

Water-energy-food nexus:

Issues and alternatives

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During the UN sustainable development agenda of SDGs (SDG 6) gives a clear recognition that, ensuring availability and sustainable management of water for all by 2030 is essential for achieving development ambitions. By definition, this means leaving no one behind. However, today, billions of people are still living without safe water – their households, schools, workplaces, farms and factories struggling to survive and thrive. Tackling the water crisis by addressing the reasons, why so many people are being left behind is the focus the theme of 2019 World Water Day. This paper synthesises the issues and highlights the necessary policy dimensions in the context of agriculture and its water use.

Key words: Energy, Food, Water

IN India, water scarcity is undoubtedly a long-standing issue considering its use for agriculture as well as for basic needs. World Resource Institute (WRI) estimated that 54% of the country's area faces extreme water stress. Agricultural sector is responsible for 78% of water use in the country. With the increasing population, the total demand for food grains will increase to 375 metric tonnes. With increase in per capita income, shift in consumption pattern towards high water demanding crops, over-exploitation of groundwater is imminent. Presently, there are over 20 million wells pumping water with free power supply, subsidised by the Government. This has aggravated the issue of declining water table (0.4 m/year), while encouraging wastage of water in many states. The existing cropping pattern does not ensure the sustainable use of water resources. The mounting pressure on water resources justifies that sustainable use of water resources is fundamental priority in Indian agriculture.

What, Where and How to produce?

The water-food-energy nexus is

crucial in the sustainability forefront. The pervasive linkages between these domains demand a deliberate approach to ensure sustainable agricultural production without compromising water and food security. Agriculture in itself is resource-consuming. The clear challenge is to produce higher yield per unit of natural resource invested. Water being the most limiting factor in agriculture, the rule of thumb for sustainability is growing more food per drop.

Rice and wheat are inimitable from food security point of view. However, these two crops along with sugarcane consume more than 80% of water available for irrigation in the country. The alarming increase of water table depth, mainly in areas with intensive rice-wheat cropping system during recent years has questioned the sustainability of the traditional rice-wheat system. Extensive rice-wheat system in traditional belts of Punjab and Haryana has not only led to reduction in agricultural output but also to salinity issues in the ground water aquifers, shortage of potable water,

leading to extensive socio-economic stress. Traditional rice producing belts are environmentally unsustainable, as depicted by high water footprints. Studies projected that if paddy-wheat cycle continues, the water table depth in central Punjab will fall below 70 feet in 66% area, below 100 feet in 34% area and below 130 feet in 7% area. Though the late rice sowing (from May to June) implemented by the Government of Punjab was a vital policy initiative, it shortened the window between the *Kharif* rice and *Rabi* wheat. This policy initiative resulted in massive amount crop residue burning, leading to excessive environmental damage to Punjab, Haryana and neighbouring cities like Delhi.

The high water foot prints of rice and wheat in traditional belts streamlines the much needed water availability based cropping pattern realignment across the zones. India must review its current trend of producing water intensive crops, such as sugarcane and rice in water scarce areas. Shift of rice cultivation from Punjab to Eastern India may reduce

the burden on fresh water sources to a certain extent. Eastern India has 2-3 times more rainfall as compared to Punjab. As per the study by NABARD, the irrigation water productivity of rice and wheat is relatively higher in eastern states. The region also holds unexploited quality ground water aquifers and irrigation sources required for water-guzzling crops. Crop residue management is also less of an issue since the climatic factors of eastern India is also favourable for mushroom cultivation, which uses straw as its growth substrate.

