

Amélie Gaudin

Assistant Professor of Agroecology,
Department of Plant Science UC Davis

Developing cover crop systems for almond orchards

*C. Creze, J. Mitchell, A. Westphal, D. Doll, D. Lightle,
M. Yaghmour, B. Hanson, N. Williams, A. Hodson,
H. Wilson*



Winter cover crops are not frequently planted in California orchards (~5% has vegetation)

CONCERNS

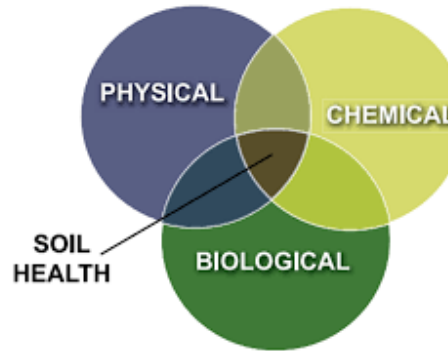
- Risk of frost
- Increase in water usage
- Issues at harvest
- Additional difficulties in management
 - Weed control
 - Winter sanitation
 - Vertebrate pest management
- Cost and uncertainties of economic return
- Difficult access to equipment (Drill, soil prep)
- Lack of information on cover crop management (species, planting dates, termination...)



Resident vegetation is common
Clean berms, unmanaged middles
Mowed during bloom
Allowed to die or terminated prior to harvest

.....despite potential benefits

- Build up of organic matter and healthier soils
 - Decrease compaction
 - Improve aggregation/infiltration
 - Conservation of precip/irrigation water
 - Decrease N losses
 - Earlier field access
 - Dust reduction
- Pollinator health
- Management of problematic weeds
- Management of soil born pests
- Host beneficial organisms



Pictures: D.Doll



Team members



Dr. Jeff Mitchell (PI)



Dr. Dani Lightle, UCCE Glenn



Dr. Neal Williams



Dr. Wilson Houston



Steve Haring, PhD Student



Dr. Andreas Westphal (PI)



Dr. Mohammad Yaghmour, UCCE Kern



Dr. Brad Hanson



Dr. Kent Daane



Kimiora Ward



Dr. Amélie Gaudin (PI)



