

On-Farm Water Management Options for Increasing Irrigation Efficiency in Command Areas of Orissa

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Abstract

Management of water below the canal outlets offers the greatest scope for increased production and productivity in the irrigation commands. This paper presents some of the issues and options available for on-farm water resources management in canal commands of one of the eastern most state of the country (Orissa) with an aim to fine-tune the activities that are, at present, undertaken for resource optimization. The traditional management systems of the area, on-farm-development measures taken through the centrally sponsored Command Area Development and Water Management (CADWM) Programme and farmers' involvement in the process of distribution and utilization of irrigation water are presented in the paper.

Keywords : Irrigation Potential, Command Area Development, On-Farm Development, Water Users' Association.

Introduction

With an average annual rainfall of 1170 mm, about 4000 billion cubic metres (BCM) of water is received in our country, annually, from natural resources. But competitive uses of the finite water resources for agriculture, settlements and industries by its huge and still expanding human and animal population pose a great threat to the society. Thus, availability remaining the same, our population has now been increased many folds in the last few decades - affecting the per capita availability of water. With only 2 per cent of world's total geographical area and 4.2 per cent of its water resources, India has to support almost 16 per cent of the World's population. There has been a drastic reduction of per capita water availability in our country from the levels of 5277

m³ per person per year in 1955 to 2464 m³ per person per year in 1997 and it is projected to be reduced further to 1496 m³ per person per year in 2025 (Panda, 2006). Because of heavy demand and less availability, cost of clear and safe water is being increased and water has now become the costliest input in agriculture. It is therefore, of the utmost importance that water resources are conserved, preserved and prudently used to derive the maximum benefit from their usage.

Moreover, its availability varies from place to place, season to season and year to year. Because of the peculiar phenomenon of monsoon, a bulk (about 80%) of the rain water is available in a short period from June to December. During this period, about 50% of the annual rainfall comes from few intense storms (Pisharoty, 1990) and

water received from such intense storms is subjected to high runoff losses. Being unutilized, most of the valuable water resources generally run to the sea. Of the 4000 BCM of water that is received in our country annually, 700 BCM evaporates, 700 BCM is lost as surface runoff and 1500 BCM of it goes straight to the sea (Behera and Panigrahi, 2007). This has been the most important consideration in agricultural planning in our country since the earliest civilizations and the rulers of the country gave utmost importance to collection, transportation and storing of water with an aim to ensure its availability, when and where it is required.

Post-Independence Irrigation Development

The foremost important agenda of the new independent Indian Government in the early years of independence was to feed its poverty stricken unfilled bellies adequately. Many a measures were taken to improve productivity. But the most important problem at that time was unavailability of sufficient irrigation potential to reduce the risk of climatic hazards. On the eve of independence, there was 28.2 million hectares (Mha) of irrigated area, which constituted 24 per cent of the net cultivated area in the undivided India. Partition resulted in a substantial reduction in the proportion of irrigated area to 20 per cent of the net cultivated area (NCPA, 1982). The situation called for tremendous efforts to make the leeway and meet the requirements of the growing population. In the initial period the five-year plans accorded higher priority to the development of irrigation. Heavy emphasis was laid on tapping the water available through major, medium and minor irrigation projects. Billions of rupees were spent in achieving this hectic process of development in the irrigation sector. Public investments to the tune of about 23% of the total outlay were allotted for irrigation development upto the seventh plan. The irrigated area increased from the pre-plan levels of 22.6 Mha to 57.20 Mha at present.

