The Use of AZSCHED to Schedule Irrigation on Cotton Safford Agricultural Center - 1991

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Abstract

Irrigation scheduling software has been developed that is menu driven, user friendly and capable of scheduling up to 60 fields. This software is demonstrated scheduling irrigation on both Pima and upland cotton in this paper.

Introduction

Over the past several years we have worked on software that would predict irrigations for cotton, be relatively easy to use, require minimal inputs and be usable for growers or research stations with large numbers of individual fields. AZSCHED (AriZona irrigation SCHEDuling) software (reference 1) is the result of that quest.

AZSCHED provides a computer based information system for the management of water applications on up to 60 fields with different planting dates and crops (9 crops are now available). It uses a soil water balance method to schedule irrigation. Crop water use is estimated using the Modified Penman method for reference crop evapo-transpiration combined with a heat unit based crop coefficient and a dryness coefficient for the soil. The heat unit based crop coefficients were designed to make the model accurate from year to year and from location to location. Water holding capacities of the soil must be inputted along with the crop selection and planting date at the time of initializing a field. A default weather location must be selected for all fields and current weather data must be inputted during the crop growing season. The program is entirely menu driven (see Figure 1) and is user friendly. Twenty fields can be viewed at a time on the screen and the status of the field is indicated numerically as well as graphically and color coded. An individual field may be selected and irrigation and/or rainfall data inputted, irrigation parameters (such as Management Allowed Depletion or Irrigation Efficiency) adjusted, or detailed chronological data viewed. The power of the software is shown in its irrigation prediction report. This report lists all fields being scheduled in order of their irrigation needs, showing the date that an irrigation is needed and the amount of water that should be applied to restore the soil to field capacity.

The AZSCHED program runs on IBM-PC or compatible computers running DOS 2.0 or higher and required less than 512 Kilobytes of RAM.

Materials and Methods

The AZSCHED software has been demonstrated at the Safford Agricultural Center in the past (2,3) and this year's research was to determine the effect of changing the Management Allowed Deficiency (MAD) over a range from 40% to 60%. Two experiments were designed, one with upland cotton (Delta Pine 90) and the

other with Pima cotton (S-6). Each experiment had four replications and the irrigations were applied as close to the prediction dates as was possible for each of the treatments. The amount of water applied was the amount necessary to get water to the ends of the rows and in most cases this was more than what the software called for.

Results and Discussion

From Table 1, it can be seen that the highest yields in both long and short staple cotton occurred when the plots reached 50% depletion before they were irrigated. The amount of water leaching through the profile decreased and the production efficiency increased as the % depletion increased. It should be noted that the yields were depressed with the 60% depletion plots and the loss in value would not be compensated by the reduction in water costs. From the graphs in Figure 3 it can be seen that the irrigation timings between the 40% and 50% depletions on upland cotton were very similar as were the yields in Table 1. The extra irrigation at the end on the Pima 40% plot (Figure 2) produced only negative effects in the Table. The leaching values shown on the graphs and in the table are theoretical calculations by the software.

The software performed very well producing yields that were comparable to the best management practices used in the area. The prediction report depicted by the bottom left hand box in Figure 1, reduced much of the burden of scheduling irrigation from the farm manager without an inordinate amount of extra work to run the program.

References

1. Fox, Fred, Tom Scherer, Don Slack and Lee Clark. In Press. AriZona irrigation SCHEDuling software, version 1.01. The University of Arizona Cooperative Extension and Department of Agricultural and Biosystems Engineering. Tucson, AZ

2. Clark, L.J., E.W. Carpenter, T. Scherer, D. Slack and F. Fox. 1990. Irrigation Scheduling on Long and Short Staple Cotton, Safford Agricultural Center, 1989. Cotton, A College of Agriculture Report, Series P-81, University of Arizona, Tucson, AZ. 5pp.

3. Clark, Lee J., E.W. Carpenter, T.F. Scherer, D.C. Slack and F. Fox, Jr. 1991. Irrigation Scheduling on Long and Short Staple Cotton, Safford Agricultural Center, 1990. Cotton, A College of Agriculture Report, Series P-87, The University of Arizona, Tucson, AZ. 8pp.

Table 1. Long and short staple seed cotton yield and other agronomic and irrigation parameters.

