

Innovative water distribution and application techniques in the command of irrigation project, for upgrading of water use efficiency

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KEYWORDS

Water use efficiency, Water User Association, Conveyance loss, Water productivity, Drip

ABSTRACT:

Large numbers of water storage structures are constructed in India. Many of them supplies, irrigation water, to the command with open channel gravity flow water distribution network. The conventional open channel gravity flow water distribution network has significant water loss, with many other lacunas. Participatory irrigation Management and volumetric water supply is the one of the basic principles to improve water use efficiency in irrigation sector. With the conventional gravity flow irrigation net work it is difficult to supply irrigation water on volumetric basis to each individual farmer. On the background of increasing water demand and water scarcity, few water user association WUA situated in Maharashtra State India, have adopted innovative techniques and achieve significant water savings. The WUA has made zero conveyance loss by replacing the extensively used conventional gravity flow open channel network with the PVC pipe irrigation network and adopted micro irrigation to avoid water application losses in the fields. Their innovative techniques are very efficient, low cost, feasible, adoptable, transparent, and supports volumetric and judicious water distribution among the beneficiaries. A combination Drip irrigation along with shallow and small pits filled with compost and essential fertilizers can be a new promising technique to this system, which ensures steady or even higher agricultural output owing to the highly efficient and economical use of water and fertilizers.

Introduction

Maharashtra is situated in the southwest of India. Agriculture has been the prominent occupation to provide foods and fiber to the growing population of the state. The total geographical area is 30.8 million hectare, out of which 22.50 million hectares are cultivable. At the end of June 2010, 4.47 million hectares irrigation potential is created. The area irrigated in 2010-2011 is 2.96 million hectares. The state lags in utilization of potential created. The gap between the potential created and utilization was very large, is now improving with the adopted reforms in water sector. There is still scope for development. The state economy is dependent upon the agriculture production. Irrigation facility is regarded as the key element of irrigated agriculture, the modern agriculture and irrigation practices play a key role in alleviating rural poverty.

Water allocation policy

In major part of the command areas of surface storages situated in Maharashtra state, water is allocated on the basis of the designed crop pattern, the demand of the farmers, and availability of the water in the reservoir. The water is released on the basis of the sanctioned crop area in a given season. The quantity is to be releases at fixed interval to satisfy the crop water demand, but in actual

practice the quantities and rotation period is fluctuates. Farmers do not irrigate in night time, since water is charged on area basis. As there is uncertainty in water supply, the farmers do apply excess water. There is tendency to apply irrigation water as much as they can, which results in deep percolation losses, leaching of fertilizers below root zone, run off at the end of borders and furrows and reducing the area under irrigation. The present water application methods are not efficient, though they are adopted over large area in command of irrigation projects. The reasons for this type of irrigation practices are,

- There are no incentives to the farmers for efficient water use.
- The farmers do not worry about the wastage of water, as they are not to pay on volumetric basis.
- The rotation of water supply schedule is not implemented as it is planned on paper. Therefore the beneficiaries will try to tap as much water as possible, when their turn is on. The head reach farmers apply excess water, while the tail reach farmers do not get water at all.
- In the night time, some of the farmers divert the irrigation water in to the drain, they are not penalized.
- The field channels are not well maintained as the farmers are not organized to share the water as their responsibility.
- The flow rate in each chak (Piece of land under command of one out let) is standardized as 30 Liter per second. But in most of the cases the outlets have very less discharge.
- All above features drives the farmers mind to apply maximum irrigation water as and when available to them.
- Farmers were penalized for irrigating more area than the sanctioned area for growing the crops.
- The water demand is varies from outlet to outlet.
- The flow time varies from one day to seven days. It is very difficult to regulate the flow rate in the main irrigation canal. Thus the operational schedule gets disturbed. The end result of this type of operation practice is heavy water losses.

Reformed water policy

As the area under the command of an irrigation managerial staff is large, it is difficult for him to maintain and keep watch on each and every field. Thus Maharashtra Government has decided to hand over the command area to the beneficiaries. The water users associations **WUA** of the beneficiaries are now formed. The command area is handed over to the WUA in step by step. Water will be released to them on volumetric basis. Overall distribution, controlling and management of irrigation, maintenance is done by water user association.

