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An Economic Study of Farmers Participation in Tank Irrigation Water Management with Special Reference to Madurai District

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ABSTRACT
Compare with system and non system tank farmers, the non system tank farmers do not get adequate water as they depend on their own catchment area. Government should initiate more modernized schemes for non system tank farmers. Socio economically poor farmers own the land in tail end areas they belong to lower caste. In a nutshell, in modernized tanks well water level was almost stable compared with non modernized tanks. The water depleted year by year in non modernized tanks In short, modernized tank farmers have got irrigation facility for two crops compared with non modernized tanks irrespective of tank systems. Farmers were not interested to cultivate third crop in system tanks even though water was available in wells.

1. INTRODUCTION

Slow agricultural growth is a concern for policymakers as some two-thirds of India's people depend on rural employment for a living. Current agricultural practices are neither economically nor environmentally sustainable and India's yields for many agricultural commodities are low. Poorly maintained irrigation systems and almost universal lack of good extension services are among the factors responsible. Farmers' access to markets is hampered by poor roads, rudimentary market infrastructure, and excessive regulation (World Bank: "India Country Overview 2008")

Government interventions in labor, land, and credit markets are hurting the market. Infrastructure and services are inadequate. The water availability is more in modernized tank system. This paper analysis how tank modernization with farmers participation to tank system can help farmers to increase irrigation utility.International Comparison credit is regulated by National Bank for Agricultural and Rural Development (NABARD) which is the statutory apex agent for rural development in the subcontinent.

The area FAO (Food and Agriculture Organization) National Accounts Statistics, under food grains production has experienced a decline during the 1990s while area under major commercial crops has witnessed a rise. Although the government has embraced the shift towards production of commercial crops since it can raise the revenues of the farmers and diversify the export basket of India, there are others who have warned about the implications of shifting towards non-food crops that includes threat to food security,

"Close to one billion people in the world suffer from hunger and malnutrition., (Gargi Parsai, 2009).The irrigation is an important factor in determining rates of poverty reduction. The significant poverty reduction in many parts of India is attributed to the availability of irrigation, which not only boosted agricultural production but also made possible the adoption of modern farming technology – seeds fertilizers and pesticides – that further reduced poverty.

2. REVIEW OF LITERATURE

Chen H.Sing (1982) has given some useful information on mass participation in Irrigation Water Management. In china, it was the local government that constructed and maintained the major and medium irrigation system. Palanisamy and Easter (1983) observed that the tank operation and Water distribution are more efficient and the maintenance of tanks is better in tanks with water users Organization as compared to tanks without water User's organizations.

Durai kannan.(1994) reported that the potential for surface irrigation from canals had been mostly exhausted in Tamil Nadu.Irrigation Tank, the main viable source to meet the irrigation demand in future, great emphasis is now laid on Modernization of Tanks system. George Chacka cherry (1996) in his study of irrigation management with Farmer participation in Kerala – problems and prospects, focuses on the problem of beneficiary participation in Irrigation Water Management. He has chosen 100BFAs from Neyyar project for field survey. The study has identified a few major issues involved in the Irrigation Water Management system in Kerala. Vishvanathan and Yogita Khandge (2006), in their study of the economics of tank modernization project under RIDF in Karnataka.

Kei Kajisa, Palanisamy, Takeshi Sakurai (August 2004) they examined the factors underlying decline in the collective management of tank irrigation system and the impact of those declines on rise yield and house hold income / consumption. Shivappa in his study (2006) examined the importance, impact and progress of Irrigation in Karnataka. The study is based on both Secondary and Primary data. Primary data has been collected by personal interviews from 360 farmers selected randomly in De ranger and Chitrudunga Districts in 2005-2006 during survey method.

3. METHODOLOGY

3.1. Statement of the problem

The Irrigation System can be divided into two types i.e. System and Non-System Tank. The awareness to do Tank Modernization with the help of Water User's Organization has been popular at present. As a Researcher is interested in analyzing the economic benefits in terms of crop productivity and water availability due to tank modernization with farmers' participation in system and non system tanks.

Madurai district is selected for the study. In Madurai district, the total number of tanks are 292 (greater than 40 ha) out of which 17 tanks are selected for the study covering six system tanks and eleven non system tanks. Out of six tanks, three tanks were chosen from modernized and three tanks from non modernized. In non system tanks, six tanks were chosen from modernized and five tanks were chosen from non modernized.