Irrigation Development in the State of Orissa

The state of Orissa has a long tradition of investing in irrigation development even in the pre-independence periods. In 1860 the East India Irrigation and Canal Company was formed for the purpose of carrying out canal works in the Mahanadi, the Brahmani and the Baitarani Delta on recommendation of Sir Arthur Cotton, who was, at that time, invited to advise in the matter of flood control in Mahanadi delta. The work was however not sufficiently advanced to be of real use resulting in occurrence of terrible famine (the Great Bengal Famine) in 1866 (DoWR, 2007). Thereafter the work was intensified and even before onset of the Plan programmes in 1951, 3 major (Orissa Canal system, Rushikulya and Mahanadi Delta) and 3 medium (Jayamangal, Baldiha and Baskel) irrigation projects were there in the state irrigating about 1,76,920 hectares. The development of irrigation got accelerated after introduction of plan programmes and Hirakud multipurpose project is the first major project of the state started after independence. Around 1960s, expansion of irrigation coverage was initiated with construction of a number of new major and medium irrigation projects namely, Salandi, Dhanei, Budhabudhiani, Salia, Dejang, Ghodahada, Bahuda, Uttei, Pitamahal including expansion of Mahanadi Delta System. The pace of development went on and between 1970 and 1980, altogether 21 major and medium irrigation projects were taken up during successive plan periods. The net irrigation potential created through construction of major and medium irrigation projects in the state of Orissa in different plan periods is given at Fig. 1. At present out of the 6.559 Mha of the cultivable land of the state, 5.9 Mha is irrigable and by end of 2004, irrigation facilities has been provided to 2.695 Mha (from all sources) which comes to about 45 per cent of the irrigable area of the state (DAFP, 2007).

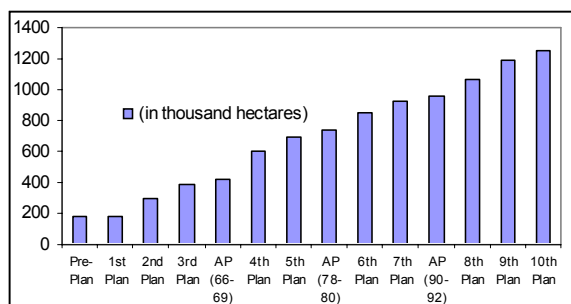


Fig. 1 Net irrigation potential created through major and medium irrigation projects in the state of Orissa in different plan periods (DoWR, 2007)

Utilization of Created Irrigation Potential

Most of the irrigation projects of the country have been under operative with a major percentage of the created potential being left unutilized. It has been estimated that there is at present a gap of about 14 Mha between the irrigation potential created and that utilized in our country. In monetary terms an investment of about 140000 crores of rupees is thus left unutilized (MoWR, 2005). The gap between the irrigation potential created and that utilized in the state of Orissa comes to 0.772 Mha, which comes to about 29 per cent of the irrigation potential created.

Causes of low irrigation efficiency

Inadequate maintenance has been cited as one of the most important factors for reduced irrigation efficiency at project levels (MoWR, 2005). Inadequate maintenance results in problems of unreliability in the availability of water at the farm level - causing low efficiency of water use and low productivity as well. But in a situation like that of Orissa, where the drawal at the head of the canals is very high in comparison to the design, the problem of inadequate availability is perhaps not so much to affect the irrigation efficiency. Moreover, huge Government funds have been spent for repair, renovation, modernization and extension of projects to get it

back to its original position at regular intervals. The efficiency of the projects has, however, hardly increased.

The most important factor of low efficiency of irrigation in Orissa is rather improper management of water below the outlets, which results in unequal distribution (insufficient or over irrigation) at most places. The problem becomes more drastic with establishment of unauthorized outlets at the head reaches drawing more than the designed quantities thereby reducing the flow in the tail end canals. The reason for this is requirement of higher quantity of water because of increase in area under paddy cultivation. It has been an established fact that the area under paddy cultivation has increased with introduction of irrigation in almost all Commands of the state. This has led to increase in size of the outlets or establishment of unauthorized ones.

Accepting people's plan

It has by now been established that people can not be dissuaded forcibly to get rid of paddy (as have been seen with experiments in the last few decades), the planning should be reoriented to get it authorized to have paddy in the head reaches. It would rather be more beneficial to reschedule the delivery system so as to get an assured middle crop in between the Kharif and Rabi crops with the available moisture to increase the cropping intensity and the productivity. This type of farming in conjunction with the On-Farm-Development activities has been proved successful in the Hirakud and other western Commands of the state (Naik, 2005).

Where does the excess water go?

