

**POLICY
PAPER
3**

**Harnessing and Management of Water
Resources for Enhancing Agricultural
Production in the Eastern Region**



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Introduction

The eastern region comprising Bihar, West Bengal, Orissa, parts of eastern Uttar Pradesh and eastern Madhya Pradesh is bestowed with abundance of rainfall, river flows and fertile soils. The ultimate irrigation potential of this region is 52.73 Mha. which is about 47 per cent of that of the entire nation. Surface water is the predominant source of irrigation in this region. The irrigation potential of major and medium projects is 19.66 Mha, while that of minor irrigation projects is 33.07 Mha. including 12 Mha. from groundwater. Almost all the major irrigation projects are diversion type. In spite of the fact that the region is served by several rivers such as Ganges, Mahanadi, Sharada, Gandak, Kosi and Sone, irrigation has been uncertain and undependable.

Historically, the eastern region was the most prosperous agricultural tract of the country. During the triennium ending 1950-51, the yield of foodgrains in this region was 6.44 t/ha while that of the northern, western and the southern regions was 6.08, 3.90 and 5.54 t/ha, respectively. However, with the advent of the input intensive new agricultural technology following the Green Revolution, the region lagged behind the other parts of the country. Public investments in agriculture in this region for the period 1969-1985 were grossly inadequate to be compatible with the requirements of input intensive agriculture and as such this region has not benefited by the Green Revolution.

Currently, the average foodgrain yields of the eastern region are far lower than those of the other regions of the country. The average yield of rice in the region is 1350 kg/ha while the all India average yield is 1746 kg/ha. Similarly, yield of oilseeds is also much lower than the national average. However, with the foodgrain yields plateauing in Punjab, Haryana and western Uttar Pradesh the increase in foodgrain production to meet needs of the increasing population of the country, has to come from this region. Thus, there is an imperative need to improve the foodgrain production from this resource-rich region.

Because of its vast water resource potential, rich soils, and the gap between the potential and actual yields of crops, the region could become the future granary of the country. The National Water Policy document of the National Academy of Agricultural Sciences (NAAS) (1996), drew attention to the vast untapped potential of water in this region and inadequacy of the current programmes, projects and policies to harness this potential.

The NAAS considered it necessary to focus attention on water related issues of the eastern region and organised a seminar on 'Harnessing and Management of Water Resources for Enhancing Agricultural Production in Eastern Region'. The seminar had four themes: (i) Harnessing surface and groundwater resources for increasing agricultural production; (ii) Rainwater management for sustainable agricultural production; (iii) On-farm water management, issues and remedies; and (iv) Socioeconomic aspects and human resource development in water resource management.* The themewise recommendations of the seminar are presented below.

* Seminar organised in February 1997. It was jointly hosted by the NAAS, Orissa University of Agriculture and Technology, Bhubaneswar and Water Technology Centre for the Eastern Region, Bhubaneswar. Several government officials from six states namely, Andhra Pradesh, Bihar, Madhya Pradesh, Orissa, Uttar Pradesh, and West Bengal, besides those of central government, the ICAR institutes and agricultural universities participated in the seminar.

Recommendations

1. *Harnessing Surface and Groundwater Resources for Increasing Agricultural Production*

1.1 Groundwater Potential Remains Largely Untapped

1. The region is rich in groundwater especially in the plains. However, the utilisation of this potential is just 5.6 per cent in eastern Madhya Pradesh, 8.4 per cent in Orissa, 19.2 per cent in Bihar, 24.2 per cent in West Bengal and 35.8 per cent in eastern Uttar Pradesh. For bringing a dramatic change in the agricultural scenario of this region, it is imperative to utilise this resource judiciously. This calls for action on technological and legislative fronts.
2. The exploration, survey and estimation of groundwater potential both in terms of quantity and quality should be strengthened. Efficient well-construction technology for exploitation of low yield aquifers in hard rock areas should be evolved for drought mitigation. The technology package should include both engineering and biological components. Conjunctive use of surface and groundwater should be encouraged in irrigation project areas to optimise the water use and to alleviate the degradation of soil and water resources. Various technologies for groundwater recharge such as, use of dug-wells, ponds, water harvesting structures in drains and rivers should be studied for feasibility and identified for their implementation depending on availability of the finances. Enactment of groundwater legislation should be expedited to protect groundwater from overexploitation and pollution.

1.2 Village Pond Culture System Needs Revitalisation

3. The region has a traditional culture of having ponds both at individual level in the backyard, and community level as village ponds. The hydrology of village ponds, taking into account surface inflow-outflow, storage, seepage, and recharge etc., should be studied to assess the availability of water for developing appropriate strategies for agricultural production in the region. These strategies should be tested in typical case studies for validation and the experience utilised to develop policy of rejuvenation and multipurpose uses of ponds with special emphasis on crop production. Harvesting surplus monsoon runoff through artificial recharge by cost-effective techniques should be encouraged.

