Evaluating the Impact of Superabsorbent Polymer on Processing Tomato Yield and Quality under Different Water Levels

South Sac Valley Processing Tomato meeting Tues
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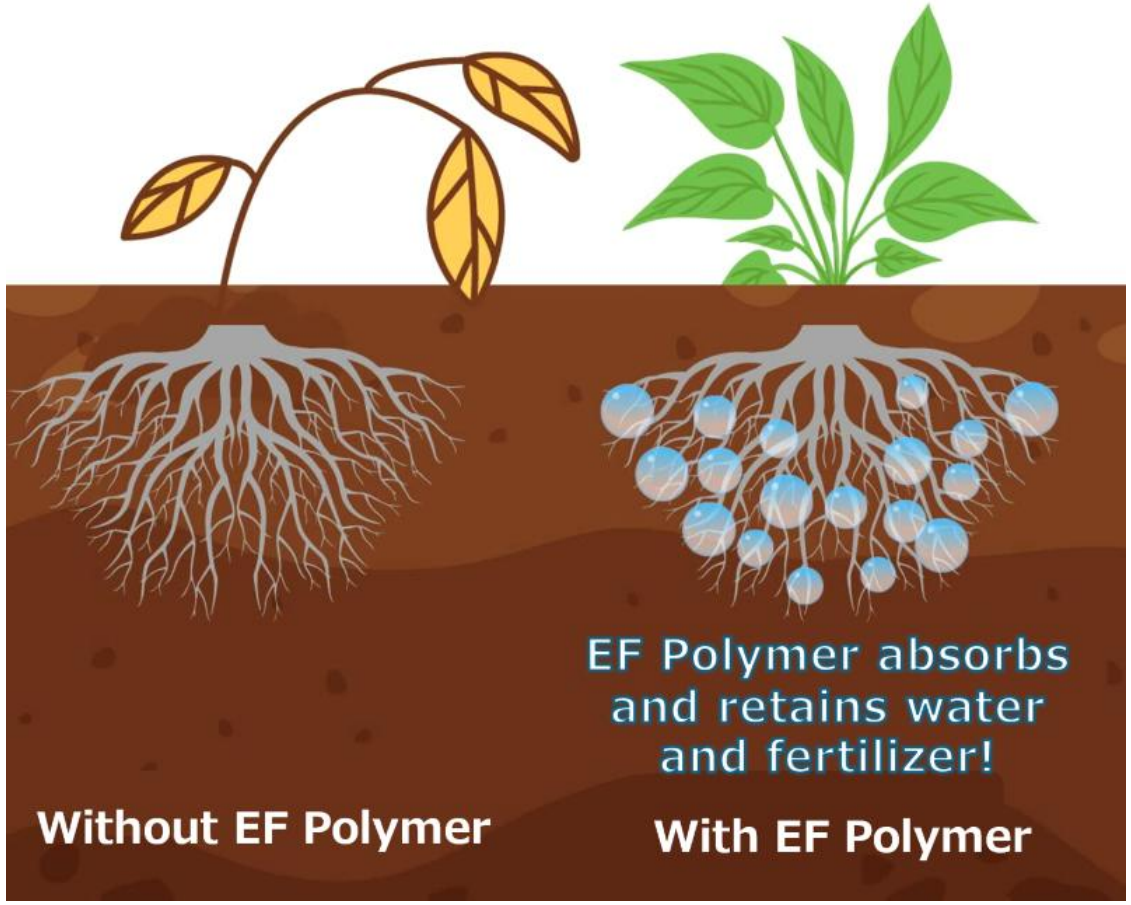
Objective: To evaluate the potential of a fruit-peel–derived biodegradable superabsorbent polymer (SAP EF Polymer) to enhance processing tomato yield, quality, and soil moisture availability, under different irrigation levels 25%, 50%, and 100% evapotranspiration (ET).

A Biodegradable Superabsorbent Polymer for Agriculture

- 100% Organic and Biodegradable: EF-Polymer is made from upcycled agricultural residues (e.g., fruit peels such as orange and banana)
- Super Absorbent Polymer (SAP): Designed to absorb and retain large quantities of water (up to ~50× its own weight) and release moisture gradually to the surrounding soil
- Biodegradable polymers do not harm soil, avoiding microplastic concerns associated with conventional SAPs



