STRAWBERRY FIELD DAY 2025

Ensuring the sustainability of the California strawberry industry through research and education that addresses industry needs.

Cal Poly
Strawberry Center

CAL POLY STRAWBERRY CENTER

FIELD DAY 2025

A MESSAGE FROM OUR CENTER DIRECTOR

Gerald Holmes, Ph.D.
Director
gjholmes@calpoly.edu
Office: 805-756-2150

Welcome to the 2025 Strawberry Center Field Day!

We're excited to host you for our ninth consecutive year as we continue our mission to support and strengthen the California strawberry industry. Today, you'll see the latest research and innovations in automation, plant pathology, and entomology—projects focused on solving real-world challenges in the field.

To accommodate our growing attendance, we're hosting sponsors in the parking lot and integrating automation directly into the field stops so that you can see them in action. We hope you leave with valuable insights and practical ideas to take back to your operations!

PROGRAM LEADERS

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AGENDA - STRAWBERRY FIELD DAY

Thursday, July 24, 2025, 7:30 AM - 12:00 PM

7:30 AM: Registration & Networking • 8:20 AM: Welcome • 8:50 AM: Rotation through Stations • 12:00 PM: Lunch

This program is approved by CDPR and CCA for 3 hours of continuing education units.

STOP 1

1. Sponsor showcase, product updates and refreshments (p. 9)

STOP 2

Topic	Speaker
2. Evaluation of Plinazolin® against twospotted spider mite (p. 11) 3. Evaluation of organic miticides against twospotted spider mite and Lewis mite (p. 12) 4. Evaluation of organic and conventional insecticides against aphid species (p. 15) 5. Efficacy of Sefina® against western flower thrips (p. 16)	Dr. Mohammad Amir Aghaee (Entomologist, CPSC)
6. Evaluation of conventional, biological, and natural products for control of Botrytis fruit rot, early season 2025 (pp. 19-22)	Kyle Blauer (Field Research Manager, CPSC)
7. Evaluation of fungicides for strawberry powdery mildew management under greenhouse conditions (p. 27) 8. Evaluation of strawberry host plant resistance to powdery mildew in 21 genotypes under greenhouse conditions (p. 28)	Samantha Simard (Assistant Research Scientist, CPSC)
9. Laser runner cutter (p. 31) 10. Operator aid system (p. 32)	Brendan Holt (Ag Engineer, CSC) Dr. John Lin (Director of Automation, CSC) Alex Herman (CP CPE Student)

STOP 3

Topic	Speaker
11. Evaluating host resistance to Macrophomina root rot (pp. 35-38) and Verticillium wilt in strawberry (pp. 43-46)	Maria Alvarez Arredondo (CP MS Student)
12. Effect of abiotic stresses on Macrophomina root rot development in California strawberry (pp. 51-52)	Marina Gutierrez (CP MS Student)
13. Cal Poly strawberry disease diagnostic service activity - 2025 (p. 57)	Dr. Shashika Hewavitharana (Plant Pathologist, CPSC)
14. Solar powered harvest aid 15. Autonomous bug vacuum	Juan Bravo (Founder, Agrobot)
16. Strawberry harvester	Alex Gutierrez (Founder, L5 Automation, Inc.)

STOP 4

Topic	Speaker
17. Portable equipment sanitizing station for California strawberries (p. 61)	Dr. Peter Livingston (CP BRAE Dept. Head)
18. Bareroot transplanter	Aidan Fischer (Field Engineer, CSC)
19. Heated hole puncher (p. 63)	Tony Sandoval (Founder, Precision Ag)
20. Dry-wash processing of mechanically collected ag film	Theron Smith (President, Flipping Iron) Ben Andros (President, Andros Engineering)

STOP 5

Topic	Speaker
21. Evaluation of UV-C light for control of twospotted spider mite, Lewis mite and *Lygus hesperus* (pp. 67-68)	Colin Koubek (Research Associate, CPSC)
22. Comparison of preventative *N. californicus* releases against a grower standard predatory mite program in fall planted strawberries (pp. 75-76)	Taylor Hibino (CP MS Student)
23. UV-C with bug vacuum	Dr. Adam Stager (Founder, TRIC Robotics)

Note: The presentation locations listed above are accessible to the public for purposes of participating in the meeting. Special accommodations will be made for physically handicapped, vision or hearing-impaired persons upon request (Please contact Center Staff at 805.756.2150).

AGENDA - DÍA DE CAMPO DE LA FRESA

Jueves, 24 de Julio de 2024, 7:30 AM - 12:00 PM

7:30 AM: Inscripción • 8:20 AM: Bienvenida • 8:50 AM: Rotación por presentaciones 12:00 PM: Almuerzo

Este programa fue aprobado por CDPR y CCA para 3 horas de unidades de educación continua.

ESTACIÓN 1

1. Exhibición de patrocinadores, actualizaciones de productos y refrigerios (p. 9)

ESTACIÓN 2

Tema	Presentador
2. Evaluación de Plinazolin® contra la araña de dos manchas (p. 11) 3. Evaluación de miticidas orgánicos contra la araña de dos manchas y el ácaro Lewis (p. 12) 4. Evaluación de insecticidas orgánicos y convencionales contra múltiples especies de áfidos (p. 15) 5. Eficacia de Sefina® contra trips de la flor occidental (p. 16)	Dr. Mohammad Amir Aghaee (Entomólogo, CPSC)
6. Evaluación de productos convencionales, biológicos y naturales para el control del moho gris por Botrytis en fruto, temporada temprana 2025 (pp. 19-22)	Kyle Blauer (Gerente de Investigación de Campo, CPSC)
7. Evaluación de fungicidas para el manejo del mildiu polvoriento en fresa bajo condiciones de invernadero (p. 27) 8. Evaluación de resistencia de 21 genotipos de fresa al mildiu polvoriento en invernadero (p. 28)	Samantha Simard (Asociado de Investigación en Patología, CPSC)
9. Cortadora láser para guía de fresa (p. 31) 10. Sistema de asistencia para operadores (p. 32)	Brendan Holt (Ingeniero Agrícola , CSC) Dr. John Lin (Director de Automatización, CSC) Alex Herman (Estudiante CP CPE)

ESTACIÓN 3

Tema	Presentador
11. Evaluación de la resistencia de la planta hospedera a la pudrición de raíz por Macrophomina (pp. 35-38) y la marchitez por Verticillium en fresa (pp. 43-46)	Maria Alvarez Arredondo (Estudiante de Maestría, CP)
12. Efecto de estreses abióticos en el desarrollo de la pudrición de raíz por Macrophomina en fresa de California (pp. 51-52)	Marina Gutierrez (Estudiante de Maestría, CP)
13.Actividad del servicio diagnóstico de enfermedades de fresa de Cal Poly - 2025 (p. 57)	Dr. Shashika Hewavitharana (Fitopatóloga, CPSC)
14. Ayuda de cosecha con energía solar 15. Aspiradora de insectos autónoma	Juan Bravo (Fundador, Agrobot)
16. Cosechadora de fresa	Alex Gutierrez (Fundador, L5 Automation, Inc.)

ESTACIÓN 4

Tema	Presentador
17. Estación portátil de sanitización de equipos para la fresa de California (p. 61)	Dr. Peter Livingston (Jefe del Departamento de BRAE)
18. Trasplantadora de raíz	Aidan Fischer (Ingeniero de Campo, CSC)
19. Perforadora de agujeros calentado (p. 63)	Tony Sandoval (Fundador, Precision Ag)
20. Procesamiento en seco y lavado de película agrícola recolectada mecánicamente	Theron Smith (Presidente, Flipping Iron) Ben Andros (Presidente, Andros Engineering)

ESTACIÓN 5

Tema	Presentador
21. Evaluación de luz UV-C para el control de la araña de dos manchas, el ácaro Lewis y Lygus hesperus (pp. 67-68)	Colin Koubek (Asociado de Investigación en Entomología, CPSC)
22. Comparación de liberaciones preventivas de N. californicus con un programa estándar de ácaros depredadores en fresas plantadas en otoño (pp. 75-76)	Taylor Hibino (Estudiante de Maestría)
23. Luz UV-C con aspiradora de insectos	Dr. Adam Stager (Fundador, TRIC Robotics)

Nota: Las ubicaciones de las presentaciones mencionadas están abiertas al público para participar en la reunión. Se harán acomodaciones especiales para personas con discapacidades físicas, visuales o auditivas si se solicita (por favor contacte al personal del Centro al 805.756.2150)

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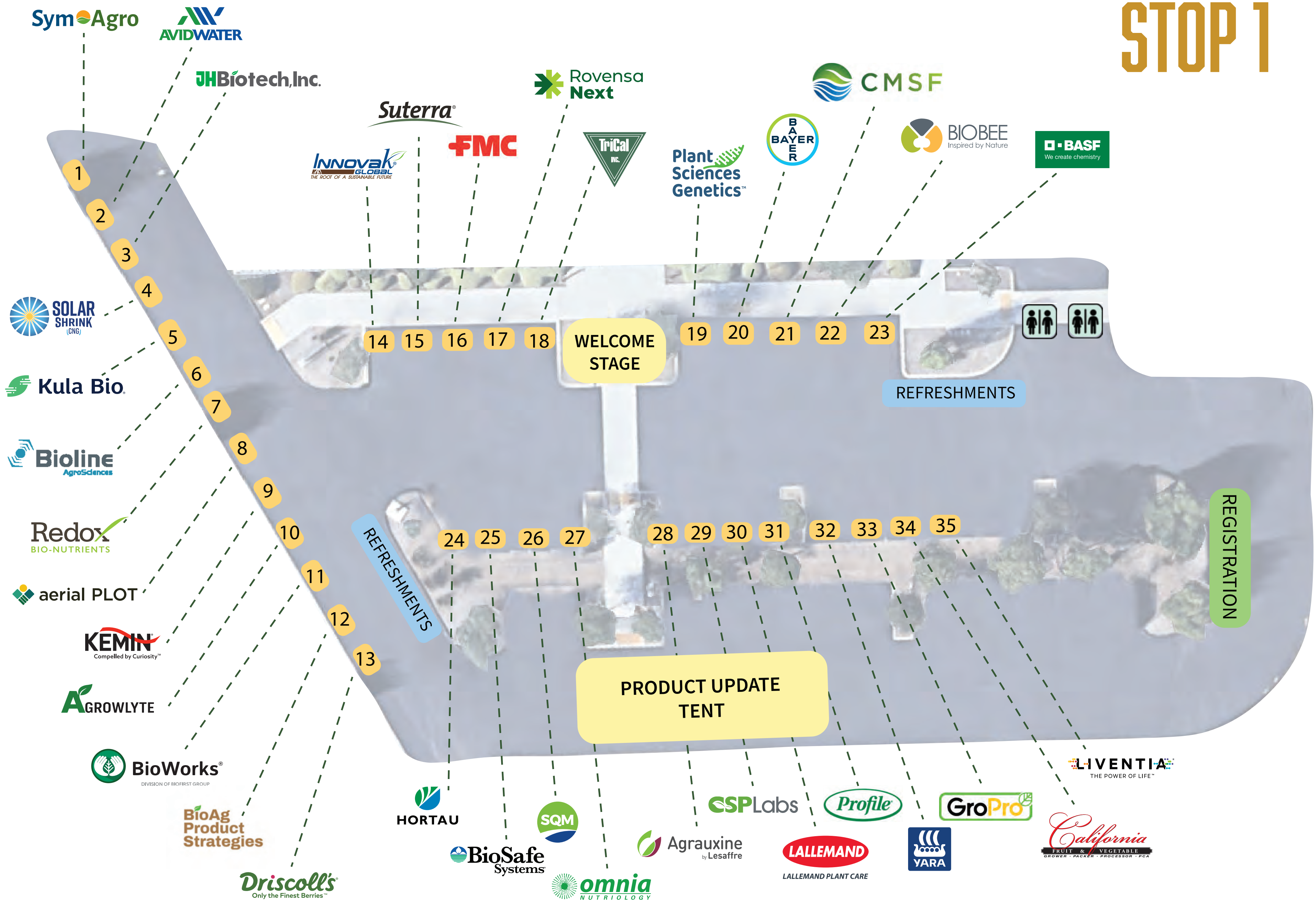

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SPECIAL APPRECIATION

California Strawberry Commission

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Conference & Event Planning

Grimm Family Organic Center

Crops Unit & Ernie Ford

Agricultural Operations & Dan Chesini

Evaluation of Plinazolin® against twospotted spider mite

M. A. Aghaee and C. T. Koubek

The efficacy of Plinazolin® insecticide on two-spotted spider mite was evaluated at the Cal Poly Strawberry Center. The experiment was conducted in Field 35a at Cal Poly (GPS coordinates: N35º18'20"; W120 º40'30") in San Luis Obispo, CA. Bare root strawberry transplants ('Cabrillo') were planted into raised beds on 31 Oct 2024. Beds were covered with 1.1 Mil black TIF (totally impermeable film) polyethylene mulch (TriCal Inc., Hollister, CA). The experimental area consisted of five beds, 120 ft long. Each strawberry bed was 64 in. center to center, with four rows of plants spaced 12 in. between rows and 15.5 in. between plants within a row. Plants were irrigated and fertilized via three lines of drip tape per bed. The plot was 10 ft long, replicated four times and arranged in a Randomized Complete Block (RCB). Treatments were applied using a backpack sprayer calibrated to deliver 150 gal/A using compressed CO_2 at 60 psi. The sprayer was equipped with a custom 48-in. handheld boom. The boom had five 14-in. dropdown tubes and eight nozzles (ALBUZ ATR 80 red hollow cone, Kisco Sales, Santa Maria, California). The outer two dropdown tubes contained a single nozzle angled inward at 45 degrees and the three inner tubes contained two nozzles, with each nozzle at opposing 45-degree angles. Dyne-Amic® was added at a rate of 18 fl oz/A to Plinazolin® at 2.1 and 3.1 fl oz/A and grower standard treatments, which consisted of a rotation of Oberon® at 3.5 fl oz/A followed by Enervate® at 16 fl oz/A. Applications were made on 25 Mar and 2 Apr. Ten mid-tier leaflets were collected per plot two days before treatment (Pre-treat), 3 days after treatment (DAT1), and 7 DAT1, 3 DAT2, 7 DAT2, 14 DAT2, and 21 DAT2. Leaflets were placed in paper bags and transported to the lab. All mites were counted under a dissecting microscope within two days of sampling. Total mite data was analyzed with analysis of variance (ANOVA) and generalized linear mixed model (Proc Glimmix) following a negative binomial distribution in SAS version 9.4 (SAS Institute Inc., Cary, NC). Means were separated according to Tukey's HSD. Data was analyzed for each time point because repeated measures analysis found that the interaction between sample date and treatment was significant ($P<0.001$).

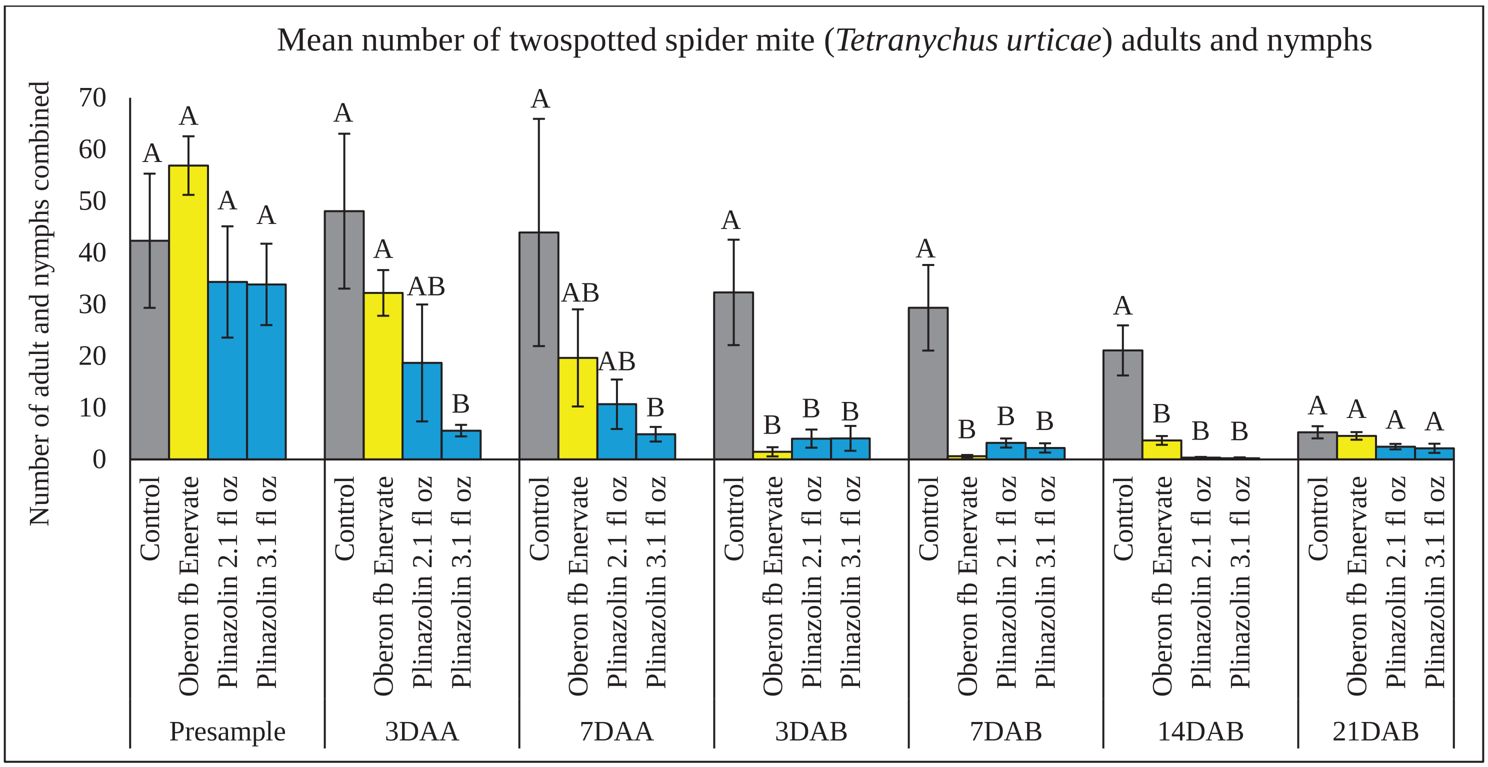

Figure 1: Twospotted spider mite (*Tetranychus urticae*) nymph and adult combined counts at the following sample times: presample, 3 and 7 days after first spray (DAA), 3, 7, 14, and 21 days after second spray (DAB). Oberon 2 SC was sprayed at 3.5 fl oz/A followed by Enervate 4 SC at 16 fl oz/A. Plinazolin was sprayed at 2.1 and 3.1 fl oz/A. Dyne-Amic was mixed with all products at a 1% v/v. Products were sprayed using a volume of 150 GPA. Error bars represent standard error of the mean. Means that do not share the same letter are significantly different (α= 0.05).

Evaluation of organic miticides against twospotted spider mite and Lewis mite

M. A. Aghaee and C. T. Koubek

Spray dates	Lewis: 21 Mar, 28 Mar; TSSM: 3 Apr, 12 Apr
Sampling dates	Lewis: 21 Mar, 24 Mar, 28 Mar, 1 Apr, 4 Apr; TSSM: 3 Apr, 7 Apr, 11 Apr, 14 Apr, 18 Apr
Backpack sprayer specs	8 hollow cone Teejet nozzles calibrated to deliver 150 GPA at 60 psi
Trial design	Randomized complete block; replicated 4 times; 4 × 10 feet plot area
Location	Lewis: Talley Farms Arroyo Grande, CA; TSSM: Cal Poly Strawberry Center Field 35a
Cultivar	Lewis: Monterey; TSSM: Cabrillo
Data collection	10 leaflets collected in paper bags and counted within 4 days of collection

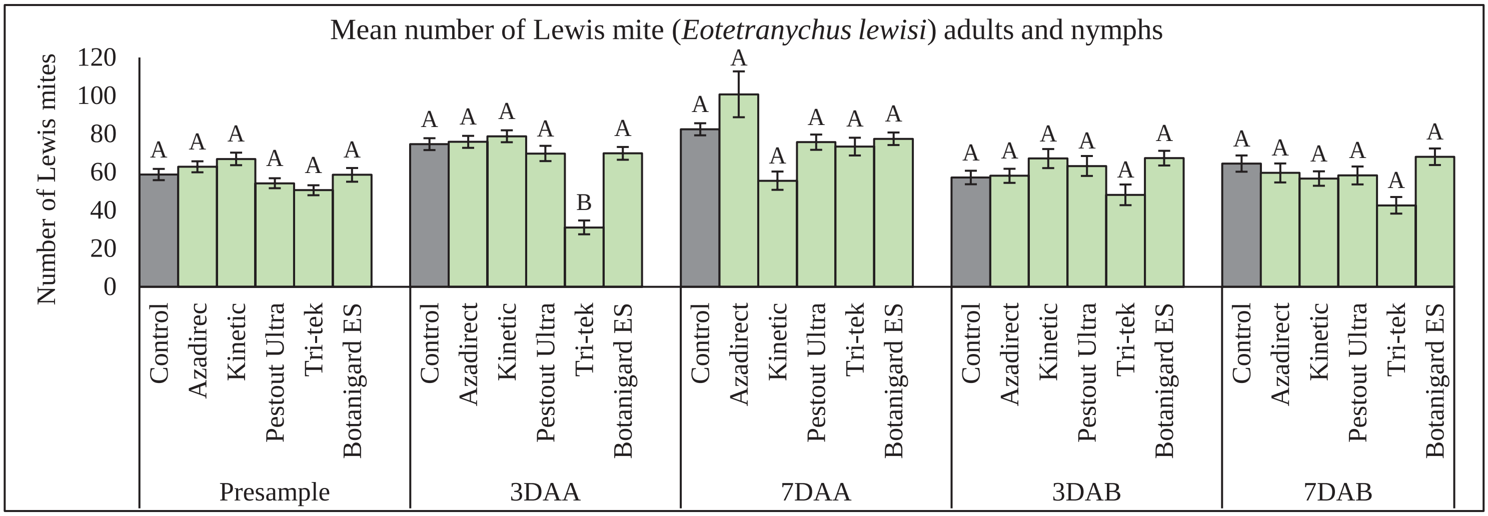

Figure 1. *Eotetranychus* nymph and adult combined counts at the following sample times: presample, 3 and 7 days after first spray (DAA) and 3 and 7 days after second spray (DAB). All products were sprayed at the following rates: Azadirect 32 fl oz/A, Kinetic 18 fl oz/A, PestOut Ultra 192 fl oz/A, Tri-tek 384 fl oz/A, and Botanigard ES 48 fl oz/A. MixWell was added to all treatments and buffered to pH to 5.5. Data was analyzed with an ANOVA and Tukey means separation with a negative binomial distribution using Proc Glimmix in SAS 9.4®. Error bars represent standard error of the mean. Means that do not share the same letter are significantly different (α= 0.05).

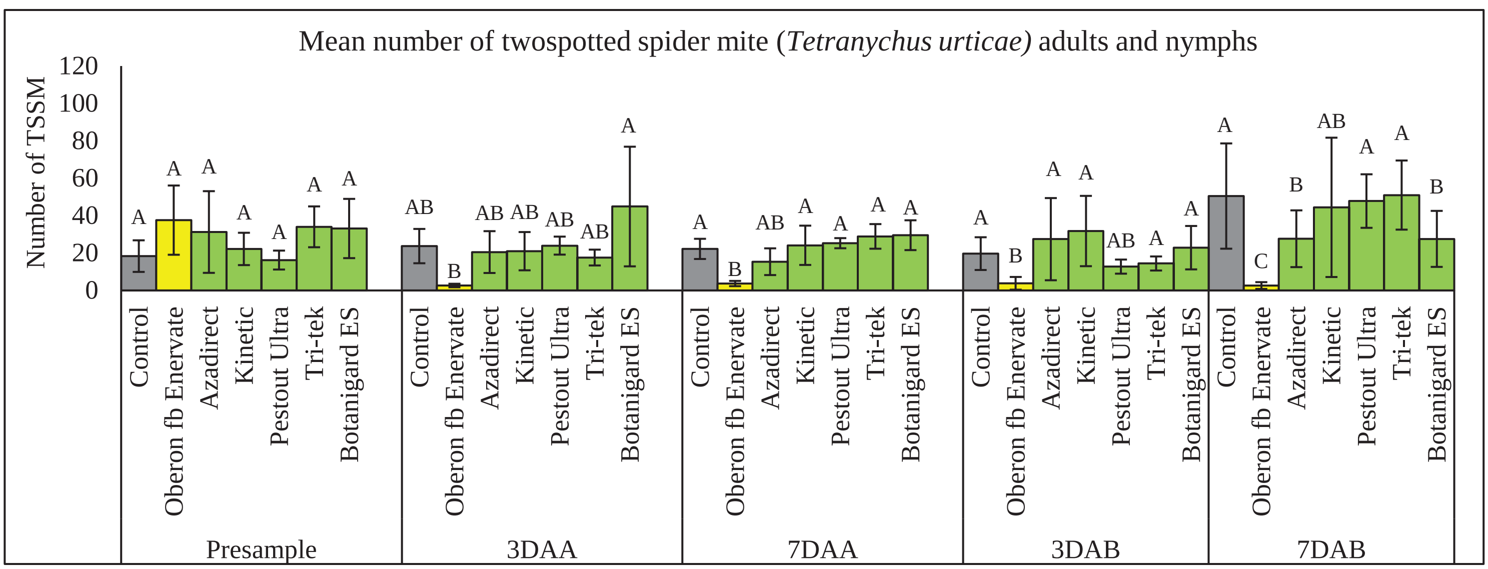

Figure 2. *Tetranychus urticae* nymph and adult combined counts at the following sample times: presample, 3 and 7 days after first spray (DAA) and 3 and 7 days after second spray (DAB). The grower standard rotation Oberon 2SC was sprayed at 3.5 fl oz/ac followed by Enervate 4SC at 16 fl oz per acre. All products were sprayed at the following rates: Azadirect 32 fl oz/A, Kinetic 18 fl oz/A, PestOut Ultra 192 fl oz/A, Tri-tek 384 fl oz/A, and Botanigard ES 48 fl oz/A. Dyne-Amic was tank mixed with the grower standard at a 1% v/v at 150 GPA. MixWell was added to all treatments and buffered to pH to 5.5. Data was analyzed with an ANOVA and Tukey means separation using Proc Glimmix in SAS 9.4® with negative binomial. Data from 7DAB was analyzed using a Poisson distribution due to lack of convergence. Error bars represent standard error of the mean. Means that do not share the same letter are significantly different (α= 0.05).

