WATER CONSERVATION IN ALFALFA FOR THE IMPERIAL VALLEY

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Abstract: An optimum irrigation was compared to lesser amounts to determine the effect on yield, stand and soil salinity of CUF 101 alfalfa. Yield loss from withholding irrigation in July, August, and September was 44%, in August and September 27.5% with water savings 85 and 49 cm respectively. Salinity accumulation was greatest at an interface of a clay over sandy horizon at 50 to 75 cm depth in the driest treatment. Stand was greatly reduced during the first of the three year trial but showed no significant differences due to the irrigation. Yield reduction and water saving was used to calculate the value of water which could be transferred to municipal use during a drought.

Keywords: Alfalfa stand, soil salinity, yield, whitefly, irrigation, neutron probe, ground cover, weeds, CUF 101.

INTRODUCTION

In times past it was common in summer to withhold irrigation from alfalfa in Imperial Valley California to limit loss of stand from root pathogens. Development of varieties resistant to the root pathogens allowed culture through the summer. The drought of the past six years prompted a restudy of the effect of withholding water on alfalfa to determine the yield loss for increments of water withheld. The data would be used to set a price of water for sale by farmers to stressed municipalities.

METHODS

A three year project was initiated using a CUF 101 variety of alfalfa that had been developed in this area. Six other varieties were compared to the CUF 101 in yield reduction from the treatments presented in Table 1.

Table 1. Irrigation treatments first year 1991.

Irrigation Treatment	Number of irrigations			
	July	August	September	October to June
Optimum check	3	2	2	10
Minimum stress	3	1	1	10
Short stress	3	0	0	10
Long stress	0	0	0	10

The soil was a Holtville series, clay over sandy texture with a clay layer to 50 cm on the east and to 70 cm on the west. The alfalfa was planted in a 9 meters wide strip 84 meters long. Plots were planted in the center 2 meters of the strip leaving 3.65 meters of CUF 101 border on each plot boundary. Irrigation was by border check. A 5 meter unplanted strip of soil was left between the border and the planted alfalfa to keep the soil moist and prevent soil cracking. Figure 1 is a diagram of the layout. Each of the smallest plots contained seven randomized varieties: CUF 101 UC Cibola, Dofari, Mesilla, Moapa 69, UC 150, and Wilson. Neutron soil moisture tubes were placed in the CUF border to monitor soil water changes in each end of the 12 irrigation treatment plots. The moisture in the top 15 cm was determined gravimetrically. Moisture readings were taken before and after harvest and before and after irrigation. Stand was counted prior to and after the treatments in harvested plots using a 0.1 m^2 steel circle. The center was marked with a steel spike and located with a metal detector so the same area could be located for counting. Weeds were counted in each of the 252 plots in

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December after the first years treatments. Soil samples were taken for saturation extraction in 30 cm intervals to 122 cm.

RESULTS

Plots were harvested as shown in Figure 2. Cumulative yield up to the latest is shown in Figure 3. The water extraction pattern of the four treatments is shown in figure 4. The total water applied is in Figure 5. Stand in Figure 6, the average salinity of the entire profile Figure 7, and the average salinity of each 30 cm horizon in Figure 8. The weed count taken in December is shown in Figure 9.

VALUE OF WATER

Costs of production were obtained from Guidelines to Production costs and practices , Imperial County. Figure 10 shows a result of calculating profit from the optimum and Figure 11 the short treatment. The difference in profit from the two treatments divided by the difference in water application of the two treatments produces the type of data shown in Figure 12.

