Developing soil Fumigation alternatives to reduce agricultural pesticide exposure

Christopher Simmons (PI)
Department of Food Science and Technology

Jean VanderGheynst (Co-PI)
Department of Biological & Agricultural Engineering

Jim Stapleton (Co-PI)
Division of Agricultural and Natural Resources

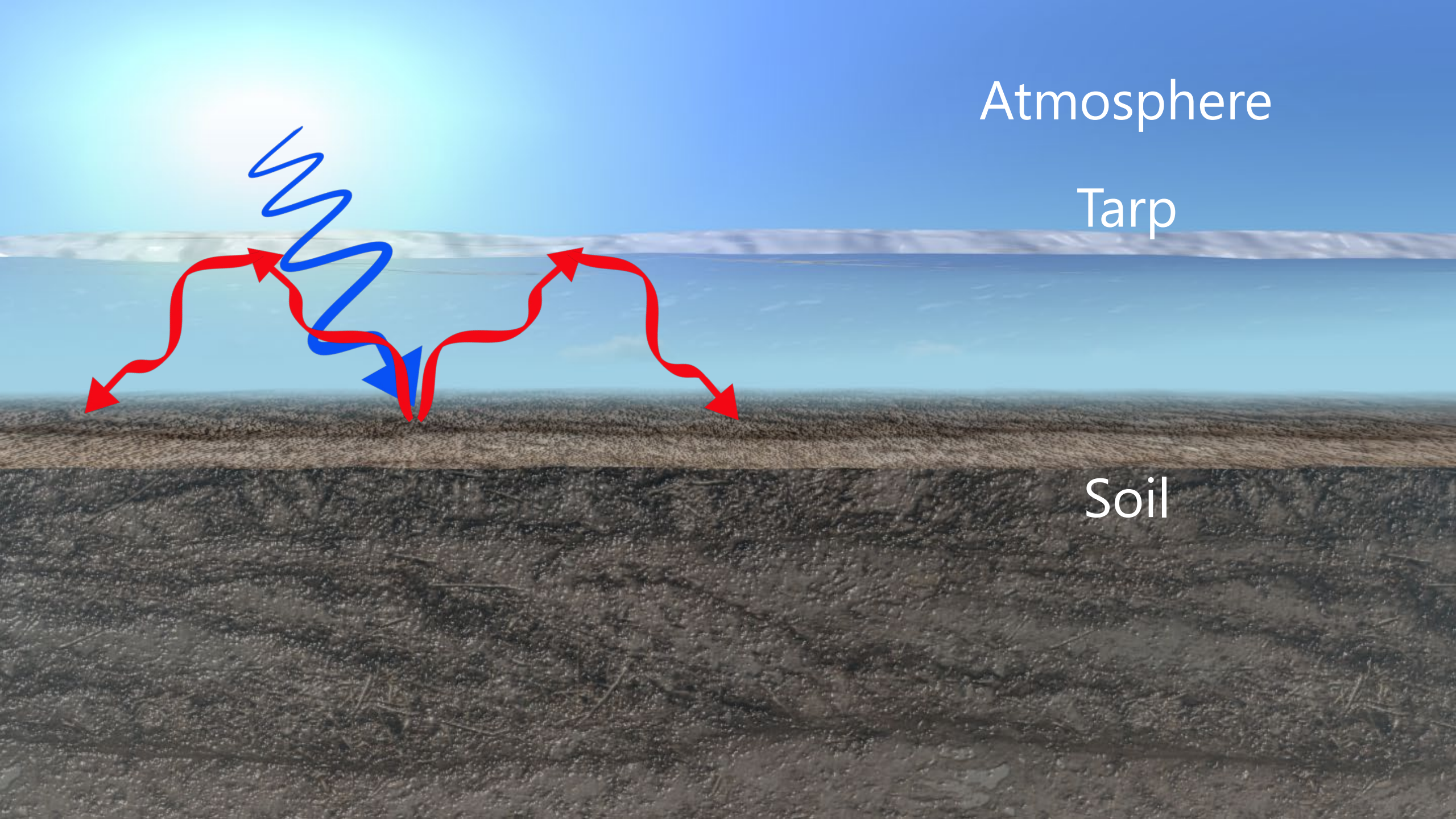
Deborah Bennett (Co-PI)
Department of Public Health Sciences

