CHAPTER I

INTRODUCTION

Agriculture sustains life, whereas irrigation sustains agriculture. This is especially true for an agrarian country like India whose economy is mainly revolving round farm venture, wherein irrigated agriculture though limited to about 30 per cent of the cropped area contributes more than half of the total agricultural production. As the demand for water has become more exacting particularly so in recent years, available water resources should be harnessed properly and husbanded judiciously for the long-term benefit of the people. Consequently, scientific management of water assumes a new dimension and paramount significance in crop husbandry vis-a-vis looming shortages of water. Moreover this is the only and best way to make our agriculture, characterised by the elements of risk and uncertainty due to the vagaries of monsoon, a competitive and profitable one.

1.1 Irrigation Water Management Issues and Solution Approaches

Irrigated agriculture has a major role to play in the years to come in meeting the country's escalating needs of the food production. Especially it is so, as the scope for expanding the arable area is rather limited. Moreover there cannot be any rapid and sustained acceleration in agricultural growth rates since diminishing returns are bound to creep into crop production. Hence it becomes imperative to increase the area under vertical expansion (more cropping intensity) as well as under irrigation. Unless the pace of irrigation development is accelerated and efficient irrigation management is achieved in areas where already irrigation potential has been created, the expected targets in food production cannot be realised by the turn of the century.

Furthermore, with the advent of high yielding varieties and higher rate of fertilizer use, the demand for water has gone up tremendously. Again, more often than not rainfall-the Nature's gift is erratic in space, time and quantum, which does not synchronize with the crop need for water - an often calamitous excess in one region with agonizing shortages in the other. Moreover, the success of the so called 'Green Revolution' has little significance in the absence of assured irrigation to sustain or further it.

Despite India's phenomenal strides in irrigation development since independence, the niggardly low operating efficiency (25-30%) of irrigation projects is a major concern. Wide gap still persists between the irrigation potential created and actually utilized. Crop yields and financial returns are disappointing. Very little attention is given to the qualitative and quantitative facets of on-farm water use and reservoir management. It is contemplated that even if a marginal 2 per cent improvement in the operating efficiency would be achieved, the thirst of an additional area of 0.5 M ha could be quenched.

Vast scope exists for increasing the efficiency of the ongoing projects and incorporating suitable improvements in the planning of the future projects. Unfortunately the lack of appreciation of the multidisciplinary nature of irrigation systems has been one of the major factors which has contributed to the poor performance of the irrigation systems. A breakthrough in increasing efficiency can be achieved only by a departure from traditional methods and adoption of modern scientific planning and management techniques.

Some of the problems that plague our irrigation systems are discussed below. Neglect of water balance of command areas is a major lacuna in planning of irrigation systems. In the context of emergence of high yielding technology no clear objectives have been evolved. Moreover as the agriculture in the past was mainly of subsistence kind, it was understandable to provide protective irrigation during kharif. This has to be changed and the concern must now be to make optimal use of the available water and other agricultural inputs to maximize crop production.

Tectonic reversal involving construction of dam first and then the network of canals being built up slowly and lackadaisically hampers the very purpose of utilizing the irrigation potential to the fullest extent possible. Past experience with irrigation projects reveals that the absence of integrated approach in planning is the cause for persisting time lag between irrigation development and agricultural progress. It is because practically not much attention is paid to agricultural development side in stark contrast to irrigation structure receiving meticulous attention.

Despite the recommendation of building up conjunctive use of surface and ground waters in irrigation projects by the Irrigation Commission in 1972, this has not even now become a planning - cum - designing reality. Wherever surface and ground waters co-exist, it is essential to develop a strategy for their conjunctive use governed by economic considerations pertaining to the region.

One of the basic and most important factors on which the success of the farming depends is the farming community. The notion that Indian farmers are too-tradition bound is not true, as the Green Revolution would testify this. The farmers are only reluctant to increase the inputs or adopt new practices unless such changes offer them relatively safe and rewarding opportunities.

In short, as the irrigation potential and water resources are limited, the applied technology will have to shift to better and efficient irrigation management. This alone will be the key to adjusting to future growth and/or changes. Hence the cardinal principle from nowonwards has to be the scientific management of irrigation water created with huge investment, dedication and yeoman efforts.

1.1.1 Command area and reservoir management

Desirably, the Government of India being alive to the irrigation situation in the country, has duly accorded irrigation the highest priority in the economic development programme. The strategy of the best use of the irrigation potential for increasing the crop productivity would help achieve increase in farm income and widen rural employment in the command areas. The Command Area Development Programme in irrigation projects is a step in this direction. The Programme aims to narrow down the gap between the irrigation potential created and utilized in addition to promoting the integrated development of the command areas.

In view of the scarce resources but growing demands, the question of allocation of water among competing crops along with optimal use of associated agricultural inputs such as fertilizer, labour and the like assumes a paramount significance. Associated with these are the command area resources planning and management and optimal reservoir operation concomitant with conjunctive use of irrigation sources. Regulated distribution including rotational supply of water on the farm, judicious methods of water application and the adoption of better soil-water-crop management practices including scientific timing of irrigation according to the developmental rhythm of the plant are all important components of irrigation planning. The degree of success in integration and synchronization of the demand-supply of irrigation water in the reservoir projects depends to a large extent on the quality of the reservoir management. The reservoir operation comprises the activities involving intertemporal storage, spillage and transfer of water.

