IRRIGATION CUTOFFS WITH ALFALFA – WHAT ARE THE IMPLICATIONS?

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Alfalfa lends itself to irrigation strategies where less water is applied than is needed by the crop. The crop may recover after irrigations are returned to normal if the crop is not subjected to excessive stress. In this way, water may be used for other crops on the farm or transferred to municipalities. Alfalfa irrigation cutoffs have been practiced in the past and there is a body of research data on this practice. The purpose of this paper is to explore some of the implications of alfalfa irrigation cutoffs on yield, water use efficiency, stand, quality, weeds, insects, and diseases. The economic or social ramifications of alfalfa irrigation cutoffs and associated water transfers will not be addressed.

Alfalfa irrigation cutoffs are most likely to occur in the summer when water requirements are high and yields, quality, and prices are low. However, alfalfa irrigation can be cutoff any time of the year and some studies have reported on the effects of cutoff during the winter (2, 3). A common effect of alfalfa irrigation cutoff is reduction in yield during the cutoff period. The severity of the yield reduction depends on the residual moisture in the soil from the previous irrigation and the water demand by the crop. If the crop is under sufficient stress during the cutoff period, yield may not recover for several cuttings or not at all (Table 1). In severe cases, the crop may be permanently damaged and stand reduced. Alfalfa irrigation cutoff may or may not reduce the yield over the life of the stand but usually results in less irrigation water application (Table 1). The irrigation water use efficiency, or the amount of alfalfa produced per unit of water, may be increased by irrigation cutoff except in severe cases at low elevations where stand loss also occurs (Table 1). Alfalfa irrigation cutoff has resulted in permanent stand reduction in studies conducted at El Centro, CA and Yuma, AZ, has not affected stand at Maricopa, AZ, and has actually resulted in less stand loss in Las Cruces, NM (Table 2). Alfalfa irrigation cutoff and water stress in general, can increase the quality of the alfalfa due to a slowing of growth, shortening of stems, and delay in maturity (Table 3).

The effect of alfalfa irrigation cutoff on weeds, insects and diseases has not been well-studied and may be situation dependent. Before the advent of effective herbicides for summer grass control, irrigations were often cutoff in July and August in the desert southwest to help control these troublesome weeds. In a study conducted at El Centro, CA, weed density in the winter was higher in the summer irrigation cutoff plots possibly due to stand loss or weaker competition from the alfalfa crop (Table 4). Some insects may be attracted to water-stressed alfalfa such as whitefly, potato leafhoppers, and three-cornered alfalfa hoppers, but there is some evidence to suggest that at least in the case with whitefly, they are eventually repelled by water-stressed plants because the sap is too thick for them to feed efficiently (Table 4). Alternatively, in the

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case of some insects, feeding on a water-stressed plant may accelerate the demise of an already weakened crop. Similarly, an alfalfa plant under water stress from irrigation cutoff may be further damaged by plant diseases. However, the only documentation of the effect of irrigation cutoff on alfalfa diseases is from a study conducted at Las Cruces, NM where phytophthora root rot infected all of the plants irrigated normally but only a third of the plants with irrigation cutoff from July through February (4). Damage from bacterial and fusarium wilts were similar regardless of irrigation in this study.

Alfalfa irrigation cutoff may have long term implications beyond the life of the crop other than reduced yield and damaged stand. In a study conducted in the Imperial Valley, alfalfa irrigation cutoff resulted in salt accumulation at about the 2-3 ft depth (Table 4) and a reduction in subsoil moisture (1). However, in a study conducted at Las Cruces, NM irrigation cutoff had no effect on a subsequent crop of sudangrass.

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Table 1. Annual yield, irrigation water applied, and irrigation water use efficiency as affected by irrigation cutoff.

			Annual yield		Annual irrigation water applied		Irrigation water use efficiency	
Location	Final Year	Cut-off months	Control	Summer cutoff	Control	Summer cutoff	Control	Summer cutoff
			tons/acre		acre ft/acre		tons/acre/ft of water	
El Centro [(1)]	1993	Aug-Sep	4.8	3.4*	4.1	3.3	1.2	1.0
Yuma [(2)]	1992	Jul-Oct	8.3	5.4*	11.0	6.4	0.8	0.8
Maricopa [(2)]	1992	Aug-Sep	8.2	7.4*	5.1	4.2	1.6	1.8
Maricopa [(3)]	2010	Aug	8.1	7.9ns	5.8	4.9	1.4	1.6
Las Cruces [(4)]	1980	Sep-Feb	6.0	5.7ns	6.7	4.0	0.9	1.4
Las Cruces [(5)]	1986	Aug-Oct	8.7	9.2ns	5.0	3.3	1.7	2.8

Table 2. Final stand density of alfalfa as affected by irrigation cutoff.

			Final stand density	
Location	Final Year	Cutoff months	Control	Summer cutoff
			plants/ft^2	
El Centro [(1)]	1993	Aug-Sep	5.9	2.2*
Yuma [(2)]	1992	Jul-Oct	4.0	1.5*
Maricopa [(2)]	1992	Aug-Sep	3.4	4.1ns
Maricopa [(3)]	2010	Aug	7.4	7.9ns
			% survival	
Las Cruces [(4)]	1980	Sep-Feb	11	19*
			% stand cover	
Las Cruces [(5)]	1986	Aug-Oct	25	53*

Table 3. Alfalfa protein and ADF as affected by irrigation cutoff.

				Protein		ADF	
Location	Final Year	Cut-off months	Sample date	Control	Summer cutoff	Control	Summer cutoff
				%		%	
Maricopa [(3)]	2010	Aug	27 Aug 09	20.3	21.1ns	30.5	24.7*

Table 4. White fly damage rating (0=none and 5=severe) on 21 Oct 91, weed density on 21 Dec 91, and soil salinity content on 20 Oct 92 affected by irrigation cut-off.

			White fly damage		Weed density		Soil salinity	
Location	Final Year	Cut-off months	Control	Summer cutoff	Control	Summer cutoff	Control	Summer cutoff
			rating (0-5)		weeds/plot		dS/m	
El Centro [(1)]	1993	Aug-Sep	2.95	2.30*	9	45*	6.1	8.2*