WATERSCHED - AN IRRIGATION SCHEDULING PACKAGE

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INTRODUCTION

WATERSCHED has been developed by research and extension agronomists from the Queensland Department of Primary Industries and uses a water balance approach to schedule irrigations. The water balance is based on an estimation of crop water use, from climatic data, according to crop growth stage.

The project to develop this package was funded by Cotton and Oilseeds Research Councils.

The package has application for both spray and furrow irrigation systems. It may be used with a wide range of summer and winter crops, and is independant of location. It is designed for use by irrigators, crop consultants and Departmental extension staff, but has application to agribusiness and as a teaching aid in secondary and tertiary educational institutions.

THE BENEFITS

Objectively predicting future irrigation dates for all fields on a property has many benefits:

- Improved yield potential by applying water at the right time.

- Better management of farm labour when irrigations are predicted in advance.

- Correct ordering of water, in situations where this is necessary.

- Crop records are generated, which assess the priority of fields to be irrigated.

- Season crop records aid trouble-shooting in the case of poor crop performance.

Proper timing of irrigations costs you very little, but can significantly boost your crop yield.

In the case where limited water supplies make proper timing difficult, an objective prediction of the first season irrigation (and irrigation following rainfall) is still valuable information.

A water balance approach using climatic data is a cheap, quick but reliable method of scheduling. It may be used in conjunction with other techniques if required.

THE PRODUCT

WATERSCHED has been developed in three forms to cater for differing requirements of irrigators. They are:

1. A Manual Package

This is operated using worksheets provided, and supported by the required technical information and instructions. This package is marketed in a half day workshop, where users are given an introduction to the system and tutorial assistance with practical examples. In this format WATERSCHED is typically used on a weekly basis.

2. Compiled Computer Spreadsheet

This spreadsheet was developed for users familiar with the operation of computer spreadsheets. It is menu driven and has been compiled as a stand alone program. The layout is similar to manual worksheets, but is designed to operate on a daily basis. A separate file is required for each field to be monitored.

Initial inputs to the program include soil field capacity, a refill point value and appropriate crop factors. Thereafter, daily inputs of rainfall or irrigation and pan evaporation are required.

Estimated crop water use is subtracted from the previous daily soil water balance to calculate a new value. Inputs such as rainfall and irrigation are added and the next irrigation is scheduled when the balance falls to the refill point.

Calculation of the next irrigation date is determined from the current balance and estimated water use. The difference between current balance and refill is divided by the crop water use rate, to calculate the number of days until that balance will be reached.

Irrigation is predicted for that date, assuming no further rainfall occurs.

A typical program output is shown in Figure 1 for a 50 ha cotton crop during early December. A graphic representation of this output is also available.

Figure 1. Irrigation prediction using the compiled spreadsheet.

WATERSCHED - A Water Scheduling Package

File :Test
Paddock :North
Crop :Cotton
Planting Date:15-Oct-89
Recalc. Date:13-Dec-89

DATE	Day No.	Evaporation (mm/day)	Crop Factor	Water Use	Rain (mm)	Irrigation (mm)	Soil Water Balance (mm)	Refill Point	Days to Stress	COMMENT	Water Req(ML) inc Lead Time
01-Dec	47	8.0	0.40	3.2			427.7	410	6	Get Ready	64
02-Dec	48	6.9	0.40	2.8			425.0	410	5	Get Ready	65
03-Dec	49	6.7	0.40	2.7			422.3	410	4	*IRRIGATE	67
04-Dec	50	6.9	0.40	2.8			419.5	410	3	*IRRIGATE	67
05-Dec	51	7.3	0.40	2.9			416.6	410	2	*IRRIGATE	70
06-Dec	52	7.5	0.40	3.0			413.6	410	1	*IRRIGATE	72
07-Dec	53	7.4	0.40	3.0			410.7	410	0	*IRRIGATE	74
08-Dec	54	7.8	0.40	3.1	15		417.5	410	2	*IRRIGATE	70
09-Dec	55	7.5	0.40	3.0			414.5	410	2	*IRRIGATE	72
10-Dec	56	7.7	0.50	3.9			410.7	410	0	*IRRIGATE	77
11-Dec	57	7.2	0.50	3.6			407.1	410	STRESS	*IRRIGATE	80
12-Dec	58	6.8	0.50	3.4		125	500.0	410	25	OK	23
13-Dec	59	6.7	0.50	3.4			496.7	410	25	OK	24

F1=HELP F2=EDIT F3=MENU F4=ERASE

3. Compiled Database Computer Program

This program is written using specific database software and is the most sophisticated of the three forms available. It has been compiled as a stand alone program with particular attention paid to user-friendliness in operation.