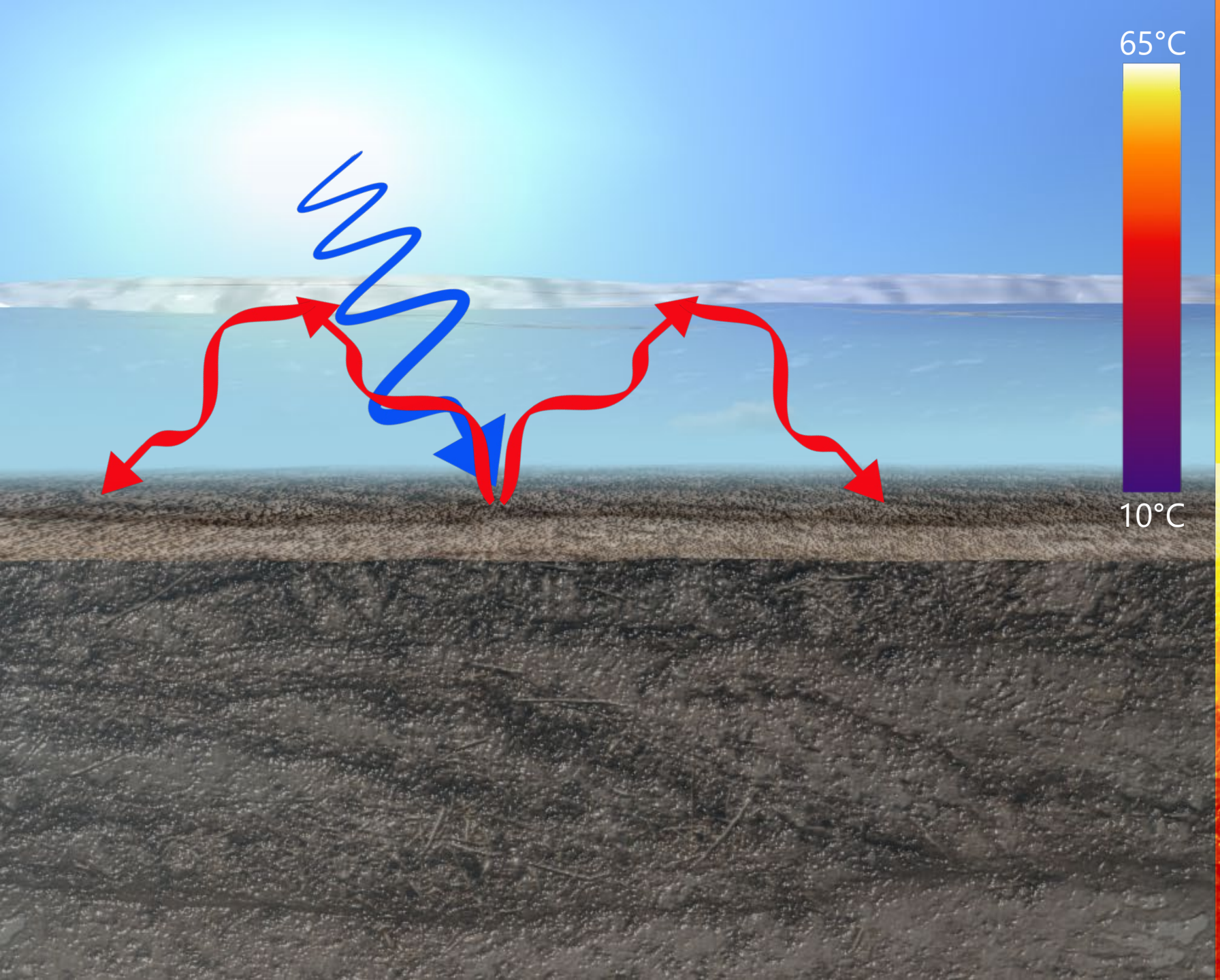
Biosolarization is…

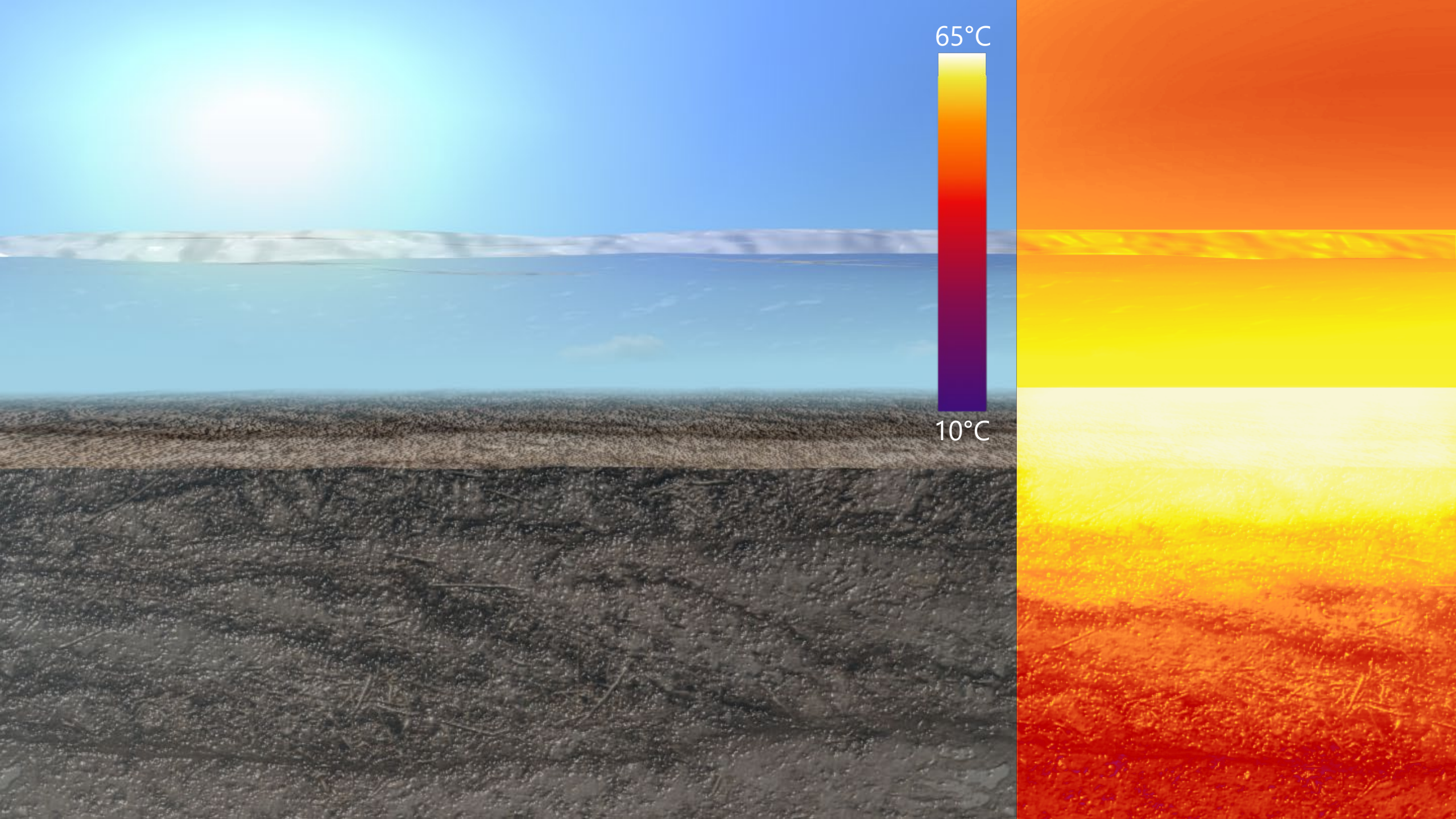
…an alternative to conventional soil fumigation for pest control.

