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A Case Study of Water Resource Utilization and Cropping Pattern in Command Area of Hariharapura Tank In Central Dry Zone of Karnataka

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Abstract :- Implication on water resource utilization and cropping pattern in the command area of Hariharapura tank in Central dry zone of Karnataka indicated that, the tail end farmers in the command area were also getting the irrigation water to take up crops and there was equitable distribution of water among all categories of water and irrespective of the distance from the sluice. The farmers could take up crops successfully and there was no bias in the share of tank water.

Key words: *Tank command area, cropping pattern, water utilization pattern.*

I. INTRODUCTION

The University of Agricultural Sciences, Bangalore had entered into an agreement to render consultancy services to implement the sub-component of the Project, the tank systems improvement - production system development in the central and eastern dry zones of Karnataka. Under the components of the consultancy services, the assignment was to conduct Participatory Technology Development through Pilot studies in eastern and central dry zones of Karnataka. In this project, one of the objective was to study the water resource utilization and cropping pattern in command areas of Eastern and Central dry zones of Karnataka

In this connection, a multi-disciplinary team of Engineers, Agricultural experts, Hydro-geologist, Social Specialists from Jala Samvardhane Yojana Sangha (JSYS), Govt. Of Karnataka and the University of Agricultural Sciences, Bangalore visited the tanks to examine the selected tanks for their consideration. After detailed observation of tanks, discussions with other partners, Hariharapura Muthurayana Kere, Pavagada taluk, Tumkur district was selected under Central Dry Zone.

For the above tank, following process was followed in collection of baseline data

- Reconnaissance survey
- Engineering/ topographic survey
- PRA exercise of TMI carried out
- Secondary sources of data – Meteorological and Hydrological data

During Engineering Survey process, the JSYS was provided all the required data to avoid duplication of survey. Accordingly, the catchment area contour map, block level survey map, feeder channels, LS/CS and tank bund L/S and C/S at regular intervals were obtained from JSYS office and used in the study.

From the Survey data, the topographic map containing the contour lines of the command area existing features like field bunds, channels, individual farmers field boundaries, open and borewells and other natural features have been prepared and supplied for the study by the consultants of survey work. Description of irrigation channels are given in Table-1.

Table-1 : Description of Irrigation Channels in Hariharapura tank

Sl. No.	*Description*	*Measurement*
1.	No. of main channel	4
	Length of main channel – 1	270.00 m
	Length of main channel – 2	1620.00 m
	Length of main channel – 3	1380.00 m
2.	RLs at beginning and end of the channel	
	Main channel – 1	97.358 & 97.030
	Main channel – 2	97.358 & 93.280
	Main channel – 3	97.358 & 93.758
3.	Slope of the main channel	1:823.17, 1:397.25, 1:383.33
4.	Sub channel	
5.	No. of Sub channel	4
6.	Slope of the sub channels 1, 2, 3, 4	1: 97.44, 1:153.32, 1:147.16, 1:71.92

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II. COMMAND AREA

Hariharapura Muthurayanakere tank had the command area of 53.25ha spread over in the eastern and southern direction of the tank. The command area farmers were in two villages namely Hariharapura and C.K.pura. Total command area surveyed by the consultant was 62.92 ha. The RL of the contour near the bund was 99.19m, at the mid reach of the command area was 91.6m, and at the tail end was 90.7m.

III. RAINFALL AND EXISTING IRRIGATION INFRASTRUCTURE

The area receives a normal annual rainfall of 494 mm with the months of September and October receiving higher rainfall (104.2 and 123.1 mm, respectively). The year 2004 received only 27 per cent of normal rainfall (131.2 mm). All the months received deficit rainfall.

IV. HISTORICAL BACKGROUND OF THE TANK

Hariharapura Muthurayanakere was built around 400 years back during Wodeayar dynasty of Mysore and it has a history of breaking twice during 1940 and 1980 and this was repaired and maintained by the villagers on community basis. It is the main source of water for domestic and livelihood activities and also for irrigation purposes in the command area. The total number of farmers in the command area is 105. The registered command area is 53.00 ha and actual area is 53.25. The entire command area has been divided into 105 plots.

V. GEOGRAPHICAL LOCATION

The tank is situated from 14º 00’ to 14º 05’ N latitude and from 77º 05’ to 27º 10’ E longitude. The tank is covered by survey of India and the concerned toposheet number is 57 K/14 on a scale of 1:50000. The Hariharapura tank is surrounded by Hariharapura boundry in the North, T.N. betta boundry in the East, command valley in the South and Hariharapura village in the west.

VI. TANK SYSTEM

It comes in North Pinakini river basin. The tank had a water spread area of 44.09 normal ha with a live storage capacity of 0.7221 MCM. The designed command was 53.0 ha.

VII. TANK FILLING STATUS

The tank did not received sufficient water during the year 2004. The water level was below sluice level during the period. The good rains in the month of May (52 mm) was not followed up by subsequent months. Due to scarcity of rains during 2004 the tank was not filled.