A Case study of Shri Ram Water Users association, Pimpalnare village, Nasik district, Maharashtra state (India)

As per the reforms initiated in Maharashtra state, A WUA named as Shri Ram WUA is formed in the command of Pimpalnare Minor Irrigation Tank. The Pimpalnare village is situated 25 Kilometers away from the district head quarter Nasik, Maharashtra (India). The monsoon rain fall occurs in month of June to mid of October. Without supplementary irrigation crops cannot be grown after the monsoon rains are over. In the summer days the peoples were fetching problems for getting water for irrigation and drinking. To overcome the water crises problems Government has constructed Pimpalnare Minor Irrigation tank near the village in the year 1983.

The salient features of the tanks are given below.

1	Name of tank	Pimpalnare Minor irrigation tank
2	Basin	Godavari River
3	Catchments area	4.88 Square Kilometer
4	Land under submergence	64 Hectors
5	Village under submergence	Ramsheja
6	Gross Storage	2.25 Million cubic meter Mcum
7	Live storage	2.2 Mcum
8	River Bed level	102.27 Meter
9	Sill level of Irrigation Sluice	107.80 Meter
10	Full tank level	117.80 Meter
11	Total length of Dam	910 Meter
12	Villages in Command [Command area]	Pimpalnare[231 Ha] Khatwad[89 Ha] Talegaon[200 Ha] Ramshej[10 Ha]
13	No. of wells in command	88
14	Total cost of the Scheme	\$ 127700
15	Length of irrigation Canal	8.0 Km

Problems

A conventional open channel water distribution network was constructed. The tank never get fill with water since their construction. In the period of 1983 to 1995, irrigation on this tank was also meager with the conventional water distribution network as the losses were significant. The irrigated area were never exceeds 30% of the irrigation potential created. It was governed by the irrigation Department, Government of Maharashtra. The maintenance, repairs and operation was done by the Irrigation staff working under the government. The irrigation was done in the Rabi seasons only i.e. October to February. The tanks could not have water to irrigate in the hot weather. The tank gets empty in two or three irrigation rotation. The tail Enders never gets water. As there was acute shortage of water the farmers were raising crops like Millet, Ground nut, Green pee, Black Gram etc in the rainy season. And crops like Wheat and Gram over a small area in the Rabi season. Due insufficient and uncertain water supply from the reservoir, the yields of the crops were not enough. As agriculture was the only source of income, the farmers were getting more and more poor day by day.

Innovations adopted

To overcome the problems, the beneficiaries united to gather. After lot of discussions and brainstorming following decisions are taken by them.

1. Decided to form water users association to take over the management of the irrigation tank in to their hands.

2. To avoid the conveyance losses, decided to adopt pipe distribution only. For that they have taken the decision to close the irrigation sluice and not to use the created conventional open channel water distribution network.
3. Group of 10 farmers having fields side by side or at convenient are to be formed. Each group has to lay a PVC Pipe line and provides a pump to lift the water from the reservoir at his group's cost.
4. For equitable distribution of the available water, the diameter of the pipe and horse Power **hp** of the pump will be designed on the basis of their distance of their farms from the reservoir (length of pipe), head available, share of water, so as to get discharge proportionate to the area of that group.
5. Individual pipe line is not allowed.
6. When the power is on all the pumps will run at the same time. Thus all the groups will get proportionate quantum of water at the same time.
7. The water reached at the head of the pipe line will be judiciously distributed among the 10 farmers.
8. The maintenance of the pipe line, pumps is not the responsibility of the WUA. It is the common responsibility of the farmers in that group.
9. Collection of the water charges and paying it to the Government is the responsibility of the WUA.
10. As the command area of the tank is small i.e.250 hectare, only one WUA is formed on this tank.
11. Government will measure the water level in the tank at the start and end of a cropping season. Accordingly Volume of water utilized by the WUA as a whole is calculated and water charges are levied. Thus the government will get revenue on the basis of volumetric basis.

