Dehydrated organic remnants (DOR) for soil disinfestation in strawberry

Oleg Daugovish, Joji Muramoto, Michael Cohen, Maripaula Valdez-Berriz, Abigail Brondos (UC-ANR) and Peter Henry (Driscoll's)

ASD: Anaerobic Soil Disinfestation

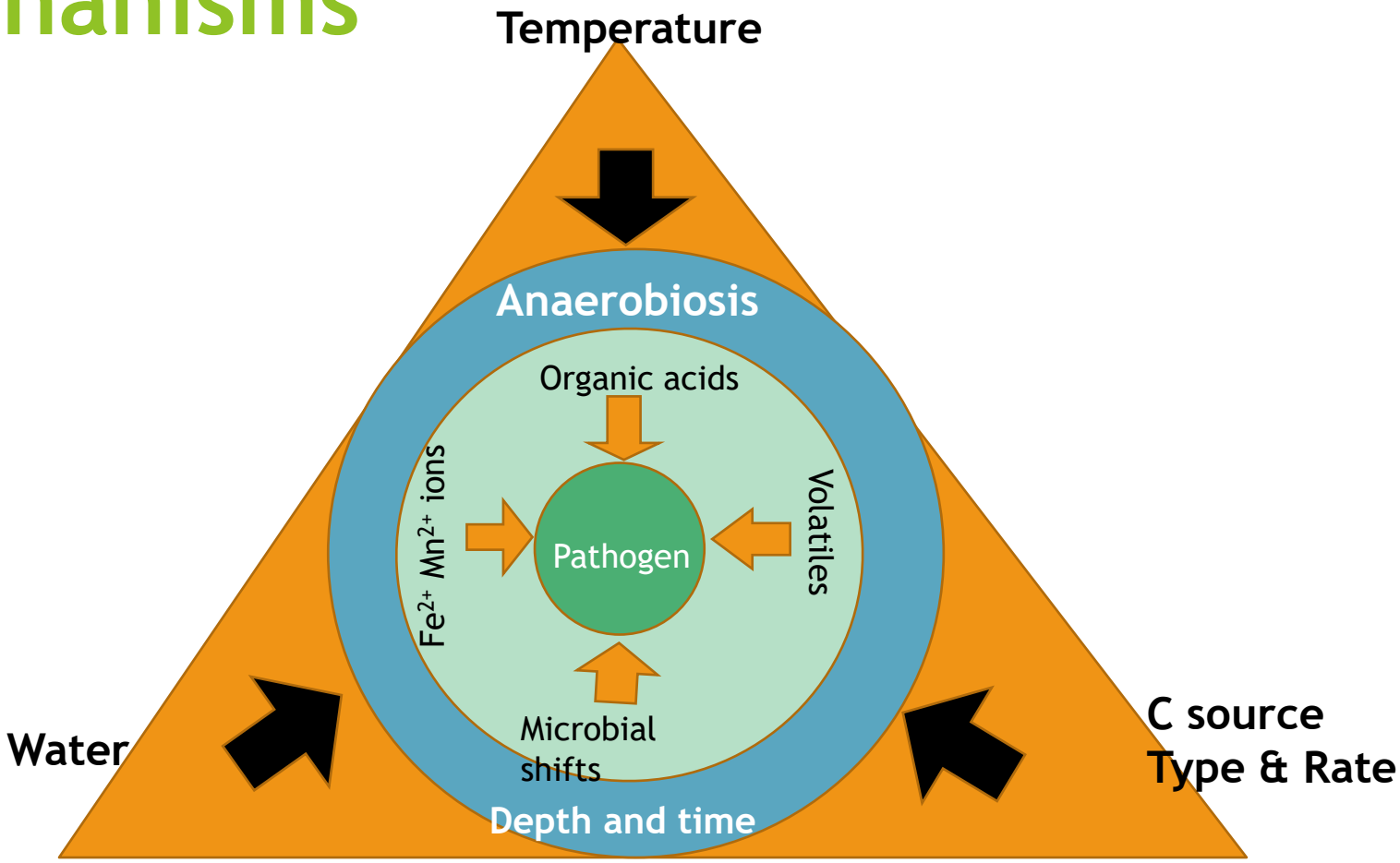
1. **Incorporate organic material**
   - ➢ Provides C source for soil microbes

