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Research Article

PERSPECTIVES OF THE STAKEHOLDERS FOR IMPROVING WATER PRODUCTIVITY IN CANAL COMMAND AREAS OF KARNATAKA

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Abstract: Water productivity is the amount of water depleted and can be assessed for crops, trees, livestock and fish. The farmers in the selected command areas play an important role in water management and enhancing water productivity. Hence, the perceptions of the farmers in the command areas of Upper Krishna Project, Bhadra and Cauvery basin project regarding enhancing water productivity were documented by collecting primary data from 135 selected farmers and 15 officials involved in irrigation water management. Among the different opinions of the farmers, in-time release of water ranked first, continuous supply of electricity ranked second, cement lining of Field Irrigation Channels to avoid water loses ranked third, need of capacity building programmes regarding efficient water management ranked fourth and good co-operation from the staff ranked fifth. The perceptions documented from the CADA and Irrigation department officers were, installation of water meters at farm gates ranked first, preventing over utilization of water by head region farmers ranked second, collection of water charges on the basis of quantity utilized by the farmers ranked third, proper lining of the FICs to ensure natural flow of water ranked fourth and adequate release of funds from the government for repairs of canal system ranked fifth. The expressed opinions are seems to be very important in increasing the water productivity not only in selected command areas but also in all the command areas of the state and while designing the new irrigation projects in future. Based on the opinion survey it was concluded that timely release of water, adoption of micro irrigation system and collection of water charges based on the quantity of water used by the farmers will enhances the water productivity in the study area.

Keywords: *Perceptions, Water productivity, Command area*

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Introduction

Water is an important natural resource available for mankind. It is an essential content in every part of life on this earth. Everything is originating from water and everything is sustained by it. "Water, as said by the eminent Greek philosopher Pindar "is the best of all things". With every passing time, importance of water is becoming evident in many parts of the world. Though water is the most copiously available resource on this planet, yet it is fast becoming scarce for human use. Of the total water resource on the earth, 97.4 percent is salt water, 1.8 percent is in frozen form and only 0.8 percent is the fresh water, which sustains life and the environment. As water resources around the world are threatened by scarcity, degradation and overuse and food demands are projected to increase, it is important to improve our ability to produce food with less water. There is a need for optimum utilization of earth's water resources to meet the growing food demands through the expansion of irrigated lands; increasing production per unit of water and changes in consumption practices. Land expansion is no longer a viable solution. Therefore, improving agricultural productivity on existing lands using the same amount of water is essential. Increasing water productivity means using less water to complete a particular task, or using the same amount of water, but producing more which is associated with improved food security and livelihood. Karnataka is the eighth largest state with total geographical area of 190.50 lakh ha which constitutes 5.83 percent of total geographical area of the country. Agriculture being the main occupation of the state, irrigation plays significant part in obtaining increased yields from the land. The total water availability in the state is 41.81 BCM which includes surface and subsurface water resources [1-4].

But the overall water demand of all the sectors works out to be 70.1 BCM and will increase to 80.17 BCM by 2020. Thus, the overall water balance of the state indicates a negative balance of 28.29 BCM and which is expected to rise up to38.36 BCM by 2020. From various past studies, it is learnt that, the farmers from head region of the canal are receiving more irrigation water than middle and tail region farmers due to positional advantage. In addition to this, the supply of canal water is not regular. Therefore, farmers in the command area are using tube well water for irrigating the crops as and when canal water is not available. Further, due to the effect of frequent drought, failure of monsoon and wastage of water at upper reaches of the command area managing the water in canal commands has become a difficult task and at the same time necessitates the need for regular monitoring of water supply, enhancing crop productivity and adaption of suitable cropping pattern to improve the crop productivity. Hence, the study on 'Perspectives of the stakeholders for improving water productivity in Canal Command areas of Karnataka state' was undertaken with an objective to document the opinion of stakeholders for enhancing water productivity in selected canal command areas of the Karnataka state.

Material and methods

There are seven major irrigation projects in Karnataka state *viz*, Upper Krishna project (UKP), Malaprabha and Ghataprabha project, Tungabhadra project, Cauvery basin project, Bhadra reservoir project. Multi-stage sampling design was adopted to study the opinions of the stakeholders regarding ways to increase the water productivity in the state.