1.3 Strengthen Collaboration and Coordination of Research on Water Use

4. Presently, the water resources developed for irrigation are used for irrigation only, while ample scope exists for their multipurpose use. However, proven technologies are not available for such use. The research on multipurpose use of irrigation water needs to be strengthened through collaborative research efforts among the various organisations, namely, the ICAR institutions, SAUs, state and central government agencies.

5. The extent of coastal saline and alkali soils should be estimated and appropriate amelioration measures, cropping/farming systems should be developed for such areas.
6. A mandatory mechanism should be envisaged to bring about coordination amongst research institutions, SAUs, and state government agencies for proper exchange of information to facilitate establishment of a National Data Bank, and to develop strategies of research as well as implementation of water resource development and watershed management programmes.

2. *Rainwater Management for Sustainable Agricultural Production*

2.1 High Rainfall Potential and Problems Need Studies

7. The high rainfall of the region, instead of being a blessing, becomes a curse because of the recurring floods, waterlogging and crop damage, every year. Therefore, proper rainwater management holds the key for effective exploitation of the rich bounty of the rainfall.
8. Scientific approach to rain water management that accounts for appropriate hydrologic analysis for identification of wet spells, dry spells, critical dry spells, assessment of runoff, design of farm ponds, seepage control with inexpensive lining materials, critical growth stages of crops, design of appropriate irrigation systems, suitable timing and assessment of benefits of supplementary irrigation to rainfed crops, etc., should be adopted for obtaining the best results from rainfall. Field evaluation studies ought to be carried out to test and evolve economically viable technologies of rainwater management.

2.2 Watershed Management-The Key to Efficient Water Resource Development and Use

9. The programmes of watershed management and soil conservation should be designed to classify and identify lands of various degrees of degradation and work out appropriate measures to rejuvenate them. Preference should be given to good marginal lands and more fragile ecosystems. Emphasis should be on harnessing indigenous techniques of soil and water conservation based on farmer's experience.
10. Water use planning should be done on micro watershed basis with government support and people's participation in blocks and districts on the pattern of land use planning for optimal and sustainable water resource development. Teams of leading scientists should be formed to explore and develop technology packages for better integrated water resource utilisation in the region.

2.3 Make Use of Experience of Water Management at Damodar Valley Corporation (DVC)

11. A number of small-scale erosion control and water harvesting structures have been constructed in DVC, Hazaribagh, which have not only reduced runoff and erosion but also assisted in large-scale conservation of water and increasing area under

agriculture. The design and installation of such small-scale soil and water conservation structures in the DVC should be properly documented for exploring their use in various watersheds in the eastern region. The research organisations working in the eastern region should collaborate with the DVC to assess and evaluate these structures for their adaptability.

2.4 Waterlogging and Flooding Problems

12. One of the major reasons of waterlogging and flooding is impediment of water flow due to construction of railway and road embankments without adequate provision of crossdrainage. There is need for closer coordination amongst the departments of railways, roads, irrigation and flood control to provide adequate cross-drainage to ensure natural flow of water.
13. A programme of construction of farm ponds/micro-reservoirs along low order streams should be advocated to intercept runoff, reduce peak flow, enhance groundwater recharge and create irrigation potential for increasing agricultural production.

3. On-farm Water Management: Issues and Remedies

3.1 Increasing Water Use Efficiency

14. Efficiency of water use in canal command areas in eastern region is quite low. Field to field irrigation is prevalent and this not only reduces irrigation and nutrient efficiency, but also makes crop diversification difficult. Although, appropriate interventions with new water management technologies have been developed through several on-farm water management studies they are yet to be extended to command areas of distributaries and branch canals.

3.2 Improving Drainage

15. Drainage congestion as well as surface flooding in canal commands, pose serious threat to sustainable irrigated agriculture in eastern region. Appropriate surface drainage technology needs to be evolved integrating preventive and curative measures. Adequate research backup with appropriate cost benefit assessment is necessary for development of efficient drainage systems. The large permanent water bodies, such as *Chauras*, *Manus*, *Taal* etc., should be used for safe disposal of drainage water and as irrigation sources. These wetlands are a part of our environment and suitable technological packages should be developed keeping socioeconomic conditions in view.

3.3 Ensuring Conjunctive Use of Water

16. Conjunctive use of surface and groundwater must get a high priority in developmental programmes of this region not only to augment water supply but also to lower water table and contain secondary soil salinisation. Adequate supply of

* *Chauras*, *Manus*, *Taal* are the local names of large permanent water bodies.

power/diesel and funding support is absolutely essential for groundwater exploitation in the region.

3.4 Introduce Crop Diversification

17. For effective crop diversification and increase in cropping intensity low water requiring, high value crops are needed. More flexibility of irrigation system to meet water demands, in terms of time, amount and locational accessibility should be ensured. Appropriate marketing and processing facilities hold the key to the success of the diversified agriculture and measures should be taken by the government to meet this need.

3.5 Need for Collaboration Between Different Agencies

18. To address water management issues in an integrated way, a strong collaboration between the agencies dealing with irrigation system management and on-farm water management is required.

