2025

GRIMM FAMILY ORGANIC CENTER

FIELD DAY

CAL POLY
Grimm Family Center *for*
Organic Production & Research

2025 FIELD DAY

Grimm Family Center for Organic Production and Research

INDEX

WELCOME

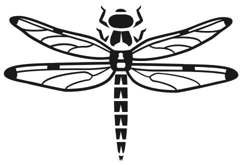
Thank you for attending the 2025 Grimm Family Center for Organic Production and Research Field Day. It has been a busy year, and we have a lot to share with you.

All of this year's presentations will be given by students working on projects either on the farm or in the newly renovated Grimm Family Soil Health and Sustainability Laboratory.

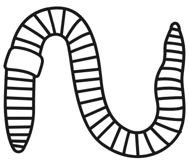
New this year, we have added demonstration stations. Station 1 focuses on general soil health, Station 2 on Nitrogen dynamics in organic fertility programs, and Station 3 on pest management. Each station will be manned by students with research in that area. PCA credit forms will be located at station 3.

We'd like to give a special thanks to this year's sponsors. You can check them out on the back page of the program or meet some of them at our refreshment table.

FIELD DAY SCHEDULE



TIME	DESCRIPTION
12:30 PM	Registration
1:00 PM	Opening Remarks: Dean Brian Dorgan and Director Matt Grieshop
1:15 PM	Student Lightening Talks
2:00 PM	Choose a Station 1
3:00 PM	Choose a station 2
4:00 PM	Adjourn



NOTES

ORGANIC FUNGICIDES FOR POWDERY MILDEW MANAGEMENT IN CHARDONNAY GRAPES

This study evaluated the performance of organic fungicides compared to a conventional positive control for managing powdery mildew in Chardonnay grapes. Two organic treatments provided disease control levels that were not statistically different from the conventional standard.

Study Overview

- Randomized complete block design with four replications.
- Disease severity assessed by visually rating 25 grape clusters per treatment & estimating the percentage of infection per cluster

Treatments

- MilStop, an OMRI-listed product, contains potassium bicarbonate as its active ingredient.
- Zayin, also OMRI-listed, contains geraniol as the active ingredient and was applied at two rates: 32 floz/acre and 48 fl oz/acre.

A: Negative control — highest disease severity, with an average of 61% infection.
B: Positive control — minimal infection observed, with a mean of 1.4%.
C: Zayin (32 fl oz/acre) — moderate disease presence, averaging 6.1%.
D: Zayin (48 fl oz/acre) — low disease levels, with an average of 0.9%.
E: MilStop — no visible powdery mildew, with 0% infection.

Results

- MilStop was the most effective treatment in reducing powdery mildew infection.
- Both Zayin treatments (32 and 48 fl oz/acre) performed similarly to the positive control (asynthetic fungicide program).
- Phytotoxicity was observed in the MilStop treatment, which may have contributed to the absence of visible disease.
- MilStop was tank-mixed with Botrystop, a biological fungicide targeting Botrytis.

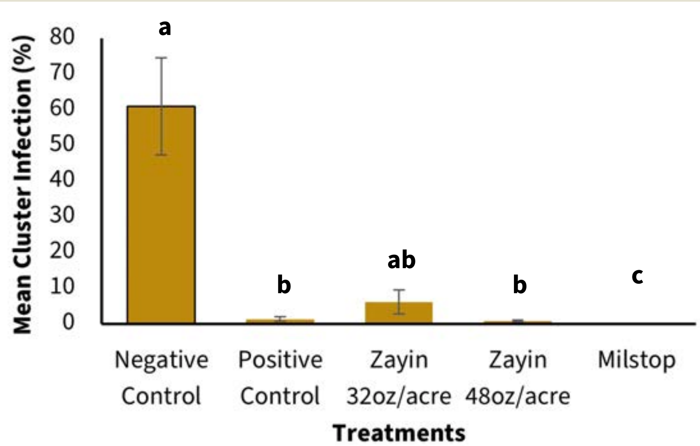


***Figure 1.** Powdery mildew infection (&) in Chardonnay clusters by treatment*

Abraham Ahumada, Dr. Shunping Ding

BIOLOGICAL TREATMENTS FOR LETTUCE FUSARIUM WILT

The soilborne fungal disease Fusarium wilt has become increasingly widespread and devastating in California lettuce production. Our research evaluates the potential of several commercial organic treatments, focusing on biologicals for managing the disease and improving yield.

Phase 1: Greenhouse Trials

- Iceberg lettuce was inoculated with *Fusarium oxysporum* fsp. *lactucae*
- Disease conducive conditions
- Screened 12 treatments across 2 trials
- 8 registered organic treatments

Most products did not provide signficant control with either 1 or 2 applications (Fig. 1)

Phase 2: Small Plot Field Trials

- Testing 8 treatments, 4 certified organic
- 3 high-label rate applications
- Pathogen introduced on infested sand at planting
- No significant reduction in disease so far.
- Second round ongoing with lower pathogen levels

Phase 3 : Commercial Field Trials

- Testing 3 biological products in commercial iceberg fields
- Naturally infested soils
- 3 Field replicates, 4 treatments
- 3 Applications per lettuce crop applied through drip
- Disease ratings, drone imagery NDVI, yield

Table 1. *Treatments evalutaed*

Code	Treatment
UTC+	UTC + Pathogen
UTC-	UTC No Pathogen
Conv.	Fludioxonil
B1	*B. subtilis*
B2	Bacterial Consortium
B3	*B. amyloliquefaciens*
B4	*P. chlororaphis*
B5	*S. lydicus*
F6	*T. harzianum + T. virens*
C7	HO + PAA
C10	Cinnamon oil

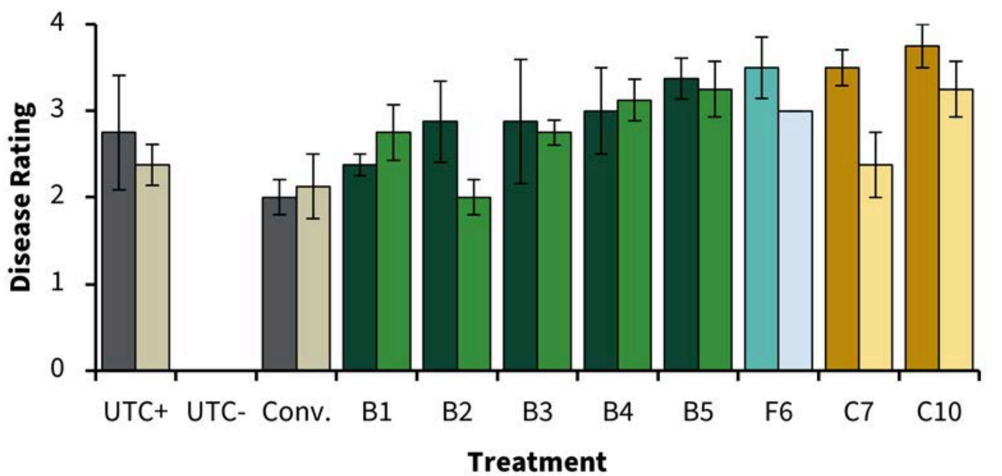


Figure 1. *Mean ± SEM disease severity of lettuce plants treated with commercial products. Dark bars indicate values from trial 1 with 1 application. Light bars indicate values from trial 2 with two applications.*

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Evan Tamayo, Dr. Shunping Ding
Acknowledgements: AerialPlot - Kaitlin Rim
Betteravia Farms - Josue Diaz and Chris Height
CSU ARI Next-Gen Fellowship

CAL POLY ORGANIC FARM BASELINE AGGREGATE STABILITY

Measuring aggregate stability helps us evaluate soil health, track the impact of farming practices, and guide decisions to improve long-term soil productivity and resilience.

