

## Management of Water in Agriculture

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At the outset it is mentioned that the discussion revolves mainly around groundwater and tank systems with a brief mention on canal irrigation. Management of rainfed crops is excluded in this presentation.

The irrigated area increased over the last 5 decades from 20.85 Mha to 57.05 Mha. But the points of concern is the enormous grown in wells, tube wells in particular during the period.

Sl. No.	Year / source	Irrigated area ('000 ha)				No. of wells (000's)	
		Canal	Tank	Well	Net irrigated area	Open	Tube
1	1950-51	8295	3613	5978	20853	3860	5.4
2	1983-84	16764	3533	19392	41949	8742	3407
3	1998-99	17741	2943	33093	57053	10501	6838

The International Water Management Institute estimates that there are over 10 million tube wells as of now and 1.0 million are being added every year in the country. The concern is not only on the numbers, but also not on the quality of groundwater in different places and the depletion levels in groundwater extraction.

Coming to the quality, CSSRI, Karnal indicated the following picture for the country.

Quality index	Areas of concern
Saline	West Rajasthan, Arid and dry semiarid Karnataka, Coastal AP, Coastal Orissa and West Bengal, Kotah region (Rajasthan), Pockets in Tamil Nadu
High SAR / RSC Saline water	Rajasthan
Alkali water	East Rajasthan, several parts of UP, Punjab, Haryana, Vidarbha, East Telangana, Parts of Rayalaseema
Fresh water overlying saline water	East coastal from Tamilnadu to Orissa
Saline water overlying fresh water	North-west Rajasthan

*SAR: Sodium Adsorption Ratio.*

*RSC: Residual Sodium Carbonate*

While the sandy soils can withstand high salinity, alkali waters are universally problematic. Further in the east coast any tube well if dug beyond the first 10-20 metres may lead to high salty waters damaging the heavy soil delta eco-system.

The present exploitation beyond 20 cm/year from 1981-2000 shown an alarming picture that as may as 211 districts in the country fall in this category.

States	Name of districts	Number of districts
Andhra Pradesh	Adilabad, Ananthapur, Chittoor, Kadapa, East Godavari, Guntur, Hyderabad, Kaminagar, Khammam, Krishna, Kurnool, Mahaboobnagar, Medak, Nalgonda, Nellore, Nizamabad, Prakasam, Rangareddy, Srikakulam, Vizianagaram, Visakhapatnam, Warangal, West Godavari	23
Bihar (including Jharkhand)	Dhanbad, Purna, Singhbhum	2
Chhattisgarh	Bastar, Bilaspur, Durg, Raigarh, Raipur, Rajnandgaon, Sarna, Sidhi	8
Gujarat	Ahmedabad, Amreli, Banaskantha, Bhanuch, Bhavnagar, Jamnagar, Junagadh, Kheda, Kutch, Mehsana, Rajkot, Surat, Surendranagar	13
Haryana	Ambala, Bhiwani, Faizabad, Gurgaon, Hisar, Jind, Kaithal, Kamal, Kurukshetra, Mahendragarh, Panipat, Rewari, Sonapat	13
Karnataka	Bangalore, Bellary, Belgaum, Bidar, Bijapur, Chikmagalur, Chitradurga, South Kanara, Dharwar, Gulbarga, Hassan, Kolar, Mandya, Mysore, Raichur, Shimoga, Tumkur, North Kanara	17
Madhya Pradesh	Betul, Bhand, Chhatapur, Chindwara, Damoh, Datia, Devas, Dhar, Guna, Gwalior, Indore, Jabalpur, Katni, Khandwa, Kharagone, Mandasaur, Morena, Narsinghpur, Neuch, Panna, Raisen, Rajgarh, Ratlam, Sagar, Sehore, Shajapur, Shivpuri, Ujjain, Vidisha	29
Maharashtra	Ahmednagar, Akola, Amravati, Aurangabad, Beed, Buldhana, Chandrapur, Dhule, Gadchiroli, Jalgaon, Jalna, Kolhapur, Latur, Nagpur, Nashik, Osmanabad, Parbhani, Pune, Ratnagiri, Satara, Sangli, Sholapur, Shindhadurg, Thane, Wardha, Yavatmai	25
Orissa	Angul, Balasore, Bargarh, Bolangir, Dhenkanjal, Gajapati, Ganjam, Jajpur, Kalahandi, Keonjhar, Khurda, Koraput, Malkangiri, Mayurbhanj, Nawapada, Nowrangpur, Sundargarh, Suvarnapur	18
Punjab	Amritsar, Bhatinda, Fatehgarh, Ferozepur, Jalandhar, Kapurthala, Ludhiana, Moga, Nawashahar, Patiala, Ropar, Sangrur	12
Rajasthan	Ajmer, Alwar, Bhilwara, Dungarpur, Ganganagar, Jaipur, Jaisalmer, Jhalawar, Jhunjhunu, Jodhpur, Nagaur, Pali, Rajsmand, Sikar, Udaipur	15
Tamilnadu	Coimbatore, Cuddalore, Dhamapuri, Kancheepuram, Kanyakumari, Chennai, Pondicherry, Pudukkottai, Sivagangai, Thanjavur, Theni, Tirunelveli, Thiruvalur, Thiruvannamali, Thiruvavur, Tuticoinn	16
Uttar Pradesh (+Uttaranchal)	Agra, Aligarh, Allahabad, Badaun, Bijnor, Bulandashar, Etah, Etawah, Farrukhabad, Fatehpur, Ghaziabad, Hardoi, Kanpur, Lucknow, Mathura, Meerut, Moradabad, Raibareli, Sharanpur, Unnao	20
West Bengal	Bankura, Bardhaman, Midnapur, N-24 Parganas, Purulia	

