ABSTRACT

To improve the performance of existing irrigation systems optimal operation through optimization and simulation is resorted to. The present work relates to development of optimal operation policies for the existing Krishnagiri Reservoir Project (KRP) across river Ponnaiyar river in TamilNadu. The gross storage of Krishnagiri Reservoir is 66 MCM, irrigating around 3600 ha. of paddy. Apart from the reservoir there are 13 tanks in the command area irrigating 780 ha. Paddy crop is grown in three seasons in KRP. The three seasons are a)August to December b)November to March c)January to May. During the start of each season if the reservoir storage is favourable to plant paddy crop and if no paddy crop exists in the command area, paddy is planted.

The optimal operation model development for KRP envisages three phases of modelling. First is a simulation model to simulate the command area consisting of paddy fields both drawing directly from the canals from the reservoir and also drawing water through tanks existing in the command area. This simulation model is used to determine the expected demand sequences by simulating the command area with the historical rainfall data. Second is the Stochastic Dynamic Programming (SDP) model to obtain optimal release policy. This SDP model considers both demand on the reservoir and the inflow into the reservoir as stochastic and are assumed to follow first order Markovian model. The transition probability matrices for inflow and demand to be used by the SDP model are constructed using historical data for inflow and using the expected demand sequences obtained from the simulation model for demand. Third is the simulation of the reservoir using the optimal release policy obtained from SDP model. Simulation model is used to study the degree of failure associated with different initial reservoir storages for each crop season.

In a typical irrigation system in South India like KRP, the number of crops planted in a year either in the entire or part of the command area changes from year to year depending upon the available storage at the start of each of cropping seasons.
In order to develop rules using scientific approach to decide on the crop sequencing an innovative Stochastic Dynamic Programming model is formulated and is applied to KRP with sugarcane crop in 600 ha. of area. The potential utility of the model for development of optimal operation policies is also indicated.

The serial correlation of inflows to KRP are statistically significant only for a few months and are insignificant for other months. Stochastic dynamic programming model can be made simpler if the inflows are treated as independent for a few months. Model formulation with three types of inflow process representation is made. One, treating the inflow process stochastic, the second with the inflow process being independent and the third with a few periods having significant serial correlation to be stochastic and the rest independent. KRP data is used to demonstrate the utility of the model and the results are discussed.