   (rice bran 6-9 T/A in coastal CA)

2. **Cover with oxygen impermeable tarp**
   - ➢ Limit the gas exchange and oxygen supply

3. **Irrigate to saturation** -NOT FLOODING- and maintain the fermentation process for 3+ weeks
   - ➢ Maintain above the field capacity
   - ➢ Create anaerobic conditions and stimulate anaerobic decomposition of incorporated organic material

ASD Mechanisms



ASD Management Triangle (Shennan et al, 2014)

Adopted on >1,000 acres in CA and world-wide

ASD

Untreated

What's ideal carbon source for ASD?

Carbon source	C:N ratio for anaerobic conditions	Available for the acreage and can be stored	N availability	Transport to field and application	Fruit yield improvement over untreated soil	Organic status	Cost
Rice bran	18:1	yes	high	>200 miles. Easy to apply	yes	yes	high
Wheat middlings /midds	13:1	yes	high	<200 miles. Easy to apply	yes	yes	< rice bran
Dried distiller's grain	11:1	yes	high	<200 miles easy to apply	yes	no	< rice bran
Coffee grounds	23:1	yes	Moderate to none	<20 miles, easy to apply	source dependent	yes	Transport only
Almond shell-rice blend	>25:1	?	low	>200 miles	no	yes	?
Grape pomace	20:1	?	low	50-150 miles	no	yes	?
Grass clippings from sod	<15:1	no	Very high	<20 miles. Hard to apply	yes	no	Transport
Spent grain/brewery waste	20:1	no	moderate	<50 miles. Hard to apply	yes	no	Transport
Rye or Barley cover crop + reduced rate of rice bran	20+ :1	yes	high	>200 miles. Easy to apply	yes	yes	Time and water for the cover crop
Liquid sources: ethanol, molasses, glycerin	Limited translocation with drip application and not cost-effective						

Is FOOD WASTE the next carbon source for ASD?

- **California Senate Bill 1383 mandates that California find ways to deal with about 20-25 million extra tons of food waste**
- **Don't have enough composting facilities**
- **Dehydrators/fermenters reduce the weight 75%+**





Larger scale dehydrators:
Processes 2200 to 6600 pounds a day

Ecovim USA:
https://www.ecovimusa.com/products/

Viably/Harp Renewables:
https://thinkviably.com/waste-streams/organic-waste/

125 Pounds a day
6-9 hours Cycle

In California:

UC San Diego

Alameda County, SF Bay area

Ventura County: Rio Mesa School district

In Nelson , BC: 500 small units

ASD-DOR (Dehydrated Organic Remnants)

