IMPROVING AGRICULTURAL PRODUCTIVITY AND WATER USE EFFICIENCY THROUGH PER DROP MORE CROP SCHEME

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ABSTRACT

Water is a natural resource, which is essentially required for agricultural production. To feed the ever increasing population of country, enhancement in production from limited resources is the need of hour. Agricultural productivity can be enhanced if land and water resources are utilized efficiently, and energy is channelized properly. India has 18% of world population, having 4% of world’s fresh water, out of which 80% of the exploitable water resources in the country is consumed by different agricultural activities. Irrigation is major water consuming activity in agriculture with only 38% water use efficiency with prevalent method of irrigation therefore a lot needs to be done to improve it. Pradhan Mantri Krishi Sinchai Yojana (PMKSY)-Per Drop More Crop has provided a sound framework for the expansion of Micro Irrigation coverage area of 36.20 lakh ha in scheme from 15th July 2015. The method of irrigation followed in the country is flood irrigation, which results in a lot of water loss. Greater efficiency in irrigation can be achieved through proper designing of irrigation system for reducing water conveyance loss. Adoption of water saving technologies such as sprinkler and drip irrigation system have proven extremely effective in not just water conservation but also leading to higher yields by delivering water in a controlled manner near the plant roots where it is most efficiently absorbed. It is also observed that contrary to common perception, drip and sprinkler irrigation is more energy efficient, since it required less energy than the surface irrigation. It is concluded that adoption of an integrated approach, which takes into account soil-water-crop-climate-resources management and farm mechanization, planning and implementation of location specific, cost effective, energy efficient, sustainable, interventions/strategies are the pathways to enhance Crop, water and energy productivity.

1. INTRODUCTION

India is already categorised as water stressed country in terms of per capita freshwater availability (1544 cubic meter in 2011). Out of the 4 per cent share of global freshwater availability in India, almost 80 percent share of water is consumed by the agriculture sector. It may be worth noting that water is likely to be a more binding constraint to Indian agriculture than even land, and therefore it is time to change the mind-set from raising agricultural productivity per unit of land to per unit of water. In addition to the sustainability issue, inequity in irrigation water use among crops across the country has left a little more than half of Indian agriculture still dependent on rainfall. Paddy in Punjab-Haryana belt and sugarcane in subtropical belt comprising of Maharashtra, Tamil Nadu, Karnataka and Andhra Pradesh are classic examples highlighting this situation. The water guzzler paddy and sugarcane crop are using more than 60 per cent of irrigation water available in the country. The relatively water abundant states in eastern region (eastern UP, Bihar, Jharkhand, West Bengal, Assam, and even Odisha), lag behind in production of rice and sugarcane they have been unable to set up suitable procurement structures for rice or attract sugar mills in their areas. To cope with water scarcity, with improving agricultural water productivity as the single most important avenue for managing

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water demand in agriculture. The famous slogan of ‘More Crop per Drop’ (Molden, 1997) or ‘Per Drop More Crop’ as rechristened by the Prime Minister of India featured throughout the past decade in analyses of WP of crops, cropping systems and agricultural production systems (Kijne et. al., 2003; Amarasinghe et al., 2007; Amarasinghe and Smakhtin, 2014).

In this context, the Indian government has tried to initiate new policies and schemes to improve agricultural productivity, while simultaneously increasing water use efficiency. One example is the launching of “Pradhan Mantri Krishi Sinchai Yojana (PMKSY)”. This scheme provides a sound framework for the expansion and effective water use in irrigation. The impact of this scheme greatly enhanced, under the newly launched PMKSY and convergence with MGNREGA. Pradhan Mantri Krishi Sinchai Yojana (PMKSY) ensure assured irrigation to every field. The focus is to ensure end-to-end solutions in the irrigation supply chain, from source to field application with the vision of “har khet ko pani” and “more crop per drop”. Moreover, in case of states like Punjab and Haryana, where the water table has already reached a critical level, in addition to improving water-use efficiency, a shift in cropping pattern towards low water-intensive crops is required for sustaining agricultural production.