As per the decisions taken above, Shriram water user Association is registered on 29th April 1995. In the year 1995 to 1997, only 22 peoples united together and laid a underground PVC pipe line of 130 mm diameter and 5.5 Km length to lift water from the reservoir for irrigation purpose. Now 25 groups of 10 farmers each, are formed. Every group had made their own financial arrangements and laid their pipe line and installed a pump in the submergence area of the reservoir, as per the directives of the WUA. They laid a PVC pipe line from reservoir to their fields. The water Cumming through the pipe line is proportionally taken by the farmers in those groups. The WUA has installed own electric transformer of 160 KV to get undisturbed electric supply of required voltage. The WUA is also responsible to collect the electricity charges and pay to the respective office.

Benefits Received

- Freedom of crop planning
- Conjunctive use of water is allowed
- Flexibility in water scheduling
- Freedom of water distribution
- Saved water can be use the next season
- Equitability in water distribution
- Quickly setting of the conflicts.
- Irrigation area is double than the potential.
- The WUA is honored with Prize **Sinchan Mitra Puraskar(2006)**, for their innovative management, improved water use efficiency, judicious water distribution.

Results

After the implementation of the scheme following changes are observed.

- The conveyance water losses are reduced to zero, thus saving in large amount of water.
- Equitable distribution of water
- Water is delivered to the farmers in command as well as non command area of the tank. Thus extending the irrigation benefits to the villagers.
- Cost of pipe line is saved due to group formation.
- Every group has a group head. He is authorized to solve the dispute among them if arises.
- Due to involvement of people's participation, the scheme runs smoothly as the powers and responsibility are decentralized.
- The youngsters turn to wards the farming instead of wondering for searching jobs in the Cities.
- It becomes possible to produce export quality grapes and vegetables.
- Able to adopt advance irrigation techniques such as Drip and Sprinkler irrigation.
- The irrigation potential is increased from 250 hectare to 400 hectare.
- Income from the farm is increased from \$250 to \$2500 per hectare.
- High water productivity

Adaptable Sub surface irrigation technique

Plants need water for evaporation and transpiration. Transpiration is the basic need and cannot be avoided. But evaporation from the surface beneath the crop canopy can now be reduced with the unconventional techniques i.e. Apply the irrigation water 10 cm below the ground surface. The water once reach underneath is safe from evaporation. Major part of the root zone lies in the 10 to 40 cm depth below surface. The controlled water and nutrient supply in this zone is very effective to increase the productivity. In this case the top 10 cm soil itself act as mulch and prevents the evaporation loss. In case of Drip irrigation 30% of the crop shade area is wetted. From these areas evaporation is taking place; hence it is not a perfect method to save the water. In the innovative technique, a pit of 30 cm diameter and 15 cm depth, below the Dripper is excavated. A 30 cm length and 150 mm diameter pipe is kept vertical in the centre of the pit and filled with sand up to 15 cm height. The remaining portion of the pit is filled with a mixture of fertile soil and manure, and pipe is taken out, thus forming a sand pillar at the centre. The dripper is then kept on the top of sand pillar. All the water coming through the dripper is immediately get down, below the ground surface and spread in the effective root zone and saves 40 to 60% water as compare to drip irrigation. Thus the fertile area is wetted having aeration and good environment for the roots.

Conclusion

It is concluded that peoples participation play a key role in sustainable development. The beneficiaries should have affection to the water resources for successful implementation and longer life of the system. Due to adoption of such schemes, the expenditure of the Government will save, 100 % of the potential created will be utilized, helps to alleviate the rural poverty. It will achieve efficient and optimum water use with easy management. A combination of drip with the subsurface water supply will improve the water productivity.

REFERENCES

Bhalage Pradeep, and Holsambre D.G.(2009).; Efficient Management of Water Resources through PVC Pipe Distribution Network and Participatory Irrigation Management – A success case study, 5th Asian Regional Conference, 8-11 December 2009, New Delhi, India.

Bhalage Pradeep, and Holsambre D.G.(2009).; Water Rights and Participatory Irrigation Management of an Irrigation Projects, International Conference on Food Security and Environment Sustainability, December 17-19, Kharagpur. India.