Source: JIFPRO: For illustration purposes only

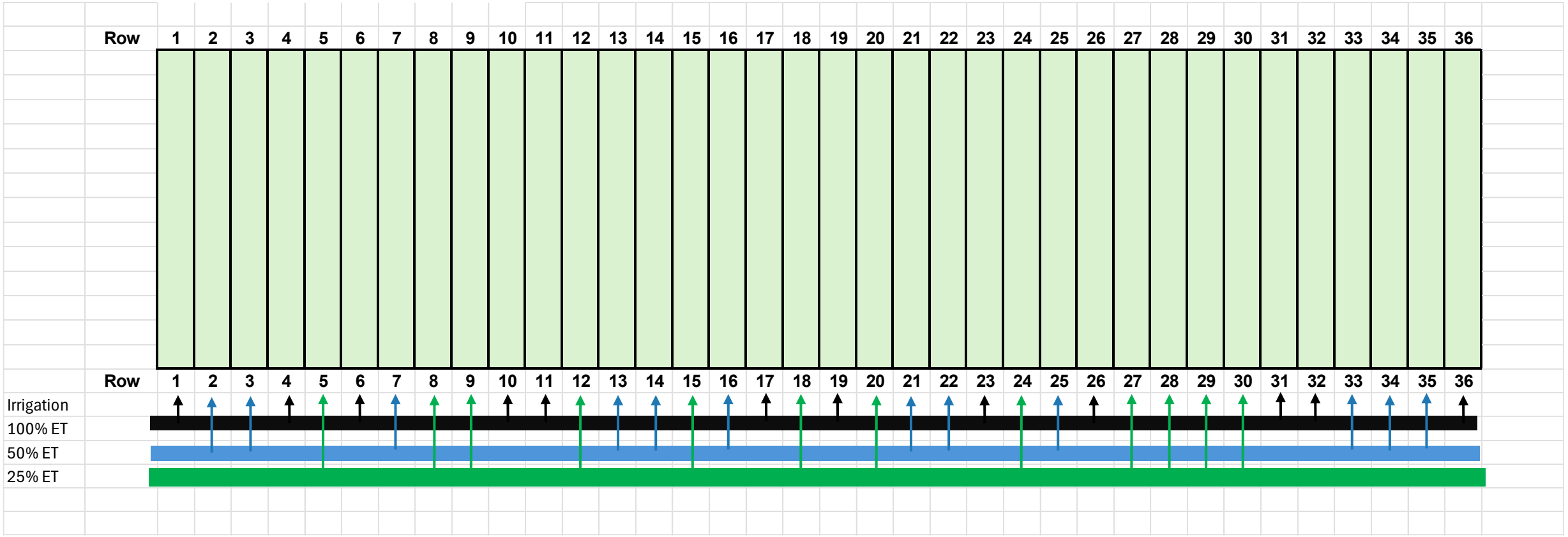
Potential Benefits of SAPs in Crop Production

- Improves Soil Water and Nutrient Retention: Enhances the soil's ability to hold moisture and nutrients, supporting plant access during dry periods
- Supports Stress-Tolerant Growth: Promotes crop establishment under water-limited conditions
- Reduces Resource Inputs: Potential to reduce irrigation water use

