There's a Plasmodiophorid in My Potatoes!

Managing Powdery Scab and PMTV

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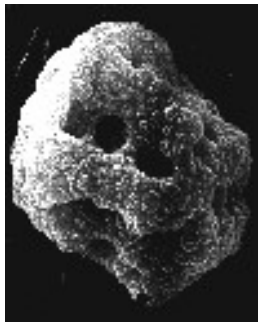
Spongospora subterranea subsp. *subterranea* (Protozoa)

Photo from Ueli Merz



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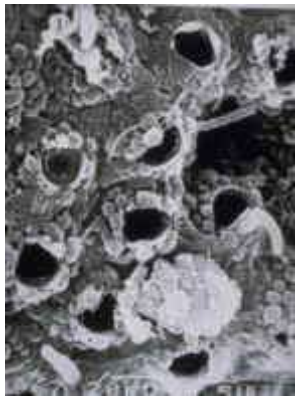

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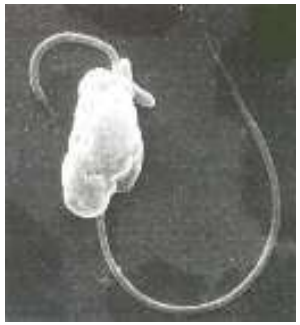

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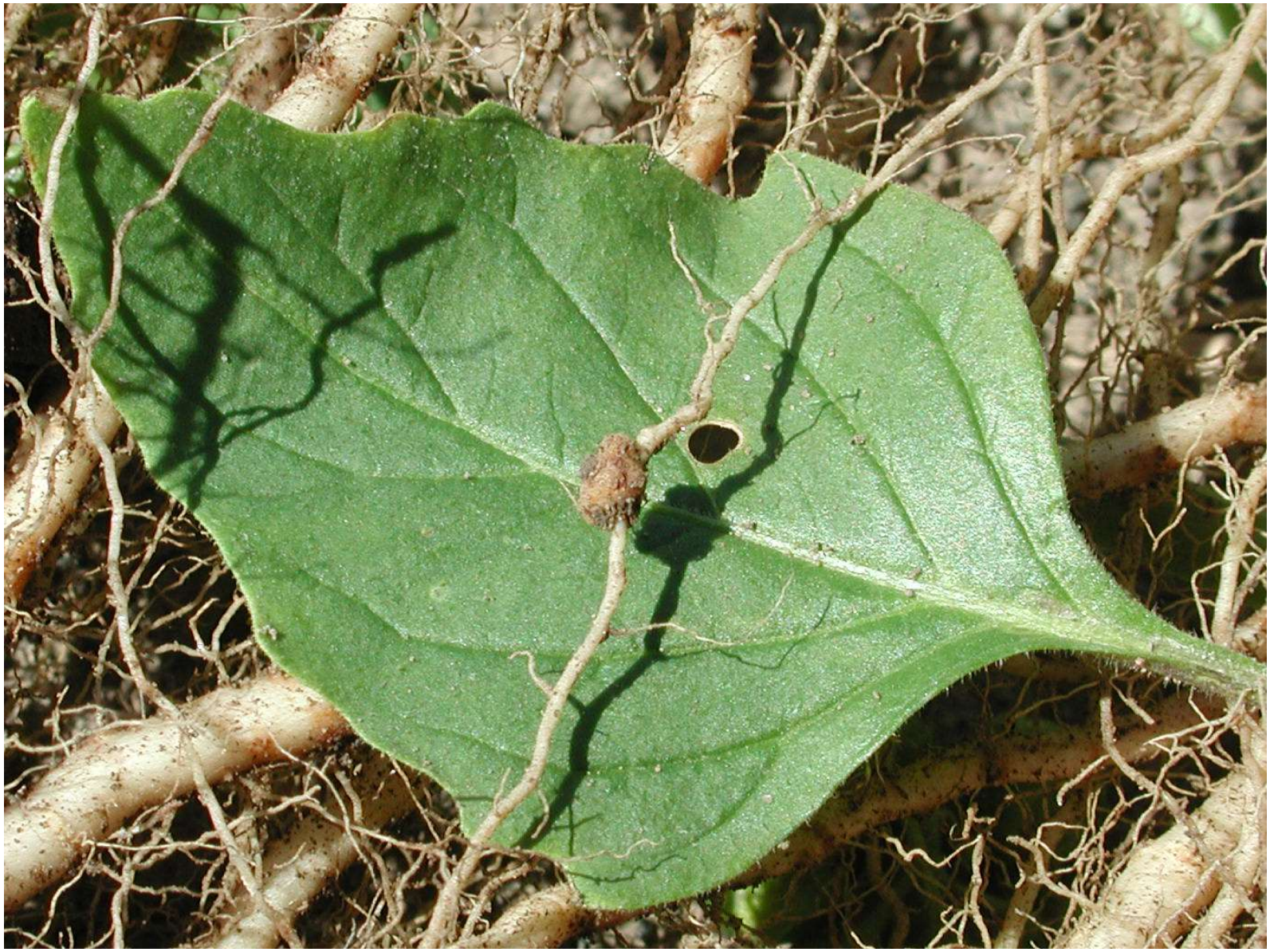
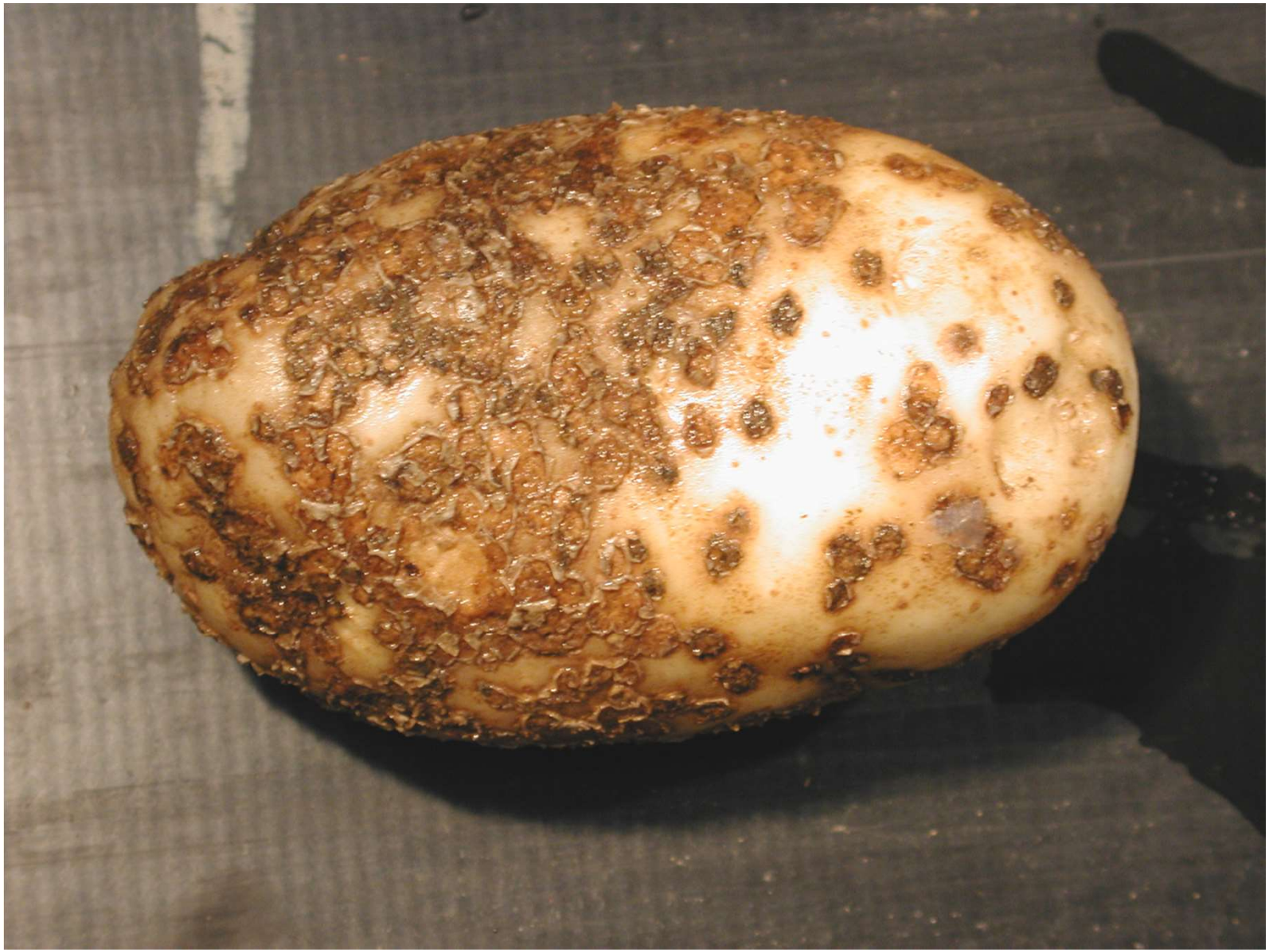