…a technology to reduce the inherent health risks associated with agricultural use of toxic pesticides.


APPLY CLEAR FILM AND
IRRIGATE TO FIELD CAPACITY


Atmosphere
Tarp
Soil


65°C
10°C

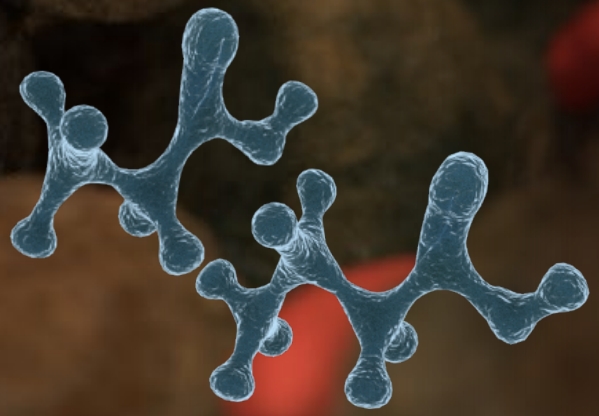

65°C
10°C

BACTERIA PRODUCE BIOPESTICIDES VIA ANAEROBIC FERMENTATION

FOR EXAMPLE, ORGANIC ACIDS:

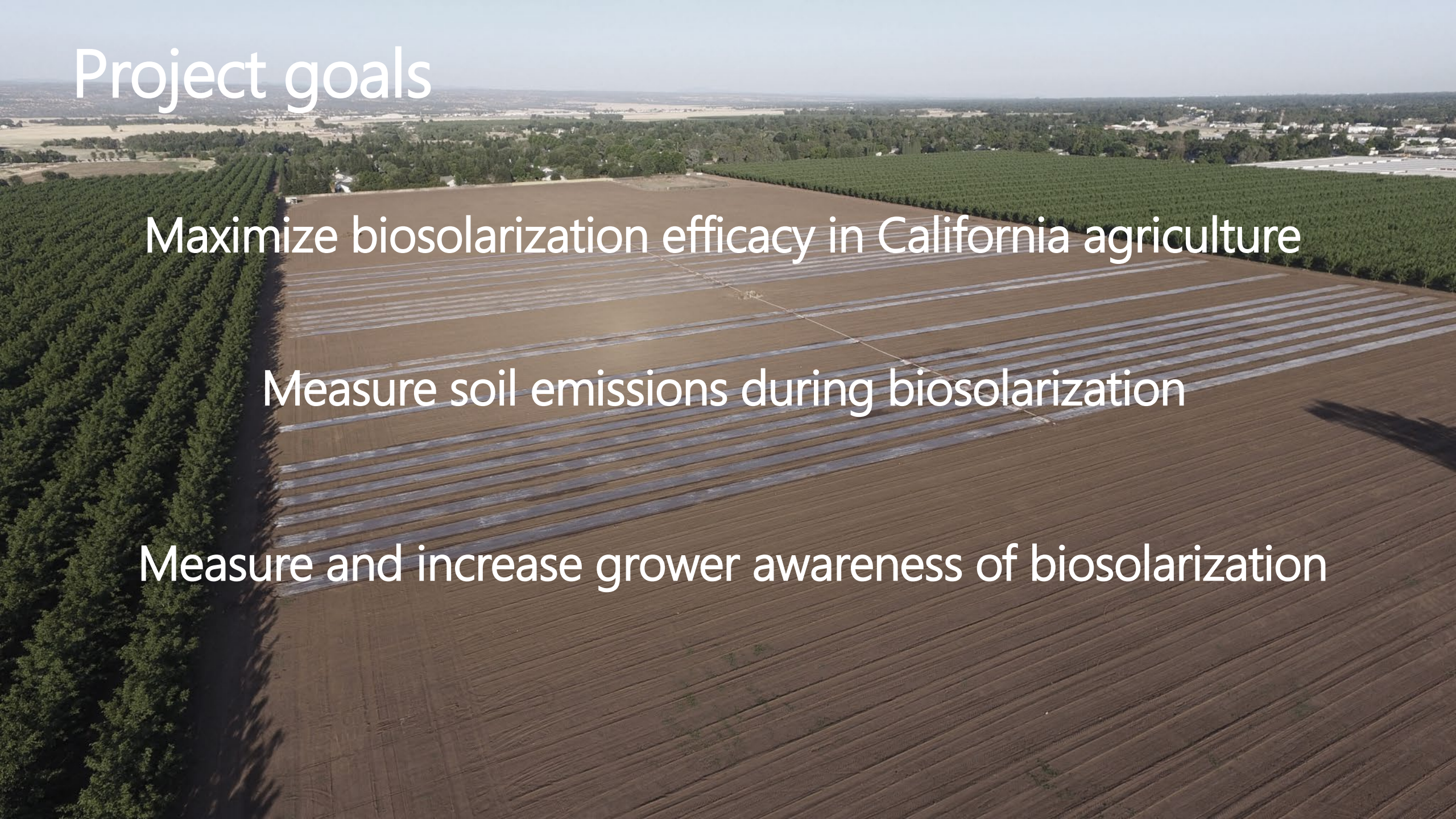
ACETIC ACID

PROPIONIC ACID



BUTYRIC ACID

Project goals