The above tanks were selected on the basis of concentration of tanks in two blocks of Madurai namely Vadipatti and Thirumangalam. In Vadipatti, system tanks are more in numbers. In Thirumangalam, Non system tanks are more in numbers. Three tanks from Madurai block were also selected which are very near to the selected blocks. Hence the selection of tanks is purposive.

3.2. Selection of Farmers

Purposive sampling is followed in the selection of farmers. A total of 227 farmers were selected from both system and Non system tanks.147 farmers were selected from non system tanks in view of large numbers of non system tanks in the study areas. In view of small numbers of system tanks, only 80 farmers were selected from system tanks. Equal representation is given for head, middle and tail reach areas as well as to marginal, small and large farmers.

The Secondary data were collected from periods 2003-04 and 2007-08. Primary data was collected during May 2007 to May 2008.

3.3.Objectives

To study the Farmers Participation in tank Maintenance and Water availability in different tank systems and farms.

3.4.Statistical tools and techniques used for the study

The cultivation details of the five years from 2003-04 to 2007-08 was obtained from respective sample farmers' tank village administration officers and taluk officers. Percentage of cultivated area for first and second crops of different tanks systems have been worked out.

Kendall's Coefficient of concordance (W) was applied to find out the extent of similarity among the respondents in assigning the ranks to the given items. The value of W varies between 0 and 1. Higher

the value of W higher will be the similarity among respondents in assigning the ranks. It is used in reasons for water wastes in tank systems.

One way analysis of variance (ANOVA) was used to test for differences among different group of means (Number of groups more than two).

4. RESULTS AND DISCUSSION

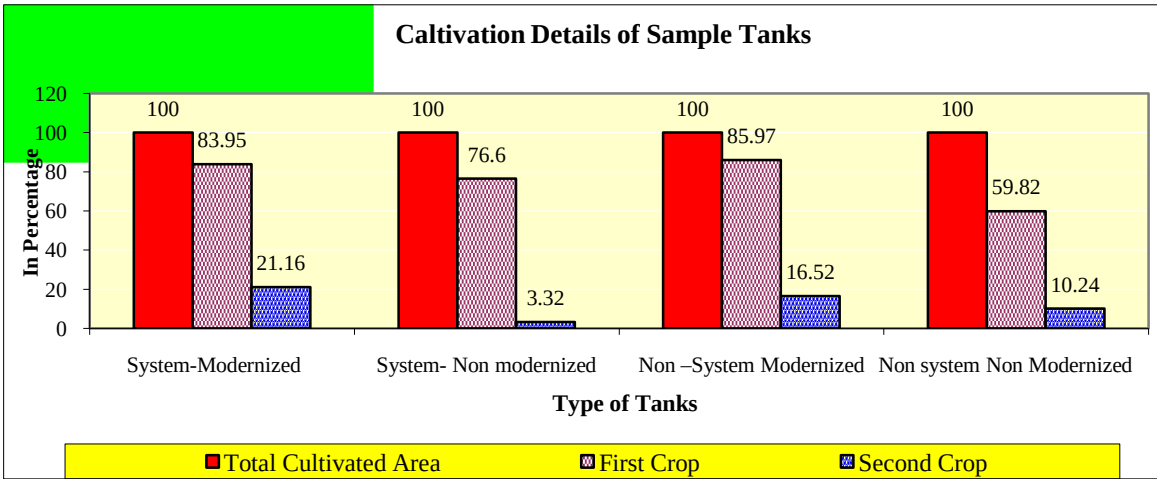
Cultivation details for five years from 2003-2004 to 2007-2008 were collected from respective sample farmers tank's Village Administrative officers and taluk offices. Rain fall also collected from respective taluk office. Five years average is calculated and taken for analysis. The rainfall is taken into account in the respective tank's nearest rainfall station. South-West and North East monsoon is taken for analysis. It is observed that there is no wide difference in rainfall.

Table 1:Cultivation Details of sample tanks

Name of the Tanks	Total Cultivation	First Crop	Gap	% cultivated	Second Crop	% cultivated	Rain Fall
System-Modernized	363.11	324.4	38.71	83.95	73.23	21.16	672.56
System- Non modernized	240.88	200.6	40.28	76.6	6.97	3.32	672.56
Non –System Modernized	167.02	143.23	23.79	85.97	24.41	16.52	705.35
Non system Non Modernized	137.02	79.19	57.83	59.82	8.16	10.24	715.02

Source: Compiled from respondents schedule

Chart 1: Cultivation Details of sample tanks



In system modernized and non modernized tanks, the first crop cultivated area percentages were 83.95 % and 76.6 % respectively. The difference was only small percentage of 7 whereas in non system modernized and non modernized tanks, the cultivated area percentages were 85.97% and 59.82 % respectively. The difference in cultivated area percentage was 25 %. It clearly shows that modernized tanks of both system and non system tank farmers have cultivated more than non modernized tank farmers. So it is observed that modernization is highly beneficial in non system tanks rather than system tanks in modernized tanks.

