Management of Pythium wilt of lettuce

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Pythium wilt of lettuce: Symptoms aboveground

- Infected plants are characteristically smaller, contrasting with healthy adjacent plants
- Outer/older leaves are yellow and wilted
- Infected plants look “water-stressed”
- At early stages wilting occurs during the warmest point of the day while plants recover during the night
- Eventually symptoms become irreversible leading to plant desiccation and death

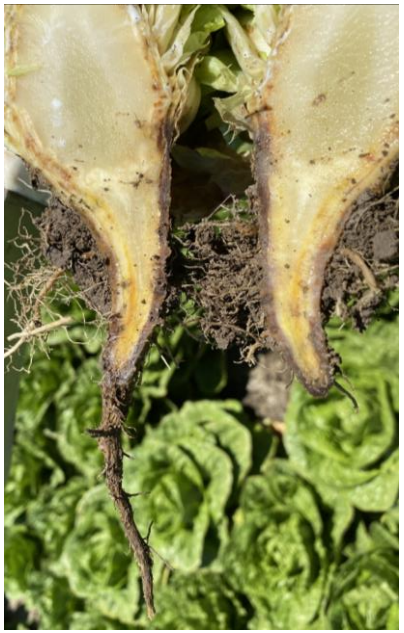



Pythium wilt of lettuce: Symptoms belowground

- Taproot of infected plant is misshapen, rough, discolored, and lacking in secondary rootlets
- Root depth is severely impaired with water-soaked and typically necrotic tissue
- External necrosis with no vascular discoloration (exception of advanced infection)







Disease field identification

Disease field Progression

Sept 29 (5 wks/post-planting)

Oct 21 (8 wks/post-planting)

Nov 9 (11 wks/post-planting)

Pythium Wilt Epidemiology: Field observations

- Survival in agricultural soils for extended periods of time
- Greater susceptibility to infection in saturated (poorly-drained or over-irrigated) soils where root growth and natural defense responses are reduced due to low oxygen
- Tail ends of fields are often more severely affected




On-Farm Pythium Wilt Management Trials

Evaluate fungicide and non-chemical products and application strategies

Focus: testing different modes of action and different application methods (seed treatment, drip, backpack sprayer, etc.), timing and rates

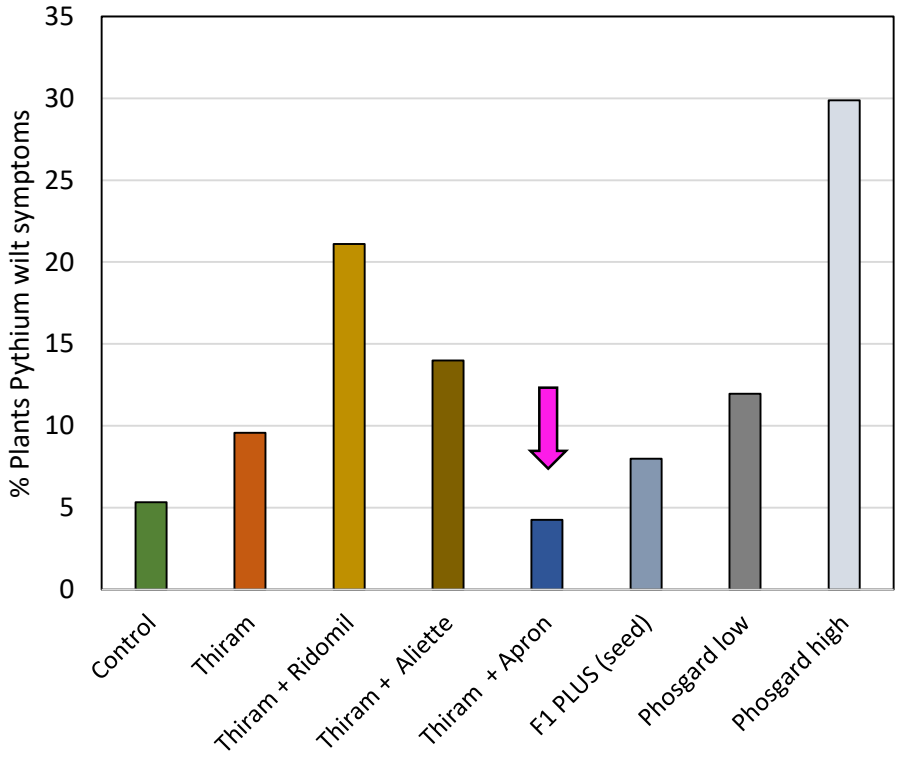
Objective: Assess the efficacy of seed and soil fungicide treatments to control Pythium wilt

