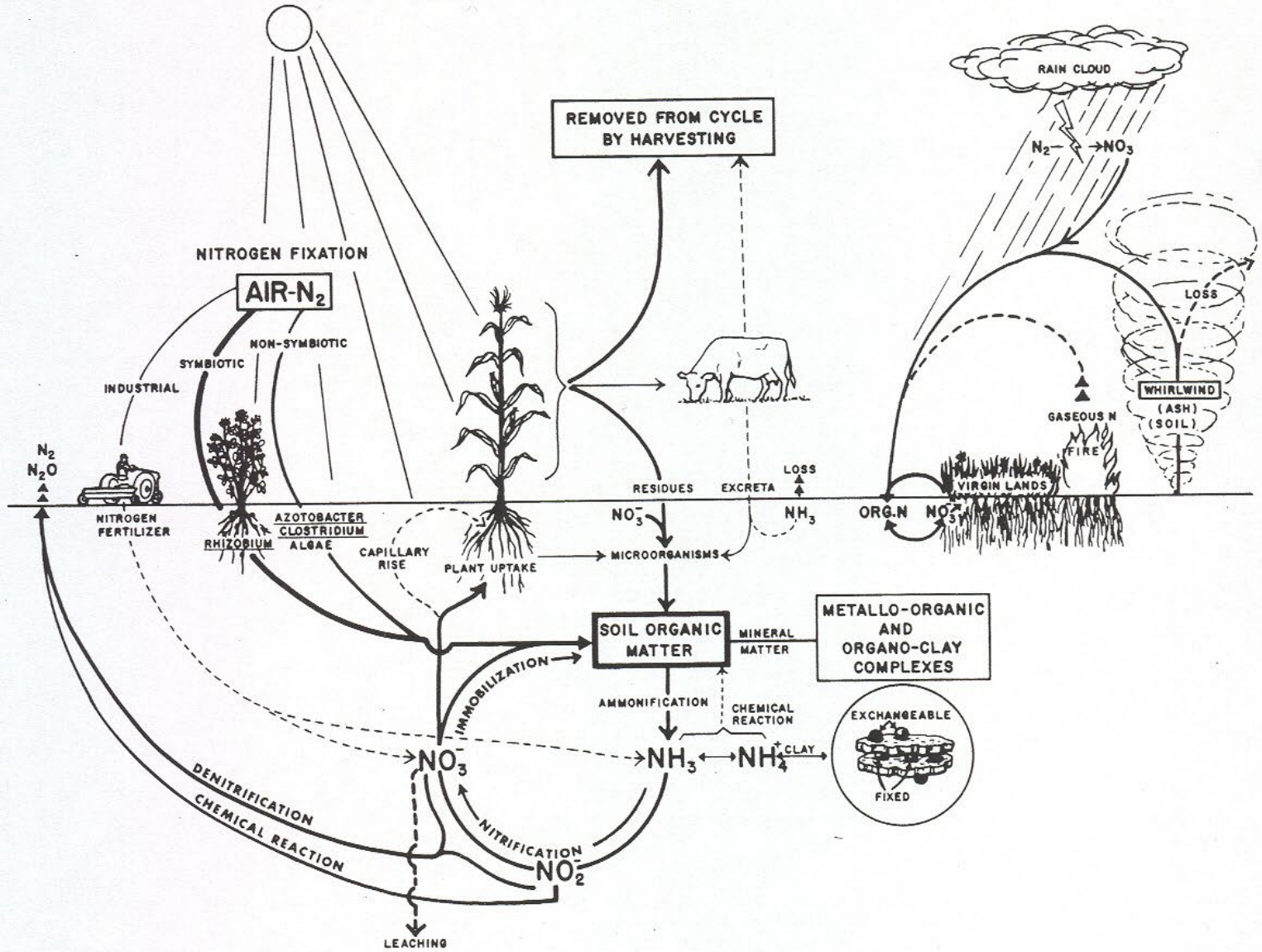


Figure 8.1. Nitrogen cycle in soil. (From Stevenson, 1982.)

The San Joaquin Valley Air Pollution Control District (SJVAD) has recently approved a program that will reward growers with funding from $300-600 per acre up to $60,000 per year to implement whole orchard recycling.

For more information on these incentive programs, contact Jacob Whitson with SJVAD at 559-230-5800 or at Jacob.Whitson@ValleyAir.org.

CDFA's Healthy Soils Program may start providing growers with incentives to practice Whole Orchard Recycling
www.cdfa.ca.gov

Thank You!

CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

AlmondBoard.com

Could Cover Crops or Whole Orchard Recycling Help with Orchard Management?

california almonds®
Almond Board of California

Upcoming Sessions at 3:30 p.m.

- Incentive Assistance: Help Applying for Grants That Fund On-Farm Practices (Room 1)
- South Korea and Japan: Almonds Make Life Beautiful (Room 2)
- Pest Management Considerations in an Ever-Changing Regulatory Environment (Room 3)

Visit the Exhibit Halls and Participate in the Passport Game

· 3P Partners	#2206	· K·Coe Isom	#707
· ABC Booth	#526	· Lincoln Agribusiness Services	#733
· AC Horn	#421	· Napasol	#2205
· Ag Spray Equipment	#2203	· NETZSCH Premier Technologies	#218
· Bayer CropScience	#127	· Satake	#521
· Best Drayage	#2112	· Suterra, LLC	#1638
· Bird Gard, LLC	#1812	· TOMRA Sorting Solutions	#335
· Borrell USA	#327	· Trécé, Inc	#516
· Cablevey Conveyors	#217	· Valent U.S.A.	#621
· Central Life Sciences	#917	· Westbridge Agricultural Products	#1534
· JAX, Inc.	#413	· Wilkey Industries	#320
· JKB Energy	#635	· Yara North America	#627

The first 500 attendees to turn in a completed passport card to the ABC booth (#526) will receive a hat and will be entered to win one of seven amazing prizes!

Research Poster Session

Wednesday, 4:30 p.m. – 6:00 p.m.
Pavilion & Building D

Featured Topics:

- Soil Quality (e.g., Cover Crops, Composts, Whole Orchard Recycling)
- Pest Management
- Irrigation Management
- Biomass/Co-Products
- Almond Leadership Special Projects (Building D)

Shuttle Schedule

Shuttle service will be provided by The Almond Conference from the downtown hotels to Cal Expo daily.

- Downtown Pickup Location: Hyatt Sacramento Front Drive
- Cal Expo Pickup and Drop-Off Location: Blue Gate

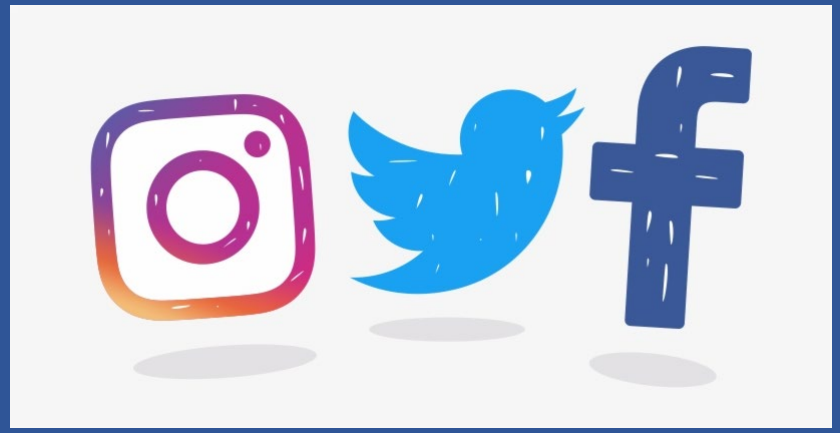
Shuttle Schedule:

- Tuesday, Dec. 10
  - 6:45 a.m. – 6:30 p.m.
- Wednesday, Dec. 11
  - 6:45 a.m. – 6:30 p.m.
- Thursday, Dec. 12
  - 6:45 a.m. – 1:30 p.m.

2019 Research Update

Pick up a copy at the ABC booth #526

Join the Conversation!



Use #AlmondConf to share highlights from The Almond Conference

Dedicated Trade Show Time

4:30 p.m. – 6:00 p.m.

Social Reception Sponsored by:

10 YEARS OF PROGRESS

JOIN THE JOURNEY

It's all there at

SustainableAlmondGrowing.org

Join Tonight's Social Reception

Come and Sample:
ALMOND BROWN ALE

Stop by:
The Almond Board Lounge in Building D.

Sample:
Almond brown ale during the Tuesday and Wednesday receptions.

This almond beverage is the result of a special project from Dominique Camou and Lucas Schmidt in collaboration with **Temblor Brewing Company**.

Industry members and attendees are welcome to stop by and have a taste.

When:
Tuesday and Wednesday evening reception from 4:30–6:00 p.m.

4:30 p.m. – 6:00 p.m. - Pavilion + Building D

Thank you!