In first stage out of seven irrigation projects in the state, three projects *viz*, UKP from North region, Bhadra from middle region and Cauvery from the South region of the state were selected purposively. In second stage, left bank canals (LBC) of three projects were selected, since length of the LBC in each project is more than the length of Right Bank Canal and every selected canal was divided into three regions *viz*., head, middle and tail regions. In the final stage of sampling, 15 farmers from each region, 5 farmers using only canal water, 5 farmers using only bore well water and 5 farmers using both the sources for irrigation purpose were selected to compare the productivity of canal water and tube well water. Thus, from each selected LBC, 45 farmers were selected purposively. In addition, the perception of the officials of CADA and irrigation department was also documented by selecting 5 officials from each selected command area. Thus, the total sample investigated for the study was 135 farmer respondents and 15 officials working in different capacities. Simple statistical tools like averages and percentages were used to analyse the general information of the selected farmers and Garrett ranking technique was used to analyse the perceptions of the farmers and officers in enhancing the water productivity. Garrett's ranking technique gives the change of orders of perceptions into numerical scores. The major advantage of this technique over simple frequency distribution is that, perceptions are arranged based on their importance from the point of view of respondents [5-8]. Accordingly, these ranks were converted into scores by referring Garrett's table. Garrett's formula for converting ranks into percent is given as

Percent position $=100*(R_{ij}-0.50) / N_j$

Where,

R_{ij} = Rank given for i^{th} item j^{th} canal region

N_j = Number of items ranked in j^{th} canal region

Result and Discussion

Socio-economic characteristics of the sample farmers

Socio-economic characteristics of the sample farmers were analyzed with the help of simple statistical tools and are presented in [Table-1]. Age and experience in farming are the important factors which affects the decision-making ability and efficiency in farming. It is revealed from the table that average age of the sample farmers in Upper Krishna Project command area was 47 years, in Bhadra Reservoir Project command area was 46 years and in Cauvery Basin Project command area was 44 years which indicated that in all the command areas middle age group farmers were involved in farming business. It was also revealed that sample farmers were having sufficient experience in the farming business which another important factor affects the decision-making ability. Education plays an important role to stay aware of fast-moving developments in science, technology, business management that affect agricultural operations. With respect to education it was observed that in UKP command area 15.55 percent farmers were illiterate and 84.44 percent were literate. In BRP command area 20 percent farmers were illiterate and 80 percent were literate and in CBP command area 11.11 percent farmers were illiterate while 88.88 percent were literate. In the study area it was found that 15.55 percent of farmers were illiterate, 84.44 percent were literate. It is concluded from the table that the literacy percentage in the selected command areas was high; therefore, farmers are aware about enhancing the productivity of all the resources in general and water in particular. With respect to the occupation of sample respondents in the selected command areas, it was found that at overall level 97.7 percent of the farmers had agriculture as a primary occupation and only 2.2 percent farmers had agriculture as a secondary occupation. Therefore, agriculture was the main source of income in the study area. The income of the sample respondents was ranged between Rs.143727 per year in UKP command area to Rs.198421 in CBP command area. At overall level income of the sample respondents was Rs.178193 per year. Family size is also one of the factors affecting marketed surplus of different crops thereby affects the income of the farmer. Family size also determines the availability of labour in farming and thereby reduces the direct cost involved in the farming. It was observed that the average family size in the study area was 5.53 members per family. While it was 6.3 in UKP command area 4.6 in CBP command area. The average size of land holding in the selected command areas was 7.35 acres, 5.20 acres and 3.37 acres in UKP, BRP and CBP respectively. At overall level land holding was 5.30 acres. According to standard classification norms, in UKP and BRP command areas the selected farmers belong to medium farmer's class while farmers in CBP command area belonged to small farmers.

