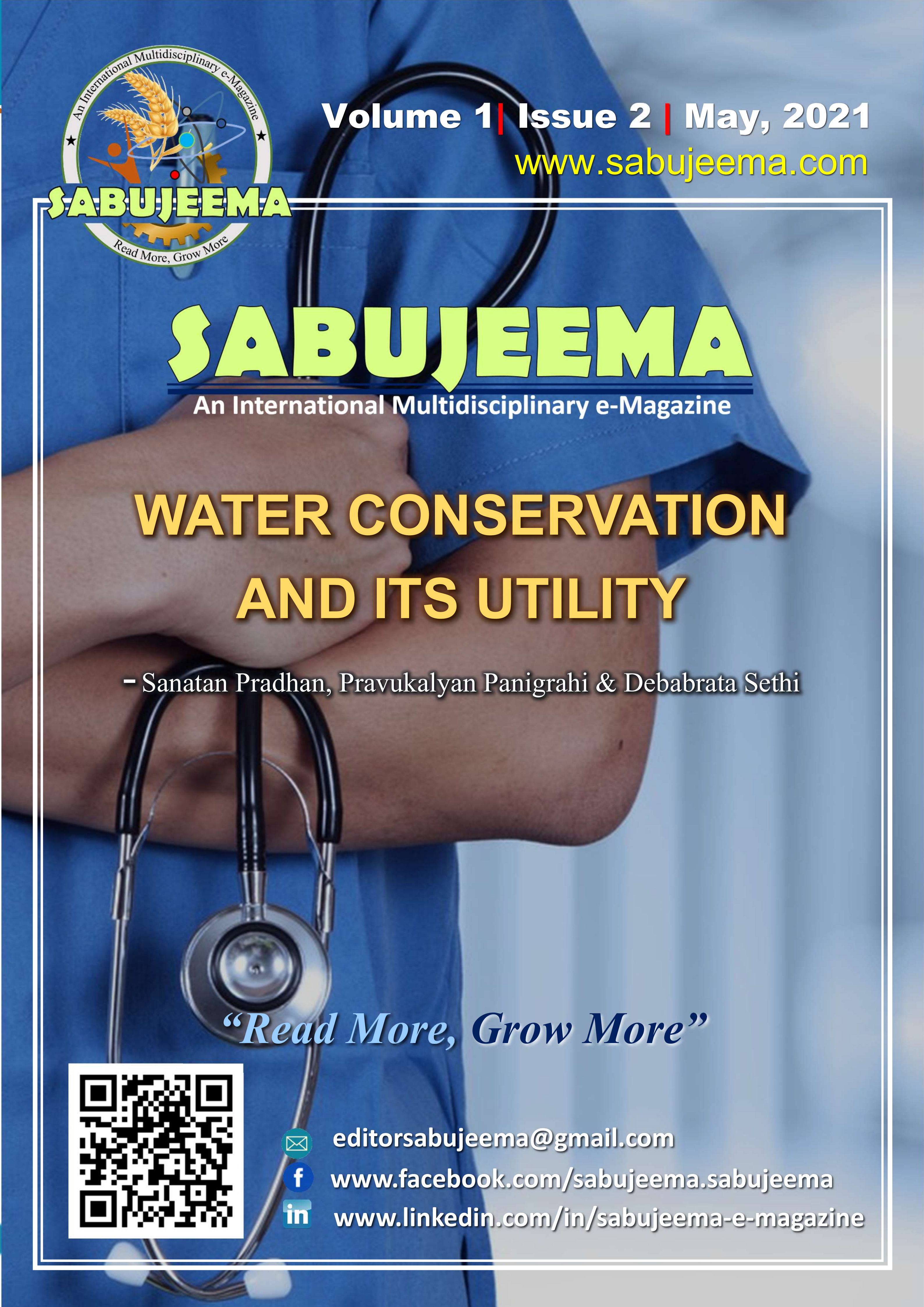

Volume 1 | Issue 2 | May, 2021
www.sabujeema.com

SABUJEEMA

An International Multidisciplinary e-Magazine

WATER CONSERVATION AND ITS UTILITY

- Sanatan Pradhan, Pravukalyan Panigrahi & Debabrata Sethi

"Read More, Grow More"

editorsabujeema@gmail.com
www.facebook.com/sabujeema.sabujeema
www.linkedin.com/in/sabujeema-e-magazine

WATER CONSERVATION AND ITS UTILITY

[Article ID: SIMM0021]

Sanatan Pradhan,
Pravukalyan Panigrahi
Debabrata Sethi
ICAR-Indian Institute of Water Management, Bhubaneswar, Odisha

INTRODUCTION

India feeds 16 percent of the world's population with only 2.5 percent land and 4 percent water resources of world. Precipitation in the form of rain and snowfall provides over 4,000 trillion liters of fresh water to India. Most of these freshwater returns to the seas and oceans through runoff across the subcontinent. A portion of this water infiltrates through the soil and exists as green water and groundwater. Moreover, a smaller portion of rainfall also stored in inland water bodies. Out of 1,869 trillion liters available water, only 1,122 trillion liters can be exploited due to topographic constraints and distribution effects.

