

## FARMERS' PERCEPTION ON WATER MANAGEMENT AND LAND DEGRADATION IN THE TAIL REACH OF WESTERN YAMUNA CANAL COMMAND

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### ABSTRACT

*A study was undertaken in the tail end command of Western Yamuna Canal Command (WYCC) in Jhajjar district, Haryana, to assess the socio-economic status and coping strategies adopted by farmers under waterlogging and saline environments. Perception on water management and control of problem of waterlogging and salinity of 100 selected farmers is reported in this study. About 85 to 100 per cent of the respondents strongly endorsed that the poor maintenance of irrigation channels, canal siltation and weed growth, seepage from the distributaries and minors and irregular supply of canal water were the major factors responsible for waterlogging and subsequent land degradation in the command area. In all, 85 per cent of the respondents opined about non-existence of any scheme by the government agencies for maintenance of field channels. As coping strategies, farmers manage the problem by cleaning field irrigation channels, creation of open ditch drains, controlled irrigation methods and increasing the seed rate besides green manuring with varying degrees of success. Farmers of the study area also expressed the need for knowledge dissemination mechanism with technology details, funding opportunities and effective and efficient functioning of water user associations besides involvement of all farmers to enhance productivity from irrigated saline environment.*

### Introduction

In spite of the strides made in irrigated agriculture, land and water productivity at farmers' field have remained low in the country as compared to the frontline demonstrations. The reasons attributed to low productivity and decline in crop yield are inadequate and

uncertain canal water supplies, waterlogging, secondary soil salinisation and alkalinisation, deterioration in groundwater quality, use of poor quality groundwater for irrigation, livelihood constraints and poor socio-economic conditions of farmers (Tyagi *et al.*, 2003). Singh *et al.* (2004) reported that for enhancing water use efficiency

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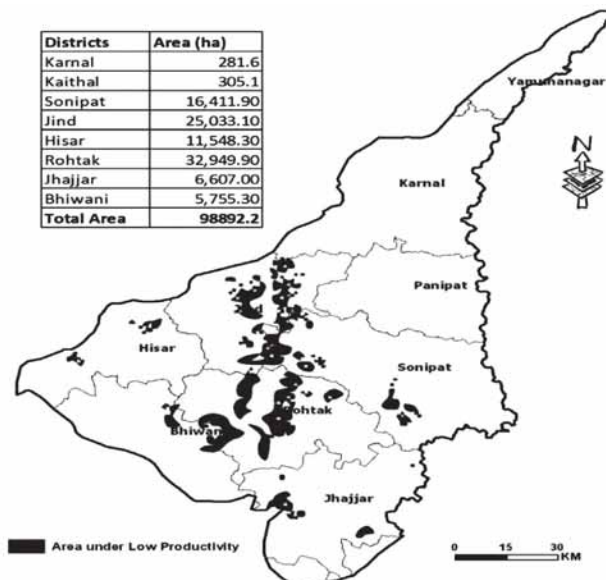
and crop productivity through technological interventions in any canal command area, a clear understanding of the socio-economic condition of the farmers, present cropping system and the constraints from the point of view of the farmers is required. Ghosh *et al.* (2002) reported that farmers being the most important stakeholders, it becomes imperative to consider the issues of irrigation as a service provided to farmers. They suggested that the criterion for assessing the constraints and evaluation of the performance of irrigation systems should be undertaken from farmers' point of view.

An investigation was carried out in two minors, namely Batta and Rohera in the Kaithal Circle of Bhakra Canal System during the year 2001 and 2002 to study the effect of unequal canal water supply in the decision making of the farmers (Anonymous, 2003). In this study, three water courses, one each at the head, middle and tail of both the minors were selected. It was observed that the water supply situation in the tail reaches was worse with very high deficiency levels as it was only 20 per cent of water supply in the head during kharif and between 30 to 50

per cent during rabi season. Therefore, such low supplies hardly left any scope for meaningful decision making and the farmers were forced to use whenever and whatever water was available in the water course.

It was observed from published literature that farmers' socio-economic status, their preferences and perception regarding irrigated saline environment in conjunction were never assessed at different reaches of the WYCC canal command. Generally, irrigation and drainage programmes are based on technical and economic considerations without substantial involvement of the stakeholders. Therefore, present study was undertaken to investigate farmers' socio-economic status, their agricultural practices and perceptions under irrigated saline environment and suggest alternative measures to overcome the problems to enhance crop productivity. Major objectives of the study were to assess the socio-economic characteristics of farmers of salinity prone areas of Jhajjar district of Haryana State and obtain their perception on management of saline and waterlogging problems in the tail reach of the canal command.