The methods of cultivation also play a crucial role in sustainable cultivation. Technology assisted cultivation in the form of seed varieties or method of sowing or improved cultivation practices is advocated for long term sustainability. For example; practices like direct seeding, alternate wetting and drying in rice, mulching in crops, raised bed cultivation in soybean help reducing both carbon and water footprint to a great extent. Studies conducted by CIMMYT shows that improved cultivation practice like intermittent flooding instead of continuous flooding reduces the global warming potential from 3,500 kg CO₂/ha to 900 kg CO₂/ha. Besides higher irrigation efficiency (up to 75% in case of sprinkler and up to 90% in drip system as compared to 40% of surface system), sprinkler and drip irrigation systems have mitigation potential of 1,276 kg CO₂e/ha/year. Similarly, practices like conservation agriculture in rice-wheat system reduces its global warming potential from 6,300 kg CO₂/ha (traditional) to 4,900 kg CO₂/ha. Conservation agriculture in maize reduces the energy and irrigation water by 48% and 71% respectively as compared to traditional cultivation. Adoption of zero tillage has a mitigation potential of 1,796 kg CO₂e/ha/year. Scientific residue management instead of crop residue burning mitigates 522 kg CO₂e/ha/year of GHG.

Another focal point should be the post-harvest food wastage. Every unit of food wasted leads to excess carbon and water foot print to produce same

unit of food for consumption. An estimate provided by Indian Council of Agricultural Research showed that an annual value of harvest and post-harvest losses of major agricultural produces at the national level was to the order of ₹ 92,651 crore, calculated using production data of 2012-13 at 2014 wholesale prices. However, in developing countries like India, food loss occurs at early stages of food value chain associated with poor infrastructure, storage and transport facilities.

The greener diner

Dietary diversification is also important as crop diversification. NITI Aayog report reveals that India is self-sufficient in food with an annual production of 750 million tonnes with a per capita availability of 1.6 kg/day. However, 45% of the dietary consumption is comprised of cereals, with water guzzling crop such as rice and wheat. Nutrition-wise, coarse grains like Bajra, Jowar, Maize and Ragi have energy and nutritive value in terms of the major cereals rice and wheat. These nutri-cereals require much less water as compared to rice, wheat and sugarcane. The food subsidies provided to the consumers (PDS, mid-day meal) are focused on these major cereals.

Sustainable policies

Food production of the country is now sufficient to feed the entire population and the surplus management is currently a rising issue. Hence, the policy focus on sustainable agriculture while analysing the impact of any activity on natural resources and ecosystem as a whole is necessary. Agricultural cropping pattern needs to be rearranged based on resource availability and foot prints. Current imbalance in cropping pattern and water availability is associated with the support on pricing aspect (both input and output pricing) and assured procurement. Gradual withdrawal of input subsidies (water and power) in the over-exploited regions and strengthening the procurement system in the eastern regions is recommended to reduce

the burden in the north-western belts. Inclusion of environmental footprints (water and carbon) in determination of MSP may be one way of addressing the sustainability issue. Water productive crops such as pulses, linseed and mustard should be advocated in water stressed belts. Strengthening of post-harvest management, crop-wise infrastructure, storage and logistic facilities for all farmer size group categories to minimise food wastage needs be considered. On the consumption side, food diversity in terms of inclusion of nutri-cereals with same amount of nutritive value and less water foot print need to be promoted. The export policy needs to be framed to minimise the virtual water flow or export of water in the form of agricultural commodities.

SUMMARY

In India, water scarcity is undoubtedly a long-standing issue considering its use for agriculture as well as for basic needs. Agricultural sector is responsible for 78% of water use in the country and demand for the sector will increase further with increasing population and transformation of diets. This article highlights issues is water-energy-food nexus and suggest technological and policy options for sustainable use of water. The high water foot prints of rice and wheat in traditional belts streamlines the much needed water availability based cropping pattern realignment across the zones. Technology assisted cultivation in the form of seed varieties or method of sowing or improved cultivation practices is advocated for long term sustainability. The higher irrigation efficiency sprinkler and drip irrigation systems and conservation agriculture, not only helps in reducing water footprints but also have potential to mitigate GHG emission. Management of post-harvest food wastage will also play significant role in reducing environmental footprints.

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