Materials and Methods: Experimental Design

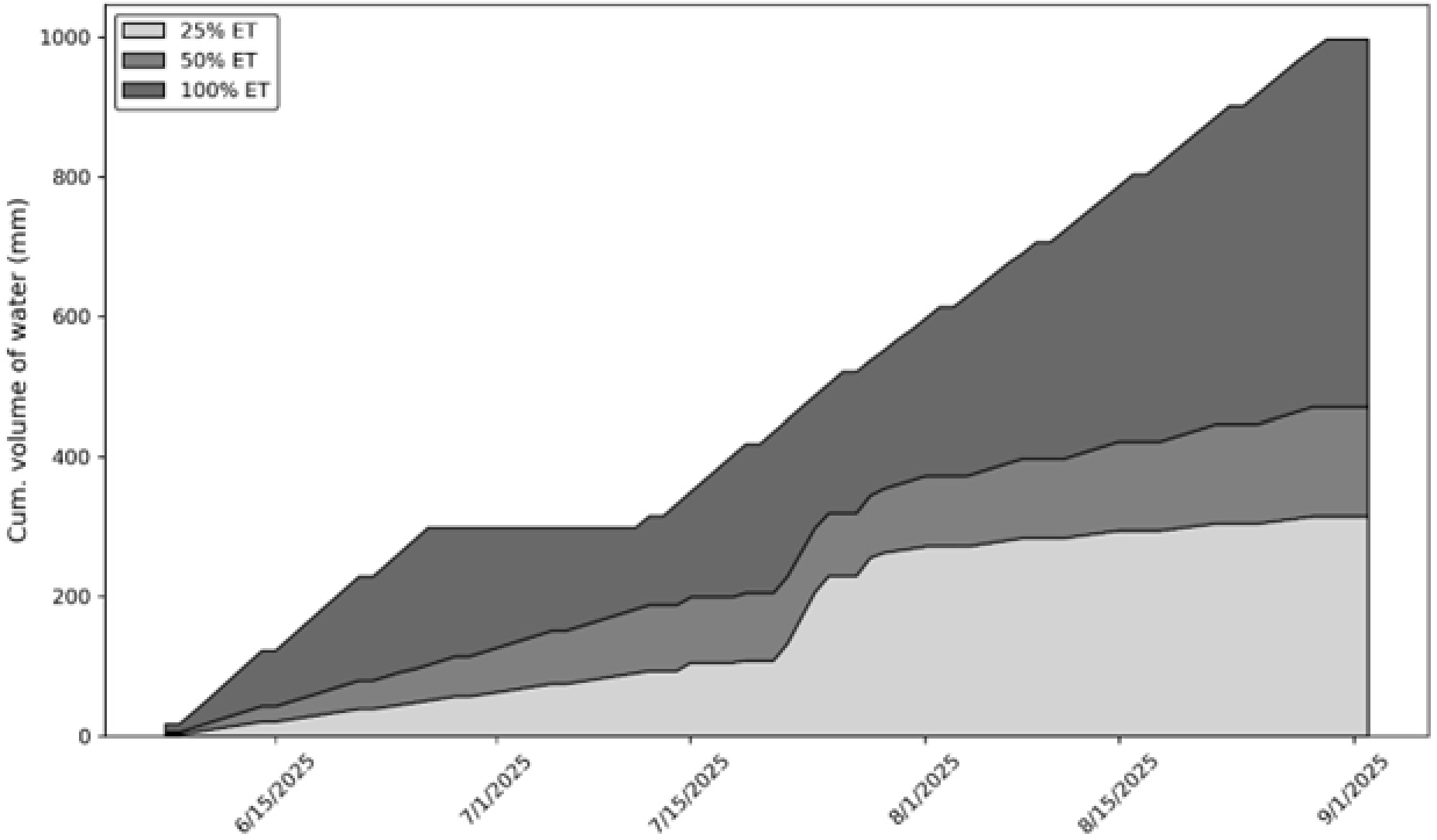
Treatment #	Polymer Level	Polymer Rate	Irrigation Regime	Treatment Label
1	Low	75 lbs/acre	100%	P75-ET100
2	Low	75 lbs/acre	50%	P75-ET50
3	None	0 lbs/acre	25%	P0-ET25
4	High	150 lbs/acre	100%	P150-ET100
5	Low	75 lbs/acre	25%	P75-ET25
6	High	150 lbs/acre	50%	P150-ET50
7	High	150 lbs/acre	25%	P150-ET25
8	None	0 lbs/acre	50%	P0-ET50
9	None	0 lbs/acre	100%	P0-ET100