Evaluation of select organic and conventional insecticides against multiple aphid species in strawberry

M. A. A. Aghaee and C. T. Koubek

The efficacy of five organic and conventional insecticides on four aphid species (*Myzus persicae*, *Aphis gossypii*, *Macrosiphum euphorbiae*, and *Chaetosiphon fragaefolli*) was evaluated at the Cal Poly Strawberry Center. The experiment was conducted at Field 35a at Cal Poly (GPS coordinates: N35º18'20"; W120º40'30'" in San Luis Obispo, CA. Bare root strawberry transplants ('Cabrillo') were planted into raised beds on 31 Oct 2024. Beds were covered with 1.1 mil black TIF (totally impermeable film) polyethylene mulch (TriCal Inc., Hollister, CA). The experimental area consisted of 5 beds, 120 ft long. Each strawberry bed was 64 in. center to center, with 4 rows of plants spaced 12 in. between rows and 15.5 in. between plants within a row. Plants were irrigated and fertilized via 3 lines of drip tape per bed. The plot size was a 10 ft long section of bed, replicated 4 times and arranged in a randomized complete block (RCB). Treatments were applied using a backpack sprayer calibrated to deliver 150 gal/A using compressed CO_2 at 60 psi. The sprayer was equipped with a custom 48-in. handheld boom. The boom had five 14-in. dropdown tubes and 8 nozzles (ALBUZ ATR 80 red hollow cone, Kisco Sales, Santa Maria, CA). The outer 2 dropdown tubes had a single nozzle angled inward at 45 degrees and the 3 inner tubes had 2 nozzles, with each nozzle facing forward/backward at opposing 45-degree angles. The treatments were sprayed at the following rates Botanigard ES 48 fl oz/A, PestOut Ultra 192 fl oz/A, Tri-tek 384 fl oz/A, Sefina 14 fl oz/A, and Beleaf 50SG 2.8 oz/A. Broadspred 18 fl oz/A was tank mixed with Beleaf and Sefina. Water for each spray was buffered to a pH of 5.5 using MixWell. Applications were made on 21 and 27 Feb. A pre-sample of 10 mid-tier leaflets was taken the day prior to the first application. Ten mid-tier leaflets were collected per plot 2 days before treatment (Pre-treat), 5 days after first treatment (DAT1), and 8 days after second treatment (DAT2). Leaflets were placed in paper bags and transported to the lab. All aphids were counted under a dissecting microscope within 2 days of sampling. Due to relatively low numbers of each species, nymphs and adults of all species were combined for analysis. Total aphid data were analyzed with ANOVA and Generalized Linear Mixed Model (PROC GLIMMIX) following a normal distribution using JMP version 18.0 (SAS Institute Inc., Cary, NC). Means were separated according to Tukey's HSD.

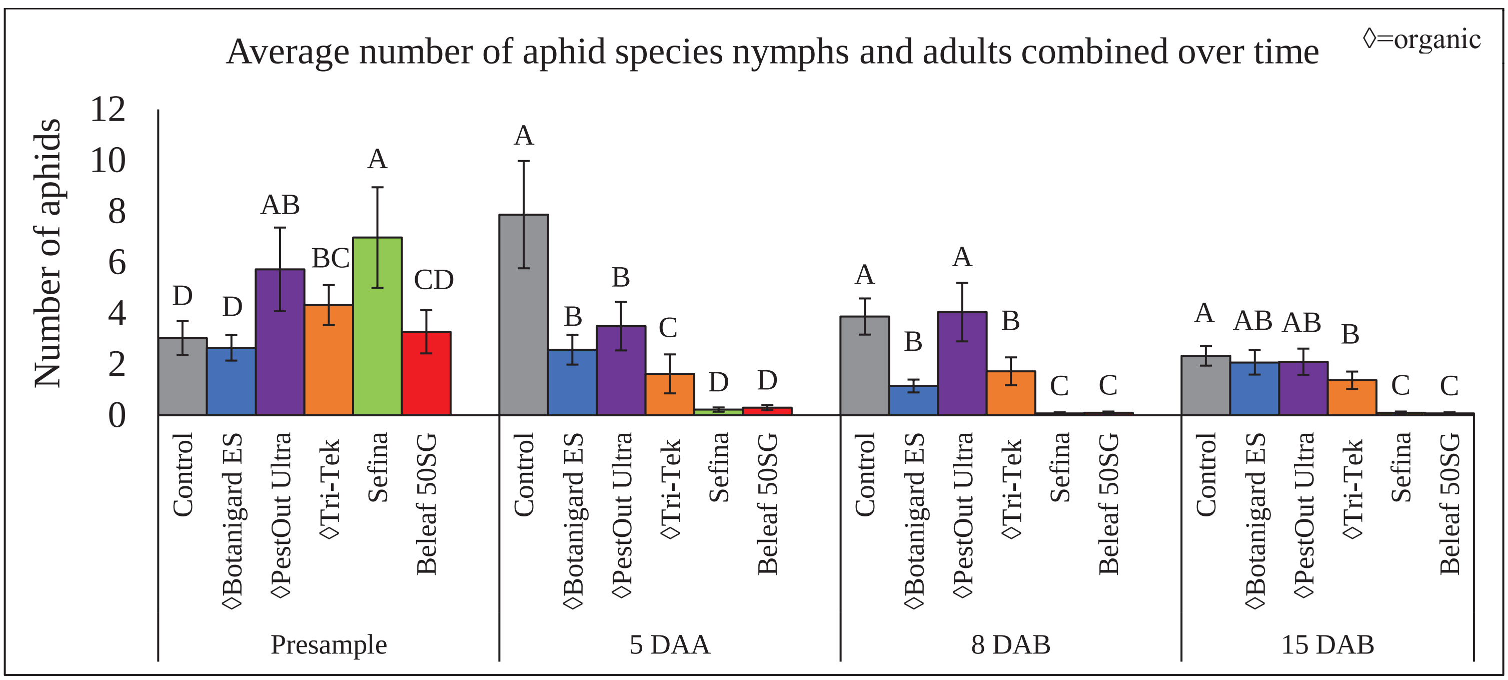

Figure 1. Comparison of total nymph and adult aphids from four aphid species (*Myzus persicae*, *Aphis gossypii*, *Macrosiphum euphorbiae*, and *Chaetosiphon fragaefolli*) from the presample, 5 days after first treatment (DAA), 8 and 15 days after second treatment (DAB). Spray volume was 150 GPA. Error bars represent standard error of the mean. Means that do not share the same letter are significantly different (α= 0.05).

Efficacy of Sefina® against western flower thrips

M. A. Aghaee and C. T. Koubek

Spray dates	19 Apr, 2 May and 27 May
Sampling dates	18 Apr, 22 Apr, 28 Apr, 2 May, 5 May, 9 May, 16 May, 23 May, 30 May, 3 Jun, and 10 Jun
Backpack sprayer specs	8 hollow cone Teejet nozzles calibrated to deliver 150 GPA at 60 psi
Trial design	Randomized complete block; replicated 4 times; 4 × 15 feet plot area
Location	Cal Poly Strawberry Center Field 35a
Cultivar	Cabrillo
Data Collection	10 flowers with full petals dropped into 50 ml falcon tubes containing 15 ml ethanol (95%)

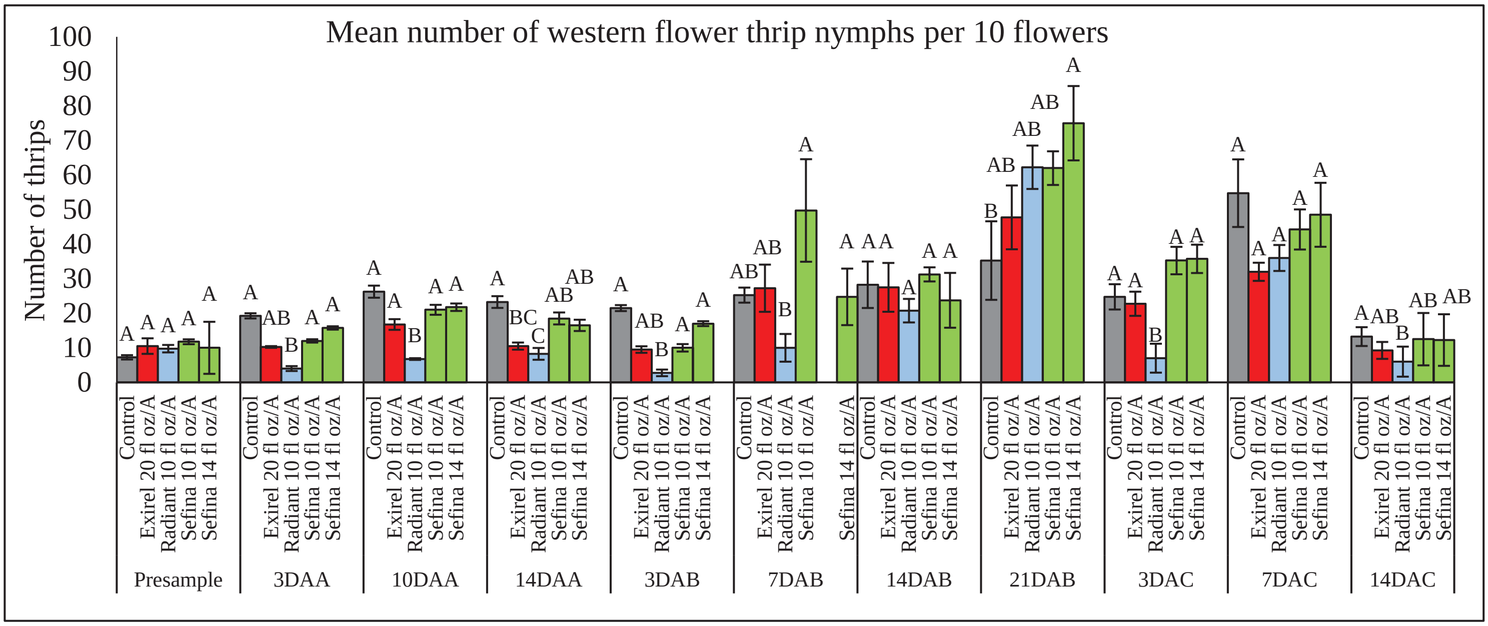

Figure 1. Comparing western flower thrips nymphs from across multiple days after treatment. Dyne-Amic® was added at a rate of 18 fl oz/A to all products. Data was analyzed using ANOVA and Tukey means separation using Proc Glimmix with a negative binomial distribution in SAS 9.4. Error bars represent standard error of the mean. Means that do not share the same letter are significantly different (α= 0.05).

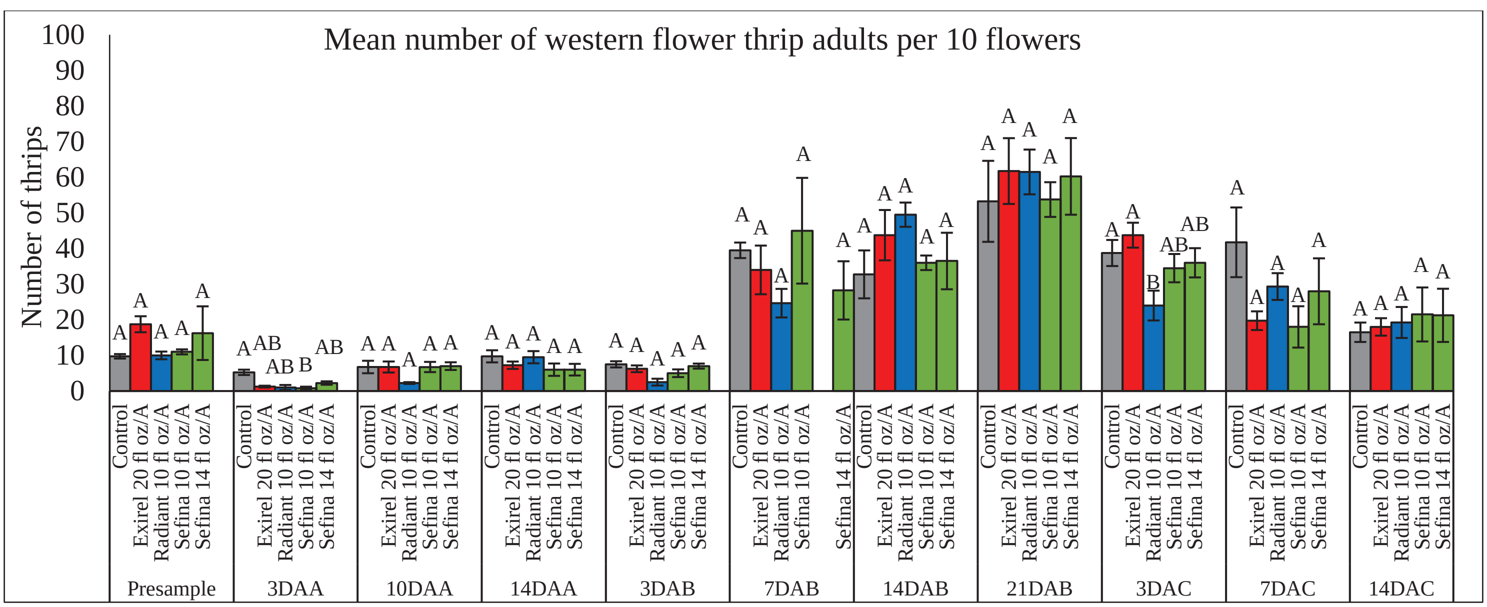

Figure 2. Comparing western flower thrips adults across multiple time points. Dyne-Amic® was added at a rate of 18 fl oz/A to all products. Data was subject to ANOVA and Tukey means separation using Proc Glimmix with a negative binomial distribution in SAS 9.4. Spray rates were the following: Sefina 14 and 10 fl oz/A, Exirel 20 fl oz/A, and Radiant 10 fl oz/A. Error bars represent standard error of the mean. Means that do not share the same letter are significantly different (α= 0.05).


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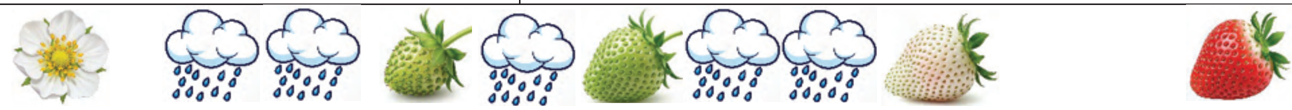
Evaluation of conventional, biological, and natural products for control of Botrytis fruit rot, early season 2025

K. A. Blauer, S. Z. Simard, and G. J. Holmes

Planting date	31 October 2024
Number of rainfall events; total rain	5 rainfall events; 2.2 inches total rainfall
Backpack sprayer specs	8 hollow cone nozzles calibrated to deliver 150 gal at 60 psi
Application dates; (spray interval days)	10, 18, 28 Mar, 4, 10 Apr ; (8, 10, 7, 6)
Trial design	Randomized complete block; replicated 4 times; 60 plants/plot
Location	Cal Poly field 35b
Cultivar	Fronteras



Start	**App A**			**App B**		**App C**			**App D**	**App E**	**Harvest**
9	10	12-14	17	18	26	28	30-31	2	4	10	11
March								**April**			

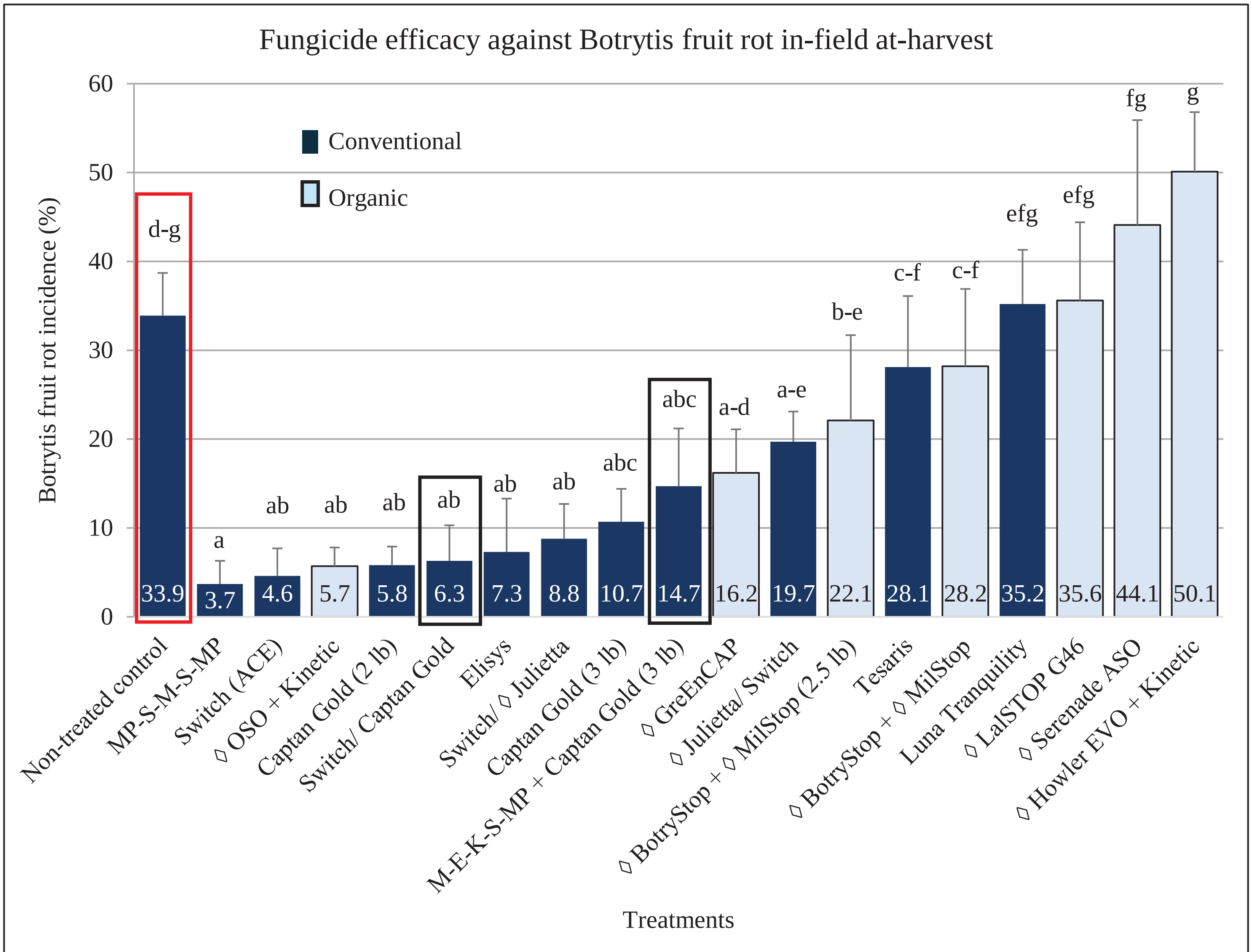


Figure 1. ▭ = Non-treated control, ▭= Strawberry Center standards, / =Weekly rotation; + =Tank mix; MP=Miravis Prime S=Switch M=Merivon E=Elevate, K=Ken a ◊= biological or natural product. Kinetic was applied at 4 fl oz/A and all other products were applied at max label rate unless otherwise stated. Sorted by level of Botrytis fruit rot incidence. Data was subject to ANOVA and Fishers LSD mean separation. Error bars represent standard error of the mean. Means that do not share the same letter are significantly different (α=0.05).

STRAWBERRY: FUNGICIDE EFFICACY - CONVENTIONAL

Fungicide[1]	Resistance risk (FRAC)[2]	Gray mold	Powdery mildew	Anthrac - nose	Rhizopus/ Mucor rot	Phytophthora diseases[3]	Common leaf spot	Angular leaf spot
Miravis Prime	medium (7/12)	5	5	3	NL (4)	NL	NL	NL
Merivon	medium (7/11)	5^{R}	5^{R}	ND	NL (4)	NL	0	NL
Kenja	high (7)	5	3	ND	NL (2)	NL	ND	NL
Pristine	medium (7/11)	5^{R}	4^{R}	ND	NL	NL	0	NL
Switch[5]	medium (9/12)	5^{R}	2	4	4	NL	NL	NL
Cannonball[5]	high (12)	5^{R}	NL	4	4	NL	NL	NL
Elevate	high (17)	5^{RR}	NL (0)	NL (0)	NL	NL	NL (0)	NL
Inspire Super	medium (3/9)	5^{R}	5	4	5	NL	ND	NL
Protocol	medium (1/3)	4^{R}	4^{R}	3	NL	NL	4	NL
Captevate**	medium (M4/17)	4^{R}	NL	4	NL	NL	NL	NL
Rovral, Iprodione, Nevado, etc.[7]	high (2)	4^{R}	NL (0)	0	NL	NL	0	NL
Thiram	low (M3)	4	NL (0)	3	NL	NL	0	NL
Captan	low (M4)	4	NL (0)	NL (2)	NL (2)	NL	NL (0)	NL
PH-D, Oso	high (19)	3	4	3	NL	NL	NL	NL
Regev	medium (3/BM 01)	3	5	4	5	NL	ND	NL
Scala	high (9)	3	NL (2)	NL	NL	NL	NL	NL
Fontelis	high (7)	2^{R}	4^{R}	NL	NL	NL	NL	NL
Luna Sensation	medium (7/11)	1^{R}	5	3^{R}	2	NL	ND	NL
Luna Privilege **(foliar)/ Velum One (soil)[4]	high (7)	1/NL	5/3	NL	ND	ND	ND	NL
Luna Tranquility	medium (7/9)	1	5	NL	1	NL	ND	NL
Tesaris	high (7)	1	ND	NL	NL	NL	NL	NL
Topsin-M, T-Methyl, Incognito, etc.[6]	high (1)	1^{RR}	4	0	NL	NL	NL (3)	NL
Intuity	high (11)	1^{RR}	2^{R}	NL	NL	NL	NL (0)	NL
Quadris, Abound, Acadia LFC, Arius, etc.	high (11)	1^{RR}	3^{R}	4^{R}	NL (2)	NL	NL	NL
Evito*	high (11)	1^{RR}	3^{R}	2^{R}	NL	NL	NL	NL
Flint Extra	high (11)	1^{RR}	4^{R}	2^{R}	NL	NL	NL	NL
Cabrio	high (11)	1^{RR}	2^{R}	3^{R}	NL (2)	NL	0	NL
Quilt Xcel, Avaris 2XS, etc.	medium (3/11)	NL $(3)^{R}$	5^{R}	0^{R}	NL (0)	NL	NL	NL
Quintec	high (13)	NL (3)	5^{R}	NL (4^{R})	NL (0)	NL	NL (0)	NL
Quadris Top, Acadia ESQ*[,8], etc.	medium (3/11)	NL $(2)^{R}$	5^{R}	4^{R}	NL	NL	3	NL
Bumper, Tilt, etc.	high (3)	NL (0)	5^{R}	NL (3)	NL (0)	NL	4	NL
Mettle, Perissim, etc.	high (3)	NL	5^{R}	NL	NL	NL	ND	NL
Procure	high (3)	NL	5^{R}	NL (2)	NL	NL	NL (0)	NL
Rally	high (3)	NL (0)	5^{R}	NL (3)	NL	NL	4	NL
Rhyme[9]	high (3)	NL (0)	5^{R}	NL	NL	NL	NL	NL
Torino	high (U6)	NL	5^{R}	NL	NL	NL	NL	NL
Gatten*	high (U13)	NL	5	NL	NL	NL	NL	NL
Sulfur	low (M2)	NL	4	NL	NL	NL	NL	NL
Cevya	high (3)	NL	3^{R}	NL	NL	NL	NL	NL
Zivion S[5]	low (48)	NL (0)	NL	4	NL	NL	NL	NL
Fungi-Phite, K-Phite, ProPhyt, etc.	high (P07,33)	NL	0	0	NL	4	NL	NL (2)
Orondis Gold	high (4/49)	NL	NL	NL	NL	4	NL	NL
Aliette[3,9], Legion**	high (P07,33)	NL	NL	NL	NL	4	NL	NL
Ridomil Gold SL, Ultra Flourish, etc.[9]	high (4)	NL	NL	NL	NL	4	NL	NL
Copper, etc.[10]	low (M1)	0	0	0	0	0	0	4[10]
Actigard	high (P01)	NL	NL	NL	NL	NL	NL	3

Rating: 5 = excellent and consistent, 4 = good and reliable, 3 = moderate and variable, 2 = limited and/or erratic, 1 = minimal and often ineffective, 0 = ineffective, NL = not on label, ND = no data. ^{R} =Resistance in this pathogen has been documented but performance is not fully compromised. ^{RR} =High level of resistance documented in this pathogen and performance is significantly compromised.

Footnotes continued on next page…

* Registration pending in California.
** Not registered, label withdrawn or inactive in California.

[1] To reduce the risk of resistance development, start fungicide treatment with a multi-site mode of action; rotate or mix fungicides with different mode of action FRAC numbers for subsequent applications, use labeled rates (preferably the upper range), and limit the total number of applications per season.'
[2] Code numbers are assigned by the Fungicide Resistance Action Committee (FRAC) according to different modes of actions (for more information, see http://www.frac.info/). To minimize resistance, make no more than one application of a fungicide with a "high" or "medium" resistance risk of the same FRAC code before rotating to a fungicide with a different FRAC code. Resistance risk determined based on single-site = high risk; premix = medium risk; multi-site = low risk.
[3] Efficacy rating for soil applied control of Phytophthora crown rot and leather rot of fruit.
[4] Velum One is a fluopyram formulation for chemigation. Soil applications are designed for nematode management but may also suppress powdery mildew.
[5] Apply as a transplant dip after digging/harvesting and prior to cold storage (nursery use) or prior to planting (field use).
[6] Generic products may not be all listed and "etc." indicates that other products may be available that have the same active ingredient.
[7] Apply as preplant dip or foliar spray; do not apply after first fruiting flower.
[8] Not for use in nurseries, on nursery transplants, or greenhouses (check label for details).
[9] Foliar applications provide systemic treatment.
[10] Apply at low rates since phytotoxicity (reddening of older leaves, slow growth and yield reduction) has been documented with repeated sprays.

STRAWBERRY - FUNGICIDE EFFICACY - BIOCONTROLS AND NATURAL PRODUCTS

Fungicide trade names	Active ingredient	Resistance risk (FRAC)[1]	Gray mold	Powdery mildew	Anthrac - nose	Rhizopus/ Mucor rot	Phytophthora diseases[2]	Common leaf spot	Angular leaf spot
Oso	Polyoxin D zinc salt	medium (19)	3	4	3	NL	NL	ND	NL
Microthiol Disperss, etc.[3]	sulfur	low/ (M2)	NL	4	NL	NL	NL	NL	NL
All Phase	*potassium sorbate; sodium lauryl sulfate*	low (NC)	ND	4	ND	NL	NL	ND	ND
Serenade ASO, etc.[3]	*Bacillus subtilis* QST 713	low (BM 02)	0	3	0	NL (0)	NL (0)	NL (0)	NL
Sonata	*Bacillus pumilis* QST 2808	low (BM 02)	NL (0)	3	0	NL	NL	NL	NL
Timorex Act	tea tree oil	low (BM 01)	0	3	ND	0	ND	NL	ND
ProBlad Verde, Fracture[3]	Banda de *Lupinus albus* doce	low/(NC)	0	3	ND	ND	NL	ND	NL
Aviv, BACIX, etc.	*Bacillus subtilis* IAB/BS03	low (BM 02)	0	3	ND	NL	ND	ND	NL
Kaligreen, MilStop, etc.	potassium bicarbonate	low (/NC)	0	3	NL	NL	NL	NL	NL
M-Pede, Des-X, etc.[3]	potassium salts of fatty acids	medium (28)	NL	2	NL	NL	NL	NL	NL
Double Nickel	*Bacillus amylo-liquefaciens* D747	low (BM 02)	0	2	0	NL	0	NL	1
Actinovate	*Streptomyces lydicus* WYEC 108	low (BM 02)	0	2	NL	NL	0	NL	1
Serifel	*Bacillus amylo-liquefaciens* MBI 600	low (BM 02)	0	2	0	NL	0	ND	2
Taegro	*Bacillus amylo-liquefaciens* FZB24	low (BM 02)	0	2	0	NL	ND	NL	NL (2)
Theia	*Bacillus subtilis* AFS032321	low (BM 02)	0	2	0	NL	0	NL	ND
Regalia	*Reynoutria sachalinensis* extract	low (P5)	0	2	ND	NL	ND	NL	NL

Table continued on next page…

Fungicide trade names	Active ingredient	Resistance risk (FRAC)[1]	Gray mold	Powdery mildew	Anthrac - nose	Rhizopus/ Mucor rot	Phytophthora diseases[2]	Common leaf spot	Angular leaf spot
Stargus	*Bacillus amylo-liquefaciens* F727	low (BM 02)	0	1	ND	NL	NL (1)	NL (1)	NL (1)
Copper, etc.[4]	Copper	low (M 01)	0	0	0	0	0	0	4[5]
Cinnerate	cinnamon oil	low (BM 01)	0	ND	NL	ND	NL	NL	NL
Lalstop G46	*Clonostachys rosea* J1446	low (BM 02)	0	0	NL	NL	ND	ND	ND
Oxidate, Jet-Ag, etc.	Hydrogen peroxide; peroxyacetic acid	low (NC)	0	0	NL	NL	NL	NL	2
Julietta	*Saccharomyces cerevisiae* LAS02	low (BM 02)	0	NL	NL	NL	NL	NL	NL
Procidic, etc.	citric acid	low (NC)	0	NL	NL	NL	0	NL	NL
Rango	cold pressed neem oil	low (NC)	2	ND	ND	NL	0	0	NL
BotryStop	*Ulocladium oudemansii* U3	low (BM 02)	0	NL	NL	NL	NL	NL	NL
Botector	*Aureobasidium pullulans* DSM 14940; DSM 14941	low (BM 02)	0	NL	ND	NL (1)	NL	NL	NL
Howler	*Pseudomonas chlororaphis* AFS009	low (BM 02)	0	NL (2)	NL	NL	ND	ND	0
Veg'Lys	garlic oil	Unknown/ (NC)	0	NL	0	NL	0	0	ND

Rating: 5 = excellent and consistent, 4 = good and reliable, 3 = moderate and variable, 2 = limited and/or erratic, 1 = minimal and often ineffective, 0 = ineffective, NL = not on label, ND = no data.

