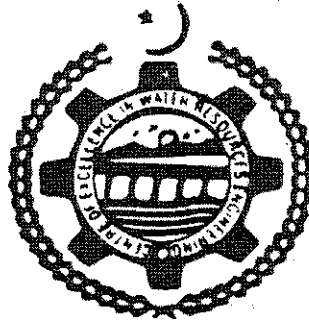


THESIS

**PERFORMANCE EVALUATION OF IRRIGATION SCHEDULING
SOFTWARE: A CASE STUDY IN PUNJAB, PAKISTAN**



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ABSTRACT

The growing demand and increasing fresh-water scarcity urgently require effective and sustainable management of water for irrigation to assure future requirements of food and fiber production. The sustainable management uses advanced technologies to improve water use efficiency. The computer-based irrigation models are globally accepted as most consistent management tools for efficiently using irrigation water on field.

The purpose of the present study was to review and evaluate the performance of various Irrigation Scheduling (IS) softwares by calibrating with the field measured data and finally rank them on the basis of their performance. The data regarding soil moisture contents was collected in field under management allowed deficit (MAD) based irrigation scheduling method.

Two IS softwares (i.e. CROPWAT version 8.0 and KanSched version 2.0) were selected for evaluation in this study. Crop evapo-transpiration (ET_c) and irrigation schedules were computed by these softwares using daily soil-water balance and crop coefficients approaches.

The selected softwares have been field evaluated and calibrated on planning and management of various irrigation schedules for wheat crop in Chak No. 149/150 N.B. of District Sargodha in Punjab, Pakistan. Total twelve plots were constructed on 1 acre (0.4 hectare) farm, each plot measuring 70ft (21.34m) x 45ft (13.72m) in dimensions. The field experiments were carried out with management allowed deficit (MAD) of 50 and 75 percent, respectively, for wheat crop. Six plots were irrigated under 50% MAD based irrigation scheduling and the remaining six plots were

irrigated under 75% MAD based irrigation scheduling. The daily deficiency in soil moisture contents of the root zone was estimated using oven dry method. Measurements of root depth and daily soil-moisture were carried out on weekly basis during the experiments.

The difference in percentage between the modeled values and field observations of soil moisture contents deficiency were calculated both for over and under-estimations of selected IS softwares on 50% MAD and 75% MAD, respectively. The comparison of over-estimated results of the two models shows that CROPWAT deficit value (-31.5) is less than KanSched deficit value (-47.4). On the other hand, the comparison of under-estimated results of the models shows that the percentage difference for CROPWAT deficit value (33.9) is again less than KanSched deficit value (40.5) on 50% MAD. Similar results are observed for 75% MAD basis. The variation in standard deviation (SD) for CROPWAT (1.85%) is less than KanSched (23.63%) on 50% MAD and SD variation for CROPWAT is again less (-8.25%) than KanSched (26.59%) on 75% MAD.

The sensitivity analysis on weather input parameters reveal that the model is more sensitive to temperature variations on outputs of crop transpiration, soil evaporation and irrigation water allocation. KanSched software is not suitable for this experimental site as it has not shown good simulation results; it only gives a rough idea of soil moisture contents in the root zone. The CROPWAT software is found to be better in terms of estimations of soil moisture deficits and can be efficiently used as a decision support system for irrigation scheduling and management for general crops, specifically for wheat crop in Sillanwali experimental site of district Sargodha, Pakistan.