VIII. WATER DISTRIBUTION SYSTEM

Hariharapura muthurayanakere had a command area of 53.25 hectares. Water was supplied through only one sluice located in the right side of the tank bund. The sluice was operated by S-block type rod for opening and closing of sluice.

The command area was irrigated by two main channels which were connected to the cistern of the sluice. The left main channel was connected to the cistern by a channel along the downstream side of the bund. The whole command area was irrigated by two main chanals running along the right side slope and another along the left side slope of the command area, which led to another sub main channel to a distance of 210 m. The total length of main channel -1 was1620 m and main channel-2 was1380 m.

IX. REGULATORY SYSTEM

Earlier there was considerable wastage of water and over irrigation in the head reaches of the command area with consequent non availability of water to tail end farmers. In order to overcome this problem the neeraganti system was brought in to force.

It was the responsibility of the neeraganti to decide on seasons water allocation, water balance and seasonal operational plan i.e. When to start water delivery, when to stop or close the supplies. The neeraganti was totally empowered to regulate the distribution of tank water.

During the commencement of the cropping season, the command farmers used to sit together and finalise the time of cultural operations so that water distribution would be satisfactory for all the farmers. The key of the sluice was in charge of neeraganti and he was only the authority to operate the sluice.

X. DISTRIBUTION

During full tank, almost all the farmers grow paddy and water is allowed from one plot to another plot and there is no individual diversion of water from channel. Tail end farmers will not get sufficient water during day time, during that period neeraganti used to open sluice at night to make the water available to them.

Command area farmers were supposed to give part of the produce grown to neeraganti. The Hariharapura neeragnti was paid 20-50kg of paddy/ragi grains per one acre of land. This system was followed only in food crops and not for commercial crops like sunflower etc.

XI. COMMAND AREA BOREWELLS

There were 10 borewells in the command area. Out of which nine are running and one has dried up. The total area irrigated by the borewells in the command was 13.10 ha. The first borewell in the command was drilled in the year 1992 and was re-bored in 2004. The most recent borewell drilled in the command was in 2004. The depths of borewells vary from

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317 feet to 512 feet. The pump capacities of borewell vary from 5-10Hp. The average water yields of borewells varied from 1.3 lps to 5.92 lps.

The water yield of command area borewells was studied from 2004 to 2008. The rate of discharge fluctuated among the months. The average discharge per borewell was highest in the month of December 2005 (4.37 lps). It was lowest in the month of March 2005 1.56 lps). The discharge fluctuated alternatively among the months from January to December 2004.

XII. COMMAND AREA OPEN WELLS

There were 30 open wells in the command. All were dried and one had been closed. None of the wells were contributing to the irrigation requirement of the crops in the command. The earliest well in the command was constructed about 150 years back (1840 AD) with a dimension of 45 feet radius and 40 feet depth which was circular in shape. The most recent one was constructed in the year 1985 with a dimension of 26 feet length, 22 ft. breadth and 45 ft. depth; which was a square type.

XIII. CATCHMENT AREA BOREWELLS AND OPEN WELLS

In the tank catchment, there were 21 borewells with the depth varied from 294 feet to 600 feet. Most number of borewells in a year were dug in 1997 (6 nos.) and 2003 (5 nos.). The discharge varied from 0.45 lps to 3.75 lps. Five open wells situated in the tank catchment have dried

XIV. CONJUNCTIVE WATER USE

During recent past Hariharapura tank had not received sufficient rains. The farmers usually go for cropping in the command in the month of August. During the study, a model water utilization plan was prepared for effective utilization of rain, tank water and ground water. The water use plan was based on the data collected during the study year.

XV. METHOD OF IRRIGATION

The farmers in the command followed flooding for all the crops. However in case of flowers and vegetable they made check basins. In paddy, the farmers irrigated either daily or on alternate days. The depth of standing water in paddy fields varied from 5–10 cm. Six to sixteen irrigations were common for field crops like ragi, sunflower and groundnut. For chrysanthamum, farmers went up to 30 irrigations per crop.

XVI. CROPPING PATTERN

The cropping pattern in the command was studied for three years (1997-98, 2000-01 and 2003-04). The years of study were selected to give the due representation to half tank, full tank and rainfed situation.

The major cropping season in the command is late kharif when ever there was water in the tank. In the year 1997-98 in which the tank was half full, ragi was cultivated in an area of 25.79 ha in late kharif. The major crop in kharif was groundnut (5.74 ha). During the year 2000-01, in which the tank was full, 83 per cent of the command was occupied by transplanted paddy (44.67 ha). In summer, ragi was the major crop (10.91 ha).

In the years of non tank filling, kharif was the major season (2003-04). Ragi occupied area to an extent of 45 per cent in such years (24.04 ha) followed by commercial crop such as sunflower (6.98 ha).

The cropping intensity was 90.4 per cent for 1997-98, 125.6 per cent for 2000-01 and 103.6 per cent for 2003-04 (Table-2). The crops and cropping pattern of the command area is given in Table-3.

