Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 03, Issue: 05 (SEP-OCT, 2023)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Water Management in Agriculture

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Water is a fundamental natural resource that is the basis of natural and all human activities. Water as a system is quite complex and cuts across the boundaries of physical, geographical, and social systems. Such complexity requires understanding and addressing challenges in the water sector holistically. Planning, development and management of water resources need to be governed by a common integrated perspective considering local, regional and state contexts.

Water is fundamental to life, livelihood, food security and sustainable development - but over years scarcity of water is becoming a major concern in the state and in the country. It is evident that agriculture is the biggest consumer of water and the large areas in agriculture depend on surface or groundwater for irrigation. Irrigated agriculture is, on average, at least twice as productive per unit of land as rainfed agriculture (World Bank, 2022). Use of groundwater, especially which is extracted through tube-wells, for agriculture has rapidly grown in significance over the past many years.

Green Revolution encompassing several components such as hybrid and high-yielding varieties of seeds, tube well irrigation, intensive use of chemical fertilisers and pesticides has added to jeopardizing water quality and quantity as the excessive withdrawal of water from aquifers has led to falling water tables and with fluoride, arsenic and even uranium, being found in groundwater deteriorate the quality of water. Today, the overuse and indiscriminate use of pesticides is destroying the very ecosystem in which agriculture is embedded. Although modern formulations are relatively safe to non-target species but pesticide residues can persist in the environment and agricultural crops producing long-term negative effects on the health of humans and animals and stability of ecosystems. Therefore, pesticides are taking a heavy toll of human health, especially the health of farming families and labourers (migrant and local) as seen below (Kalyabina, 2021)

Mono-cropping system has led to more water use. Analysis of water level data indicates a decline in groundwater level in about 34% of wells in Madhya Pradesh, 18% wells in Bihar, 26% wells in Uttar Pradesh, and 59% wells in Rajasthan whereas the remaining wells registered a rise in groundwater level (Jain, 2022).The policy of providing free electricity for irrigation pump sets has aggravated the

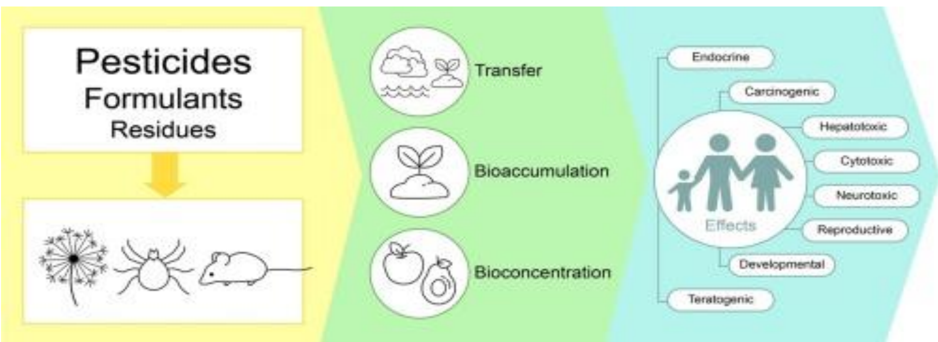

Figure 9 Effect of pesticides residue in environment and human health

groundwater depletion problem. At the same time, farmers complain that electricity supply is so unreliable that they are forced to over-irrigate whenever it is available. If free electricity is replaced by highly subsidized solar photovoltaic-based (PV) pump sets, the situation will not change. The farmer will now have a reliable and almost free source of electricity for pumping groundwater.

Suggestions

1. Improve the sustainability of farming while maintaining low water demand, by gradually moving away from chemical agriculture towards sustainable agriculture-There is need for a 'holistic' approach, such as agro-ecology, agro-forestry, climate- smart agriculture and conservation agriculture that protect and enhance the natural resource base, while increasing productivity such as:-

- Zero Budget Natural Farming
- Organic farming
- Low external input sustainable agriculture (LEISA),

2. Incentivising shifts in the Cropping Pattern - It is known that the water requirement of jowar, ragi and tur is a mere15% to 30% of the water requirement of paddy. Therefore, what is required is a major shift in cropping from water-intensive crops like wheat and paddy to millets (bajra, jowar, kodo-kutki and other millets) and pulses (tur, chana, urad, moong). The health benefits of this shift will also be significant.
3. Improving Irrigation Efficiency - There is need to increase the water use efficiency in Indian command areas through

a) Expansion of drip and sprinkler irrigation to reduce water use
b) Facilitating adoption of System of Rice Intensification (SRI), Alternative Wetting and Drying (AWD) and Direct Seeded Rice (DSR) technologies in farming
c) Finally, the possibility of pipe-based irrigation supply
d) Charging for conjunctive use of groundwater

4. Integrated management of groundwater, watersheds and minor irrigation tanks - The idea of watershed development is a great solution to the precarious nature of rainfed farming in drought-prone or semi-arid areas. Hence, the ongoing efforts to rejuvenate/repair tanks, treat watersheds or enhance local water harvesting in other ways (e.g., using farm ponds) need to be linked with groundwater regulation in an overall integrated water management framework. And we also need to understand the lithological setup constituting the aquifer along with necessary recharge structures.

5. Break the groundwater-energy nexus, while ensuring that substituting grid-based electricity supply - To address the groundwater depletion problem in relation to free electricity provision now require some groundwater regulatory system.

6. Ensure better utilization of the irrigation potential already created in major and medium irrigation projects through improved participatory management of water in irrigation commands.

Thus, to sum up, water management in agriculture depends critically on water conservation as well as efficient water usage management like improved water delivery systems to provide adequate on-demand service as well as use of advanced technologies (i.e. soil moisture sensors and satellite evapotranspiration measurements). Resolving the challenges of the future requires a thorough reconsideration of how water is managed in the agricultural sector, and how it can be repositioned in the broader context of overall water resources management and water security.