Treatment	Yield (lbs/ac)	% 1st Pick	Pl Ht (in)	Irr (in)	Leach (in)	Effic (#lnt/acin)
LS 40% Depleted	2699.5 a*	99.5 a	29.0 a	35.5	7.6	26.6
LS 50% Depleted	2717.0 a	99.2 a	29.8 a	27.2	5.0	35.0
LS 60% Depleted	2260.4 b	99.2 a	29.1 a	22.3	3.3	35.4
SS 40% Depleted	3833.6 a	99.2 a	32.3 b	29.4	7.5	45.7
SS 50% Depleted	3837.5 a	99.0 a	37.6 a	27.3	4.8	49.3
SS 60% Depleted	3403.6 a	97.1 b	28.8 b	23.1	3.9	51.6

* Values within a column followed by the same letter are not significantly different at the 5% level using Duncan's Multiple Range test.

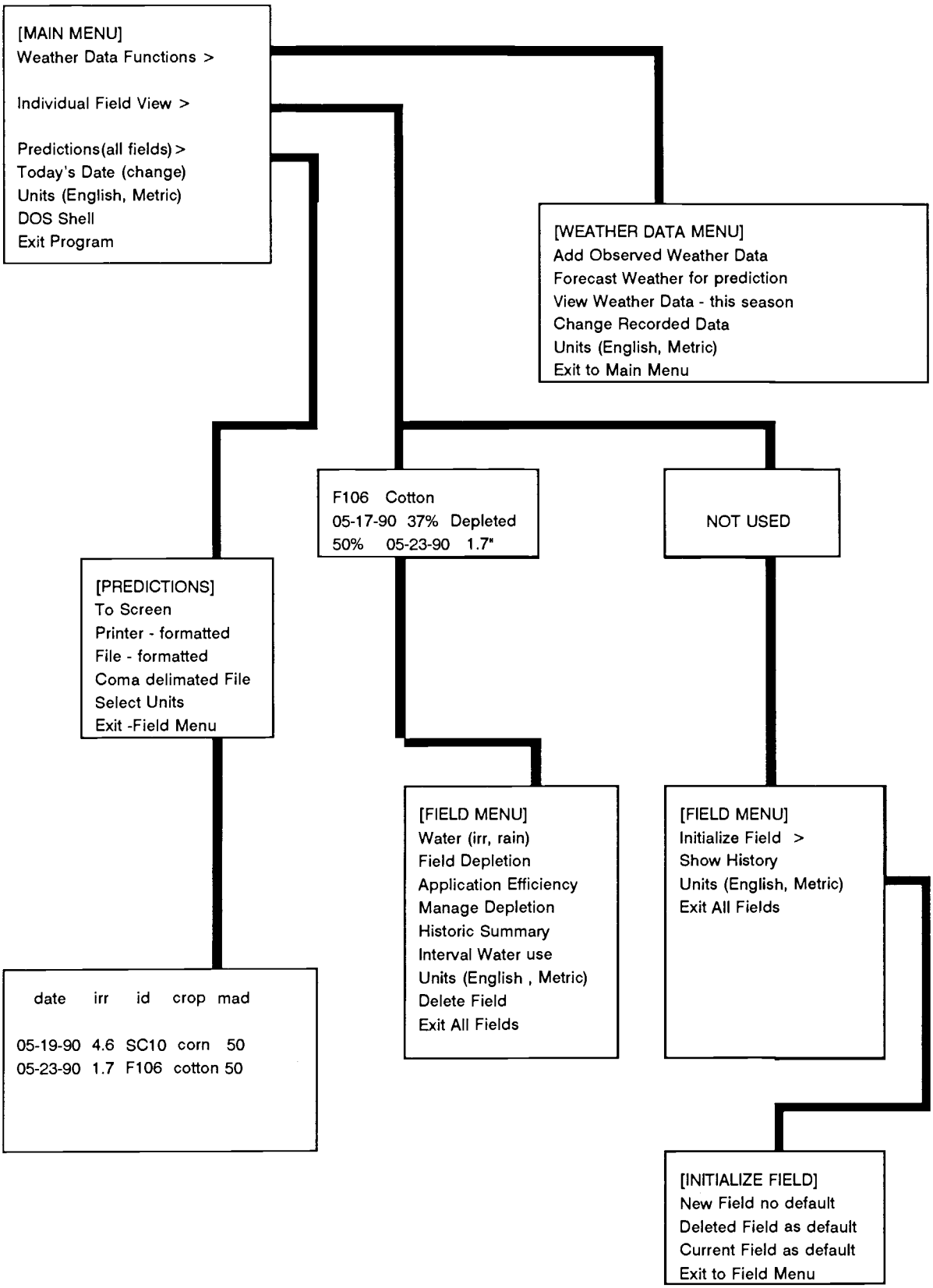

Figure 1. Menu Tree from the Main Menu.