What is Aggregate Stability?

Aggregate stability refers to how well soil particles remain intact. Soils with higher aggregate stability are less prone to compaction and erosion, making them more tolerant to physical disruption. These soils have better **water infiltration**, **moisture retention**, **nutrient exchange**, and **root growth**, leading to better resistance to equipment traffic and quicker recovery after rain or irrigation.

Study Summary

- Collected soil samples using a soil auger to a depth of 100 cm.
- Divided each soil core into four depth intervals: 0–10 cm, 10–40 cm, 40–70 cm, and 70–100 cm.
- Dried the samples and treated each depth interval as a separate sample for analysis.

Aggregate Stability on three blocks at the Cal Poly Organic Farm

- Stability increased with depth in B3 and C1; C3 showed little change by depth (Fig. 1).
- The deepest C1 layer had the highest values, followed by the deepest layer in B3.
- C3 had the lowest, most uniform values overall.
- Greater depth effects in B3 and C1 may reflect management or soil factors.

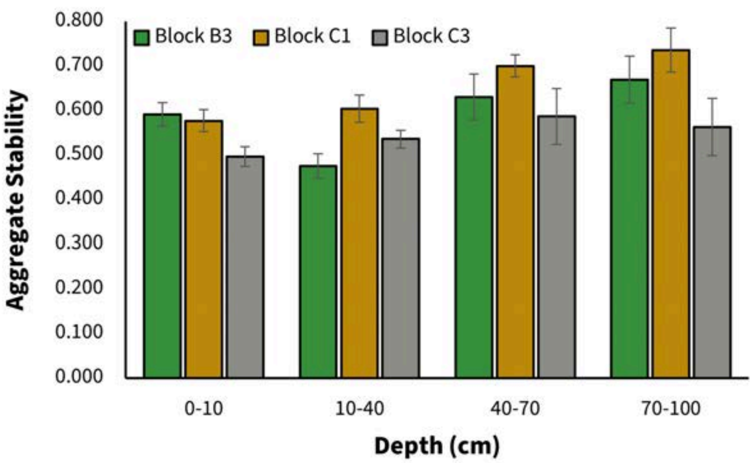

Figure 3. Aggregate stability by depth over 3 blocks at the Cal Poly organic farm

To improve low-stability areas like Block C3, it is suggested to adopt practices such as **reducing tillage**, **planting cover crops**, **maintaining living roots** year-round, **minimizing soil compaction**, and using diverse **crop rotations** to enhance soil structure and resilience over time.

Figure 1. *Block B3 at the Cal Poly Organic Farm*

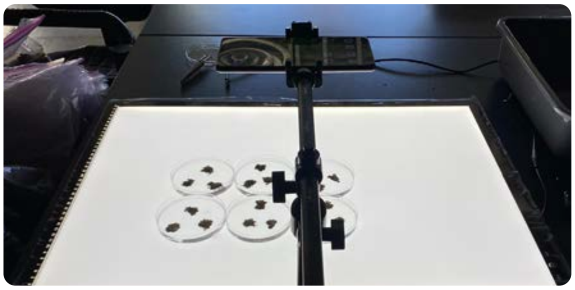

Figure 2. *Slake test image acquisition*

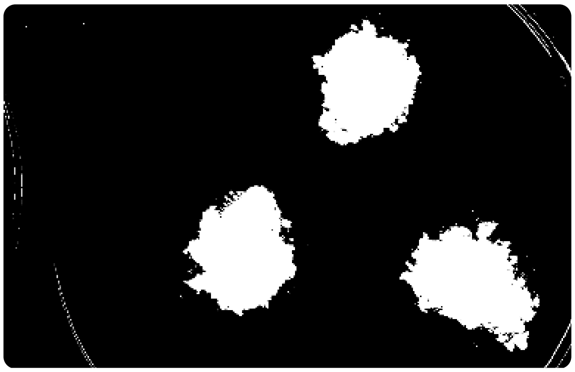

Figure 4. *Soil aggregate image processing*

Una O'Connell, Dr. Charlotte Decock, Dr. Matt Grieshop

CARBON SATURATION IN VINEYARD SOILS

*Soil carbon storage is widely recognized as essential to both reducing atmospheric CO_2 levels and improving soil health. To optimize soil carbon storage, it is important to understand both its potential and limitations. This is done by studying two pools of carbon: **Particulate Organic Carbon (POC)** is unstable and easily lost without sustainable management. **Mineral-Associated Organic Carbon (MAOC)** is more stable and binds to soil minerals for long-term storage. Distinguishing between POC and MAOC is essential for assessing carbon saturation, the point at which soils can no longer retain additional stable carbon. Identifying whether vineyard soils are nearing this saturation threshold allows for better-informed land management decisions.*

OBJECTIVES

Assess MAOC saturation in vineyard soils

Estimate effective carbon capacity

Quantify carbon saturation deficit

Evaluate impact of organic/regenerative management

ORGANIC/REGENERATIVE PRACTICES

All these practices increase soil organic carbon

6
C
Carbon
12.011

Growers want to maximize MAOC for long term carbon storage, but its accumulation plateaus due to mineral or physicochemical constraints

PARTICULATE ORGANIC CARBON

- Free floating in soil
- Lasts <10 years— decades in soil
- Plant and fungal derived

MINERAL ASSOCIATED ORGANIC CARBON

- Chemically bound to minerals
- Lasts decades - centuries in soil
- Plant and microbe derived

Gwendolyn Richards,
Dr. Charlotte Decock,
Dr. Matt Grieshop,
Casey Fison, Sonia Lemonier

- 87 vineyard blocks were sampled across 12 California vineyards. Vineyard sites had a history of up to 25 years of regenerative management.
- Laboratory Analysis: Organic carbon is separated into two pools, MAOC and POC.
- Carbon and nitrogen content were then measured with an elemental analyzer.

PRELIMINARY RESULTS

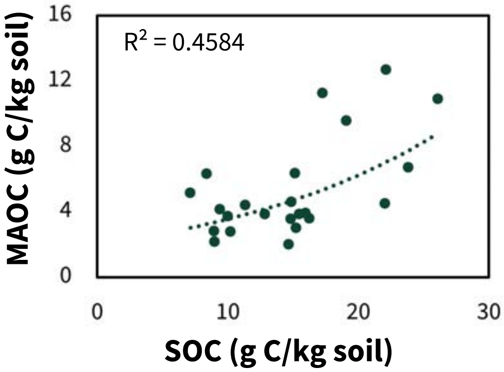

Figure 3a. *POC increases exponentially with total SOC, suggesting greater POC in soils with higher SOC.*

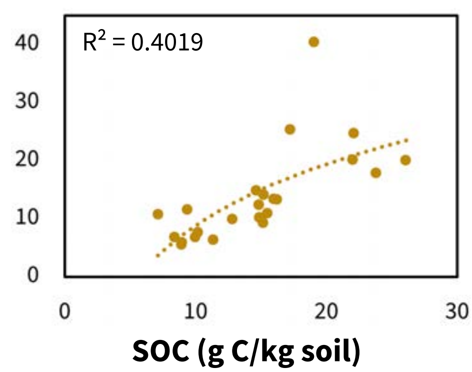

Figure 3b. *MAOC rises logarithmically with SOC, indicating that saturation may occur at high SOC sites.*

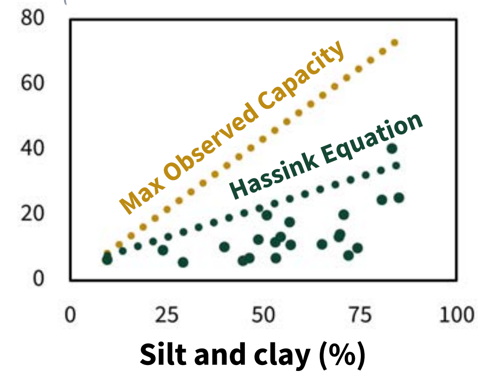

Figure 3c. *Relationship between MAOC and the fine fraction. The MAOC vs. silt and clay boundary in our study matches the Hassink equation, but falls below the global max capacity line for 2:1 clay soils.*

POC and MAOC increase with soil organic carbon (SOC), but MAOC shows signs of saturation at high SOC and fine fraction levels.

