Drip irrigation as an effective water conservation tool in the low desert of California

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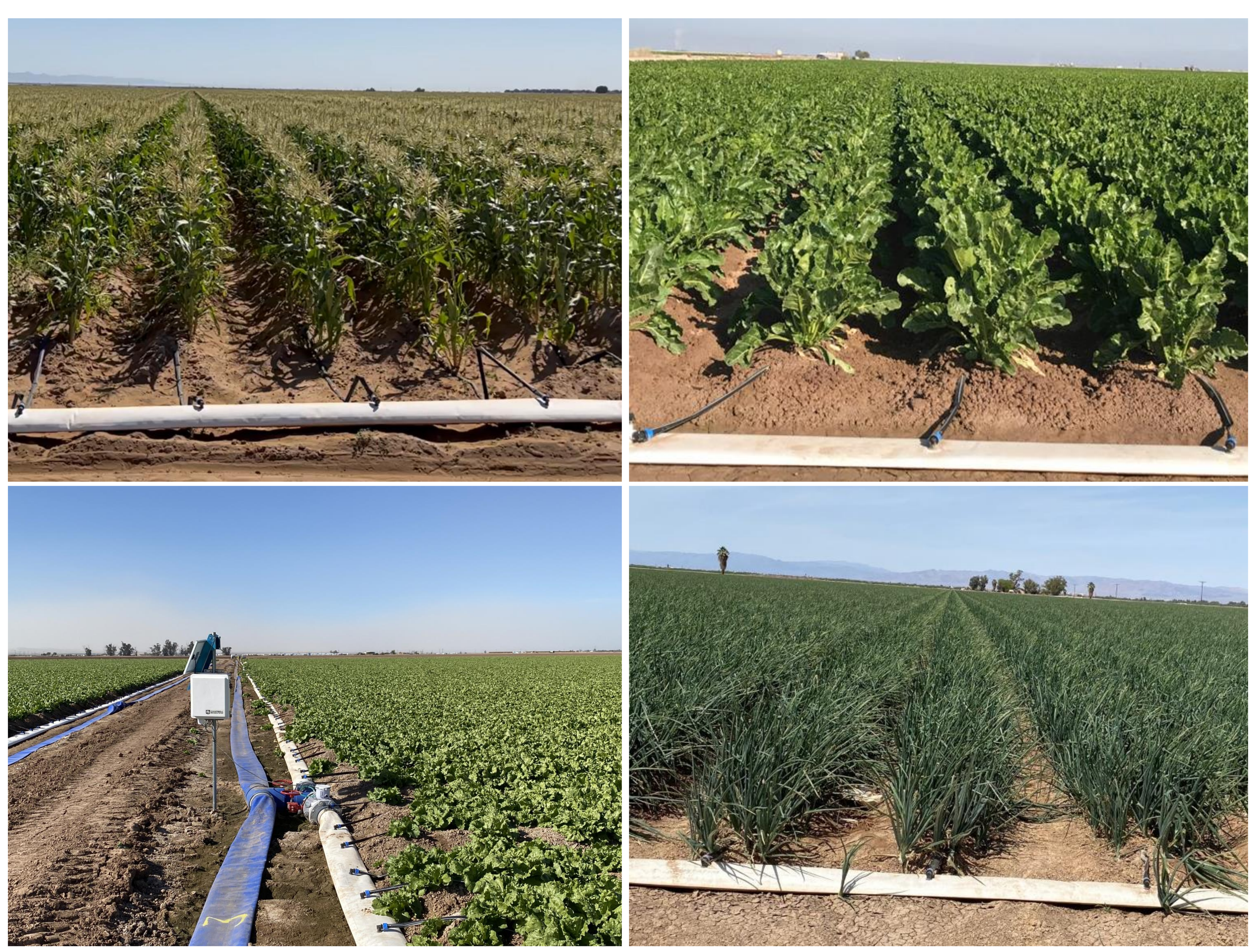
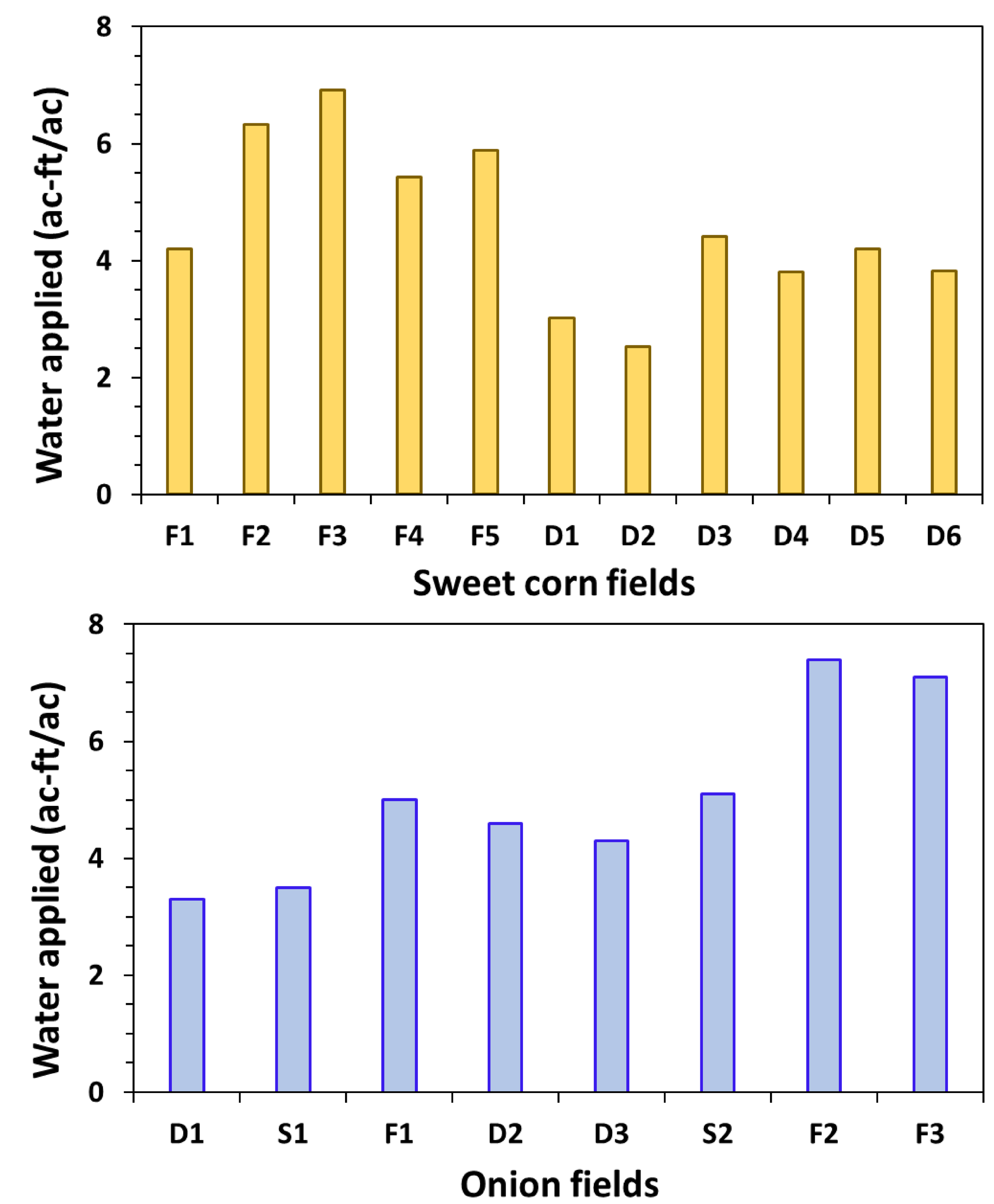
Introduction. Climate-Smart Agriculture (CSA) is a catchy term that seems to imply farming smarter in an era of climate change targeting increased productivity, enhanced resiliency, and reduced emissions. More efficient water usage through drip and subsurface drip irrigation (SDI) systems, supplemental and precision irrigation strategies and on-farm water conservation practices are considered as effective CSA tools to improve resource-use efficiency. The main purpose of this study was to explore the viability of subsurface drip irrigation versus conventional furrow and sprinkler irrigation methods in the low desert crop production systems.