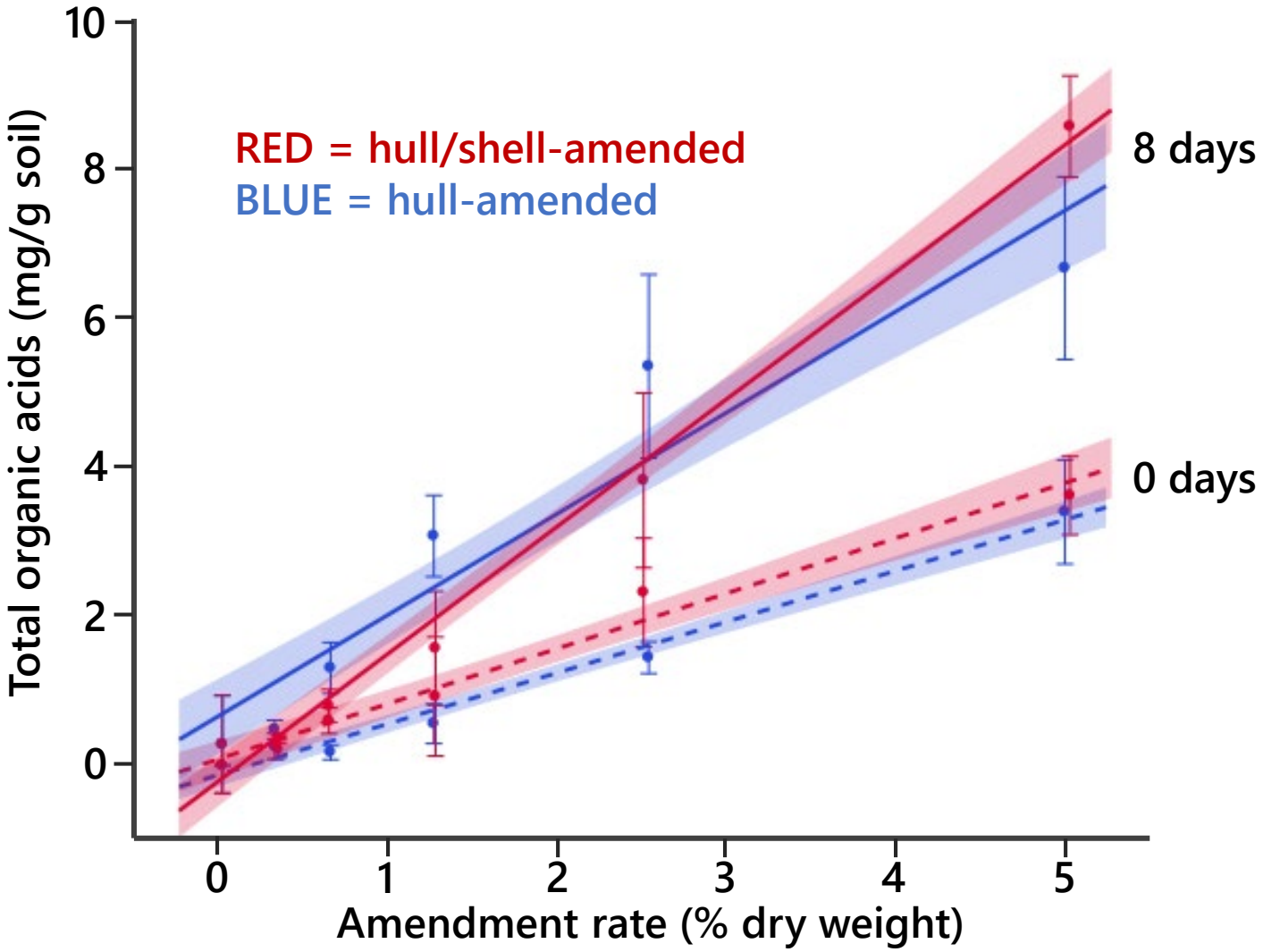
Maximize biosolarization efficacy in California agriculture

Measure soil emissions during biosolarization

Measure and increase grower awareness of biosolarization

Interfacing with the CA almond industry

Hull- and hull/shell mix-amendments lead to accumulation of organic acids in the soil



Endogenous organic acids on almond residues provide immediate acidification of the soil, which may improve pest inactivation kinetics.

