COMPUTER AIDED QUANTIFICATION OF THE IRRIGATION WATER ALLOCATION TO THE WATER USERS ASSOCIATIONS

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ABSTRACT

The CRIWAR model calculated the summarized irrigation water requirements at the root zone of a cropping pattern in Tungabhadra command area in Karnataka using Modified Penman method and Penman Monteith methods, whereas the WUAS-D model developed by the authors transferred the Water Users Association (WUA)-wise root zone water requirements into the quantities of irrigation water to be delivered at the various managerial points taking various system efficiencies into consideration. The application and dissemination of the integrated model was found to be useful in various scenarios like variations in the water availability, alternate cropping pattern, change in the quality of canal network etc., when a large number of WUAs are to be supplied water. The feedback from the water management officials who were trained in the use of the above models in their routine water management activities helped to draw the conclusion that the model could reduce their computational time and labour remarkably, help visualize and react to various water delivery scenarios in the command area.

***Keywords**: Irrigation, Water Management, Water Users Associations, Water Allocation Models*

INTRODUCTION

A research project was taken up under the National Agricultural Technology project (NATP) funded through the Indian Council of Agricultural Research. The overall objective of the study was to optimize the scarce irrigation water under the best mix of the technically feasible, economically viable and socially acceptable conditions to the Water Users Associations (WUAs) in the distributory D99 command area of the Tungabhadra project (TBP). Training the water managers like the officials of irrigation and agricultural departments and farmers of WUAs in the optional water management in their water distribution activities followed this. This in turn would result in the equity of distribution of water and the farmers would move from nearly a mono-cropping system of paddy towards a cropping pattern which caters to food, fodder and local industry needs.

MATERIAL AND METHODS

The integrated model applied consisted of two models: Crop Irrigation Water Requirement (CRIWAR) model of ILRI, Wageningen, the Netherlands, and Water Users' Associations- Distributory level (WUAS-D) model developed by the authors under NATP. The CRIWAR model calculated the summarised irrigation water requirements by Modified Penman and Penman-Monteith methods at the root zone of a cropping pattern for a larger area, faster and with ready to use output tables and graphs.

The localised (prescribed) cropping pattern and its distribution in the lower reach distributory, D99, under Tungabhadra Left Bank Canal (TLBC) was adopted (Anonymous, 1998). Among the kharif light crops, sunflower area was highest (33.34 per cent) and area under pigeon pea and green gram, etc., was lowest at 6.67 per cent. Similarly, under rabi crops, area under sunflower cultivation was highest (45 per cent) and area under wheat and vegetables (5 per cent each) was lowest. The same percentage of allocation was adopted for all the WUAs.

Input Data for Criwar Model

The mean monthly meteorological data for 16 years (1985-2000) collected from Meteorological observatory, Regional Research Station, Raichur, which is located very near to the project site, was used. It consisted of temperature, precipitation, sunshine hours, humidity and wind speed. The stage-wise crop coefficient values for different crops required for model as input data were adopted from Manohar and Nagaraj (1998) and Balakrishnan (2000).

Input data for WUAS-D model

The WUAS-D model transferred the WUA-wise root zone water requirements into quantities of irrigation water to be delivered at various managerial points. (Fig 1)