Perception of farmers regarding enhancing water productivity

With regards to perception of farmers in enhancing water productivity in the study area, the farmer's opinion was elicited. Some of the common perceptions are presented in [Table-2]. Among different perceptions, in time release of water and proper repairs of canals was ranked first with a score of 68. This is because of the fact that farmers in the study area were facing the problem of irregular supply of canal water. The canal water was released continuously during rainy season when farmers demand for canal water is less. Further, canal water was released with a large gap in summer season when water demand from farmer's side was high. This situation resulted in losing the entire crops and harvesting fewer yields. Therefore, in time release of canal water is the top most factors affecting the water productivity in the command area. Similarly, the perception, continuous supply of electricity ranked second with the score of 62 and percentage of 26.39. Farmers opined that due to irregular supply of electricity, they were unable to lift the water as and when required, which also affected the productivity of the crop and ultimately the productivity of irrigation water. The Field Irrigation Channel's in the command area were broken to the high extent and too much canal water was wasted. As a result, the tail region farmers were not received sufficient quantity of irrigation water. Hence, the perception, cement lining of FIC's was ranked third with a mean score of 57. Farmers in the command area had little knowledge regarding efficient management of irrigation water and hence they opined that Irrigation department should organize frequent training programmes about water management. Hence, this perception was ranked fourth with score of 52 and percentage of 44.72. Good co-operation, proper co-ordination and communication between government officials and farmers will enhance the water productivity in canal command areas. Hence, this perception ranked fifth by the farmers with a score of 47. The area under micro–irrigation in the command area was meager. Majority of the farmers were using conventional method of irrigation which resulted in wastage of water to the great extent, which in turn affected the productivity of water. Therefore, the perception, use of micro-irrigation system ranked sixth with a score of 45. The perception, installation of water meters at the field gates ranked seventh with a Garrett score of 44, because to increase the crop productivity and also water productivity it is essential to irrigate the crops with appropriate quantity of water. It would also avoid the excess use of water and thereby maintains the soil health. When farmers in the command area follow the recommended cropping pattern, the productivity of all the resources used would be increased. It would also direct the farmers towards the optimum utilization of the resources and checks excess utilization. The excess utilization of the resources increases the cost in farming. Thus, perception, following the recommended cropping pattern ranked ninth with a score of 42. Formation of Water Users Associations and its proper functioning for efficient water management ranked tenth and eleventh with a score of 41 and 40 respectively.

Perception of the officers regarding enhancing water productivity

Documentation of the farmer's perceptions regarding enhancing water productivity was one side of the study but another side perception of officers of irrigation department was documented and their opinion regarding enhancing water productivity in canal commands was also studied. The same has been presented in [Table-3]. Among the different opinions of the officials, installation of water meter at farm gates ranked first with a score of 61. Officers were realized that farmers were using the canal water without studying the water requirement of the different crops they grown which adversely affected the crop productivity and soil health. Similarly, the farmers in the head region of the canal used more amount of water and the tail region farmers received less water. It was the positional advantage to the head region farmers and positional disadvantage to the tail region farmers. But, in both the situations water productivity was affected severely. Therefore, the perception, preventing over utilization of water by head region farmers ranked second with a mean score of 59. The perception, collection of water charges on quantitative basis ranked third with a score of 57.

Table-1 *Socio-economic characters of the sample farmers*

SN	Particulars	ALBC (UKP)	LBC (BRP)	VC (CBP)	Overall
	Number of respondents (N)	45	45	45	135
1	Age (Years)	47	46	44	45.67
2	Education (No.)				
	i. Illiterate	7 (15.55)	9 (20.00)	5 (11.11)	7 (15.55)
	ii. Literate	38 (84.44)	36 (80.00)	40 (88.88)	38 (84.44)
3	Occupation (No.)				
	i. Agriculture	44 (97.77)	43 (95.55)	45 (100.0)	44 (97.77)
	ii. Non agriculture	1 (2.22)	2 (4.44)	0 (0.00)	1 (2.22)
4	Income (Rs.)	1,43,727	1,92,432	1,98,421	1,78,193
5	Family size (No.)	6.3	5.7	4.6	5.53
6	Size of Land holding (Acre)	7.35	5.20	3.37	5.30

(Figures in parentheses indicate percent to respective total); ALBC (UKP) – Almatti Left Bank Canal (Upper Krishna Project)
LBC (BRP) – Left Bank Canal (Bhadra Reservoir Project); VC (CBP) – Visvesvaraya Left Bank Canal (Cauvery Basin Project)