PMTV

- Foliar symptoms not associated with primary infection.
- Foliar = similar to calico.
- Symptoms favored by cool weather.
- Tuber = necrotic arcs (may require alternating storage temperatures to develop).
  - Can look like TRV, PVY^{ntn}, internal brown spot
- Symptoms increase with time in storage
- Can cause external symptoms

PMTV

TRV

Photos courtesy of Jonathan Whitworth

Which one is PMTV? TRV?

Photo courtesy of Jonathan Whitworth

PMTV Positive

Powdery Scab Disease Cycle

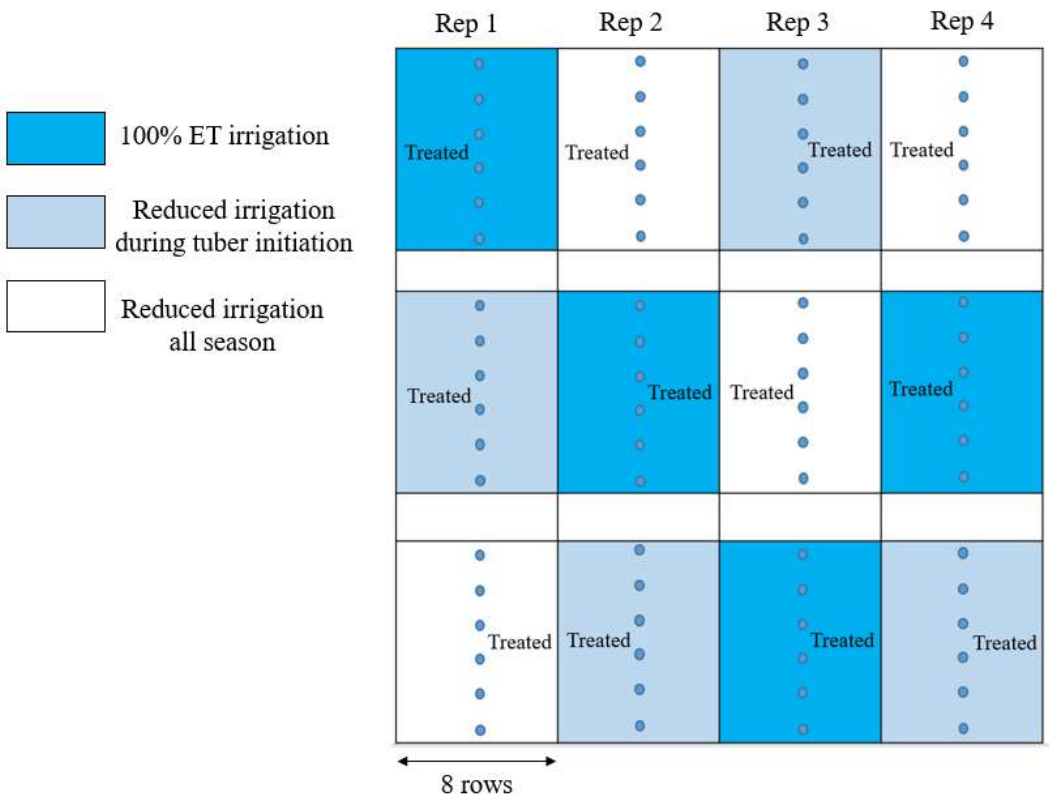
- Environmental conditions which favor disease:
  - Cool, wet soil
  - 52-65°F
  - Alternating wet/dry conditions
  - Excessive soil moisture (especially 3-4 weeks after TI)
- Sandy soils and poor drainage more conducive for disease.
- Tuber infection typically occurs at tuber initiation.
- Very little inoculum required to cause disease.