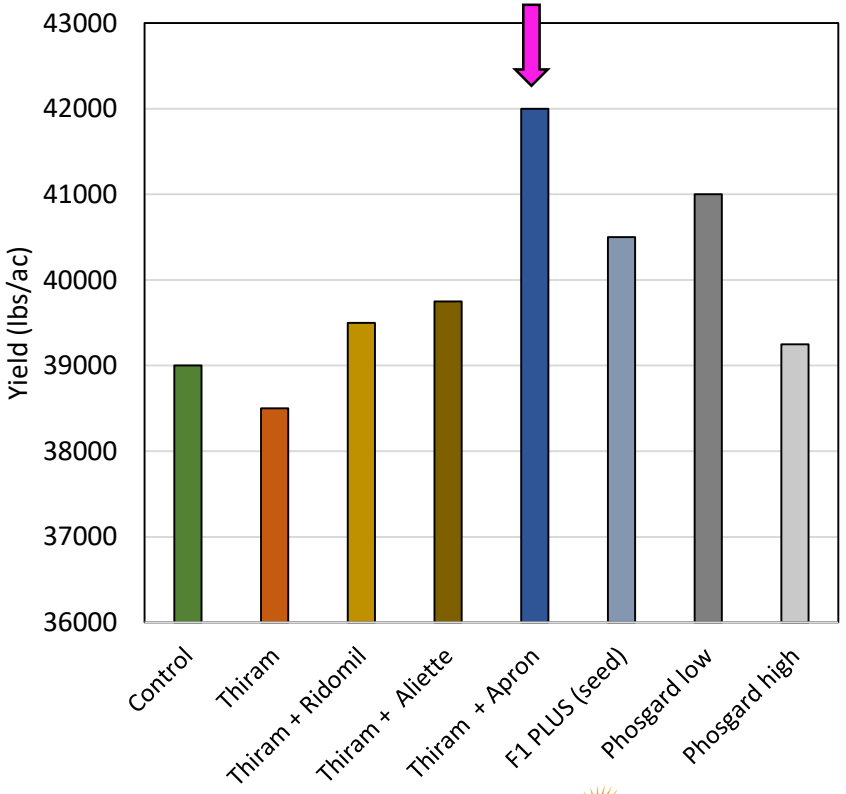
Rafael Davila

Bonduelle

Locations: Chualar, Salinas
Romaine, variety Arroyo
Planting 6/11/21
Harvest 8/9/21

Thiram (Tetramethylthiuram disulfide) [seed]
Aliette (Fosetyl-Al) [drench]
Ridomil Gold (Metalaxyl) [drench]
Apron (Metalaxyl) [seed]
F1 Plus (Biological) [seed]
Phosgard (Phosphoric Acid) [foliar]