Methods. The experiment was conducted in 36 commercial fields over four growing seasons. A comprehensive data collection was carried out for sugar beets, onions, sweet corn, and lettuce crops to evaluate the impacts on marketable yields, actual soil nitrate content and total N in the plants, actual ET (evapotranspiration), soil water availability, applied water and fertilizer, and soil salinity survey. Out of the 36 fields, 17 fields were drip irrigated, 15 fields were furrow irrigated, and 4 fields were under solid-set sprinkler irrigation.



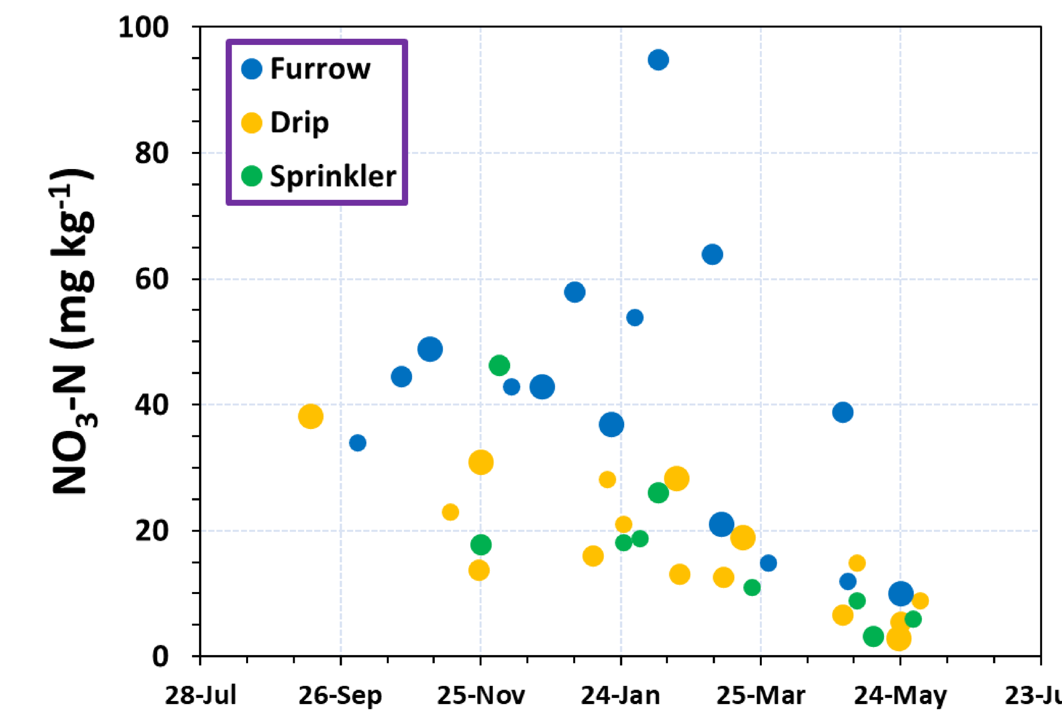
Four drip irrigated trial fields of sweet corn, sugar beets, lettuce, and onions in the Imperial Valley.

Results. While using sprinkler irrigation is a common practice for germinating sweet corn, lettuce, and onion fields in the low desert, all drip irrigated trial fields were effectively germinated using drip irrigation. Considerable water conservation was suggested at the SDI trial fields in compared with conventional irrigation practices. For instance, an average of 2.4 and 0.4 ac-ft/ac less water applied was observed at the drip irrigated onion fields than he furrow and sprinkler irrigated fields. This measure was 2.2 ac-ft/ac at the sweet corn trial fields. The average water conserved was found 1.0 and 1.3 ac-ft/ac for the lettuce and sugar beets fields as a result of adapting drip irrigation.



Water applied in the sweet corn and onion trial fields. D, F, and S stand for fields under drip, furrow, and sprinkler irrigation methods.

Higher nitrate-N concentration at the topsoil (1-ft) was observed at post-harvest and during the crop season at the furrow irrigated fields. The results demonstrated a greater nitrogen-use efficiency at the drip irrigated fields. Yield improvement was gained at drip irrigated sweet corn and sugar beets fields, 5% and 15%, respectively. It could be an advantage of drip in onions and lettuce, while more data is required for a solid conclusion.



Soil nitrate-N concentration (top 1 foot) in the onion trial fields (Drip vs. Furrow and Sprinkler irrigated fields).

Soil salinity can be a limitation for using SDI in onions, while salinity survey at the trial fields revealed that more frequent irrigation events and summer leaching are effective tools to manage the issue.

Conclusions. SDI clearly demonstrated a significant potential to enhance the efficiency of water and fertilizer use and to be considered as an effective water conservation tool in the desert southwest. The findings suggested yield improvement promises for drip irrigation. Further work is needed on the optimal system design and management practices, and strategies on the viability of drip irrigation to maintain economics and environmental sustainability for the low desert cropping systems.

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