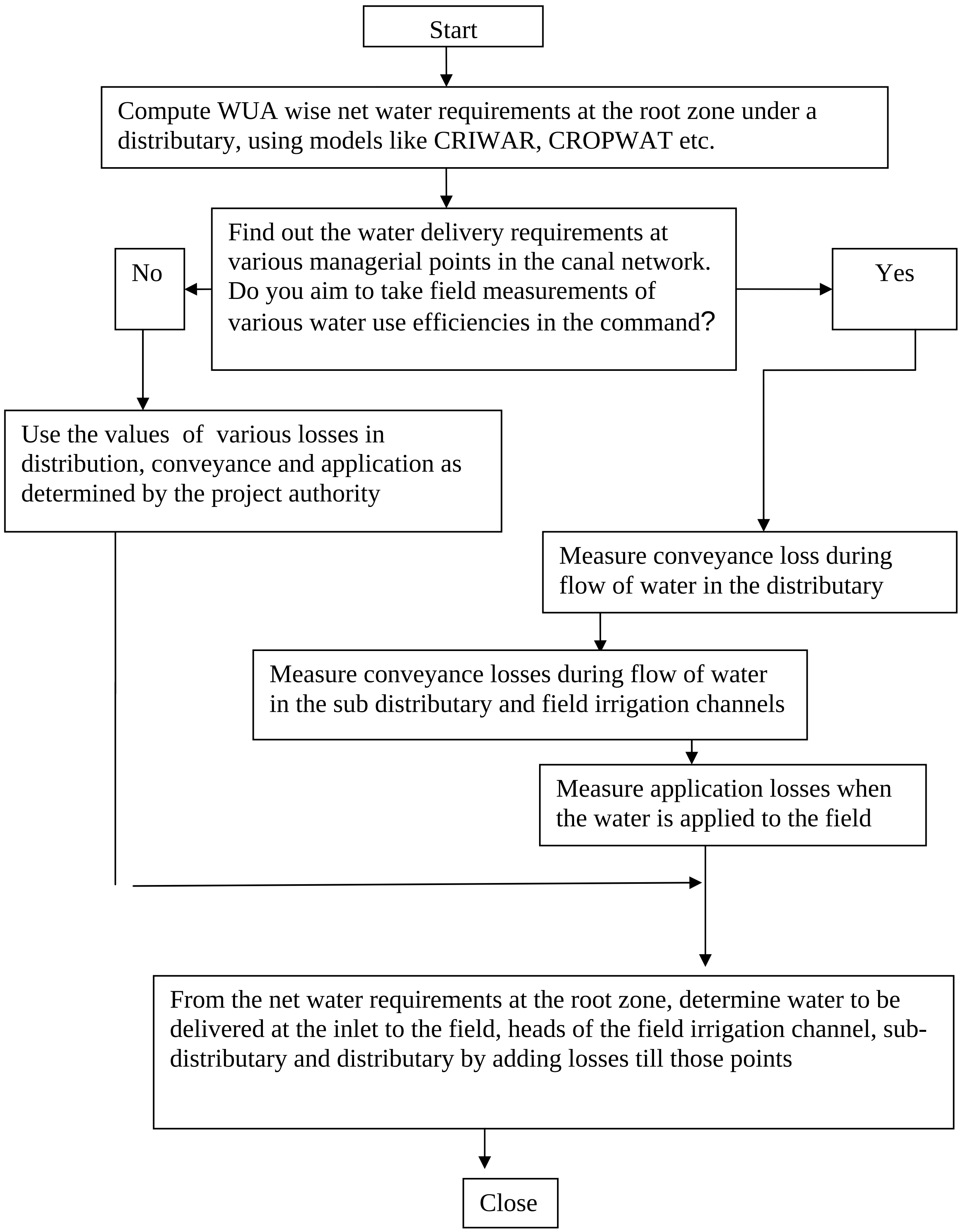

Fig. 1. **Flow chart for transferring net water requirement at the root zone into water to be delivered at various levels upstream**

The water losses computation subroutine of WUAS-D offered two choices to the users: either to use the project determined values of losses at various stages, or, alternatively to enter the field measured values of depth of soil, bulk density, soil moisture data and flow data at different lengths of canal network etc. The output report gave water delivery requirements in million cubic meters at various field inlets, as well as at supply structures of Field Irrigation Channels (FICs), and at the inlets of minors and distributaries which encompass the set of WUAs.

WUAS-D model Structure

The structure of the WUAS-D model is as follows: The main menu of the software WUAS-D is displayed after the title screen. In the main menu, going to *File* and clicking on *New*, will prompt us to give a name of the file to be created. For opening an existing file click on *Open*, which will display a list of files already existing to chose from.