XVII. WATER USE EFFICIENCY

Water use efficiency was estimated for the crops grown in the command in kharif 2004. The source of water for the crops was rainfall and ground water (borewells). Seventy per cent of rainfall for the crop growth period was considered as effective rainfall. The total water used for raising crops in the season was 3559.36 ha–cm^{-1}. The contribution by ground water source was 53 per cent and remaining 47 per cent was contributed by rainfall. Seventy three per cent of ground water was consumed by transplanted paddy (1524.35 ha–cm^{-1}) and sixteen per cent by sunflower (324.9 ha–cm^{-1}).

Water use efficiency was in the order of 30.30 kg ha–cm for paddy, 22.38 kg ha–cm for ragi, 14.40 kg ha–cm for groundnut and 13.8 kg ha–cm for sunflower. Among flower crops marigold recorded WUE of 94.0 kg/ha–cm cm and chrysanthamum recorded 122.0 kg ha–cm (Table-3).

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Table-4 : Water use efficiency of the crops grown in kharif 2004

Crops	*Area (ha)*	*Water used(ha-cm)*			*Yield (q)*	*WUE (Kg/ ha-cm)*
		Effective rainfall (ha-cm)	*Alternative source (ha-cm)*	*Total water used (ha-cm)*		
Ragi	15.89	607.07	120.7	727.77	22.38	48.86
Sunflower	12.73	543.35	324.9	868.25	13.80	20.23
Paddy	7.84	308.85	1524.35	1533.2	30.30	15.49
Groundnut	4.84	209.89	15.4	225.29	14.40	30.94
Arecanut	1.21	60.95	-	60.95	9.50	18.86
Chrysanthamum	0.5	36.97	71	45.7	122.50	134.03
Marigold	0.5	21.35	12.50	33.85	94.00	138.85
Mulberry	0.5	17.85	17	34.85	475.00	681.49
Jowar	0.48	20.50	-	29.5	421.00	685.02
Total	44.49	1826.78	1871.27	3559.36		

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Table- 2 : Cropping pattern and cropping intensity in the command

Total command area : 53.8 ha *Area in ha*

Crops	*1997- 98*			*2000 - 01*			*2003 - 04*		
	Kharif	*Late kharif*	*Summer*	*Kharif*	*Late kharif*	*Summer*	*Kharif*	*Late kharif*	*Summer*
Paddy		2.52		-	44..67	-	2.32		
Ragi	1.68	25.79		-	0.44	10.91	24.04	2.66	1.72
Jowar							1.1		
Ground nut	5.74	1.2	0.4	-	1	-	1.04	1.18	1.92
Sunflower	0.2	3.02					6.98	2.84	1.34
Chrysanthamum	0.1								
Watermelon							0.24		
Mulberry	2.26	2.26	2.26	1.86	2.26	2.26	1.4	1.4	1.4
Arecanut	0.4	0.4	0.4	1.39	1.39	1.39	1.39	1.39	1.39
Total	**10.38**	**35.19**	**3.06**	**3.25**	**5.09**	**14.56**	**38.51**	**9.47**	**7.77**
CI (%)			**90.39**			**42.57**			**103.62**

Table-3:- Crops and cropping pattern in Hariharapura tank command area

Total command area = 53.25ha

Crop	*Kharif*						*Rabi/ summer*						*Perennial*					
	Only from tank water			*Conjunctive water use*			*Only from tank water*			*Conjunctive water use*			*Only from tank water*			*Conjunctive water use*		
	Area (ha)	*%*	*Average Yield (q/ha)*	*Area (ha)*	*%*	*Average Yield (q/ha)*	*Area (ha)*	*%*	*Average Yield (q/ha)*	*Area (ha)*	*%*	*Average Yield (q/ha)*	*Area (ha)*	*%*	*Average Yield (q/ha)*	*Area (ha)*	*%*	*Average Yield (q/ha)*
Paddy	24.03	45.13	45.34	1.47	2.76	45	-	-	-	1.97	3.70	37.5	-	-	-	-	-	-
Paddy/ Ragi	18.11	34.01	41.80/18.34	-	-	-	-	-	-	0.5	0.94	37.5/15	-	-	-	-	-	-
Groundnut	-	-	-	0.47	0.88	15	-	-	-	0.7	1.31	13.5	-	-	-	-	-	-
Ragi/ Groundnut	2.62	4.92	19.9/14.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sunflower	1.35	2.54	15.75	0.45	0.85	12.5	-	-	-	1.8	3.38	13.8	-	-	-	-	-	-
Vegetables	-	-	-	1.39	2.61	230	-	-	-	2.5	4.69	253.75	-	-	-	-	-	-
Areca nut	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	1.88	200
Mulberry	-	-	-	-	-	-	-	-	-	-	-	-	0.56	1.05	250	1.8	3.38	275
Total	**46.11**			**3.78**						**7.47**			**0.56**			**2.8**		