The program operation is similar to that for the spreadsheet. Output is of a slightly different form, allowing comparison between fields. Temperature data may be input to the program, to allow prediction on a 'growing day-degree' basis if required.

The program prompts the user with a series of pull downs menus, which display the various options when the appropriate selections are made.

The program can schedule up to 15 different fields using weather data from a base weather station and rainfall either from the site or the weather station. It has been set up for a range of field crops grown in Queensland but other crops can be included provided a set of crop factors is available.

The SET-UP option is selected initially to create a file containing the basic data for each field. From then on the program is run regularly using the PREDICT option, which will require the input of all weather data to date and the recording of irrigation applications. A typical output from the program is shown in Figure 2 for an irrigation property during the last two weeks of February. This shows a field summary, providing a listing of all fields and their current status. Daily soil water balance, crop use and predicted next irrigation date can be summarised for each field.

Weather data can be entered manually from the keyboard or can be read from an external text file which has been downloaded in the appropriate format from an automatic weather station.

Other program options are:

1. UTILITIES - a program management menu for back up, deletion of files, editing of records, optimisation of data and the recalculation of soil moisture balance.

2. REPORTS - provides reports relating to crop factors, soil moisture balance, paddock, weather and irrigation details.

3. HELP - with respect to menu options and the software.

Figure 2.Output from the Database Program

Date 25/02/90 Time 17.38

WATERSCHED - Q.D.P.I.

PREDICTION REPORT - Paddock Summary

PADDOCK DESCRIPTION	CROPTYPE	DD/DAYS	C/F	AVG	M/B	PR-DATE
1 TEST1	COTTON	142 Days	1.1	4.2	420.9	27/02/90
2 TEST2	SOYBEAN	72 Days	1.0	3.6	288.9	21/02/90
4 TEST4	SOYBEAN	67 Days	1.0	3.3	415.2	01/03/90
5 TEST5	MAIZE	107 Days	1.0	3.6	138.5	25/12/89
6 TEST6	SUNFLOWER	39 Days	0.3	1.5	451.5	15/03/90

WATERSCHED - Q.D.P.I.

PREDICTION REPORT FOR : 1 TEST1 - Days After Planting

DATE	RAIN	EVAP	TMAX	TMIN	DD/DAYS	C'FACT	DAILY	M'BAL	IRR	PROBE
15/02/90	0.0	7.6	0.0	0.0	132	1.1	0.0	500.0	$	-
16/02/90	0.0	5.7	0.0	0.0	133	1.1	6.3	493.7	-	-
17/02/90	0.0	8.9	0.0	0.0	134	1.1	9.8	483.9	-	-
18/02/90	0.0	6.7	0.0	0.0	135	1.1	7.4	476.6	-	-
19/02/90	0.0	6.2	0.0	0.0	136	1.1	6.8	469.8	-	-
20/02/90	0.0	7.1	0.0	0.0	137	1.1	7.8	461.9	-	-
21/02/90	0.0	8.2	0.0	0.0	138	1.1	9.0	452.9	-	-
22/02/90	0.0	7.9	0.0	0.0	139	1.1	8.7	444.2	-	-
23/02/90	0.0	7.1	0.0	0.0	140	1.1	7.8	436.4	-	-
24/02/90	0.0	6.8	0.0	0.0	141	1.1	7.5	428.9	-	-
25/02/90	0.0	7.3	0.0	0.0	142	1.1	8.0	420.9	-	-

Mean Daily Water Use : 4.2mm
Predicted Irrigation date is : 27/02/90

HOW TO OBTAIN WATERSCHED

The three forms available may be obtained from Agriculture Branch staff of the Queensland Department of Primary Industries at Toowoomba, Dalby, Emerald and Kingaroy.

A charge is made to cover printing, disc copying and a small margin for further development of the program.

Back-up help is available from staff at these centres to get you familiar with the package chosen.