

MID-SUMMER DEFICIT IRRIGATION OF ALFALFA IN THE SAN JOAQUIN VALLEY FOR WATER CONSERVATION

Daniel H. Putnam¹, Dong Wang², Sultan Begna², Khaled M. Bali³

¹ Department of Plant Sciences, University of California, Davis, CA 95616, USA. Email: dhputnam@ucdavis.edu

² USDA-ARS, Water Management Research Unit, Parlier, CA 93648, USA

³ UC Kearney Agricultural Research and Extension Center, University of California, Parlier, CA 93648, USA. Email: mbali@ucanr.edu

ABSTRACT

Efficient and practical irrigation water-saving measures are needed to cope with drought and water shortages in California. Alfalfa is one of the major field crops in California with over 50% of the production in the San Joaquin Valley. A mid-summer deficit irrigation study was conducted to investigate the effect of mid-summer deficit irrigation on alfalfa yield, water use efficiency (WUE), crop water productivity (CWP), and hay quality in the San Joaquin Valley. A three-year (2019-2021) field study was conducted on sandy loam soil at the University of California Kearney Agricultural and Extension Center (KARE) near Parlier, California. A Randomized Complete Block Design with two irrigation treatments (deficit and full irrigation) with three replications was used in this study. All treatments received standard irrigation amounts to satisfy full crop evapotranspiration (ET_c) prior to August (after the 5th cutting) after which no additional irrigation water was applied to the deficit treatments. Alfalfa was harvested on a 28-day cutting schedule. Applied irrigation water was measured using flow meters and soil matric potential values were determined using Irrometer Watermark soil moisture sensors. Actual evapotranspiration (ET_a) values were estimated by two Tule Technologies stations and climatic data were obtained from a California Irrigation Management Information System (CIMIS) weather station located at KARE. Results from the 3-year experiment showed that ET_a differences measured with the Tule system between fully irrigated and deficit treatments were relatively small. In general, we observed minor differences in ET_a between treatments ranging from 0.5 to 1.5 in. The seasonal average ET_a ranged from 43 to 46 in. Alfalfa WUE was highest during the first harvest cycle for both irrigation treatments. Mid-summer deficit irrigation resulted in saving significant amount of water, from 18 to 24 in. Mid-summer deficit practices resulted in 36% savings in applied water with only 13% decrease in alfalfa yield of deficit irrigated alfalfa as compared to fully irrigated alfalfa. The deficit and full irrigated treatments had similar neutral detergent fiber digestibility (NDF), acid detergent fiber (ADF), and lignin contents, with only minor differences in crude protein (CP) observed in some years. During drought periods in California, alfalfa growers could implement mid- to late-summer deficit irrigation as a feasible strategy to cope with reduced water allocations to reduce the impact of limited water supplies on crop productivity.

Keywords: Mid-summer deficit irrigation, Alfalfa water use efficiency, Crop water productivity, Forage quality.

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