Excess water because of over irrigation is generally lost in two ways, e.g. deep percolation and surface or subsurface flow. While deep percolation results in increase in the ground water tables, surface or subsurface flow affects the area at lower gradients with waterlogging, flood and

related problems. The irrigated Commands of the state of Orissa are of two types, one as that in the coastal plains with very high ground water table and the second as that in the undulated terrains of the hill plateaus inside with distinct layers of hard rock very near to the ground surface. The high water table in the coastal areas acts as an impervious layer as water is generally not allowed to go downwards. In both the cases, deep percolation is therefore not possible because of the impervious layers very near to the ground surface. This has led to accelerated drainage of water from the head reaches of every irrigation projects in Orissa. This unutilized water is generally let off in the streams downward. The most affected portion from this type of situation is the coastal plain irrigation commands where ground water table rises every year to new high levels. Drainage from these areas to the sea is practically impossible particularly in the monsoon periods of high discharge. Horizontal drainage systems have failed and vertical drainage too have a problem of disposal at times.

Recycling of the lost water

With quick disposal of the excess water in the head reaches straight to the downward streams, the option of drainage-cum-recycling projects to take the lost water back to the canals or the crop fields at higher elevations is perhaps the best option to increase irrigation efficiency, particularly in the undulated terrains. A series of such structures with provision of some head-raising component at closer intervals would even prove to be successful in reducing the extent of waterlogging in the coastal plain commands.

Command Area Development and Water Management (CADWM) Programme

The problem of gap between the irrigation potential created and that utilized was thought of as the foremost barrier for agricultural development at the national level and much

emphasis was laid to remove these deficiencies and optimize the agricultural production. A programme for integrated development of command areas was launched during the 5th five-year plan and Command Area Development Authorities were set up for identified projects. The programme is continuing in Orissa since 1976-77 and is constructing micro level distribution systems through a network of field channels and field drains and also educates the farmers on scientific water management practices for better water utilization and higher productivity.

The programme has been restructured and renamed as "Command Area Development and Water Management Programme" by the Central Government and at present the programme is being implemented in 14 irrigation projects of the state with a cultivable command area of 0.788 Mha. The scheme components of the programme presently implemented in the state of Orissa are as follows.

Construction of Field Channel

The Field channel network starts below the outlet and leads to the tail end of the outlet command. It consists of earthen channel, lined channel and hydraulic structures for negotiating to the designed slope. It is designed to carry 1 to 1.5 Cusec discharge and to irrigate about 40 Ha. of lands in its command. It facilitates to carry water conveniently to each plot independently by avoiding wild flooding. It ensures timely use of irrigation water throughout the command and helps in increasing productivity. So far an area of 4,30,686 ha has been covered under the field channel programme.

Construction of Field Drain

The field drain is a small drain executed along the valley line and is linked to the existing link drain or trunk drain. The Field channel network is designed in such a way that all the field

channels drain into the field drains. The field drains are mainly surface drains with carrying capacity of 10 to 12 Cusec. Hydraulic structures are provided at vulnerable points in the field drain to negotiate with the permissible slope. They drain out excess water from the crop field to the link drain and provide healthy surrounding for adopting diversified crops. So far an area of 1,23,880 ha has been covered under the field drain programme.

Demonstration and Training :

For making the farmers' conversant with the benefits of the diversified cropping with proper

water management and equitable use of available irrigation water, crop demonstrations are under taken in the farmers' field and training programme is imparted at village level under the programme adaptive trial in the Command Area Development Programme.

Financial norms and Funding pattern

The activities under CAD&WM programme being implemented in Orissa at present and the financing norms & funding pattern is given in Table 1.

Table 1. Cost norms of CADWM scheme components in Orissa

Sl No	Items	Cost Norms Per Ha	Central Share	State Share	Farmers Share
1	Construction of Field Channels	Rs 15,000/- for areas in Non-KBK districts and Rs 22,000/- for areas in KBK districts	50%	40%	10%
2	Construction of Field Drains	Rs 4,000/- for areas in Non-KBK districts and Rs 5,000/- for areas in KBK districts	50%	50%	
3	Reclamation of Waterlogged Area	Rs.15,000/-	50%	40%	10%
4	Crop Demonstration	As per location specific need	75%	25%	
5	Farmers Training	As per location specific need	75%	25%	
6	Correction of system deficiencies above outlet up to Distributaries of 150 Cusec capacity	Rs.6000/-	50%	50%	
7	One time functional grant to water Users' Association	Rs 1000/-	45%	45%	10%