- Preliminary data show an exponential increase in POC and a logarithmic increase in MOAC with increasing SOC. This suggests that C saturation may be occurring in high SOC vineyards within the dataset.
- This framework helps target vineyard blocks where regenerative practices can be most effective at storing carbon.
- Extending this work to additional production systems and climates will require similar data to be collected under those circumstances.

HOW DOES THIS HELP GROWERS?

- Our study will inform growers how to prioritize resources for organic/regenerative practices that maximize carbon storage.
- In soils with low C storage capacity, regenerative practices may better support functions like infiltration and microbial activity. This highlights the need to match management strategies to both soil capacity and grower goals at the vineyard block scale.

Gwendolyn Richards,
Dr. Charlotte Decock,
Dr. Matt Grieshop,
Casey Fison, Sonia Lemonier

RATE & TIMING IN ORGANIC FERTILIZER NITROGEN MINERALIZATION

A 12-week lab study tested how fertilizer rate and timing impact organic fertilizer nitrogen (N) mineralization. Available soil N increased when more fertilizer N was applied but fertilizer mineralization efficiency decreased, especially with split application. Our findings emphasize using a microbial lens when optimizing organic fertility programs.

Study Design

- **Soil:** Clay loam from an organic field in Santa Maria
- **Conditions:** 12-week incubation at 20°C & 60% water holding capacity
- **Fertilizer:** Pelleted 8-5-1 applied as:
  - Single dose (100% on Day 0)
  - Split dose (50% on Day 0, 50% on Day 42)
- **Rates:** 50–400 mg N/kg soil
- Low N rates simulate **broadcasting**
- High N rates simulate **banding** (based on 10" band on 80" bed)

Fertilizer Rate (mg N/kg soil)		lbs N/acre broadcasted	lbs N/acre in a 10" band
50	→	100	12.5
100	→	200	25
200	→	400	50
400	→	800	100

Figure 2. *Realized N rate when broadcast or banded*

Figure 1. *Broadcast vs. Banded fertilizer application*

Figure 3. *Soil incubation vessels*

Ria Chhabra, Dr. Charlotte Decock, Dr. Matt Grieshop

Acknowledgements: Shane Egerstrom, Anna Rodriguez-Paiatsyka, & Craig Stubler

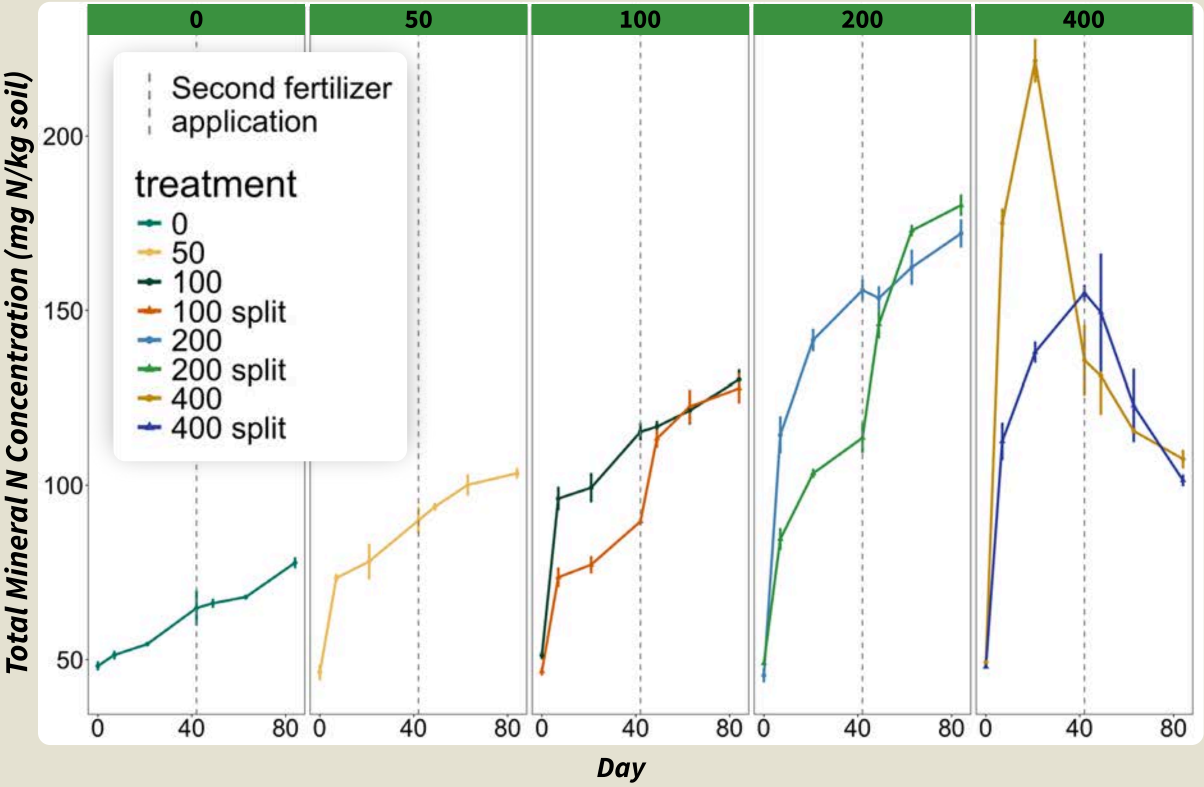

Figure 4. *Total mineral N (NO_3^- and NH_4^+) concentration over the 12-week incubation.*