[1] Group numbers are assigned by the Fungicide Resistance Action Committee (FRAC) according to different modes of actions (for more information, see http://www.frac.info/).

[2] Efficacy rating for soil applied control of Phytophthora crown rot and leather rot of fruit.

[3] Generic products may not be all listed and "etc." indicates that other products are available that have the same active ingredient.

[4] Apply at low rates since phytotoxicity (reddening of older leaves, slow growth and yield reduction) has been documented with repeated sprays.

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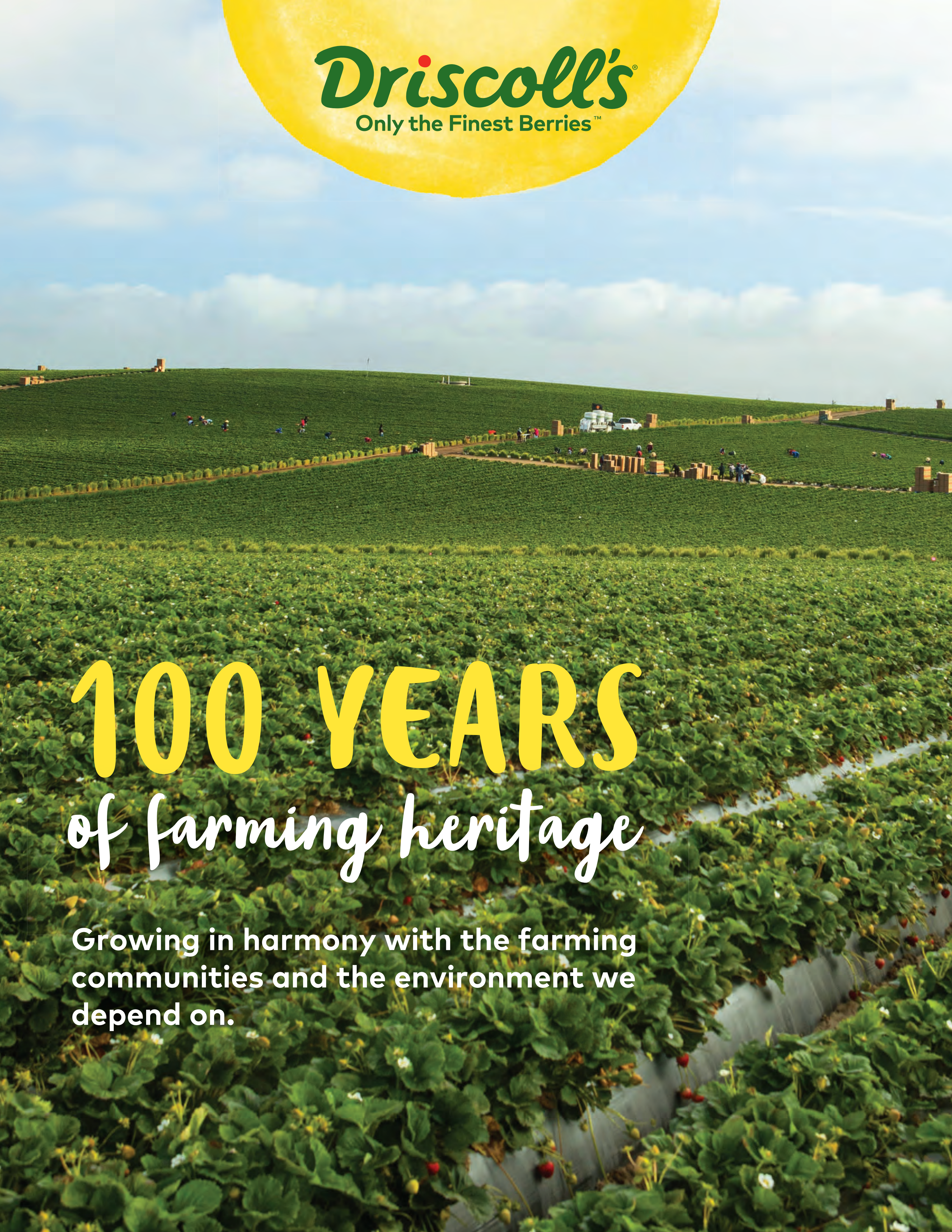

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Effect of biostimulants on yield and plant quality on fall planted strawberries

J. E. Millan Rodriguez and K. A. Blauer

This experiment was conducted on fall-planted 'Monterey' strawberries to evaluate the effect of five biological products applied via drip irrigation and/or foliar application on yield and plant health. The study took place in field 35A at the Cal Poly Strawberry Center, in a clay loam soil in a first-year strawberry planting. Four beds were shaped at 64-inch spacing, covered with black non-TIF plastic mulch and planted with four rows of bare-root transplants on 1 Nov 2024. Each bed, representing a replicate, was divided into six plots, with 66 plants per treatment. Treatments were delivered through three drip irrigation lines (Fig. 1). Foliar treatments were applied using a backpack sprayer. Plants were fertilized following standard growing practices with 5 lb N/acre/week from Jan through Mar, increasing to 10 lb N/acre/week from Apr through Jul. Treatments were applied every three weeks, from 16 Jan to 24 Jul. Applications were made at max label rate. Plant vigor was assessed both visually (on a 1–10 scale) and aerially using NDRE drone imagery (Fig. 2). Fruit (both marketable and unmarketable) were harvested weekly beginning 4 Apr and transitioned to bi-weekly from 23 May to 3 Jun, due to increased fruit volume for a total of 12 harvests.

Figure 1. Manifold and drip chemigation system, picture taken on 16 Jan 2025.

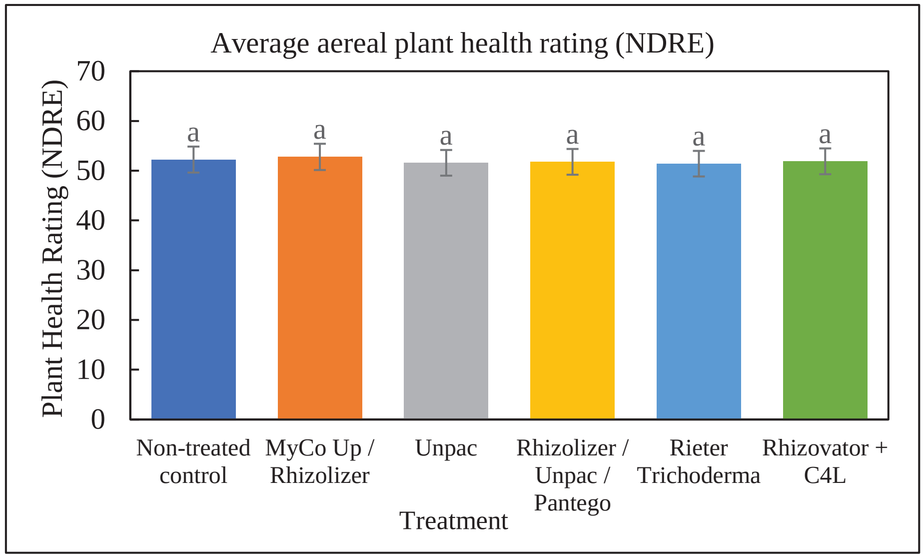

Figure 2. / =Weekly rotation; + =Tank mix. Average NDRE (Normalized Difference Red-Edge; $P = 0.05$) to assess plant quality. Error bars represent standards deviation from mean.

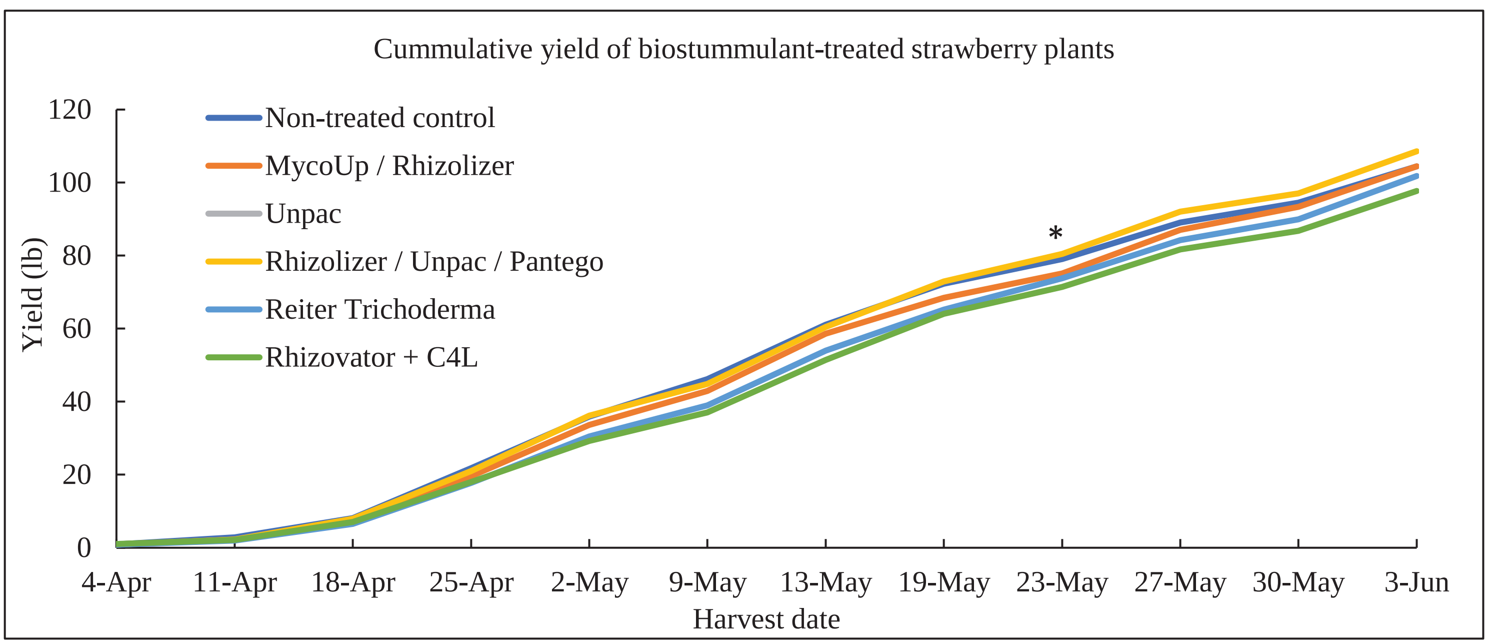

Figure 3. / =Weekly rotation; + =Tank mix. Cumulative yield (lb) of fall-planted strawberries ('Monterey') over time when treated with biostimulants in San Luis Obispo, CA. * = Significantly higher marketable yields were observed in Unpac and Reiter Trichoderma compared to the control for the 23 May harvest.


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Evaluation of fungicides for strawberry powdery mildew management under greenhouse conditions

S. Z. Simard, K. A. Blauer, and G. J. Holmes

The trial was conducted in a greenhouse at the Cal Poly Crops Unit in San Luis Obispo, CA. Bareroot 'Monterey' transplants were planted outdoors on raised nursery benches on 20 Mar 2025 in plastic nursery 1 gal trade pots containing a soilless mixture called CB 1294 (Sun Gro Horticulture, Nipomo, CA). Plants were inoculated on 21 Apr (31 days after planting) by moving them from the outdoor nursery benches and placing them in the greenhouse where powdery mildew-infected strawberry plants were present with high levels of sporulation. No symptoms of the disease were detected on plants on the day they were transferred to the greenhouse. Treatments were replicated four times with each replicate consisting of 4 plants (1 plant/pot), arranged in a randomized complete block design. Two standards were included in the trial: Luna Sensation (conventional standard) and Microthiol Disperss (organic standard). One water-treated control was also included. Disease severity was based on the percent of the upper and lower leaf surfaces covered by visible mycelial growth of each fully emerged trifoliate leaf. Disease incidence was assessed as the percent of trifoliate leaves with at least one powdery mildew lesion. The disease index was calculated by multiplying disease incidence by disease severity for each replicate. Stolons (runners), and flowers were removed from plants once per week.

The first visual symptoms of infection were detected on 26 Apr, 5 days after planting transplants in the greenhouse. There were no significant differences among treatments for powdery mildew incidence or severity before the first fungicide application (data not shown). Powdery mildew incidence and severity on 21 May (30 days after inoculation) offered the most treatment separation. Overall, powdery mildew pressure was high as demonstrated by the non-treated water control (Table 1). Typically, the powdery mildew efficacy trials conducted at the Cal Poly Strawberry Center receive 5 weekly fungicide applications. Due to a mechanical failure of automated irrigation, all treatments in this trial received only 3 fungicide applications. Despite the early conclusion of the experiment, significant differences among treatments were still observed at the conclusion of this trial.

Table 1. Treatments sorted in ascending order by powdery mildew disease index.

Treatment (amount/A)	Application sequence[z]	Disease index[w]	Powdery mildew (%) on 21 May: Severity	Powdery mildew (%) on 21 May: Incidence[x]
Non-treated water control (100 gal)	ABC	2.16 ab	4.39 a	49.49 a
Luna Sensation (7.6 fl oz)	ABC	0.13 g	1.15 f	9.69 g
Luna Sensation (7.6 fl oz)	AC	0.16 g	1.25 ef	13.19 fg
Regev (8.5 fl oz)	B			
Luna Sensation (7.6 fl oz)	AC	0.39 fg	1.76 def	19.12 efg
Timorex Act (21 fl oz) *	B			
Merivon (7 fl oz)	ABC	0.40 fg	1.79 def	19.64 efg
Flint Extra (3 oz)	ABC	0.85 efg	2.74 bcd	28.36 de
Miravis Prime (13.4 fl oz)	ABC	0.88 efg	2.50 cde	26.26 def
Microthiol Disperss (5 lb) *	ABC	1.14 def	2.85 bcd	39.74 bcd
OR-dSl-120 (4.9 L) *	ABC	1.25 cde	3.45 abc	34.89 cd
Amara (2 qt) *	ABC	1.28 cde	3.41 abc	37.09 bcd
Cevya (5 fl oz)	ABC	1.36 b-e	3.39 abc	36.70 bcd
Serenade ASO (4 qt) *	ABC	1.95 a-d	3.99 ab	44.88 abc
LalSTOP G46 (1.8 oz) *	ABC	2.04 abc	4.41 a	45.26 abc
LalStim OSMO (4.3 oz) *	ABC			
Zorda (2.5 lb) *	ABC	2.41 a	4.16 a	57.30 a
EXP2501 (40 fl oz) *	ABC	2.42 a	4.58 a	51.14 ab
Crop4Life (3 fl oz) *	ABC	2.66 a	4.60 a	49.49 ab
LSD $P = 0.05$		0.84	1.31	14.46

[z] Application sequence: A=30 Apr, B=8 May, C=16 May.
[w] Disease index calculated by multiplying disease incidence by disease severity for each plot.
[x] Cultivars that do not share a letter are significantly different according to Fisher's LSD mean separation test (α=0.05) calculated using ARM version 2024.2 (Gylling Data Management, Brookings, SD).
*Indicates bactericides, plant extracts, or natural products.

Evaluation of strawberry host plant resistance to powdery mildew in 21 genotypes under greenhouse conditions

S.Z. Simard , K.A. Blauer, and G.J. Holmes

The trial was conducted in a greenhouse at the Cal Poly Crops Unit in San Luis Obispo, CA. Bareroot transplants were planted directly in a greenhouse on 10 Dec 2024 where powdery mildew-infected strawberry plants were present with high levels of sporulation. Transplants were planted in 1-gal plastic nursery pots containing a soilless potting mix with 10 g of Osmocote Plus added to the surface of each pot 28 days after planting (7 Jan). Treatments were replicated four times with each replicate consisting of 3 plants (1 plant/pot), arranged in a randomized complete block design. Disease severity was based on the percent of the upper and lower leaf surfaces covered by visible mycelial growth of each fully emerged trifoliate leaf. Disease incidence was assessed as the percent of trifoliate leaves with at least one powdery mildew lesion. The disease index was calculated by multiplying disease incidence and disease severity for each replicate. Stolons (runners), and flowers were removed from plants once per week.

The first visual symptoms of infection were detected on 24 Dec, 14 days after planting transplants in the greenhouse. Overall, powdery mildew pressure was high, reaching 79.6% incidence and 23.2% severity in 'Golden Gate, the most suspectable cultivar in the trial (Table 1). '088W02' was the most resistant cultivar in the trial with 5.0% disease incidence and 0.3% disease severity. These results show the dramatic difference in susceptibility to powdery mildew among strawberry genotypes.

Table 1. Cultivars sorted in ascending order by powdery mildew disease index.

			Powdery mildew (%) on 23 Jan [y]	
Cultivar	**Breeding program**	**Disease index** [z]	**Severity**	**Incidence** [x]
088W02	Good Farms	0.03 f	0.3 g	5.0 g
24-414R	Planasa	0.11 f	0.6 g	8.3 g
24-410R	Planasa	0.28 ef	1.2 fg	14.9 fg
24-407R	Planasa	0.51 ef	1.6 fg	23.9 efg
HW026.029	Driscoll's	0.69 ef	1.8 efg	27.3 d-g
PE-16.4092.013	Plant Sciences, Inc.	0.74 ef	2.8 efg	25.6 d-g
SB_13_164-030	Plant Sciences, Inc.	0.75 ef	2.5 efg	27.8 d-g
24-415R	Planasa	0.81 ef	2.4 efg	26.5 d-g
PEP-15.1890.010	Plant Sciences, Inc.	1.37 def	3.4 d-g	36.3 c-f
Angelina	Driscoll's	1.95 c-f	4.7 c-g	40.5 cde
152X15	Good Farms	3.26 c-f	6.3 c-f	58.3 abc
152X18	Good Farms	3.62 c-f	5.4 c-g	47.4 b-e
PS-13.467.089	Plant Sciences, Inc.	4.13 c-f	6.6 b-f	46.0 b-e
Monterey	University of California, Davis	4.51 c-f	7.4 b-e	47.6 bcd
24-413R	Planasa	4.56 c-f	6.6 b-f	38.0 c-f
122X08	Good Farms	4.87 c-f	7.2 b-f	44.7 b-e
UCD_Royal Royce	University of California, Davis	5.21 cde	8.8 bcd	55.8 bc
060z12	Good Farms	6.27 bcd	9.4 bc	58.6 abc
SB_14_028-025	Plant Sciences, Inc.	6.55 bc	7.5 b-e	54.8 bc
Cuyama	Driscoll's	8.26 bc	11.9 b	67.9 ab
UCD_Golden Gate	University of California, Davis	18.71 a	23.2 a	79.6 a
LSD *P* = 0.05		5.08	5.6	23.7

[y] This disease assessment was made 44 days after planting.
[z] Disease index calculated by multiplying disease incidence by disease severity for each plot.
[x] Cultivars that do not share a letter are significantly different according to Fisher's LSD mean separation test (α=0.05) calculated using ARM version 2024.2 (Gylling Data Management, Brookings, SD).



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Characterization of laser irradiation dosage on strawberry runners

D. Soto, T. Starling, J. Jaime, S. Klosterman, P. Henry, M. Ahmadi, G. Kondo, J. Lin

The effects that red (639 nm), green (520 nm), blue (445 nm), and white laser irradiation has on strawberry plant runners (for reference, white laser is a combination of red, green, and blue lasers) are shown in Figures 1 and 2 below. The findings are used to apply appropriate irradiation dosages for in-field laser pruning operations.

The laser specifications are shown in Table 1 below.

Table 1. Laser specifications

R | G | B [mW]:	2,700 | 2,700 | 4,800
R | G | B [Wavelength]:	638nm | 525nm | 455nm
Beam Size [mm]:	5 x 3
Beam Divergence:	<1.1mrad [Full Angle]

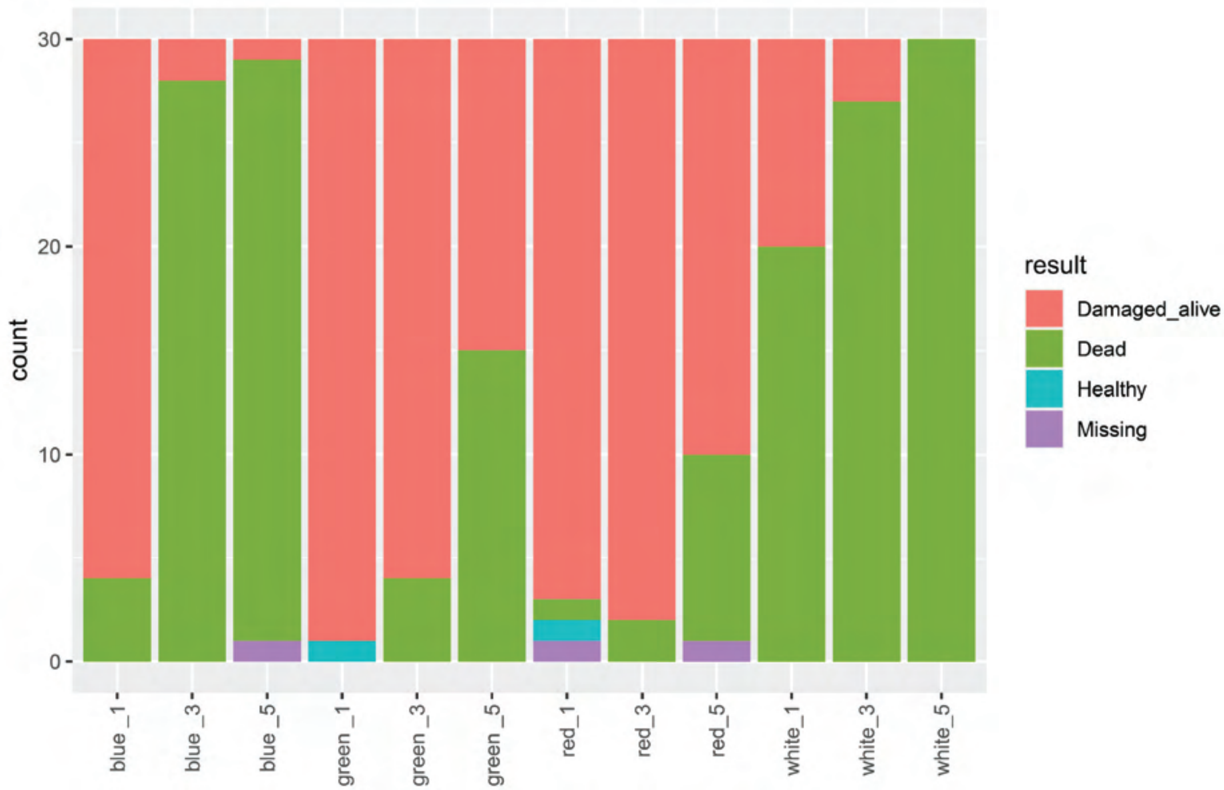

Figure 1. The effect of laser light on the health of runners is shown. The y-axis shows the number of runners tested; the x-axis shows the laser wavelength and irradiation duration in seconds. 360 potted plants were used (120 plants/rep, 3 reps in total). The experiment was performed from Mar 2024 to Jul 2024.

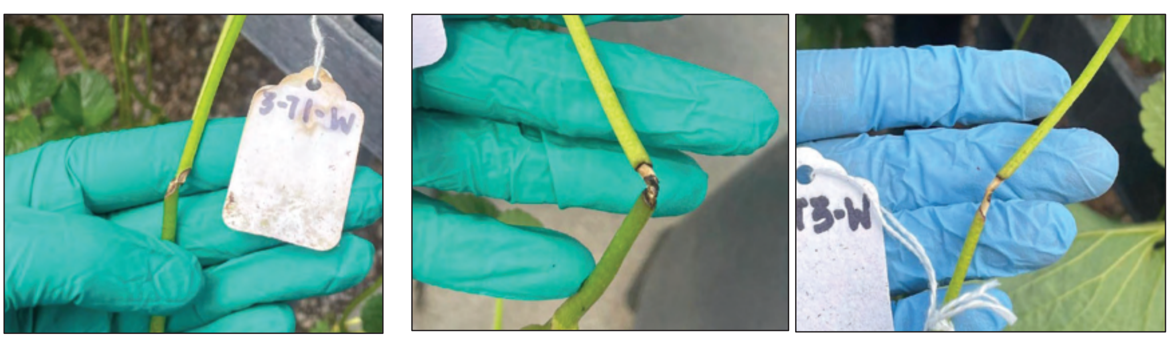

Figure 2. Photos of runners irradiated by laser. Photos were taken within 1 day of laser treatment.

Operator Aid System (OAS)

A. Atefi, M. Ahmadi, C. Fink, W. Kraemer, M. Mendez, and J. Lin

The operator aid system was developed to monitor bug vacuum and spray rig operational factors, including but not limited to tractor speed, implement height, airspeed of the vacuum fan, and the nozzle pressure of a spray rig. The system also incorporates LED indicator lights that are installed on the tractor to assist drivers in maintaining the recommended operating parameters. Preliminary results indicate that this system can be beneficial in enhancing the efficacy of the bug vacuum for eliminating Lygus bugs and spray rig coverage and uniformity. An infographic of how OAS can be used on farm is shown in below (Fig. 1).

