RESPONSE OF ALFALFA TO DIFFERENT LEVELS OF IRRIGATION

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Under and over irrigation can seriously affect alfalfa production and decrease the profitability of the crop. Because of harvest constraints, soil type, weather changes, and the year long crop culture, supplying the right amount of water to alfalfa can indeed be challenging.

Alfalfa has a high water requirement. A summarization of estimated alfalfa water use in California and Arizona was given by Marble (1974) and showed water use to be about 53, 59, 81, and 79 inches for the Sacramento, San Joaquin, and Imperial Valleys of California and the Salt River Valley of Arizona, respectively.

While alfalfa water use varies from area to area and year to year, a certain minimum of water is required to produce a ton of forage. In tests in such diverse areas as California (Donovan and Meek, 1983), Nevada, New Mexico, Nebraska, and North Dakota (summarized by Sammis, 1983) about 6-7 inches of water were required to produce a ton of alfalfa under non-limiting conditions.

In an extensive trial at Brawley, California during the period 1974-1978 (Donovan and Meek, 1983), effects of both under and over irrigation were studied. Yield decreased by 32% when 25% less water than Et (Evapotranspiration or consumptive water use) was put on. There was a yield decline of 15% when 12% less water than Et was applied. Yields remained the same or increased slightly when 12% more water than Et was put on. The amounts of water required per ton were 8.0 inches in the dry (25% of Et) treatment, 7.6 inches in the semi-dry (12% of Et), 7.3 inches at estimated Et and 8.0 inches in the wet treatment (12% of Et). Yields ranged from 7.5 tons in the dry treatment to 11 tons in the wet treatment.

The effects of under-irrigation may not be too severe unless deficits are more than 10% lower than optimum applications because there is usually a small reserve of soil moisture that the plant roots can tap to "tide the plant over" until better moisture conditions resume either by rainfall or irrigation. The larger the rootzone, the more available water (Davis, 1963).

Extended drought accompanied by rather high temperatures may severely curtail yields especially in shallow soils or soils with low water holding capacity. This condition would certainly call for an evaluation of the amount of evapotranspiration that has taken place (usually available through statewide climatological monitoring stations) and an actual appraisal of soil moisture itself to the bottom of the rootzone.

The stands in fields where water applied is less than optimum usually remain above levels where stand loss would be a problem. Consequently, weeds or grass would be less likely to invade the alfalfa than under waterlogged conditions. Soil oxygen levels would be expected to be adequate also.

The effects of over-irrigation are more drastic and could result in extensive stand loss. Beyond this, only small or no yield increases occur when amounts applied exceed Et. In the Brawley alfalfa irrigation trials where 12% more water than estimated Et was applied, yields increased only 2% and this was not significant. Some stand loss occurred In commercial production any weed or grass infestations into thin stands could lead to yield and quality decreases.

In 1978, shortly before the conclusion of the Brawley irrigation trials, an unusual tropical storm descended on the area bringing an unexpected 4.7 inches of rain to the experimental site. Since the plots had been irrigated a few days before the rain and the temperatures were high, the wet plots were virtually wiped out. Alfalfa plants died mainly because of low oxygen levels in the rootzone. Meek et al (1980) showed that low oxygen conditions for prolonged periods were instrumental in bringing about alfalfa mortality. Lehman et al (1968) emphasized that letting water stand on clay soils (via

frequent heavy irrigations) could create problems and advocated more frequent light irrigations to avoid stand loss. A point to remember here is that loss of plants can occur in hot weather where excessively dry clay soils are irrigated heavily, especially after a cutting.

Improved Alfalfa Germplasm

Some progress is being made with new alfalfa cultivars (varieties) having the ability to stand "wet feet." A number of recent cultivar releases have shown a degree of tolerance to waterlogged conditions under high summer temperatures (Lehman, 1973). While both flooded and dry conditions are avoided where possible, built-in hardiness may help in some adverse conditions.

Efforts are continuing to find and utilize those cultivars which perform well under limited water conditions. Wilson et al (1983) conducted an irrigation trial in which 24 cultivars were compared in dry, medium, and wet conditions. There was a difference in the response of the cultivars. A few cultivars did better at low levels of irrigation while others did better at medium and high levels of irrigation. A number of cultivars did well at all levels of irrigation, demonstrating their overall adaptability.

Another area being looked at by various researchers for improved forage yield and utilization of irrigation water is to enhance production during those periods when the crop grows best. This would include increased adaptability of the cultivars to their growing situations, and also an effort to manage water, harvest traffic and other items so the built-in yield potential of the cultivars can be expressed.

Grower Situations

Grower goals and objectives are an important part of any alfalfa irrigation program. Therefore, alfalfa responses to irrigation should be judged in that light. Also, constraints of soil type, environment, water availability, and economics have to be considered. Recently two articles appeared in a farm magazine, one pointing out the possibility of alfalfa yield losses with inadequate summer irrigation and another citing a grower preference for letting the alfalfa dry out during part of the summer. In each case, the cause for concern was valid even though the remedies represented a different way of handling the alfalfa crop. In the first instance, the unusually high summer temperature could contribute to an overdry subsoil and the addition of some supplemental irrigations would be warranted. In the other case, the grower was more interested in a long-lived stand and means to maintain it.

Our knowledge of alfalfa response to irrigation or soil moisture in general has increased in the past several decades. We also have more precise means of assessing soil moisture and effects of past and ongoing weather. Weather forecasting, at least in the short run, is fairly accurate. It is quite likely that we can do a better job of learning what existing trends of soil moisture are in our soils and how to defend against the vulgarities of weather be it too wet or too dry. Additionally, we can help restore optimum soil moisture more quickly when the opportunity for doing so presents itself.

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