Powdery Scab Management Recommendations

1. Plant disease-free seed
2. Avoid planting in contaminated, poorly drained soils
3. Avoid the use of manure if animals have ingested infected tubers
4. Rotate out of infested fields for >5 years (12 yr survival)
5. Plant resistant cultivars
6. Avoid tomato in crop rotation and control nightshade
7. Manage irrigation water

Compendium of Potato Diseases, 2nd Ed.
Falloon, AJPR (2008) 85:253-260

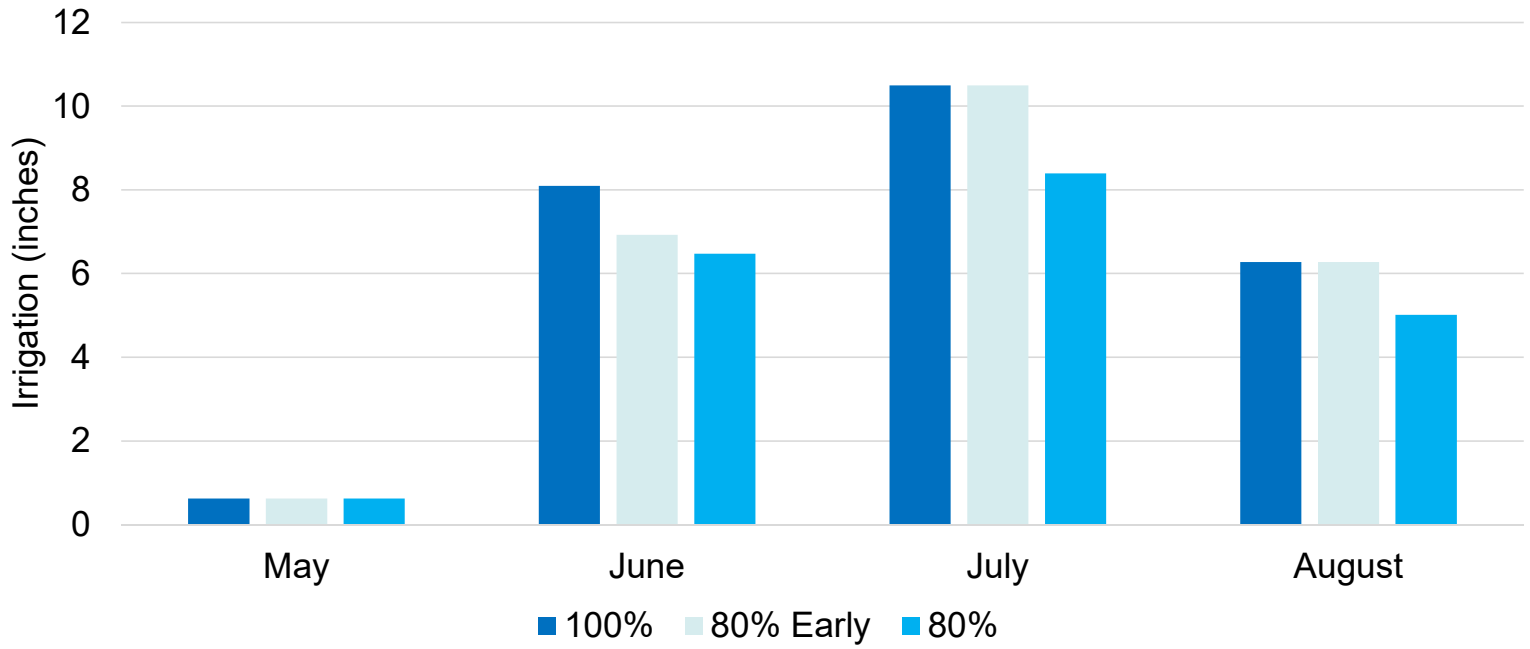
Experimental Design



First time varying moisture tested against PS/PMTV in the field.

2021 Irrigation Treatments

Source	May	June	July	August	Total	% of Total
1. 100% ET	0.63	8.10	10.50	6.28	25.51	100
2. 80% ET early	0.63	6.93	10.50	6.28	24.34	95
3. 80% ET	0.63	6.48	8.40	5.02	20.53	80
Rain	1.05	0	0.06	0.15	1.26	



Effect of Irrigation on Mop-Top Symptoms (Harvest) – 2021

	Visual Mop-Top	Total Yield	% US#1	% Culls
100% ET	11	462 a	69 a	5.0 a
80% ET early	11	390 b	62 b	6.2 a
80% ET	9	348 b	58 b	9.5 b
Untreated	9	404	64	6.8
Omega (3 pt/acre)	10	396	62	7.0

Cultivar: Alturas
No root galls observed during the season

Reducing irrigation water and applying Omega did not reduce mop-top symptoms.
Reducing irrigation water resulted in significant yield and quality reductions.