1.1 Water productivity:

Increasing the productivity of water means, in its real sense, getting more benefit from every unit of water used for various production systems. From the farmer’s viewpoint, it means getting more production per unit of irrigation water. Water productivity will depend on many factors other than quantity of water applied. Various factors, which influence water productivity, include cropping pattern, crop variety, level of other inputs applied, management factors etc. Though water is only one of the factors of agricultural production and cannot be meaningfully separated from the others, an estimate of its productivity and knowledge about the factors which influence it will help in making the future plans to improve water productivity in a particular area.

Raising crop water productivity means raising crop yields per unit of water consumed, though with declining crop yield growth globally, the attention has shifted to potential offered by improved management of water resources. In simple words, it implies growing more food or gaining more benefits with less water. Physical water productivity relates the mass of agricultural output to water use- “Per Drop More Crop.”

The concept of water productivity (WP) was offered by Kijne et al. (2003) as a robust measure of the ability of agricultural systems to convert water into food. So, the basic expression of agricultural water productivity is a measure of output of a given system in relation to the water it consumes, and may be measured for the whole system or parts of it, defined in time and space (Cook et al., 2006).

Water productivity = Agricultural benefit/ Water use. It is normal to represent water productivity in units of kg m⁻³, where crop production is measured in kg ha⁻¹ and water use is estimated as mm of water applied or received as rainfall, converted to m³ ha⁻¹ (1 mm = 10 m³ ha⁻¹).

1.2 Crop water productivity:

Crop water productivity denotes the amount or value of product (i.e., crop) over volume or value of water used.
1.3 Agricultural water productivity:

If all water users are taken into account and concept of recycling and reuse of water is considered in agricultural production system, then agricultural output per unit of total water input is referred as agricultural water productivity.

Irrigation scientists and engineers have used the term water (irrigation) use efficiency to describe how effectively water is delivered to crops and to indicate the amount of water wasted at plot, farm, command, or system level and defined it as “the ratio of irrigation water transpired by the crops of an irrigation farm or project during their growth period to the water diverted from a river or other natural source into the farm or project canal or canals during the same period of time (Israelsen, 1932). Crop physiologists defined water use efficiency as the amount of carbon assimilated and crop yield per unit of transpiration (Viets, 1962) and then later as the amount of biomass or marketable yield per unit of evapotranspiration. Crop scientists express and measure water use efficiency as the ratio of total biomass or grain yield to water supply or evapotranspiration or transpiration on a daily or seasonal basis (Sinclair et al., 1984).

1.4 Per Drop More Crop: The Challenges of Irrigation:

With increasing demand for food production under resource-poor situations where agriculture becomes more and more competitive, cultivation must be geared to achieve higher productivity (yield per unit land and/or water resource) in order to meet the market demand for the commodity. In this context, judicious management of all the inputs in an agricultural production system is vital. The agriculture, which depends purely on rainfall, will not be a viable venture since we cannot totally rely on the rainfall which is beyond human control. Water is a critical input into agriculture in nearly all its aspects. How much, at what time and how plants are watered has determining effect on the eventual yield. Good seeds and fertilizer fail to achieve their full potential if plants are not optimally watered.

Per Drop More Crop mainly focuses on water use efficiency at farm level through precision/micro irrigation (Drip and Sprinkler Irrigation). Besides promoting precision irrigation and better on-farm water management practices to optimize the use of available water resources, this component also supports gap filling interventions like micro level water storage or water conservation/management activities as to complement and supplement the works under taken through various national/state level programmes for drought proofing measures.
Micro-Irrigation has made its mark as an agri-input that enhances productivity and enables cash crop and in some cases export oriented cultivation using very little water by enabling better nutrient management. Various field experiments have shown this technique to increase farm level water use efficiency up to 80 - 90%.