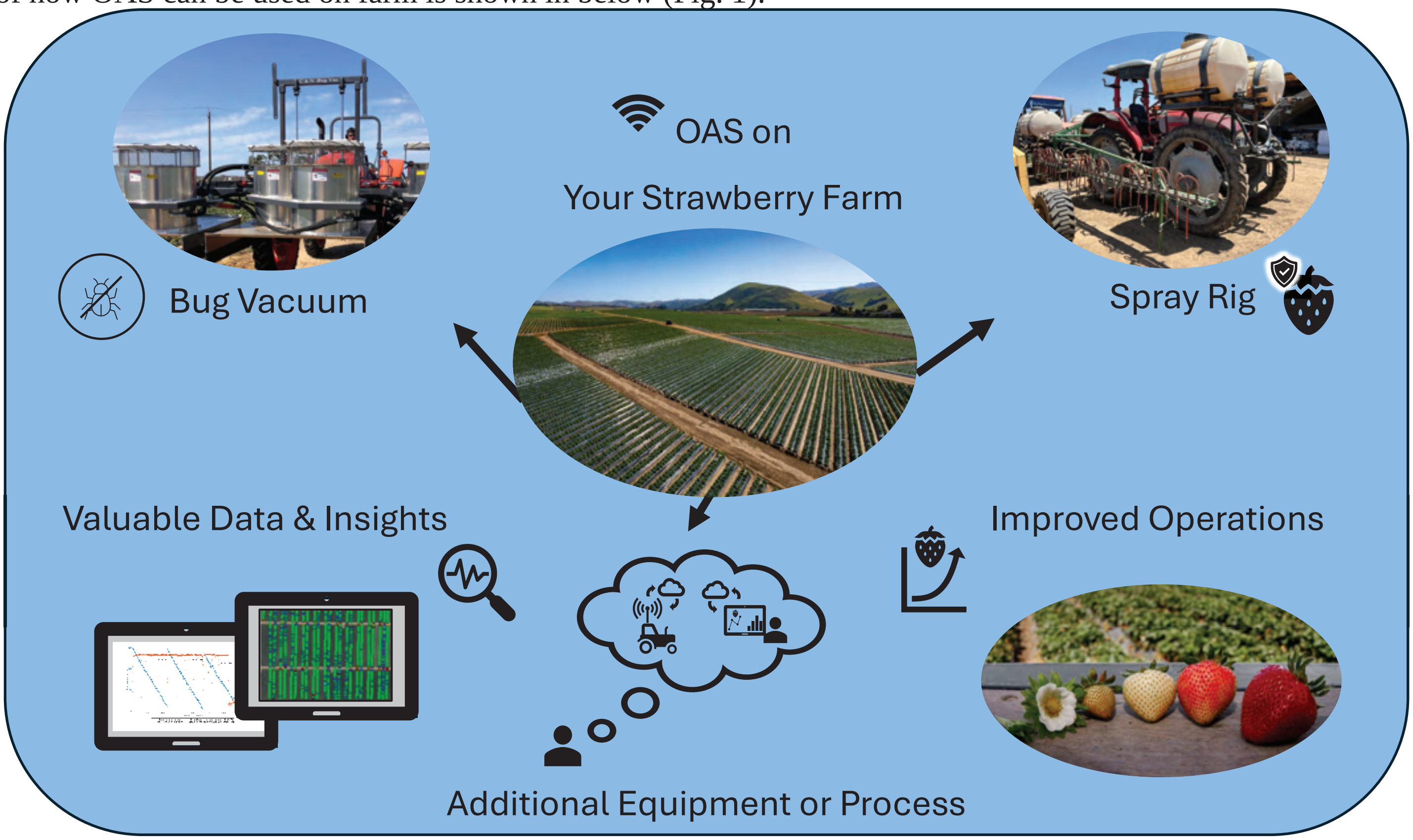

Figure 1. Infographic of a farm utilizing OAS's to monitor bug vacuums and spray rigs to improve pest and disease management.

An example of a spray rig OAS is shown below (Fig. 2).

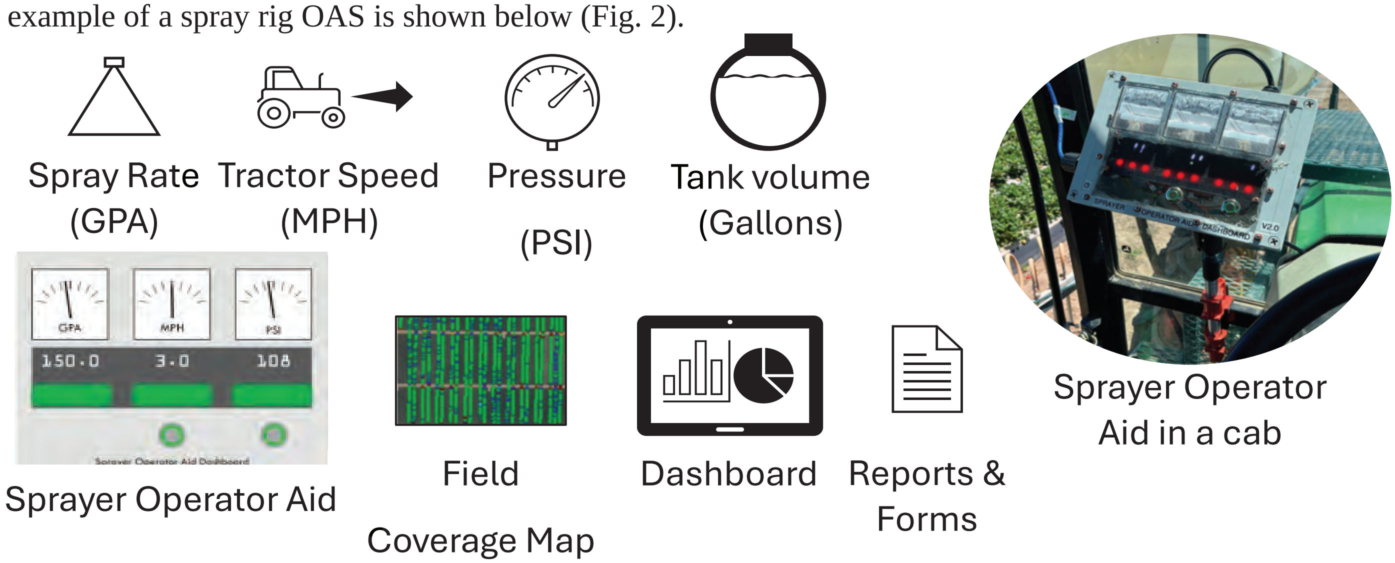

Figure 2. The spray rig OAS (shown in the rightmost image) provides monitoring for your spray operations. Spray application parameters are displayed on gauges and indicators. Afterwards, a report is generated showing spray coverage on a field map.

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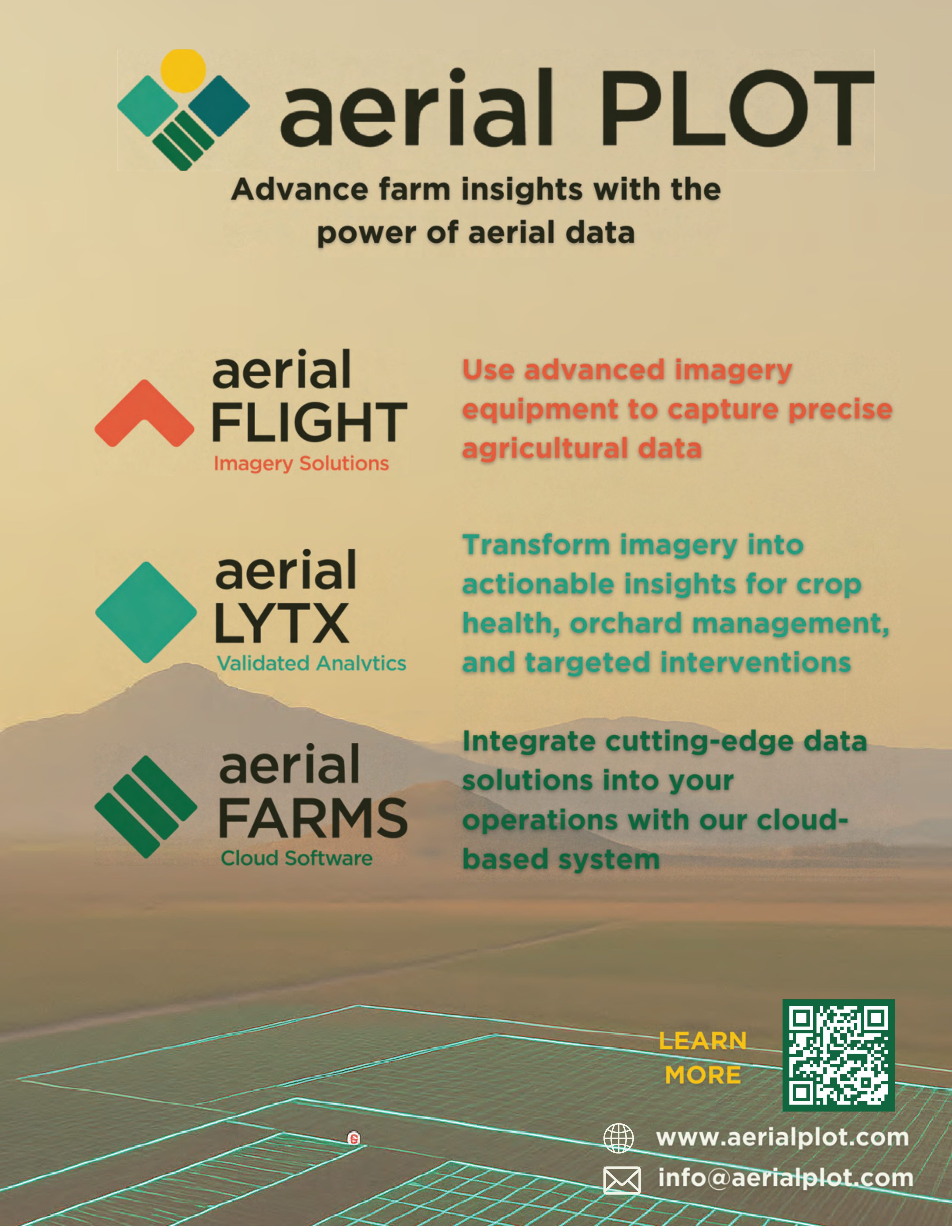
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Evaluating host resistance to Macrophomina root rot in strawberry

M. G. Alvarez Arredondo, S. S. Hewavitharana, and G. J. Holmes

The ninth consecutive field trial evaluating host resistance to Macrophomina root rot was conducted during the 2024–25 fall growing season at field 35b on the Cal Poly, San Luis Obispo campus (Fig. 1). This year's trial included 81 strawberry genotypes from eight breeding programs/nurseries: Crown Nursery, Driscoll's, Good Farms, Lassen Canyon, Pinnacle Berry Genetics, Planasa, Plant Sciences, and UC Davis. Plots consisted of 20 bare-root transplants per genotype, with slight variation in some plots due to plant availability. Each genotype was replicated across four randomized blocks. Standard 64-inch beds were used, with four rows of plants per bed and three lines of drip tape for irrigation and fertigation. Most transplants were planted on 31 Oct 2024, with additional plantings for UC Davis and select Driscoll's entries on 5 Nov 2024. On 20 Nov 2024, each plant was inoculated with 5 g of cornmeal-sand inoculum containing *Macrophomina phaseolina* at 1,034 CFU/g, applied around the crown and upper root zone (Fig. 2A). To promote disease expression under stress conditions, irrigation was reduced by 25% starting 9 Jun 2025. Plant mortality (Fig. 3 and 4) and canopy loss per day (Fig. 5) were assessed weekly. Plants were recorded as dead when all above ground foliage was necrotic. Pathogen presence was confirmed in host tissue using standard plating techniques. Due to cooler weather conditions during the 2025 growing season, disease expression has been less severe so far compared to previous years. As a result, Figures 3 and 4 show many zero values for plant mortality, reflecting delayed disease development across most genotypes.

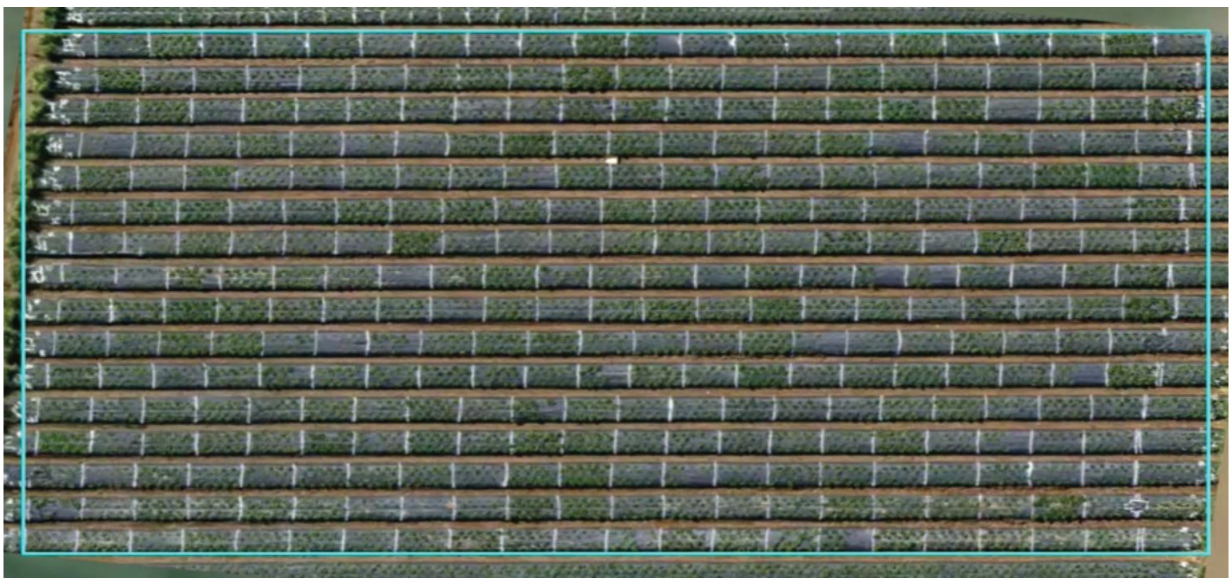

Figure 1. Aerial image of the Macrophomina root rot host resistance field trial on 15 Mar 2025, located in field 35b on the Cal Poly SLO farm. Plants in the area outlined in blue were inoculated.

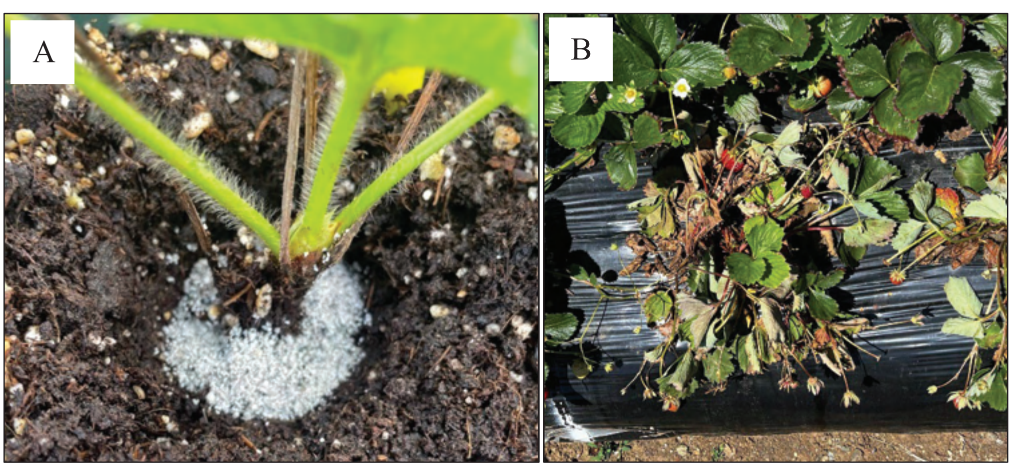

Figure 2. A) Transplant inoculation with *Macrophomina phaseolina*. B) Symptoms of Macrophomina root rot.

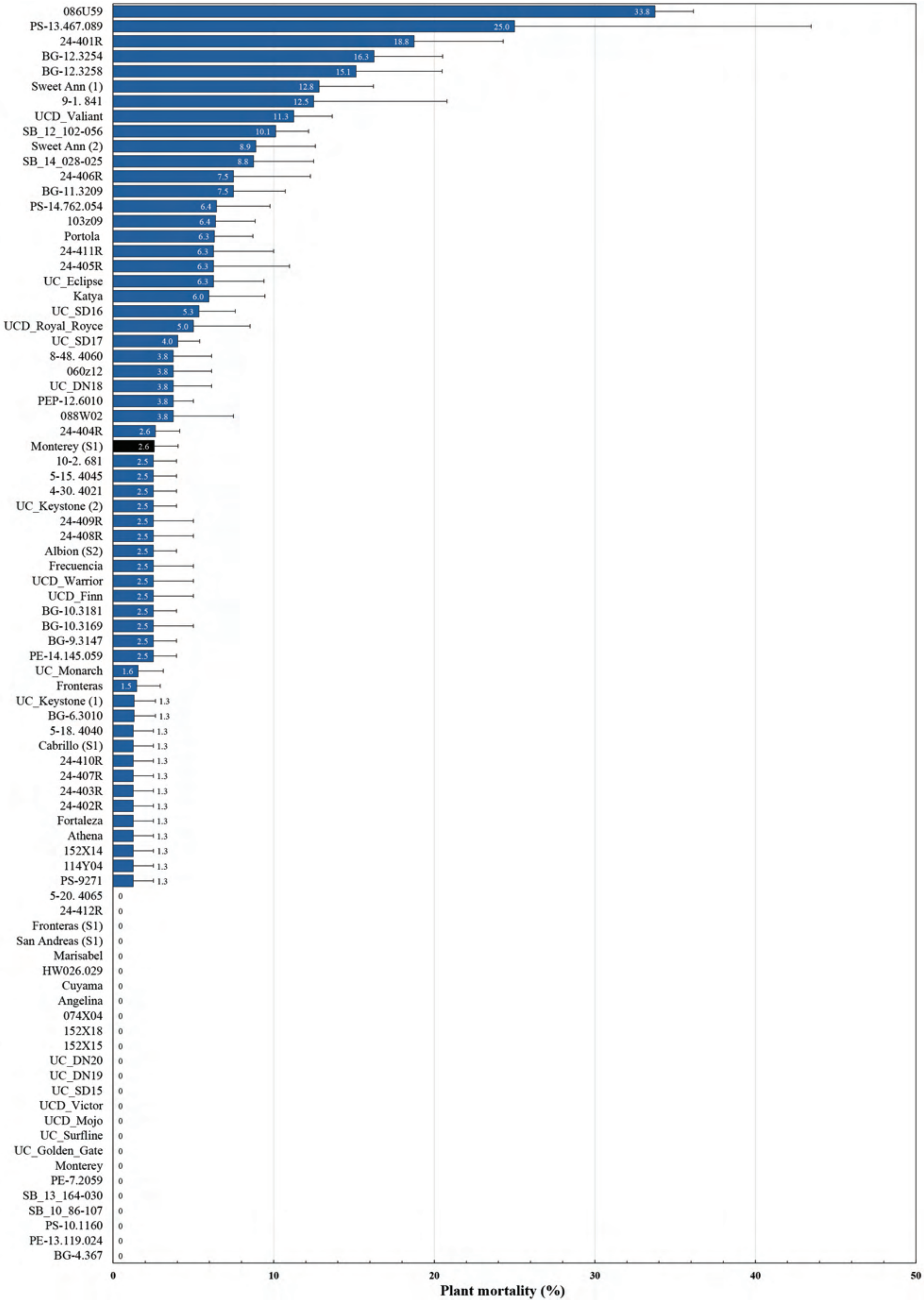

Figure 3. Average percent plant mortality due to Macrophomina root rot as of 03 Jul 2025. Error bars represent standard error from four replicates per genotype (n=4). UC_Keystone (1) and UC_Keystone (2), as well as Sweet Ann (1) and Sweet Ann (2), are from the same source but are duplicate entries in the trial. S1 and S2 represent different plant sources/nurseries.

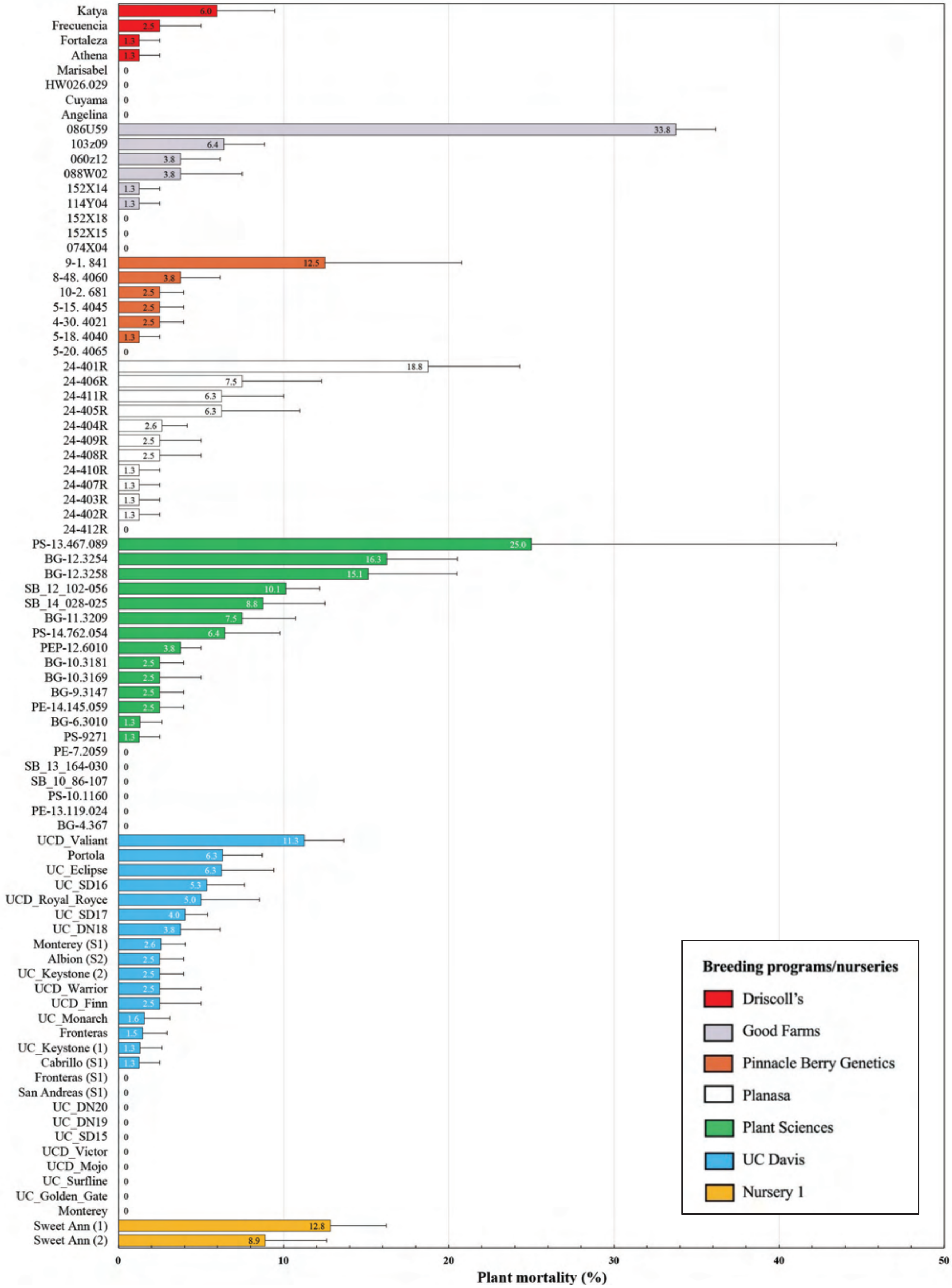

Figure 4. Average percent plant mortality due to Macrophomina root rot (sorted by breeding program) as of 03 Jul 2025. Error bars represent standard error from four replicates per genotype (n=4). UC_Keystone (1) and UC_Keystone (2), as well as Sweet Ann (1) and Sweet Ann (2), are from the same source but are duplicate entries in the trial. S1 and S2 represent different plant sources/nurseries.

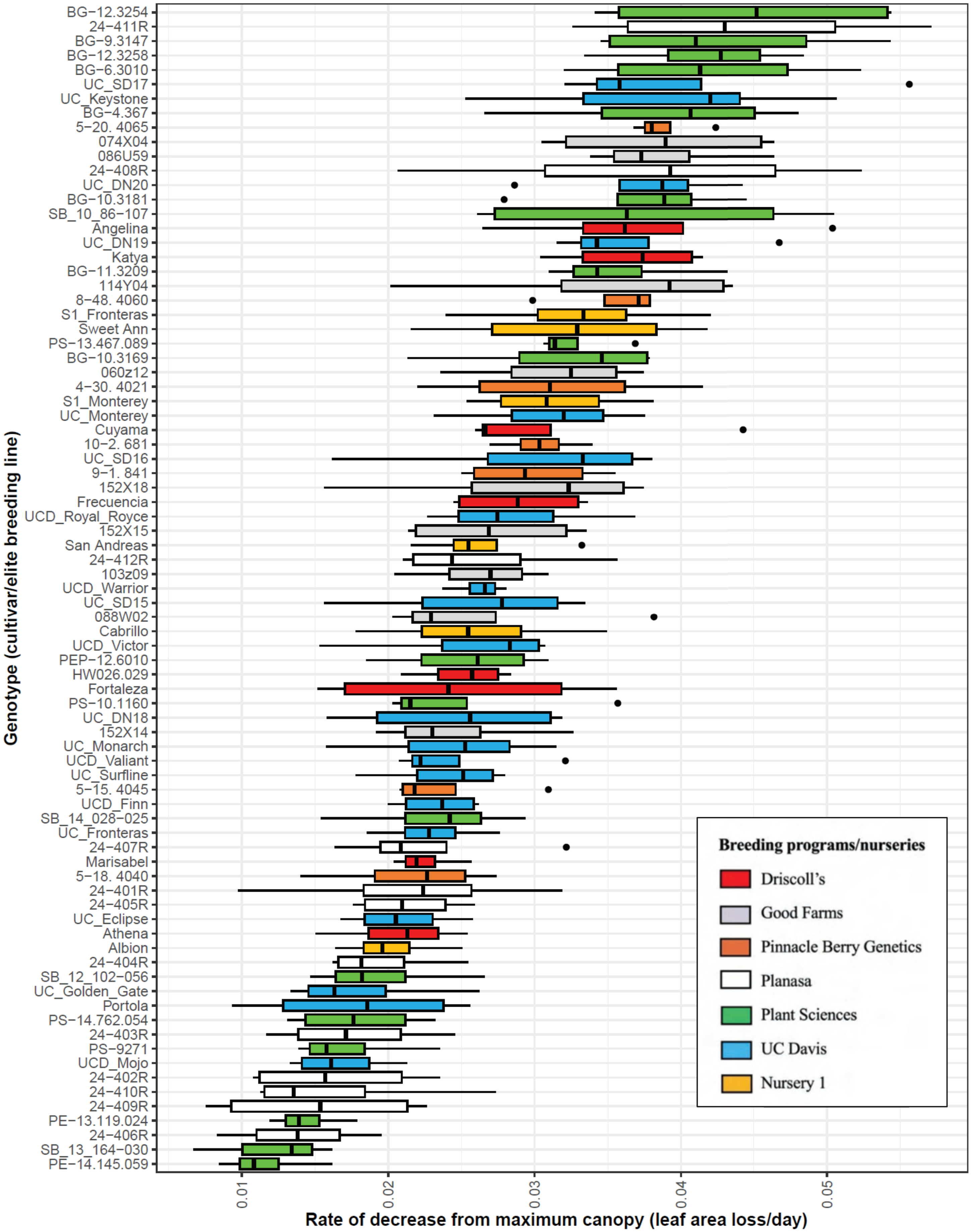

Figure 5. Bar and whisker chart showing the rate of canopy loss using Leaf Area Index (LAI) per day from peak to minimum in the Macrophomina root rot, up to 27 Jun 2025 (figure by Kaitlin Rim, Aerial-Plot).


