***Opinion Article***

# ADAPTATION OF INNOVATIVEINTERVENTIONS FOR ENHANCEMENT OF WATER USE EFFICIENCY: AN EXPERIENCE OFFARMERS' EMPOWERMENT IN SSPC




## ABSTRACT

Water is an elixir of life and it plays an important role in economy of any country. Around 70 % of the freshwater is used in agriculture for irrigation and therefore, Govt. of India has adopted an approach of 'more crops per drop' for Water Use.The impacts of irrigation relate to the changes in quantity and quality of soil and water, specifically in irrigation commands are crucial for sustenance of irrigated agriculture. The problems of deterioration of soil health and environment, there by reduction of productivity is common in command area.

Infact,the agricultural sector has been slow and has much room for improvement to save water in irrigated agriculture. However, for enhancing WUE in command area, more important is the involvement of the beneficiary farmers in crop and irrigation management.Relay cropping is a complex suite of different resource-efficient technologies, which possesses the capability to improve soil quality, net return, and land equivalent ratio, besides control of weeds and pest infestation. A recommended practice of the main crop of cotton-castor relay cropping that gave one and half times higher income than sole crop has been evolved and popularized. Cumin is a 2$^{nd}$main crop grown after cotton. The improved practices of line showing on raised bed instead of broadcasting, inter cropping with isabgul/ajwain, and practicing deficient irrigation that gave overall 43% higher yield is largely adopted. The concept of alternative furrow irrigation and applying irrigation at critical stages, which saves water to the extent of 30-35 %, is conceived and practiced by the farmers. The distinguish social engineering approach, articulation by facilitatingthe farming community with highest knowledge back-up and precision have been successful in sardar sarovar project command and have prime scope for enhancement of WUE in irrigation commands.


*Keywords: Social Engineering, Community Mobilization, Water Saving, Cropping Practices*

## 1. INTRODUCTION

The Sardar Sarovar project comprises of a gravity dam on the NarmadaRiver near Navagam, Gujarat. In terms of the volume of concrete involved for gravity dams, it ranks second largest in the world. It has F.R.L. 455 ft and a canal off taking on the right bank with its full supply level (at off take) at ht. 300 ft. A total utilizable flow of 28 MAF at 75 % dependability is estimated and allocated as Madhya Pradesh – 18.25 MAF; Gujarat – 9.0 MAF; Rajasthan – 0.5 MAF and Maharashtra – 0.25 MAF. The main canal after traversing 458.318 km through middle and north Gujarat cross the boundary and runs 74 km in Rajasthan with 598 different types of structures on it. The canal network consists of 44 branches, and 727 distributaries, 4459 minors.

The project command of 18.45 lakh ha lies between $21^{o}$ 40' to $24^{o}$ 40' N latitude and of $69^{o}$ 33' to $73^{o}$ 50' E Longitudes. The topography is characterized by flat alluvial plains except small parts having undulating and marked by small hillocks. In most of the parts drain density is good and the soils are alluvial in nature derived from Deccan Traps.The command area covers 3177villages of 77 talukas in 17 districts of Gujarat. With a view of efficient use of precious water, 'Narmada Planning Group' have worked for years and carried-out various studies. The whole command area is divided into 13 Agro-Climatic Regions (ACRs) considering parameters of topography and land forms, rainfall, groundwater features, land irrigability class including drainage patterns and canal alignments.

The irrigation water allowances for the different Agro Climatic Regions have been worked-out keeping in view the soil classification, groundwater availability, crops grown and climatological factors. In poorly drained flat lands with relatively high water table, limited water allowance has been planned. A special allocation of 0.86 MAF of water has been made to provide drinking water to 173 towns and 9490 villages (53% of total 18676 villages of Gujarat) within and out-side command in Gujarat. The villages and urban centres of arid region of Saurashtra and Kutch and all "no source" villages and the villages affected by salinity and fluoride in North Gujarat are benefited.

