Research Paper :

Optimal cropping pattern in command area

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ABSTRACT

The irrigation water requirement of major crops and total water available in the Natuwadi dam located in Konkan region of Maharashtra was estimated. A linear programming model was formulated to suggest optimal cropping pattern giving the maximum return at different water availability levels. The objective function of the model was subject to following constraints: total water available and land during *Rabi* season, minimum area under rice and sugarcane for local food requirement and preference to grow particular crop in a specific area. This model has given the optimal cropping pattern for a command area of 2050 ha at water availability levels of 100, 90, 80 and 70 per cent and net returns of 120,109.50, 99.10 and 88.64 million rupees, respectively. It is found that, the water available in the command area may support optimally 36.50, 1018, 50, 273, 45, 98 and 127 ha of rice, banana, sugarcane groundnut, chilli, brinjal and maize for fodder, respectively, to get maximum returns of 120 million rupees at 100% water availability levels. Banana appears to provide the most consistent profit in the command area.

Efficient management of irrigation system is becoming key issue for agricultural development. There will be increasing need for more extensive water supply systems to meet ever-increasing agriculture, domestic and industrial demand due to population pressure. Water is not found when and where it is needed and also it may not be of good quality. Optimum development and efficient utilization of water resources, therefore, assumes great significance in the country. Important aspect of water management includes optimal allocation of water for irrigation purposes over an irrigation season and selection of cropping pattern for a given land area and water availability. This is usually achieved through the application of optimization techniques. Linear programming (LP) has been one of the widely used technique for solving water resources problems (Yeh, 1985; Benedini, 1988). Bahauddin and Hussain (1995) evolved a methodology for optimal surface irrigation practices, which aimed at maximizing the benefits of crop production per unit water applied to a case study of Sri Ram Sagar project. Linear programming technique was employed to evolve optimal allocation of water to crops. Singh (1996) developed a linear programming model to obtain optimum crop combination for maximum net benefit with available land and water in Bijnor district. She concluded that by optimum utilization of land and water resources it would be possible to increase the agricultural income of the district by almost

80 per cent. Cheng Yun (2008) proposed a linear programming model to study the consumptive use of surface water and groundwater for optimum water allocation in Taiwan.

METHODOLOGY

In the present study, a LP model was formulated for arriving at an optimal cropping pattern for Natuwadi Project in Konkan region, Maharashtra. The model was solved for different availability levels of inflows *viz.*, 100, 90, 80 and 70 per cent, to obtain various possible cropping patterns under coastal conditions.

Study area:

Natuwadi project is the state sector medium irrigation project on Choriti river, situated in southern Konkan region of Ratnagiri district of Maharashtra, India between the latitude $17^0 50'$ N and $73^0 24'$ E. The location map of Natuwadi medium irrigation project is shown in Fig. 1. The salient features of Natuwadi Project are presented in the Table 1.

Inflow data:

The daily inflow data for 20 years *i.e.* from 1988 to 2007 for Choriti river at Natuwadi dam site were collected from the office of the Irrigation Department. The average monthly inflow discharges were obtained by adding up