Impact of late-season deficit irrigation on processing tomato yield and quality

D. Wang, D. Rath, I. Herrera and K. Scow

Nearly complete conversion of tomato production in the SJV from furrow irrigation to drip irrigation in the last 20 years

Initial experience with drip suggested that yield increases came at the expense of fruit soluble solids concentration (SSC)

Industry-sponsored research from 2000-2005:

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Managing Fruit Soluble Solids with Late-season Deficit Irrigation in Drip-irrigated Processing Tomato Production

P.R. Johnstone, T.K. Hartz, M. LeStrange,[1] J.J. Nunez,[1] and E.M. Miyao[1]

Department of Plant Sciences, University of California, Davis, CA 95616

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Abstract. **Fruit soluble solids concentration (SSC) is an important quality factor for tomatoes (*Lycopersicon esculentum* Mill.) grown for processing. The use of drip irrigation often results in undesirably low SSC. The effects of late-season irrigation management on fruit yield and SSC was investigated in a series of drip-irrigated field trials in California from 2000–04. The effects of irrigation cutoff or deficit irrigation implemented 40 to 50 days preharvest (the period corresponding to the initiation of fruit ripening) were compared to a standard grower practice of irrigation cutoff 20 days preharvest. Irrigation cutoff 40 to 50 days preharvest increased SSC but resulted in substantial yield loss, with signifi-**

rots, making this approach uneconomical (May and Gonzales, 1999). Irrigation cutoffs within the final 6 weeks have given highly variable results, in some fields having no impact on SSC, while in others causing an unacceptable degree of yield loss. This variability appeared largely related to field-specific factors (soil texture, rooting depth, wetting pattern from the drip tape, etc.), making it impossible to develop a generic cutoff date recommendation. Currently, many California growers adopt a conservative approach of full irrigation until cutoff 10 to 20 d preharvest.

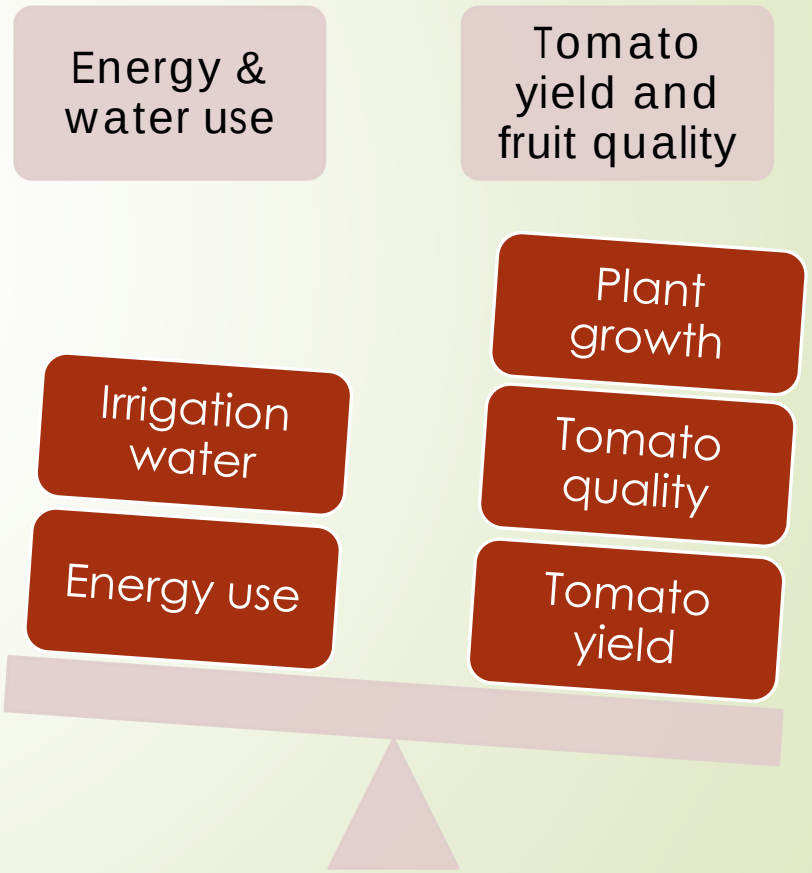
An alternative approach to complete irrigation cutoff is deficit irrigation. Imposing a controlled water deficit early in the fruit ripening phase has shown the potential to increase SSC with only a minimal sacrifice in fruit yield (Cahn et al., 2001; Renquist and Reid, 2001). The objective of this research was to evaluate the effects of late-season deficit irrigation management on fruit yield and SSC of drip-irrigated processing tomatoes across a range of field conditions representative of the California industry.