**Fig 1 : Delineated Low Productivity Areas of the Jhajjar District in WYCC**



## Methodology

Methodology adopted to accomplish the objectives was a judicious mix of qualitative and quantitative techniques. It was felt that this combination would enable a cross verification of information at various stages of data acquisition and subsequent analysis.

**Study Area :** The Western Yamuna Canal (WYC) has a geographical area of about 13,543 km<sup>2</sup> and is located between 75° 48' to 77° 35' E longitude and 28° 20' to 30° 29' N latitude .The command area is spread over eastern, central and southern part of the Haryana State covering Karnal, Panipat, Sonapat, Rohtak and Jhajjar districts.Out of five districts, Jhajjar district was selected for data acquisition and subsequent implementation of technologies to enhance productivity under irrigated saline environment under the National Agricultural Innovation Project (NAIP) funded sub-project entitled "Decision support system for enhancing productivity in irrigated saline environment using remote sensing, modeling and GIS ".The study area was selected as part of the project objective to study the productivity of crops grown in the area commanded by the Jhajjar distributary which is under WYC. The Jhajjar distributary is at the tail reach of WYC. Generally, the head reaches of any command area are more prone to waterlogging and salinity problem, but it was observed that some parts in the tail reach of the WYC commanded by the Jhajjar distributary faced the problems of waterlogging and salinity (Fig.1). Therefore, interventions through use of the judicious water management technologies for the rice and wheat crops grown in the canal command to enhance the productivity under waterlogging and salinity situations prevalent in the study area were investigated. This necessitated conduction of surveys to identify the farmers' perception to waterlogging and soil salinity problems in this region. Preliminary survey indicated existence of some patches of waterlogged and saline areas.

Further, geospatial tools and techniques were used to delineate the low productivity zones in the Jhajjar district and the generated map is shown in Fig.1.The delineated low productivity area in the Jhajjar canal command was observed to be about 6607 ha. The delineated region of low productivity was the result of indiscriminate use of canal water, rising of groundwater table and existence of saline soil. It was also observed from geospatial analysis that the low productivity zones due to waterlogging and salinity were predominant in two villages (i.e.Baghpur and Silani) of Jhajjar district (Fig.1.).Therefore,these two villages were selected for the study.In order to study the farmers' perception on waterlogging and salinity problem of the command area, about 100 farmers were randomly selected from these two villages out of whom 60 and 40 farmers reported the problem of waterlogging and salinity, respectively.

**Data Collection and Analysis :** Geospatial data analysis using the remote sensing images and field survey was undertaken to delineate the area of low productivity in the canal command area of the Jhajjar district. Reconnaissance survey of the area was undertaken with the help of identified local officials and key informants to formulate the comprehensive interview schedule covering all aspects of the problem pertaining to land degradation and low productivity in the region.Further,the acquired information obtained from the farmers was analysed to accomplish objectives of the study. Thus, primary data were collected from the respondent farmers using the above procedure. Data acquisition was for the rabi 2009 and kharif 2010 cropping seasons. Primary data acquired through field surveys and discussion with farmers included general and socio-economic information of farmers, their perceptions on problem of soil salinity and waterlogging, and coping-up strategies adopted by farmers. The Participatory Rural Appraisal (PRA) tools like transect walk and focused group discussions were held with the farmers of the selected