Effect of Irrigation on Mop-Top Symptoms (Storage) - 2021

	Visual Mop-Top	% Arcs/Rings	% Blotch	% Spots
100% ET	10	2.0	1.6	6.0
80% ET early	11	3.0	1.5	6.5
80% ET	10	2.5	1.3	6.5
Untreated	9	2.3	1.3	5.3
Omega (3 pt/acre)	11	2.7	1.7	7.1

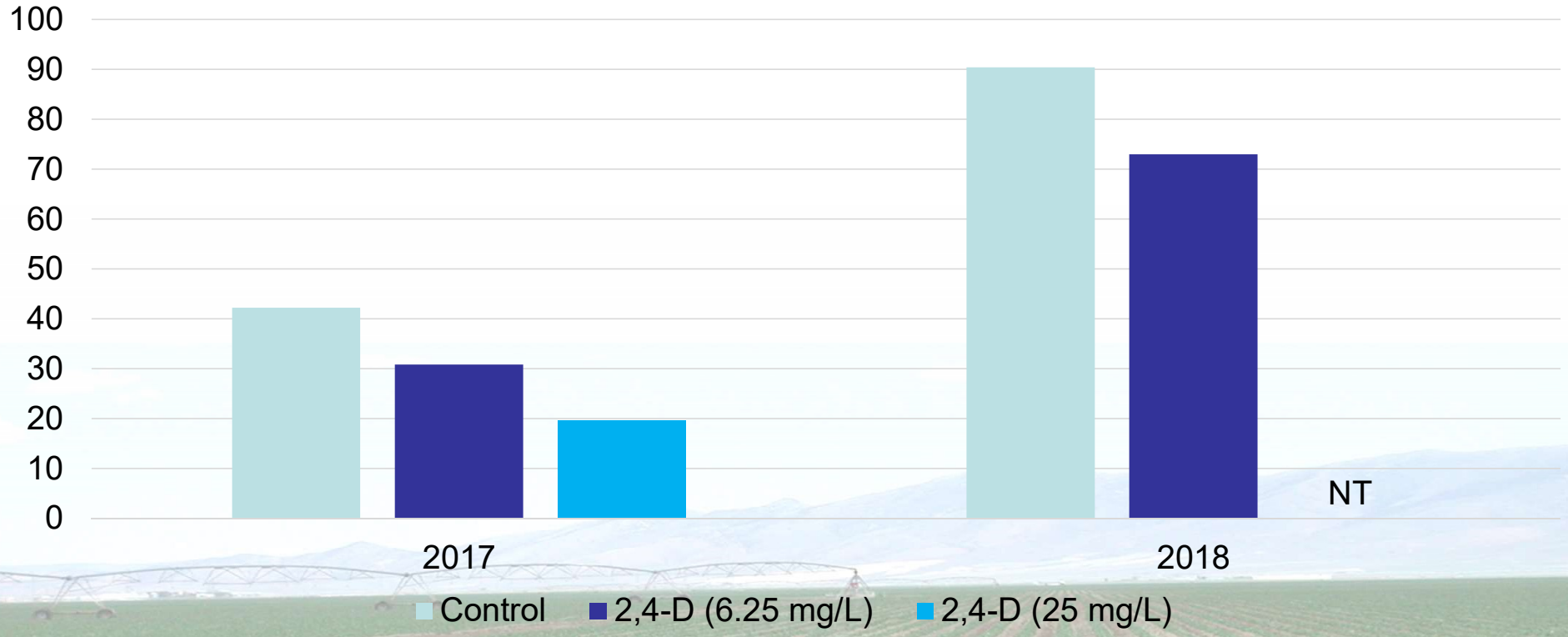
Evaluation: February 14, 2022

Reducing irrigation water and applying Omega did not reduce mop-top symptoms after storage.

Take Home from Year 1

- Reducing irrigation did not reduce PMTV symptoms.
- Fluazinam (Omega) did not reduce PMTV symptoms.

