IMPACT OF WATER CONSERVATION ON RURAL AGRICULTURAL PRODUCTIVITY AND ITS SUSTAINABILITY

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Abstract: Agriculture has undergone significant developments since the time of the earliest cultivation. India's water resources potential and the country's agricultural economy hinge on the monsoon rains and its spatial and temporal variations. Water resources of a country constitute one of its vital assets which are conserved in tanks (an earthen bund constructed across a shallow valley) during monsoon and the same is used for various purposes in the following dry periods. The pre-eminence of tanks as a source of water storage and supply for multiple uses was lost due to a variety of factors. Realising the importance of tanks, the south Indian states have started rehabilitating the tanks in mid 1980's under state funds as well as external assistance. The main focus of tank rehabilitation is to maximise the agricultural productivity per unit area, per unit time and per unit of water. In rural village, tank system rejuvenation helps people to develop their source of revenue in an equitable comportment. This is only because of farmers cooperation through active Water Users Association and proper planning of water distribution. In order to prove the above statement a study was carried out in a rural village named 'Pelasur' of Thiruvannamalai district in Tamil Nadu, South India. Households of women and men farmers who owned at least one irrigated plot of land under the study tank command area were taken into consideration. From the above mentioned households 20% of the total respondents from both the villages were selected in a stratified sampling method. Stratification with sampling unit i.e. households was felt necessary and the households were divided into different strata i.e. size of the land holding, reach, and well owning status. In order to achieve the proposed objectives, combinations of qualitative and quantitative methods were used to gather information. Data obtained were coded, master tabulated and analysed using SPSS (Statistical Package for Social Science). Though many questions were included in the interview schedule, other qualitative methods such as stakeholders meetings and group discussions with certain categories of non-farm villagers too added important information. Results envisages that after irrigation tank rehabilitation a drastic improvement was experienced by the local farmers in terms of bio-physical characteristics such as cropping pattern, cropping season, crop diversification and ground water status. Hence conserving rainwater through irrigation tanks plays a major role on sustainable agricultural productivity.

Keywords: Agricultural productivity, water conservation, rural development, cropping pattern, tank rehabilitation

INTRODUCTION

Water is being treated as a revered divine gift. Tanks are important means to conserve precious water resources in semi-arid areas. A tank is a natural or a manmade reservoir created by simple earthen construction that captures surface runoff. Tank systems are an important traditional decentralised form of irrigation. Tanks environmental importance lies not only in its functions of collecting and impounding water for irrigation but also in enabling percolation and recharging the ground water. And it is also a mechanism to cope up with water scarcity and flood control. In addition to ground water recharge, tanks provide water resources for fish culture, silt for fertilising, livestock, duck rearing, washing, bathing, drinking, collection of fodder, fuel wood, vegetable cultivation, tree planting, clay for brick and pot making. The tank never existed as isolated from the

lifestyle of people who used it whole day long for a variety of purposes (Raju 2003). With limited water resources, vagaries of the monsoon, and looming water scarcity in many parts of India, the need for rehabilitating and restoring the tanks assumes significance. In south India from 1960 to 1996 30% total area under tank irrigation is reduced (Narayanamoorthy 2002 and 2004, Janakarajan 1996). The tank systems of South India are both a technology and a resource and need to be treated in terms of a wide complex of natural resources, physical facilities, land use patterns and managerial institutions. Equally, they imply a particular system of social relations which defines a set of rights, entitlements and obligations which make cooperation, conflicts resolution and collective action Tanks are generally classified based on the source of augmenting water and size of command area. Many a time, they enable the farmers to raise more than one crop. Non-system tanks depend on the rainfall in their own catchment area and are not connected to the river system and usually single crop is raised under these tanks. Non-system tanks are often linked with the other tanks thus forming upper and lower tanks in a cascade form. During times of heavy rainfall, the surplus water from upper tanks will flow to the lower tanks.