4. Socioeconomic Aspects, and Human Resource Development in Water Resource Management

4.1 Farmers' Irrigation Cooperatives Needed

19. The farmers' irrigation cooperative movement should be encouraged. The operation and maintenance of irrigation minors and subminors must be entrusted to the farmers' cooperatives. Concession in water rates can be given to these cooperatives for the services rendered by them. Suitable changes should be made in the Irrigation Act to revitalise the system. At present, the revenue officers such as *Tehsildars* are declared as Irrigation Officers. This practice should be discontinued as these officers have little exposure to the complexities of modern irrigation system. The District Agricultural Officer who has overall responsibility of agricultural production for a particular district and knows various aspects of agricultural developments including irrigation is technically competent to become Irrigation Officer so as to meet the requirement of the Irrigation Act and the rules made thereunder. Alternatively, the Irrigation Engineer responsible for water delivery can also be designated as Irrigation Officer.

4.2 Develop Water Management Centres at Different Levels

20. There should be Water Management Committees at district, block and *panchayat* levels involving District Agricultural Officer, Block Development Officer, *Tehsildar*, irrigation field functionaries, agricultural engineers, economists, and farmers' representatives. The committees will take decisions on, (a) timing of canal closure for annual repair and maintenance, (b) design of suitable cropping pattern for each block within the irrigation command, (c) delineating the waterlogged and high water table areas for rice and fish farming, (d) control of stray cattle menace specially during dry season, (e) avoiding mismatch between timing of water delivery and crop needs in canal command areas, (g) laying out field channels and drains and making suitable provisions for their maintenance at *gram panchayat* level.

4.3 Assessment of Improvement in Agricultural Productivity as a Measure of Irrigation Efficiency

21. The primary objective of irrigation system is to improve agricultural production to specified degrees. However, the performance evaluation of a system is done only in terms of area irrigated with no emphasis on quality of irrigation and its productivity. It is, therefore, necessary that besides the gross irrigated area, the quality of irrigation and productivity of the area is also recorded and used in evaluation of performance of irrigation systems.

4.4 Encourage Farmers' Association

22. The farmers' association could purchase pump sets and accessories and other essential farm equipments like, seed drill, bund former etc., the cost of which could be financed by banks under Preferential Group Loan Scheme, and cooperatives of *Panchayat* could render custom hire services for pumping water from open wells, tanks and rivers to the cropped areas of the farmers. Provision for custom hire service should be made for repair and maintenance of tube wells and pump sets at the *panchayat* level. For electric pump sets uninterrupted power supply should be assured for at least eight hours a day. If this is not possible, a rotational system of power distribution should be introduced.

4.5 Entrust Management Functions to *Panchayats*

23. The management and maintenance of tanks, *jheels* and lakes specially in West Bengal and Orissa should be vested with *Panchayats* through appropriate legislation. Fish culture in permanent water bodies like *Taals*, *Jheels* etc., will help in providing food and employment besides reducing breeding of mosquitoes and incidence of diseases.

4.6 Encourage Rice-Fish Farming

24. Rice-fish farming accommodates crop diversification and reduces the investment risks in rainfed lowland rice cultivation. The system also generates year round employment in the farm and ensures high productivity and profitability besides assuring conservation of ecosystem. This needs to be improved through integrated use of crop and fish culture technology.

4.7 Treatment of Industrial and Municipal Water

25. The conventional treatment of industrial and municipal waste water and its appropriate recycling can provide an additional source of nutrient rich irrigation water for improving productivity of vegetable and other crops. This approach should be extensively tested by the soil scientists and agronomists for various soil types and cropping systems and where the potential exists the policy and implications should be determined and steps taken to implement them.

4.8 Need for Creation of Specialised Cadre of Water Management

26. So far, there is no specialised cadre of water management in the country, hence the subject does not attract any attention. We suggest that the graduates and postgraduates in agriculture, agricultural engineering, and civil engineering should be given sufficient theoretical and practical training in this subject through specialised postgraduate programmes in water science and technology. The faculty of the institutions should be provided appropriate exposure and training in national and international institutions having such specialised expertise. Water resource management in agriculture is a multidisciplinary subject matter area and hence, a multidisciplinary training should be provided to all personnel involved. Special courses need to be designed for transfer of technology to the farmers connected with water use and management. Training on watershed management should be an important and integral part of human resource development, particularly in the rainfed areas.

4.9 Strengthening Water Users' Agency through Training and Appropriate Legal Acts

27. In accordance with the spirit of the National Water Policy (1987) of Government of India, farmers should be made partners in management of distribution system and distribution of water. This can be realised by organising farmers into registered Water Users' Associations (WUA) at appropriate hydrologic units of about 300-600 ha, with appropriate transfer of certain operation and maintenance (OM) responsibilities to them. The responsibilities of WUAs can begin from minor downwards leaving the department to pay greater attention to management of head works and main/branch canals. Suitable legislative action should be taken to provide legal status to WUAs. The managerial aspect of personnel of irrigation department should be highlighted and they should be suitably trained.