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Veeresh S Wali
Ph.D., Scholar, Department of Agricultural Economics, OUAT, Bhubaneswar, Odisha, India

Rajendra Poddar
Director Water and Land Management Institute WALMI Dharwad, Karnataka, India

SM Mundinamani
Professor, Agriculture Economics, Department of Agricultural Economics, UAS Dharwad, Karnataka, India

BS Yenagi
Agronomist, AICRP Oilseeds, UAS Dharwad, Karnataka, India

Correspondence
Veeresh S Wali
PhD Scholar, Department of Agricultural Economics, OUAT, Bhubaneswar, Odisha, India

Enhancing the water productivity in upper Krishna project (UKP) and Malaprabha Ghataprabha project (MGP) command areas: A probe into the stakeholders' perspective

Veeresh S Wali, Rajendra Poddar, SM Mundinamani and BS Yenagi

Abstract
The farmers in the command areas play a vital role in water management in the command areas. The system of water distribution, cropping pattern and quantity of water allocated depends on the farmers living in the region. The opinion of all the stakeholders assumes a prime importance in deciding the policies at macro levels. Stakeholders in agriculture and water issues have different perceptions about productivity of water. Both primary and secondary data were used for the study. The secondary data on area coverage of different crops grown in both the project command areas was obtained from the Agriculture Offices of the project zones. Primary data was collected from 120 respondents from head and tail regions of Almatti Left Bank Canal (ALBC), Indi Branch Canal (IBC), Malaprabha Left Bank Canal (MLBC) and Ghataprabha Right Bank Canal of both Upper Krishna Project (UKP) and Malaprabha Ghataprabha Project (MGP) command areas. The perceptions of stakeholders was documented by collecting the perceptions from both farmers and officers/staff of the Command Area Development Authority (CADA) and Irrigation Departments (ID).The socio-economic characteristics were analyzed using the simple tabular analysis. The perceptions of the farmers and staff of different offices of Irrigation department and CADA are documented. They were analyzed using Garrette ranking method. It was observed that the farmers are of the opinion for formation of Water Users' Association (WUAs) in the command areas should be encouraged and attention needs to be given to strengthen Participatory Irrigation Management (PIM) to ensure efficient water management in command areas.

Keywords: Perceptions, water productivity, command areas

Introduction
The farmers in the command areas play a vital role in water management in the command areas. The system of water distribution, cropping pattern and quantity of water allocated depends on the farmers living in the region. The opinion of all the stakeholders assumes a prime importance in deciding the policies at macro levels. Stakeholders in agriculture and water issues have different perceptions about productivity of water. Generally, productivity of water entails the net socioeconomic and environmental benefits achieved through the use of water in a production activity, including agriculture, fisheries, livestock, crops, agroforestry and mixed systems. Farmers consider water as an important input in agricultural production. Nevertheless, they do not express the water use as quantities or volumes, but instead they rather use relative expressions. In rainfed agriculture farmers estimate the amount of water that is available for the season by expressing the season as good, normal or bad. It is evident that there is a very strong link between the farmers' conceptual understanding of water productivity with their actions in order to achieve higher water productivity. Farmers value water very much because they know that crop yield is related to water, all other things being equal. They will, therefore, do anything including 'fighting and stealing water' if the need be, to get access to it. They are willing to pay more for a plot of farmland if it is close to a water source that they can easily divert to irrigate their fields, or if the field is upstream of an irrigation scheme where they have the advantage of a better service of water delivery. Generally, productivity of water entails the net socioeconomic and environmental benefits achieved through the use of water in a production activity, including agriculture, fisheries, livestock, crops, agroforestry and mixed systems. The productivity analysis can be done at different scales; the crop or animal, a field or farm, an irrigation system, a basin or landscape with interacting ecosystems. The concept drives at producing products and services using less water. The water use may be accounted as depleted or diverted. Water depleted can either be through crop evapotranspiration, incorporated into a product, rendered unavailable or unusable, for example, by being heavily polluted (Molden 1997) [3].