The impacts of irrigation relate to the changes in quantity and quality of soil and water specifically in irrigation commands are crucial for sustenance of irrigated agriculture. The problems of deterioration of soil health and environment, there by reduction of productivity is common in command areas. Soil salinity is a prime problem in irrigation commands which not only decreases the agricultural productivity but also, reduce the economic returns and affects the physicochemical properties of the soil. Two-third of the command is having semi-arid climatic condition, where inherent salinity exists. There are coastal areas called 'Bhal' and 'Bara Track' having coastal salinity and problem of drainage. Vast area in the vicinity of little run of Kutch is low lying flat having salt affected soil.

It has been experienced that farmers' response is more aggressive towards their problems in practicing irrigated agriculture rather in comparison of many activities under taken for their benefits, with this consideration, solving the farmers' problems were undertaken on priority basis.

## 2. METHODOLOGY

Appropriate strategic actions viz. mitigation measures for land affected by excessive seepage, reclamation of 'Teliyo Khar' affected land, conjunctive use of water, restricted use of pesticides has been successfully carried-out in Sardar Sarovar Project Command are discussed hereunder:

### 2.1 Rejuvenation of land affected by excessive seepage:

The excessive seepage in the fill segment of canal i.e. earthen embrace is a commonly occurring problem in commands. Such a problemof soil degradation was faced by the farmers of three villages having their fields adjoining Saurashtra Branch Canal. Located just on upstream of each of the three fall structures of canal based power houses. As the canal reaches in banking having FSL quite above the ground level, the excessive seepage on both the sides had caused water logging condition. Normal cropping was under hindrance due to soil degradation. The farmers were demanding to take suitable measures to mitigate the problem, such as they can continue taking crops.

## 2.2Reclamation of "TeliyoKhar" affected land:

The tail end area of Bolera and Rajpura branch canals of Sardar Sarovar Project is in the vicinity of the little run of Kutch, have inherent soil salinity, flat topography and inferior ground water at a depth varying from 2.1 to 10.9 m. There is a soil layer with calcium content at a depth varying from 1.2 to 4.0m. which acts as an impervious layer. This layer restricts downward movement of water causing temporary water logging condition in the entire area.

The soil of this area has high concentration of Sodium (Na), Bicarbonate ($HCo_3$) and Chloride (Cl) which makes the soil sticky and salty. Also, found that the soils is in the range of 'highly' to 'very highly saline' soils with more than 20 SAR that indicate that the area have alkali hazard. The presence of chloride makes the soil hard and the presence of bicarbonate makes the soil sticky and soft. The combination of this two makes the soil of swelling in nature, sticky and itself looks like *"Teliyo Khar"*. This problem have made many limitations on normal agriculture and, therefore, the farmers have been representing about this age-old problem.

## 2.3Participatory Irrigation Management:

As envisaged in the 'Water Use Plan' of SSP, the delta available at head of main canal is about 550 mm which may reduce to about 320 mm at field level. It's a great challenge to fulfil irrigation requirement with this available delta. Therefore, it is inevitable to use this canal water as efficiently as possible. In fact, the agricultural sector has been slow and has much room for improvement to save water through educational, economic, and policy incentives. However, the situation in Sardar Sarovar Project is more critical in view of the envisaged allocated delta.

Creation of physical infrastructure is only a part of the envisaged achievement of the irrigation projects. The ultimate realization is in the achievement of higher water use efficiency. In the case of irrigation projects, the higher WUE is only possible if successful PIM combines with better crop and agricultural practices. The government has accepted the concept of Participatory Irrigation Management which ensure equitable and efficient distribution of irrigation water.

## 2.4Farmer Centered Interventions:

It was felt needed to create interest among the beneficiary farmers for practicing PIM such as to achieve higher Water Use Efficiency. Farmers are mainly interested in their income through agriculture. Specifically providing support in resolving agricultural problems, enhancing their income may win the confidence and faith towards better irrigation management. In view of this few such approaches made in the SSP command are discussed here under.