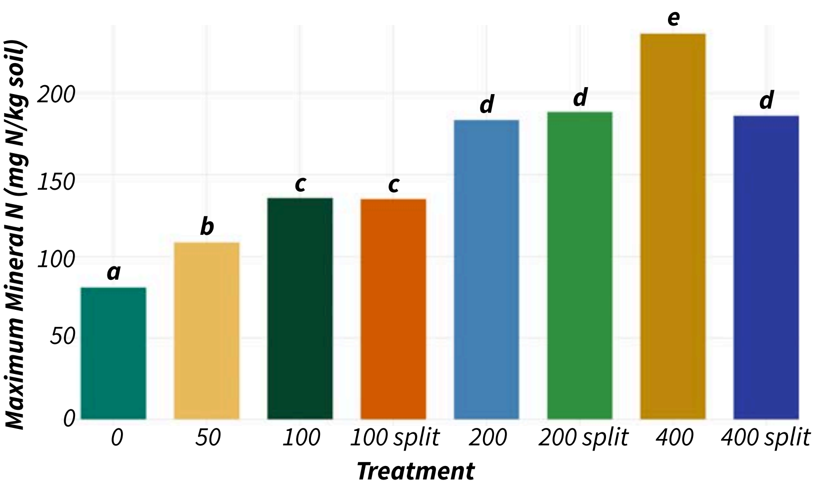

Figure 2. *Maximum rate of N mineralization over 12-weeks.*

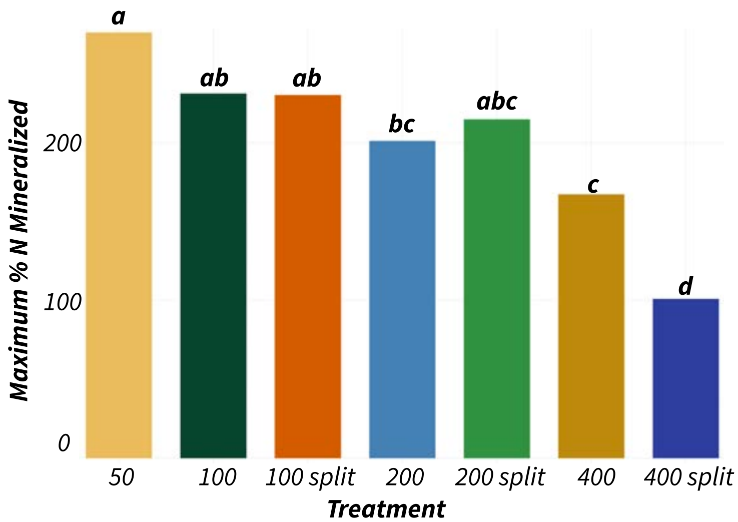

Figure 3. *Maximum % of fertilizer N mineralized over 12-weeks.*

Key Findings

- Available N increased as N rate increased, except in the highest N treatments.
- In the highest N treatment, Split applications mineralized less N than single applications.
- At lower N rates, available N was similar in single vs split applications by week 12
- Fertilizer mineralization efficiency decreased from 81% to 23% with increasing N rate.

What This Means for Growers

- In organic systems, microbial activity in contact with fertilizer determines how much N becomes plant-available
- Broadcasting spreads N out, potentially increasing fertilizer N mineralization efficiency
- Single applications may be more effective than splits when banding >100 lbs N/acre
- Split applications may help manage N release and reduce losses at low rates

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Ria Chhabra, Dr. Charlotte Decock, Dr. Matt Grieshop

Acknowledgements: Shane Egerstrom, Anna Rodriguez-Paiatsyka, & Craig Stubler

ASSESSING NITROGEN LEACHING RISK IN ORGANICS

Tightening nitrogen (N) regulations make N leaching risk assessment in organic systems essential. In two organic trials, we combined partial N budgets with long-term soil N monitoring. Estimated N discharge exceeded measured leaching losses, suggesting that a considerable portion of the applied N remained within the system. Overwintering cover crops further reduced N leaching risk, underscoring their value as a management tool.

Study Overview

- Ag Order 4.0 limits nitrogen balances on the Central Coast, assuming all surplus N leaches to groundwater, but this may not apply to organic and regenerative systems that build soil organic matter.
- For two trials, we built partial N budgets, which included preplant and post-harvest soil samples, inputs by fertilizer and irrigation, and N in biomass.
- We also installed passive monitoring tools called Self-Integrating Accumulators (SIAs) to measure N leaching at 1m depth
- In trial 2, we assessed the effect of crop residue and cover crops on N leaching.

Table 1. *Partial N budget for trial 1 and leaching measurements from SIAs.*

A: Applied N (lbs/acre)	R: Removed N (lbs/acre) Mean ± SEM	Discharged N (lbs/acre) Mean ± SEM	Leached N (lbs/acre) Mean (range)	Post-harvest N (lbs/acre) Mean ± SEM	Post-harvest Leaching (lbs/acre) Mean (range)
125	4 ± 0	48 ± 0	10 (4-16)	84 ± 3	11 (0 –22)

Figure 1. *SIA installation at the Cal Poly Organic Farm*

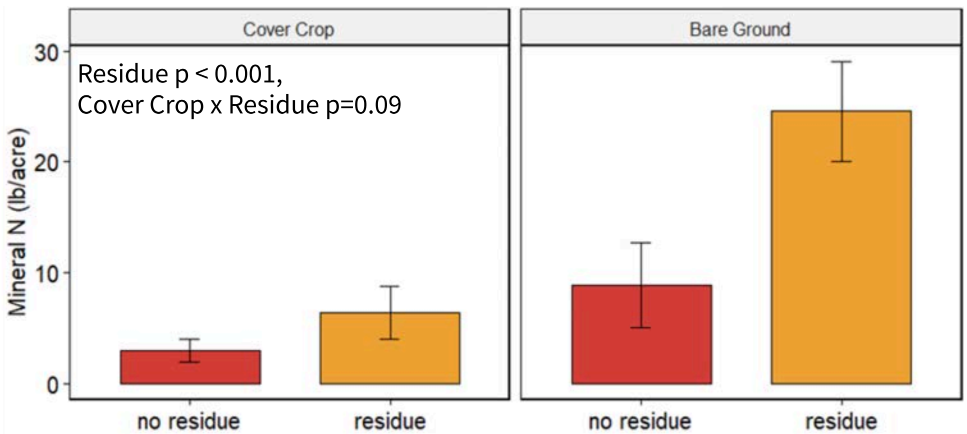

Figure 2. *Leached mineral N from Trial 2, comparing cover-cropped plots versus bare ground under different residue management practices.*

Major Takeaways

- Partial N budgets may overestimate N leaching in organically managed systems
- Residues were an important source of leached N
- Cover crops reduced leaching, especially where residues were retained
- Regulatory frameworks should be adjusted to better account for the unique N cycling dynamics in organic farming systems.

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Megan Widle,
Dr. Charlotte Decock

Acknowledgements:
Dr. Wolf-Anno Bischoff

NOTES

NITROGEN AND WATER MANAGEMENT IN ORGANIC BROCCOLI PRODUCTION

To prepare growers for increasingly stringent N management, the efficacy of strategies that improve nitrogen use efficiency (NUE), and the predictability of available N from organic sources must be tested. CropManage is an irrigation support tool that calculates evapotranspiration-based irrigation recommendations, helping retain more N in the root zone.

Study Design

- Three trials were conducted on organic commercial broccoli fields, in three different regions/seasons (Table 1).
- Accross trials N fertilizer rates ranged between 0 (or preplant only) and 150% of the grower practice. Grower N rates were 193, 187, and 210 lbs N/ac in trials 1, 2, and 3 respectively.
- Irrigation treatments were added to trial 2 and included grower practice (GS) and evapotranspiration based irrigation (CM) (Fig. 2).
- Plant samples were collected for assessment of yield and N uptake (Fig. 3).
- Pre-planting and post harvest soil samples were collected to a depth of 3’ for determination of available N concentrations, at four depths (Fig. 1).
- Irrigation water N levels were measured throughout all three studies.

Figure 1. *Deep core soil sampling*

Figure 2. *Trial irrigation manifold*

Table 1. *Field characteristics and irrigation management across 3 trials.*

	Trial 1 (Spring ‘24)	Trial 2 (Fall ‘24)	Trial 3 (Spring ‘25)
Location	Oceano	Santa Maria	Soledad
Soil Type	Clay Loam	Sandy Loam	Fine Gravelly Sandy Loam
Irrigation input (as % of ET recommendation)	121% (GS only)	123% vs 100%	180% (GS only)

Figure 3. *Trial 2, in Santa Maria*

Let us know your perspective!
Please fill out our survey on preplant soil sampling and pump-and-fertilize practices.

Shane Egerstrom
Dr. Charlotte Decock

Results

- Yield increased significantly with increasing N rate in trial 1, but variability was high likely due to aphid pressure (Fig. 4a)
- Yield was not affected by N rate in trial 2, likely due to high preplant N concentration in the top foot of soil (Figs. 4b & 5) .
- There was a weak increase in yield with increasing N rate in trial 3, which had lower preplant N but much more N input through irrigation water (Fig 6).
- Post harvest N sampling in trial 2 suggested that irrigation using evopotranspiration increased N retained within deeper soil strata (Fig. 7).

