Water Management Strategies for Achieving Food Security

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Abstract

Water is a precious natural resource, a basic human need and prime national asset. Fresh water is the natural resource on which food security and the sustainability of eco systems depend. Rapid urbanization, large scale industrialization and population growth have affected the net availability of water in India & abroad. In order to attain food security, Rainwater harvesting by Watershed management practices is the need of the hour.

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1. Introduction

Water is a precious natural resource, a basic human need and prime national asset. Fresh water is the natural resource on which food security and the sustainability of eco systems depend. Rapid urbanization, large scale industrialization and population growth have affected the net availability of water in India & abroad. Article 25 of the Universal Declaration of Human Rights (1949) recognizes the right of everyone to adequate food. Article 11 of the International Covenant on Economic, Social and Cultural Rights (1966) and General Comment 12 of the Committee on Economic, Social and Cultural Rights further elaborate the responsibilities of all State Parties to recognize the right of everyone to be free from hunger. The concept of FOOD SECURITY literally grew from these deliberations. The FAO proposed this concept as “availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food...
consumption and to offset fluctuations in production and prices” in their Universal Declaration on Eradication of Hunger and malnutrition. (World Food Summit 1974, ) Later in World Bank Report” Poverty and Hunger”(1986) “access of all people at all times to enough food for an active, healthy life” “Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (1996 World Food Summit ) MDG 1 also calls for halving hunger and poverty by 2015 in relation to 1990. However, few economic rights are violated on such a scale as food and nutrition rights as was observed by Mary Robinson (1999), the Former United Nations High Commissioner for Human Rights.

2. Food security and its indicators

“Food security is physical, social and economic access for all people to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. (FAO )”

Food security requires that:
- sufficient quantities of food of appropriate quality be available – a production issue;
- individuals and households have access to appropriate foods – a poverty issue; and
- nourishment is taken under good conditions, including regular meals, safe food, clean water and adequate sanitation – a public health issue

2.1. FAO estimate for Food Security

During the second half of the 20th century, world population had a twofold increase, agriculture doubled the food production and consequently developing countries increased per capita food consumption by 30 percent. The world’s growing population will require about 50 percent more food by 2030 compared to 1998. The MDG-1 targeted to reduce the proportion of people who suffer from hunger by HALF between 1990 and 2015. But the assessments made in 2011 shows that the average number of people suffering from lack of adequate food over these years remains disconcertingly high at 840 million worldwide. Trends in the prevalence of undernourishment remain unchanged with South-Eastern Asia, Eastern Asia and Latin America and the Caribbean.

2.2. Global Hunger Index

The Global Hunger Index designed to comprehensively measure and track hunger globally and by country and region is based upon
- (a) Undernourishment: the proportion of undernourished as a percentage of the population
- (b) Child underweight: the proportion of children younger than the age of five who are underweight
- (c) Child mortality: the mortality rate of children younger than the age of five

In GHI -2011 India stands at a dismal 67th position in the ALARMING category along with nations like Angola, Bangladesh, Djibouti, Ethiopia, Haiti, Niger etc. The neighboring nations like Nepal, Sri Lanka, Myanmar etc. are in better position in Serious category. In last twenty years, though India’s GHI decreased from 30.4 to 23.7 still it presents a very sorry state of affairs on food security. The average calorie intake in rural India has also gone down from 2240 cal in 1980 to 2047 cal in 2005 and the scenario is similar in urban
India too. The MoAgr-GoI(2009) estimates for 2020 for food grain is about 250 MT which a very tough target keeping in view the production performances between 2008 and 2011 showing reduction in Food Surplus from 15 MT to 5 MT.

3. Agriculture and Water

Attainment of self sufficiency in food grains at the national level is one of the country’s major achievements in the post-independence period especially taking into account the India’s share of global land and water resources of 2% and 4% respectively and to cater the requirements for 17% of the world’s population. After remaining a food deficit country for about two decades after independence, India became largely self-sufficient in foodgrain production at the macro level. There have hardly been any foodgrain imports after the mid-1970s. Foodgrain production in the country increased from about 50 million tonnes in 1950-51 to around 250 million tonnes in 2010.