Findings:

- **Late-season deficit irrigation can be managed to increase fruit SSC without reducing brix yield (tons of fruit solids); some tradeoff between fruit yield and SSC is likely**
- **Water stress only influences the SSC of green fruit, meaning that deficit irrigation must be started early (5-6 weeks preharvest) to allow maximum control**

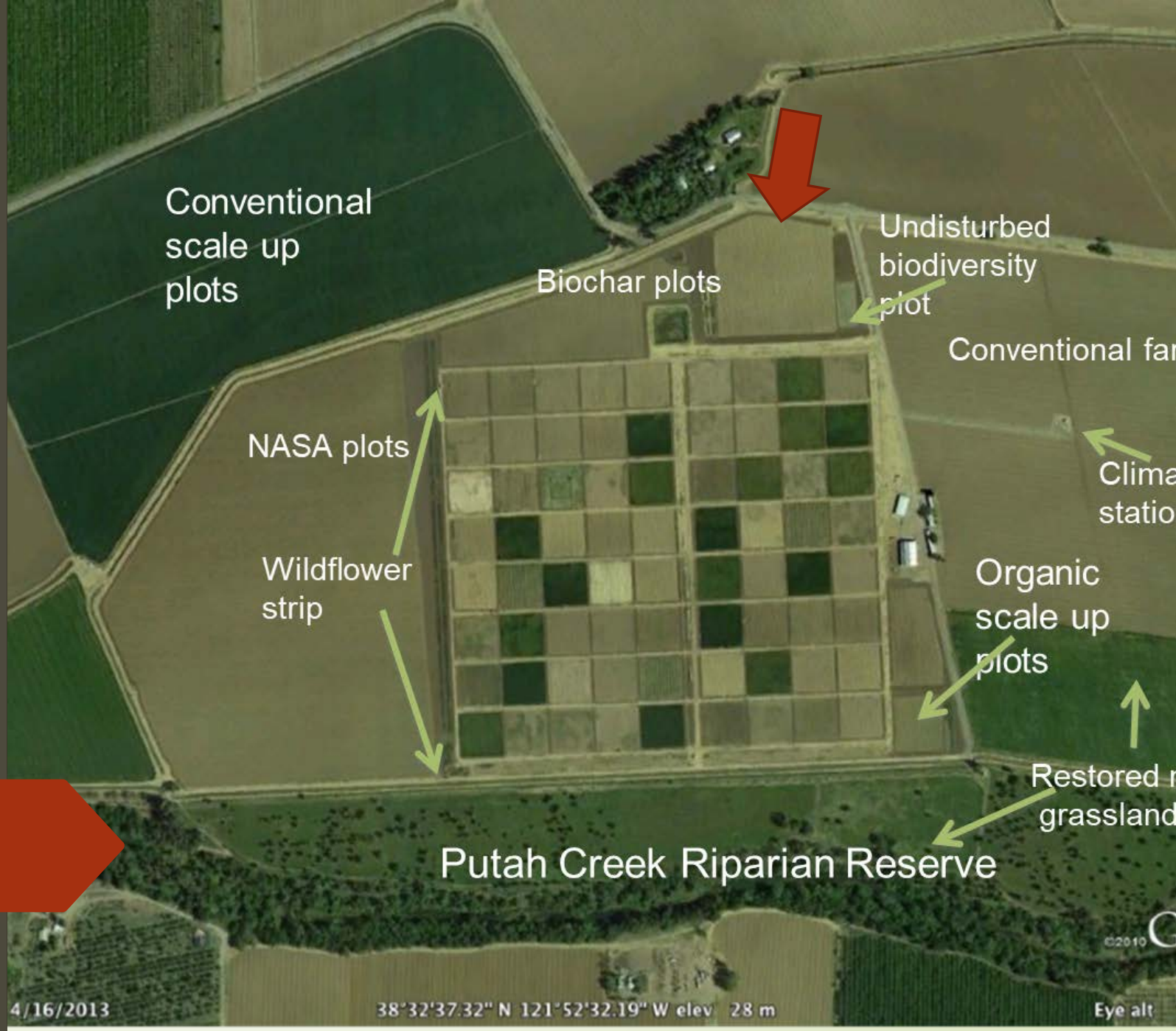
2017 Experiment:

Document the effects of deficit irrigation during fruit ripening on drip-irrigated processing tomatoes



Location:

UC Davis Russell Ranch Sustainable Agriculture Facility



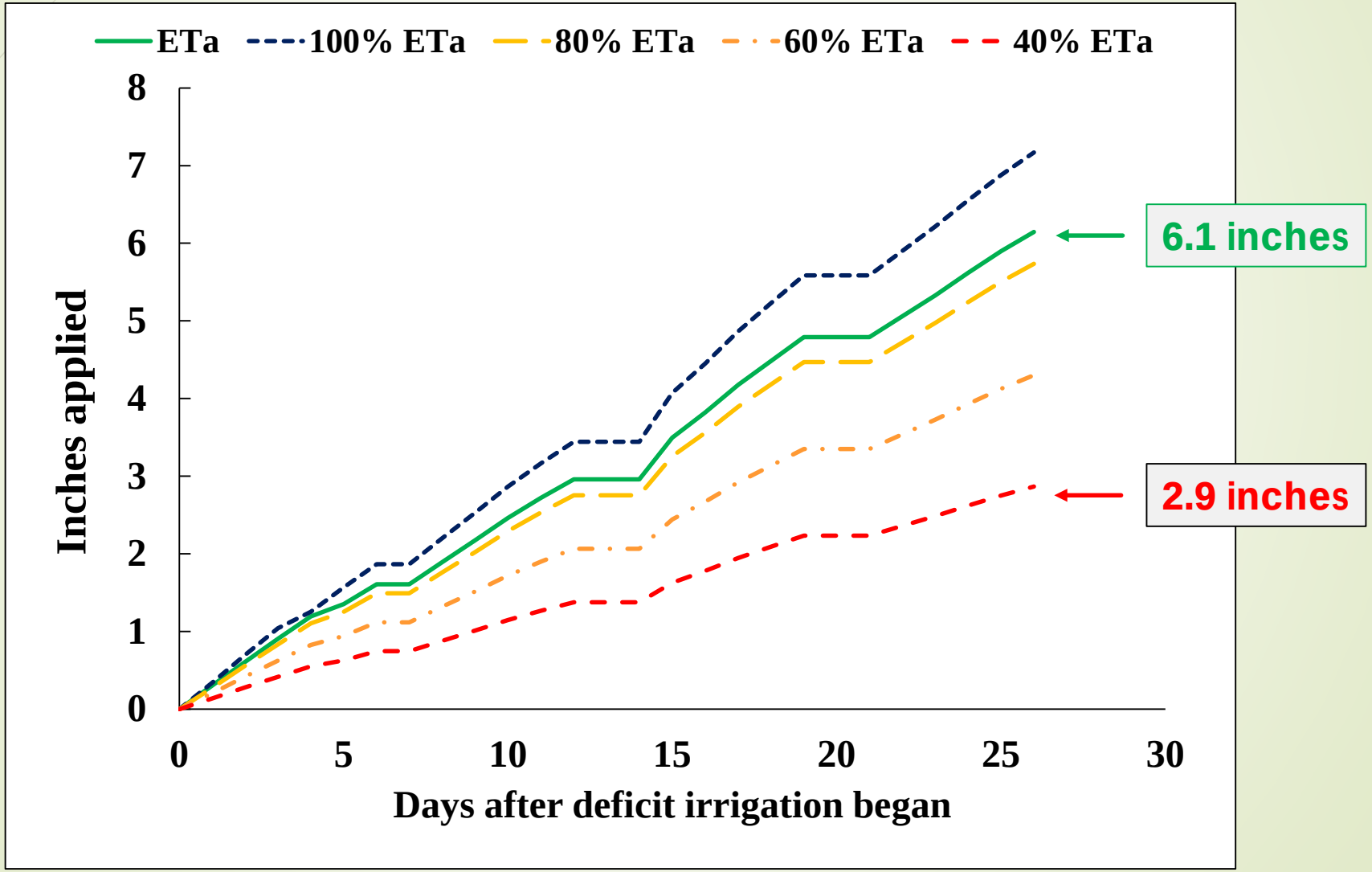
Study protocol:

- Whole field received 100% of ET_a (as measured by a Tule ET sensor) early in the season
- Deficit irrigation treatments started approximately 6 weeks preharvest (as early fruit begin to ripen)
- 4 treatments, 5 replications
  - Treatment targets were 100%, 80%, 60% and 40% ET_a

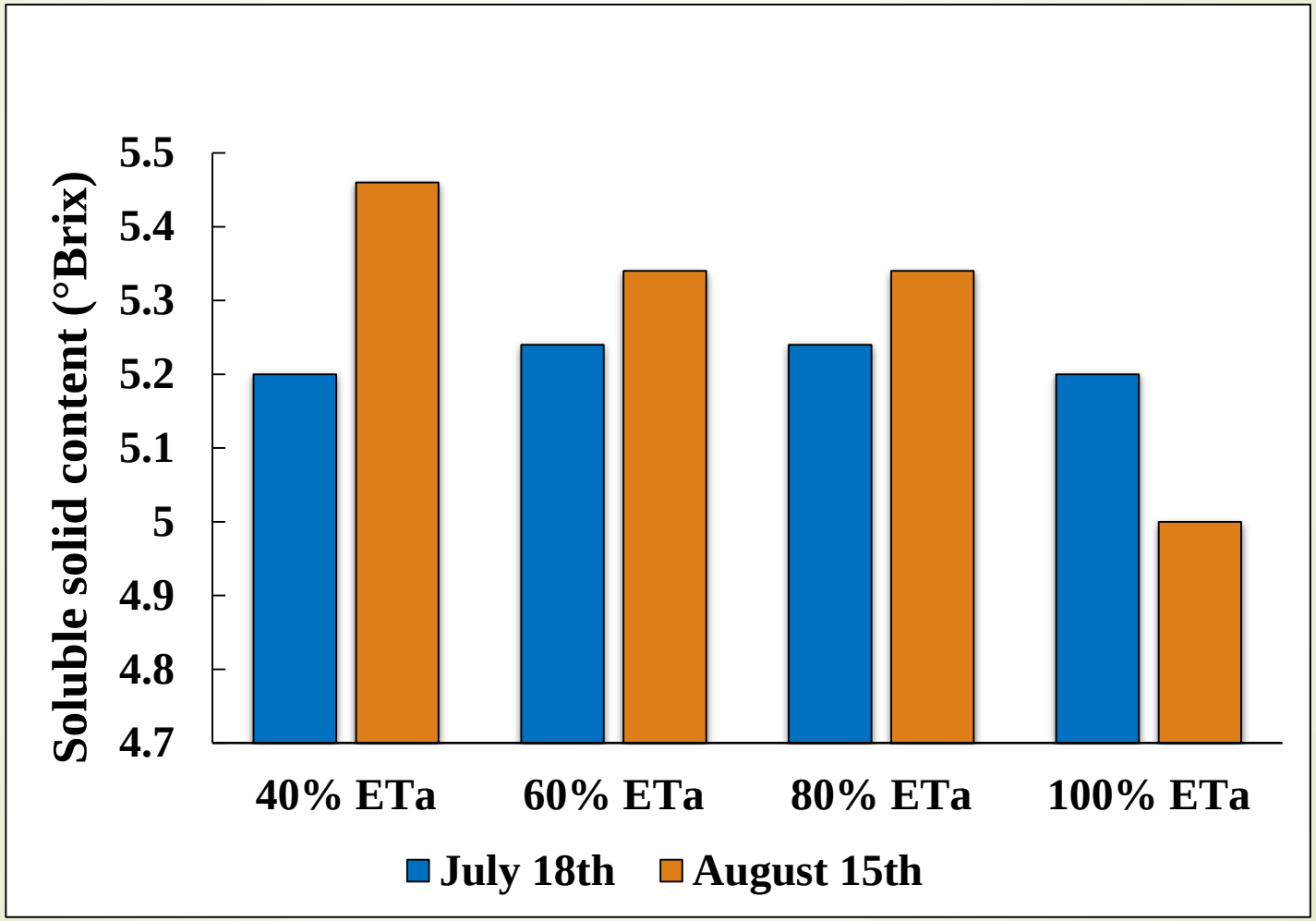