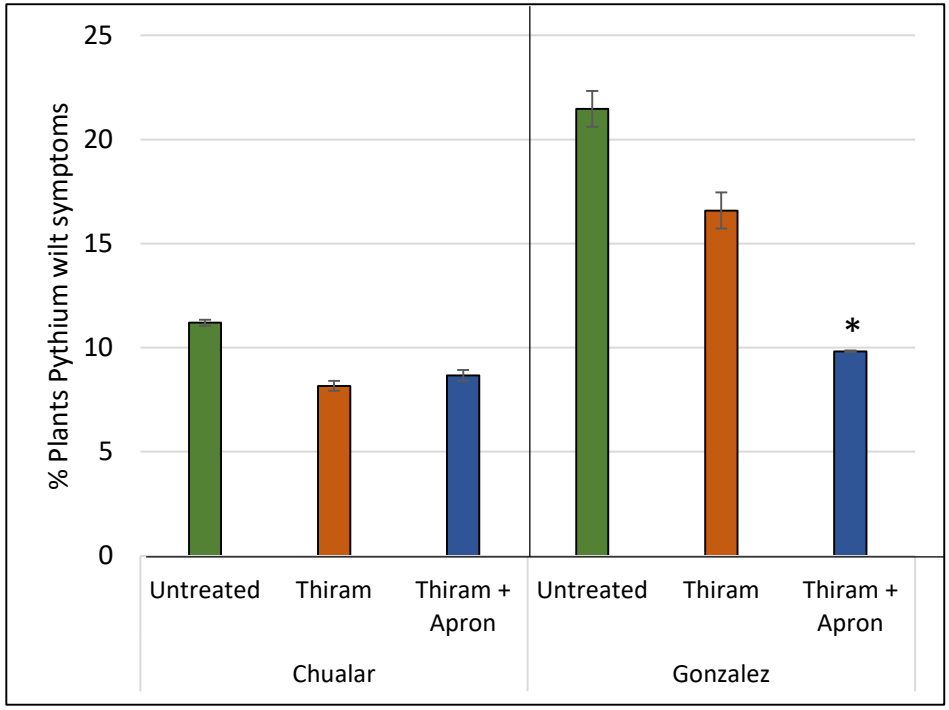
GOWAN SEED COMPANY

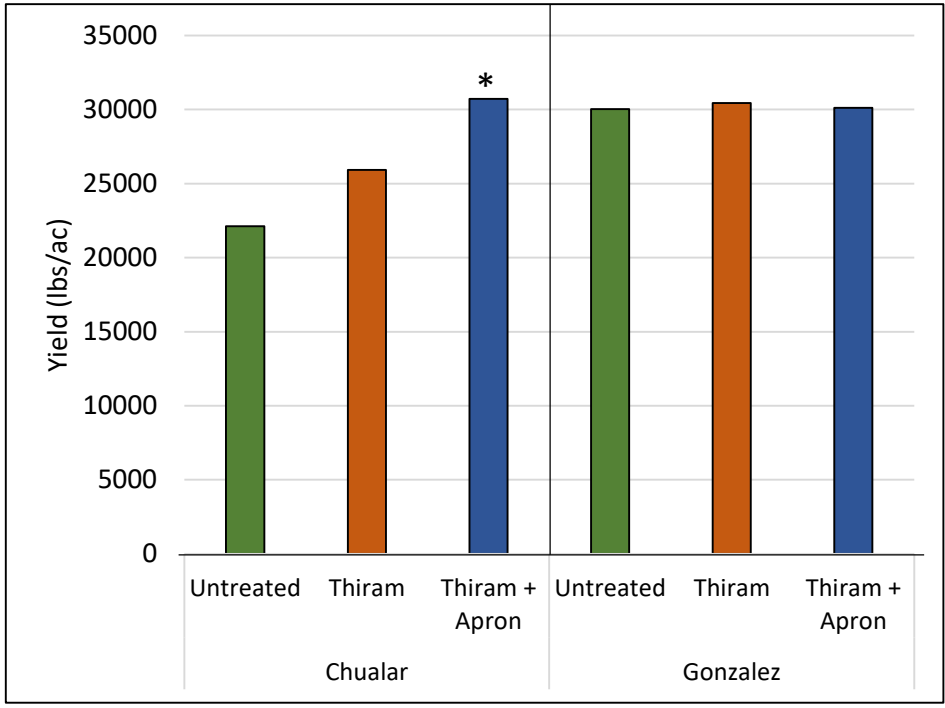
SETECO

Objective: Assess the efficacy of Thiram (Tetramethylthiuram disulfide) and Apron XL (Mefenoxam) seed treatment to control Pythium wilt

Locations: Chualar, Gonzalez
Romaine, variety Arroyo
Planting 8/25/21
Harvest 11/12/21
Weekly stand counts, and final evaluations

Untreated
Thiram [seed]
Thiram + Apron [seed]





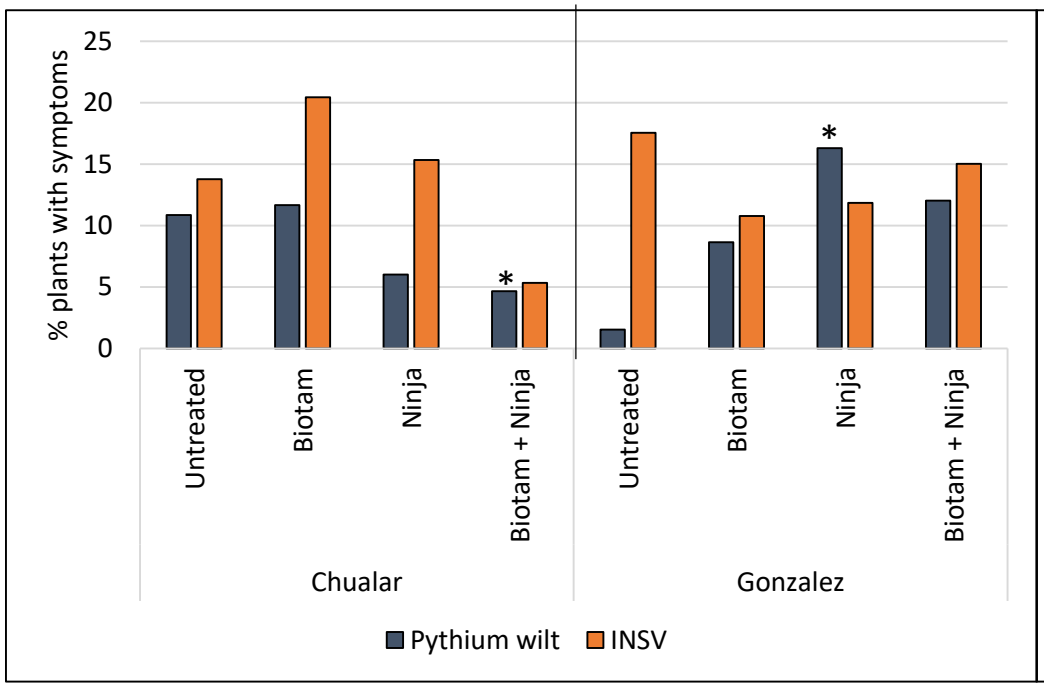
* Significant diff. from untreated ($P = 0.05$)

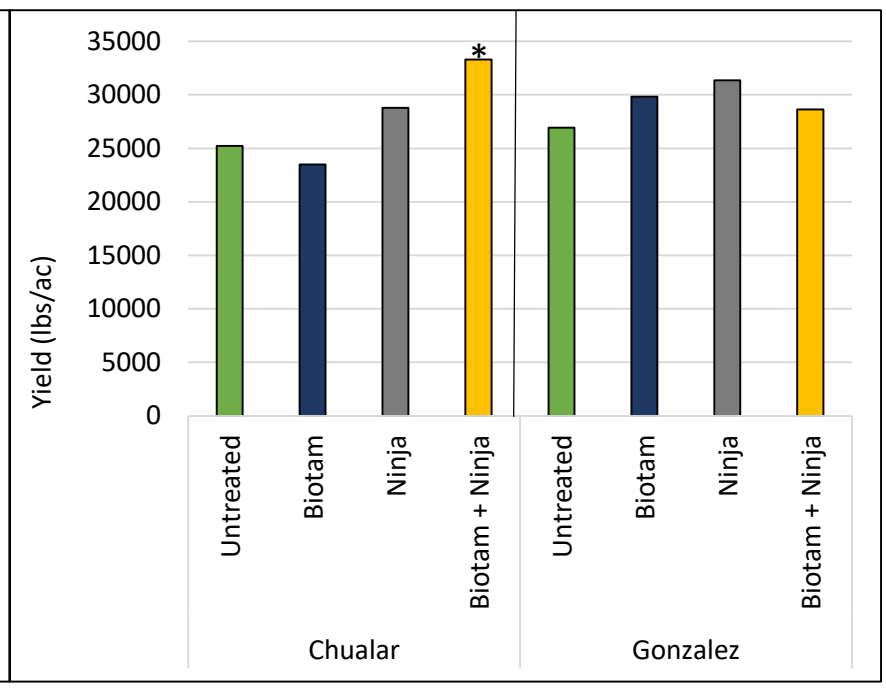
Objective: test the field efficacy of non-chemical products for the management of Pythium wilt and INSV

