SUPPORTING AGRICULTURE THROUGH RENOVATION OF IRRIGATION TANKS: AN OPPORTUNITY AND CHALLENGE FOR TAMILNADU

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Abstract : The importance of controlled water supply is indispensable for the sustainability in low land paddy production, which varies enormously from region to region and country to country. What essential is the degree of importance given to the three elements of water management namely (i) resource management within the watershed (ii) conveyance to the crop fields and (iii) management within farm fields. While water losses in the paddy fields are to be discouraged, they need not necessarily amount to the losses to the watershed as a whole, if they are converted into groundwater and pumped back to the surface. In India, the second largest rice producing country of the world, 80% of water is used for irrigation. There are around 40,000 irrigation tanks in Tamilnadu, India, irrigating about 0.63 million ha of paddy fields. Past experiences show that availability of surface water resources are not always reliable, which has turned the paddy farmer's attention to the exploitation of ground water on a very much larger but manageable scale. The objective of this paper is to bring out the challenges and opportunities of the development strategies for the sustainability of paddy agriculture in the developing countries, (based on the experiences in Tamilnadu, India), where natural resources are plenty but financial resources are scarce. The short-term opportunities include on farm development works through modernization of existing irrigation facilities/structures and conjunctive use of surface and ground water resources. Initial evaluations of such integrated modernization approaches adopted through Pilot studies indicate better environmental and economic benefits, contributing for sustainable development of paddy agriculture

Keyword: Agriculture, Irrigation

INTRODUCTION

Over the last forty years world agriculture has been remarkably successful in increasing the food production. Greater output has been mainly due to improved land productivity, that is increased crop yield per hectare in Asia, although expanding the area in cultivation has been important in some areas, notably in Latin America and tropical Africa. As a result investment in the irrigation sector by the national governments and the major funding agencies has decreased. All previous works on analysing the potentials of sustainable paddy production assume that there is a substantial increase in crop yield in the future. For satisfying the future demand of increasing population, more than 10 billion in 2025, the present production of 525 M T rice has to be increased by 150% over the 25-year period (FAO, 1996). If past trends continue, some 95% of the increased output has to come from higher land productivity. World average rice yield will have to be rise from present 3.5 t/ha to 7.0 t/ha in 2025. Hence a balanced strategy for expanding irrigation to increase the crop productions is needed. But, there are few opportunities in the future than in the past, indicating very clearly that much efforts will have to put for improving the efficiency of existing irrigation systems for sustainable crop production in lowlands.

With competing demand for water, the quantities of water consumed by crops in an irrigation project are considerable. Also, the total volume of water handled by a irrigation project has to take account of system efficiency, a product of efficiencies during conveyance, distribution and field application. It is an obvious fact that such problems cannot be solved on a project-by project basis, but have to be part of national sustainable agricultural development strategies, in which (i) resource management within the watershed (ii) conveyance to the fields and (iii) management within fields will be at the forefront. Experiences that tank water management was not reliable have turned the farmers attention to the exploitation of ground water resources, as a supplemental smaller and hence manageable scale.

The objective of this paper is to bring out the challenges and opportunities of the development strategies for the sustainability of agriculture in the developing countries, (based on the experiences in Tamilnadu, India). Discussions are focused to answer the following two questions (1) what are the potential returns from the tank modernization (2) how the challenges for benefits can be converted into opportunities for improved land and water productivity, through modernization measures, which at times are as important as environmental incentives and economic benefits in contributing for sustainable agriculture.

Crop Productions and Tank Irrigation in India

India has the world's largest harvested area under paddy rice crop, accounting for about 43 Mha and is the second largest producer of rice, with 97 M tons. It attained selfsufficiency in rice grain production, in late 1960s especially after the dissemination of high yielding varieties of rice. Thus there is no or limited possibility of increasing the net cropped area to an appreciable extent. Therefore increased crop production has to come from increased output from the same land. This is mainly because of limitation in availability of water during the critical months of crop growing season.