Root lesion nematode (*Pratylenchus* spp.) inactivation

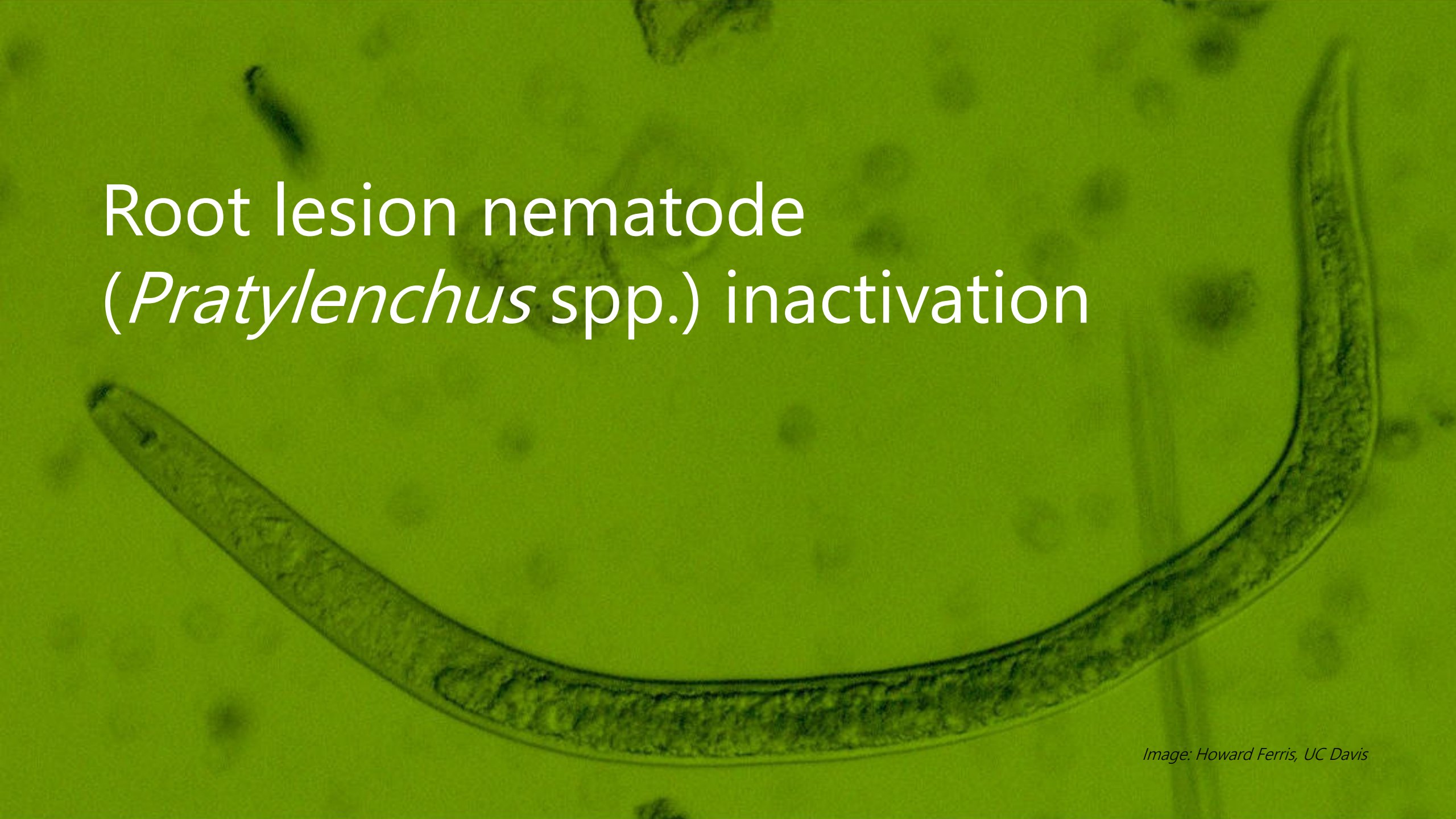
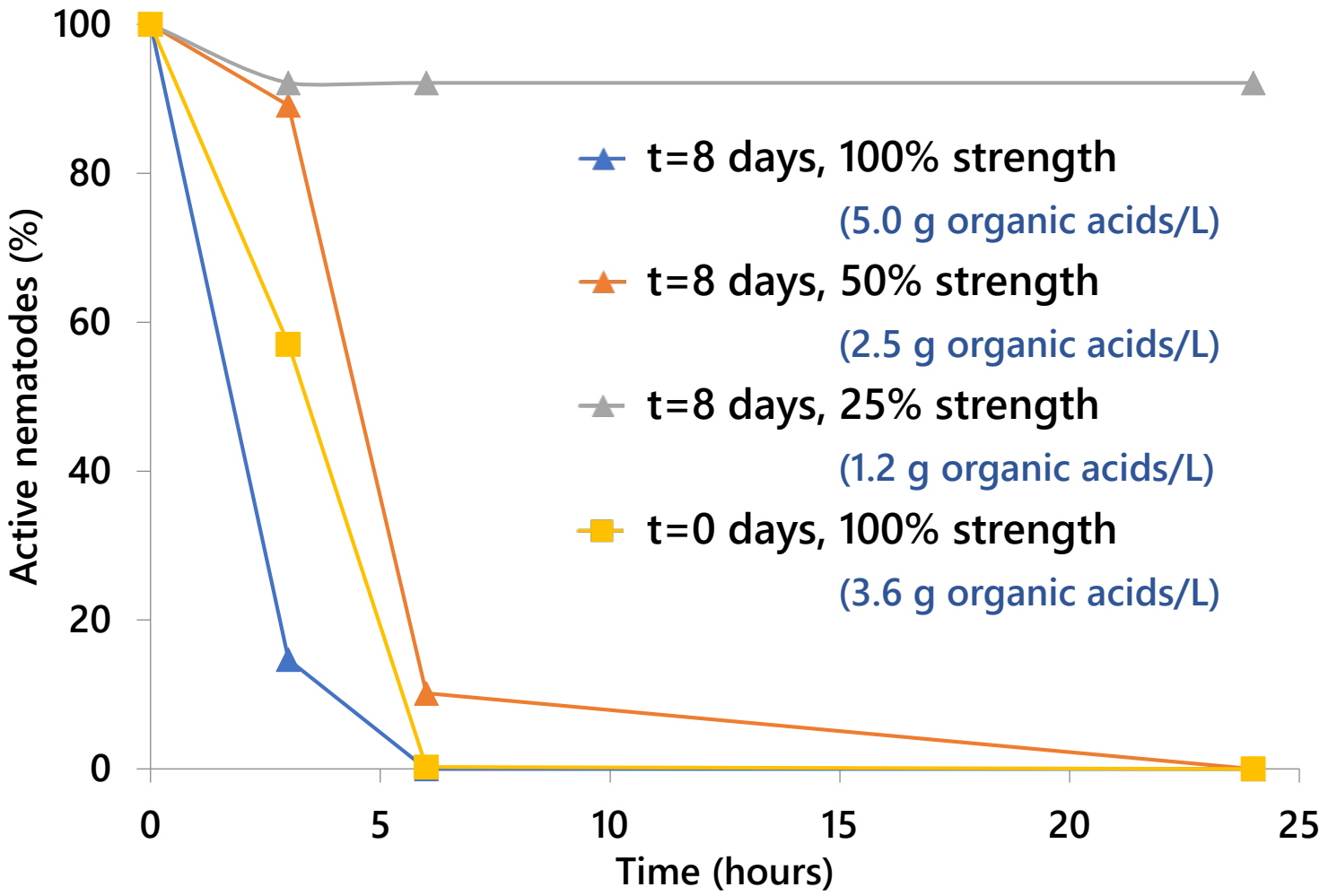