Edit Menu contains two options: *Add new data* and *Edit old data*. Clicking one of them prompts you to give the information pertaining to different water users' associations in a distributory such as WUA No., respective areas and net water requirement at the root zone for each WUA as taken from the CRIWAR / CROPWAT model. Repeat the above steps for different water users' associations.

Water losses menu contains two options: *Project losses* and *Measured losses.* Choose one of the options by clicking the mouse. If *Project losses* option is chosen, it will open up a form. If *Measured losses* option is chosen, it will open up different set of forms.

Simulate menu prompts the users to run the model. It may be noted that all the input data have to be entered as required by the model before going to the simulate menu.

Output menu contains three options: *View*, *Export* and *Print*. To view the results, click on *View* button. A new table of output values will be displayed. The table will have the title "WUAs-D output report of (user file name)". Output can be exported to another file or can be printed by clicking on the corresponding button.

RESULTS AND DISCUSSION

The model resulted in ensuring water to the last irrigator under the distributory command of 5990 ha. The prescribed cropping pattern needed 37.58 Mm^3 of water as against water requirement of 63.73 Mm^3 for current cropping pattern (table 1). Enforcing the prescribed cropping pattern under all distributaries, and sharing the resulting saved water to meet the deficits, could help solve the water shortages. The training conducted was well received and trainees showed interest in the field application of the knowledge they gained.

Table 1: An Image of the Output Screen Showing the Results of Model Run for Distributory 99 in the Tungabhadra Project

		------------- Water Delivery Requirement (in Million Cubic Meters) at ----------------				
WUA No.	Area[Ha]	RootZone	Field Inlet	Field Channel	Minor	Distributory
1	466	2.24	2.35	2.51	2.74	2.96
2	312.34	1.42	1.49	1.59	1.73	1.87
3	414.7	2.69	2.82	3.02	3.29	3.55
4	435.21	1.91	2.01	2.15	2.34	2.53
5	388.9	1.88	1.97	2.11	2.3	2.48
6	486.84	2.04	2.14	2.29	2.5	2.7
7	452.48	2.1	2.2	2.35	2.56	2.76
8	324.72	1.51	1.59	1.7	1.85	2
9	437.32	2.26	2.37	2.54	2.77	2.99
10	518.25	3.33	3.5	3.75	4.09	4.42
11	489.85	2.11	2.22	2.38	2.59	2.8
12	493.98	1.89	1.98	2.12	2.31	2.49
13	358.7	1.19	1.25	1.34	1.46	1.58
14	409.64	1.85	1.94	2.08	2.27	2.45
TOTAL	5988.93	28.42	29.83	31.93	34.8	37.58

The integrated model was found to be useful in various scenarios like alternate cropping patterns, which have to be adopted in case of variations of water supply and change in the quality of canal network etc., when a large member of WUAs are to be supplied water. The above study, as well as the feed back from representatives of irrigators and water management officials of the state irrigation, agriculture and command area development authorities from five different irrigation projects, who were trained in the use of the above models in their routine water management activities, helped to draw the conclusion that the model could be widely adopted. The water management officials concluded that these models could reduce their computational time and labour remarkably, help visualize and react to various water delivery scenarios; they showed interest in using these models in their regular water management computations, provided technical support is given from the scientists from time to time.

Training Methodology:

The training programme for the water management officials consists of step-by-step demonstration of the use of the above models by the trainers. This is followed by the trainees executing the models to have hands-on experience of visualizing the various quantities of water to be delivered to the water users' associations under different scenarios. Post training, the trainee officials are equipped with training package in the form of a CD, a printed step-by-by training manual and follow up technical support from the trainers.

> (Views expressed in the paper are personal opinions of the authors and may not be construed to be that of the organisation)

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BRIEF PROFILE OF THE AUTHORS

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