Nature has endowed this country with ample irrigation water resources, but has simultaneously posed a challenge by making their distribution highly uneven. Water scarcity is therefore considered to be primary factor limiting crop production in these areas. Therefore water storage becomes an essential component for sustainable crop production.

Research results shows that if supplemental irrigation was available to crop in the command area of tanks, crop yield would increase by more than 1 ton/ha in tank irrigated area. Tanks would also be useful in reducing floods, recharging wells and providing drainage in high rainfall periods (Walter, 1963). The above points out the key role that tanks have played in irrigating the paddy cultivation areas. In many areas, tank irrigation is the only water source to harness rainwater and help farmers through crop growing period and provide stability to crop production. The underdevelopment, stagnation and even decline of agriculture in this region are usually attributed to their constraints in tank water supply.

Components of Tank Irrigation System in Tamil Nadu

The term minor Irrigation Tank (MIT) or simply tank refers to a small storage reservoir raised to impound the runoff water from the monsoon rains, which occurs during a few months of the year. Although these tanks are widespread in India, the density of the tank irrigation varies considerably from district to district. The main components of the tanks are catchment area, water spread area and command area. The subcomponents are large earth embankments, sluices, surplus weirs and channels leading to field lots. The system tanks, in addition to rainwater, receive their water supply from nearby perennial rivers through as system of canals into series of tanks situated as a chain along the river.

Performance Tanks in Crop Production

Bulk of these tanks are very old; they were built by ancient Kings hundreds of years ago. Their water use efficiency has come down to almost 25-30% in many cases (PWD, 1986). This is due to inadequate maintenance, operational inefficiency and lack of control over the regulation and excessive use of water at the field level. Because of these defects, the full contemplated command areas does not get the benefit and the net irrigation area has started declining, which is compensated by increase in the ground water utilization. The constraints that impaired the irrigation efficiency of tanks and crop production in the tank command area are discussed below.

Tank Catchment Hydrology

As the area under crop cultivation is based on the capacity of the tank times the number of fillings, variation in rainfall pattern influences the storage quantity and irrigated area. From 1965 to 1995, the average annual rainfall in Tamilnadu was 764 mm with a coefficient of variation of 23%. One measure of water scarcity would be when the rainfall is less than 750 mm of average rainfall in the monsoon months of August to October. The first filling is expected between August – September and the second in October – November. Any delay in getting the first filling will delay the planting of rice crop, which adversely affects the crop yield. Hence farmers, on the basis of their past experience, will be cautious in starting rice planting in years with low September rains.

In general tanks with assured water supply for crop cultivation, such as system tanks have lesser catchment area than the rainfed tanks. The same study found that there exist a close correlation between the tank capacity, catchment area and cultivated area. The ratio between the free catchment to water spread area varies from 1.51 to 4.67, indicating the need for certain engineering solutions like raising the bund height, soil conservation measures in the catchment, reducing the evaporation loss by deepening the water storage area. In fact, storage of capacity of tanks is greatly reduced by siltation.

Structural Components of Tank System

The maintenance and repairs of many structural components of the tanks are poor. Almost all the tanks require repairs either in tank itself or in their components. Most of the irrigation tanks were constructed long time ago. After the declination of traditional maintenance system, no proper maintenance was implemented for the tank facilities including catchment treatment by farmers. The water distribution system, especially sluices, is not properly operated because of poor maintenance and poor water storage in tank.

Field Water Management in Tank Command Area

Paddy rice is cultivated either as a single cop or double crop in tank command areas. To attain maximum field productivity, water must be supplied and regulated in such a way that maximum production could be obtained from the available tank water. This is not happening in the tank command area at present juncture. In fact, the lowest paddy yield per unit area in irrigated land is only from the failed tank irrigated lands. The dominance of small sized land holdings, high level of fragmentation as well as low returns to irrigation due to lack of each plot arrangement contemplates land consolidation, which will increase the effectiveness of water regulation.