Image: Howard Ferris, UC Davis

Extracts from amended soils exhibit robust nematocidal activity



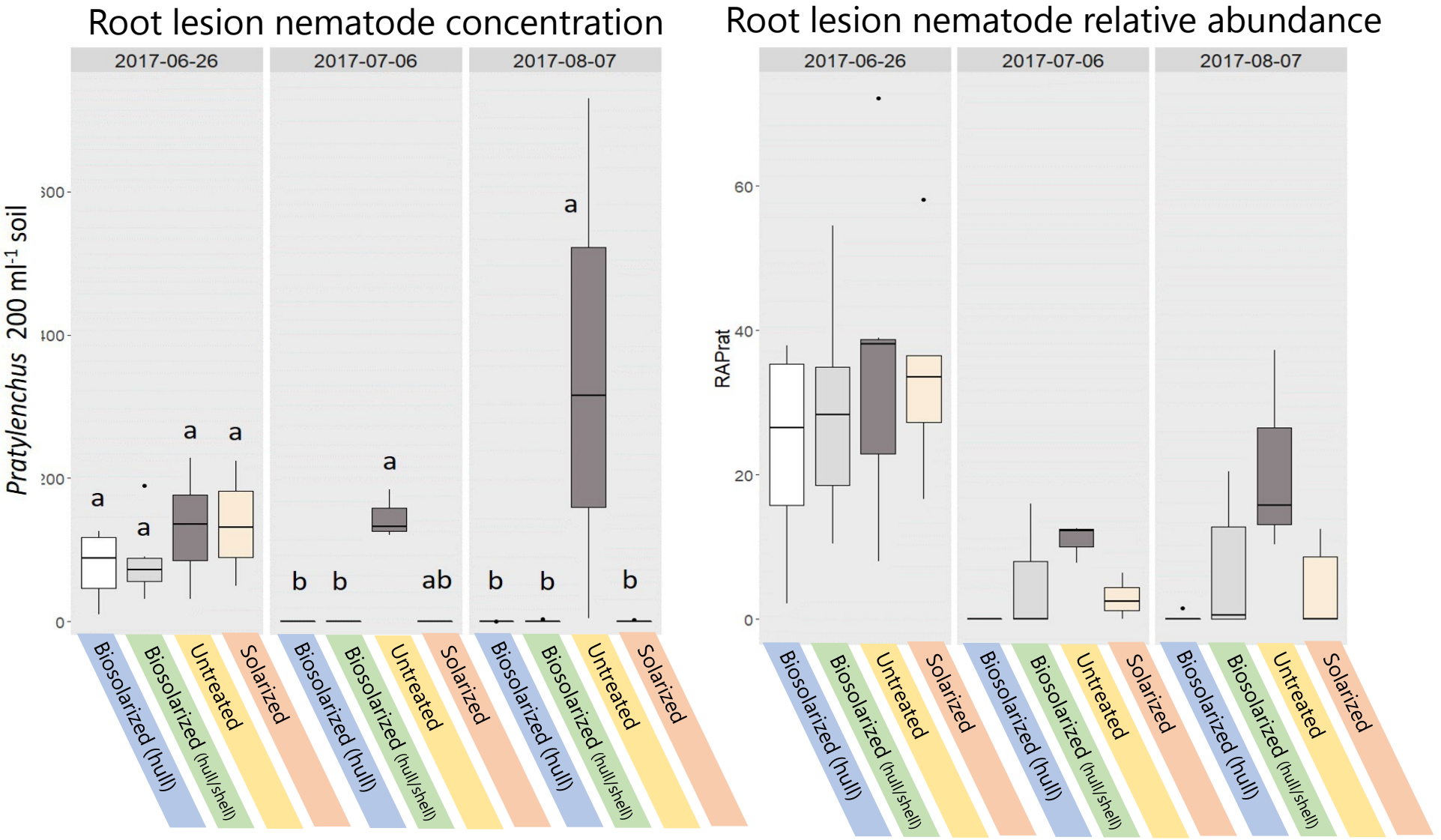
- Soil amended with nonpareil hulls (5% dw).
- Aqueous extracts taken immediately after amendment and after 8 days of anaerobic incubation.