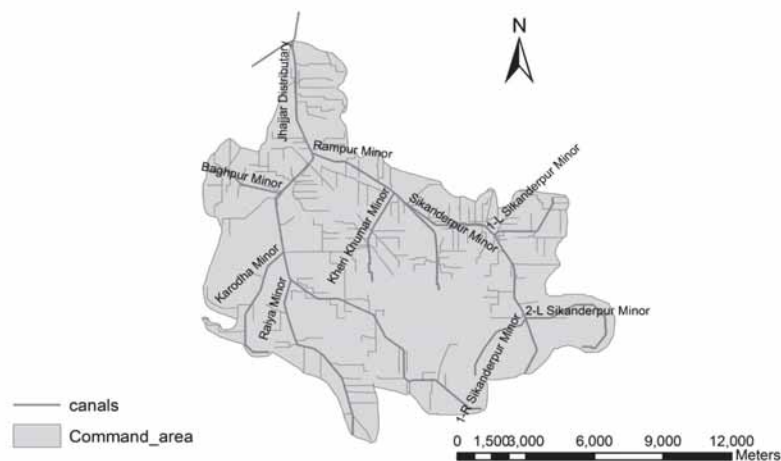
villages. Moreover, cross checking and ground truthing information of the secondary data with regard to envisaged cropping pattern were carried out using the Global Positioning System (GPS). Besides this, the extent of problematic areas, characteristics of reservoirs and canal systems and groundwater level data were obtained from the irrigation and agriculture departments of Jhajjar district, Haryana. The data acquired from farmers through personal

interview using the developed questionnaire were analysed. The geospatial database of Jhajjar distributary with the minors with attribute table on water release to different minors under warabandi based irrigation rostering was prepared using GIS tool and presented in Fig. 2.

## Results and Discussion

**Socio-economic Status of Farmers:** The socio-economic status of farmers acquired from

**Fig 2 : Geospatial Map of Jhajjar Distributary with Minor Canals**



field survey through the questionnaire was analysed. It was observed that 48 per cent of the respondents were in the age group ranging from 35 to 53 years followed by 37 and 15 per cent in young (*i.e.* 18 to 34 years) and old age (*i.e.* above 53 years of age) category, respectively. Educational status of the farmers revealed that maximum percentage (*i.e.* 42) of the respondents had high school education while 34 per cent respondents were educated up to intermediate level. It was observed that only 6 per cent of the respondents were educated up to graduation. However, 18 per cent of the respondents were illiterate and have not attended any primary schooling. In general, the educational status of the farmers was observed to be of moderate nature.

Most of the respondents (*i.e.* 57 per cent) belonged to nuclear family category followed by joint family category (*i.e.* 43 per cent). Majority of the respondents (*i.e.* 88 per cent) had agriculture as their main occupation. Moreover, 10 per cent respondents were engaged in animal husbandry business besides agriculture. The other occupation as their primary occupation was reported by only 2 per cent respondents. Regarding landholding size, 38 per cent farmers belonged to large farmers category followed by 33 and 29 per cent belonging to small and marginal farmers' categories, respectively. The income from different sources by the farmer was included in the study. Majority of the respondents (*i.e.* 67 per cent) had middle category of annual income (*i.e.* ₹ 20264 to

₹ 75977) followed by high with 20 per cent (*i.e.* greater than or equal to ₹ 75977) and low with 17 per cent (less than or equal to ₹ 20264) category of annual income. Majority of the respondents (*i.e.* 92 per cent) were not having any membership in any social organisation followed by membership in one organisation (*i.e.* 5 per cent) and more than one organisation (*i.e.* 3 per cent). About 69 per cent of the respondents belonged to high level of agricultural mechanisation followed by 18 per cent under medium and 13 per cent under low degree of agricultural mechanisation.

### Perceptions on Irrigation and Drainage Conditions and Their Externalities

**Transect Walk:** Transect walk of village area was conducted along with the farmers of villages. It was observed that certain areas of villages faced the problems of waterlogging and salinity. Moreover, good quality groundwater is available alongside the canal but groundwater quality was observed to deteriorate while moving away from the canal. Generally, there was a tendency in the area to buy farm land alongside the canal for sinking own tubewell for getting good quality groundwater for irrigation and transporting it to other fields in saline groundwater zones. Generally, farmers of the canal command followed the rice-wheat cropping system and the vegetable and fruits production were negligible in this area. Therefore, the farmers were advised to take up vegetables and horticultural crops in the region during interaction with the farmers.