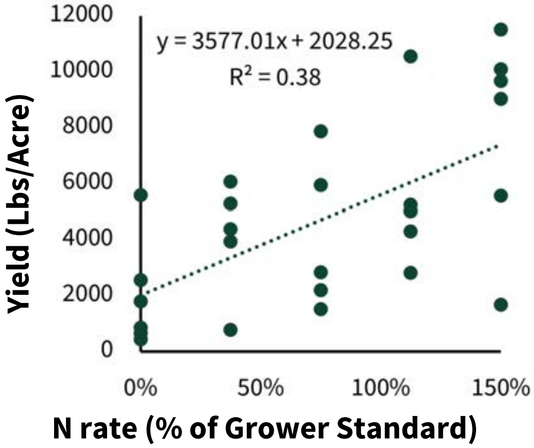


***Figure 4a**. Yield by nitrogen rate, across 5 scaled fertilizer treatments.*

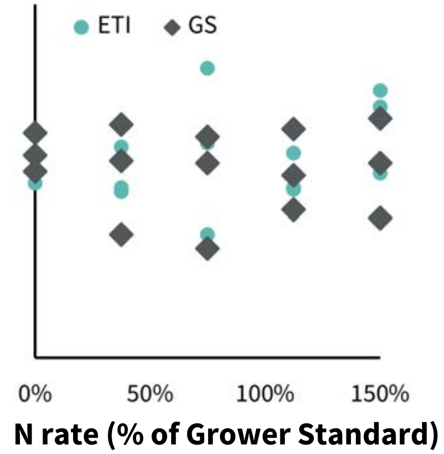


***Figure 4b**. Yield by nitrogen rate, with irrigation treatments CM (CropManage) and GS (Grower Standard).*

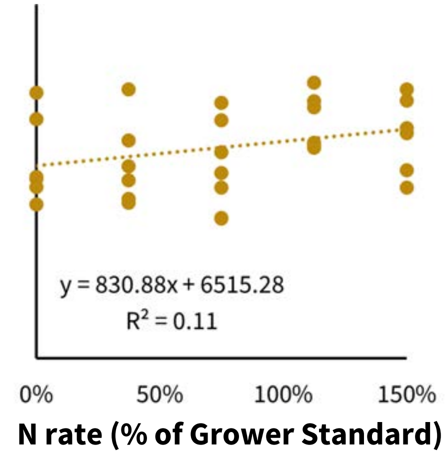


***Figure 4c**. Yield by nitrogen rate. The regression has a weak positive trend.*

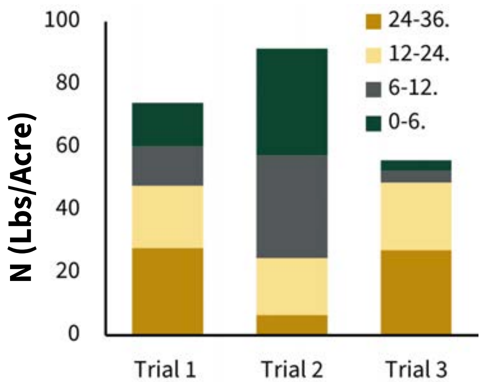


***Figure 5**. Preplant N by depth.*

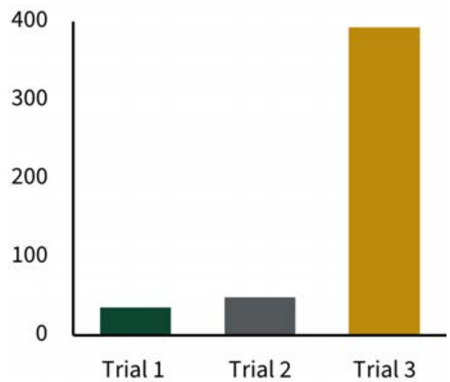


***Figure 6**. N contribution from irrigation water.*

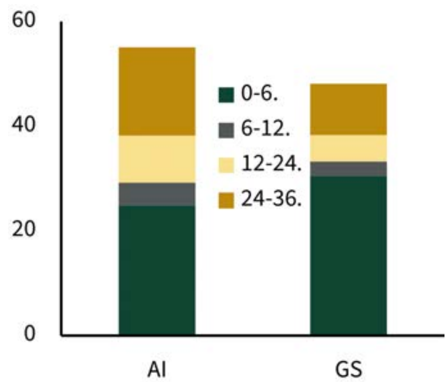


***Figure 7.** Post harvest residual N by irrigation treatment for Trial 2.*

Conclusions

- Similar to conventional production, accounting for preplant soil nitrate and N in irrigation water can help save N fertilizer.
- Soil nitrogen testing to a deeper depth can justify reduced N inputs in deep rooted crops
- Efficient irrigation management can keep N in the root zone for use by current and future crops.
- The availability of N from irrigation water is affected by irrigation management.

***Figure 8.** Seperating and bagging soil cores by depth.*

Shane Egerstrom
Dr. Charlotte Decock

NOTES

MEASUREMENTS FOR ASSESSING SOIL HEALTH

Three practical and affordable soil health measurements recommended by the Soil Health Institute to monitor changes of soil health: Soil Organic Carbon, Carbon Mineralization Potential, and Aggregate Stability

1. Soil organic carbon (SOC):

- Carbon is the backbone of organic compounds in plants, animals, and microorganisms.
- As plant, animal, and microbial residues decompose in soil, they form part of Soil Organic Matter (SOM).
- SOC contributes 45-60 % of SOM.

Importance of SOC: improved soil aggregation (soil structure), reduced soil erosion (improved soil aggregation), increased water retention, and serves as a food source for soil microorganisms.

How it is measured: Dry combustion method. Total soil carbon = Soil organic carbon + inorganic carbon (carbonates).

2. Carbon mineralization potential or mineralizable carbon (Min C)

- Mineralizable carbon (or soil respiration) is an indicator of microbial activity.
- Soil organisms are live organisms, and they respire CO_2 like humans.
- The amount of CO_2 respired by soil organisms indicates the size and activity of the microbial community.

Importance of Min C: linked to decomposition and mineralization rate of organic fertilizer and plant residues.

How it is measured: a soil sample is wetted at optimal moisture level for microbial activity. CO2 emission is measured after 2 days of incubation.

Figure 1. Jar with wetted soil incubated for 48 hours.

- LICOR measures CO_2 (ppm) -> Math -> mg C/kg soil/day.

What impacts Min C:

- Soil texture.
- Irrigation (moisture).
- Amount of carbon at sampling.
- Sampling depth.

Table 1. Min C ranges for different crops and soils.

Apple orchard, compost, tree row	Apple orchard, row, 0-6 inch depth	Vegetable, Clayey soil, 0-4 inch depth	Vineyard, very sandy soil, 0-6 inch depth
118-449	30-71	5-17	1-6

3. Aggregate stability

- Soil aggregation describes how well soil particles (sand, silt, and clay) stay together to form distinct soil units. SOM serves as a glue that keeps soil particles together.

Importance of soil aggregation : water movement, plant root growth, air for plant roots and soil microorganisms.

How it is measured: Wet aggregate stability.

Soil aggregate held together by roots.

https://soilhealth.ucdavis.edu/soil-challenges/structural-degradation

Anna Rodriguez-Paiatsyka
Riley Blemker
Grimm Family Soil Health Lab

MEASURING AGGREGATE STABILITY WITH SLAKES APP

The Slakes app (available for both IOS and Android) was developed by the Soil Health Institute and Sydney University. This free app makes measuring aggregate stability a simple process and requires only a smartphone and a few simple supplies.

