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# Arizona Cooperative Alfalfa Forage Yield Trials (1993-2020)

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## Abstract

The University of Arizona conducted alfalfa forage yield trials at Maricopa and Tucson from 1993 to 2020 (CLICK HERE FOR DATASET). Both the Maricopa and Tucson are located in the low elevation desert, but the Maricopa location at 362 m elevation is warmer than the Tucson location at 712 m elevation. The cultivars and lines tested were provided by the alfalfa seed industry. Two public varieties (CUF 101 and Lew) were included as checks. The seed was sown into five rows spaced 152 mm apart. The plots were 0.91 m wide by 3.66 m long. Irrigations of about 152 mm were applied at an interval of twice per cutting or as needed based on rainfall or length of cutting cycle. The plots were cut with a sickle-bar mower with a 1.02-m cutting bar set at a height of 51 mm. The fresh forage was weighed, and yields were reported on a dry matter basis. Final plant density (stand) was estimated at the end of the season by counting crowns from two 0.28 $m^2$ areas in each plot after the last harvest. The trials were conducted for two harvest years in most cases. A dataset is provided in an Excel workbook that includes crop management, daily weather, soil profile descriptions, and the harvest and stand data. Potential applications include simulation modeling and analyses of climate uncertainty.

**Key words:** Alfalfa cultivars, alfalfa lines, productivity, plant density, plant population, stand

## Background

The Arizona Cooperative Alfalfa Forage Yield Trial Program, administered by the Arizona Agricultural Experiment Station and Arizona Cooperative Extension, conducted alfalfa forage yield trials in cooperation with the alfalfa seed industry from 1993 to 2020 at the University of Arizona's Agriculture Centers in Maricopa and Tucson. The main objective was to provide alfalfa growers and seed industry representatives with a neutral assessment of relative performance of new germplasm compared to standard cultivars. The Maricopa location is at 362 m elevation and has a sandy clay loam soil. The Tucson location is at 712 m elevation and has a very fine sandy loam soil. Very non-dormant cultivars are well-adapted to this environment, which is typical of agricultural areas of the low elevation deserts of Arizona where 8 to 10 harvests of alfalfa are common each year, and stands typically remain productive for 3 to 4 years. All fields were laser-leveled and alfalfa was irrigated using the border-strip method.

## Protocol

Alfalfa varieties and experimental lines were solicited from and provided by private seed companies and public varieties (CUF 101 and Lew) were included as checks. Detailed information on individual alfalfa cultivars and lines is available from the Association of Official Seed Certifying Agencies (AOSCA, 2021). We usually planted in October, but there were exceptions (indicated in the dataset). The experimental design was four randomized complete blocks with an average of 24 entries, but ranging from 11 to 46 entries. The seed was sown into five rows spaced 152 mm apart using a single-row hand planter at a rate of 2.24 g/m2. The plots were 0.91 m wide by 3.66 m long. Irrigation water was applied the day after planting to germinate the seed. Irrigations of about 152 mm were applied as needed based on rainfall or length of cutting cycle. From planting to the first harvest, four to 11 irrigations were applied (mean of 7). After the first harvest, about two irrigations were applied between harvests. The plots were cut with a sickle-bar mower with a 1.02-m cutting bar set at a height of 51 mm, the forage was raked, placed on a tarp, and weighed with a hanging scale suspended on a tripod. The fresh forage was weighed and converted to a dry matter basis by assuming a moisture

content of 80%. The plots were not subjected to insect pressure severe enough to warrant chemical control. No herbicides or fertilizers were applied. Final plant density (stand) was estimated at the end of the season by counting crowns from two 0.28 m2 areas in each plot after the last harvest. The trials were conducted for two harvest years in most cases, and sometimes a few harvests were obtained in the third harvest year.

## Data Format

Data are formatted to facilitate processing with software that can read individual worksheets of an Excel workbook.. The terminology is described in the Dictionary sheet (Table 1) and is based on the ICASA standards (White et al., 2013).

Table 1. Excel worksheets and their content.

| Excel worksheet | Content |
|---|---|
| Readme | Brief description of the Arizona Cooperative Alfalfa Forage Yield Trials (1993-2020) including background with site characteristics and protocol providing details on how the trials were conducted |
| Dictionary | Description of each variable as well as variable units and data type |
| Trial name description | Explanation of the name of each trial including location and years of first and last harvest |
| Summary of trials | Summary of the total forage yield over harvest dates and final plant density for each entry |
| Genotypes | Description of each entry including original names or experimental designations, release year, and breeding program |
| Locations | Description of each location including elevation, longitude, latitude, field designation, soil series, and soil taxonomic class |
| Soil physical properties | Sand, silt, clay, soil texture, bulk density, field capacity, and permanent wilting point. |
| Soil chemical properties | Organic matter, pH, and concentration of major, secondary, and minor plant nutrients |
| Plantings | Planting date and row direction for each trial |
| Irrigations | Irrigation date for each trial |
| Harvests | Harvest date for each trial |
| Weather | Air temperature, relative humidity, vapor pressure deficit, solar radiation, precipitation, soil temperature, wind speed, wind vector, wind direction, heat units, reference evapotranspiration, actual vapor pressure, and dewpoint |
| Maricopa 1993-95<br>Maricopa 1995-97<br>Maricopa 1997-99<br>Tucson 2019-20 | Forage yield on a dry matter basis for individual harvest dates and total of harvest dates for each entry |
| Maricopa 1999-00<br>Tucson 2001-03<br>Tucson 2003-04<br>Tucson 2005-06<br>Tucson 2007-08<br>Tucson 2009-10<br>Tucson 2011-12<br>Tucson 2013-14<br>Tucson 2015-16<br>Tucson 2017-18 | Forage yield on a dry matter basis for individual harvest dates and total of harvest dates and final plant density at last harvest for each entry |

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