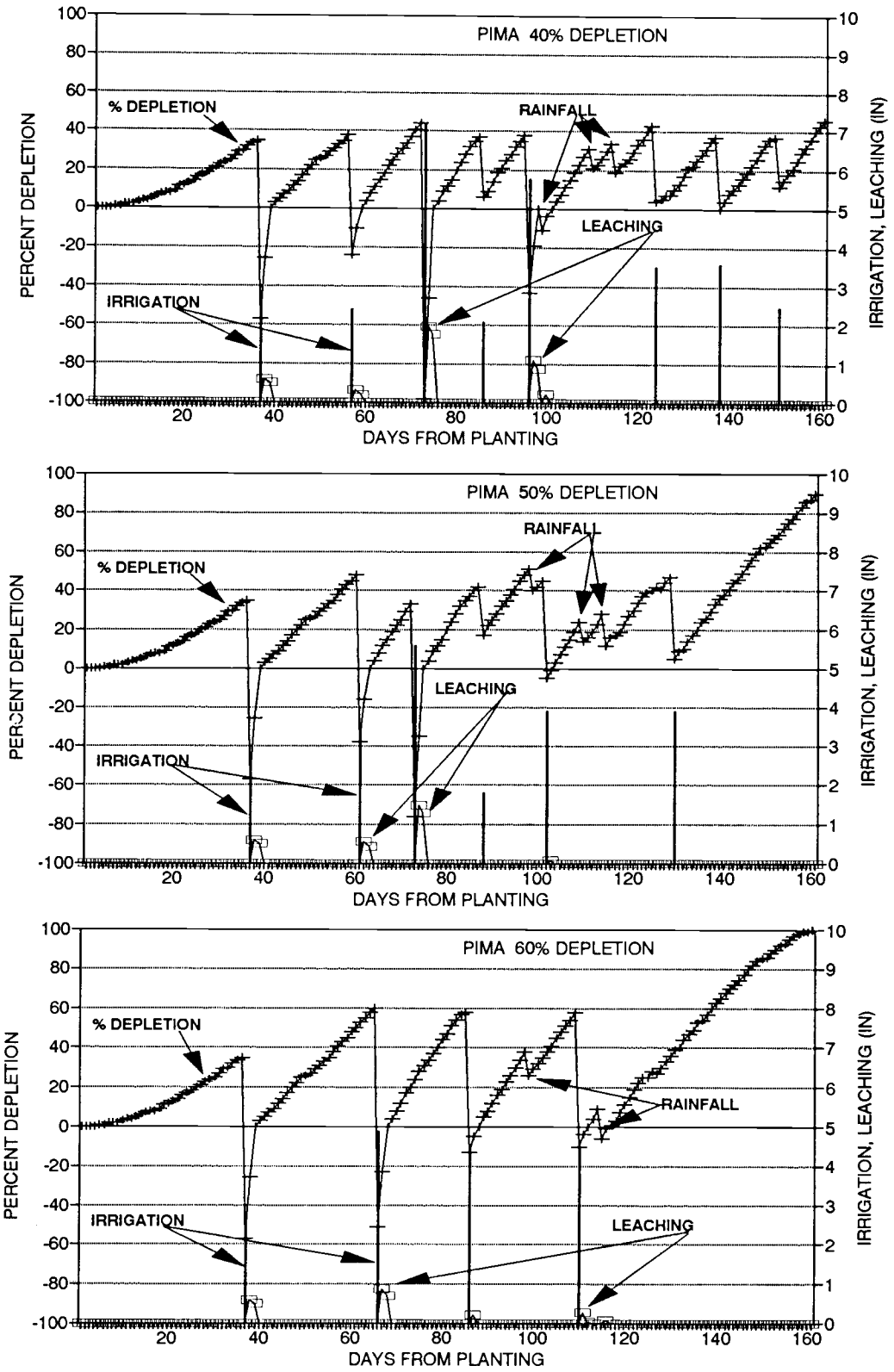

Figure 2. AZSCHED calculated percent depletions and leaching along with applied irrigations plotted against days from planting for Pima cotton.

