Importance of Agricultural water productivity

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ABSTRACT: (9 pt)

The term water productivity is the value of product over volume of water delivered for crop production. The value of the product might be expressed in different terms (biomass, grain, money). Crop requires water for evapotranspiration. However crop water production is governed only by transpiration. Evaporation does not contribute directly to crop production. It is difficult to separate transpiration from evaporation from the soil surface. In irrigated agriculture in saline areas, the leaching requirement, i.e. the amount of water that needs to percolate to maintain root zone salinity at a satisfactory level, should also be included together with evapotranspiration in the amount of water that is necessarily depleted during plant growth. Water losses from seepage and field percolation also reduce the water use efficiency. In this paper importance of all above factors in agriculture production and solutions to overcome these problems are disused.

INTRODUCTION

There is an urgent need to improve water use efficiency in irrigation sector. The Agriculture sector uses 70 percent of all fresh water withdrawals globally, and up to 95 percent in several developing countries, to meet the present food demand. Historically, large-scale irrigation projects have played a major role in ensuring food supply for a rapidly growing population, and in contributing to poverty alleviation by providing food security, protection from flood and drought, and expanded opportunities for employment. In general it can be stated that irrigated agriculture is a major device for economic growth and poverty reduction. Groundwater has played a major role in meeting domestic and irrigation demands especially in arid and semi-arid regions. In this region water scarcity is almost prevalent though massive use of groundwater has been made, due to which ground water is excessively depleted. Irrigated agriculture sector gets badly affected by water shortage and increased scarcity, resulting in a decreased capacity to maintain per capita food production while meeting water needs for domestic, industrial and environmental purposes. In general only 30 to 50 percent of the water diverted for irrigation is actually used by crops. Best management practices and technology for irrigated and rain fed farming systems (not only limited to water-related practices) have still to play a significant impact on the productivity of water. Skill has not been fully developed at adaptable level in the optimization of water use and improves the water productivity. Therefore, in this sector, there is wider range of options to cope with water scarcity exists.

CROP WATER NEED

Crop water productivity **WP** is expressed in kg/m³ is expressing the amount of marketable product (e.g. kilograms of grain) in relation to the amount of input needed to produce that output (cubic meters of water). The water used for crop production is referred to as crop evapotranspiration. This is a combination of water lost by evaporation from the soil surface and transpiration by the plant, occurring simultaneously. Distinguishing between the two processes is difficult. Representative values of WP for cereals at field level, expressed with evapotranspiration in the denominator, can vary between 0.10 and 4 kg/m3

The water requirement of plant

Transpiration is the basic need of Plants. It cannot be reduced. If the water supplied to the plant is more or less than the transpiration then it will affects the productivity. With the conventional methods of water application, considerable amount of the water supplied to the plants is lost due to evaporation. Drip and sprinkler irrigation methods are presentably known as the efficient methods, but it is not true. The basic principal of the drip is to wet 30% of the surface area below the plant's canopy. Through this wetted area evaporation is bound to occur. Our aim is to reduce the evaporation losses to zero.

In fact, the transpiration requirement of plant is about 15% of pan evaporation rate **PER.** Assuming PER at 12 mm, then the transpiration requirement of a pant would be 2 Liter/day/Sq. meter of canopy area. The irrigation water requirement of conventional water application method will be the sum of needs of evaporation + transpiration. This comes out to 8 to 10 liters per day per sq. meter canopy area (PER assumed at 12 mm). Thus we are supplying 3 to 4 times more than the actual need. There is a scope to reduce the evaporation loss.

INNOVATIONS TO REDUCE EVAPORATION LOSSES

Depending upon the canopy area of the plants, 4 to 8 pit of 20, liters storage capacity are to be excavated along the periphery of the canopy, where the tinny white roots exists. These pits are refilled with mixture of fertile soil and organic and inorganic fertilizers. Thus bulbs of fertile soil are formed below the soil surface. Cylindrical earthen pot known as diffuser is kept at the centre of the pit, in such a way that its bottom lies 10 cm below the surface. The water storage capacity of this diffuser is 3 liters. It has 5 holes at the bottom and the top is open. A dripper is kept over it, in such a way that the dripper water is discharges in to the diffuser. The irrigation water supplied to the plant is directly goes to the fertile bulb and 10 cm deep below the soil surface, through the diffuser. The top 10 cm thick soil layer acts as mulch, and the evaporation is checked efficiently.

Increase in Agricultural Productivity

The water storage is done in the zone containing the great part of root system of the tree or the plant. The plant/fruit growth is directly proportional to nutrients absorbed by plant. 70to 100 grams biomass growth is obtained per one gram nutrients absorption. Nutrients are absorbed through water, taken in to fulfill transpiration requirement of the plant. On an average the plant absorbs 2 liters of water per sq. m. leaf area (canopy) per day. Hence the quantity of nutrients absorbed is determined by the concentration level of nutrients in water at the root zone. In case of diffuser technology, water and nutrients are fed together at the root zone level in a predetermined suitable proportion so as to get maximum advantage of transpiration led absorption of water.

Productivity of water

This is the most important principle the agriculture. The productivity of all other inputs e.g. fertilizer, labor; land etc. is directly in proportion to the productivity of water. Unfortunately many of us in Agriculture field is aware of this principle and hence there is poverty. In India systems and measures are now developed to attain the productivity of water at the highest level. By adopting diffuser technology, one cubic meter (1000 liters) of water earns $3 to 4 (In Drip system only $ 1 are earned per cubic meter of water). Thus the productivity of water concept solves the water problem as well as improves the productivity of all inputs and reduces per capita cost of every input.

SALINITY IN IRRIGATED AGRICULTURE

Salinity from irrigation water is also greatly increased by poor drainage and use of saline water for irrigating agricultural crops. Salts concentrate in irrigated soils through the process of evaporation. In saline soils agricultural productivity is declines and land become infertile, if ignored. Extra watering is to be done to such soil to leach salt deep into the ground, creeks or rivers. This water is to be taken in to account while calculating the irrigation water requirement.

Correcting salt-affected soils

Salt-affected soils can be corrected by: Improving drainage, Leaching, reducing evaporation, applying chemical treatments and a combination of these methods. In soils with poor drainage, deep tillage can be used to break up the soil surface as well as clay pans and hardpans, which are layers of clay or other hard soils that restrict the downward flow of water. Tilling helps the water move downward through the soil. While deep tillage will help temporarily, the parts of the soil not permanently broken up may reseal.

Leaching can be used to reduce the salts in soils. You must add enough low-salt water to the soil surface to dissolve the salts and move them below the root zone. The water must be relatively free of salts (1,500 - 2,000 Parts per million total salts), particularly sodium salts. Applying residue or mulch to the soil can help lower evaporation rates. Application of water below the soil surface as stated in diffuser technology is a good to reduce the evaporation. Before leaching saline-sodic and sodic soils, you must first treat them with chemicals, to reduce the exchangeable sodium content. To remove or exchange with the sodium, add calcium in a soluble form such as gypsum.

CONCLUSION

The key principles for improving water productivity at field, farm and basin level, which apply regardless of whether the crop is grown under rain fed or irrigated conditions, are, increase the marketable yield of the crop for each unit of water transpired by it, reduce all outflows (e.g. drainage, seepage and percolation), including evaporative outflows other than the crop stomatal transpiration; and increase the effective use of rainfall, stored water, and water of marginal quality.

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