DEFICIT IRRIGATION STRATEGIES WITH SDI ALFALFA VARIETIES

Dan Putnam, CE Specialist, Ali Montazar, Project Scientist,
James Radawich, Grad Student, and Daniele Zaccaria, UC Davis.

INTRODUCTION

If the drought of the past 5 years has taught us anything, it's that full water allocations may be uncertain in the future. Further, there is an ongoing need to move water from one crop to another, or perhaps to transfer water to other users for payment. Alfalfa is well suited to short-term drydown (droughts), in fact may be the best crop to have in a drought due to its ability to survive stress periods. This research was instituted to see if 1) Drip irrigation would improve the ability to deficit irrigate alfalfa, and 2) Discover the interactions between irrigation deficits and variety performance.

EXPERIMENTS

Fifteen commercial or newly-released alfalfa varieties were established Fall, 2014 using a split plot design with four replications. Sprinkler irrigation was used for stand establishment and the trials were irrigated by SDI starting April 20, 2015, for the entire season, with 40-in spaced driplines installed 10-12-in deep. The driplines are of commercial type (Netafim Typhon 875 series) with inner diameter of 0.875 inches and regularly spaced (14") emitters with nominal flow rate of 0.18 gph at 10 psi.

Irrigation treatments. The irrigation treatments (Figure 1) included 1) full irrigation at 100% of crop ETc , 2) 75% of full water with sudden water cutoff on August 13, 3) 75% of seasonal water supply (full irrigation until 50% of seasonal ET occurred July 2nd, and then ½ normal irrigation for the rest of the season, and 4) 50% of ET (sudden cutoff on July 2nd). The full alfalfa ET

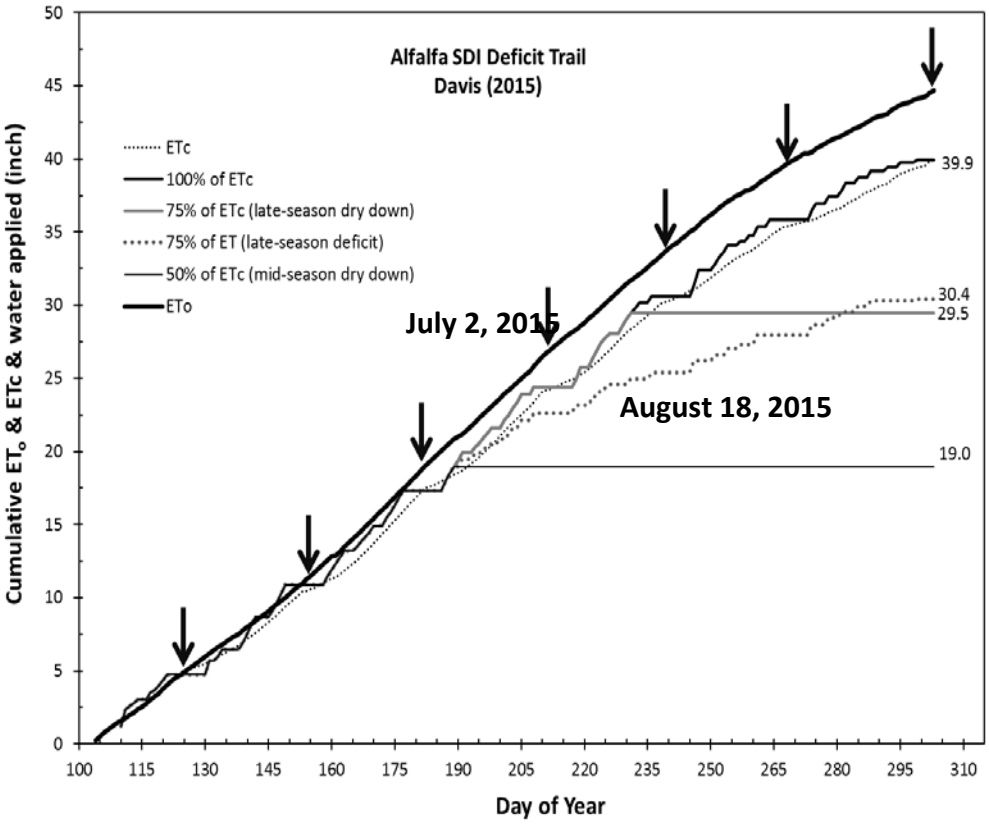

Figure 1. Cumulative alfalfa ET and applied water at the different irrigation treatments over the season 2015

