Implications of using subsurface drip irrigation on water productivity, forage yield and quality of alfalfa under a Mediterranean Climate

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Abstract:
Hot and dry summers in California bring challenges to sustainable forage production for feeding dairies. The irrigated agriculture in California suffers due to periodic droughts and climate variability. To cope with all these challenges, improvement in irrigation practices and strategies are required. Subsurface drip irrigation (SDI) may deliver water more efficiently as a result of more timely applications and better distribution uniformity. This study was designed to understand the potential of SDI for enhancing water productivity, forage quality and yield of alfalfa under water deficit strategies in California Central Valley with a typical Mediterranean climate. The study was conducted at Parlier, CA on sandy loam soil with five treatments: T_1 (Check Flood Full irrigation, 100% of ET), T_2 (SDI-50% deficit, midseason cutoff-July), T_3 (SDI-25% deficit, cutoff mid-August), T_4 (SDI-25% deficit, with continual deficit 25% of ET), T_5 (SDI Full irrigation to 100% of ET), using a randomized complete block design with four replications. Irrigations were applied following the daily crop evapotranspiration (ET_c) which was calculated using the reference ET from Parlier CIMIS station and proper crop coefficient values developed at UC Davis. The preliminary results of first year (2017) revealed significant differences among the treatments with an increase of 9% in yield with SDI-Full compared to check flood irrigation, and a 12.4% increase in water productivity. Higher water productivities over the season were achieved in the deficit treatments with significant reduction in yield. The greatest water productivity was observed in T_2 (2.2 t/acre-foot) and the lowest one (1.9 t/acre-foot) was found in check flood. Acid detergent fiber (ADF) and apparent neutral detergent fiber (aNDF) results were non-significant but crude protein (CP) and digestible neutral detergent fiber at 48 hours (dNDF48) were found to be significant. Highest CP was obtained in T_5 (26.7%) and lowest was in T_2 (24.9%), higher dNDF48 was in T_1 (16.3%) and lowest was in T_2 (14.6%), higher ADF was in T_1 (27.4%) and lowest was in T_2 (25.8%), highest aNDF was in T_1 (34.5%) and lowest was in T_2 (32.5%). SDI has a high potential to improve alfalfa water productivity and forage quality due to its ability to more closely match ET_c and could be valuable during deficit irrigations because of the ability to apply small amounts of water to keep the crop from damage during droughts.