

## **ABSTRACT**

India is basically an agricultural country. Its economy completely depends on agricultural output. It is only possible by improving technology and maximizing agricultural production. This is possible by increasing the irrigation intensity to as much as possible and using both the resources, viz surface water and ground water. If the available surface water is not adequate, it becomes imperative to look for ground water as an alternative to meet irrigation demand.

Water is a scarce and precious national resource. Planning, development and systematic utilization of this resource for various sectors such as agriculture, domestic and industry is important. Hence, to obtain the optimal cropping pattern and optimum release policy, a linear programming model for conjunctive use of surface and ground water resources for Kakrapar Left Bank Main Canal command area is developed. The main canal consists of the eight branch canals, having a total of sixty-six minors under it. The model is run for three different strategies i.e., considering unit cost of surface water charged to the farmers by N.W.R.W.S. & K. Department and unit cost of ground water, also referred to as the general Strategy, space integration strategy and space – time integration strategy for all the above said minors and for different irrigation intensities i.e. existing to Designed irrigation intensity with an increment of 10%.

Operating constraints relating to area availability constraint, water requirement constraint, surface water availability and canal capacity constraints, ground water potential and capacity constraints, drainage requirement constraints, socio-economic constraints under each of the three strategies have been brought out in the study.

The sensitivity analysis is carried out by ten different ways for all the above said minors for all the three strategies like three different ways considering unit cost, four different ways considering risk and uncertainty in the selling price / yield, three different ways considering special cases which are discussed in detail in the chapters.

The output of the linear programming model developed suggests that the irrigation intensity can be maximized upto 80% to 420% for different minors depending upon the existing irrigation intensity, where maximum benefits can be obtained.

Using the last 10 years data obtained for the K.L.B.M.C. Command area, the value of each constraint, which is deviating from that of the value of the same in the year 1999-2000 are being observed. These fuzzified values of each constraint are listed and the optimal net benefits, Rs./ha.m are found out using the fuzzy linear programming for the entire K.L.B.M.C command area, as has been done in the linear programming.

Then, the optimal net benefits, Rs./ha.m obtained due to the linear programming and fuzzy linear programming are compared, analysed and then the conclusions are drawn out.

Therefore, an approach incorporating linear programming technique for selection of best water allocation policy for conjunctive use of water is suggested. The study indicates that ground water development and its Conjunctive use may become an important policy issue in view of its regional implications as providing irrigation to larger areas.