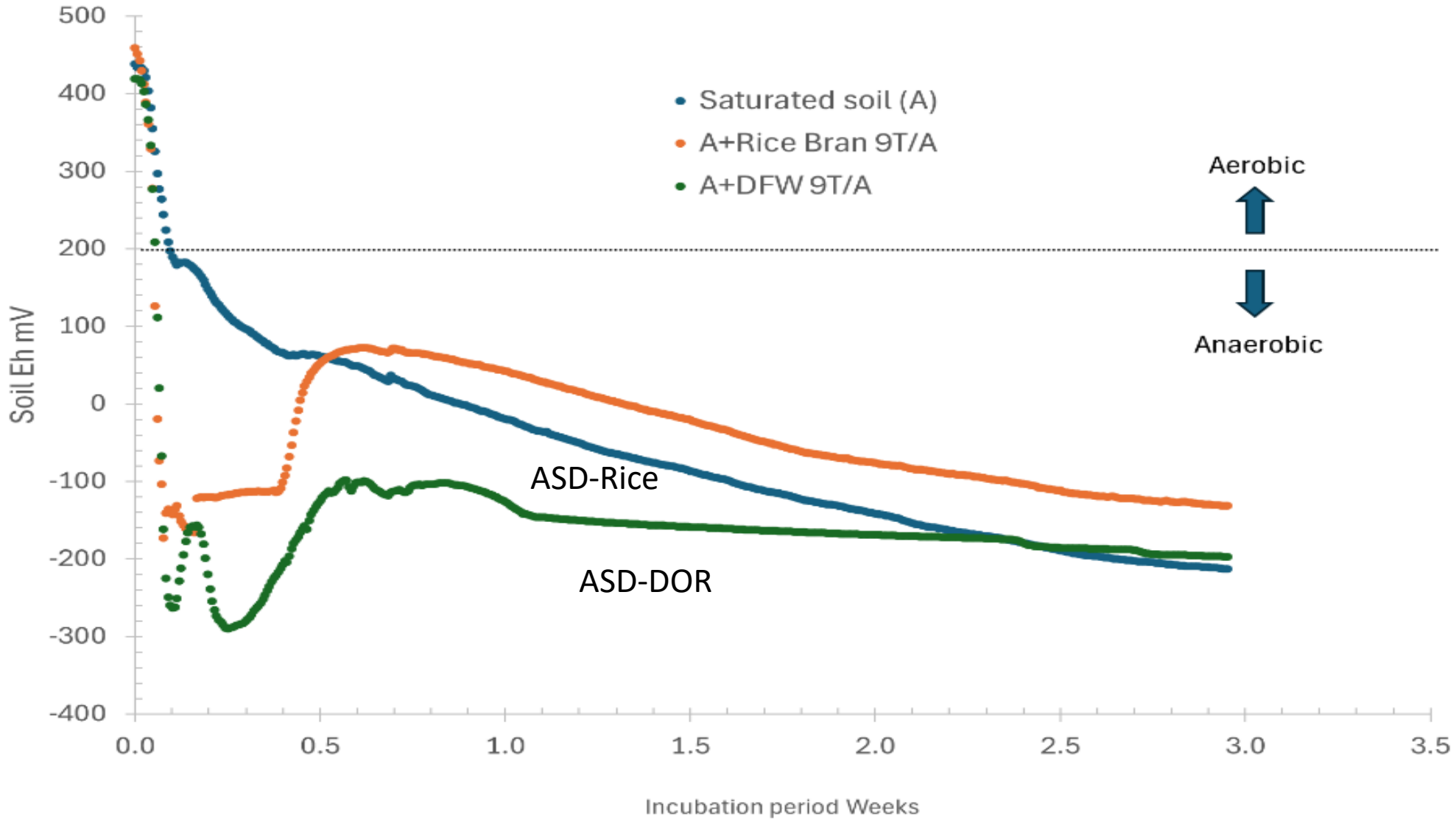
- 14-48 h from loading until finished DOR
- Can pile and store w/o deterioration until use
- Light, easy to transport and mix into soil
- No smell or food safety concerns
- **Check for Na and Cl ppm before deciding on application rate!**

Is DOR consistent?

	(DM basis)	Total N, %	C, %	DM, %	
Foodbank	22.8	3.64	46	93	42.78
Grocery	21.7	3.47	53	97.1	51.46
Restaurant	21.1	3.37	49.3	95.3	46.98
Cafeteria	19.1	3.05	52	97.6	50.75
Hospital	20.2	3.23	50.5	95.6	48.27
JuiceProcessor	25	4	51	79.8	40.69
TofuProcessor	27.3	4.368	51.7	99.4	51.38
Avg. (excludingfood processors)	21.0	3.4	50.2	95.7	48.1
Avg. (including processors)	22.5	3.6	50.5	94.0	47.5

C:N = 14-18 : 1

Does DOR create anaerobiosis as good as rice bran?