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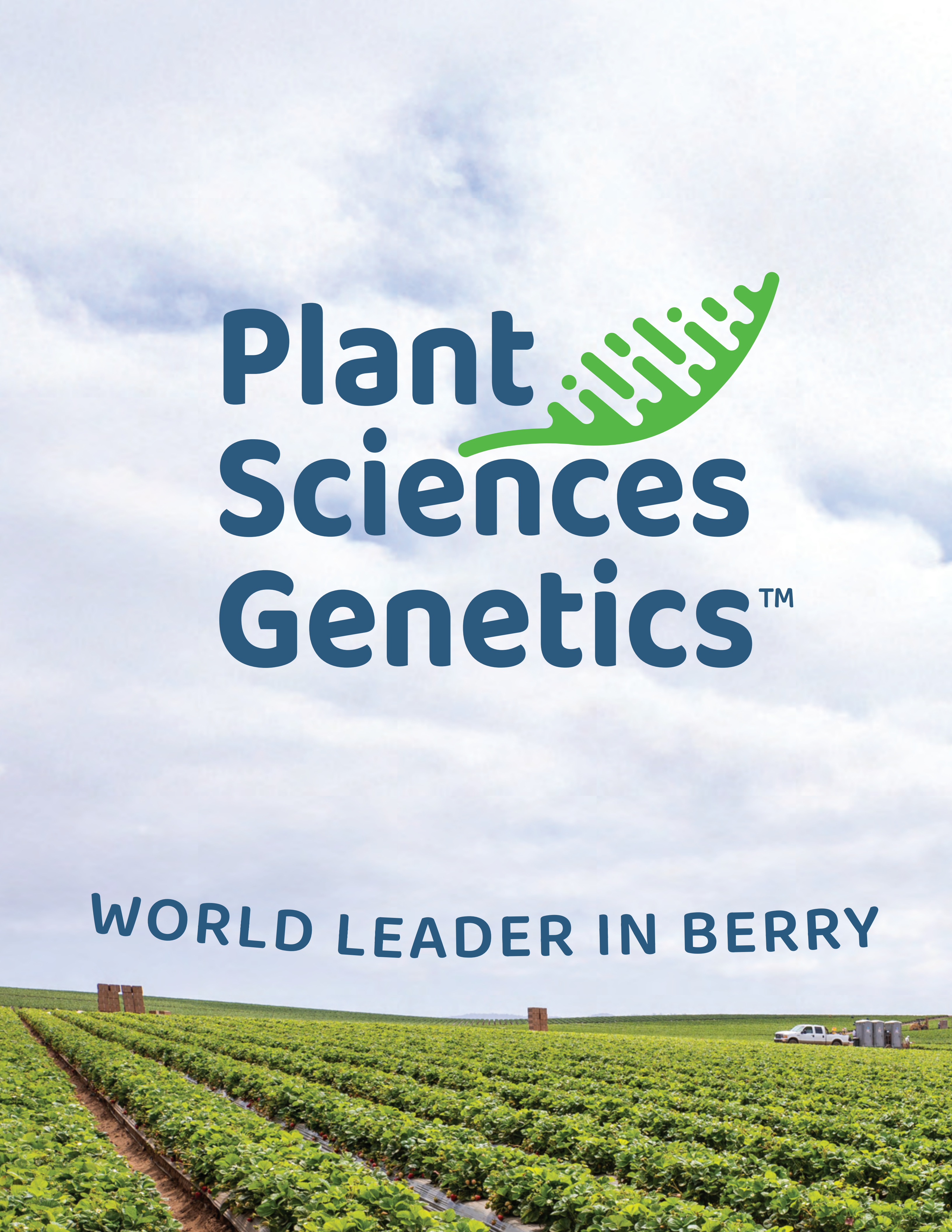
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Evaluating host resistance to Verticillium wilt in strawberry

M. G. Alvarez Arredondo, S. S. Hewavitharana, and G. J. Holmes

The 2024-25 season marks the ninth year of an ongoing field study aimed at assessing resistance to Verticillium wilt in strawberry, caused by *Verticillium dahliae*. This year's trial included 81 cultivars from eight breeding programs/nurseries: Crown Nursery, Driscoll's, Good Farms, Lassen Canyon, Pinnacle Berry Genetics, Planasa, Plant Sciences, and UC Davis. Bare-root transplants were established in field 25, block 4 at Cal Poly San Luis Obispo, a site with a documented history of Verticillium wilt. Planting occurred primarily on 31 Oct 2024, with additional transplants from UC Davis and a few Driscoll's selections added on 5 Nov 2024. The field was not fumigated prior to planting, allowing natural inoculum levels (7.81 CFU/g soil) to drive disease pressure. Cultivars were arranged in 20-plant plots, though some plots contained slightly fewer plants due to limited transplant availability. Each cultivar was replicated across four blocks. Symptomatic plants were sampled to confirm the presence of *V. dahliae* through standard plating techniques. Mortality assessments took place every week (Fig. 3 and 4) and canopy loss per day (Fig. 5), with plants classified as dead once 50% or more of the foliage exhibited necrosis. Notably, growth across the field was uneven. Certain areas, particularly toward the center and rear of the field (Fig. 1), exhibited weaker plant establishment and reduced vigor. In contrast, plants in block 1 developed a noticeably larger canopy compared to other replicates, suggesting more favorable localized growing conditions that may have influenced disease expression and overall plant performance.

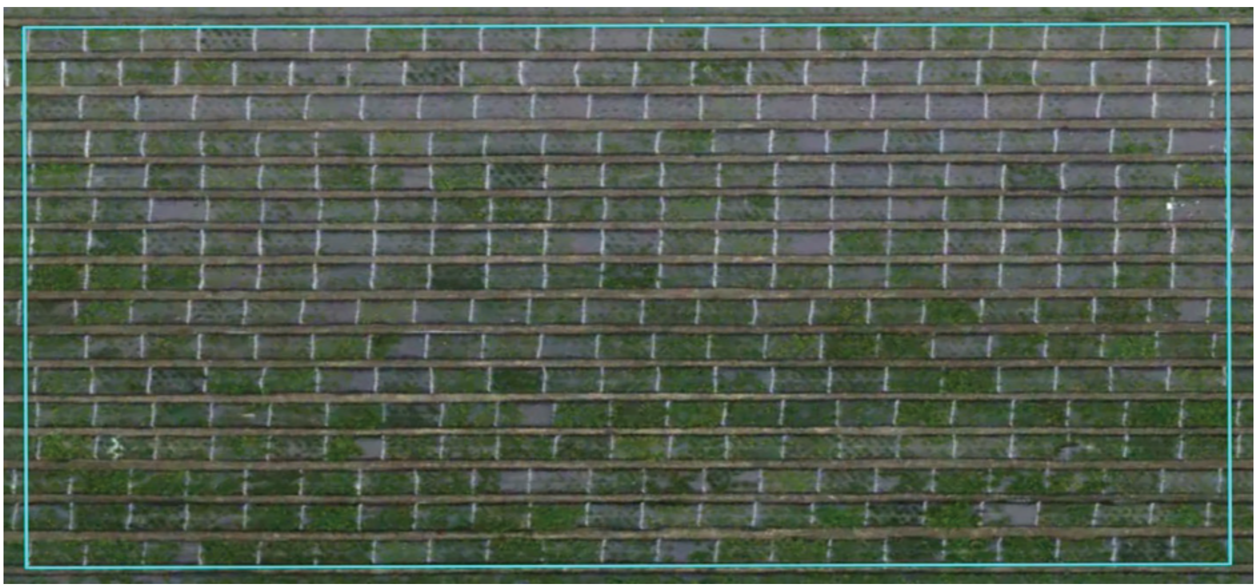

Figure 1. Aerial image of the Verticillium wilt host resistance field trial on 27 Jun 2025, located in field 25 block 4 on the Cal Poly SLO farm. The trial area is outlined in blue.

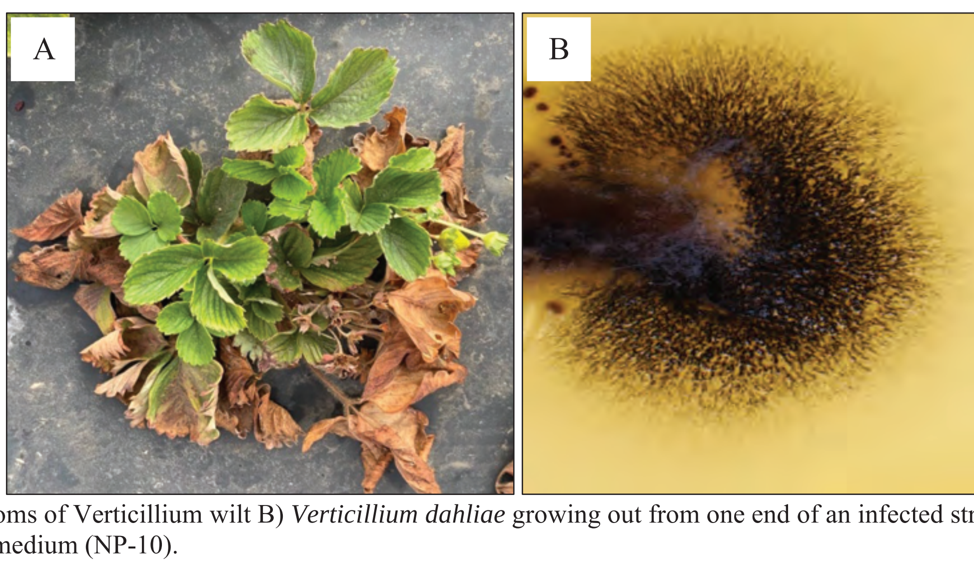

Figure 2. A) Symptoms of Verticillium wilt B) *Verticillium dahliae* growing out from one end of an infected strawberry petiole plated on a semi-selective medium (NP-10).

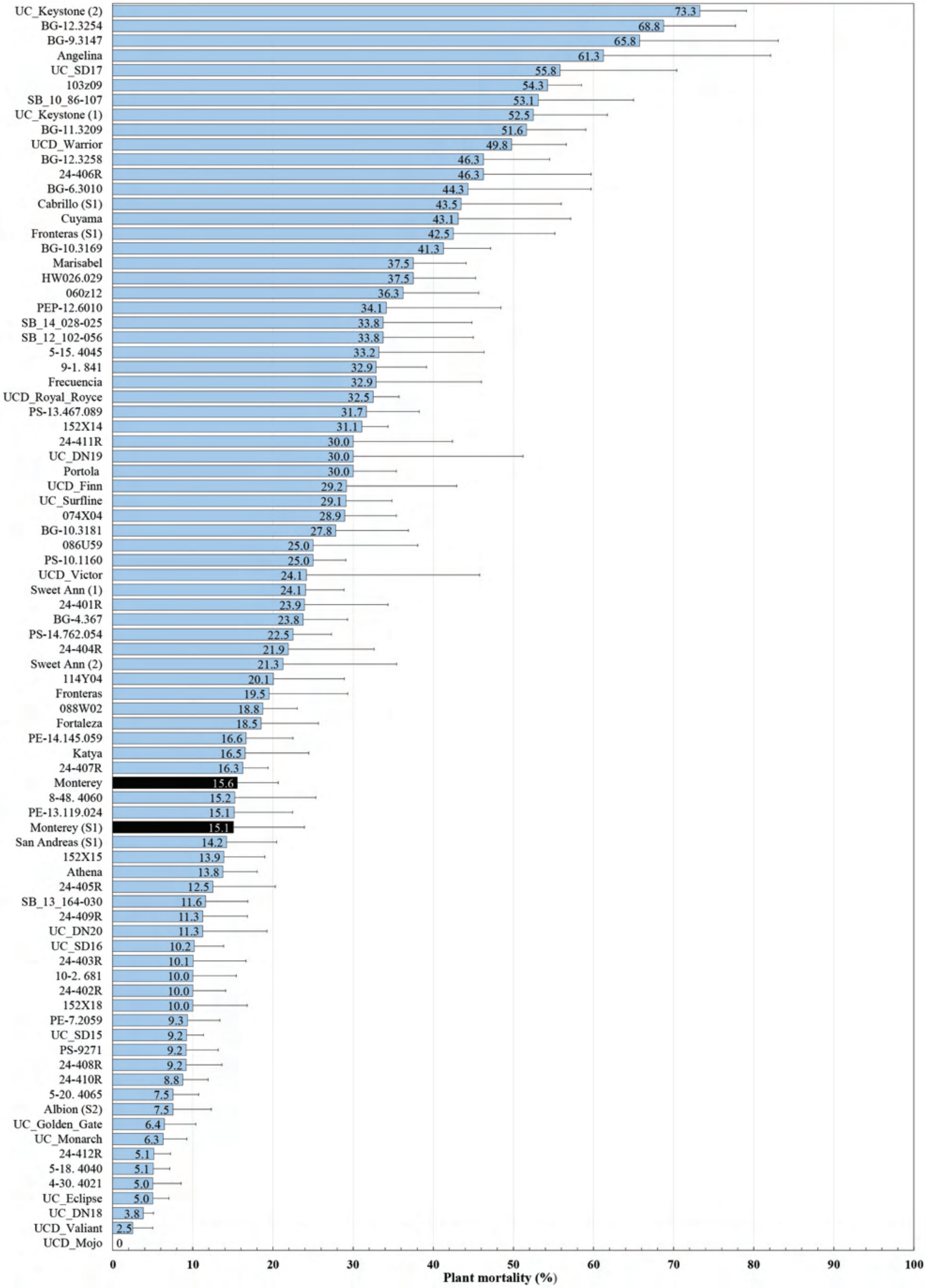

Figure 3. Average percent plant mortality due to Verticillium wilt as of 03 Jul 2025. Error bars represent standard error from four replicates per genotype (n=4). UC_Keystone (1) and UC_Keystone (2), as well as Sweet Ann (1) and Sweet Ann (2), are from the same source but are duplicate entries in the trial. S1 and S2 represent different plant sources/nurseries.

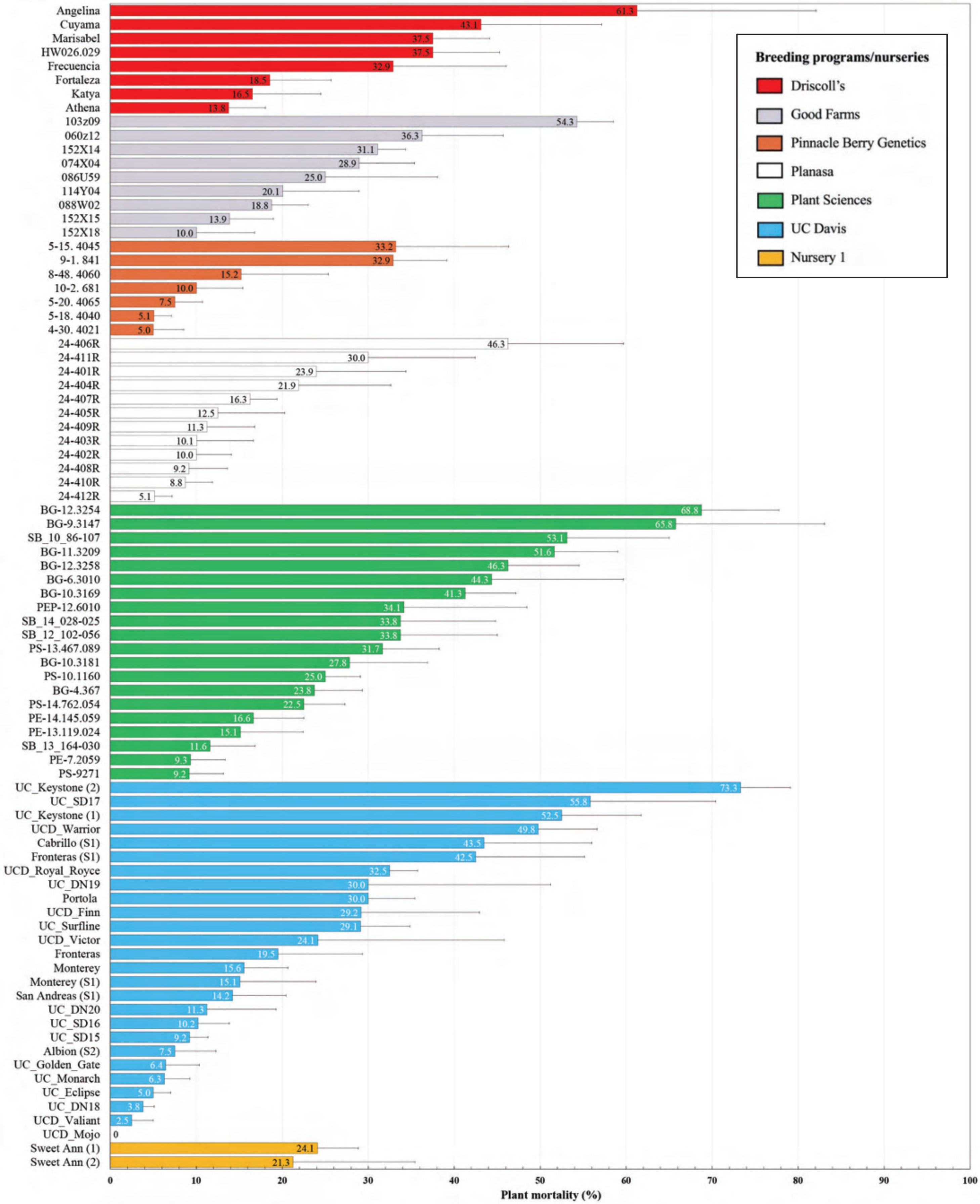

Figure 4. Average percent plant mortality due to Verticillium wilt (sorted by breeding program) as of 03 Jul 2025. Error bars represent standard error from four replicates per genotype (n=4). UC_Keystone (1) and UC_Keystone (2), as well as Sweet Ann (1) and Sweet Ann (2), are from the same source but are duplicate entries in the trial. S1 and S2 represent different plant sources/nurseries.

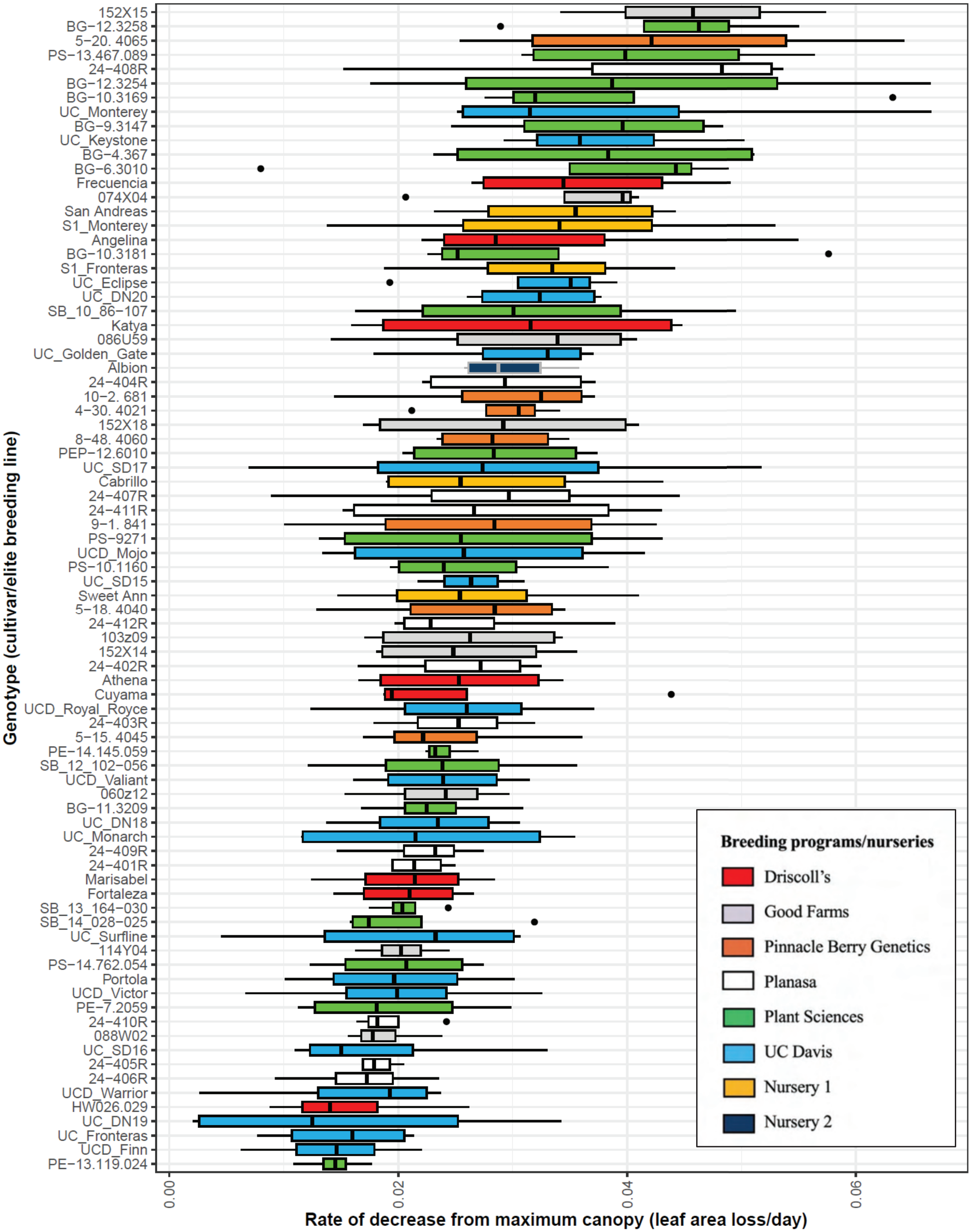

Figure 5. Bar and whisker chart showing the rate of canopy loss using Leaf Area Index (LAI) per day from peak to minimum in the Verticillium trial, up to 27 Jun 2025 (figure by Kaitlin Rim, AerialPlot).

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Mite cultivar evaluation for host plant resistance to twospotted spider mite

M. A. Aghaee and C. T. Koubek

The experiment was conducted in Field 35a at Cal Poly (GPS coordinates: N35º18’20”; W120º40’30”) in San Luis Obispo, CA. Bare root strawberry transplants were planted into raised beds on 31 Oct 2024. Beds were covered with 1.1 mil black TIF (totally impermeable film) polyethylene mulch (TriCal Inc., Hollister, CA). The experimental area consisted of five beds, 120 ft long. Each strawberry bed was 64 in. center to center, with four rows of plants spaced 12 in. between rows and 15.5 in. between plants within a row. Plants were irrigated and fertilized via three lines of drip tape per bed. The plot was 5 ft long, replicated four times and arranged in a randomized complete block (RCB). Each plot was hand infested twice between February and March with at least 50-100 *T. urticae* adults and nymphs and allowed to proliferate until plants were either killed or external predators reduced the population. Five leaflets were collected every 2 weeks beginning on 11 Feb 2025 until 1 Jun 2025 for a total of seven collections. All adults and nymphs were counted. Normalized difference vegetation index data and trichome counts collected will be analyzed with this data in the future.

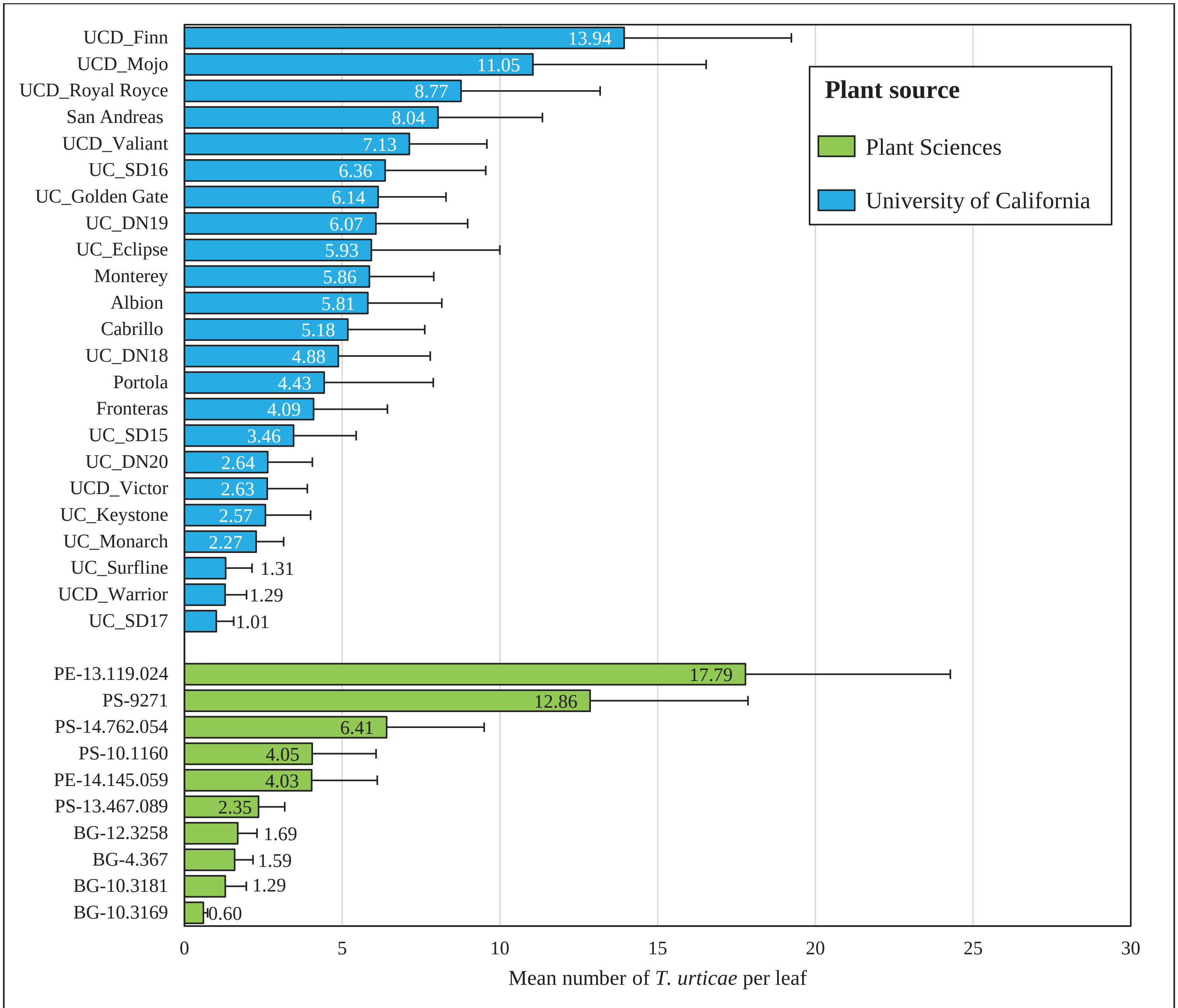
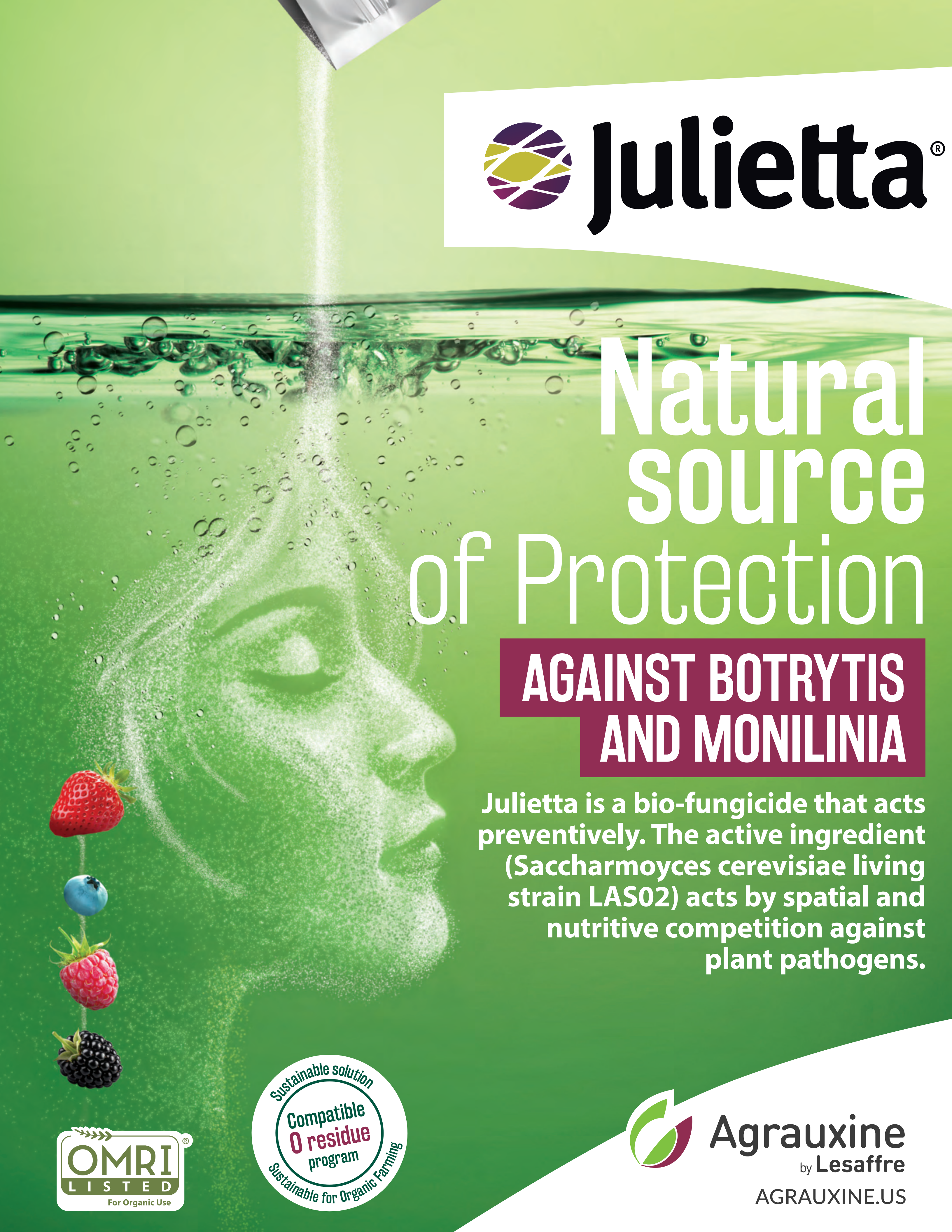


Figure 1. Twospotted spider mite (*Tetranychus urticae*) nymph and adult combined counts on genotypes/cultivars across five of the seven collection time points.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Effect of abiotic stresses on Macrophomina root rot development in California strawberry

M. J. Gutierrez, P. M. Henry, O. Daugovish, A. S. Biscaro, K. A. Blauer, S. S. Hewavitharana, and G. J. Holmes

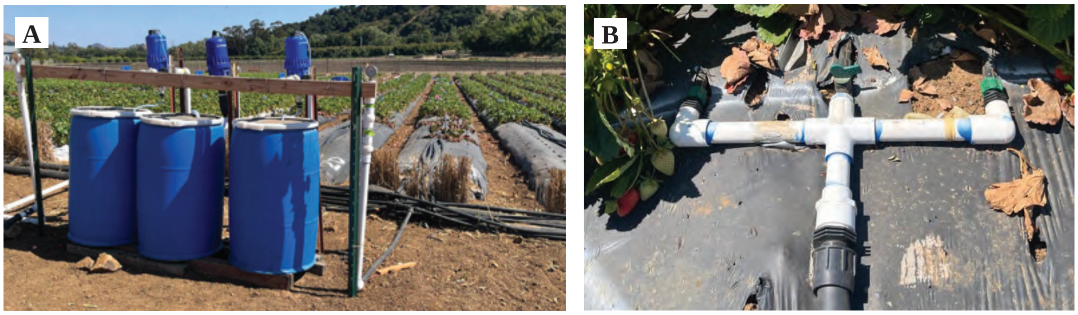

Figure 1. A) Irrigation setup located at the end of the field. B) Individual irrigation tubing leading out from setup pictured in A to a manifold leading into drip tape.