David Doll, UCCE Merced



Dr. Amanda Hodson



Cynthia Crézé, PhD Student



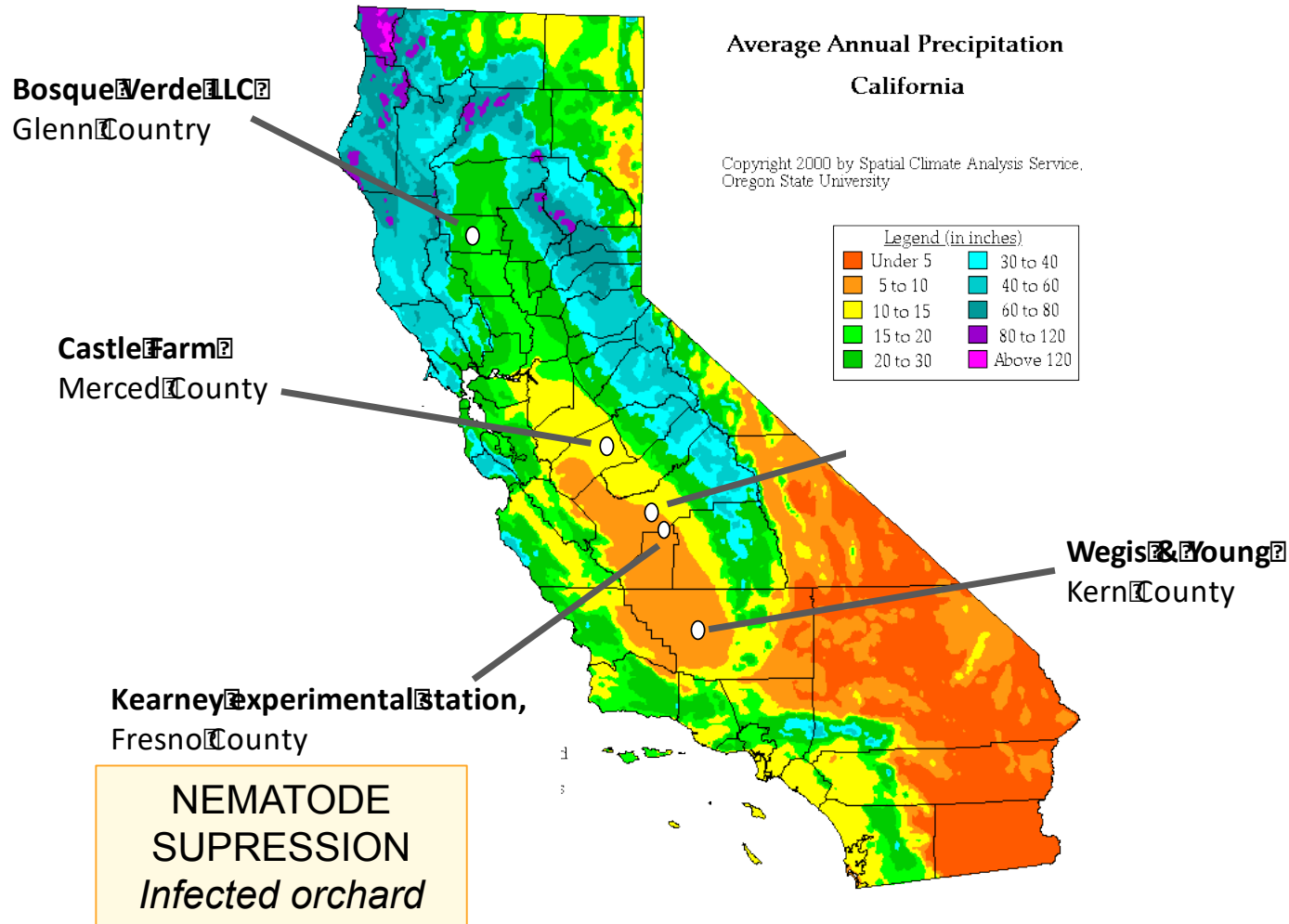
Cameron A.T. Zuber

- Weed sciences
- Entomology
- Nematology
- Soil Science
- Orchard production

2 PhD thesis



Study sites across rainfall gradient



Rainfall gradient

4 treatments, replicated designs

- **PAM "Pollinator mix"**
Bracco White Mustard, Diakon Radish, Nemfix Yellow Mustard, Common Yellow Mustard, Canola
- **"Soil mix"**
Bracco White Mustard, Diakon Radish, Merced ryegrass, Berseem clover, Common vetch
- **Perennial resident vegetation**
- **Bare soil**
Conventional herbicide control

Project *Apis m.*

Kamprath
Seeds

Our system's approach to evaluating winter cover crop options

#1 : Feasible and practice
Maximize agronomic benefits and reduce operational concerns



What levels of C and N capture and increased in **soil health** may be provided by common cover crop mixtures or natural vegetation during the winter?



Do cover crop **use or help conserve** water in our climate?



How does it impact soil and surface temperature and **frost risk** at blooming?



Can cover crops be used to **deter soil born-pests such as nematodes**? Does it interfere/helps with **NOW control**?



Do cover crop impact weed pressure and help **control noxious weeds**?



What is the impact on **pollination** of almond orchards?

Our system's approach to evaluating winter cover crop options

#2 : Work toward developing best management practices

- Termination dates
Before bloom or summer
- Species composition

2nd field season
3-year study
All sites recently planted



What have we learned?

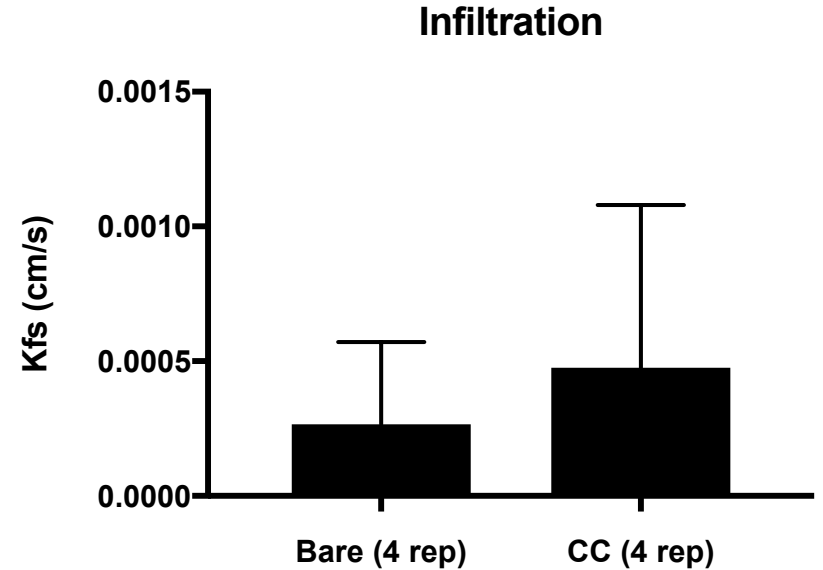
- What you seed is not always what you get
 - C:N ratios varied from 10:1 to 18:1
 - But compared to resident vegetation, the seeded CC can produce up to 300% more dry matter biomass.
- Treat it as a crop to be successful
- Does not interfere with and can even facilitate NOW sanitation (trafficability - shake and mow)
- Probably little to none competition for pollination
- Changes in frost risk still being evaluated
- Harvest: possible to get clean harvest without conditioner (April termination)
- 1-2 more irrigations (Merced/Corning)
- No negative impacts on yields and tree water status

Visit us @ our
poster locations
Weeds #23
Soil health #112
NOW #98
Pollinator #113/114



What have we learned?