Locations: Chualar, Gonzalez
Romaine, variety Arroyo
Planting 8/25/21
Harvest 11-12-21
Weekly stand counts, and final evaluations

-Untreated
-Biotam (7.5oz/ac)
-Ninja (11 oz/ac)
-Biotam (7.5oz/ac) + Ninja (11 oz/ac)

5 drench weekly applications





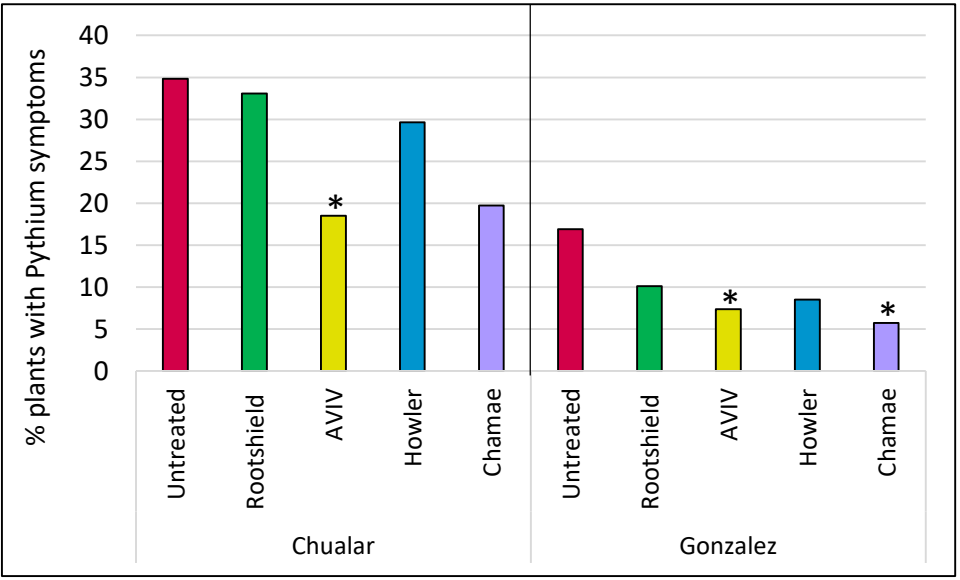
* Significant diff. from untreated ($P = 0.05$)

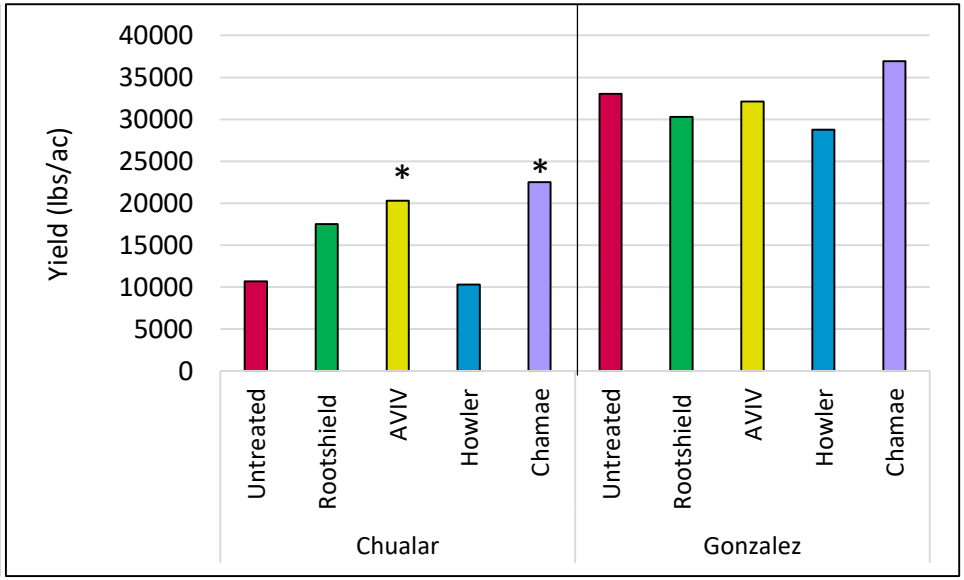
Objective: evaluate the efficacy of commercial non-chemical (microbial and plant-based) products to control Pythium wilt

Locations: Chualar, Gonzalez
Romaine, variety Arroyo
Planting 8/25/21
Harvest 11-12-21
Weekly stand counts, and final evaluations

- Untreated
- [1]Rootshield (*Trichoderma*) [ab]
- [2]AVIV (*Bacillus subtilis*)[ab]
- [3]Howler (*Pseudomonas chlororaphis*)[ab]
+ Theia (*B. subtilis*)[a]
- [4]Chamae (pepper plant liquid fertilizer)