MATERIALS AND METHOD

In Tiruvannamalai district, Polur taluk, chetpet block a Non-system PWD tank called Pelasur Esa Eri had been selected as a rural tank for the study. This tank is rehabilitated in the year 2002 with World Bank fund of about 60 lakhs. Tank capacity is 2.55 Mm^3 and registered ayacut is 214 ha. Secondary sources of information were collected from various sources and the primary first hand information was gathered using qualitative data collection methods like focus group discussions and one to one interactions from landless, women and other vulnerable groups. Detailed questionnaire was prepared and data were collected from 102 respondents which is 20% of the total house hold in study village. Land owning farmers are classified in to three groups viz. Marginal, Small, Medium whose land owning size are less than 2.5 acres, 2.5 to 5 acres and more than 5 acres. By and large it was observed that there is improvement in the livelihood status of the farming and non farming community during post rehabilitated period.

RESULTS AND DISCUSSION

Table 1 and Figure 2 clearly explicate the increase in total wet land cultivated area in post rehabilitation period. There is a reduction in first and second season paddy cultivation, which is compensated by a drastic increase of annual crop cultivation. Availability of assured water supply throughout the year for irrigation either through surface or subsurface sources is the major reason for the change in cropping pattern. This indicates the positive impact of tank rehabilitation in Pelasur village. Also, there is an increase of 9 ha area of cultivation in the third season paddy crop during the post rehabilitation period. Paddy is overpriced in third season while marketing, labour cost is low due to surplus labour availability and easy availability of fertiliser may be the reasons for increased third season paddy cultivation. Area cultivated during the third season is very low when compared to the total cultivate area and hence the availability of labour and fertiliser is high. Since the climate is hot, pesticide and rat problems are low in third season when compared to first and second seasons. The output presented in Table 2 confirms the result that a significant positive relationship exists between the total area cultivated in wet land and the tank rehabilitation ($r = 0.866$, $p<0.05$). Therefore, the increased total area cultivated in wet land during first season is highly associated with the tank rehabilitation.

Observations in Table 3 related to the total area cultivated before and after the tank rehabilitation were randomly assigned to ensure that responses are due to the tank rehabilitation and not due to other factors. Paired t-test technique was used to test the null hypothesis and compare the results to prove that there is a difference between the total area cultivated before and after the tank rehabilitation.

The analysis output reveals that there is no difference between total area cultivated by the respondents in pre and post rehabilitation periods. Tank rehabilitation does not significantly improves the area cultivated in wet land during first season, $t (101) = 0.520$, $p>0.05$. Hence, it is concluded that area cultivated in the post rehabilitation period is highly correlated with the tank rehabilitation but does not show significant change during first season paddy cultivation. The output presented in Table 4 confirms the result that a significant positive relationship exists between total area cultivated with annual crop (sugarcane) in wet land and tank rehabilitation ($r = 0.651$, $p<0.05$). Therefore, increased total area cultivated with annual crop (sugarcane) in wet land is associated with tank rehabilitation.

To test the null hypothesis of no difference between total area cultivated during pre and post rehabilitation periods, paired t-test was used to compare the results. As can be seen from the output presented in Table 5.20, a significant difference exists between total area cultivated with annual crop (sugarcane) in wet land by the respondents in pre and post rehabilitation periods. Tank rehabilitation significantly improves the total area cultivated with annual crop (sugarcane) in wet land, $t (101) = 5.379$, $p<0.05$.

Table 1: Season wise area cultivated in wet land before and after rehabilitation by Pelasur respondents

Season wise total cultivated area in acres				
S. No.	**Description**	**Area cultivated before rehabilitation (ha)**	**Area cultivated after rehabilitation (ha)**	**Difference**
1	Total cultivated area	138.28	162.92	24.65
2	First season	46.14	39.95	-6.19
3	Second season	43.79	28.49	-15.30
4	Third season	4.13	12.57	8.45
5	Annual crop	44.21	81.91	37.70

Table 2: Paired samples correlations for first season wet land before and after rehabilitation

	Description	**Number of total respondents**	**Correlation**	**Sig.**
Pair 1	Wet land cultivable area first season before rehabilitation and Wet land cultivable area first season after rehabilitation	102	0.866	0.000

Table 3: Paired samples t-test for first season wet land before and after rehabilitation by Pelasur respondents

