

# Developing, Testing, & Implementing Improved Alfalfa Varieties for a Water-Challenged Future

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Alfalfa (*Medicago sativa* L.) production in the western USA is heavily dependent on irrigation. Irrigation water for much of the alfalfa in California derives from snowmelt in the Sierra Nevada (for the Central Valley) or Rocky Mountains (for the Imperial Valley). With the changing climate, irrigation water is expected to diminish, and many growers will be unable to fully irrigate their alfalfa, potentially leading to a decrease in yield and stand health. As a result of low water availability, alfalfa growers will need to cut-off irrigation for some part of the season, creating a deficit irrigation. Therefore, alfalfa will need to be able to survive periods of no irrigation during summer and early autumn when the temperatures are very high and be able to recover when water becomes available either as rain or irrigation during late autumn or winter. The objectives of this research are to identify cultivars that thrive under these extreme drought conditions and to breed new cultivars explicitly for the deficit irrigation environment.

We planted small plot field trials with commercial and experimental cultivars of alfalfa managed with full and deficit irrigation treatments at two locations in California. There will be two similar trials planted at two different locations in Utah. The trials include several paired populations selected from the same source germplasm under deficit and full irrigation in Davis and El Centro to determine if this selection method helps improve alfalfa for these conditions. In addition, we will identify commercial cultivars optimally suited to production under one or both irrigation environments. For the deficit treatment, the crop will be fully irrigated through June, with irrigation stopped in July for three months. Yield will be measured approximately monthly throughout the life of the trials during the growing season, or all year long in El Centro. Soil moisture, water applied, and estimated ET will be recorded throughout the experiment to judge the economic impact of using summer-cut-off irrigation at each location.

UC Davis experimental entries that are observed to have high yield and good stand persistence under both full and deficit irrigation will be released for commercial use. This study is important for the alfalfa industry since it will provide more knowledge to growers about how different germplasm of alfalfa reacts to summer deficit irrigation. As a result, we will be able to recommend cultivars and irrigation strategies to enable growers to optimize alfalfa production during years with limited irrigation water.

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