### 2.4.1 Restricted use of pesticide:

The use of pesticides increases with the intensification of agriculture as along with the creation of irrigation facility. The pesticides are considered a vital component of modern farming, playing a major role in maintaining high agricultural productivity. However, excessive use of it could result in adverse effect on environment and human health in particular. It causes threat to the ground water contamination. Presence of pesticide residues in ground water is especially serious because it is a source of drinking water. Of course, the use of pesticide in the present day agriculture seems to be unavoidable. But,

ensuring their judicious use by conservative manner adopting recommended method is enough to prevent the problem to the large extent.

With a view to take strategic preventive measures, the pesticide residue monitoring in SSPC was initiated in the year 2009 in collaboration of All India Network Program (AINP) on Pesticide Residue, ICAR, Unit-9, Anand. Strategic locations were selected scientifically to collect the samples of surface runoff water in ponds and sub-surface water from open wells. Total 176 pesticides were monitored by determining multi-residue analysiswith the limit of 0.5 µg/L (ppb).

**2.4.2 Improved practices of cumin cultivation:**

India is the largest producer and consumer of cumin seed in the world. Gujarat is a leading state in cumin production contributing more than 60 per cent production of India. The area under this high value cash crop have increasedmuch after availability of Narmada water for irrigation, which becomes a strength of SSP command.

Growing of two or more crops simultaneously on the same land which makes efficient use of limited arable land. Efficient intercropping not only improves the productivity but also sustain soil fertility status (Singh *et al*., 2013), besides assured income from any crop against collapse of anyone.Patel and Amin concluded that intercropping of cumin with ajwain in 1:4 row arrangements with cutting of ajwain at 45 DAS is better for realizing higher cumin equivalent yield, gross return and net return.

**2.4.3Cotton-Castor relay cropping:**

Cotton is main crop which is grown in over 40 % area of command. BT Cotton is a heavy feeder whichtake short time to reach in reproductive phase and ultimately it requiresshort period as compare to hybrid cotton and also it is space plantedcrop so intra row space can be utilized. Relay cropping is a complex suite of different resource-efficient technologies, which possesses the capability to improve soil quality, to increase net return, to increase land equivalent ratio, and to control the weeds and pest infestation. The furrow and drip methods of irrigation gave higher WUE up as observed by Shirahattiet al.(2007) and Choudhary et. al. (2016).

Castor is another less water requiring long duration cash crop. Which can be grown in between tworows of BT cotton after cotton crop reaches at reproductive stage.Castor crop grown in between two row of standing cotton duringrabiseason (relay cropping), which provide supplementary income.The uniqueness of the cotton- castor relay cropping system is thecombination of two cash crops, which improves the economy of farmers through the cultivation of cotton and castor as an industrialcommodity. Plant spacing in castor crop plays an important role inboosting the yield.

## 2.5Development of Model ‘Village Service Area’:

The Water Use Plan of Sardar Sarovar Project command envisages the concept of Village Service Area covering and area of a minor canal. The Participatory Irrigation Management is primarily accepted for the successful operation and maintenance of irrigation systems in commands. But, so far successful precedencies are rare. An agriculture centred distinguished approach was adopted for the development of a modal VSA – a minor (Vegadvav) in Halvad Taluka.

Farmers were motivated, guided and facilitated for adoption of improved practices of agriculture aimed at increasing the farmers' income. Farmers were provided with the scientific know how from time to time as per their need as and when arise. The implementation of Participatory Irrigation Management was an inclusive component of ultimate goal of achieving integrated agricultural development. This farmer centered bottom up approach is time taking but, holistic and sustainable.

## 3. RESULTS AND DISCUSSION

### 3.1 Rejuvenation of land affected by excessive seepage:

As an effort, first the problem was defined based on available earlier and current soil and crop data.Possible mitigation measures comprised of activities to prevent seepage, providing intercepting drain and on-farm soil reclamation measures namely suggestion of salt tolerant/field/tree/crops and grasses, green manuring, crop rotation by legume, restriction of inferior ground water use, frequent and lite irrigation, fertilizer selection and its application methods, tillage at specific soil moisture content, enhance use of farm yard manure and compose and other location specific measures, where evolved scientifically. This was followed by finalization of an acceptable action plan on consultation among the stake holders. Which was then implemented and, now the farmers are able to take their crops as earlier.