Funding of financial assistance: Under the Per Drop More Crop (Micro Irrigation) component of PMKSY the subsidy amount payable to the beneficiary will be shared in the ratio of 60:40 between the Central & State Governments for all states except North Eastern & Himalayan states, where the sharing will be in the ratio of 90:10. In the case of Union Territories, the scheme subsidy will be funded 100% by the Central Government.

1. The existing pattern of assistance payable to the beneficiary under the scheme guidelines is 55% for small and marginal farmers and 45% for other farmers which will be met by both Central Government and State Governments.

2. 25% higher amounts have been taken into calculation of subsidy for the North Eastern and Himalayan states and 15% higher for states with low penetration of MI namely Bihar, Chhattisgarh, Jharkhand, Odisha, Uttar Pradesh, West Bengal and Union Territories.

The impact of adoption of micro-irrigation is crucial for different states of India like Karnataka, Andhra Pradesh, Gujarat, and Maharashtra giving a massive push to promote micro-irrigation for water resource conservation. The Per Drop More Crop Micro Irrigation component Karnataka have brought 6.74 lakh Ha. area under micro-irrigation during 4 years followed by Andhra Pradesh 6.21 lakh Ha.

### 2. Benefits of Micro Irrigation:

1. Reduction in input costs and significant cost savings observed for irrigation in all surveyed states. Irrigation cost reduced by 20% to 50% with average of 32.3%.

2. Labour savings on account of irrigation, weeding, fertilizer and other operations. Use of human labour decreased significantly and ranged from 7.41% to 18.75% in pre-harvest operations. However, labour use increased in post-harvest operations for harvesting, assembling & grading, handling, transportation and disposal of produce.

3. Electricity consumption reduced after installation of micro irrigation system by about 31%.

4. Saving of fertilizers with average reduction of about 28% in total fertilizer consumption in all surveyed states. Fertilizer saving vary from 7% to 42%.
5. Irrigated area increased in all surveyed states (13 states, 64 districts) after introduction of NMMI scheme by an average of 8.41% from same source of water. Maharashtra topped the list with 22.28% growth in irrigation area followed by Chhattisgarh.

6. Increase in area under horticulture crops after adoption of micro irrigation by farmers.

7. Average productivity of fruits and vegetables increased by about 42.3% and 52.8% respectively mainly because of crop spacing, judicious use of water and other inputs etc.

8. Overall benefits accrued from micro irrigation reflect in income enhancement of farmers. Farmer's income increased in the range of 20% to 68% with average of 48.5%.

9. Benefit cost (BC) ratio of micro irrigation is greater than “1” across states and crops which signify importance of micro irrigation in net income enhancement of farmers.

10. Positive outcomes of micro irrigation has made food security effective due to increase in production and productivity of different crops and increased area under irrigation from same source of water.

An impact evaluation study for Micro Irrigation was carried out in the year 2014 and major findings of the study are:

- Irrigation cost reduced by 20% to 50% with average of 32.3%.
- Electricity consumption reduced by about 31%.
- Saving of fertilizers vary from 7% to 42%.
- Average productivity of fruits and vegetables increased by about 42.3% and 52.8%.

Overall income enhancement of farmers in the range of 20% to 68% with average of 48.5%

3. CONCLUSION

The Successful implementation of the PMKSY serves in the rapid development and growth of agricultural systems, since the farmers can invest in the agricultural activities readily with enhance confidence of returns on investments in availability of proper water sources & technologies for its efficient application. The enhanced coverage of irrigation facilities can efficiently reduce the income disparity among the different areas furthering the equality among the communities. Efficient systems such as drip enhance productivity & quality of produce rendering the additional income to farmers. With availability of water, the farmers can diversify the cropping for horticulture based farming which is more beneficial to them. The ultimate objective of the Government for “Doubling of Farmers Income” will be ably supported by the program.

4. REFERENCES