The diverted water can give more social and economic water productivity if it can serve multiple uses such as drinking water, industries, fisheries and livestock. The stakeholders (Farmers and people associated with irrigation and other line departments of agriculture) in general have a greater role to enhance the water productivity in the command areas. This study is an attempt to document the perceptions of stake holders in enhancing water productivity in Upper Krishna Project (UKP) and Malaprabha Ghataprabha Project (MGP) command areas.

Materials and Methods

Both primary and secondary data were used for the study. The secondary data on area coverage of different crops grown in both the project command areas was obtained from the Agriculture Offices of the project zones. Primary data was collected from 120 respondents from head and tail regions of Almatti Left Bank Canal (ALBC), Indi Branch Canal (IBC), Malaprabha Left Bank Canal (MLBC) and Ghataprabha Right Bank Canal of both Upper Krishna Project (UKP) and Malaprabha Ghataprabha Project (MGP) command areas. The perceptions of stakeholders was documented by collecting the perceptions from both farmers and officers/staff of the Command Area Development Authority (CADA) and Irrigation Departments (ID).

The socio-economic characteristics were analyzed using the simple tabular analysis. The perceptions of the farmers and staff of different offices of Irrigation department and CADA are documented. They are analyzed using Garrette ranking method.

This technique was used to evaluate the problems encountered in sugarcane cultivation and marketing. In this method, the farmers were asked to rank the given problem according to the magnitude of the problem. The orders of merit given by respondents were converted into ranks by using the following formula.

$$\text{Percentage Position} = \frac{100\ (Rij - 0.5)}{Nj}$$

Where,

R_{ij}= Rank given for i^{th} item by j^{th} individual

N_j= Number of items ranked by j^{th} individual

The percentage position of each rank thus obtained was converted into scores by referring to the table given by Garrett. Then for each factor the scores of individual respondents were added together and divided by total number of respondents for whom the scores were added. These mean scores of all the factors were arranged in the order of their ranks and inferences were drawn

General characteristics of the sample farmers in the study area

A review of the results presented in Table 1 indicates that, in ALBC command area the average age of the sample respondents was 45.63 years, whereas the average age of the farmers in IBC command area was 44.40 years. The farmers in MLBC and GRBC command area are of 50.0 and 52.70 years respectively. The overall average age of the farmers in the command area was 48.15 years. The possible reason for this might me that younger population in the command area are out of farming profession therefore the middle and old aged people were engaged in agriculture.

The average family members in ALBC and IBC command areas were 4.46 and 4.63 persons respectively with an average of 85.87 per cent of them working on farm and 14.13 per cent of them working off farm in ALBC command area. In case of IBC command area it was 84.23 per cent and 15.77 per cent of the farmers working on and off farm, respectively.

The average family members in MLBC and GRBC command areas were 4.46 and 4.63 persons respectively with an average of 85.10 per cent of them working on farm and 14.90 per cent of them working off farm in MLBC command area. In case of GRBC command area it was 84.85 per cent and 15.15 per cent of the farmers working on and off farm, respectively.

Average family size of the respondents was 4.49 members per family amongst which 3.82 members were working on farm and the remaining of 00.67 members in the family were working off farm. This might be due to the fact that all the command areas being well irrigated and involved many agricultural operations throughout the year, most of the family members (85.30%) worked on farm and lesser (14.70 per cent) worked off farm.

Canal wise extent of irrigation in the command area

Table 2 presents the canal wise area under dry farming and irrigation. On an average the cultivated area of farmer respondents was 3.73 ha across the canals in the different command areas. The percentage of irrigated area was about 92 per cent while the dry land was about 8 per cent.

Among the different canals, the percentage of area under irrigation was more under ALBC (97.3 per cent) followed by MLBC (94.25 per cent), GRBC (92.5 per cent) and IBC (82.82 per cent).

It was found that nearly 92 per cent of the area was irrigated and the remaining area remained as dry land. ALBC was found to have highest area under irrigation which is mainly due to the presence of dam (Almatti dam) near the villages under the canal. In case of IBC the area under irrigation was comparatively less due to the reason that the canal has not been completely constructed and the distribution network in the area was not working in full condition. On an average, MLBC and GRBC have a greater area under irrigation. This might be due to the fact that these two canals are quiet old and matured canals in the Malaprabha and Ghataprabha project command areas.