1 DRY SOIL & GATHER MATERIALS

1. Download and install the SLAKES smartphone app.
2. Collect a soil sample/s and dry for >24 hrs
3. Select aggregates for test
4. Get 2 petri dishes or other clear shallow containers a white background and a camera stand

Slakes

SOIL HEALTH INSTITUTE

THE UNIVERSITY OF SYDNEY

2 SET UP SMARTPHONE

1. Position the smart-phone face up above dry dish
2. Place 3 soil aggregates in dry dish.
3. Fill 2nd dish with water.

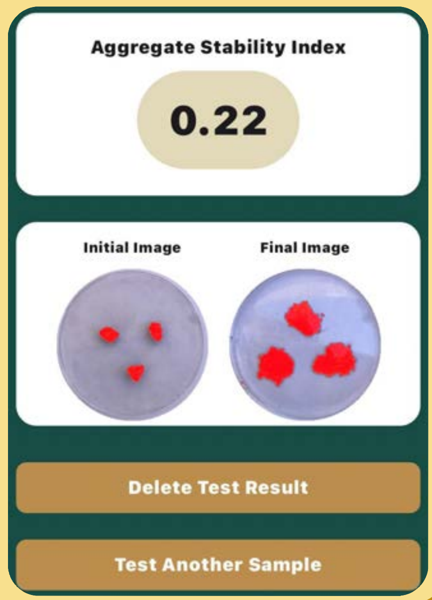
3 TAKE INITIAL AND FINAL PHOTOS

1. Open Slakes App
2. Name sample
3. Center aggregates in view & collect 1st image
4. Adjust slider until **only aggregates** are orange/red
5. Move aggregates into wet dish and center under camera
6. Push collect image and wait 10 min.
7. Repeat step 4

4 GET IMMEDIATE RESULTS!

1. Read result: *a result closer to 1 indicates a better score*
2. Record data
3. Repeat with new sample

**Slakes also works with saved images*



SCORING SOIL HEALTH WITH RATING CURVES

This is a vineyard-focused case study that develops soil health scoring to evaluate how management practices impact soil health across diverse California winegrowing regions.

WHY IT MATTERS

- Soil Health Rating Curves can track the **effectiveness** of **management practices** on **soil health**.
- For regenerative organic certification, these scores provide a way to demonstrate measurable improvement.
- Curves **MUST** be developed for individual production system/region/climate contexts to be relevant, and each curve requires samples from many individual fields/ranches.

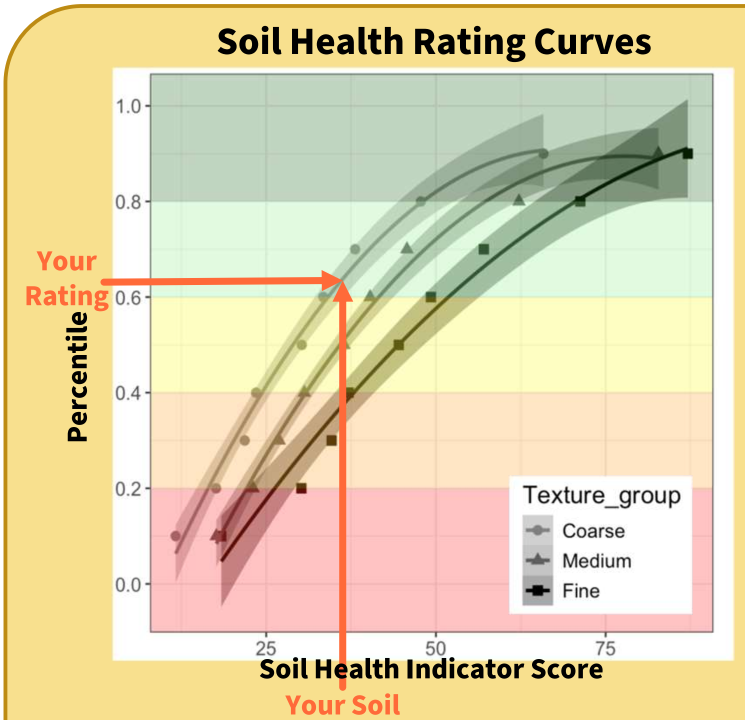


Table 1. Soil health scores for vineyards with organic/regenerative practices. CC = Cover Crop, NT = No Till. Red = 0-20%, orange = 20-40%, yellow = 40-60%, light green = 60-80%, & dark green = 80-100% compared to other blocks.

Block	Practices	SOC (%)	MinC (mg C/kg soil/day)	ASI
1	CC, compost, NT, Grazing	0.89	38.34	0.94
2	CC, compost, Grazing	0.89	33.87	0.74
3	CC	0.72	30.07	0.73
4	CC	0.73	17.48	0.68

VINEYARD RATING CURVES

- These curves were developed for California vineyards accounting for:
  - Regional soil types
  - Management practices
  - Climate conditions.
- Rating curves are based on **mineralizable carbon**, **aggregate stability** and **soil organic carbon** data from coarse, medium, and fine textured soils for a specific production system, region and climate.
- Curves provide a context specific indicator of realized and potential soil health.

FUTURE WORK

- Develop rating curves for other crops
- Link soil heath ratings to environmental, agronomic and economic outcomes.
- Develop action thresholds for soil building practices.

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NOTES

PREPLANT SOIL SAMPLING AT DEPTH

Nitrogen tests from the top 6 inches of soil may not provide an accurate picture of N available in deeper soil profiles. Preplant soil samples from the rooting zone of deeper-rooted crops can provide valuable information for optimizing N fertility.

WHY DEEP SOIL SAMPLING?

- Crops such as broccoli have deep roots reaching 2-3' deep.
- For deep rooted crops, N available at depth can be an incremental source.
- Topsoil N is available early in the season, while subsoil N will be available later, if irrigation is used efficiently to keep N in the root zone.
- Rotations of deep-rooted crops, including cover crops, can help retain N availability in the root zone.
- Deep preplant soil sampling can save on N input costs and support compliance with water board regulations.

Figure 1. Deep soil corer kit. This one uses a gas-powered post pounder to drive 4" cores to 8'. https://www.ams-samplers.com/gas-powered-core-sampling-kit/

Figure 2. 4' soil core collected using a 4" soil core driven by a gas-powered post pounder

DEEP SOIL SAMPLING PROCEDURE

- Use a soil sampler designed for 3'+ core extraction (Fig. 1).
- Collect cores from across the field to create a representative sample.
- Before combining soil samples, split into depth increments to separate topsoil from subsoil (Fig.2).
- Perform onsite N tests or send soil to a diagnostic lab (Fig. 4).

Figure 3. Gas-powered soil corer in action.

QUICK NITRATE TESTS (UCCE PROCEDURE)

1. Order supplies and make solution.
2. Fill tube to the 30 ml level with 0.01 $CaCl_2$ solution.
3. Add soil to tube to 40 ml; shake vigorously and let particles settle.
4. When clear, dip strip into solution, shake off, and wait 60 seconds. Take color reading and use UCCE conversions to estimate soil N content.

https://ucanr.edu/site/irrigation-and-nutrient-management/soil-nitrate-quick-test

Figure 4. Quick nitrate test.

