Evaluating the Response of Two Alfalfa Varieties to Deficit Irrigation in Northern Nevada

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In terms of economic production, alfalfa (*Medicago Sativa* L.) is the fourth most important crop in the U.S. (USDA-NASS, 2022) and the most important crop in Nevada (NDA, 2019), occupying approximately 41% of the land irrigated in the state (USDA-NASS, 2017). As a perennial crop with a deep root system and an extensive ground cover, alfalfa has a high consumptive water use in comparison with other crops. Increasing pressure over water resources in Nevada and other states in the arid Western U.S. is forcing alfalfa producers in the region to irrigate alfalfa without meeting its full evapotranspiration demands, a practice known as deficit irrigation. We are conducting an experiment at the Valley Road Experiment Station of the University of Nevada, Reno (UNR) to evaluate the response of two alfalfa varieties to deficit irrigation. We identified two alfalfa varieties that we expected would have contrasting water demands, as one is marketed as being drought tolerant (Ladak II, Great Basin Seeds) and the other is marketed as being highly productive (Stratica, Croplan). We applied three irrigation treatments to both varieties: full irrigation (full replenishment of soil water depletion in the top 1.5 m of soil to field capacity), mild deficit irrigation (80% of full irrigation), and moderate deficit irrigation (60% of full irrigation). We sow a total of 18 plots with dimensions of 1.6 m wide and 9.1 m long in the Fall of 2020. We arranged the plots in a randomized complete block design with a split-plot structure, with three irrigation treatments as the main plots, and the two alfalfa varieties as the subplots. We treated the nine main plots resulting from this design as nine independent irrigation blocks where the two alfalfa varieties received the same irrigation amounts throughout the growing season. We determined the irrigation amounts required by irrigation treatments using a network of six soil water sensing stations (one per alfalfa variety and irrigation treatment) connected to the Internet-Of-Things. Each sensing station consisted of three Time Domain Reflectometer (TDR) soil water sensors (TDR-315H, Acclima, Meridian, ID) buried at depths of 20, 60, and 90 cm. Hourly volumetric water content measurements collected by the network of soil water sensing stations showed that the highly productive alfalfa variety consumed water from the soil at a much faster rate than the drought tolerant variety. In despite of this, during the first year of the study we found no significant differences in yield or quality indicators among alfalfa varieties at any of the irrigation treatment levels. The yield of both alfalfa varieties decreased in linear proportion to the deficit irrigation level, but the yield difference was only significant between the full irrigation treatment and the moderate deficit irrigation treatment applied to the drought tolerant alfalfa variety. We found no significant differences in quality indicators among irrigation treatments.

References

NDA (2019). *Economic Analysis of the Food and Agriculture Sector in Nevada*. Retrieved June 25, 2022, from https://agri.nv.gov/uploadedFiles/agrinvgov/Content/Resources/Data_and_Reports/EcAn_final_web_1.pdf

USDA-NASS (2017). *2017 Census of Agriculture, Nevada. Table 10. Irrigation*. Retrieved June 25, 2022, from https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Nevada/st32_2_0010_0010.pdf

USDA-NASS (2022). *Crop values 2021 summary*. Retrieved June 25, 2022, from https://downloads.usda.library.cornell.edu/usda-esmis/files/k35694332/gb19g8865/jd474051x/cpvl0222.pdf

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