In Modernized system tanks, the second crop cultivated percentage was 21.16 % where as in non modernized tanks, 3.97 %. In Non system modernized and non modernized tanks, the second crop cultivated percentages were 16.52 % and 10.24 % respectively. It is clearly seen that in modernized

system tanks, the second crop cultivated acre percentage was higher than modernized non system tanks. It indicates modernization programme helped to cultivate more land due to better water availability and better water management of farmers.

Table 2: Irrigation practice of the respondents

Irrigation Practice	Type of Tank												Table Total	
	System				Group Total		Non-system				Group Total			
	Modernised		Non-Modernised		No.	%	Modernised		Non-Modernised		No.	%	No.	%
	No.	%	No.	%			No.	%	No.	%				
Open			27	71.1	27	33.8	13	16.3	55	82.1	68	46.3	95	41.9
OruMadai	42	100.0	11	28.9	53	66.3	67	83.8	12	17.9	79	53.7	132	58.1
Table Total	42	100.0	38	100.0	80	100.0	80	100.0	67	100.0	147	100.0	227	100.0

Source: Compiled from respondents schedule

Table 2 stated the irrigation practice followed by the respondents viz., Open and Orumadai.
Under the open system, the entire distribution network carries water and the farmers are free to use as much water as they need. In this practice, large amount of water is wasted.

Under the Orumadai paichal (single channel) system, the tank water, in the orumadai paichal system, is distributed through one branch channel at a time in rotation. A neerkatti (water guide) is appointed by the farmers to look after the water distribution system. No other individual is allowed to interfere with this arrangement to maintain a discipline in the water distribution.
It was found that Majority of the respondents both in the system category (66.3 percent) and in the non system category (53.1 percent) followed Orumadai paichal irrigation practice. In the system category, all the respondents of the modernized group and the majority of the respondents (71.1 percent) of non - modernized group had followed the orumadai paichal irrigation practice.
In the Non-system category, Most of the modernized group of respondents (83.8 percent) followed orumadai paichal irrigation practice whereas most of the respondents of Non-modernized group (82.1) had followed open irrigation practice.

Table -3: Kendalls Coefficient of Concordance For The Water Wastage

Reasons for Water Wastage	Type of Tank						Table Total
	System		Group Total	Non-system		Group Total	
	Modernised	Non-Modernised		Modernised	Non-Modernised		
Sluice Gear Open	1.74	2.58	2.14	3.06	4.33	3.64	3.11
Seepage	2.98	4.13	3.53	2.80	3.15	2.96	3.16
Bund Damage	3.79	3.16	3.49	4.44	4.12	4.29	4.01
Main Channel	4.90	4.34	4.64	3.99	4.16	4.07	4.27

Damage							
Field Channel Damage	5.95	5.82	5.89	5.53	3.27	4.50	4.99
Neerkatti Problem	1.50	1.21	1.36	1.21	1.96	1.55	1.48
Kendall's W	**0.887**	**0.746**	**0.781**	**70.625**	**0.238**	**0.345**	**0.421**

Source: Compiled from respondents schedule

Looking at the above table, it was observed that there was only a moderate level of similarity among the respondents in assigning the ranks to the six items for mentioning the reasons for water wastage.

The Kendall's W varies between as low as 0.238 in the case of non modernized group of respondents belonged to Non System Category and the maximum of 0.887 in the case of modernized group of respondents belonging to System category.

Looking at the mean ranks, in the System Category, field channel damage was the first reason for water wastage whereas Neerkatti problem was the least reason for water wastage revealed by the respondents.

In the Non system category, Field channel damage was the first reason mentioned by the modernized group of respondents. Sluice Gear open was the first reason mentioned in the case of non-modernized group of respondents. The Neerkatti problem was the least reason mentioned by the various groups of respondents in this category.