Canal wise source of irrigation in the study area

Table 3 depicts the different sources of irrigation under different canals. Of the total irrigated area, on an average 61 per cent of land across all canals was under canal irrigation while 28 per cent of land was under open wells and only 11 per cent was irrigated from bore wells. Across the canals, the area irrigated by canals was more under MLBC (75.4 per cent) followed by ALBC (71.38 per cent), GRBC (59.22 per cent) and IBC (34.96 per cent). About 51 per cent area of IBC irrigated area was covered by open wells. The percentage of area covered by the bore wells was highest under ALBC (19.60 per cent0 followed by IBC (14.21per cent).

Command area wise sources of irrigation are presented in Table 4. It was found that ALBC had nearly 72 per cent of area under canal irrigation and about 20 per cent area under bore well. This is due to the presence of dam near to the villages and presence of adequate quantity of ground water resources in the region. IBC had about 51 per cent of area under open wells while about 35 per cent of area was under canals. The major source of irrigation was open well in the command area. This might be due to fact that IBC command

area has good number of traditional water harvesting and storage structures. Another important reason is that the canal has not been completely working and therefore adequate water has not been released from the canal to the villages in the command area.

MLBC (75.40%) and GRBC (59.27%) have a significant share of canals irrigation in the command area. This is due to the fact that these canals are quiet old and matured and therefore working efficiently. The agro climatic conditions in these command areas are favorable to good rainfall and hence the water is available in adequate quantities in these command areas.

Opinions of the farmers in ALBC command area

An insight into Table 4 shows the case of farmers of ALBC command area, it is observed that formation of Water Users' Association (WUA) for water management was ranked I which recorded a mean score of 70 followed by proper functioning of WUCs to ensure efficient irrigation management which was ranked II with a mean score of 58. Good cooperation from the staff / officials was ranked III with a mean score of 54. Changing the localization pattern and adoption of cultivation of light irrigated crops and installation of water meters at the field gates were ranked IV with a mean score of 49. Timely release of water from the canal was ranked V with a mean score of 46. Adequate release of water and proper repair of canals and cement lining of FICs to avoid water losses was ranked VI with a mean score of 42. Collection of water charges on a quantitative basis was ranked VII with a mean score of 41.

Opinions of the farmers in IBC command area

Table 5 depicts the opinions of farmers of IBC command area, it is observed that formation of Water Users' Association (WUA) for water management was ranked I which recorded a mean score of 71 followed by proper functioning of WUCs to ensure efficient irrigation management which was ranked II with a mean score of 58. Good cooperation from the staff / officials was ranked III with a mean score of 54. Changing the localization pattern and adoption of cultivation of light irrigated crops were ranked IV with a mean score of 50. Installation of water meters at the field gates was ranked V with a mean score of 49. Timely release of water from the canal was ranked VI with a mean score of 42. Adequate release of water and proper repair of canals was ranked VII with a mean score of 43.Cement lining of FICs to avoid water losses was ranked VIII with a mean score of 42. Collection of water charges on a quantitative basis was ranked IX with a mean score of 41.

Opinions of the farmers in MLBC command area

The opinions of farmers of MLBC command area can be seen from Table 6, it is observed that proper functioning of WUCs to ensure efficient irrigation management was ranked I which recorded a mean score of 71 followed by formation of Water Users' Association (WUA) for water management which was ranked II with a mean score of 60. Good cooperation from the staff / officials was ranked III with a mean score of 58. Changing the localization pattern and adoption of cultivation of light irrigated crops was ranked IV with a mean score of 50. Timely release of water from the canal and installation of water meters at the field gates were ranked V with a mean score of 46. Adequate release of water and proper repair of canals was ranked VI with a mean score of 43. Cement lining of FICs to avoid water losses and collection of water charges on a quantitative basis were ranked VII with a mean score of 42.