Table-2 *Perception of farmers regarding enhancing water productivity*

SN	Perception	Percentage	Garratt Score	Rank
1	In time release of water and proper repair of canals	18.23	68	I
2	Continuous supply of electricity	26.39	62	II
3	Cement lining of FICs to avoid water losses	35.92	57	III
4	Capacity building programmes for the farmers regarding efficient water management	44.72	52	IV
5	Good cooperation from the staff/ officials	55.03	47	V
6	Using micro irrigation (Sprinkler and Drip) system	59.17	45	VI
7	Installation of water meters at the field gates	62.45	44	VII
8	Collection of water charges on a quantitative basis	63.18	43	VIII
9	Following the recommended cropping pattern	66.79	42	IX
10	Formation of Water User Associations (WUA) for water management	68.37	41	X
11	Proper functioning of WUCs to ensure efficient irrigation management	70.09	40	XI

Table-3 *Perception of officers regarding enhancing water productivity*

SN	Perception	Percentage	Garrett Score	Rank
1	Installation of water meters at farm gates	27.87	61	I
2	Preventing over utilization of water by Head region farmers	31.93	59	II
3	Collection of water charges on quantitative basis	35.93	57	III
4	Proper lining of FICs to ensure natural flow	41.33	54	IV
5	Adequate release of funds for canal repairs	46.97	51	V
6	Encouraging farmers to use micro irrigation (Sprinkler and Drip) system	53.61	49	VI
7	Good cooperation from farmers	53.83	48	VII
8	Continuous supply of electricity	60.73	45	VIII
9	Training and capacity building to farmers and officials	61.56	44	IX
10	Limited Staff available for timely inspection and supervision of canal sites	64.87	42	X

In this regard officers opined that, if the appropriate charges were collected based on the quantity of water utilized by the farmers, it would be a check to the head region farmers who were utilizing water in excess and hence sufficient water would be available for tail region farmers. In addition, sufficient funds would be generated for the repairs and maintenance of canal irrigation system.

Due to non-availability of funds at proper time, proper lining of FIC's or maintenance of canal system becomes difficult. Therefore, the perception, proper lining of FIC's to ensure natural flow of water ranked fourth with a score of 54. In addition, adequate release of funds for canal repairs ranked fifth with a score of 51. To avoid excess utilization and wastage of canal water, farmers should be encouraged to use micro irrigation systems and this perception was ranked sixth with a score of 49 by the officers. Similarly, the perception regarding co-operation from the farmer's side ranked seventh with a score of 48. Use of water as and when available, continuous supply of electricity should be available in the command areas and this perception was ranked eighth with a score of 45. Training and capacity building programmes for farmers and officials ranked ninth with a score of 44. In all, the officials opined that due to limited staff in the offices of the command areas, timely inspection and supervision of canal sites become difficult. Hence, sufficient staff should be appointed by government for proper and in time inspection and supervision of the command areas and this perception ranked tenth position with a score of 42.

Conclusion

Water is an important natural resource available for mankind and agriculture sector is the biggest user of available water resource in developing countries. But water resources around the world are threatened by overexploitation and scarcity, therefore it is important to use the available water resource at its optimal. The farmers in the study area were middle aged with high percentage of literacy and experience. Hence, to increase the water productivity in command areas whatever opinions expressed by the farmers and the officials are very important. These perceptions need to be taken into account by policy makers in enhancing the water productivity not only in command areas but also while designing the new irrigation projects in future. Based on opinion survey of farmers in three canal command areas and the officials of irrigation department, following policy implications were drawn. To enhance the water productivity in the study area,

1. Timely release of canal water at critical stages of crop growth.
2. Encouraging the farmers to adopt micro irrigation systems.
3. Pricing the canal water based on the quantity of water used by the farmers.

Application of research: This study helps in analyzing the perceptions of the stakeholders in enhancing the water productivity in canal command areas of Karnataka. The results can be used for policy regarding the productive use of water in command areas and pricing of canal water based on the quantitative basis.

Research Category: Agriculture Economics.

Abbreviations:

CADA: Command Area Development Authority
FICs: Field Irrigation Channels, BCM: Billion Cubic Meter
UKP: Upper Krishna project, LBC: Left Bank Canal
BRP: Bhadra Reservoir Project, CBP: Cauvery Basin Project

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