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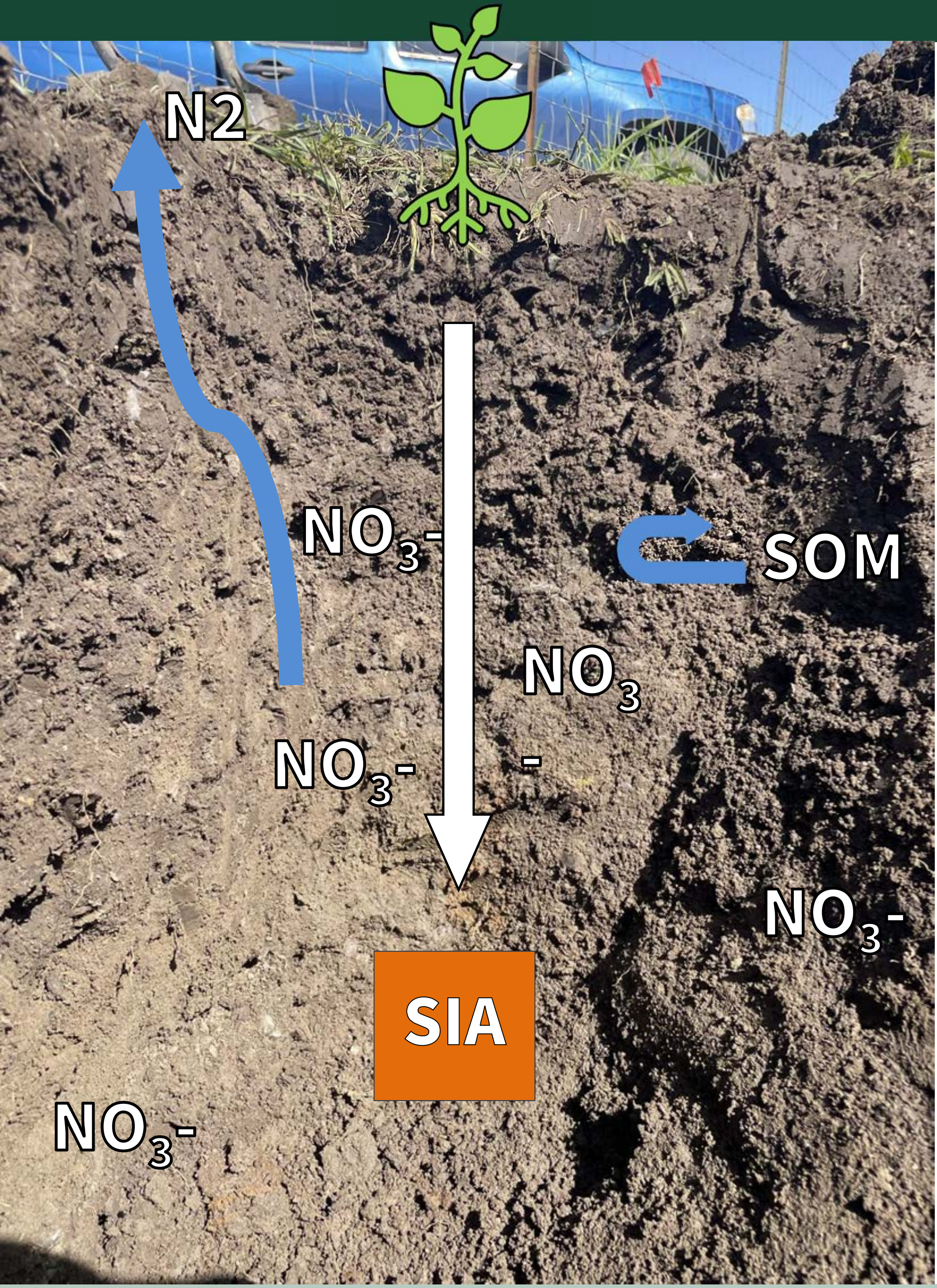
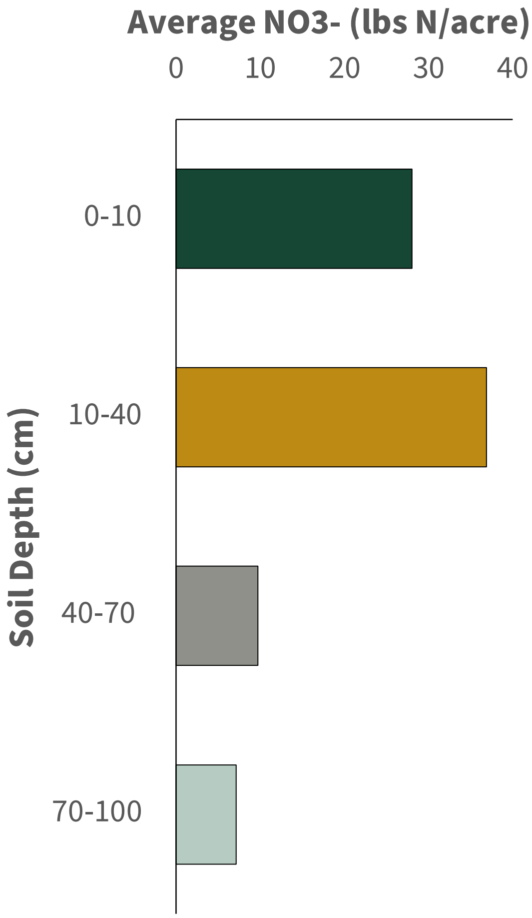
MONITORING N LEACHING RISK

Given increasingly stringent nitrogen (N) regulations, identifying reliable methods for monitoring N leaching risk is critical for regulatory compliance and advancing sustainable agriculture on the Central Coast.





TOOLS:

- Preplant and post harvest soil samples
- Partial N Budgets
  - Applied minus Removed (A – R)
- Self Integrating Accumulators (SIAs)
  - ion-exchange resin-based long term N monitoring tools

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LABORATORY EVALUATION OF ORGANIC NITROGEN AVAILABILITY

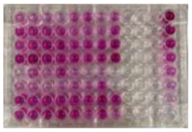
With endless combinations of fertilizer timing, source, rate, and placement in organic fertility management, context specific solutions are paramount. The Grimm Family Soil Health Lab Center uses laboratory incubations to screen combinations of factors that impact nitrogen availability.

FROM FIELD TO FILE: LABORATORY ANALYSIS OF SOIL NITROGEN

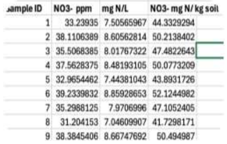
Collect Soil/s

Prepare Soils and Add Materials

Lab Incubations & Extractions



Colorimetric Analysis



Sample ID	NO3- ppm	mg N/L	NO3- mg N/ kg soil
1	33.23935	7.50565967	44.3329294
2	38.1106389	8.60562814	50.2138402
3	35.5068385	8.01767322	47.4822643
4	37.5628375	8.48193105	50.0773209
5	32.9654462	7.44381043	43.8931726
6	39.2339832	8.85928653	52.1244982
7	35.2988125	7.9706996	47.1052405
8	31.204153	7.04609907	41.7298171
9	38.3845406	8.66747692	50.494987

Nitrogen Calculations

LABORATORY SOIL INCUBATIONS TO DIAGNOSE PROBLEMS AND SCREEN SOLUTIONS

Soil Texture & Minerology

Fertilizer application frequency & timing

Fertilizer Source Material

Soil Temperature & Moisture

YOUR QUESTION NEXT??

IN ORGANIC MANAGEMENT

- N availability is harder to predict in organic compared to conventional management
- Mineralization models offer helpful frameworks, but organic N management needs site-specific solutions

PREVIOUS & ONGOING INCUBATIONS

- Soil Fertility & Minerology (2022)
- Fertilizer Source Material & Temperature (2023)
- Fertilizer Pellet Density (2024)
- Fertilizer Application Rate & Timing (2025)
- Combining Liquid & Solid Fertilizers (2025)

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NOTES

LETTUCE FUSARIUM WILT MANAGEMENT

Lettuce is one of the most valuable crops in California worth ~ $4 billion. Production is increasingly threatened by Fusarium wilt, a soilborne fungal disease. Understanding the pathogen life history and management tools available are the first steps in developing a plan for this disease.