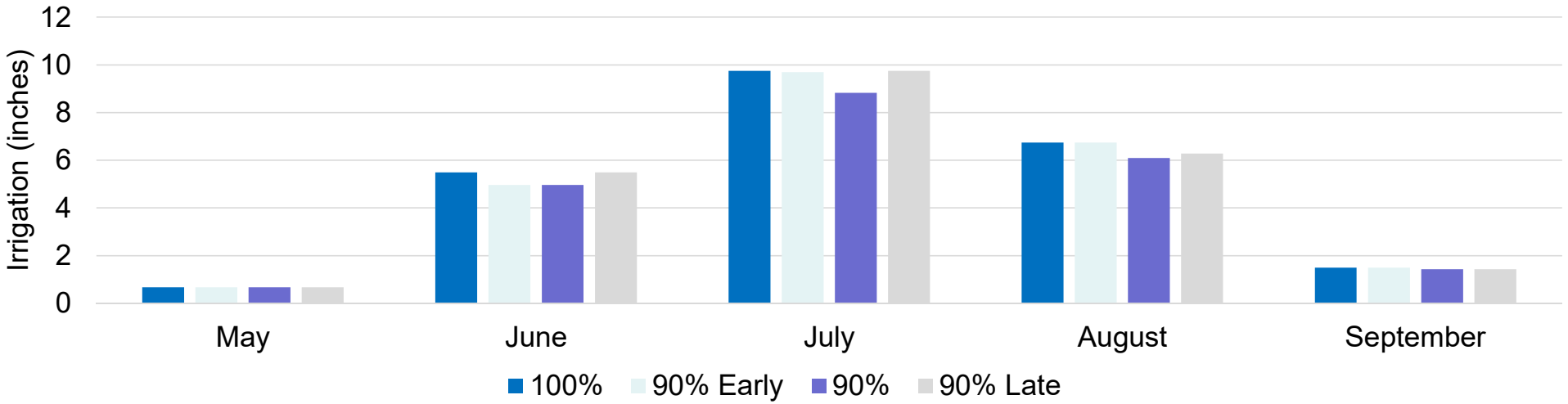
Incidence of Tuber Powdery Scab Lesions



From Clarke, et al., 2020, Crop Protection 136:105208

2022 Irrigation Treatments

Source	May	June	July	August	September	Total	% of Total
1. 100% ET	0.68	5.50	9.75	6.75	1.50	24.18	100
2. 90% ET early	0.68	4.97	9.70	6.75	1.50	23.60	97.6
3. 90% ET	0.68	4.97	8.83	6.10	1.43	22.01	91.0
4. 90% ET late	0.68	5.50	9.75	6.29	1.43	23.65	97.8
Rain	1.42	0.41	0.03	0.55	0.24	2.65	



Effect of Irrigation on Powdery Scab - 2022

	Root Gall Incidence	Root Gall Severity	Tuber Scab Incidence	Tuber Scab Severity
100% ET	22	4	33	1.0
90% ET early	15	1	27	0.6
90% ET	25	5	30	0.8
90% ET late	35	1	30	1.0
Untreated	40 a	4	32	0.9
2,4-D (0.75 fl oz/a)	12 b	1	28	0.8

Cultivar: Shepody

Reducing irrigation water did not reduce powdery scab symptoms.
2,4-D application did reduce root gall incidence but did not affect tuber scab.

Effect of Irrigation on Mop-Top Symptoms (Harvest) - 2022

	Visual Mop-Top	Total Yield	Marketable	Avg. Tuber Wt
100% ET	6.3	503 a	395 a	7.5
90% ET early	6.1	480 ab	365 a	7.9
90% ET	8.7	446 c	322 b	7.3
90% ET late	5.4	467 bc	386 a	7.4
Untreated	7.6 a	490 a	398 a	7.8 a
2,4-D (0.75 fl oz/a)	5.7 b	459 b	336 b	7.2 b

Cultivar: Shepody

Reducing irrigation water did not reduce mop-top symptoms, but reduced yield and quality.
2,4-D slightly reduced visual mop-top symptoms, but also reduced yield.

Take Home from Year 2

- Reducing irrigation did not reduce powdery scab or PMTV symptoms.

- 2,4-D (10.121 g ai/acre) reduced root galling and PMTV symptoms at harvest, but reduced yield/quality.

Trial Summary

- Irrigation management was not effective.
- Omega was not cost-effective.
- 2,4-D may be reduce disease, but affects yield/quality negatively.