Table 4: Cultivation Details of Sample Farmers (per acre)

Land Under Reach			Type of Tank						Table Total
			System		Group Total	Non-system		Group Total	
			Modernized	Non-Modernized		Modernised	Non-Modernised		
Head	Total Ayacut	TOTAL	88	78	166	123	168	291	457
		Mean	5.87	6.00	5.93	6.15	8.84	7.46	6.82
		S.D	2.00	1.53	1.76	2.35	4.75	3.91	3.27
	Irrigated Area-I season	TOTAL	88	78	166	121	128	249	415
		Mean	5.87	6.00	5.93	6.05	6.74	6.38	6.19
		S.D	2.00	1.53	1.76	2.16	3.56	2.91	2.49
	Irrigated Area-II season	TOTAL	49	39	88	84	20	104	192
		Mean	3.50	3.00	3.26	4.42	2.50	3.85	3.56
		S.D	1.02	.91	.98	1.84	.53	1.79	1.46
Middle	Total Ayacut	TOTAL	75	41	116	158	174	332	448
		Mean	5.00	3.42	4.30	5.10	6.96	5.93	5.40
		S.D	2.88	.51	2.28	2.97	3.56	3.35	3.13
	Irrigated Area-I season	TOTAL	75	41	116	155	138	293	409
		Mean	5.00	3.42	4.30	5.00	5.52	5.23	4.93
		S.D	2.88	.51	2.28	2.67	2.49	2.58	2.51
	Irrigated Area-II season	TOTAL	39	-	39	73	34	107	146
		Mean	3.25	-	3.25	4.29	3.09	3.82	3.65
		S.D	1.48	-	1.48	1.79	1.76	1.85	1.75
Tail	Total	TOTAL	56	19	75	64	61	125	200

	Ayacut	Mean	4.67	1.46	3.00	2.21	2.65	2.40	2.60
		S.D	7.18	.52	5.14	1.26	2.42	1.86	3.28
	Irrigated Area-I season	TOTAL	56	19	75	64	51	115	190
		Mean	4.67	1.46	3.00	2.21	2.22	2.21	2.47
		S.D	7.18	.52	5.14	1.26	1.35	1.29	3.10
	Irrigated Area-II season	TOTAL	32	.	32	15	21	36	68
		Mean	3.20	.	3.20	2.14	1.91	2.00	2.43
		S.D	3.61	.	3.61	1.46	.70	1.03	2.32
Table Total	Total Ayacut	TOTAL	219	138	357	345	403	748	1105
		Mean	5.21	3.63	4.46	4.31	6.01	5.09	4.87
		S.D	4.27	2.14	3.50	2.82	4.40	3.71	3.64
	Irrigated Area-I season	TOTAL	219	138	357	340	317	657	1014
		Mean	5.21	3.63	4.46	4.25	4.73	4.47	4.47
		S.D	4.27	2.14	3.50	2.64	3.15	2.88	3.11
	Irrigated Area-II season	TOTAL	120	39	159	172	75	247	406
		Mean	3.33	3.00	3.24	4.00	2.50	3.38	3.33
		S.D	2.11	.91	1.87	1.91	1.25	1.82	1.83

Source: Compiled from respondents schedule
Note : 1 Hectare = 2.47 acres.

Table 4 showed the cultivation details of sample farmers (per acre). In the head reach, the total cultivated area was 457 acres with the mean of 6.82. Out of this, 166 acres were under system category with the mean of 5.93 and 291 acres under non system category with the mean of 7.46. The irrigated area during the I season stood at 415 acres in which 166 acres under modernized group and 249 acres under non modernized group. Irrigated area during the II season was up to 192 acres.

At the middle reach, the total ayacut area was 448 acres with the mean of 5.40 in which 166 acres were under system category and 332 acres under non system category. The irrigated area during the I season stood at 116 acres in which 75 acres under modernized group and 41 acres under non modernized group. Irrigated areas during the II season were up to 293 acres.

At the tail reach, total ayacut area was 200 with the mean of 2.60 in which 75 acres were under system category and 125 acres under non system category. 19 acres was under non modernized group. Irrigated area during the II season was 68 acres.

Totally, total ayacut area was 1105 with the mean of 4.87 in which 357 acres were under system category and 748 acres under non system category. The irrigated area during the I season stood at 357 acres under modernized group and 657 acres under non modernized group. Irrigated area during the II season was upto 406 acres.