[a] OMRI approved
[b] Leafy greens registered
[1-3]drench applications around based of the plant
[4] foliar application





* Significant diff. from untreated ($P = 0.05$)

Seed treatment and non-chemical trials

- At the end of these trials, Pythium wilt infection (and INSV) was moderately distributed across the field trial, but largely accumulated in areas with saturated soils

- Seed treatment could represent an alternative to manage disease in fields with fields with history if disease

- Non-chemical products have potential for organic production AND/OR to complement conventional management practices

On-Farm Fungicide Trials

- 12 fungicide trials were established from July to October evaluating the following materials:

Aliette (Fosetyl-Al)

Ridomil Gold (Metalaxyl)

Previcur Flex (Propamocarb)

Ranman (Cyazofamid)

Minuet (*Bacillus subtilis*)

LifeGuard (*Bacillus mycoides*)

- Materials were sprayed on and watered in, or

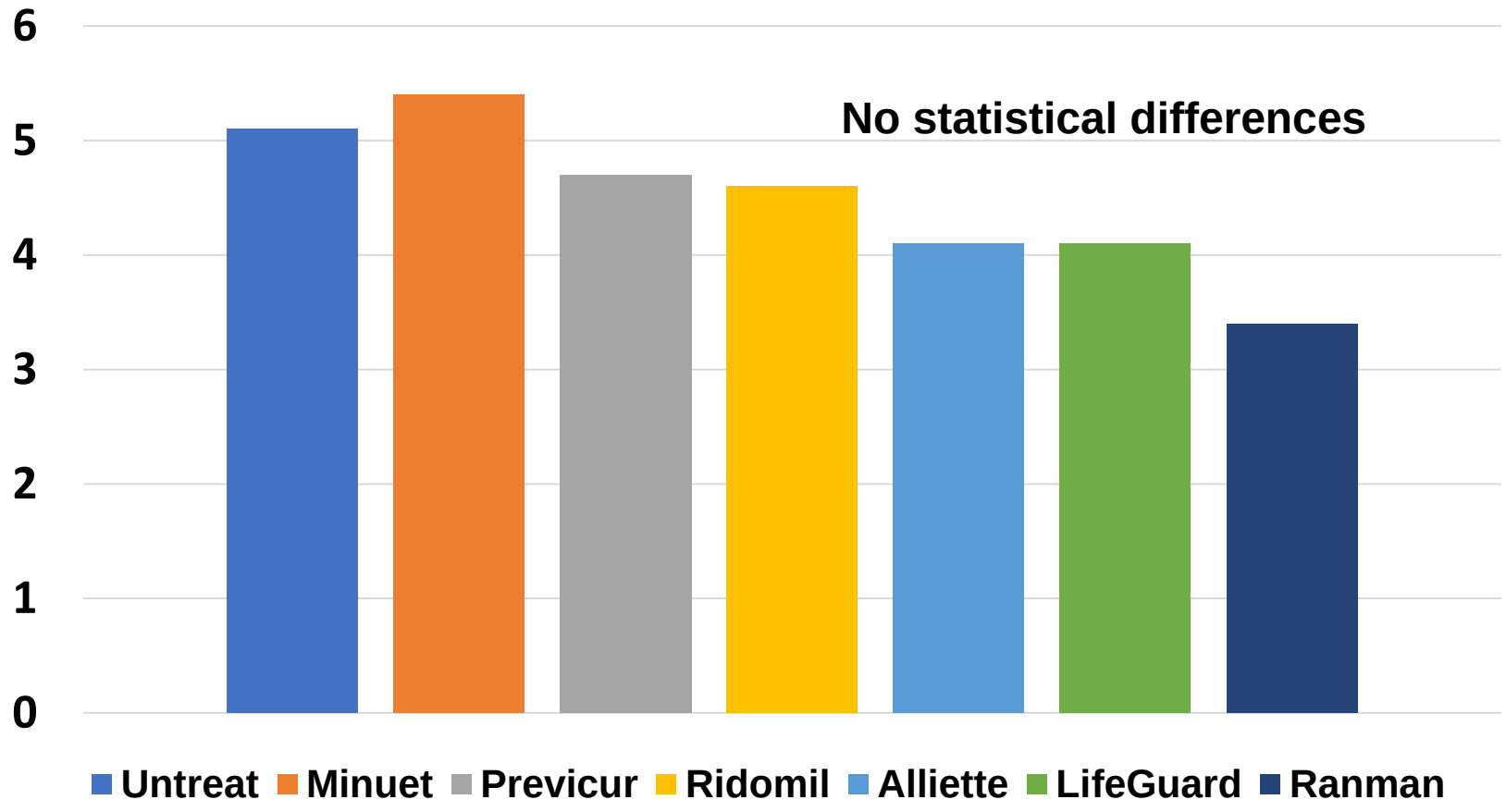
injected in the drip system (separate trials)