Strawberry plants subjected to environmental stressors are more prone to infection by *Macrophomina phaseolina*. This trial aims to address which stressors contribute significantly to disease progression and to use this information to improve management. This experiment consisted of 4 beds, each 153 ft long, with 10 plots per bed. Each plot was 14 ft long (44 plants per plot), with a 2.4-ft buffer between each treatment. All abiotic treatments started 78 days after planting, on 17 Jan 2025. Bare-root transplants of cultivars Fronteras and Sweet Ann were planted on 31 Oct 2024 and artificially inoculated by placing a cornmeal-sand-*Macrophomina* inoculum (1,034 CFU/g) at the base of each plant two-weeks after planting. The abiotic stress treatments (Table 1) were delivered directly through two high-flow drip tapes within each plot (Fig. 1). Data will continue to be collected until early-Aug 2025. Plant mortality was assessed weekly and recorded as "dead" once plant foliage reached 75% necrosis (Fig. 2). Plant crown tissue was then processed and plated to confirm the presence of *M. phaseolina*. Fruit was harvested at 7-day intervals during the early-season and 3-day intervals during the peak- and late-season (Figs. 3 & 4).

Table 1. Minimum soil tension for irrigation application and salts received by each treatment.

Treatment	Soil tension (kPa)	Added salts	Chloride (meq/L)	Sodium absorption ratio (SAR)	EC value* (dS/m)
Standard	10	No added salts	0.73	0.60	0.70
Drought stress	60	No added salts	0.73	0.60	0.70
Chloride stress	10	$CaCl_2$, $MgCl_2$, NaCl	6.20	0.90	1.36
Chloride × 2 stress	10	($CaCl_2$, $MgCl_2$, NaCl) × 2	13.00	1.10	2.09
High EC_W stress	10	$MgSO_4$, Na_2SO_4, $MgCl_2$, NaCl	3.70	1.80	2.52

*Salinity threshold for strawberries is 1 dS/m

Mortality results

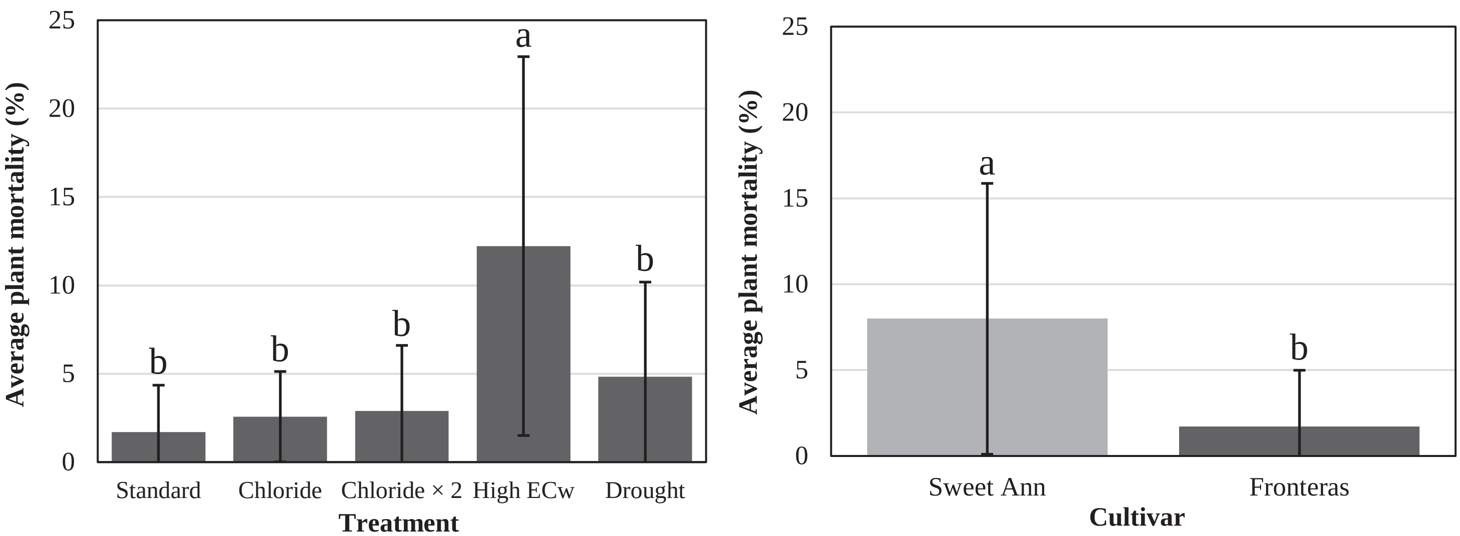

Figure 2. Average total plant mortality (%) separated by treatment (left) and by cultivar (right) as of 26 Jun 2025. Values not connected by the same letter are significantly different ($P < 0.05$). Error bars represent the standard deviation from mean.

Fruit yield results

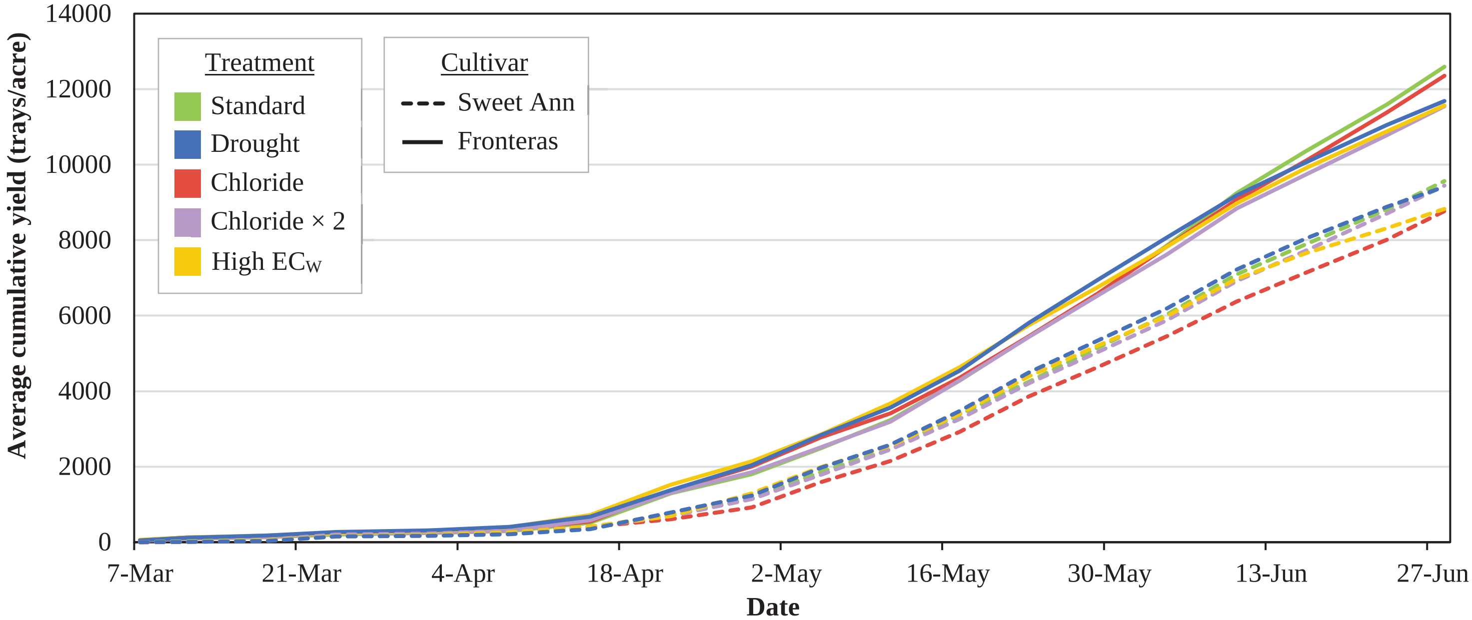

Figure 3. Timeline showing the average cumulative fruit yield of each treatment, separated by cultivar, throughout the entire season as of 28 Jun 2025. Trays per acre was calculated assuming 8 lb/tray. No significant differences between treatments were observed ($P > 0.05$).

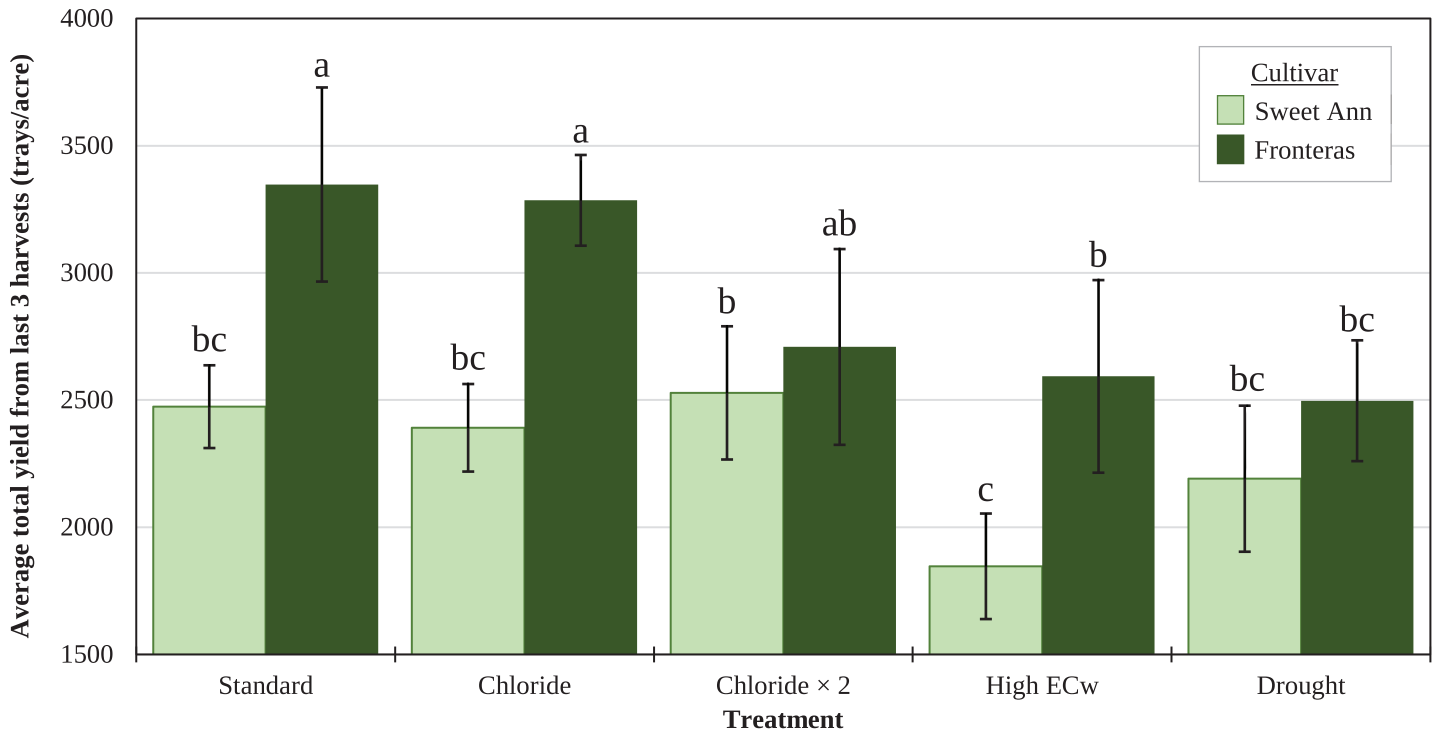

Figure 4. Average total fruit yield from the last 3 harvest events as of 28 Jun 2025. Trays per acre was calculated assuming 8 lb/tray. Values not connected by the same letter are significantly different ($P < 0.05$). Error bars represent the standard deviation from mean.

Discussion

It's important to note that this experiment does not account for salt accumulation in the soil that would typically occur in a commercial field using irrigation water with elevated salinity over multiple years. Plant mortality is expected to peak between mid-Jul and early-Aug as temperatures continue to rise. Based on last year's results, the drought and high EC_W treatments are expected to be the most severe stressors, causing the highest rates of plant mortality. For fruit yield results, a statistically significant difference in weekly yield between treatments was first observed on 23 Jun and is expected to continue separating through the late season.

Efficacy of nano-encapsulated, commercially available orange oil to control Botrytis fruit rot

M. J. Gutierrez, L. C. Garner, J. Chen, L. Yang, S. Horner, Y. Feng, G. J. Holmes, and S. S. Hewavitharana

Essential oils can provide control of *Botrytis cinerea*, and slow resistance to major fungicide classes. However, low solubility and high volatility present challenges. Nano-encapsulation of essential oils may address these limitations by enhancing dispersibility and retention of volatile compounds, thus also providing longer residual protection. For this experiment, citrus was harvested from groves at Cal Poly San Luis Obispo, and the essential oils were extracted and characterized. A nano-encapsulation technique is currently being developed and optimized. The efficacy of nano-encapsulated, commercially available orange oil for the control of *B. cinerea* was evaluated through a field trial and a detached fruit bioassay.

Field trial

This experiment consisted of 4 beds with 7 plots per bed. Each plot was 20 ft long (64 plants per plot). Bare root 'Fronteras' transplants were planted on 31 Oct 2024. Blooms were tagged prior to the first spray, and all fruit was removed. Spray treatments began on 23 Apr 2025, and were applied weekly for 5 consecutive weeks using a backpack sprayer equipped with 8 hollow cone nozzles, calibrated to deliver 150 gal/A at 60 psi. Once fruit within the trial reached full ripeness, evaluations for Botrytis fruit rot incidence were conducted at-harvest and postharvest to assess treatment efficacy.

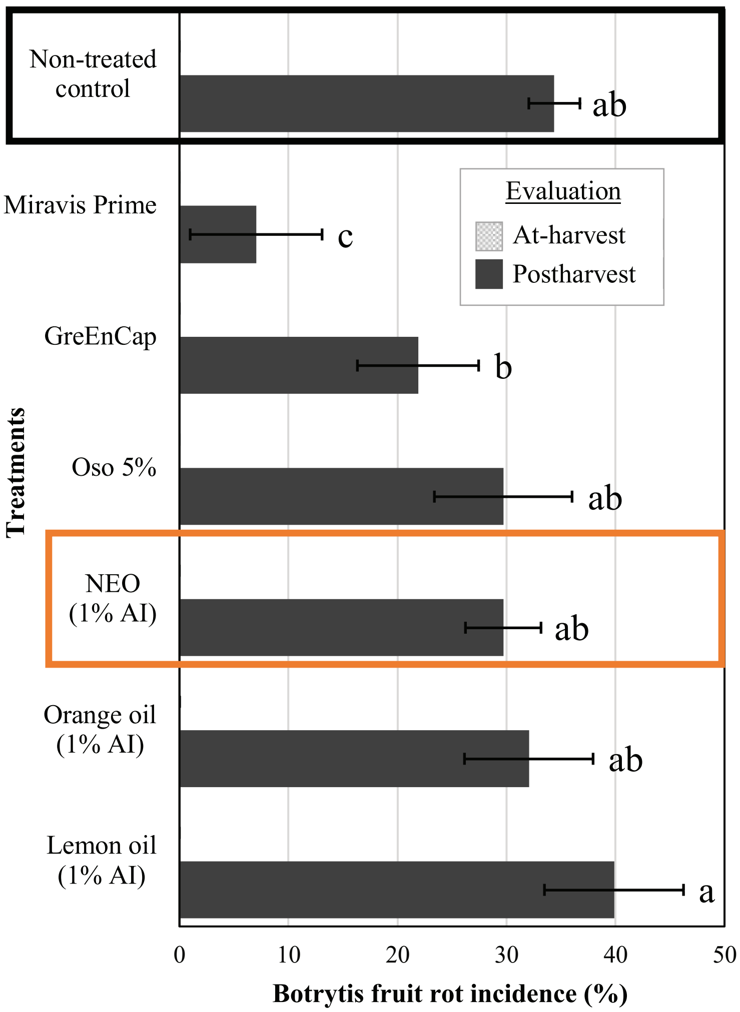

Figure 1. Botrytis fruit rot incidence at-harvest and four days postharvest. NEO = nano-encapsulated orange oil; AI = active ingredient. Fungicides were applied at max label rate. Data was subject to Fishers LSD mean separation. Error bars represent standard error of the means. Values not connected by the same letter are significantly different ($\alpha = 0.05$).

Detached fruit bioassay

Pink (half-ripe) 'Fronteras' strawberries were harvested and surface sterilized in a 0.5% bleach solution. Berries were dipped into a treatment for 1 sec, slightly wounded with a sterile toothpick infested with *B. cinerea* spores and incubated at room temperature for four days. Resulting lesions were measured and the percent inhibition of *B. cinerea* was calculated using the following equation:

$$\frac{Control - Treatment}{Control} \times 100 = Inhibition\ (\%)$$

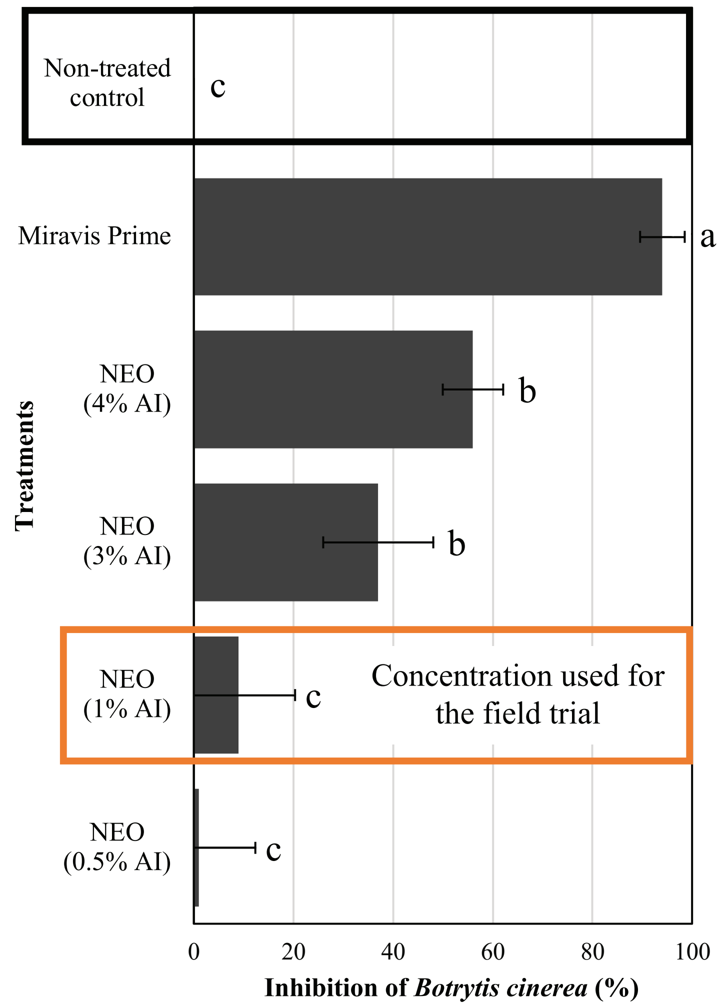

Figure 2. Percent inhibition of *Botrytis cinerea* on detached fruit, four days after treatment and inoculation. NEO = nano-encapsulated orange oil; AI = active ingredient. Fungicides were applied at max label rate. Error bars represent standard error of the means. Values not connected by the same letter are significantly different ($P < 0.05$).


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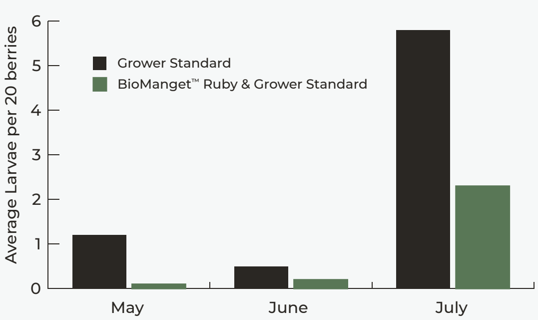
(Average is calculated using trials conducted in California cane berries in 2023)



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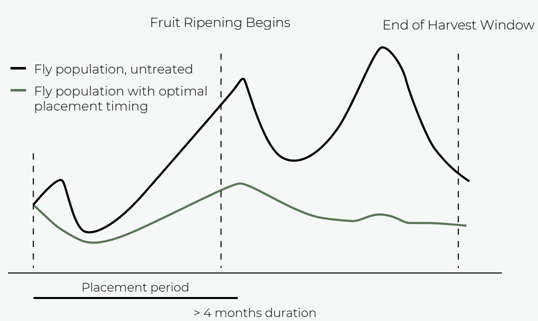

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Cal Poly strawberry disease diagnostic service activity - 2025

S. S. Hewavitharana and S. Z. Simard

The diagnostic service is funded by the California Strawberry Commission and a free service for the California strawberry growers. From Jan to Jun 2025, we received 169 samples from four strawberry growing regions (Fig. 1). Samples typically consist of 3-5 plants but can be more if they are fruit, leaf, or transplants. The samples were analyzed using microscopy, incubations, plating on selective media and molecular methods for fungal, oomycete, and bacterial pathogens and nematodes (Table 1).

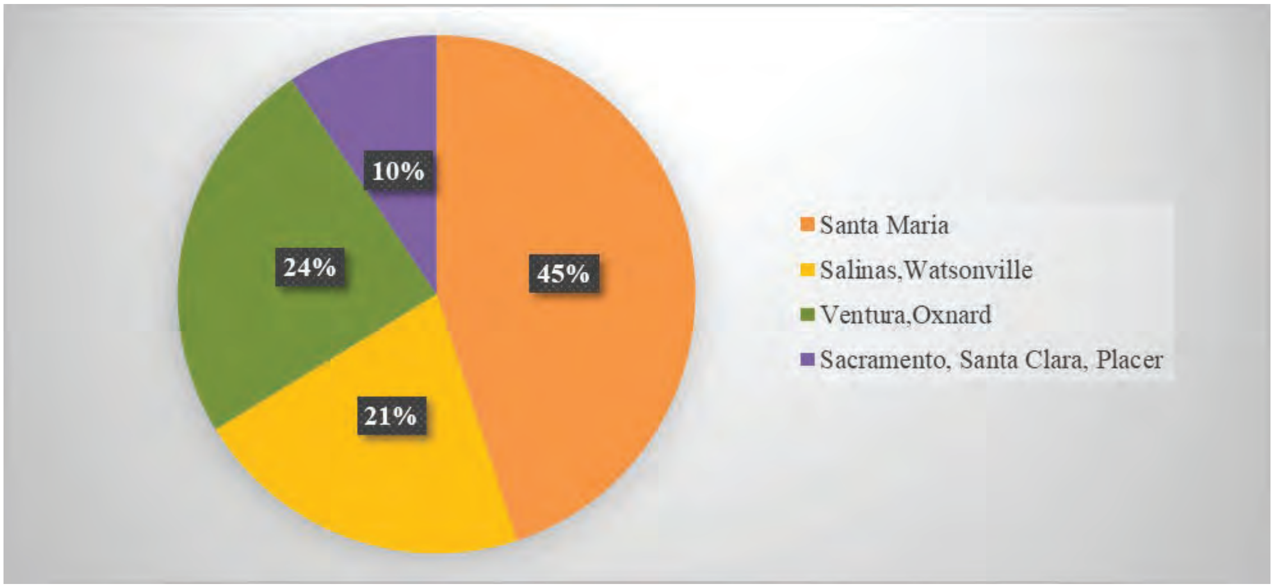

Figure 1. Diagnostic samples by district.

Table 1. Comparison of disease identification from Jan to Jun 2025 with the past years.

Disease/pathogen/disorder	2022	2023	2024	2025 (Jan-June)
Abiotic / pest problems	34 (21%)	26 (21%)	44 (22%)	15 (9%)
Macrophomina root rot	34 (21%)	36 (28%)	31 (15%)	22 (13%)
Phytophthora crown rot	29 (18%)	23 (18%)	19 (10%)	22 (13%)
Fusarium wilt (race 1)	28 (17%)	31 (24%)	39 (19%)	45 (27%)
Fusarium wilt (race 2)	NA	NA	8 (4%)	7[a] (4%)
Verticillium wilt	11 (7%)	12 (9%)	15 (8%)	18 (11%)
anthracnose	2 (1%)	0 (0%)	19 (10%)	26[b] (15%)
root-knot nematode	4 (3%)	8 (6%)	6 (3%)	5[c] (3%)
Pythium spp.	33 (20%)	42 (33%)	37 (18%)	40[d] (24%)
Total number of samples	162	127	201	169[e]

[a]Not new sites for *Fusarium oxysporum* f. sp. *fragariae* race 2
[b]Does not indicate the number of individual sites.
[c,d]Not the primary cause of disease.
[e]Samples can have more the one pathogen, therefore this number is smaller than the sum of the numbers.