was measured with Eddy Covariance instruments established nearby at Davis – the daily crop coefficient (Kc) values were adjusted based upon the changes observed during each cutting schedule – with the summed Kc values totaled approximately 0.85 of ETo directly from our Eddy Covariance readings for the fully irrigated treatment.

Alfalfa Yields. The average alfalfa DM yields of 15 varieties over eight cutting events at the irrigation treatments of Full (I1), 75% sudden cutoff (I-2); 75% cutoff full early, later deficits (I-3), and 50% cutoff (I-4) were 10.1, 9.7, 9.6, and 8.1 ton ac^{-1}, respectively in year one (Figure 2). A 20% yield reduction was observed for the 50% deficit irrigation scenario over the year, mostly from the last four cuttings of the growing season, which were affected by severe water limitations.

The reasons that alfalfa is capable of high yields in spite of midsummer irrigation cutoffs is that a smaller percent of the yield is harvested in the last 3 cuts of the year vs. the early production period. In most environments, more than 60% of the seasonal yields are harvested by July 1, and typically, an additional harvest based upon residual moisture is feasible after irrigation ceases. The long-term consequences of deficits on stand need further research, as well as the interaction with varieties.

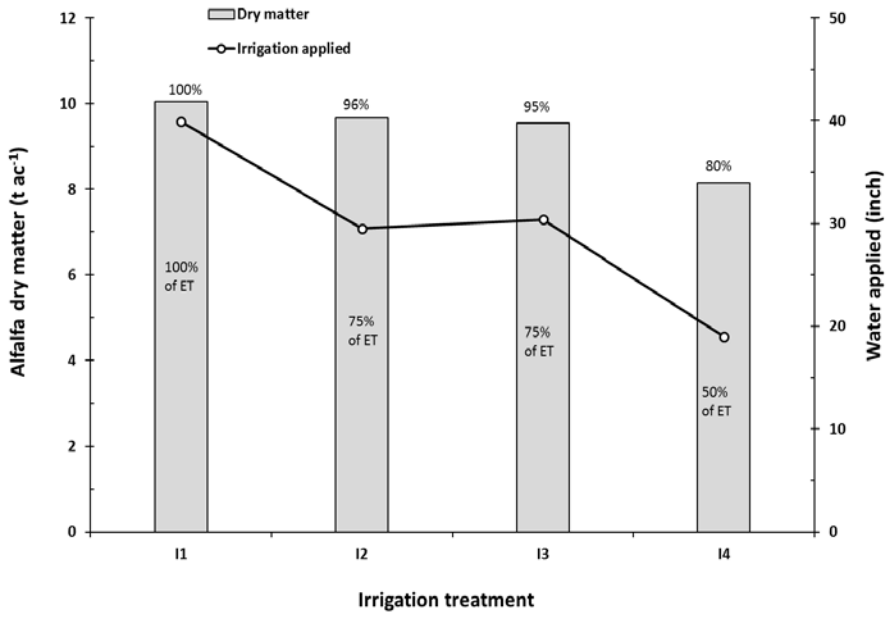

Figure 2. The average alfalfa DM of 15 varieties over the growing season and water applied for different irrigation treatments

PRELIMINARY CONCLUSIONS

Alfalfa is highly conducive to deficit irrigation strategies during low water years due to its deep rooted characteristics, flexibility, high yields under partial irrigation, and drought tolerance compared with many crops. In the first year of this study, yields were about 80% of normal when applied irrigation water was cut to 50% of full ET irrigation requirements. Yields were 95% of normal when irrigation was 75% of full ET. SDI in alfalfa enables greater 'fine tuning' of water applications, so that yields are maximized during early growth periods to lessen the effects of later water deficits. This experiment continues for two more years to understand long-term effects of deficits on alfalfa stand and the interactions of varieties with water.