ACKNOWLEDGEMENTS

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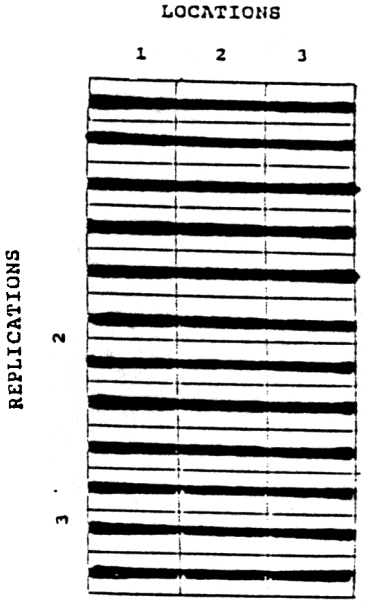
REFERENCES

Laemmlen, F.F. 1991. Guidelines to production costs and practices. Imperial County Cooperative Extension University of California Field Crops Circular 104-F.

FIGURE 1. PLOT LAYOUT



EACH PLOT HAS UC CIBOLA, CUF 101, DOFARI, MESILLA, MOAPA 69, UC 150 AND WILSON RANDOMIZED IN 1 X 6 METER PLOTS WITH 3 METERS PLANTED BORDER AND 5 METERS UNPLANTED BORDER TO PREVENT SOIL CRACKS.

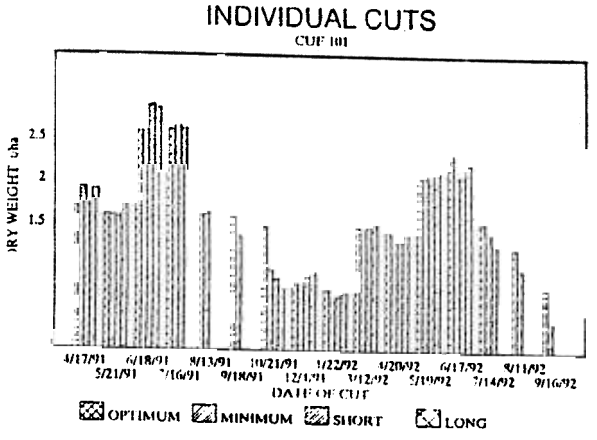


Figure 2. Individual harvests of four irrigation treatments.

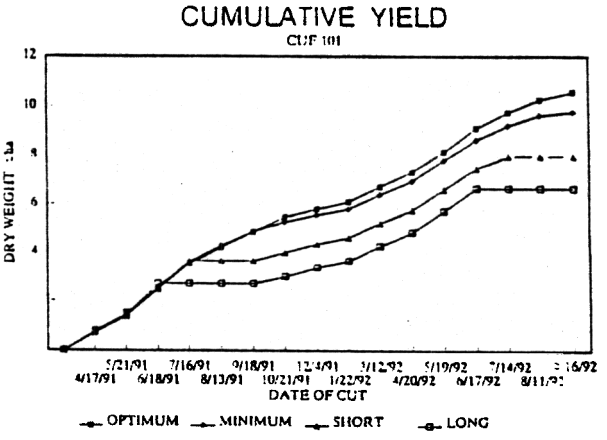


Figure 3. Cumulative yield of four irrigation treatments.

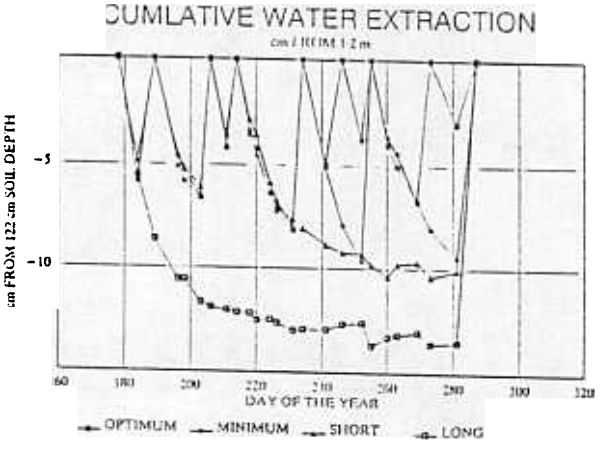


Figure 4. Soil Water extraction from 122 cm profile in four irrigation treatments.