**Irrigation and Drainage Conditions Promoting Soil Degradation:** Farmers of the study region also recognised various irrigation and drainage related factors responsible for soil degradation process. The farmers' perceptions on such irrigation and drainage factors were analysed. All respondents agreed that the drainage system is laid in their farm areas but 90 per cent of them consented that the drainage system was not working up to its full capacity due to heavy

siltation and weed infestation. About 90 per cent of the respondents emphasised on the maintenance of lateral drainage system laid in their farm to carry excess drain water to the main drainage system constructed in the region. About 88 per cent of farmers also showed apprehensions about the role of canals in aggravating the conditions for waterlogging and soil degradation. Poor maintenance of minor canals and field channels without crop water demand based irrigation scheduling in the canal system were also considered important factors contributing to waterlogging and degradation by 85 and 87 per cent of the respondent farmers, respectively. Other notable perceptions shared by the farmers were the adverse impact of the existence of canal system near the village and use of canal water for non-agricultural purposes. These views were shared by 65 and 75 per cent respondents, respectively. Some farmers believed that flood irrigation method was the best practice for water management and crops grown during kharif season was the most affected due to waterlogging problem. Moreover, contrary to the understanding of the farmers regarding flood irrigation, they were disseminated that the soil moisture deficit and controlled surface irrigation methods are better than the flood irrigation which generally saves water without deterioration of the grain yield in rice and wheat crops. Also the benefits of drip and sprinkler irrigation systems were also disseminated to the farmers during this study to appraise them about water use efficiency of different irrigation methods and for different crops. However, farmers were neutral to the opinion that government facilitates to remove the surplus water from field were poor and timely access of water supply from the canals were contributing factors leading to the problem of land degradation. Moreover, majority of the farmers recognised that waterlogging problem was noticed with the advent of canal irrigation systems in the area and this was further aggravated by the secondary salinisation problem. However, the farmers were

disseminated about the judicious agricultural water management practices which would prevent the waterlogging and salinity problems in the canal command areas. Regarding the spread of soils degradation problems in the Jhajjar command area, 60 per cent respondents felt that the problem was more severe during kharif season and problems of salinity were more severely felt in rabi and during summer season, which discourages them for taking up crops during summer season.

**Coping Strategies Adopted by the Farmers of WYC Command:** Different coping up strategies adopted by the farmers of the Western Yamuna Canal (WYC) to combat the soil degradation problems due to waterlogging and soil salinity are presented in Table 1. These strategies were

classified under mechanical, irrigation and cultivation practices. Among mechanical measures, cleaning of field irrigation channels and creation of open field drains were resorted to by 85 and 67 per cent of the respondent farmers, respectively. Controlled irrigation was also practised by majority of the farmers (85 per cent). However, under cultivation practices measures, increase in seed rate was the most common strategy adopted by 96 per cent of the farmers to mitigate the adverse impact of the land degradation, both in waterlogged and saline areas. Deep and frequent plowings were adopted by 94 per cent farmers. Application of more irrigation water to leach down the salts from the crop root zone were also practised by some of the farmers in the tail end region of the command during canal water supply periods.

**Table 1: Coping up Measures Followed by the Farmers (N=100)**

S. No.	Measures	Number of farmers		
		Waterlogged (n1=60)	Salinity (n2=40)	Total (N =100)
1	Frequent cleaning of field irrigation channels	55(91.67)	30(75)	85(85)
2	Construction of open ditch drains to remove surplus water	42(70)	25(62.5)	67(67)
3	Use of controlled irrigation methods	50(83.33)	35(87.5)	85(85)
4	Growing of green manure crop to upgrade fertility status	48(80)	35(87.5)	83(83)
5	Increased seed rate during sowing	56(93.33)	40(100)	96(96)
6	Increased use of organic manure	30(50)	23(57.50)	53(53)
7	Increased use of nitrogenous fertilisers	32(53.33)	35(87.50)	67(67)
8	Soil amendments and plant management practices for reducing salinity and waterlogging	10(16.67)	12(0.30)	22(22)
9	Deep and frequent ploughing of the field	60(100)	34(85)	94(94)
10	Land leveling and bunding	10(16.67)	08(20)	18(18)

Note : Figures in parentheses indicate percentage of the total; "n1" is the sample size of respondents for waterlogging problem; "n2" is the sample size of respondents for salinity problem and "N" is the total sample size of the respondents in this study.



Growing green manure crops, increased use of organic manure, increase in the use of nitrogenous fertilisers and land leveling and bunding were some of the other measures practised by the respondent farmers in the study area.