DOR at 7 t/A

Untreated with 350 lb/A 24-0-0

Beds fumigated 2 years ago, residual *M. phaseolina* at 5-10 CFU g/soil 0.7-2.5 CFU/g soil

Untreated

ASD-DOR at 7 t/acre

ASD-DOR vs Untreated

- 70% in MS/g soil of charcoal rot pathogen
- 68% in nustedge shoots

+ 16% larger plants

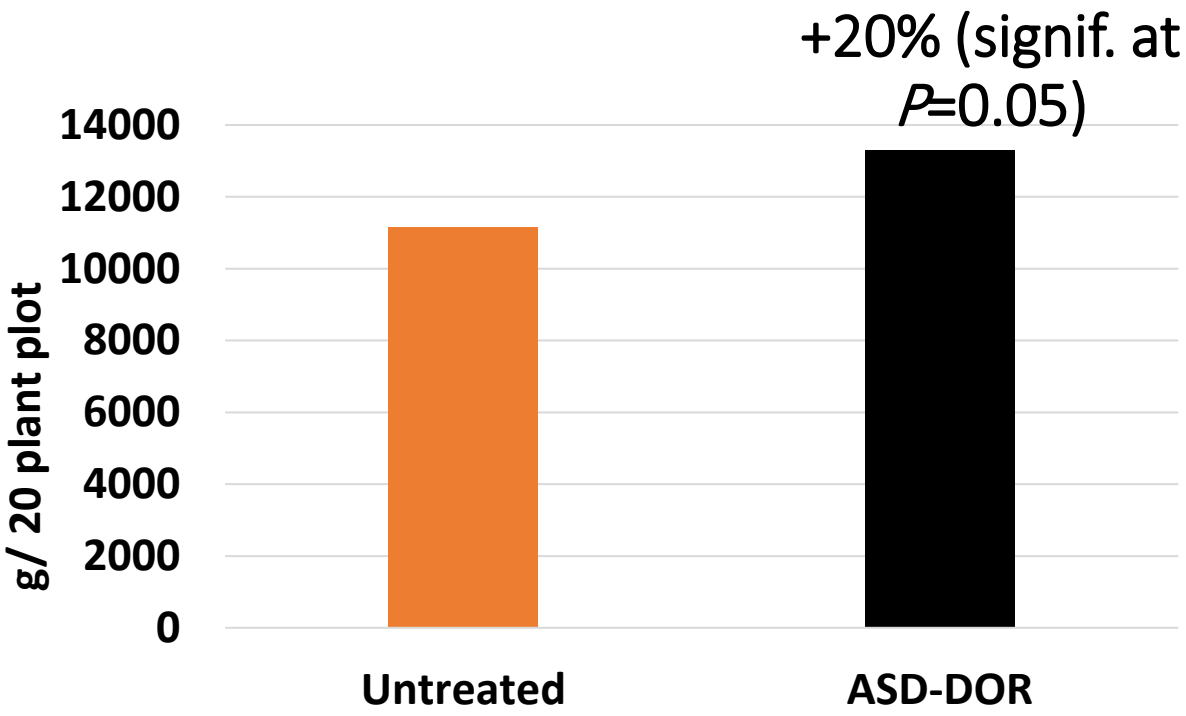
NO_3-N: 23.8	51.2 ppm
Total N: 2000	1500 ppm
Chloride 133	74 ppm
Sodium: 180	140 ppm
Soil: silt loam	clay loam