Irrigation controlled in each row

- A flow meter and valve were installed in each experimental row
- Deficit irrigation treatments were controlled manually, with applications 5 days per week
- All irrigation terminated 10 days before harvest

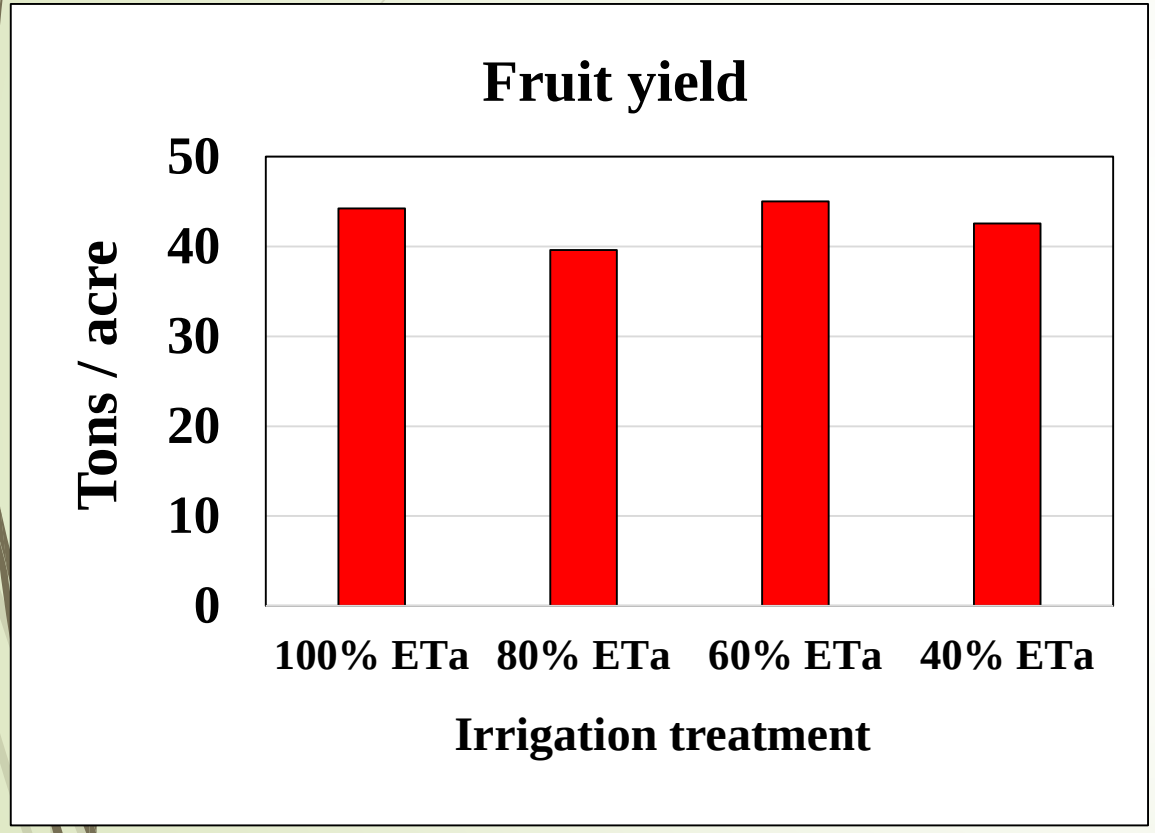
Irrigation management during the deficit period