THE DISEASE: FUSARIUM WILT

- Fusarium wilt is caused by the soilborne fungus *Fusarium oxysporum* f. sp. *lactucae*.
- New genetic variants can overcome resistant lettuce cultivars.
- Disease favored by hot weather.
- Infestations may cause total yield loss.

Figure 1. (L) Fusarium oxysporum culture, (M) Lettuce plant with disease symptoms, (R) Heavily infested field

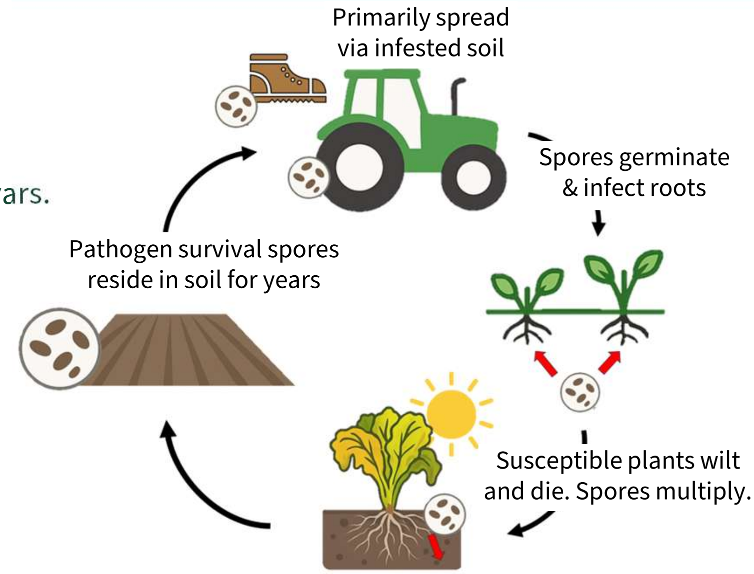

Figure 2. Fusarium Wilt Disease Cycle

MANAGEMENT

Prevention and soil health are key in organic systems:

- **Crop rotation** with non-hosts slows pathogen buildup.
- **Resistant cultivars** can remain healthy even in infested soils.
- **Sanitation** – cleaning field equipment between fields prevents the spread.
- **Biologicals and soil amendments** may suppress Fusarium through increased microbial diversity. Extensive testing is necessary to optimize their use for sustainable disease management.

Figure 3. Cultivar resistance in infested central coast soils.

FUTURE WORK

- Evaluate more biological products and identify optimal conditions for their success.
- Develop practical sanitation methods for preventing the spread of the pathogen.
- Test new resistant cultivars against emerging variants of the pathogen.

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COMMON AUGMENTATIVE BIOCONTROL AGENTS

The following five species of biocontrol agents are commonly available and valuable in a variety of annual and perennial production systems.

Predatory Mites (Neoseilulus & Amblyseius spp.)

Phytoseiid mites live in crop canopies, where they hunt a range of pests—spider mites, thrips, whiteflies, and insect eggs. Specialists like *Phytoseiulus persimilis focus on* spider mites while generalists like *Amblyseius swirskii* and *Neoseiulus cucumeris* attack multiple pests surviving on pollen when prey are scarce.

Figure 1. (R) *P. persimilis* feeding on two spotted spider mite and (L) typical release material for predatory mites.

Figure 2. (R) Green lacewing larva and adult and (L) Lacewing pupae release card.

Green Lacewings (Chrysoperla rufilabris)

Green lacewings are generalist predators whose larvae feed on aphids, thrips, whiteflies, spider mites, mealybugs, caterpillar eggs, and more. Easy to release as eggs or larvae, they are an excellent management choice for a variety of pests. Adults feed on nectar and pollen

Aphid Midge (Aphidoletes aphidimyza)

Aphidoletes aphidimyza, the aphid midge, is a tiny fly whose larvae are aphid predators. One larva can kill 4–65 aphids per day and feeds on a many aphid species. They are typically released as pupae.

Figure 3. (R) Larval aphid midge feeding on aphid and (L) Adult aphid midge.

Figure 3. (R) Larval and (R) and (L) adult mealy bug destroyer beetle.

Lindorus lophanthae (Mealy Bug Destroyer)

Lindorus lophanthae, are small black-and-orange lady beetles from Australia, that feed on scale insects, mealybugs and insect eggs. Larvae and adults feed on all life stages— eggs, crawlers, nymphs, and adults—consuming hundreds per lifetime.

Trichogramma spp. (Egg Parasitoids)

Trichogramma are tiny egg-parasitoid wasps that attack insect eggs, most commonly of moths and butterflies. Females lay eggs inside insect eggs where larvae consume the host before emerging. Matching the correct species to target pest and habitat is critical for success.

Figure 3. (R) Adult *Trichogramma spp.* parasitizing and (L) parasitized egg release card.

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MAKING THE MOST OF BIOLOGICAL CONTROL

Biological control depends on living organisms. Think of beneficial insects like livestock. They require food, shelter, water and gentle handling to thrive!

RELEASING NATURAL ENEMIES

- **Biocontrol behavior and biology**
  - *How mobile are they?*
  - *What habitat/pests do they prefer?*
- **Release Early**
  - *Biocontrol works best at **low pest densities***
- **Check Quality**
  - *Keep records of shipment quality*
- **Store Carefully and Use ASAP**
  - *Insects/Mites have limited shelf stability*

Optimize Release Strategy

Hand Release

Precision: Low — High

Speed: Slow — Fast

Labor: High — Low

Drone Release

Precision: Low — High

Speed: Slow — Fast

Labor: High — Low

Blower Release

Precision: Low — High

Speed: Slow — Fast

Labor: High — Low

MAXIMIZING BIOCONTROL

1. MAXIMIZE HABITAT

Beneficial Habitat Factors to Consider

Beneficial Habitat: SNAP, DIVERSITY, STABILITY

SNAP: Provides, **S**helter, **N**ectar, **A**lternative Hosts, & **P**ollen.

DIVERSITY: Supports broad habitats in which beneficials and prey can exist.

STABILITY: Consistency over seasons and years.

Build Diversity at Multiple Scales

Hedgerow

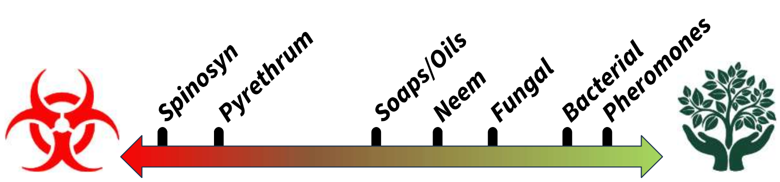
Floral Strip

Interplanting

https://www.wildfarmalliance.org/managing_pests_guide

2. JUDICIOUS INSECTICIDE USE

- **Timing of applications**
  - *Dusk, Dark, and Dawn*
  - *Delay applications after releases*
- **Carefully target applications**
  - *Avoid non-crop diverse habitat*
- **Choose least toxic options**
  - *Avoid contact neurotoxins*
  - *Be mindful of fungicides (e.g., Sulfur, Copper)*



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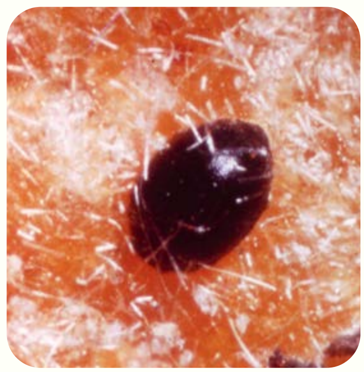







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