Opinions of the farmers in GRBC command area

Table 7 reveals the opinions of farmers of GRBC command area, it is observed that formation of Water Users' Association (WUA) for water management was ranked I which recorded a mean score of 70 followed by good cooperation from the staff / officials which was ranked II with a mean score of 60. Proper functioning of WUCs to ensure efficient irrigation management was ranked III with a mean score of 58. Changing the localization pattern and adoption of cultivation of light irrigated crops was ranked IV with a mean score of 50. Timely release of water from the canal and installation of water meters at the field gates were ranked V with a mean score of 46. Adequate release of water and proper repair of canals was ranked VI with a mean score of 43.Cement lining of FICs to avoid water losses and collection of water charges on a quantitative basis were ranked VII with a mean score of 41. Analysis of the results shows that farmers in the command areas were of the opinion that formation of WUAs for irrigation management will enhance the water productivity. This was mainly due to the disparity between Head and the Tail region farmers regarding share of canal water. The formation of WUAs will lead to uniform, efficient and timely distribution of water to the fields. Collection of water on quantitative basis and good cooperation from the officials and staff of the departments and CADA was expected by the farmers. Installation of water meters at the field gates was suggested by the farmers which will result in scientific quantification of the water in the command areas.

Opinions of officials/ staff of Irrigation Department and CADA

Table 8 represents the results of perceptions of officials of staff of Irrigation department and CADA. Adequate releases of funds for canal repairs and training and capacity building to farmers were ranked I with a mean score of 57. Scientific quantification of water at the field level was ranked II with a mean score of 51. Timely inspection and supervision of the canal sites was ranked III with a mean score of 46. Good cooperation from the officials / staff was ranked IV with a mean score of 45. Installation of water meters at the field gates was ranked V with a mean score of 41 and proper lining of FICs to ensure the natural flow was ranked VI with a mean score of 19. The study indicated the opinions of officials and other staff of irrigation departments (ID) and Command Area Development Authority (CADA). Adequate release of funds and effective training and capacity building for farmers to enhance water productivity was expressed by them.This is mainly due to inadequate release of funds for canal development works and lack of training and capacity building to farmers and officers.. The findings of the study were similar to those obtained by Chandran and Chackacherry (2004) [2] in Kerala and Cutforth *et al* (2001) [1] and thus the hypothesis of the study was accepted.

Table 1: General characteristics of the sample respondents (n=120)

Canal	Age	Family members	On farm	%	Off farm	%
ALBC	45.63	4.46	3.83	85.87	0.63	14.13
IBC	44.4	4.63	3.9	84.23	0.73	15.77
MLBC	50	4.7	4.0	85.10	0.7	14.90
GRBC	52.7	4.16	3.53	84.85	0.63	15.15
Total	48.15	4.49	3.82	85.07	0.67	14.13

Table 2: Canal wise extent of irrigation in the command area (n=120)

Command Area	Total	Dry land	%	Irrigated land	%
ALBC	3.65	0.1	2.70	3.592	97.30
IBC	3.79	0.66	17.18	3.18	82.82
MLBC	3.65	0.212	5.75	3.48	94.25
GRBC	3.85	0.292	7.50	3.6	92.50
Average	3.73	0.316	8.36	3.46	91.64

Table 3: Command area wise source of irrigation in the study area (n=120)

Canal	Open Well	Per cent	Bore Well	Per cent	Canal	Per cent
ALBC	0.32	8.90	0.704	19.60	2.564	71.38
IBC	1.612	50.69	0.452	14.21	1.112	34.96
MLBC	0.692	19.88	0.132	3.79	2.624	75.40
GRBC	1.24	34.45	0.224	6.22	2.132	59.22
Average	0.964	27.86	0.38	10.98	2.108	60.92

Table 4: Perceptions of farmers in enhancing water productivity in ALBC

		HR			TR		
	Perception	**Percent**	**G. Score**	**Rank**	**Percent**	**G. Score**	**Rank**
A	Formation of Water User Associations (WUA) for water management.	14.444	70	I	38.14	56	II
B	Proper functioning of WUCs to ensure efficient irrigation management.	33.703	58	II	58.14	46	V
C	Change the localization pattern and adopt cultivation of light irrigated crops.	50.74	49	IV	24.07	63	I
D	Adequate release of water and proper repair of canals.	64.07	42	VI	52.22	49	IV
E	Cement lining of FICs to avoid water losses.	65.55	42	VI	67.03	41	VII
F	Collection of water charges on a quantitative basis	66.29	41	VII	38.14	56	II
G	Timely release of water from the canal	58.88	46	V	59.62	45	VI
H	Installation of water meters at the field gates.	52.22	49	IV	71.48	39	VIII
I	Good cooperation from the staff/ officials	41.85	54	III	45.55	52	III