Wheat cover cropping and crop termination for Macrophomina root rot management of strawberry

C. B. Calvin, and S. S. Hewavitharana

Wheat cover cropping was evaluated in conjunction with crop termination for its effect on Macrophomina root rot. Crop termination is the practice of killing the previous diseased crop using a fumigant with herbicidal and fungicidal properties to reduce the amount of pathogen inoculum in the soil for next season's crop. This study was conducted in two grower fields in Arroyo Grande (Field 1-conventional; crop termination and cover crop) and Santa Maria (Field 2-organic; cover crop only) with previous high incidence of Macrophomina root rot. At Field 1 the previous crop was terminated with metam potassium (K-Pam-HL at 47 gal/acre) in Nov 2023 and cover crops wheat 'Summit 515' and triticale 'Pacheco' were seeded separately at 150 lb/acre in Dec 2023, and flat fumigated with chloropicrin (Tri-Clor EC at 17.4 gal/acre) in Jun 2024. At Field 2 the same cover crops were seeded at the same rate in Feb 2023 and grown until Aug 2023. At Field 2 soil samples were collected prior to crop termination, post crop termination, and post cover crop. At Field 2, soil was collected post cover crop treatment. Soil samples were evaluated for *Macrophomina phaseolina* levels using the "pour plate" technique.

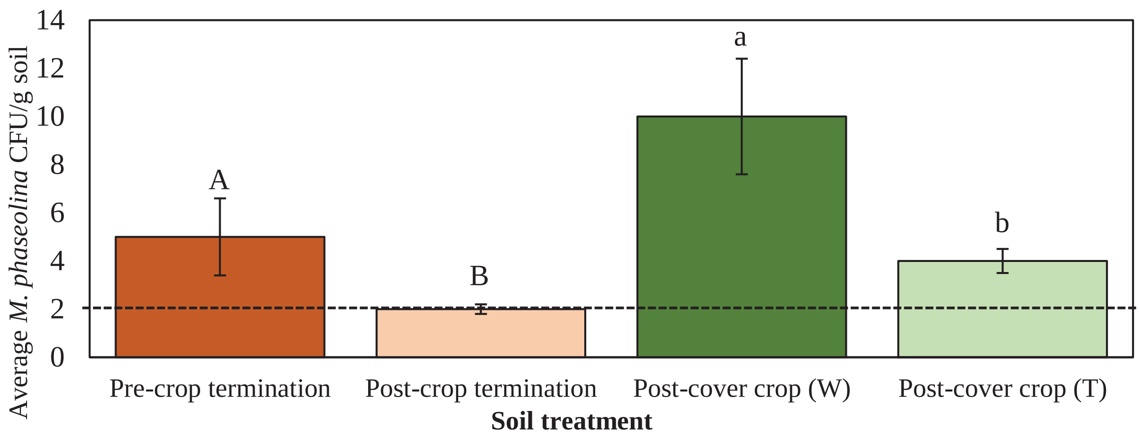

Figure 1. Average *Macrophomina phaseolina* colony forming units (CFU)/g soil across soil treatments of the conventional field trial (Field 1). W = wheat 'Summit 515' and T = triticale 'Pacheco'. Treatments without connecting letters were not significantly different (P = 0.05). Pre- and post- crop termination were analyzed separately to post-cover crop wheat and triticale due to field sampling location changes between strawberry production and cover cropping. Error bars of the pre- and post- crop termination treatments represent standard error of the means (n = 10). Error bars of the post-cover crop treatments represent standard error of the means (n = 4). Horizontal dashed black line represents disease threshold (2 CFU/g soil).

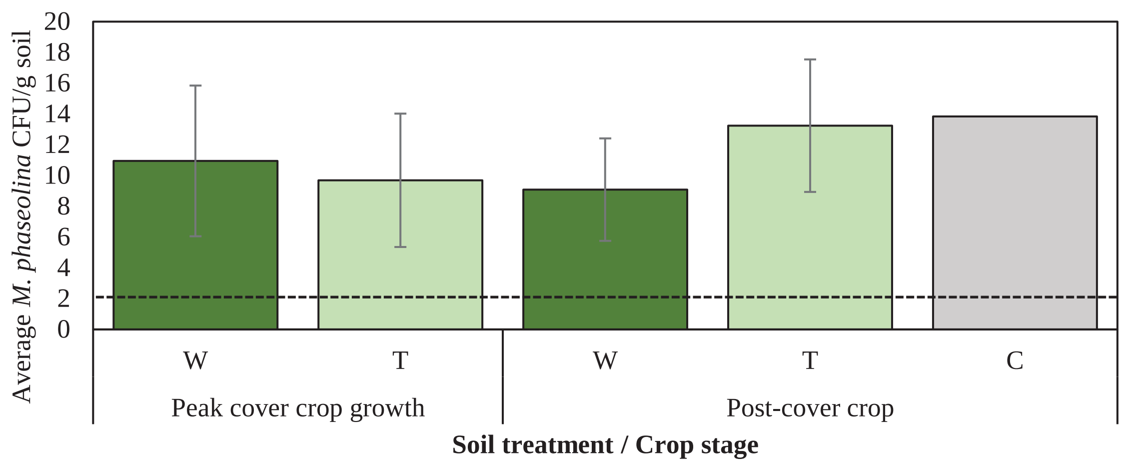

Figure 2. Average *Macrophomina phaseolina* colony forming units (CFU)/g soil across soil treatments wheat 'Summit 515' (W), triticale 'Pacheco' (T), and no-treatment control (C) and crop stages peak cover crop growth and post-cover crop of the organic field trial (Field 2). There was no significant soil treatment × time interaction (P = 0.1745), time effect (P = 0.6573), or soil treatment effect on the MP CFU/g soil values (P = 0.4508). Error bars of the wheat and triticale treatments represent standard error of the means (n = 4). Horizontal dashed black line represents disease threshold (2 CFU/g soil). C was a reference point outside of the experimental design (left fallow) and not included in the data analysis.


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Portable equipment sanitizing station for California strawberries

Z. Azevedo, A. Carrillo, E. Carrillo, U. Figueroa, N. Mercado and M. A. Sadek

The system allows for precise injection of sanitizing chemicals into the hot water stream of a pressure washer, ensuring efficient debris removal and disinfection of tools, clothing, footwear, and tractor tires—common carriers of contaminated soil. By using this specially equipped wash trailer, users can take proactive steps to reduce the spread of soilborne pathogens in strawberry fields.

Trailer specifications

Dimensions: 7 ft long by 5 ft wide, pin hitch. $3,000

Weight: 4,016 lb (full) and 1,725 lb (empty).

Lighting: 200W LED flood light outdoor with plug + 10 ft wire, adjustable height. $50

Tank capacity: 275-gal IBC Tank, $700

Cleaning: Hotsy 1075BE hot water pressure washer with Honda GX390 engine, and adjustable chemical injection system. 4 GPM, 3500 PSI, 200 F. $10,000

Power supply: RYOBI generator 1800 watts (running), 2300 (starting watts), Bluetooth technology. $2,000

Trailer features: toolbox, wash ramps, boot scrubber.

Total cost: $16,000

Figure 1. Custom built portable ramp.

Figure 2. Hot water pressure washer unit.

Heated hole puncher

W. Kraemer, M. Ahmadi, C. Fink, J. Wells, and J. Lin

A fabrication manual is available for growers to build their own Heated Hole Puncher. The machine is also commercially available through Precision Ag Services.

Figure 1. A worker hand burning holes in Salinas, CA

The Heated Hole Puncher is a three-point mounted implement that is entirely mechanically driven (Fig. 2). Ground engaging wheels turn the burning assembly and create holes at the desired plant spacing (Fig. 3).

Hole spacing can be altered simply by replacing a single sprocket on each burning assembly.

Also, standard is a hydraulic side shift for when operating the machine on hilly terrain or centering the holes on the bed.

Figure 3. A completed bed in Moss Landing, CA (left). An example of the hole produced by the machine (right).

The Heated Hole Puncher was developed for the Northern Strawberry Districts to address the grower's needs for a hole burning machine.

Current practices require a tractor to pull a spike roller on the plastic covered beds to mark where the burned holes will go. Hand crews then walk the fields with propane backpacks and burn holes at the marked spacing (Fig. 1).

Figure 2. The Heated Hole Puncher operating in Moss Landing, CA.

Results:

- In 2023, 610 Acres were completed with 5 machines.
- In 2024, ~1000 Acres were completed with 6 machines.
- It achieved a speed of 5 MPH in uniform, sandy soil conditions.
- In heavier soil conditions, speed was reduced, yet still accomplished burning 1.5 to 2 acres/hour.
- Propane torches worked well at high speeds and early morning when the plastic was wet.
- Accommodates a wide variety of bed heights and plant spacings typically used by growers.
- Saves ~$100/acre in labor costs

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3. **In-Field Operation**
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   Get in touch to set machine specs and lead time.
2. **Custom Build**
   Machine fabricated to specs.
3. **Machine Pickup / Delivery**
   Machine delivered and setup by PAS to growers satisfaction.

Ag Plastic Recycling Program for Drip Tape and Hoop House

Growers may drop off separated and clean drip tape and hoop house ag plastic for recycling for $50 a ton at ReGen Monterey .

Program Acceptance Requirements

- Only hoop house film and drip tape can be dropped off
- Any quantity of qualifying agricultural plastic may be dropped off at a reduced price of $50 a ton
- Material must be separated and not mixed with other plastics
- Please do not include tires, other plastics, trash, paper, glass, or mixed metals
- Ensure ag plastic is as clean as possible by collecting it in dry weather, shaking off as much dirt as possible, and removing any other trash contaminants
- Heavy zinc ties used to attach the drip tape at the ends are okay
- Unseparated plastics will not be recycled and their tipping fee will be charged at problem waste fee of $112 per ton

ReGen Monterey has the right to refuse recycling of excessively contaminated plastic and is willing to work with stakeholders to help prevent contamination. Thank you for implementing strategies that help prevent ag plastic from entering our local Monterey Bay National Marine Sanctuary.

To participate in recycling agricultural plastic simply bring your hoop house or drip tape to ReGen.

ReGen Monterey

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CMSF
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Tim Lichatowich

503.705.0384

timjlich@gmail.com

Evaluation of UV-C light for control of twospotted spider mite, Lewis mite, and *Lygus hesperus*

C. T. Koubek and M. A. Aghaee

Laboratory and field tests were conducted to evaluate the effects of UV-C on multiple stages of twospotted spider mites (TSSM), Lewis mite (LM), and *Lygus hesperus*. Applications of UV-C in the laboratory were performed in a square tent and dosages were measured using a radiometer. Field applications were performed by TRIC robotics after sunset. Dose response curves were generated for larva and adult TSSM and LM, and 1st, 3rd, and 5th instars of Lygus (Table 1). Mortality was evaluated 48 hours after application. A binomial generalized linear model with a logit function was used to determine the LD_{50} and LD_{90} for each life stage. Dose response curves revealed that field relevant dosages of UV-C (<1800 J/m2) do not provide substantial mortality for mobile stages of TSSM, LM, or Lygus.

Ovicidal effects on Lygus were evaluated by placing egg packs on top of the strawberry crown (Figure 1A). For TSSM and LM, leaf discs containing eggs were pinned to the underside of strawberry leaves (Fig. 1B). Laboratory ovicide tests positioned the egg packs and leaf discs with eggs facing up at the bottom of the UV-C tent. The percentage of egg hatch for Lygus was recorded 12 days after application, and 5 days for TSSM and LM. Lygus egg hatch in the lab and field showed a normal distribution, and a standard least squares ANOVA and Tukey HSD was performed. Egg hatch for TSSM and LM was not normally distributed, therefore, a non-parametric Kruskal–Wallis test was used to evaluate treatment effects, followed by Dunn's test with Holm correction for pairwise comparisons. Although the 350 J/m^2 treatment significantly reduced Lygus egg hatch compared to the control in the lab, no statistical differences were found in the field. UV-C demonstrated ovicidal effects on TSSM and LM in both the lab and field, with every UV-C treatment separating from the control in each test (Fig. 2). These results show that UV-C is a highly life-stage-specific tool for the management of arthropod pests in strawberries.

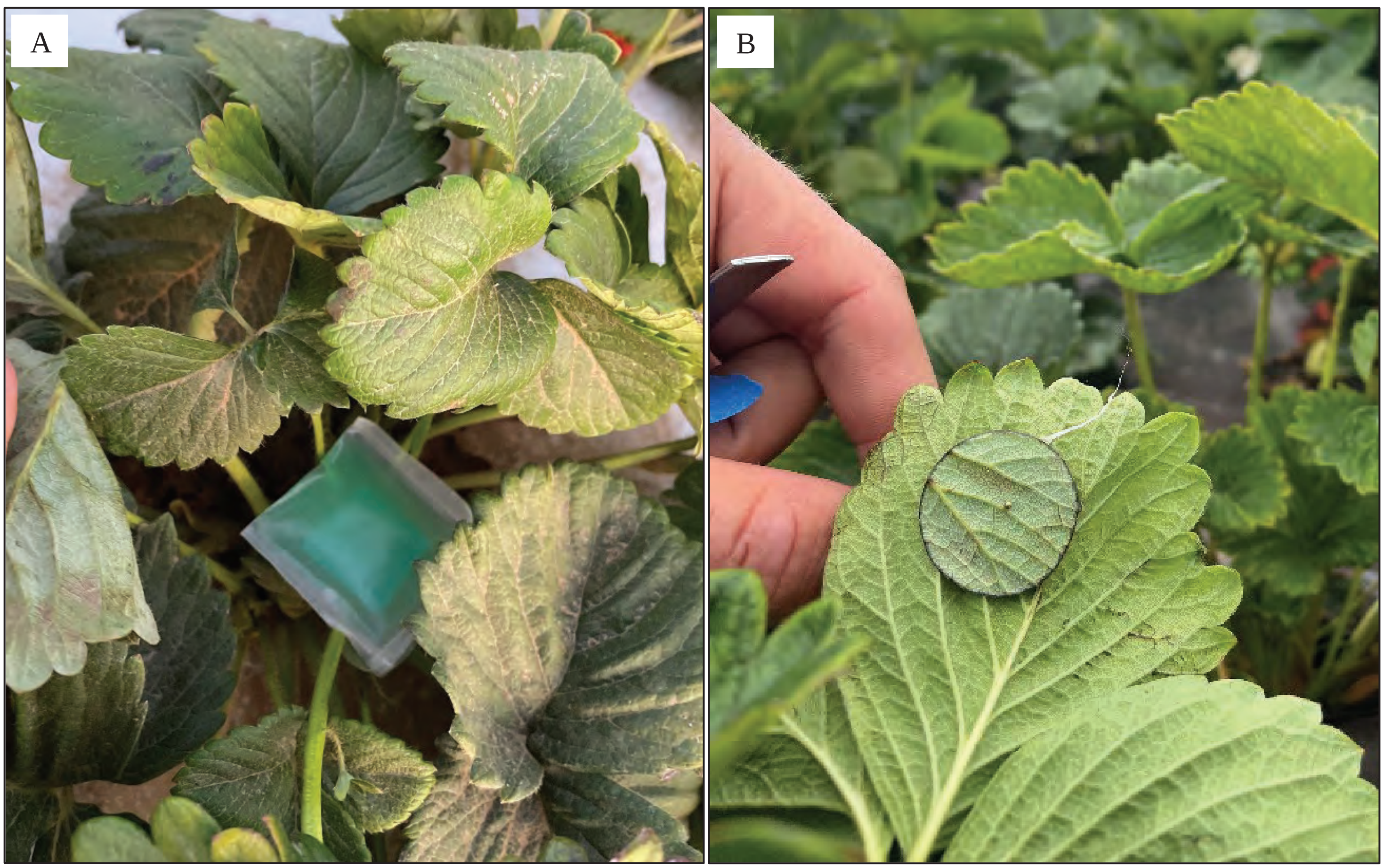

Figure 1. A) Lygus egg pack placed atop a strawberry crown B) egg leaf disc method used for twospotted spider mite and Lewis mite.

Table 1. Binomial generalized linear model with logit function dose response analyses for twospotted spider mite (TSSM) and Lewis mite (LM) adults and larvae, and first, third, and fifth instar lygus. LD50 = Lethal dose killing 50% of the population, LD90 = Lethal dose killing 90% of the population.

	Twospotted spider mite		**Lewis mite**	***Lygus hesperus***		
	Adult	Larva	Adult	1st Instar	3rd instar	5th instar
LD50 (J/m^2)	9,019	3,562	9,690	19,527	23,879	25,591
LD90(J/m^2)	16,875	12,318	20,085	30,947	43,388	59,248

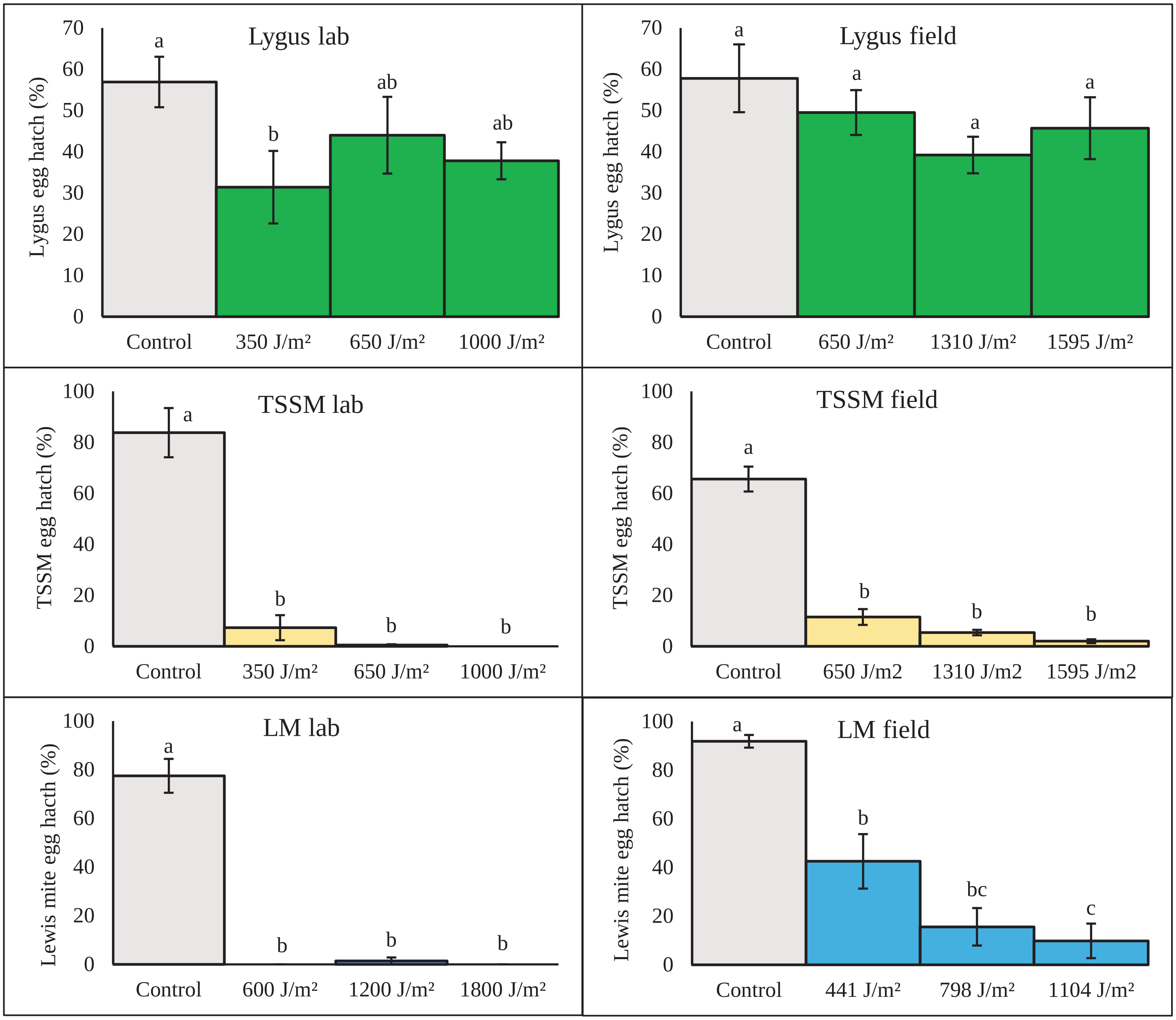

Figure 2. Lygus (green) ovicide lab (n=10) and field (n=6) results, separated using Tukey's HSD. Twospotted spider mite (TSSM; yellow) lab (n=10) and field (n=15) results, analyzed with Kruskal Wallis. Lewis mite (LM; blue) lab (n=10) and field (n=10) results, analyzed with Kruskal Wallis. Means that do not share a letter are statistically different (α = 0.05).

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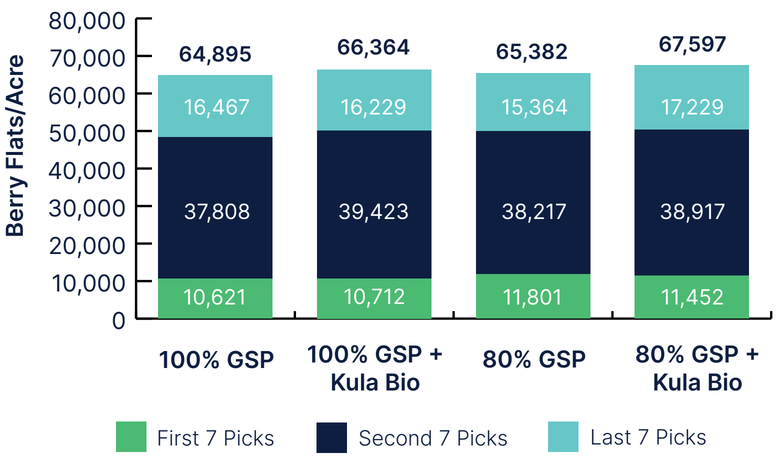

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Interactive effects of fungicides and adjuvants on *Phytoseiulus persimilis*

C. T. Koubek and M. A. Aghaee

Lethal effects of six fungicides (the most–used in California strawberry production in 2023) and industry-recommended adjuvants on the predatory mite *Phytoseiulus persimilis* were evaluated under controlled laboratory conditions. For each combination, five *P. persimilis* nymphs were confined to a green-bean leaf disc and offered 20 two-spotted spider mites as prey and then sprayed with a Potter's tower at maximum field rates in a dilution equivalent to 150 GPA. Mortality was assessed after 48 hours and analyzed in R by fitting a bias-reduced logistic regression model to estimate percentage mortality for each fungicide–adjuvant combination. Estimated marginal means on the probability scale were calculated, and Tukey-adjusted pairwise comparisons identified which adjuvant treatments differed significantly in their lethal effects.

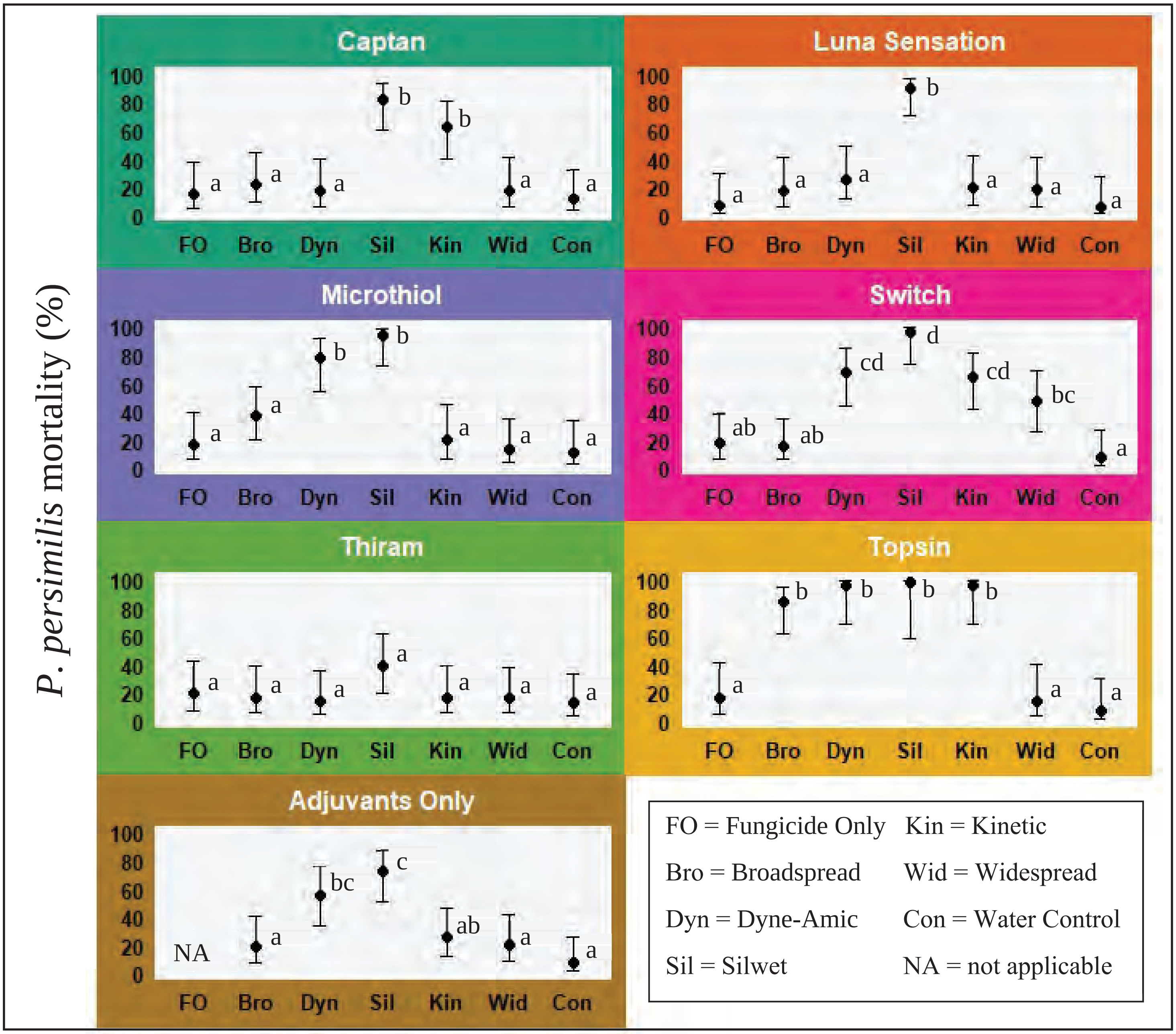

Figure 1. Predicted mortality probability of *Phytoseiulus persimilis* following application of fungicide and adjuvants combinations, estimated using a bias-reduced logistic regression. Each panel represents one fungicide or the no-fungicide control. Points show estimated marginal means ± 95 % confidence intervals, and letters indicate Tukey-adjusted groupings. Treatments sharing the same letter are not significantly different (α = 0.05)

Miticide tolerance in field populations of twospotted spider mite in California strawberry production

C. T. Koubek and M. A. Aghaee

Adult twospotted spider mites (TSSM) were sampled from strawberry fields in Arroyo Grande (AG), Ventura (VEN), and Santa Maria (SM). The miticides Nealta (a.i. cyflumetofen; IRAC 25), Enervate (a.i. bifenazate; IRAC 20D), Agri-mek (a.i. abamectin; IRAC 6) and Onager (a.i. hexythiazox; IRAC 10A) were evaluated. For each location and chemical treatment, five adults were placed on a green bean leaf disc, with five replicate discs per combination. In the Onager assay, adults remained on the leaf discs for 24 hours to allow oviposition before removal and subsequent egg counts. All leaf discs were then sprayed using a Potter's tower at each chemical's maximum field rate, diluted to 150 GPA, and mite mortality was recorded 48 hours post-application. Egg hatch was counted for Onager 8 days after application.

Table 1. Cumulative acres treated with each a.i. in Santa Barbara County from 2018-2022. Cumulative acres means if one acre was treated three times in a year, the cumulative acres would equal three acres.

