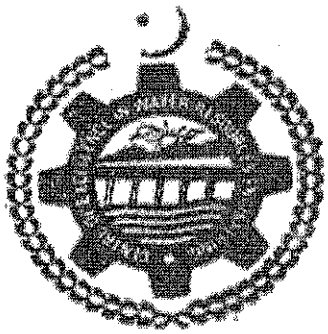
CROP WATER ALLOCATION MODEL (CWAM) FOR EQUITABLE DISTRIBUTION OF WATER IN SELECTED COMMAND AREA



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ABSTRACT

Water is a fundamental resource and critical component for sustainable agricultural development in arid and semi-arid regions. Although nature has blessed Pakistan with abundant surface and ground water resources in addition to favorable climatic conditions for crop production, the crop production per unit of water is less as compared to many other countries in the world. The population is also increasing rapidly in Pakistan with a growth rate of 2.7%, and expected to reach from 138 millions to 208.06 millions by 2025. Although the growth rate of agriculture has also increased from 3.9 to 6%, but this rate of increase does not meet the food demand of ever increasing population of the country.

In the context of increasing population, slow food production with associated environmental problems, the operational characteristics and performance the canal irrigation system are of great concern for policy makers, irrigation managers and researchers. Under these circumstances, the water allowance of canal commands is one of the key factors in improving the crop productivity, and therefore needs to be rationalized. The water allowance for early canal system was designed keeping in view the average values of the cropping intensity and the area to be irrigated. The water allowances are different for different canal commands in Pakistan and these affect the command area differently. For instance, in command areas where designed water allowances are higher than the crop water requirements, water logging problems occurred in those areas; while in commands where designed water allowances are low, unsatisfication to crop water requirements and resulted in low yields are observed.

The present study was conducted at Kasur minor command area during the period of Kharif 2009 and Rabi 2009-10. The Kasur minor originates from the Thamman distributary. To calculate the required water allowance at watercourse, sub-minor and minor level, a variety of data e.g. designed discharge of the command area, CCA, Climatic data, were needed. Those data were collected from various departments such as Punjab Irrigation & Power Department, Lahore, Meteorological Department, Lahore, and Statistical Department of Agriculture, Kasur, and from literature such as IWMI Report (2001) etc. The Reference evapotranspiration was calculated from the CROPWAT Model by using the climatic data of the study area. By using the above given data, the water demand of watercourses, Lakhne ke and Kasur sub-minor and Kasur minor was calculated on the basis of crop water requirement and the water Allowances were also calculated.

The investigate revealed that due to increase in rate of evapotranspiration in Kharif season, the Kharif season required 1.74 times more water than the Rabi season. The required net continuous flow rate at Kasur minor command ranged between 0.004 and 0.161 cumecs. The average required flow rate at the root zone level for a watercourse command of Kasur minor was estimated as 0.051 cumecs. Out of 42 watercourses of Kasur minor, 22 were below the average required flow rate and the remaining 20 were above the average required flow rate. For Kasur minor, the required discharge on the basis of crop water requirement was 8.679m^3/s, where as the existing designed discharge was only 1.998m^3/s; indicating a water deficit of 6.681m^3/s at the head of the minor, and available water meeting only 23% requirement of the command area. The required supplies at the head of Lakhne ke and Kasur sub-minor were found to be 1.744 and 0.526

cumecs respectively, showing the water deficits for the Lakhne ke and Kasur sub-minors as 1.35 and 0.405 cumecs; and meeting only 22.6 and 23% of the required water supplies of the command area.

The designed water allowance for the Kasur minor command is 0.089 cumecs per 1000 acres; whereas required water allowance is 0.385 cumecs per 1000 acres. The optimal water allocation for the watercourse commands of the Kasur minor ranged from 0.002 and 0.089 cumecs with an average of 0.028 cumecs, while the existing designed flow rate (Q_d) ranged from 0.0014 to 0.102 cumecs with an average of 0.035 cumecs.

The existing shortage of water can be minimized by building more dams, and water deficit can be reduced by improving the conveyance efficiencies of the irrigation system. The conveyance efficiency can be improved by watercourse lining and improving the earthen watercourses.