Materials and Methods: Experimental Design



Materials and Methods: SAP Application

Results: Cumulative irrigation applied



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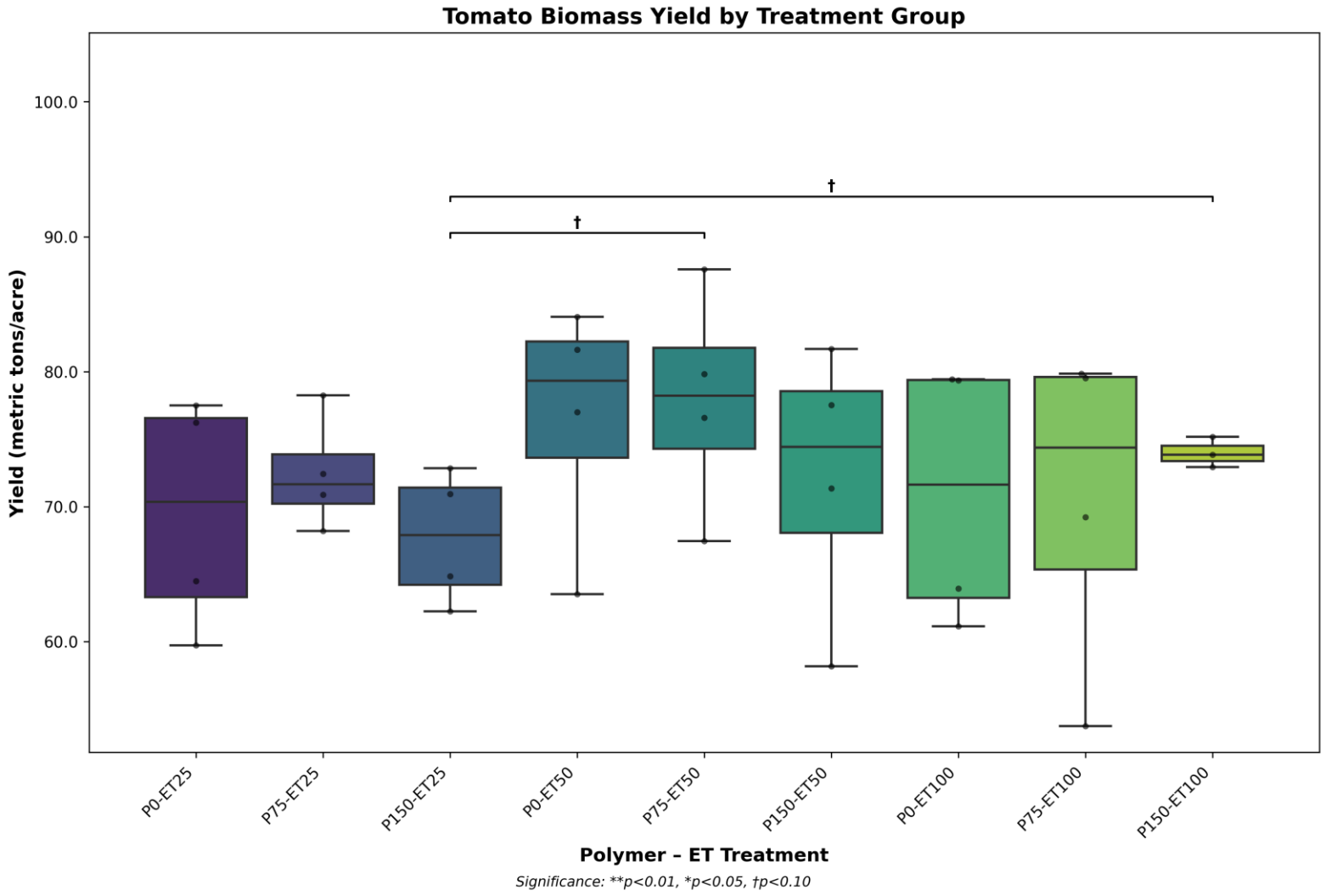
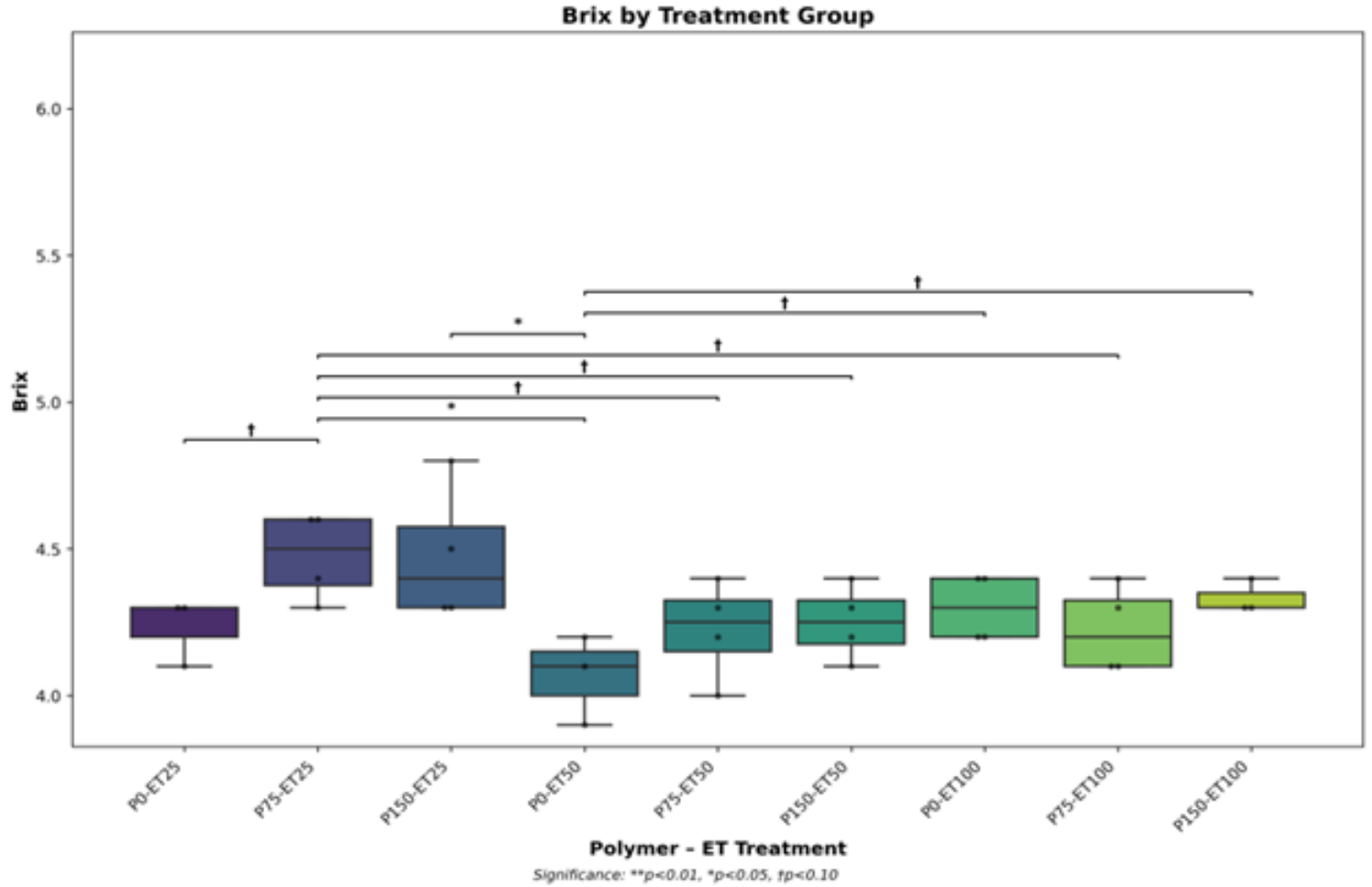
Results: Processing tomato yield (tons/ac)