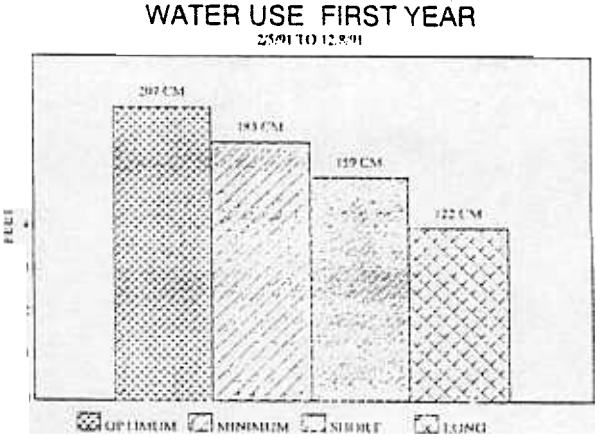


Figure 5. Total water applied to four irrigation treatments.

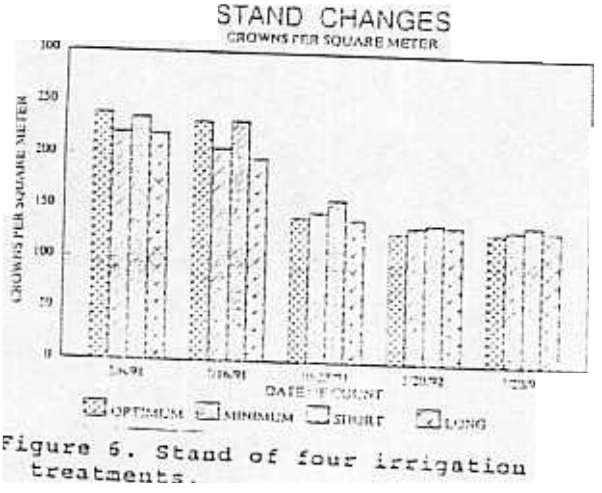


Figure 6. Stand of four irrigation treatments.

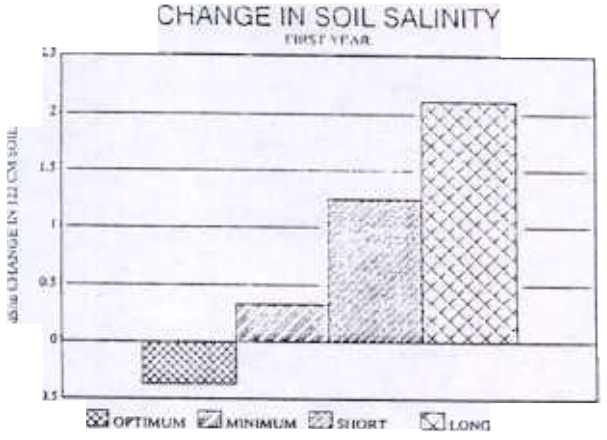


Figure 7. Average salinity of a 122 cm profile.

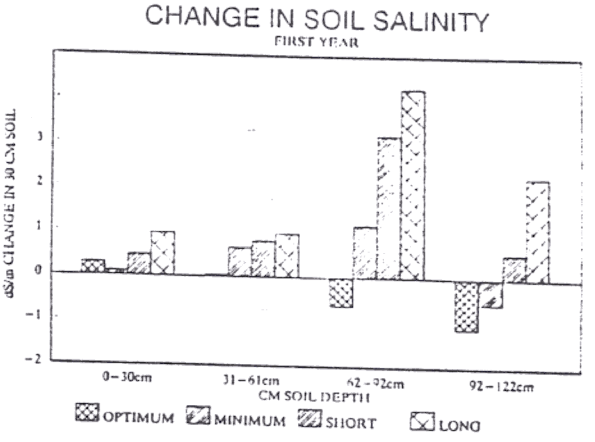


Figure 8. Average soil salinity of four 30 cm increments in four irrigation treatments.