Impact of Command Area Development Programme:

This has been proved to be the best method of managing water below the irrigation outlets. The impact of the programme since it's starting

has been very much appreciated by the cultivators. The Field Channel networks constructed in the farmers' field below the canal outlet have immensely benefited the farmers to provide available irrigation water uniformly throughout the command area of the outlet. During drought

situation, the presence of Field Channels has helped the farmers to a great extent to avoid crop loss at the tail end. The social disputes arising out of non-uniform distribution of available water during peak period and also during the period of scarcity have been reduced to a great extent. The impact of the Field Drain by the farmers is also very much encouraging. It has been observed that due to construction of Field Drains, the prevalent waterlogging condition has been substantially removed and the average yield of the affected area has been increased. Due to farmers' training and Crop Demonstration Programme, the cultivators in the command area are now ready to go for diversification of crops and adoption of modern methods of cultivation and water management practices for higher productivity. The need of Field Channels are so felt by the farmers that they are now coming forward to donate the required land for construction of Field Channel and Field Drains.

Independent impact evaluation studies have also pointed that CADWM activities increase the utilization of created potentials in irrigation systems, increase in cropped area and productivity and more prominently the increase in yield per unit volume of water to a great extent. Study indicates 15% increase in utilization of irrigation potential and up to 125% increase in the water use efficiency in terms of yield per unit volume of water in kg/m³ in the command of Mahanadi Delta Stage I Irrigation project (WAPCOS, 2007). The Benefit Cost ratio of the Command Area Development measures taken in the area was worked out to be as high as 4.56 : 1. The On-Farm-Development activities through the CADWM programme should therefore be extended to more and more irrigation projects to get the maximum results of the created irrigation potentials of the state.

Farmer's Participation

Lack of participation of farmers in the process of irrigation water management has been said to be the most important factors in under utilization of the created potentials. Irrigation is a community subject and unless all the farmers in a given area adopt a common approach in selecting varieties of crops, sowing time and cropping sequence the water delivery would not match exactly with crop water requirements for obtaining maximum yield. More emphasis is therefore given to farmers' participation in management of irrigation water in all irrigation projects of the state. The Orissa Pani Panchayat Act has been enacted in 2002 and Orissa Pani Panchayat Rules have also been framed in 2003 giving substantial rights to the Water Users' Associations in managing the water resources.

Only formation of Pani Panchayat is not the solution for better functioning of CAD projects. The entire Govt. machinery relating to the Water Resources should be involved seriously for involving the farmers' actively in the process of management of available water, maintenance of sub minor and field channel systems and better crop management process for achieving the ultimate aim of better production and productivity. On the other hand, the farmers should also be conscious of their rights and responsibility on the available water and upkeepment of the distribution system within their Pani Panchayat with a view to provide uniform irrigation water to the entire area of the Pani Panchayat by mutual equitable sharing method. In the Command Area where On-Farm-Development work has not been taken up, it is the duty of the Pani Panchayat to motivate farmers to donate land required for construction of the field channel and field drains under the Command Area Development programme and actively participate for their construction and maintenance.

Conclusion :

Huge investments have been made for development of water resources through construction of irrigation projects. But a major chunk of the resources remain unutilized because of lack of management of water resources below the outlet level. On-Farm-Development activities through the CADWM programme have been proved to be the most effective method for reducing inequality in distribution of irrigation water below the outlets and increasing irrigation efficiency. The activities should therefore be extended to all the irrigation projects of the state. As the climatological and geomorphological situation of the state of Orissa accelerates surface and subsurface flows, the option of having a series of drainage-cum-recycling projects to take the lost water back to the canals or the crop fields at higher elevations is the best option to increase irrigation efficiency and should also be extensively practiced in all canal systems of the state. These programmes can be effectively implemented with involvement of the farmers as a group (Water Users' Association) in the process of operation, management and upkeepment.

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