Table 5: Water Availability till no. of crops wise distribution of the Respondents

Water Availability till no. of crops	**Type of Tank**										**Table Total**	
	System				**Group Total**		**Non-system**				**Group Total**		**No.**	**%**
	Modernized		**Non-Modernized**		**No.**	**%**	**Modernized**		**Non-Modernized**		**No.**	**%**		
	No.	%	No.	%			No.	%	No.	%				

One	19	45.2	23	60.5	42	52.5	57	71.3	58	86.6	115	78.2	157	69.2
Two	23	54.8	13	34.2	36	45.0	9	11.3	0	0	9	6.1	45	19.8
Three	0	0	2	5.3	2	2.5	14	17.5	9	13.4	23	15.6	25	11.0
Table Total	**42**	**100.0**	**38**	**100.0**	**80**	**100.0**	**80**	**100.0**	**67**	**100.0**	**147**	**100.0**	**227**	**100.0**

Source: Compiled from respondents schedule

Table 5 dealt with the Water Availability and number of crops wise distribution of the Respondents. Among the total respondents, majority of the respondents (69.2 percent) availed water for cultivating only one crop whereas 19.8 percent of them did not get water for the cultivation for two crops and 11 percent have got water for three seasons.

In the system category, 52.5 percent of the respondents had used water for cultivating only one crop. 45 percent of them had used water for cultivating two crops. Only 2.5 percent of them who belong to non modernized group have got water for cultivating three crops. Majority of the modernized group of respondents (54.8 percent) had availed the irrigation facility for cultivating two crops whereas majority of the non modernized group of respondents availed water for cultivating only one crop.

In the non system category, majority of the respondents (78.2 percent) have got irrigation for cultivating one crop whereas none of them have got irrigation for two crops under this category. Majority of the respondents of the modernized group (71.3 percent) and the non modernized group (86.6 percent) availed water for cultivating only one crop. In nutshell, modernized tank farmers have got irrigation facility for two crops compared with non modernized tanks irrespective of tank systems. Farmers were not interested to cultivate third crop in system tanks even though water was available in wells.

Table 6: **Water Depth (ft)**

		Type of Tank						Table Total
		System		Group Total	Non-system		Group Total	
		Modernised	Non-Modernised		Modernised	Non-Modernised		
Current Year	Mean	19.70	18.46	19.25	22.12	46.57	40.88	33.73
	S.D	.82	1.33	1.18	.99	8.67	12.88	14.68
	No.	23	13	36	17	56	73	109
5Years Back	Mean	18.30	14.85	17.06	19.18	40.07	35.21	29.21
	S.D	2.65	.55	2.71	1.01	8.15	11.41	12.75
	No.	23	13	36	17	56	73	109
10Years Back	Mean	18.30	14.85	17.06	15.59	33.46	29.30	25.26
	S.D	2.65	.55	2.71	.87	7.91	10.29	10.32
	No.	23	13	36	17	56	73	109

25 Year back	Mean	14.40	12.77	13.76	14.12	28.95	25.49	21.84
	S.D	1.23	.83	1.35	.78	6.62	8.57	8.98
	No.	20	13	33	17	56	73	106

Source: Compiled from respondents schedule
Note: 1 Feet = 30 cm

The table 6 showed the year wise distribution of water indepth in wells. During the Current year, the mean stood at 40.88 with the SD of 12.88. In the system category, the mean well water depth modernized group and the non modernized group well water depth stood at 19.70 and 18.46 respectively. In the non system category, the mean modernized group and the non modernized group was 22.12 and 46.57 respectively.

5 years back, the mean well water depth stood at 35.21 with the SD of 12.75. In the system category, the mean modernized group and the non modernized group well water depth stood at 18.30 and 14.85 respectively. In the non system category, the mean modernized group of well water depth and the non modernized group was 19.18 and 40.07 respectively.

10 years back, the mean well water depth stood at 20.26 with the SD of 29.30. In the system category, the mean modernized group and the non modernized group well water depth stood at 18.30 and 14.85 respectively. In the non system category, the mean modernized group well water and the non modernized group was 15.59 and 33.46 respectively.

25 years back, the mean well water depth stood at 21.84 with the SD of 25.49 in group. In the system category, the mean modernized group and the non modernized group stood at 14.40 and 12.77 respectively. In the non system category, the mean modernized group and the non modernized group was 14.12 and 28.95 respectively. In a nutshell, in modernized tanks well water level was almost stable compared with not modernized tanks. The water depleted year by year in non modernized tanks.

Ho: There is no significant difference among the Land under reach with regard to irrigated area I season in the non modernized non system category.