About 70 percent of gains in cereal production are expected to come from irrigated land as irrigated land in developing countries are expected to increase by 34 percent by 2030, but the amount of water used by agriculture will increase by only 14 percent, thanks to improved irrigation practices. Globally, rainfed agriculture is practiced on 80 percent of cultivated land and supplies more than 60 percent of the world’s food. However, while feeding the world and producing a diverse range of non-food crops such as cotton, rubber and industrial oils in an increasingly productive way, agriculture also confirmed its position as the biggest user of water on the globe. Irrigation now claims close to 70 percent of all freshwater appropriated for human use. Agriculture is by far the biggest user of water, accounting for almost 70 percent of all withdrawals, and up to 95 percent in developing countries. Irrigation provides a powerful management tool against the vagaries of rainfall, and makes it economically attractive to grow high-yield seed varieties and to apply adequate plant nutrition as well as pest control and other inputs, thus giving room for a boost in yields. 40% of the world’s agricultural production comes from 20% of the cultivated land under irrigation. The water needed for crops amounts to 1 000-3 000 cubic meter per tonne of cereal harvested. The Rainfed Agriculture has dominant role in the economy of developing countries like India where they serve as the most important component for sustainable livelihood. Non-irrigated (rainfed) agriculture depends entirely on rainfall stored in the soil profile and accounts for some 60 percent of production in the developing countries. In rainfed agriculture, land management can have a significant impact on crop yields in which the overriding requirement is to harvest sufficient foodstuffs to ensure nutrition of the household through to the next harvest. This objective may be reached with robust, drought-resistant varieties associated with low yields. A water footprint is a calculation of the water needed for the production of any product or service from start to finish.

On the global front the availability of water for food production is one of the major limiting factor due to its finite reserve.

The Water Footprints during the agriculture and associated activities can be classified as follows:

- Green water footprint: The volume of rainwater that evaporates during the production of goods; for agricultural products, this is the rainwater stored in soil that evaporates from crop fields.

- Blue water footprint: The volume of freshwater withdrawn from surface or groundwater sources that is used by people and not returned; in agricultural products this is mainly accounted for by evaporation of irrigation water from fields.

- Grey water footprint: the volume of water required to dilute pollutants released in production processes to such an extent that the quality of the ambient water remains above agreed water quality standards.
The management of water resources is a major policy issue in attainment of food security goals. The Dublin Principles of Water Resource Management provides the guiding principles as well as best practices methodology in this endeavour which are as follows:

**Principle 1:** ‘Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment’

**Principle 2:** ‘Water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels’

**Principle 3:** ‘Women play a central part in the provision, management and safeguarding of water’

**Principle 4:** ‘Water has an economic value in all its competing uses and should be recognized as an economic good’.

Increasing the productivity of agriculture through better water control clearly makes a significant impact. Farmers can use a variety of simple and affordable water management techniques to increase their yields and reduce their vulnerability to erratic rainfall or drought. During irrigation only 45% of the water is used directly by the plants. Effective water management through low water based irrigation techniques like sprinkler, drip irrigation etc. are helpful in productivity enhancement of crops. There is wastes of water when we waste food and unfortunately 30% is wasted between the farm gate and the market in less developed economies. In industrialised economies families throw 30% of purchased food away.

### 4. Food Security and Constitutional Provisions in India

Ensuring food security ought to be an issue of great importance for a country like India where more than one-third of the population is estimated to be absolutely poor and one-half of all children malnourished in one way or another. The food security issues have been addressed in the Indian constitution. The Art.47. dealing with the Directive Principles of State Policies emphasizes that The State shall regard the raising of the level of nutrition and the standard of living of its people and the improvement of public health as among its primary duties. As ameliorative measure the Art.48. suggests that The State shall endeavour to organise agriculture and animal husbandry on modern and scientific lines. The Supreme Court of India has also recognised the right to food and nutrition as integral to the right to life The Art.51A. lay the duty of every citizen of India—

**Right to access of food security**

Every person shall have physical, economic and social access, at all times, either directly or by means of financial purchases, to quantitatively and qualitatively adequate, sufficient and safe food, which ensures an active and healthy life.

**Life-Cycle Approach**

Food Security and the obligations created under this Act of appropriate governments, shall be based on access to adequate and appropriate food throughout the life cycle of a human being from pregnancy to old age so as to ensure a healthy body and mind.