Conjunctive Use of Tank and Well Water

Conjunctive use of ground water and tank water is also one of the important factors that influence the rice yield in tank command areas. In the non-system rainfed tanks, the dependency of well water is also high. The average numbers of wells vary from 10 - 22 in rainfed tanks while it is in the range of 8 – 14 in the system tanks, implying the inadequacy of irrigation water in rainfed tanks. They also found that rice yield was progressively higher with number of supplemental irrigation, than tank water alone. Also it was revealed that paddy yield is higher in tail reach farms with well irrigation than head reach farms without well irrigation. So, the conjunctive use of tank water and ground water should be considered in the integrated modernization program.

Farmers Organizational Framework for Water Management

Most of minor irrigation tanks are chained each other, and self catchment area of one tank is the command area of upper tanks, and both tanks are connected by the surplus or supply channels. Under these conditions, water distribution and tank storage operation need to be coordinated each other. There exist no such synchronized institutional frameworks within the present chained tank basin. After fading out of traditional maintenance system under the strong leadership, farmers lost their awareness that tank and irrigation facilities are their property. Hence, the tank system has to be managed inevitable by the users themselves. Besides the effective and efficiency of the system depend on the involvement of the users only. Moreover management by a government agency will result in huge organizational expenditure too.

Strategies for Sustainable Crop Production through Integrated Modernization of Irrigation Tanks

Above discussions, official data and academic studies prove that the tank based crop production system in Tamilnadu has been deteriorating over time. Though high yielding varieties and other modern inputs of farming are widely adopted, in respect of water use and water regulation the farmers in the tank command area still poorly informed and have not paid their attention. Such plans should, besides providing for large-scale repairs and improvements to the physical components (hardware) of the tank system also provide for better regulation of irrigation water and also capacity building of the farmers on optimum water use (software). An integrated modernization program with the following short term and long-term strategies can solve these problems.

1) Short term Opportunities on Maximization of Tank's Land and Water Resources

- Modernization of irrigation facilities, such as bund itself, sluices, surplus weirs.
- Selective lining of field channels in a systematic way on a priority basis, installation of measurement devices, and gate controlled diversion box.
- Provision of drainage canals for plots and blocks.
- Scientific water management at plot level.
- Instituting strict land use guidelines such as choice of crop in the command area and soil conservation measures in the catchment area. These guidelines ought to be strictly enforced.

2) Long term Challenges on Management of Tank Resources

- Remodelling of sluices structures.
- Transferring the water, wherever feasible from one sub-basin to another through systemization. Thus all supply channels, tanks and small percolation ponds can be linked so as to form a single water resource grid.
- Harvesting of early monsoon rainfall and using for rice nursery, which otherwise goes as waste by the established water grids connecting these modernized tanks in a chain.
- Implementing appropriate soil and water conservation practices in catchment, including afforestation, monsoon water harvesting techniques and good maintenance of supply channels to increase the water flow into the tanks.
- Motivation of farmers as beneficiary of tank common proprietor and for restoration of traditional self-help approaches.

Also, above discussions show that evolving a comprehensive but integrated modernization strategy for the tanks is a complex task, due to the dynamic interactions of water which is routed through catchment, tank and field levels as well as because of other pertaining land based issues. So, number of topics should be included in research program to address the modernization needs.

Conclusion

Tank irrigation is a profitable technology in economic, environment and social terms; but under present conditions of management it is deteriorating rapidly. Extent as well as reliability of this technology is decreasing. Because of potentials for additional rice cultivation for about 16 million ha under tank irrigation, it is important to select holistic improvement strategies that fully exploit the potentials of tank irrigation. In general, sustainable crop production requires better performance of these small-scale irrigation structures tanks, which needs (i) modernization of physical structures (ii) efficient distribution of water to and in farm fields as well as among the farmers (iii) proper maintenance of tank system after the modernization through farmers participation.

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