Impact

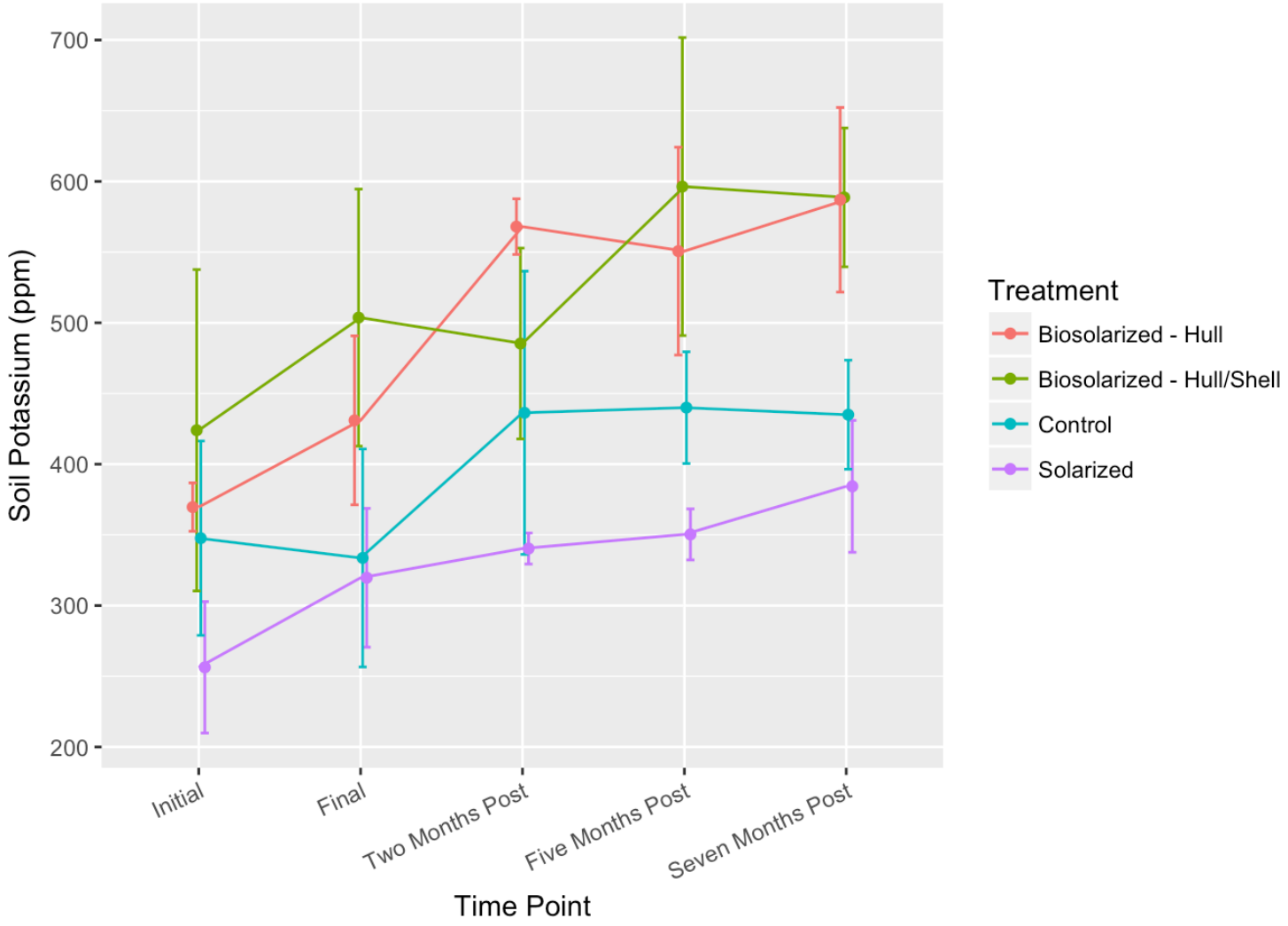
~10 acre field trial with
the Nicolaus Nut Co. in Chico, CA