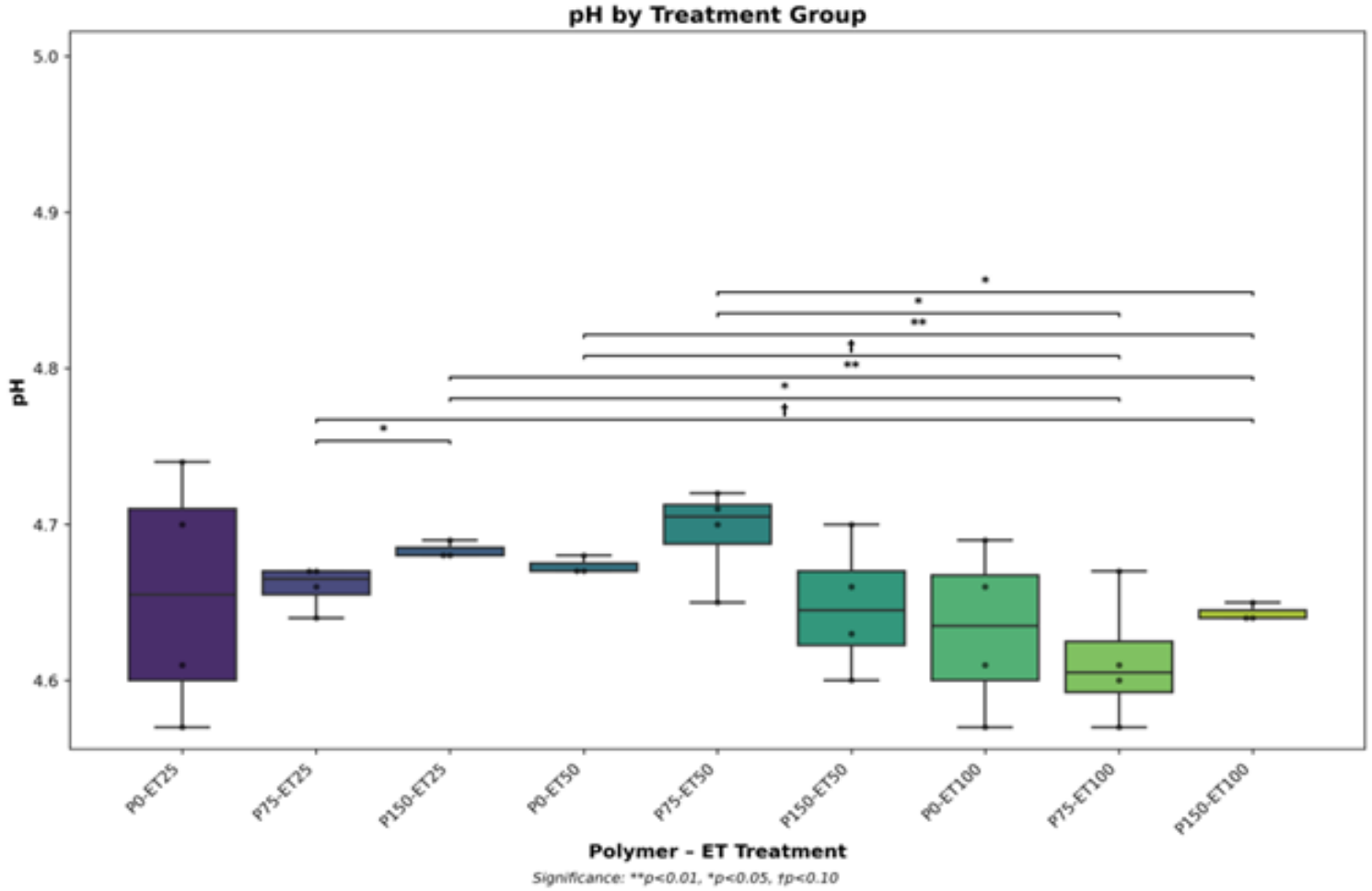
While no consistent yield increase was observed with higher polymer rates, polymer-amended treatments tended to exhibit reduced yield variability, indicating a stabilizing effect under both deficit and full irrigation.