The farmers were provided with the possible mitigation measures of managing their land resources scientifically, as evolved from available knowhow/technologies, soil investigation report and interactive discussion/brainstorming among farmers, field staff and experts.

### 3.2Reclamation of "TeliyoKhar" affected land:

As a result of detail soil investigation, analysis and interpretation by reports as well as several consultations/field visits/brain storming among the farmer, officers of line department and experts. An integrated approach of implementation consisting various activities for adoption by the farmers besides providing sound surface drainage system in place have been evolved. A cluster of 26 most affected villages are selected for undertaken reclamation measures on pilot basis. Farming community is now fully involved in the process of development such as to reclaim the degraded land.

### 3.3Participatory Irrigation Management:

For involving beneficiaries and stakeholders in irrigation management, the Government has enacted PIM Act in 2007. Water Users' Associations (WUAs) have been formed from amongst the beneficiary farmers in the SSP command area with expectation to take over the operation and maintenance of the system from minor head and below along with community based agricultural and economic activities. Inspite of all efforts to educate and involve the WUA members with the support of competent NGOs and extension activities, the farmers' response is sluggish and the successful functioning of WUAs are very few. Hence, distinguished approach which can involve the farming community in managing their crops with the least water is felt needed in the project.

### 3.4Farmer Centered Interventions:

Each location of pesticide residue monitoring has assessed area contributing runoff water and the test results were looked into precisely such as to identify the need for strategic

preventive measures to be undertaken based on the observations. The farmers of identified clusters namely vegetable growers around Padara andcotton growers around Karjan talukas were educated and convinced in person for controlled use of pesticides by integrated pest management which has reduced the cost as well. As a result, so far the status of pesticide residue in the entire Sardar Sarovar Project command is 'Below Detectable Level'.

By under taking large number of demonstrationon recommended improved practices, namely, line sowing instead of broad casting, raised bed sowing with irrigation through drip system, practicing deficient irrigation and interculturing using wheel hoe. This improved practice resulted in on an average 33 % increase in productivity besides saving in water and increase in area from about 0.5 lakh ha to 1 lakh ha during last three years. Further, farmers were motivated for adoption of value addition such as shorting and cleaning, which gave higher economic return.

Cotton-castor relay cropping technique was recommended earlier by the State Agricultural University.This recommendation was reassessed and modified appropriately by trial for three years on Narmada Irrigation Research Project farm. By this time large scale demonstration on farmer's field were also conducted. Results have shown 27 % higher income to the farmers. This resource efficient practice giving higher return to the farmer has been adopted largely in Karjan, Thasra, Harij talukas and majority of the farmers have realized the benefit of the new cropping system.

### 3.5Development of Model 'Village Service Area':

The community efforts of construction of storage tanks, blending ground water which is inferior with canal water, adoption of MIS, Rotational Water Distribution, and diversification to high value crops and other improved agricultural practices along with common economic activities of purchase of inputs and sell of the produces have been evident of success. After the initiation in the year 2010, presently more than half of the land holdings have their own tube well, a storage tank of required capacity, piped water distribution network and MIS adoption. The remaining farmers are quickly joining in the adoption now.

## 4. CONCLUSION

For achieving the objectives of the Sardar SarovarProject, long-term sustained efforts both in terms of time bound completion of identified activities and ensuring the implementation of identified policies have been envisaged.

The command area development activities carried out mainly for enhancement of Water Use Efficiency on sustainable basis an effective utilization of water as per distinguish water use policy envisaged under the project is to empower Water Users Associations such that they can distribute the water by Rotational Water Supply and use it efficiently from canal network at minor and below.For this purpose, the farmers are trained for participatory irrigation management and specific practices of crop management. However, the successful achievements are is very few.

Hence, a bottom up approach of engaging the local farmers in the process of command area development specifically crop and irrigation management by creating willingness among them followed by need based empowerment with facilitation have been successfully adopted. This farmer's centric approach mobilizing community is time taking but holistic to enhance water use efficiency on sustainable basis.

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