Reduction of ms/g soil of *M.phaseolina* with ASD-DOR

replicate		
1	ASD-DOR	62
1	Untreated	640
2	ASD-DOR	132
2	Untreated	595
3	ASD-DOR	221
3	Untreated	475
4	ASD-DOR	414
4	Untreated	905

nustedge tubers after ASD-DOR

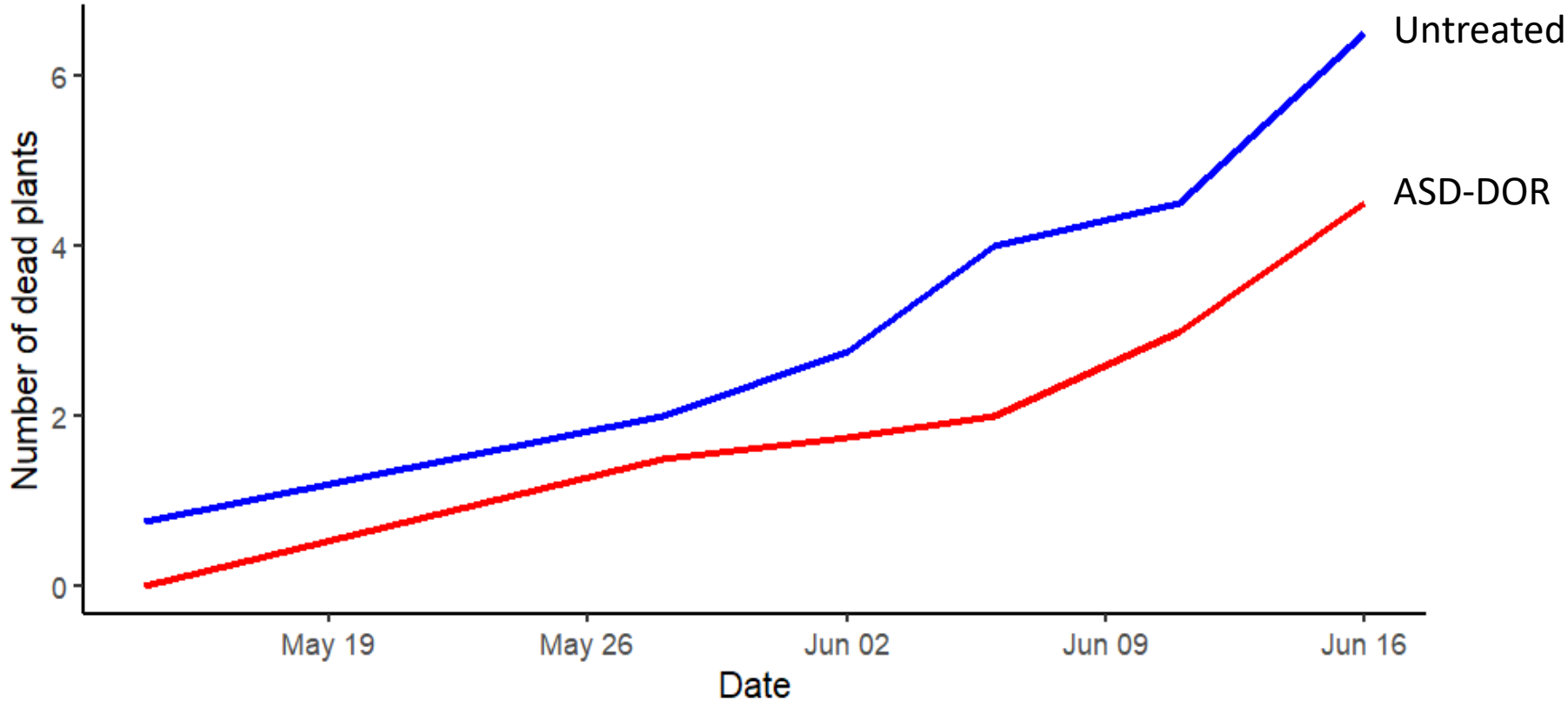
‘Fronteras’ marketable yields



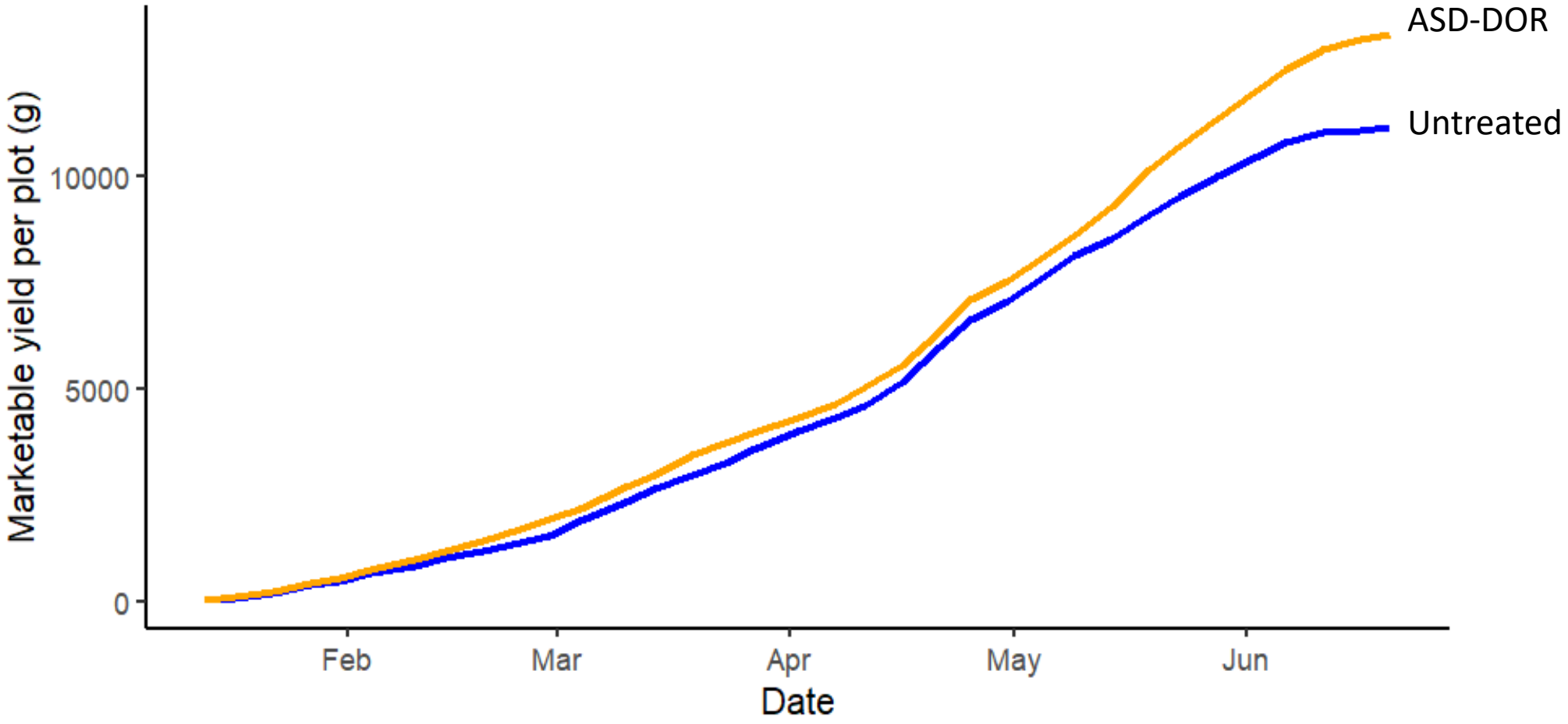
ASD-DOR in June