Table 5: Perceptions of farmers in enhancing water productivity in IBC

		HR			TR		
	Perception	**Percent**	**G. Score**	**Rank**	**Percent**	**G. Score**	**Rank**
A	Formation of Water User Associations (WUA) for water management.	14.44	71	I	38.14	56	II
B	Proper functioning of WUCs to ensure efficient irrigation management.	33.70	58	II	58.14	46	V
C	Change the localization pattern and adopt cultivation of light irrigated crops.	50.74	50	IV	24.07	64	I
D	Adequate release of water and proper repair of canals.	64.07	43	VII	52.22	49	IV
E	Cement lining of FICs to avoid water losses.	65.55	42	VIII	67.73	41	VII
F	Collection of water charges on a quantitative basis	66.29	41	IX	38.14	56	II
G	Timely release of water from the canal	58.88	46	VI	59.62	45	VI
H	Installation of water meters at the field gates.	52.22	49	V	71.50	39	VIII
I	Good cooperation from the staff/ officials	41.85	54	III	45.67	52	III

Table 6: Perceptions of farmers in enhancing water productivity in MLBC

		HR			TR		
	Perception	**Percent**	**G. Score**	**Rank**	**Percent**	**G. Score**	**Rank**
A	Formation of Water User Associations (WUA) for water management.	30.00	60	II	24.07	64	I
B	Proper functioning of WUCs to ensure efficient irrigation management.	14.50	71	I	52.22	49	V
C	Change the localization pattern and adopt cultivation of light irrigated crops.	52.30	49	IV	67.03	41	VIII
D	Adequate release of water and proper repair of canals.	70.00	40	VII	28.14	61	II
E	Cement lining of FICs to avoid water losses.	74.44	37	VIII	60.60	45	VII
F	Collection of water charges on a quantitative basis	52.22	49	IV	71.50	39	IX
G	Timely release of water from the canal	65.55	42	VI	45.60	52	IV
H	Installation of water meters at the field gates.	56.67	47	V	58.14	46	VI
I	Good cooperation from the staff/ officials	34.44	58	III	38.14	56	III

Table 7: Perceptions of farmers in enhancing water productivity in GRBC

		HR			TR		
	Perception	**Percent**	**G. Score**	**Rank**	**Percent**	**G. Score**	**Rank**
A	Formation of Water User Associations (WUA) for water management.	15.55	70	I	38.14	56	II
B	Proper functioning of WUCs to ensure efficient irrigation management.	33.70	58	III	59.10	45	V
C	Change the localization pattern and adopt cultivation of light irrigated crops.	50.75	50	IV	24.08	64	I
D	Adequate release of water and proper repair of canals.	64.07	43	VI	52.22	49	IV
E	Cement lining of FICs to avoid water losses.	65.55	42	VII	67.03	41	VI
F	Collection of water charges on a quantitative basis	66.29	42	VII	39.16	55	III
G	Timely release of water from the canal	58.98	46	V	59.62	45	V
H	Installation of water meters at the field gates.	53.25	46	V	72.64	38	VII
I	Good cooperation from the staff/ officials	31.24	60	II	38.14	56	II

Table 8: Perceptions of officials of Irrigation Department (iD) and Command Area Development Authority (CADA) in enhancing water productivity in UKP & MGP command areas

		HR		
	Perception	**Percent**	**G. Score**	**Rank**
A	Adequate release of funds for canal repairs	36.63	57	I
B	Training and capacity building to farmers	36.67	57	I
C	Scientific quantification of water at field level	47.78	51	II
D	Proper lining of FICs to ensure natural flow	94.81	19	VI
E	Installation of water meters at farm gates	67.03	41	V
F	Timely inspection and supervision of canal sites	58.18	46	III
G	Good cooperation from farmers.	60.33	45	IV

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