- Biomass production is a key factor for SH increase
 - Water infiltration increase in CC
- In micro sprinkler irrigated orchards, wetting zone vs. rainfed soil have different initial soil health
 - Greater C+N in center where residues are piled + shredded
- Overlap of irrigation + CC is important to increase benefits
 - wider CC will be more beneficial for soil health
 - May be difficult to get wider seeding in older orchards → requires 2 drill passes and potential hedging of branches



Follow us and our results : <https://almondcovercrop.faculty.ucdavis.edu> Grower Survey – we want to learn from you

Online

UCDAVIS
UNIVERSITY OF CALIFORNIA

2017 California-wide
Almond Orchard – Cover Crop Survey

English

Welcome!

This survey is part of a UC Davis research project in collaboration with the University of California Cooperative Extension and the Almond Board of California. The objectives are to obtain baseline data on cover-crop use in almond orchards and to identify the most important benefits and concerns of growers about this practice. Data will be used to guide research and extension activities. This survey is anonymous and voluntary. There is no incentive nor compensation for taking this survey.

Who can take this survey?

1. Individuals involved in almond farming
2. Farmers with 1 acre or more of almond trees
3. Both users and non-users of cover crops

Time needed: 10 minutes

Will my information remain confidential?
Yes. To ensure this, please do not include personal information (names, addresses...) in the comments sections.

Do I have to answer all questions?
No. However, surveys with more than 10% incomplete responses will not be used in our study.

[Completion and submission of the survey indicates your consent to participate in this project.](#)

For further information or if you have questions or concerns, please contact the project director:
Amélie Gaudin, Ph.D.
University of California, Davis
agaudin@ucdavis.edu

Paper – mail / available here

Zoom level. Click to open the Zoom dialog box.

**2017 California-wide
Almond Orchard - Cover Crop Survey**

Is almond farming your primary activity? ☐ Yes ☐ No
Do you have 1 acre or more of almond trees? ☐ Yes ☐ No
Are you involved in agronomic decisions? ☐ Yes ☐ No
If you answered "Yes" each time, you're invited to complete this survey!

PART I: Cover cropping opportunities

How knowledgeable are you of cover cropping in almond orchards?
☐ Not at all ☐ Somewhat knowledgeable ☐ Very knowledgeable
Have you previously considered using cover crops in your orchard?
☐ Yes ☐ No

In your opinion, are cover crop benefits mostly:
☐ Agronomic: organic matter, reduces dust...
☐ Operational: earlier field access...
☐ Economic: reduces input expenses, positive economic returns...

In your opinion, which of the following are **most improved** by cover cropping?

	Not improved	Somewhat improved	Most improved
Tree nutrition	☐	☐	☐
Allows earlier field access	☐	☐	☐
Pollinator habitat	☐	☐	☐
Weed control	☐	☐	☐
Water retention	☐	☐	☐
Soil health (organic matter, less dust)	☐	☐	☐
Soil biodiversity	☐	☐	☐
Pest nematode control	☐	☐	☐

The survey is also available online at the following link or QR code:
https://ucdavis.co1.qualtrics.com/jfe/form/SV_3UspPhXFER2QvSS



About this survey:
The survey is part of a UC Davis research project in collaboration with the University of California Cooperative Extension and the Almond Board of California. The objectives are to obtain baseline data on cover crop use in almond orchards and to identify the most important benefits and concerns of growers about this practice. Data will be used to guide research and extension activities.

Who can take this survey?
1. Individuals involved in almond farming.
2. Farmers with 1 acre or more of almond trees.
3. Both users and non-users of cover crops.

Time required: 10 minutes

Will my information remain confidential?
Yes. To ensure this, please do not include personal information (names, addresses...) in the comments section. This survey is **anonymous** and **voluntary**.

**There is no incentive nor compensation for taking this survey.

Do I have to answer all questions?
No. However, surveys with more than 10% incomplete responses will not be used in our study.

For further information or if you have questions or concerns, please contact the project director:

Amélie Gaudin, Ph.D.
University of California, Davis
agaudin@ucdavis.edu

Completion and return of the survey indicates your consent to participate in this project.

Visit us @ our
poster location
#112



Thank you

agaudin@ucdavis.edu
web: gaudin.ucdavis.edu

Visit us @ our
poster locations

Weeds #23

Soil health #112

NOW #98

Pollinator #113/114