Land Under Reach	Irrigated Area-I season		
	Mean	S.D	No.
Head	6.74	3.56	19
Middle	5.52	2.49	25
Tail	2.22	1.35	23

ANOVA for Irrigated Area-I season

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	237.327	2	118.663	18.263	**
Within Groups	415.837	64	6.497		
Total	653.164	66			

The one way ANOVA was applied to find whether there is significant difference among the Land under reach with regard to irrigated area I season in the non modernized non system category. The ANOVA result shows that the calculated F ratio value is 18.263 which is greater than the table value of 4.953 at 1% level of significance. Hence, the hypothesis was rejected. Since the calculated

value is greater than the table value, it is inferred that there is significant difference among the Land under reach with regard to irrigated area I season in the non modernized non system category.

Ho: There is no significant difference among land under reach with regard to Water Availability till number of crops in all the farmers

Land Under Reach	Water Availability till no. of crops		
	Mean	S.D	No.
Head	1.37	.57	67
Middle	1.05	.44	83
Tail	1.00	.43	77

ANOVA for Water Availability till no. of crops

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.816	2	2.908	12.654	**
Within Groups	51.479	224	.230		
Total	57.295	226			

The one way ANOVA was applied to find whether there is significant difference among land under reach with regard to Water Availability till number of crops. The ANOVA result shows that the calculated F ratio value is 35.544 which is greater than the table value of 4.701 at 1 % level of significance. Hence, the hypothesis is rejected. Since the calculated value is greater than the table value, it is inferred that there is significant difference among land under reach with regard to Water Availability till number of crops.

Ho: There is no significant difference among the type of the farmers with regard to water availability till number of crops in the non modernized system category

TYPE OF FARMERS	Water Availability till no. of crops		
	Mean	S.D	No.
Marginal	.85	.38	13
Small	1.25	.45	16
Large	2.00	.00	9

ANOVA for Water Availability till no. of crops

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.123	2	3.562	26.567	**
Within Groups	4.692	35	.134		
Total	11.816	37			

** Significant at 1% Level

The one way ANOVA was applied to find whether there is significant difference among the type of the farmers with regard to water availability till number of crops in the non modernized system category. The ANOVA result shows that the calculated F ratio value is 26.567 which is greater than the table value of 2.635 at 1 % level of significance. Hence, the hypothesis is rejected. Since the calculated value is greater than the table value, it is inferred that there is significant difference among the type of the farmers with regard to water availability till number of crops in the non modernized system category.

5. FINDINGS AND CONCLUSION

5.1. Findings

In this study, it is clearly seen that in modernized system tanks, the second crop cultivated acre percentage was higher than modernized non system tanks. It indicates modernization programme helped to cultivate more land due to better water availability and better water management

The tail end farmers often have problems in receiving water especially in years of low rainfall and poor storage. At such times, the problems of equitable distribution of water between the source and tail end farmers worsen. This can be avoided by modernizing tank with farmers participation.

Compare with system and non system tank farmers, the non system tank farmers do not get adequate water as they depend on their own catchment area. Government should initiate more modernized schemes for non system tank farmers. Socio economically poor farmers own the land in tail end areas they belong to lower caste.

In a nutshell, in modernized tanks well water level was almost stable compared with not modernized tanks. The water depleted year by year in non modernized tanks.

Majority of the modernized group of respondents (54.8 percent) had availed the irrigation facility for cultivating two crops whereas majority of the non modernized group of respondents availed water for cultivating only one crop.

In short, modernized tank farmers have got irrigation facility for two crops compared with non modernized tanks irrespective of tank systems. Farmers were not interested to cultivate third crop in system tanks even though water was available in wells.

5.2. Conclusion

Tank modernization with farmers' participation seems to be the best tool to reduce economic backwardness of tail end farmers, especially marginal and small farmers. Reviving the physical structure of tanks through modernization is a necessary conditions, but at the same time, equally finding ways to keep modernized tanks in good condition on a sustainable basis. Maintenance is the responsibility of both the government and the farmers. Every farmer tries to suck the water from the ground by deepening the well leading to acute water shortage. At the same time, they have to think how to augment water resources during the rainy season. Former Prime Minister of India, Manmohan Singh once remarked that how banks are mobilizing deposits before lending the funds. Likewise, farmers can also harvest the water before using the water.

Tank irrigation is not only concerned as a sustained option but an economic tool. Government is trying to interlink rivers but it is actually a costly affair. In this context, renovation of tanks will provide a viable solution in a equitable way. Water shortages could lend to economic backwardness, hunger and conflict. With the increased investment in water, farmers and other users can get more water

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