- Early fungicide trials were not successful to little disease development

- The later trials yielding more data

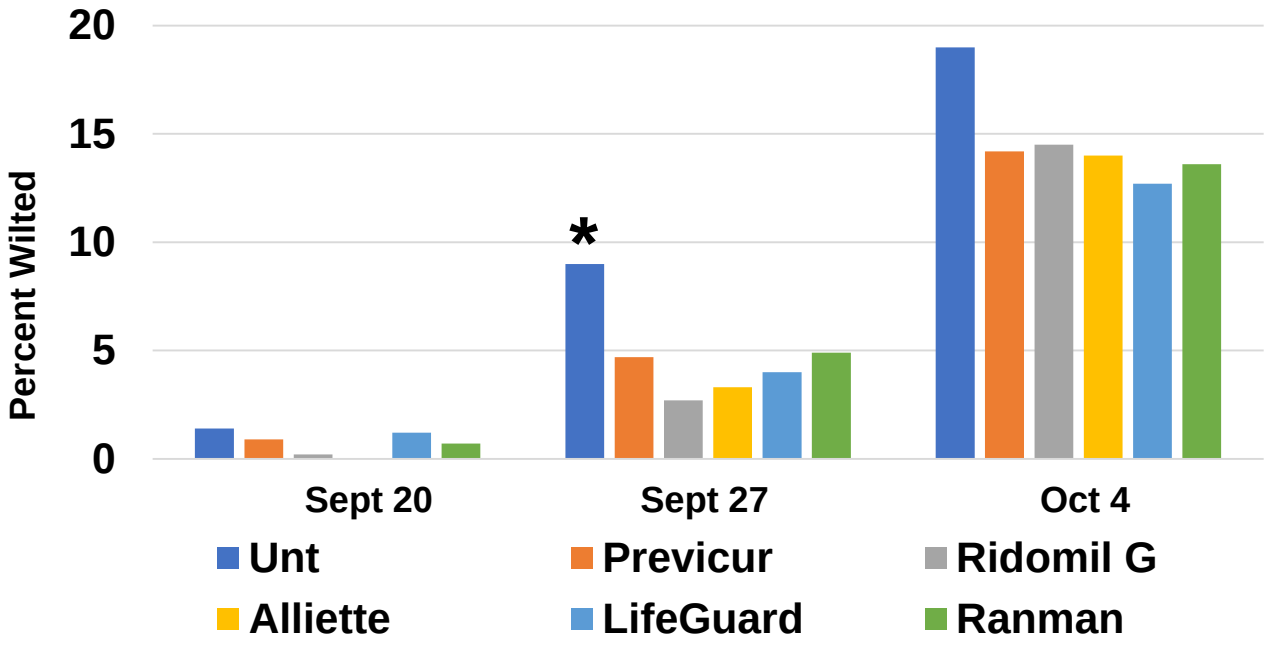
Fungicides Sprayed on and Watered in with Sprinkler Irrigation

Overall Mean (10 trials)



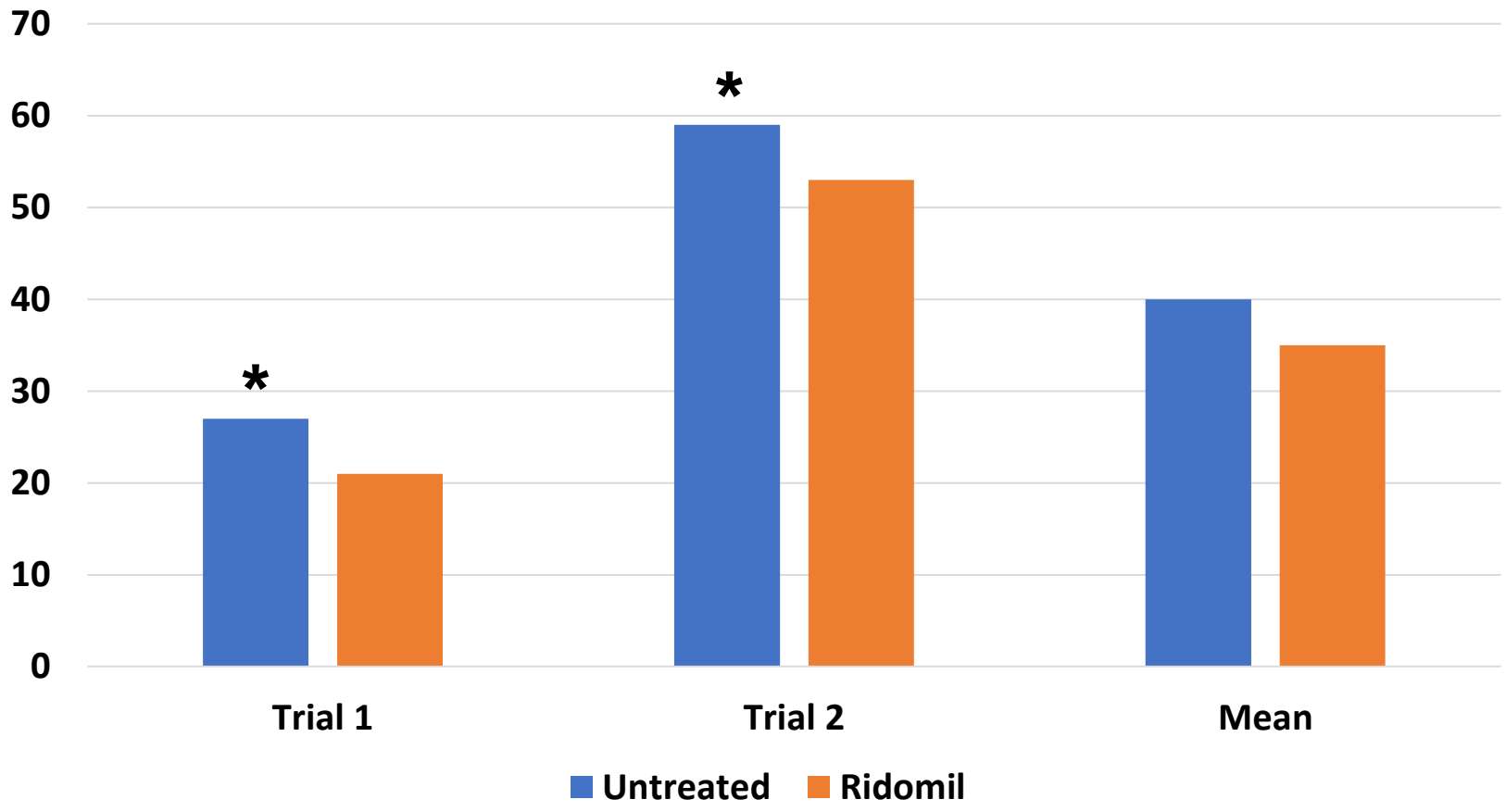
Fungicides Sprayed on and Watered in with Sprinkler Irrigation