Results: Processing tomato quality (Brix)



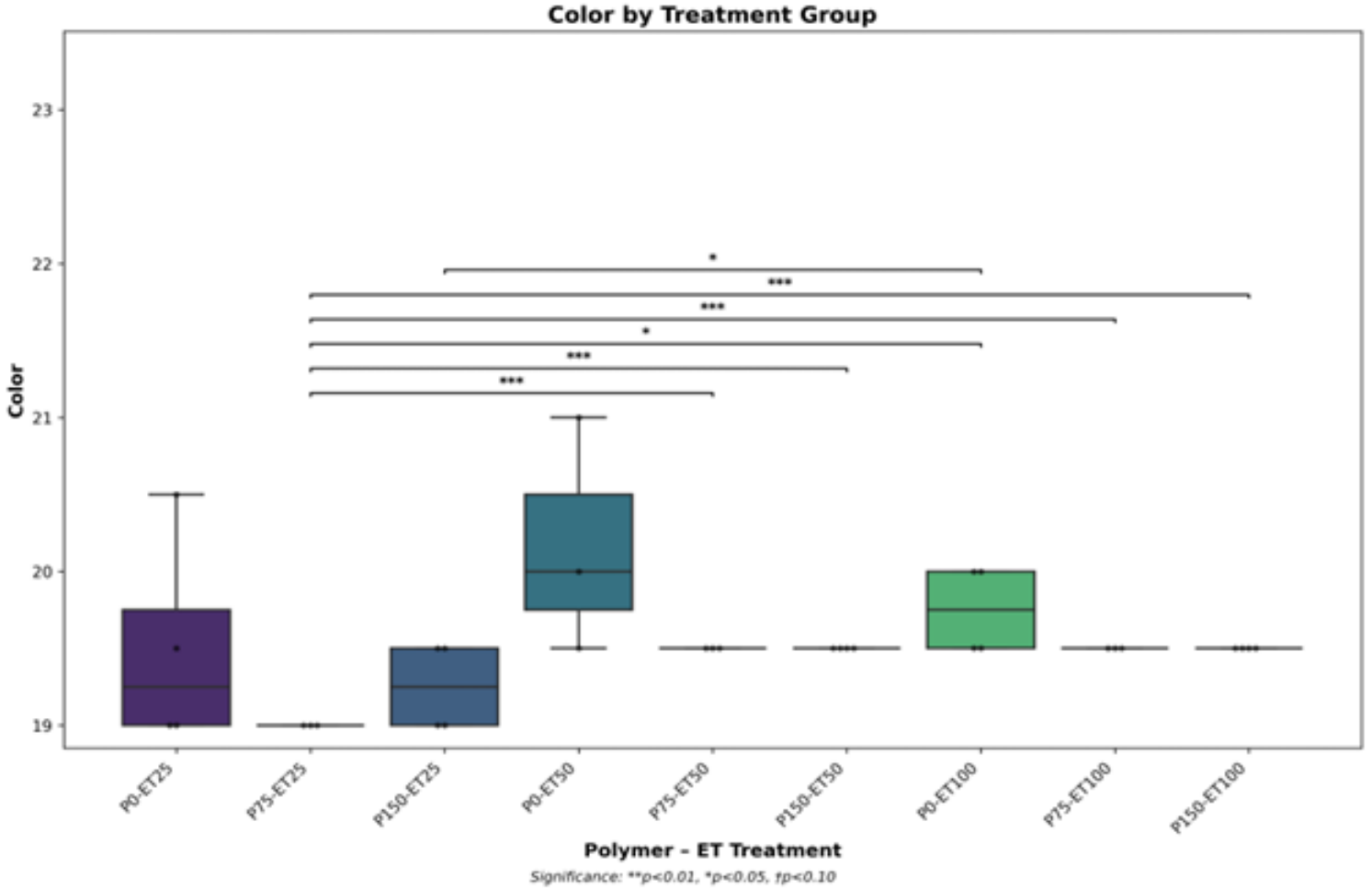
Overall, these results demonstrate that deficit irrigation strongly improves fruit sweetness and that SAP application can amplify this benefit under the most water-limited conditions.