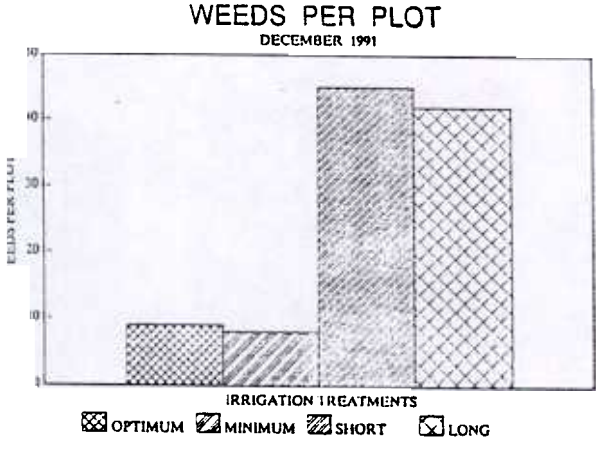


Figure 9. Weeds per plot in December after first year treatments.

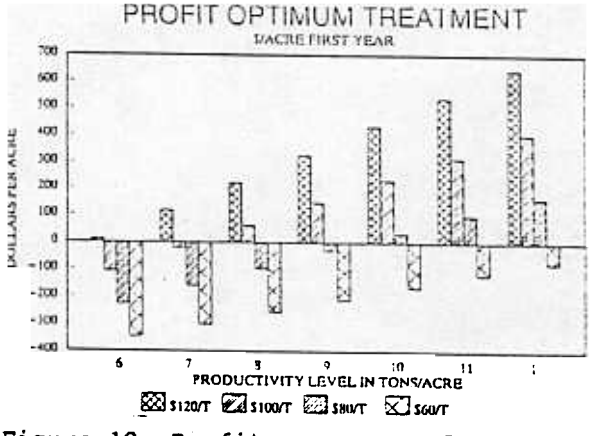


Figure 10. Profit per acre of Optimum irrigation treatment at four market values of alfalfa and four productivity levels.

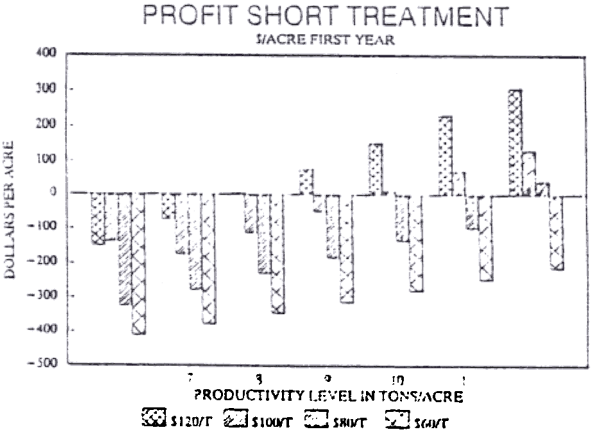


Figure 11. Profit per acre of Short irrigation treatment at four market values of alfalfa and four productivity levels.

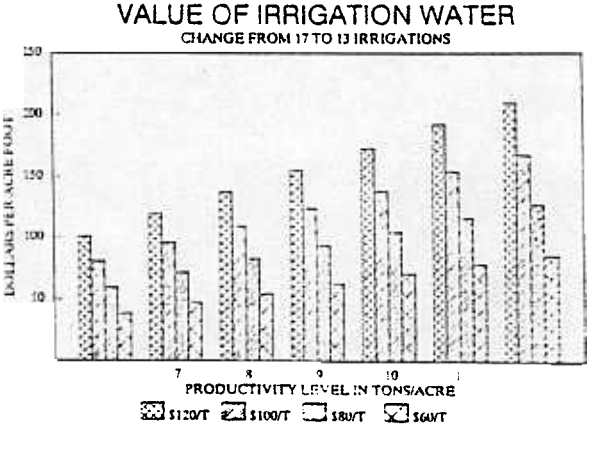


Figure 12. Value of water when changing from the Optimum to the Short irrigation treatments at four market values and four productivity levels.