

Water Use By Alfalfa

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The amount of water available to alfalfa (*Medicago sativa* L.) is generally assumed to be a strong determinant of yield, and it is frequently reported that the relationship between rainfall and forage yield is linear with about 67 mm water required to produce a dry matter yield of 1 Mg ha⁻¹ (6" for 2000 lbs/acre). Most data reporting water use by alfalfa have come from controlled environments or irrigated field trials. The objective is to determine the relation between rainfall and rainfed alfalfa forage yield in Oklahoma in the southern Great Plains of the USA.

Annual forage yield data were used for 1985 to 2004 from alfalfa cultivar evaluations, consisting of first, second, and third harvest years from nine locations. The number of harvest years was three at Ardmore, Cherokee, El Reno, and Woodward; 12 at Chickasha and Stillwater; 13 at Haskell; 15 at Tipton; and 42 at Perkins, for a total of 106 harvest years during 21 years.

Daily precipitation records from the National Oceanic and Atmospheric Administration site nearest each trial, usually within 3 km were totaled for five intervals of dates to determine if precipitation during some periods were more important than others. The five intervals were:

- Calendar Year (the most commonly cited)
- 23 Sept. to 22 Sept. (100 d prior to the beginning of the year for 365 days)
- 1 April to 15 Oct. (growing season, 198 d)
- 1 April to 10 d prior to last harvest of year
- 23 Dec. (100 d before the growing season) to 10 d prior to last harvest of year

Total annual yield estimates came from cultivar tests consisting of about 20 entries, sown in plots 5 meters long consisting of five rows, 15 cm apart, with six replications. Pesticides were used to control pests as needed, and plots were harvested when most entries were in bud or early bloom stage, 3 to 6 times per year, depending on the site and weather. Yields were recorded for each harvest during 3 years. The site mean total yield for each year was used for this study.

The relation between rainfall and alfalfa forage yield was not linear in this set of environments because rainfall in excess of 900 mm (35") tended to reduce yield (fig. 1). Rainfall totals in intervals beginning in April or ending near last harvest resulted in the highest correlations between rainfall and forage yield. Perkins, with the most harvest years, had significant correlations for all intervals, using data from 2 and 3 years. Highest correlations were at the Chickasha site for time intervals beginning in April or ending near last harvest. The same time intervals were significant for the overall (all sites) relationships. Rainfall for calendar year and yield were not correlated except at Perkins. In all cases the R² values were higher for years 2 & 3 yields than when the 1st-year yields were included. Highest R² were for years 2 and 3 when the time interval ended just prior to last harvest of the year (fig. 2).