Applications made at planting July 28; Thinning August 17; Rosette August 27 full rate at each application



*** P = 0.0346**

Ridomil Injected into the Drip System



Trial 1: One application (rosette); Trial 2: Two applications (thinning & rosette)

Fungicide Trial Conclusions

- **Spraying the fungicide and watering it in with sprinkler irrigation was only effective in one of 10 trials.**
- **Injecting Ridomil Gold in the drip system gave more of a positive signal than spraying it on and watering it in**
- **The effect however was marginal in two trials**

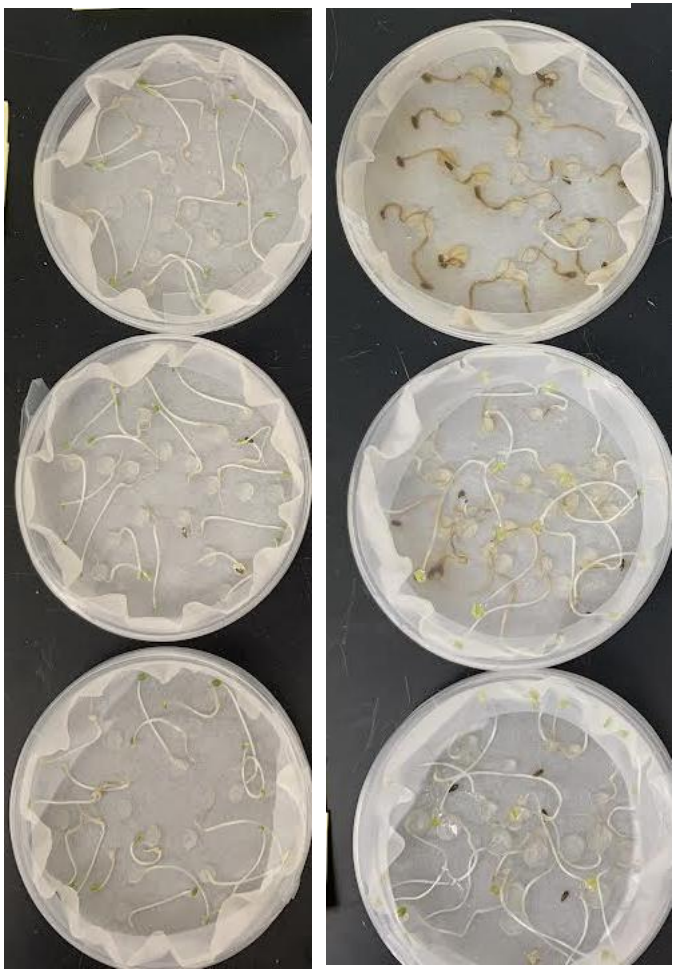
Pathogenicity

Day 1 Day 5

Isolate 1

Isolate 2

Control



Rhizoboxes

Pot-trials

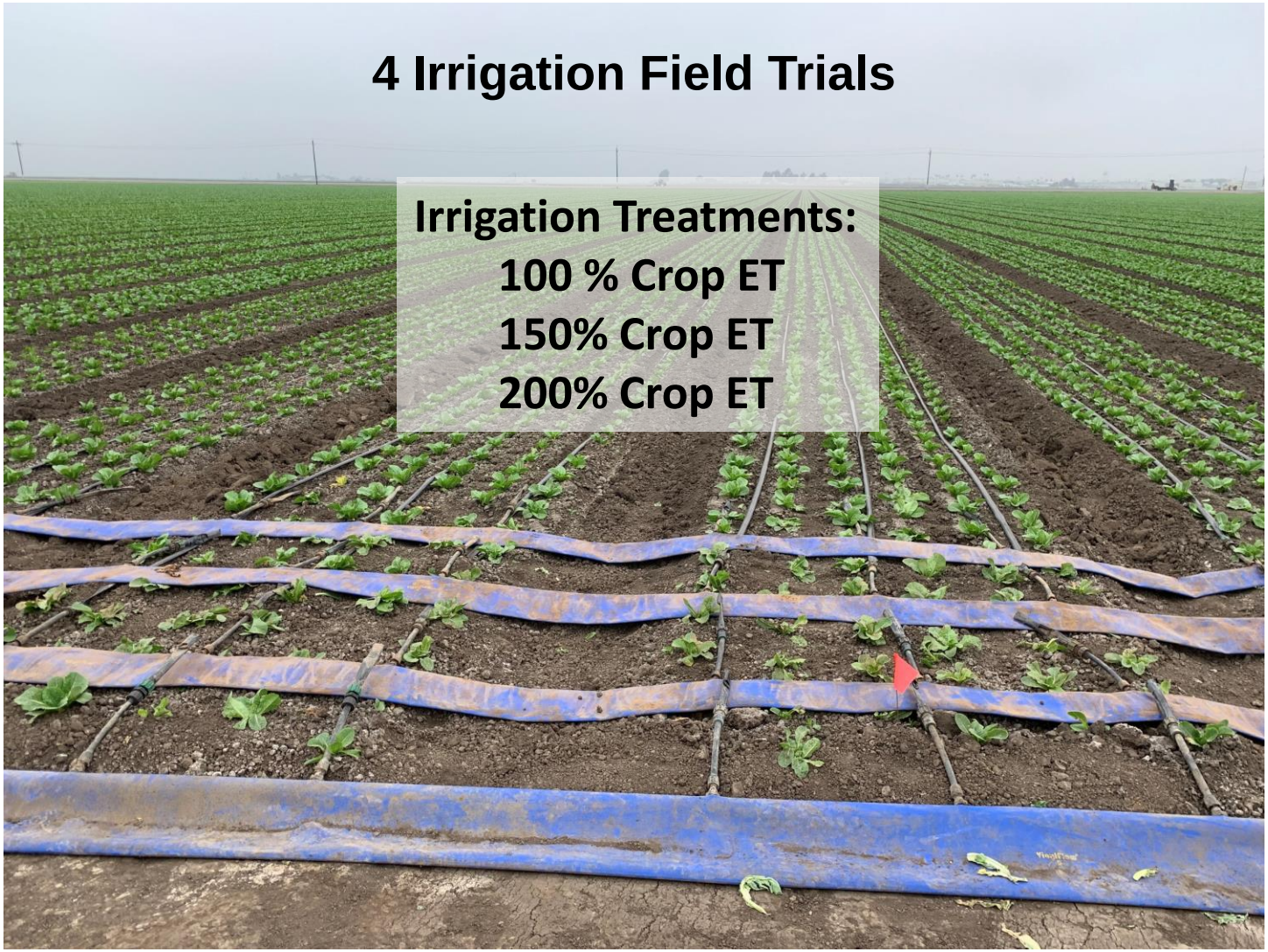
This trials, alone with field trials can allow us to better characterize variety susceptibility

Variety Susceptibility to Soilborne Pathogens

Variety	Total Wilted Plants Percent	Percent of Wilted Plant			
		Pythium	Vascular wilt	Vascular wilt & Pythium	Sclero.
Sept 17					
Salvius	31.3	18.2	60.6	12.1	0.0
Momentus	1.5	0.0	100.0	0.0	0.0
Vicious	8.4	---	---	---	---
Oct 1					
Salvius	47.6	56.7	6.7	20.0	16.7
Boronda	13.7	76.7	3.3	3.3	16.7
Copious	3.5	10.0	0.0	0.0	83.3
Klondike	36.8	50.0	10.0	33.3	6.7

Other Varietal Observations

- **Momentous and Copious are produced by Nunhems seed**
- **Seed company variety trials showed resistant romaine varieties from other companies other companies**
- **Teengreen was observed to be very tolerant to Pythium when grown right next to blocks of romaine that had significant infection**