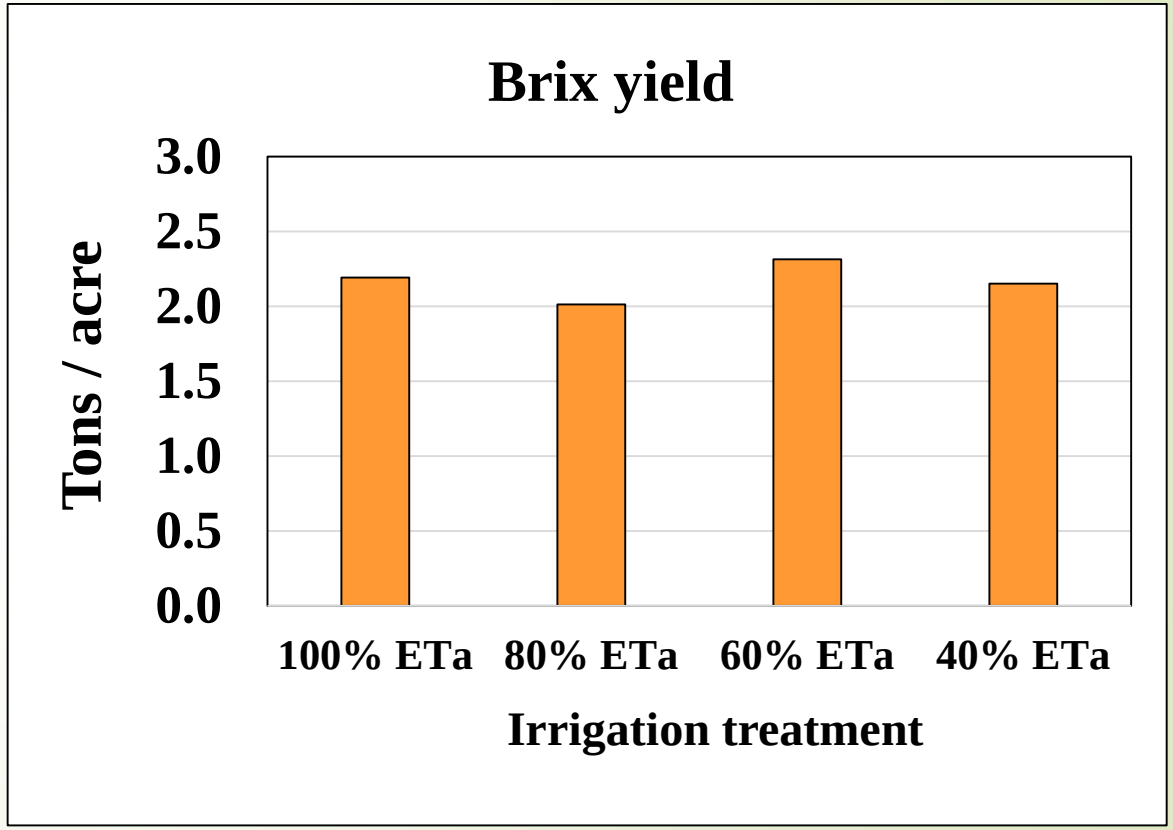


4 weeks of deficit irrigation significantly increased SSC in late-ripening fruit



Deficit irrigation did not significantly reduce fruit yield, or brix yield





Conclusions:

- deficit irrigation begun at first red fruit stage (5-6 weeks preharvest) offers the potential for water savings (and associated energy savings) for the grower
- potential increase in fruit SSC has energy use implications for the processor
- ideal late-season irrigation management is field-specific, but in most circumstances the crop can tolerate as little as 50% of ET_a with no loss of brix yield