It is well known that water release, a component of reservoir operation is dependent on the agroclimatic factors, topography, soils and the cropping patterns. Some of these could change rapidly even during the crop season per se. Again, the cropping pattern keeps changing and is influenced by agroclimatic parameters, soils and a host of socioeconomic factors. Moreover an efficient cropping pattern, on which depends the reservoir operation, should absorb the essence of advances in crop technology like high yielding seeds. In addition, it should be able to recognize the various objectives of optimal use of resources in production.

As the use of land and water are inseparable, water allocation decisions always imply directly or indirectly land use decisions and vice versa. Where water is scarce, its allocation will dictate land use decisions and our policy in agriculture then becomes maximization of production from land with the application of given amount of water. On the other hand, where water is bountiful, the problem is simply how much water to be applied in any growth stage to achieve optimum return.

Of late, the planning and management of command area resources, optimal reservoir operation along with conjunctive use of irrigation sources and their optimal allocation have received the attention of Indian scientists. As evidenced by their studies, the problem of management of irrigation commands with respect to their land and water resources and related agricultural inputs is of utmost importance from the view point of socioeconomic parameters of the regions in question; and also national targets of self sufficiency and exports if any in crop production front. The problem becomes non-deterministic as the occurrence of water resource is non-deterministic in nature. Also a large number of interrelated variables and parameters describing the physical characteristics of the system and the economic measure of the problem need to be taken into account. This becomes all the more complex when we consider multiobjectives as they give rise to multifarious problems especially in the face of conflicting requirements like irrigation and power generation.

1.1.2 Mathematical programming approaches

With the advent of high speed digital computers, several types of mathematical programming techniques and systems approach have been employed to provide valuable information in agricultural resources planning and reservoir management in irrigation commands. These techniques provide guidelines for the efficient use of the scarce agricultural resources and for deriving optimal reservoir operating policies for those responsible for planning and decision making in the agricultural and irrigation sectors. They do so by bringing the diverse elements of the planning process together in a conceptual framework that ideally facilitates better understanding of alternatives and their possible impacts. Linear programming (LP) is the tool widely used, other tools being dynamic programming (DP), simulation, non-linear programming (NLP) etc. LP models are usually of the maximum return or minimum cost type (single objective models). Within the context of agricultural planning, the LP models mostly have been useful in determining the mix of crops so as to take advantage of the limited resources to produce the maximum economic return.

As regards multiobjective problems, the dimensions of the complexities present in them can be realised by the fact that currently relatively few methodologies exist for quantification of all the aspects (Taylor et al. 1975). Goal programming (GP) is one such candidate methodology which can adequately portray the impacts of multiobjective planning. It aims to minimize the deviations from the desired levels of goals. While LP stresses the optimization of a single objective, GP stresses the satisfaction of many objectives (Ignizio, 1976).

1.2 Nature and Scope of the Problem

The present research problem has been envisaged to provide guidance on the planning and management of agricultural land and water resources including reservoir operation in the command area of Kangsabati Reservoir Project (KRP) in West Bengal, India. This is one of the major multipurpose projects in the State, concerned primarily with irrigation and flood control.

Kangsabati Project is not an exception as it experiences problems which are common for river valley irrigation systems in India. Lack of appreciation of the multidisciplinary nature of irrigation, absence of water balance of the command area and tectonic problem involving slow built-up of canal network are some of the problems that reveal the present situation in the command. Use of high yielding seeds, fertilizer and other modern inputs-the components of technological advance, have little impact on agricultural production in the command, if the available water is used in traditional fashion. In the command, the irrigation scheduling of crops is based on age-old practices. Tradition oriented operating policies have not changed for the better either. Consequently the cropping pattern remains almost static since long. Hence the present irrigation system is not adapted to the modern intensive agriculture recognizing the economic opportunities offered by the high yielding varieties (HYVs) and associated crop technology.

Moreover, if the past experiences are any indication, the project water supply has been overestimated at the time of proposal due to lack of data; the effect of which is being severely felt at present. Absence of regular water courses and the lack of field channels contribute to improper utilization of the reservoir water. As a result, considerable areas in the tail reaches do not receive reservoir water for most of the time. In the past, the major concern was to motivate the farmers to use irrigation water to increase agricultural production. Presently as we know the value of scarce irrigation water, we have to evolve policies that will ensure the farmers to have a deep appreciation of its correct use so that there are no problems of waterlogging or unequal distribution of irrigation water. Also the conjunctive use aspect of surface and ground waters has not got the attention it deserves. The present system of protective irrigation caters mostly to kharif rice, considerable portion of which is composed of less profitable traditional varieties. The problem of rural unemployment among agricultural labour force is acute for most part of the year. Elaborate discussion on the physical setting and planning base is presented in Chapter-III.

All these reveal that the existing cropping pattern and the system of irrigation and reservoir management of Kangsabati Project are not keeping pace with the advance in agrotechnology; and the utilization of the agricultural resources of the command is far from optimal. Thus there exists vast scope for improvement through evolving efficient cropping pattern particularly in view of the growing concern for HYVs; and through exploring alternative reservoir operating policies for the project. Keeping all these in mind, the present investigation was undertaken to analyze the impact of reallocation of command area resources on all-round development of agriculture in the region through mathematical programming approach. This involved exploring whether the changes in existing cropping pattern as well as reservoir operating policy along with conjunctive use of irrigation sources would ensure the optimal use of agricultural and related resources of the region to maximize agricultural production. Also this was to evaluate whether the study would result in improvement of farm return and rural employment thereby help accomplish transformation in betterment of the socio economic milieu of the region; and provide for the national goal of self sufficiency in food production front in the command area. All these would indirectly boost the development of agriculturally allied industries and enhance the employment potential.