Additional support from the Almond Board of California

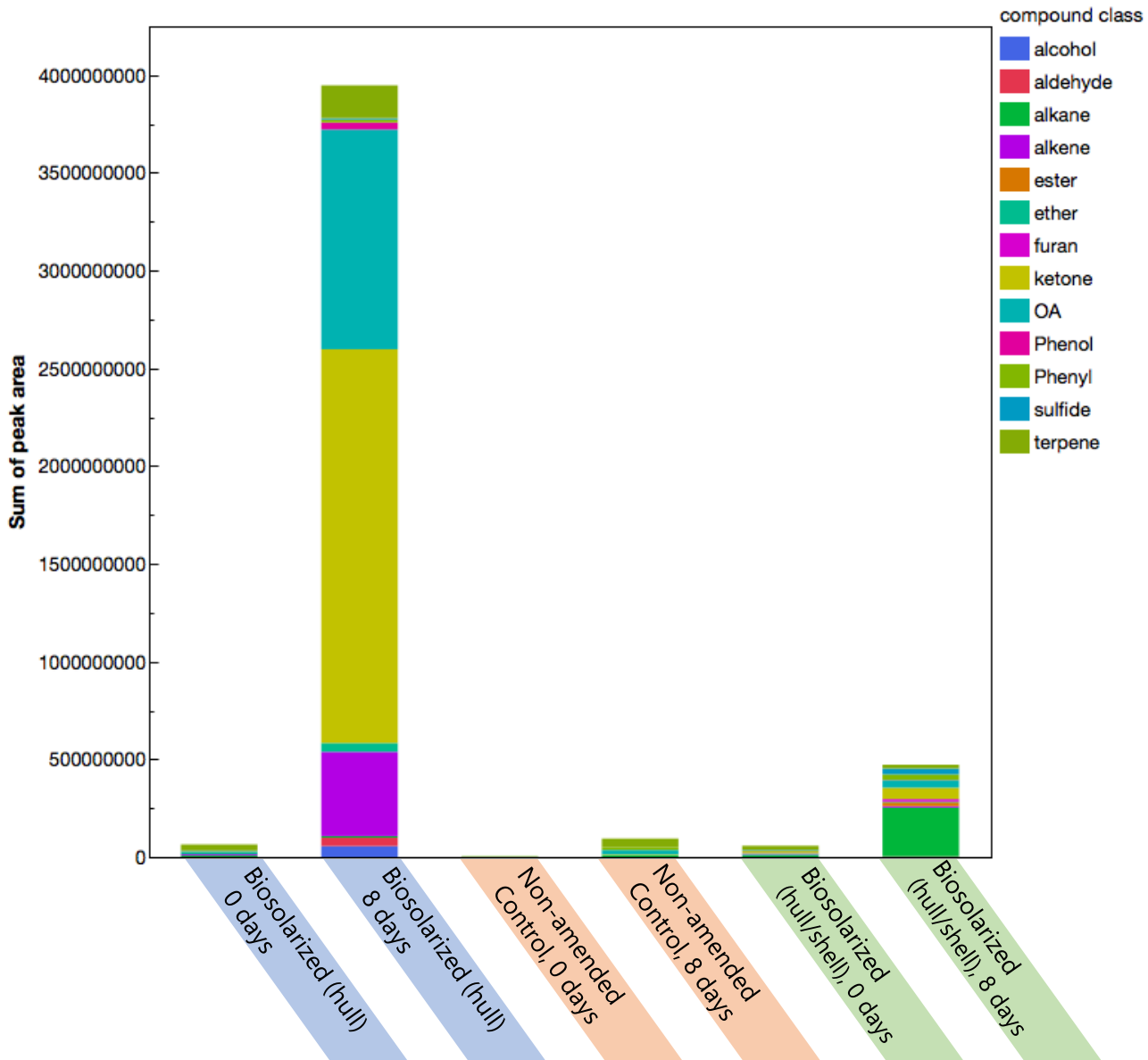
Root lesion nematodes were controlled in solarized and biosolarized soils



Biosolarization amendments can introduce plant nutrients to the soil



A complex array of volatile compounds are produced during biosolarization



A complex array of volatile compounds are produced during biosolarization

COMPOUND	PROPERTIES	PROMINENCE
Isoamyl Alcohol	•Anti-fungal •Starch fermentation by-product •unpleasant odor, irritant at 150 ppm	Small constituent of volatiles from hull amended samples ~ 1 %
2-Butanone	•Natural product: fruits, veggies, trees •PEL 200 ppm 8 hr	Medial constituent of volatiles from hull amended samples ~ 5-10
2-Pentanone	•plants and apple •PEL 200 ppm 8 hr	Medial constituent of volatiles from hull amended samples ~ 5-10
Diacetyl	•secondary or malolactic fermentation •"popcorn workers lung", PEL 8 hr 0.01 ppm	Large constituent of volatiles from hull amended samples ~ 10 %
Acetoin	•product of microbial fermentation •Antimicrobial •Plant - growth promoting •Oxidizes to **diacetyl** on exposure to air.	Very large constituent of volatiles from hull amended samples ~ 20 %
phenylethyl alcohol	•found in almond •Saccharomyces cerevisiae, plant, aspergillus metabolite •antimicrobial, antiseptic •plant growth retardant	Small constituent of volatiles from hull amended samples ~ 1 %

Ongoing work

- Almond yield effects
- Effects on additional crops
- Exposure risk reduction
- Grower outreach

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Duff Harrold
Kelley Hestmark
Tara Randall
Jean VanderGheynst (Co-PI)

Jim Stapleton (Co-PI)

Deborah Bennett (Co-PI)

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