The rapid increase in population, urbanization and industrialization has led to a significant increase in water requirement. In the next decade the demand of water is expected to grow by 20 percent. The per capita water availability in 2025 and 2050 is estimated to come down by almost 36 percent and 60 percent respectively compared to the 2001 levels (MoWR, GOI). Moreover, the water availability for agriculture will be reduced significantly in coming years. With less water availability, higher food production to feed the burgling population in coming years becomes a challengeable to researchers and managers of our country. In this scenario, crop production through efficient water conservation and management practices is needed.

Efficient water conservation and utilization can be done basically by the following three ways;

1) Rainwater management
2) Canal water management
3) Groundwater management

Of course, the efficient utilization techniques under any water management programme is similar, the methodologies for conserving water are different.

RAIN WATER CONSERVATION

India is bestowed with abundant rainfall by nature. However, the quantity and distribution of rainfall temporarily and spatially highly varies throughout the country. Because of short duration with high intensity rainfall, most of the rain falling on the ground surface leaves as runoff. Therefore, it is very essential to harvest the rainwater where it falls. Basically, rainwater harvesting is done using two methods, such as in-situ methods and ex-situ methods.

In essence, the in-situ technologies are soil management strategies which enhance rainfall infiltration and reduce the surface runoff.

The primary objective of in situ methods is to enhance the water storage in the soil profile by improving infiltration of harvested rainwater in the cultivated area.

The commonly used in-stiu rainwater harvesting methods are:

(a) Broad bed and furrow system: It consists of broad beds of about 100 cm wide separated by sunken furrows of about 50 cm wide. The bed width can be varied to suit the site condition, crop geometry and management practices for cultivation. This technique is best suitable in deep black soils in areas with dependable rainfall averaging 750 mm or more.

(b) Ridges and furrow: Under this method, the principle is to increase sub-surface soil water content by improving surface storage of rainwater through ridegs and furrows in the field. When the ridges and furrows are made along contour, the method is called contour ridges and furrow system. It is generally done on the land with slope up to 5% and rainfall of 350–750 mm. Crops are planted on both sides of the furrow.

(c) Contour trenching: In this technique, trenches are artificially dug along the contour lines of the crop field. Water flowing down the hill is retained by the trenches and get infiltrated to sub-surface layers which support in crop growth and yield.

(d) Terracing and Contour Bunding: Terracing and contour bunding which divides the hill slope into numerous small slopes, checks the flow of water, promotes absorption of water by soil and saves soil from erosion. But there is a limit to which bunding is an effective measure of soil conservation. When the slope is steeper than 8 per cent, bunding becomes expensive and less effective. However, terracing is suggested for the land with higher slope.

(e) Contour farming: It involves farming activities (ploughing, planting, cultivating and harvesting) across the slope instead of up and down the slope. The contour furrows act as mini barriers across the flow path of the runoff which increases the opportunity time, and enhance infiltration of rainwater into the soil profile. Contour farming is most effective on the moderate slopes of 2 to 7%.

(f) Microcatchment: Under this technique, the rainfall runoff from non-cropped area get collected in cropped area and improves soi water in the harvested area. Microcatchments are mainly used for growing trees or bushes. This technique is most suitable for arid and semi-arid areas with rainfall as low as 150 mm per annum.

Under ex situ methods, the rainfall runoff is conserved outside of crop field. For this, the mechanical structures such as farm pond, check dam etc are needed.

Farm ponds: Farm pond may be of embankment type or dug out type. Embankment type pond is preferable at the sites with some depressions on the drainage channels. In this type of pond, soil is removed from the depression and put to make an embankment to harvest the rainwater. In dugout pond, the pond is made in such a site of the field that it gets maximum runoff from natural flow. In this type of pond, the embankment is constructed in four sides with inlet and outlet structures.

Check dams: This type of structures are constructed in drainage channels of watersheds. The materials used for construction of these structures may be of locally available or of brick/stone-sand-cement composition.

Water conservation in canal commands

Canals constitute the second most important source of irrigation contributing 29 % of the total irrigated area in India. As some of the canals provide perennial irrigation and supply water as and when needed which saves the crops from drought conditions and helps in increasing the farm production. However, in most of canal commands the crop productivity is low compared to potential productivity, due to less quantity and unreliable water availability for cropping. In this situation, rainwater conservation and groundwater exploitation to safer limit are suggested. Further, the construction of auxiliary water harvesting structure to store the canal water when canal supply is there is needed for assuring water supply to crops in lean period in the command areas.

Groundwater Recharge

Groundwater is the vital resource meeting the water requirements of irrigation, domestic and industrial sectors of the country. The annual groundwater draft of the entire country for 2010-11 has been estimated as 245 billion cubic meter. Agriculture sector consumes 91 % and domestic and industrial sector combined 9 % of total annual groundwater draft. So proper development along with efficient management of groundwater will not create water conservation but also agricultural sustainability.