***Outcome of Farmers' Group Discussions :***

Different dimensions pertaining to issues discussed with the farmers in this study and the ameliorative measures can be summarised as follows:

- Farmers of selected villages of the canal command followed the paddy-wheat cropping system besides taking up green manuring crops for maintaining or upgrading fertility status of soil. In this context, the farmers were encouraged to take vegetable and horticultural crops to enhance farm income.
- Crop related information is being acquired by farmers from input suppliers, progressive farmers from the village, farmers from neighbouring villages and their friends. Moreover, farmers were advised to acquire the crop related information from the agriculture departments of the district and also contact the KVKs' for getting assistance on package and practices for raising crops in the area. Farmers were also suggested to adopt water saving irrigation methods and avoid over-irrigating the fields. Use of drip and sprinkler methods of irrigation for vegetable and horticultural crops and use of salt tolerant rice and wheat varieties developed for the region by CSSRI, Karnal to enhance both farm income and water productivity was also discussed. Farmers were observed to be highly receptive to the ideas but expressed their concerns in implementing the same due to financial and constraints in availability of seeds.
- Problems of waterlogging and consequent land degradation were dealt by farmers

through preventive and coping up measures to get rid of these detrimental factors on crop productivity. But majority farmers expressed that the extent of problem and lack of resources were the prime reason for their inability for not adopting any measure. Lack of incentives and technical know-how were the other reasons expressed by the farmers. The farmers also felt the need for community approaches to combat the soil degradation problems as individual actions were not sufficient to reclaim the degraded lands. It was suggested that farmers may seek advice of agricultural officers and extension workers and formulate water users associations and conduct regular meeting on use of the modern technologies and water saving methods to combat the problems of waterlogging and salinity in the command area.

**Conclusions**

Farmers perceived that inadequate natural drains, siltation and weed infestation of existing drains, irrigation water return flow and seepage losses and flooding methods of irrigation were some of the prime factors which have aggravated the problems of waterlogging and soil salinisation in the canal command. The coping-up strategies adopted to mitigate soil degradation problems by the farmers were meant to achieve only the short-term objectives to delay the degradation process. The inability of the farmers to undertake long-term measures was constrained by resource availability, poor technical knowledge and lack of funds for maintenance of both irrigation and drainage systems. Farmers emphasised the need of timely availability of canal water in the tail end and also consented that the crop water demand based irrigation scheduling would ameliorate the problem of waterlogging and secondary soil salinisation in the region. During discussion and group meetings pertaining to dissemination of agricultural water management practices, the farmers expressed that they were not aware of

many of these technologies and opined that proper demonstration of these technologies will definitely assist them in managing their farm lands in general and combating the soil degradation in particular. Therefore, there is a need to provide extension services to create awareness of different technologies to enhance farm income and their livelihood. Moreover, to expedite the dissemination of technologies, periodic trainings and on-farm demonstrations of surface and sub-surface field drainage technologies, land leveling, leaching methods of surface salts, micro-irrigation technologies,

growing salt-tolerant crop varieties and use of soil moisture deficit based irrigation scheduling besides green manuring, organic amendments and package and practices for growing seasonal vegetables and horticultural crops should be organised. Further, the farmers were encouraged to seek advice from the agriculture departments, nearby KVKs or use the toll free telephone *kissan* helpline services and organise active village level farmers' group meetings to enhance the productivity of farm land for sustainable agriculture in the Western Yamuna Canal (WYC) Command area.

### References

1. Anonymous (2003), CSSRI-IWMI Project Report on "Farmers' Decision Making Process in Water Allocation and Distribution at the Farm Level in Water Scarce Areas: A Case from North-west India, CSSRI, Karnal and IWMI, Colombo, p. 55.
2. Ghosh, S., Kanan, K., Singh, R., Kundu, D.K. (2002), Socio-economic Profile and Cropping Pattern in Canal Command Area in Khurda District of Orissa, *Indian Journal of Extension Education*, 38 (1&2): 99-103.
3. Singh, R., Ghosh, S., Kundu, D.K., Kanan, K. Verma, H.N. (2004), Farm Level Constraints to Efficient Use of Canal Water in Coastal Orissa and Some Technological Interventions to Enhance Crop Production, Research Bulletin No. 18, WTCER (ICAR), Bhubaneswar, India: 29pp.
4. Tyagi, N.K., Sakthivadivel, R., Sharma, D.K., Ambast, S.K. and Agrawal, A. (2003), Farmers' Decision Making in Irrigation Commands : The Need and Scope for Improvement, Synthesis Paper 1, Central Soil Salinity Research Institute, Karnal, pp 11.