### 5. Food Security and Water Resource concerns

The food security requirements in India with rising population needs increase in productivity of the crops and future lies in the most effective water management. It has been estimated that in order for growing about 500 million tonnes food crops, 800 BCM and for providing drinking water as well as other domestic and municipal use for rural and urban population about 100 BCM will be required in 2050. However the global warming may affect the agriculture due to these five main climate change-related drivers viz. temperature...
rise, precipitation patterns, including rainfall and snow, incidence of extreme events (floods and droughts), sea-level rise and increasing atmospheric carbon dioxide content. The resultant effects will be manifested as irregular rainfall distribution, lowering of number of rainy days, more frequency of cyclonic storms providing larger volume of precipitation in smaller duration, frequent flash floods etc. The sea level increase will affect the floods plains of the river valleys which are the main grain producing zones of the country. Even semi inundated areas will be affected by salinization of the soil. The Agriculture-based livelihoods are likely to be impacted most by climate change. The most vulnerable people are the poor, landless and marginal farmers in rural areas dependent on isolated rainfed agricultural systems as small changes in rainfall can result in locally significant changes in surface water and groundwater resource availability. It has been evidenced that the most of the food emergencies are either due to drought or flood. In rainfed agriculture, land and water resource management holds the key for sustainable agricultural development. Land management can have a significant impact on crop yields since proper land preparation leading surface runoff to infiltrate close to the roots improves the conservation of moisture in the soil. Various forms of rainwater harvesting can help to retain water in situ. Rainwater harvesting not only provides more water for the crop but can also add to groundwater recharge and help to reduce soil erosion.

The traditional water harvesting systems, too, have shown their efficacy in this endeavor, some of which are:

- **Rapat**: A rapat is a percolation tank, with a bund to impound rainwater flowing through a watershed
- **Jhalaras** (*in Rajasthan and Gujarat*): rectangular tanks having steps on three or foursides; the steps are built on a series of levels
- **Aahar-Pynes**: Aahar is a catchment basin embanked on three side, the 'fourth' side being the natural gradient of the land itself. Pynes are artificial channels constructed to utilize river water in agricultural fields
- **Johads**: small earthen check dams to capture and conserve rainwater, improving percolation and groundwater recharge. Starting 1984, the last sixteen years have seen the revival of some 3000 johads spread across more than 650 villages in Alwar district, Rajasthan. This has resulted in a general rise of the ground water level by almost 6 metres and a 33 percent increase in the forest cover in the area
- **Zings**: water harvesting structures found in Ladakh. They are small tanks, which collects melted glacier water; the system comprises of a network of guiding channels that brings the water from the glacier to the tank

The modern methods of rain water harvesting are Contour Terrace, Contour Bunding, Check dams, Percolation tank, Recharge Shaft etc are highly effective in water resource management. The rampant use of groundwater for irrigation is another important determinant of food security. Excessive pumping of groundwater can impact the water quality through increased concentrations of naturally occurring compounds that become dangerously high as the amount of water dwindles. In India, fluorosis potentially threatens or directly affects millions of people. Groundwater quality may also be affected by increasing salinity levels as a result of saltwater intrusion into their coastal aquifers overuse of surface water reduces the natural flow and increases the concentration of harmful substances present in the water due to pollution. India is already a leader in groundwater abstraction with annual withdrawal of 250 km³, followed by China and USA with abstraction rate of 100 km³ per year and this trend is certain to increase for more food production and consequently the groundwater level will be lower drastically as being observed in almost all parts of the country. This calls for more emphasis on rain water harvesting for the recharge of groundwater coffer as envisaged in the Agenda 21 for sustainable development. The Watershed development programs can provide surface water for the irrigation and side by side will recharge the groundwater coffer for providing in situ...
subsurface water harvesting as well as increase in the base flow for providing semi perennial character to the rain fed river systems. The watershed program may be focused on developing wasteland/degraded lands, drought prone and desert areas on watershed basis, restoring ecological balance by harnessing, conserving and developing natural resources viz. land, water, vegetative cover and promoting overall economic development and improving the socio economic condition of the resource poor and disadvantaged sections inhabiting the programme areas.

In the plateau and hilly areas like Jharkhand (India), a hard rock terrain, agriculture still provides sustainability to more than two third of her populace. Being a agro climatic area of rainfed drainage system, the baseflow management is very important for increasing the cropping intensity in the state. The wasteland and other fallow accounts for 23% of the land resource which can be effectively utilized for watershed management practices with their characterization and prioritization help in amelioration of such situations as they are mainly situated in the uplands and degraded forests (Kumar and Kumar 2011). Such efforts, without encroaching the existing agricultural land, can help in increasing the cropping intensity with the present precipitation in the endeavor for making the state hunger free.

References

[5] Indian Constitution