	Cumulative acres treated in Santa Barbara County strawberry per year				
	2018	**2019**	**2020**	**2021**	**2022**
Cyflumetofen	5,281	5,702	7,687	10,824	14,680
Bifenazate	8,609	8,851	11,538	11,711	13,699
Abamectin	4,089	2,800	6,967	5,898	8,624
Hexythiazox	3,380	3,906	4,606	5,586	5,910

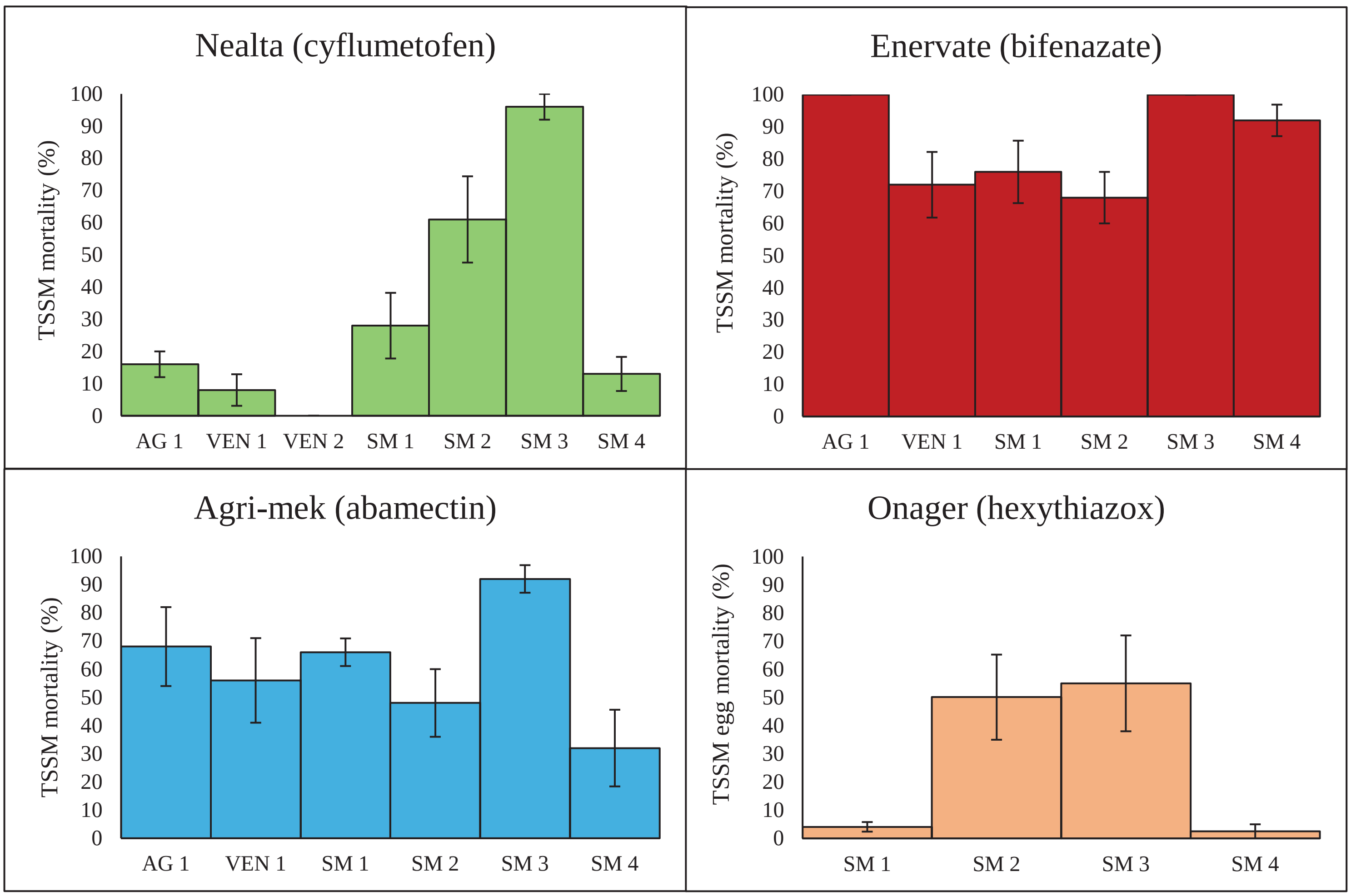

Figure 1. Mean mortality (± SE) of adult twospotted spider mites (TSSM) 48 hours after application of maximum field rate of Nealta, Enervate, Agri-Mek, and Onager. SM = Santa Maria; VEN = Ventura; AG = Arroyo Grande.

STRAWBERRIES

SOLUTIONS / PESTS	Two-spotted spider mite *Tetranychus urticae*	Carmine spider mite *Tetranychus cinnabarinus*	Lewis Mite *Eotetranychus lewisi*	Cyclamen Mite *Phytonemus pallidus*	Aphids	Thrips	Root weevil larvae
BioPersimilis *Phytoseiulus persimilis*	✓	✓					
BioPersi+ *Phytoseiulus persimilis*	✓	✓					
BioCalifornicus *Neoseiulus californicus*	✓	✓	✓	✓			
Cali Combo *Neoseiulus californicus + C. lactis*	✓	✓	✓	✓			
BioSwirski *Amblyseius swirskii*						✓	
BioCucumeris *Neoseiulus cucumeris*				✓		✓	
BioOrius *Orius insidiosus*						✓	
BioAphidius / BioErvi *Aphidius colemani / A. ervi*					✓		
BioHb *Heterorhabditis bacteriophora*							✓

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Comparison of preventative *Neoseiulus californicus* releases against a grower standard predatory mite program in fall planted strawberries

T. K. Hibino and M. A. Aghaee

This study evaluated early, high-rate preventative releases of *Neoseiulus californicus* versus a grower standard program with *Neoseiulus californicus* and *Phytoseiulus persimilis* to manage *Tetranychus urticae* and *Eotetranychus lewisi*, two important spider mite pests in strawberries. The trial was conducted on fall-planted strawberries on the Central Coast in an organic field. As a generalist, *N. californicus* preys on both *T. urticae* and *E. lewisi*, while *P. persimilis* specializes in *T. urticae*. Three treatments replicated four times were tested: a control, preventative *N. californicus*, and a grower standard program. Preventative *N. californicus* was released four times starting in Dec at 200,000 mites/acre. Grower standard *N. californicus* applications began in Jan 2025 at 30,000 and 150,000 mites/acre; *P. persimilis* was released four times beginning in Feb 2025 at 40,000 mites/acre. Results showed that the preventative *N. californicus* treatment maintained the lowest and longest average spider mite populations and was associated with healthier plants compared to the control and grower standard treatment. However, none of the treatments kept spider mite populations below the economic threshold, likely due to grower spray decisions during a critical establishment period. These results highlight the potential of early, high-rate predatory mite releases to improve spider mite control. They also emphasize the need for proper implementation and research that can help growers and PCAs on effective biological control strategies.

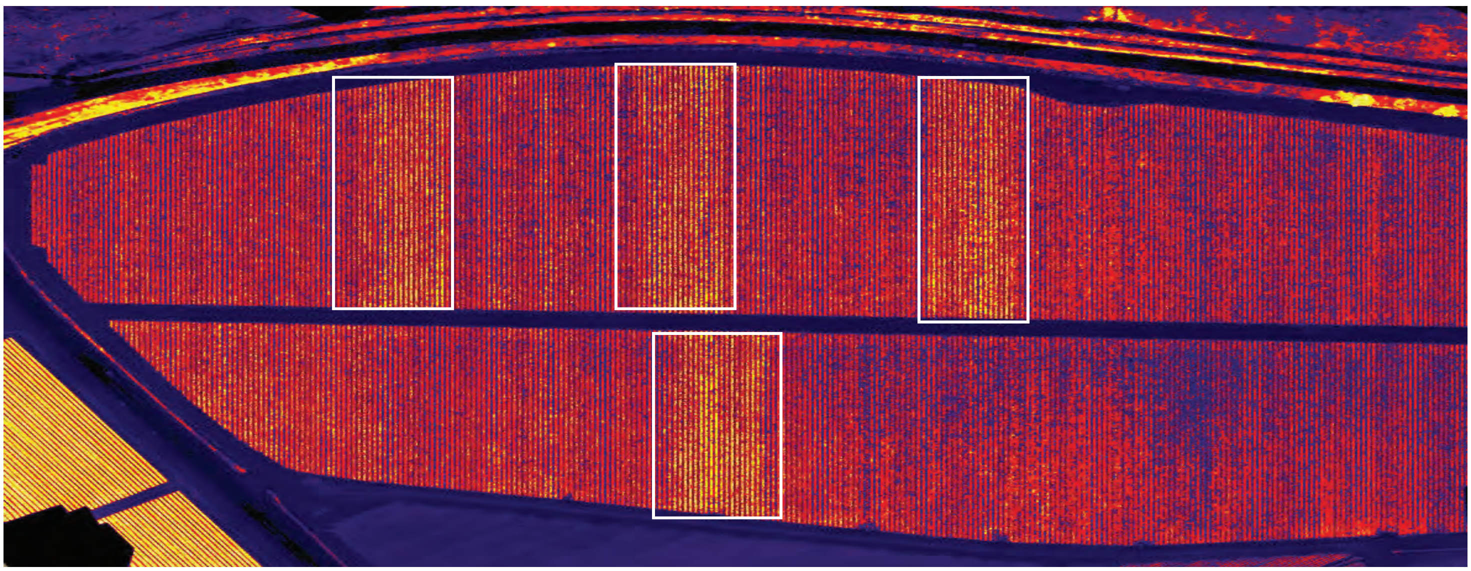

Figure 1. Normalized difference vegetation index (NDVI) image of field taken on 11 Apr 2025. White boxes indicate preventive *N. californicus* treatments.

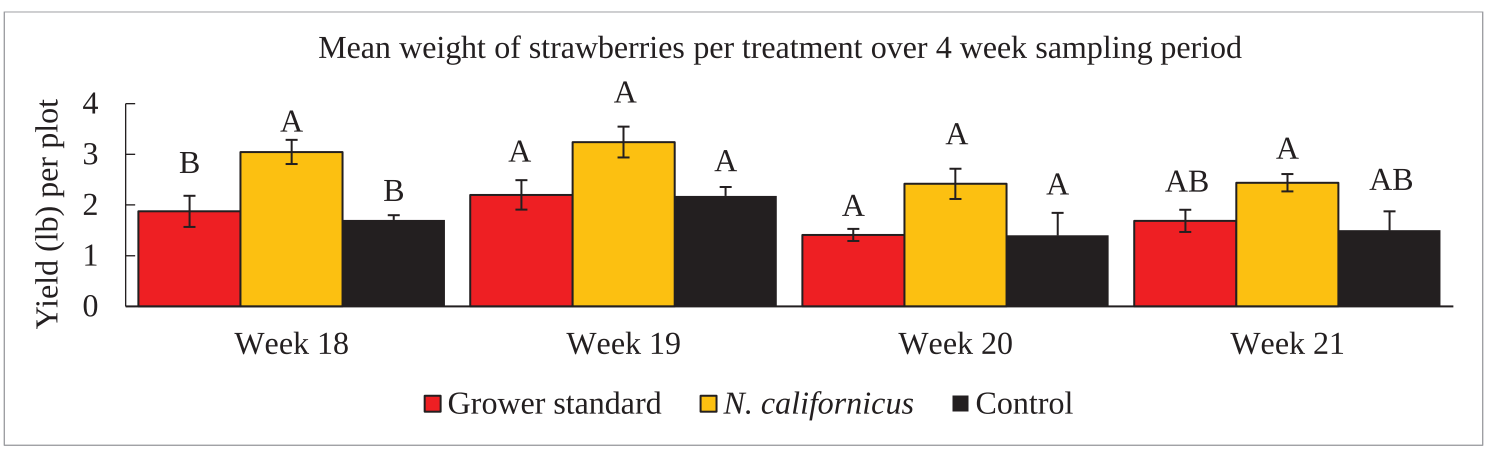

Figure 2. Mean sample fruit weight (lb) of strawberries from 60 plants per replicate for each treatment taken in Apr and May 2025. Data was analyzed using Proc Glimmix in SAS 9.4. Bars sharing the same letters are not significantly different according to Tukey HSD test. Error bars represent the standard error of the mean.

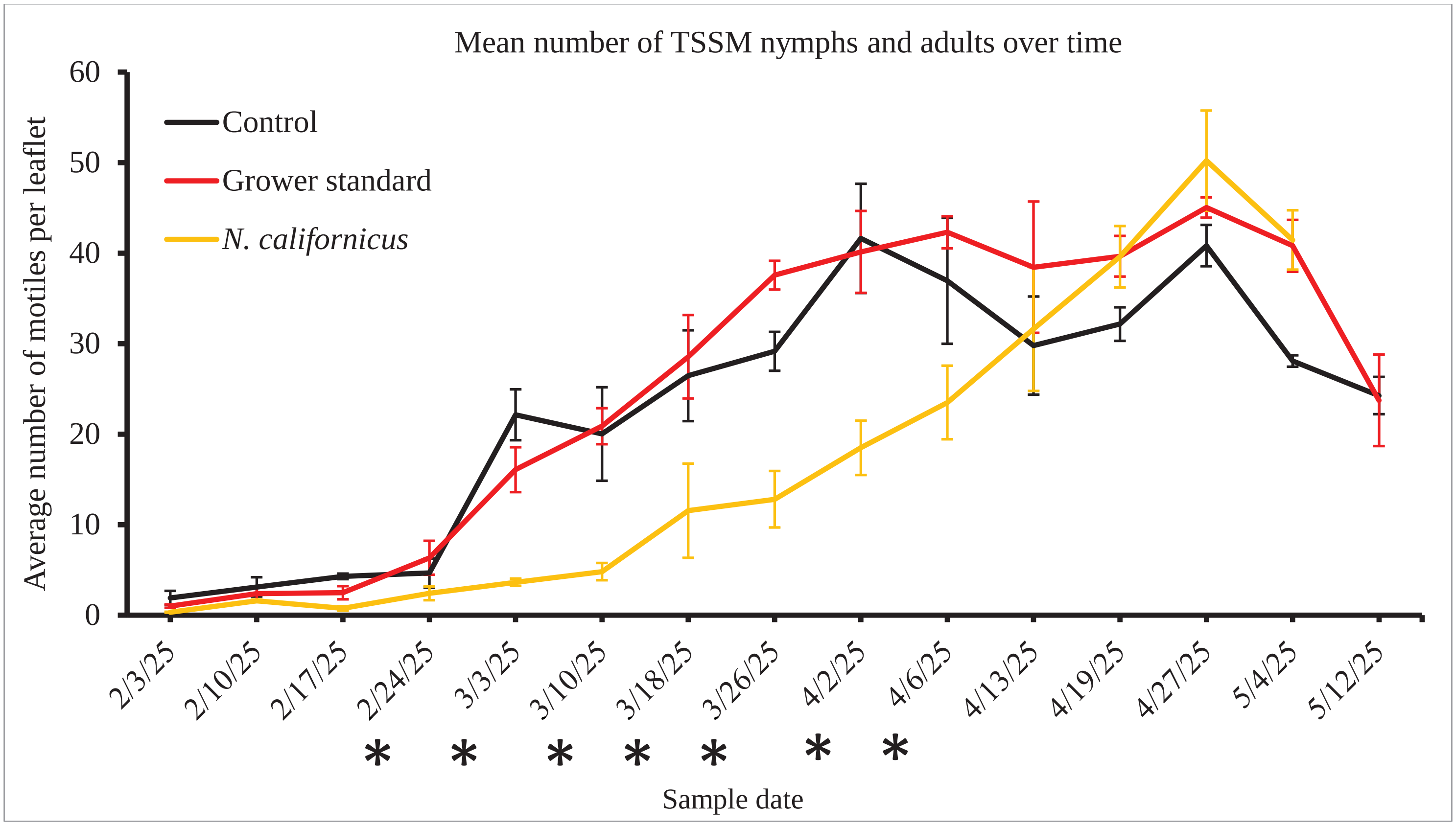

Figure 3. Mean sample populations of *Tetranychus urticae* per leaflet over time across four predatory mite treatments. Data was analyzed using Proc Glimmix in SAS 9.4 using a Poisson distribution. Bars with * are significantly different according to Tukey HSD test and represent where *N. californicus* had the lowest number of prey mites.

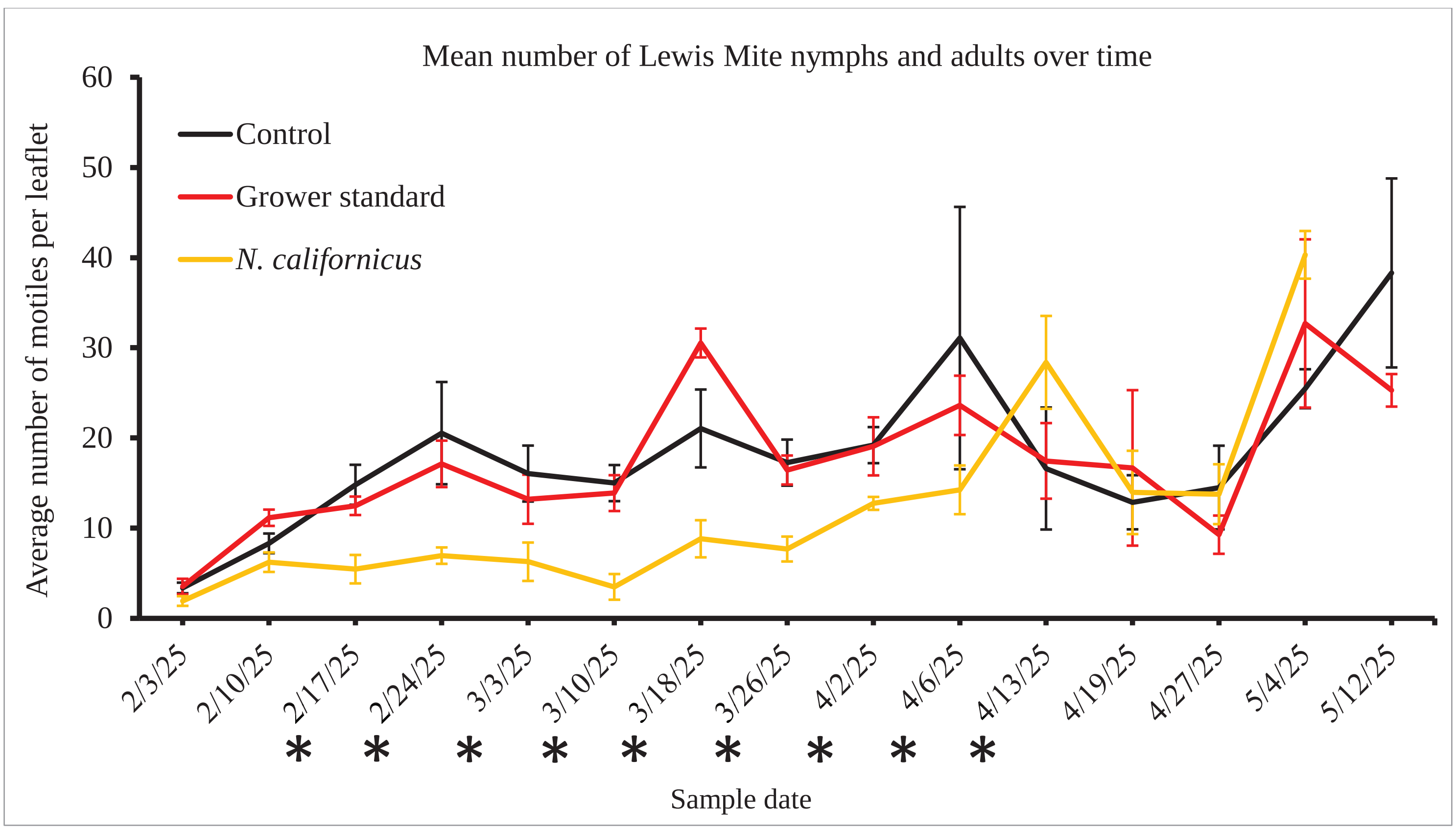

Figure 4. Mean sample populations of *Eotetranychus lewisi* per leaflet over time across four predatory mite treatments. Data was analyzed using Proc Glimmix in SAS 9.4 using a Poisson distribution. Bars with * are significantly different according to Tukey HSD test and represent where *N. californicus* had the lowest number of prey mites.

Assessing quality control methods of commercially reared *Phytoseiulus persimilis* for biological control

T. K. Hibino and M. A. Aghaee

In 2024, we evaluated the quality of commercial *Phytoseiulus persimilis*, a key predatory mite used to manage twospotted spider mites (*Tetranychus urticae*) in California strawberries. Three evaluation methods were tested: the lab's original "Old Method," which uses a heated lamp to drive mites down onto sticky cards through a sieve; the International Organization for Biological Control's (IOBC) subsampling method to estimate live and dead mites; and a reverse Berlese method that uses light to draw mites upward (Fig. 1). Thirty bottles were assessed to compare mite recovery rates and method reliability. Using the Old Method, recovery dropped from roughly 70% in 2k bottles to 40% in 4k bottles. IOBC recovery ranged from roughly 50% to over 60%, with greater variability in the 4K bottles. The recovery using reverse Berlese method was consistent for 2k bottles, around 90%, but fell to around 60% in 4k bottles (Fig. 2). These preliminary results highlight the variation in quality and method reliability, emphasizing the need for continued testing.

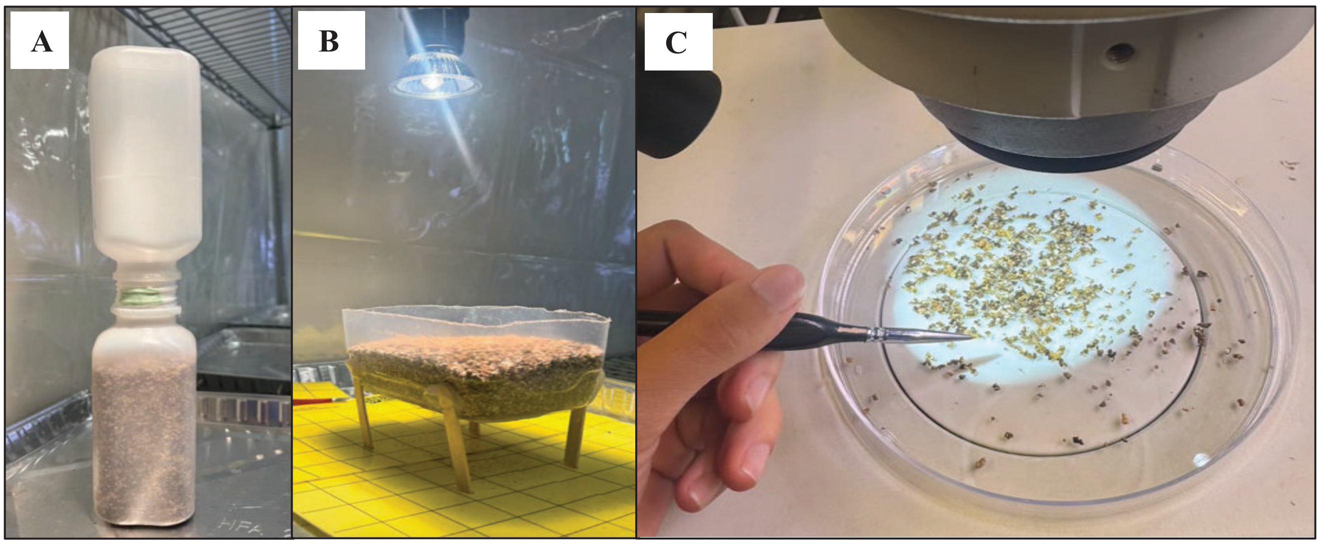

Figure 1. Methods used to assess the quality of *Phytoseiulus persimilis*: the reverse Berlese method (A), the "Old Method" (B), and the IOBC subsampling method (C).

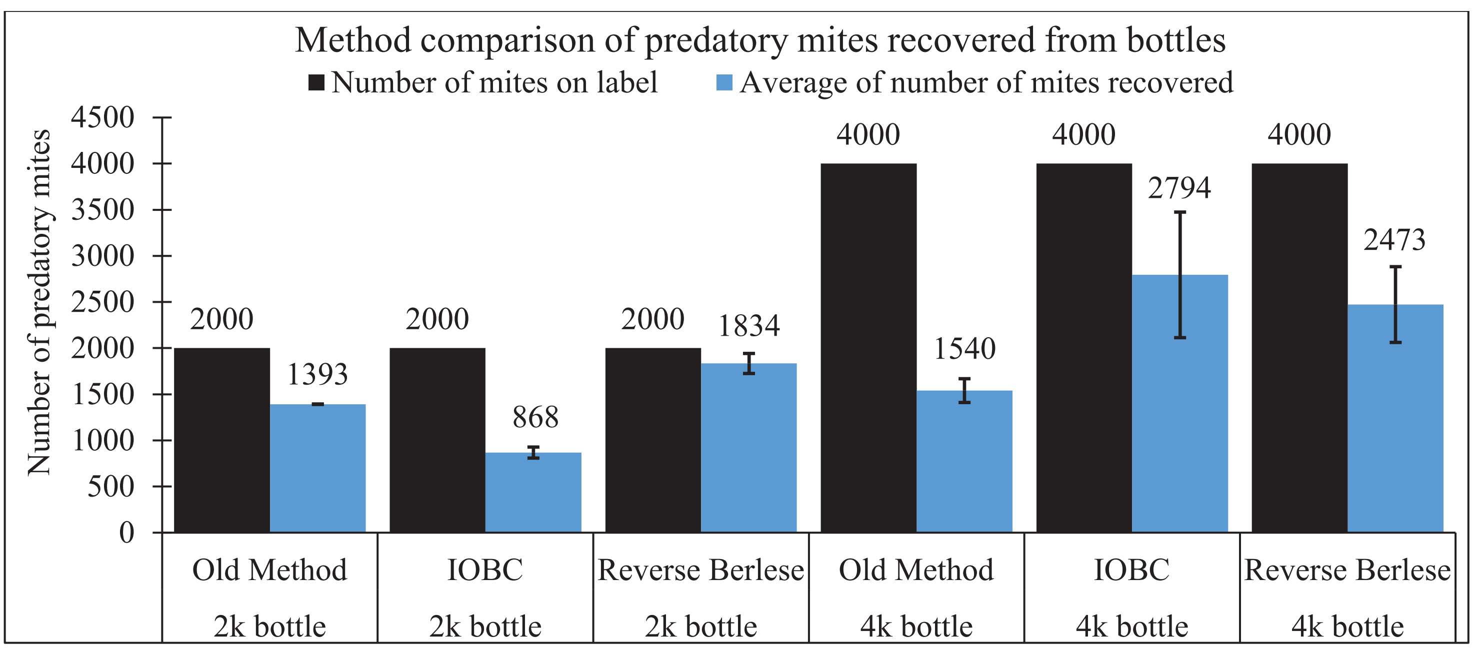

Figure 2. Comparison between the labeled number of mites (2k or 4k) and the average number of mites recovered using the "Old Method", IOBC, and reverse Berlese methods. Error bars represent the standard error of the mean. Data has not been analyzed for statistical differences.

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Depth (in)	Date of measurement: **one day before application** Location: **Block #7 Reservoir** West Side	Center	East side	Date of measurement: **7 days after application** Location: **Block #7 Reservoir** West Side	Center	East side	
0"	48	33	30	17	13	10	
1"	49	77	35	19	13	10	
2"	112	80	74	19	14	17	
3"	159	88	89	25	24	26	71%
4"	178	94	87	27	38	29	
5"	236	120	133	43	63	50	
6"	241	125	184	53	79	71	
7"	285	134	193	76	99	79	
8"	328	138	190	94	106	76	
9"	324	161	253	103	122	87	-56%
10"	304	148	285	100	113	87	
11"	274	140	273	110	133	90	
12"	270	159	255	100	143	99	
13"	288	239	270	106	156	119	
14"	359	310	281	126	154	150	
15"	433	315	327	121	154	152	-59%
16"	433	344	354	125	158	150	
17"	432	392	353	141	145	143	
18"	400	373	347	144	164	175	

Strawberries compated soil levels: 0 - 90 PSI Light; 91 - 120 PSI Moderate; >120 PSI High

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NOTES - Strawberry Field Day

THANK YOU FOR ATTENDING FIELD DAY!

We can't wait to see you next year!