Continued withdrawal of water from a basin without a management plan could eventually deplete the groundwater resource. By regulating inflow and outflow from the basin an underground reservoir can be made to function beneficially and indefinitely. In order to increase the natural supply of groundwater, recharging of groundwater is utmost essential. It can be natural or artificial. Natural replenishment of ground water reservoir is a slow process and is often unable to keep pace with the excessive and continued exploitation of ground water resources in various parts of the country. This has resulted in declining groundwater levels and depletion of groundwater resources in such areas. So, artificial recharge besides natural recharge is encouraged for better groundwater resource development. Artificial recharge aims at augmenting the natural replenishment of ground water storage by some method of construction, by spreading of water, or by artificially changing natural conditions. A variety of methods have been developed, including water spreading, recharging through pits and wells, and pumping to induce recharge from surface water bodies.

The various methods for artificial recharge are described briefly as follows:

1. Water spreading: This is the most widely practiced methods for artificial groundwater recharge. It involves releasing water over the ground surface in order to increase the quantity of water infiltrating into the ground and then percolating to the water table.

2. Percolation ponds: These are artificially created surface water body submerging a highly permeable land area so that the surface runoff is made to percolate and recharge the groundwater storage.

3. Pits and shafts: Pits and shafts are used in areas where an impervious layer is encountered at shallow depths. Pits and shafts could break the impervious layer and maintain a high recharge rate.

4. Injection wells or recharge wells: These are used to recharge deep confined aquifers. Flow in such wells is the reverse of pumping wells. Injection wells are relatively costly to install and operate.

5. Induced recharge: Induced recharge refers to the withdrawl of water near a surface source like river so that seepage rate increases into the aquifers due to the lowered water table. This method is effective when the source is connected to the adjoining aquifer.

EFFICIENT UTILIZATION OF WATER

Along with water resource development, management of water judiciously and efficiently is needed for higher productivity and water productivity in agriculture of an area. The following practices can be adopted for improved irrigation efficiency and higher water productivity:

i. Proper irrigation scheduling: Irrigation scheduling is a water management strategy that reduces the chance of too much or too little water being applied to an irrigated crop. Proper irrigation scheduling involves method, timing and quantities of irrigation water to be applied. These criteria normally depend upon crop time, soil type and climate of the region. In water scarce areas, deficit irrigation and partial root zone drying irrigation works well to improve water productivity in crops.

ii. Land leveling and land configuration: This method increases the uniformity of irrigation by reducing slope of the land. Normally, leveling of land plays vital role in improving the efficiency of surface irrigation methods in crop field on mild or modulate land slope. Now a day the laser leveler is used for leveling the agricultural lands. Different land configuration practices (raised bed furrow system, furrow dikes etc) also helps in improving water productivity in crop production.

iii. Mulching and residue management: Mulching and crop residue conserve soil moisture by reducing evaporation in crop field. Plastic mulch performs better than organic mulch (grass, crop residue, etc.) in relation to conserving soil moisture in field, whereas organic mulch enhances soil fertility along with conserving soil moisture.

iv. Improved conveyance system and optimum plot size: Conveyance of irrigation water from source to field is important in improving irrigation efficiency under surface irrigation. For efficient conveyance, the lined channel and pipe line conveyance are necessary. Lining of the channel may be done using brick and cement or cement concrete. By using proper conveyance system, the loss through seepage and percolation reduces up to 30% compared with non-lined channels. Optimum plot size is also a factor for enhancing irrigation efficiency. The plot size depend upon soil type, land slope and stream size.

v. Drip and sprinkler irrigation system: Under drip irrigation, water is provided through pipe networks directly to the plant root zone by means of surface or sub-surface applicators or emitters. The application of fertilizers is also possible through irrigation. The irrigation system has following merits: (i) saves water and nutrients (ii) reduces labour cost (iii) land leveling is not required (iv) increases yield and quality of produce (v) reduces weed problem (vi) increases profitability in cropping. Drip irrigation is normally used for horticultural crops. The water saving and yield enhancement of some horticultural crops under drip irrigation is given in Table-1.

Table-1. Water saving and yield enhancement under drip irrigation

Crop	Water saving (%)	Yield enhancement (%)
Sugarcane	50	30
Cotton	55	30
Lady's finger	40	15
Brinjal	55	20
Ridgegourd	60	20
Cabbage	60	25
Grapes	50	90
Groundnut	40	70
Lemon	80	35
Papaya	60	75
Radish	73	15
Chilli	60	45

(Source: INCD, 1994)

Drip irrigation in capsicum

Sprinkler irrigation is suitable for closely growing crops. High pressure is required for operation of the system. Under the system, water saving takes place up to 50% with enhancement of yield up to 40% compared to that under surface irrigation.

Sprinkler irrigation in wheat

vi. Improved surface irrigation methods: Alternate furrow/ skipped furrow and surge irrigation are found as efficient irrigation methods. Under these methods, water can be saved up to 30% with marginal yield reduction of the crops.

CONCLUSION

In almost all regions of the world, water supply is the major constraint to crop production due to water demand for rapid industrialization and high population growth. The further scarcity of irrigation water for crop production should be checked for sustaining the food supply through efficient water conservation and management practices even in high rainfall areas. Moreover, the financial return per every drop of irrigation water should be enhanced while considering the best water use efficiency associated with any crop.