Results: Processing tomato pH values



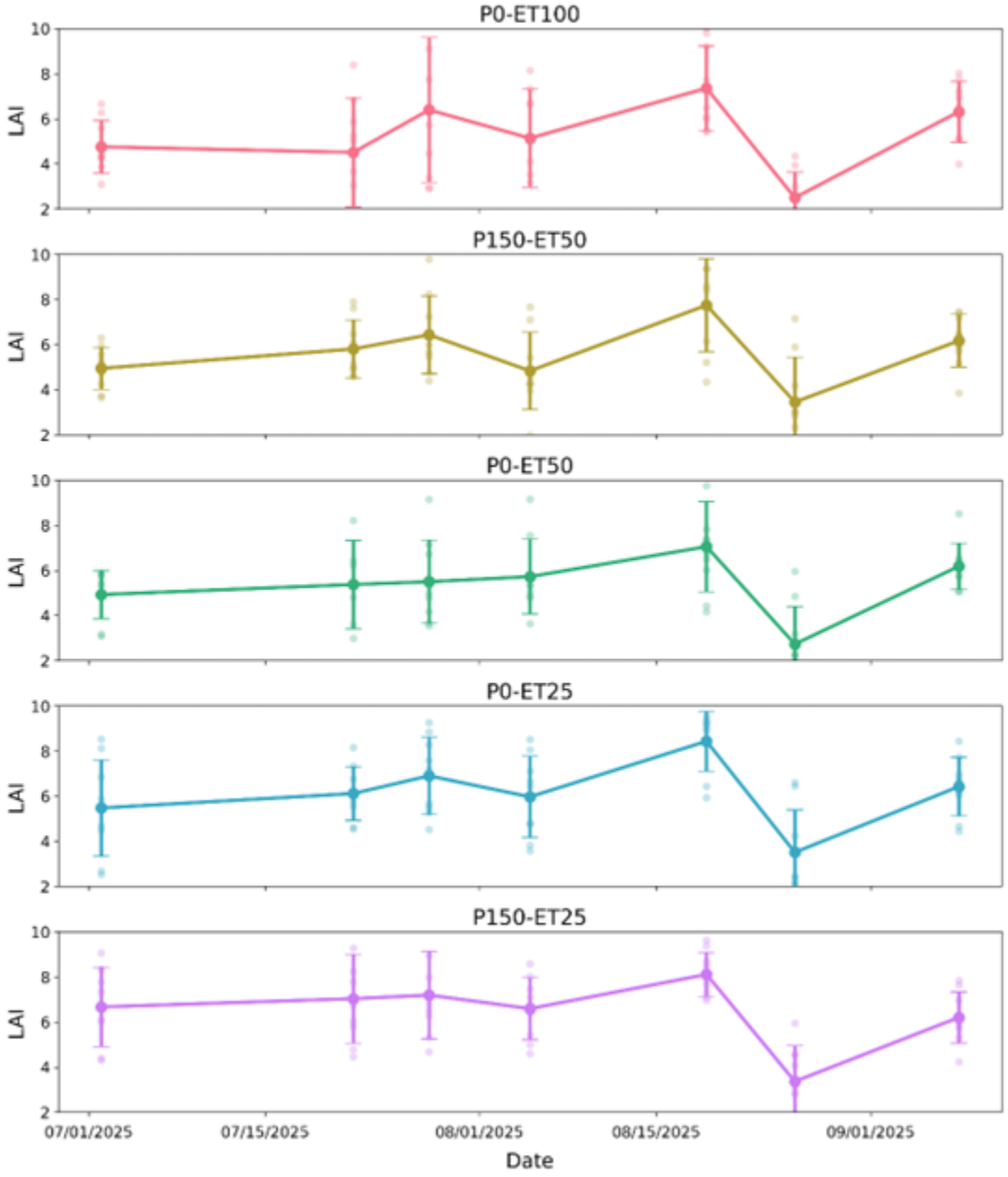
Overall, neither deficit irrigation nor SAP application had a major practical impact on fruit acidity.