	Description	**Paired Differences**					**t**	**df**	**Sig. (2-tailed)**
		Mean	**Std. deviation**	**Std. error mean**	**95% confidence interval of the difference**				
					Lower	**Upper**			
Pair 1	Wet land cultivable area first season before rehabilitation and wet land cultivable area first season after rehabilitation	-.060	1.179	0.116	-.292	0.171	-0.520	101	0.604

Table 4: Paired sample correlations for annual crop cultivated in wet land before and after rehabilitation

	Description	**N**	**Correlation**	**Sig.**
Pair 1	Wet land cultivable area annual before rehabilitation and wet land cultivable area annual after rehabilitation	102	0.651	0.000

Table 5: Paired sample t-test for annual crop cultivated in wet land before and after rehabilitation

	Description	Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. deviation	Std. error mean	95% confidence interval of the difference				
					Lower	Upper			
Pair 1	Wet land cultivable area annual before and after rehabilitation	-0.912	1.714	0.169	-1.249	-0.576	-5.379	101	0.000

CONCLUSION

Tanks in the Indian context are inextricably linked to the socio-cultural aspects of rural communities especially and are considered an indispensable infrastructure of each and every village for sustaining the socio ecological balance. The tank system, which have been developed ingeniously over a period of several centuries have provided insulation from recurring droughts and floods and vagaries of monsoon, and provided the much needed livelihood avenue to the marginal and poor people living in the fragile semi-arid tropics. The importance of tanks is being realised more and more, as the continued use of ground water and other large-scale water resources system is proving to be costly and inadequate to meet the increasing demands. So, the tank ecosystems have to be conserved to provide a safety net to the livelihood of millions who depend on these systems. The conservation of tanks has to be done considering the multiple uses such as irrigation, drinking water for people and animals and for recharging ground water. The tank systems also provide fuel wood and timber, fodder, silt, water for rearing fish, and animals and bio-diversity complex for flora and fauna. Results envisages that after irrigation tank rehabilitation a drastic improvement was experienced by the local farmers in terms of bio-physical characteristics such as cropping pattern, cropping season, crop diversification and ground water status. The concept of sustainable livelihood has been gradually developing over the last decade to a position where it is widely accepted as offering new insights into the dynamics of development and the diversity of experiences of the poor people. It is an approach that is flexible and dynamic, and in particular that provides a basis for understanding the relationship between poor communities, their local environment and external socio-economic, environmental, and institutional forces. Water resources are vital inputs to livelihood production activities in a wide variety of ways. Agriculture is the most obvious one. As in many rural communities, agricultural production is the basis of the economy and the viability of agriculture are closely linked to reliable access to water. This is true for both irrigated areas, where some degree of control exists over the availability of water and rainfed areas where production is far more directly subject to the vagaries of climate. Many poor people are not directly farmers themselves but are rather agricultural labourers and as such are dependent (indeed at times more dependent) upon the viability of agriculture as the farmers employ them. Hence conserving rainwater through irrigation tanks plays a major role on sustainable agricultural productivity

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Dr.N.K.Ambujam is currently a Professor and Director of Centre for Water Resources, Anna University, Chennai, India. She is an Agricultural Engineer. Have masters in Irrigation Engineering. Dr.Ambujam has over 22 years of teaching, research and consultancy in the areas of irrigation Engineering, water management and Integrated water resources management. She has coordinated Dutch funded “Crossing Boundaries project” along with 5 South Asian partner institutes. She has introduced one U.G program in Agricultural Engineering and

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Brief biograbhy of Dr.B.Anuradha

Dr.B.Anuradha is currently a Professor and Head of the Department in Civil Engineering, Madha Engineering College, Chennai, India. Have masters in Irrigation Water Management. Dr.B.Anuradha has over 7 years of teaching and research in the areas of irrigation engineering, and water management. Her dissertation was successfully completed a couple of years back and covers all aspects of tank management. As a part of her thesis work she has published 12 papers in national and international journals and 33 conferences papers. Her current interest is on strategies of integrating technical, social and economical in tank management on effective optimization for maximizing agricultural productivity.