4 Irrigation Field Trials
Irrigation Treatments:
100 % Crop ET
150% Crop ET
200% Crop ET

Effect of Irrigation Amount on the Incidence of Pythium Wilt

Irrigation Treatment	Trial 1	Trial 2	Trial 3	Trial 4
100% ET	4.1	5.3	25.9	14.9
150% ET	4.5	5.0	---	15.9
200% ET	4.4	5.0	32.8	15.4

Irrigation Treatment	Total wilted plants Percent	Percent of Total		
		Pythium wilt	Sclerotinia	Vascular wilt
100% ET	4.1	41.4	39.0	19.5
150% ET	4.5	40.0	46.7	13.3
200% ET	4.4	34.1	59.1	6.8
100% ET	5.3	100.0	0.0	0.0
150% ET	5.0	100.0	0.0	0.0
200% ET	5.0	100.0	0.0	0.0
100% ET	25.9	95.0	0.0	5.0
200% ET	32.8	90.0	0.0	10.0
100% ET	14.9	31.3	68.8	0.0
150% ET	15.9	46.3	53.8	0.0
200% ET	15.4	37.5	62.5	0.0

Summary of Irrigation Trials

- **Excess irrigation water did not seem to aggravate the incidence of Pythium wilt of lettuce in these trials**
- **This was surprising given the biology of Pythium wilt and its prevalence at the bottom end of fields**
- **These finding may point to the importance of other factors that stimulate outbreaks of Pythium wilt in particular fields and in the general area**

Overall what we have learned so far

- Disease occurrence heavily influenced by environmental conditions AND by other stresses
  - Spring crop could lead to greater inoculum in the fall (specially for field with high disease in previous year)

- Different treatments have shown promising results, but only when high disease pressure
  - Mode of application
  - Timing

- Further work is needed to evaluate the efficacy of cultural practices, AND their combination with chemical and biological applications