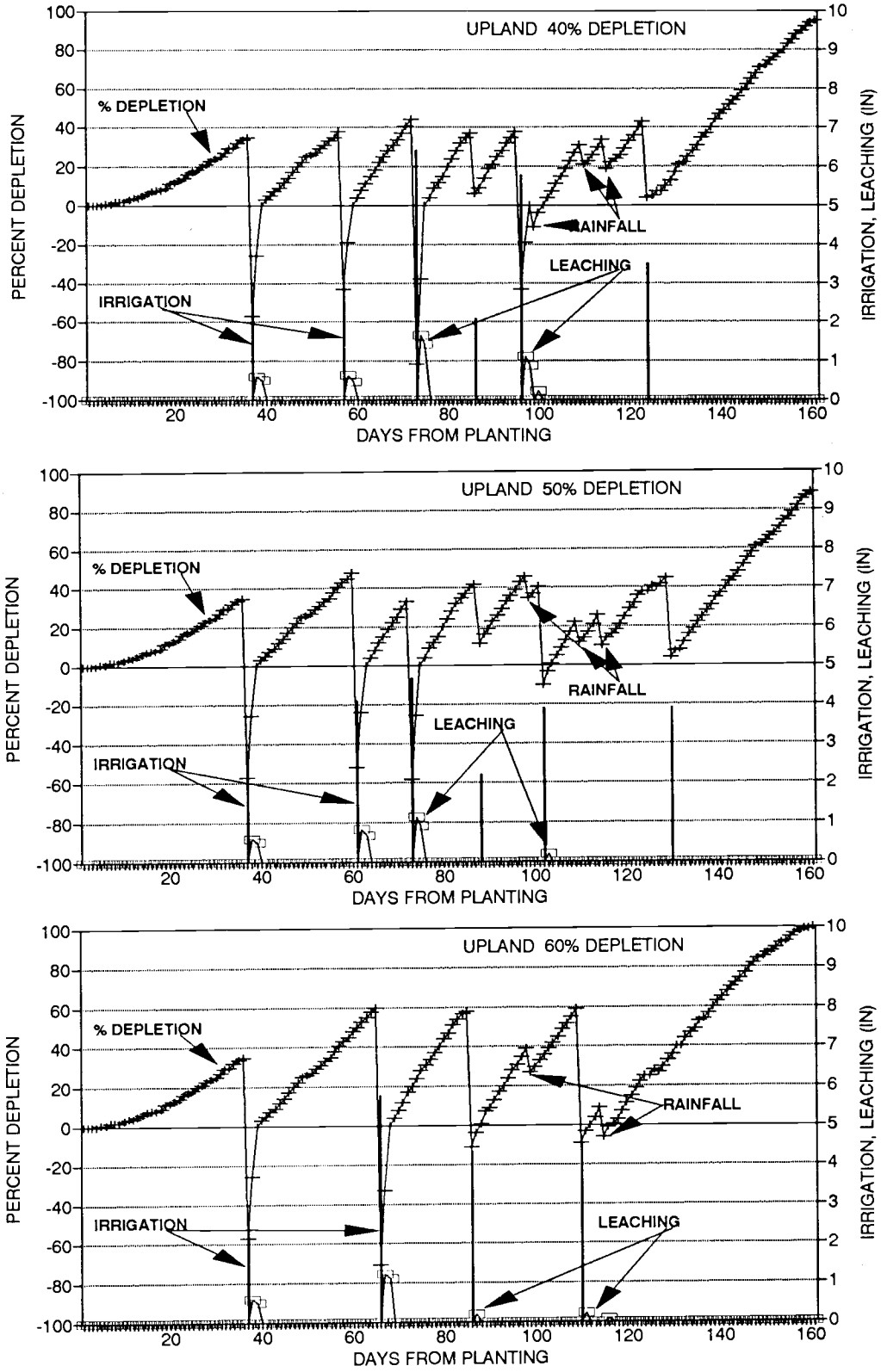

Figure 3. AZSCHED calculated percent depletions and leaching along with applied irrigations plotted against days from planting for Upland cotton.