Results: Processing tomato color



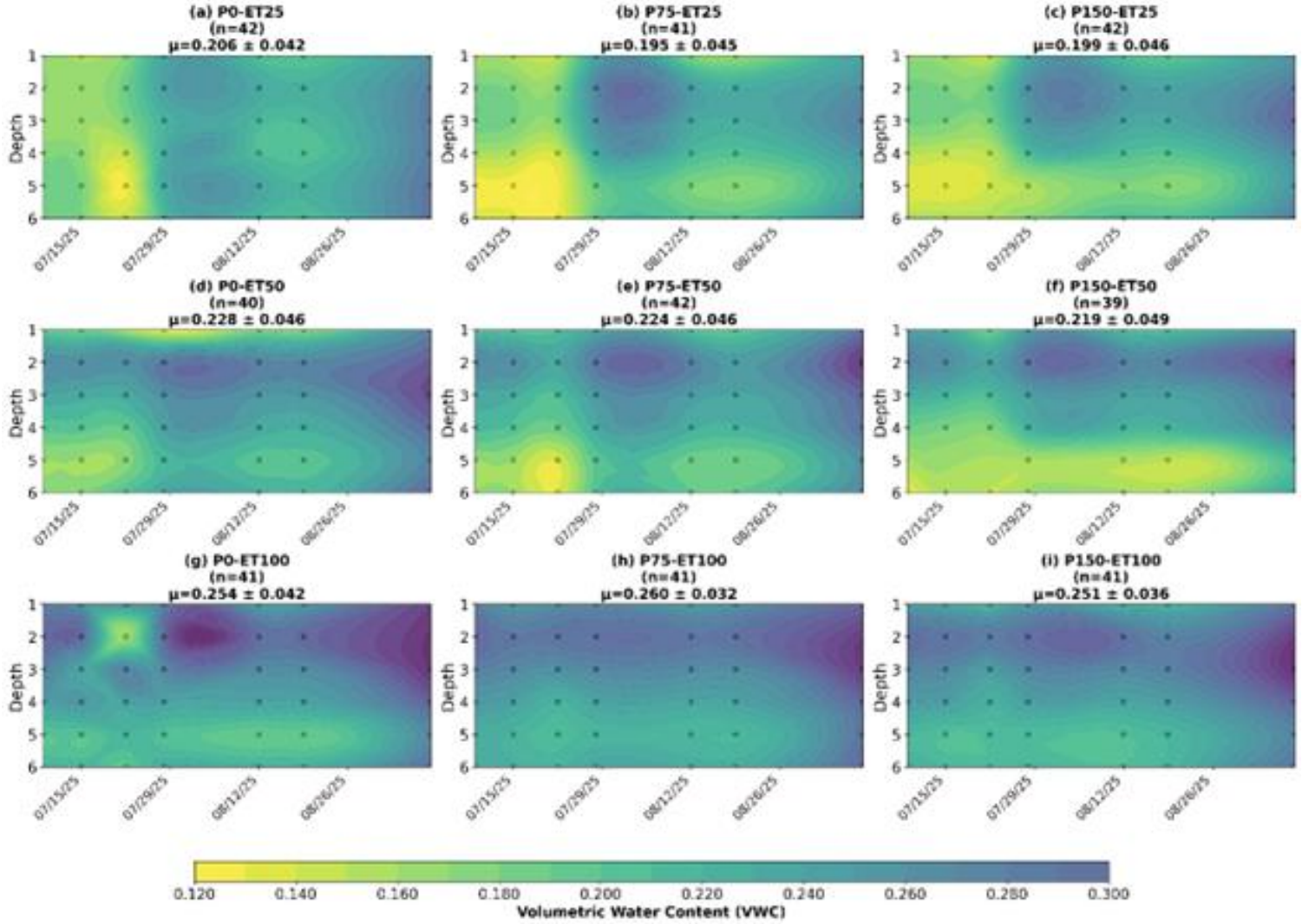
Several statistically significant pairwise differences confirm that irrigation level not polymer rate was the dominant factor shaping fruit color, with full irrigation providing the most favorable conditions for pigment development.

Results: Leaf Area Index (LAI)



Canopy growth (LAI) was **remarkably resilient and relatively insensitive to both deficit irrigation and SAP**, reinforcing that treatment effects were expressed more strongly in **yield stability and fruit quality** than in canopy size.

Results: Soil Moisture



Treatments with deficit irrigation (ET25) produced visibly lower soil moisture across the monitored soil profile (a-c). However, the treatments with polymer applications under 25%ET displayed higher soil water content within the upper 3 ft of soil (b, c). These patterns indicate that polymers can potentially help enhance soil moisture retention under water-limited conditions.

Conclusion

- Irrigation level was the dominant driver of processing tomato performance
- 50% ETc achieved the best balance of yield and quality, producing the highest yields despite using ~ half the water of full irrigation
- SAP improved soil moisture retention, particularly in the upper 0–90 cm, with benefits most evident under severe deficit irrigation
- SAP had limited direct effects on total yield, but reduced yield variability, suggesting a stabilizing role under fluctuating moisture
- Fruit quality was more responsive than yield

Main Takeaways

1. Overall, **50% ETc is a viable, water-efficient strategy** for processing tomatoes in the Sacramento Valley

2. **Biodegradable SAPs provide complementary benefits**, particularly under severe water stress, but do not replace irrigation management

3. Continued multi-year research is needed to **optimize SAP placement, rates, and integration with deficit irrigation strategies**

Thank you!

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