Untreated in June

M.phaseolina- caused plant mortality

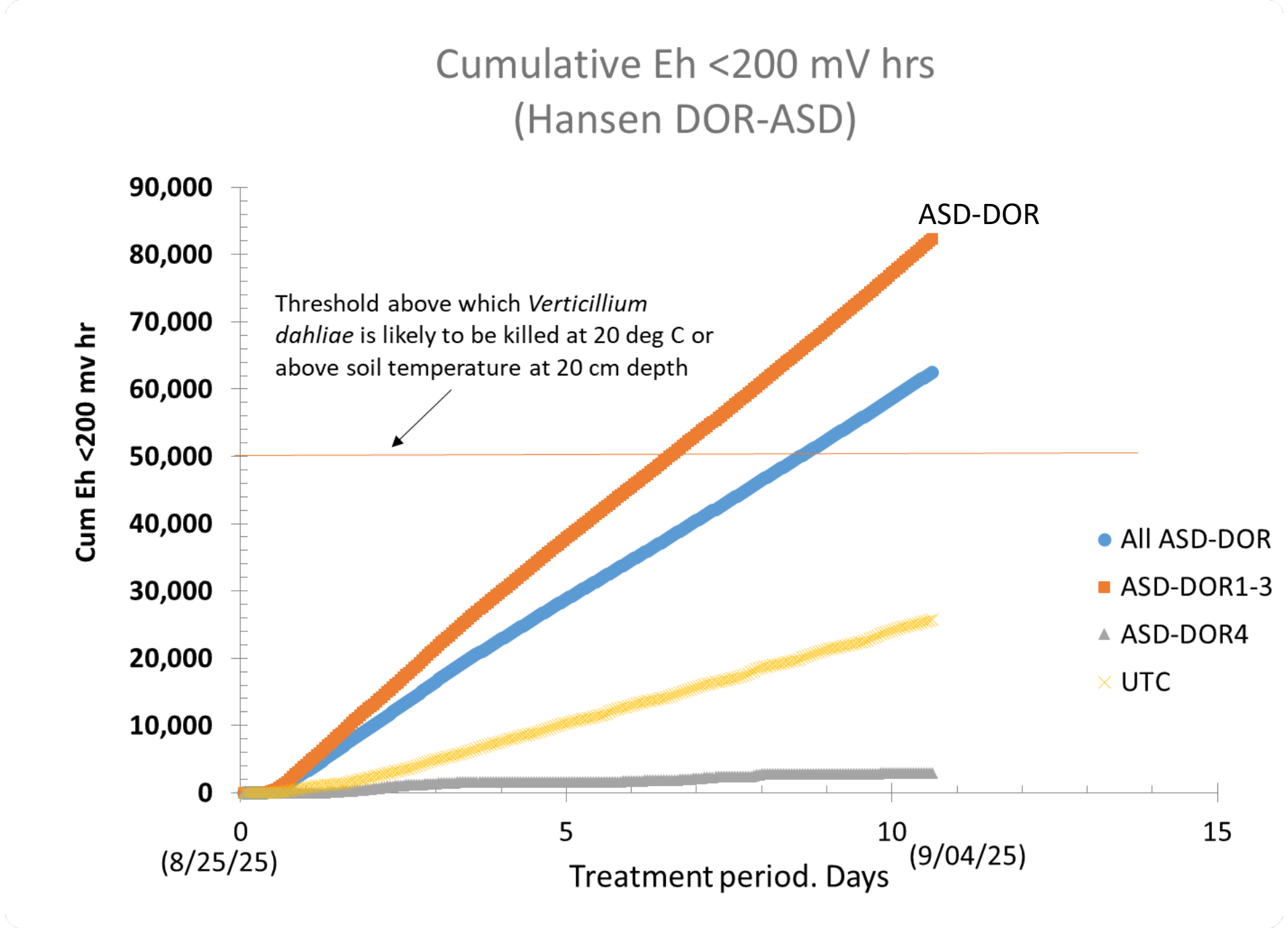


Marketable yield for the season



2025-2026 season

- Small UC Hansen grant to support similar trial,
- If results are consistent - seek CDFA Organic materials approval for DOR
- Share the ‘end-use’ info with groups targeting dehydration of organic waste


Cumulative Eh <200 mV hrs
(Hansen DOR-ASD)
Cum Eh <200 mv hr
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Threshold above which Verticillium dahliae is likely to be killed at 20 deg C or above soil temperature at 20 cm depth
ASD-DOR
All ASD-DOR
ASD-DOR1-3
ASD-DOR4
UTC
0
(8/25/25)
5
10
(9/04/25)
15
Treatment period. Days