Evidently a self-control mechanism is needed in use of groundwater, through a participatory approach. The groundwater need be a real Common Pool Resource (CPR) to be managed by the people. This is happening in Zimbabwe from 2001 inspite of the present political situation. Then applying correctives in (a) overexploitation and (b) scientific use of poor quality waters would be feasible.

Coming to tank irrigation, it is said that there is a gradual decline in the command area of the tanks. Several are dysfunctional as the catchment areas are mutilated. And in quite a few, the new watershed programmes have come up, leading to capture of runoff to a high degree without relevance

to scientific principles. Not beyond 30% of the runoff should be captured. Instead several checkdam, rockfill dams, trenches, etc. have been put in place concurrently with large number of tubewells. Consequently the surface as well as subsurface inflows into the traditional tanks are curtailed. Hence the demise of the very system.

In orders to retrieve these dysfunctional tanks we need to (a) revive the traditional tank management systems and (b) repair and maintain these structures on a cascade basis as it would be cheaper besides involving the community at large. There would be a great scope in not only distributing the bounties in good rainfall years, but also share the distress in poor rainfall years.

Also there are a few governments (e.g. Andhra Pradesh, Tamil Nadu, Maharashtra) who have formed water users associations, displacing the traditional tank managers. In Andhra Pradesh alone about 100,000 families had been traditionally managing tank waters. It is also found that several such traditional systems of management have been dismantled with the governmental interventions in states like Himachal Pradesh, Jammu & Kashmir and Uttaranchal. This is a cause for concern in sustainable management of tank and other traditional rainwater harvesting systems (RWHSs).

Next is canal irrigation. Even though 43.30 Mha irrigation potential is created only 35.17 Mha is under irrigation. One of the main reasons for this malady is silting up of the reservoirs. That is why the catchment treatment is now taken up in the river valley projects (RVPs). As much as 78.75 Mha come in this category with various degrees of degradation. In a few places even the command area is not fully developed. Still lot more need be done in this area of development. The excessive/uncontrolled use of canal water and its consequences (waterlogging / salinization) are too well known.

Now a few state governments (e.g. Andhra Pradesh, Haryana, Tamil Nadu) have formed water users association for better management of canal water as well. They are said to be autonomous, but more often not. One issue with RVPs is the payoff. The economists view that best pay-off is when the RVPs are located in drier regions than in humid / high rainfall areas.

Added to this, is the comment of the World Bank. It states that in the 25 years to come the food prices may decline. If these projections hold true, investments in large irrigation systems may not be any more viable.

At the end it would be prudent to assume that irrigation water, particularly under wells and tanks would be scarcer with time. This is more so in scarcity regions (arid and dry semiarid – about ¼th of cultivated area). In such ecoregions water need be treated as *liquid gold*.

Thus it would be necessary to identify the relative order of tolerance to moisture stress. Pearl millet, safflower, sesame and groundnut have high tolerance. On the other hand maize has very low tolerance. In between come the other crops namely chickpea, urdbean, mungbean, pigeonpea, soybean, sorghum, cotton and sunflower. It should be the endeavour of the community to assess the possible scarcity and its magnitude and accordingly choose the crops for the season. It is needed to lay stress on the critical stages of the selected crops such that water is provided during such periods. As a principle the crop can stand delayed irrigation during vegetative phase but not during reproductive phase. Finally, the two general strategies for distribution of irrigation water during scarcity are 1) to distribute the water scarcity equitably among all the beneficiaries and 2) to distribute the water scarcity on zonal basis on rotation over the years.

Finally, as Kofi Annan said focus has to be on increasing productivity per unit of water – more crop per drop. Presently 80% of water supplies are for agriculture with a poor water use efficiency (WUE) of 35% in the case of canal water and 50% in the case of groundwater. Pressurized systems of irrigation can improve the WUE. But the needed equipments are expensive. Hence there is a need for conjunctive use of all waters (rainwater, groundwater and surface water) meeting the critical needs of the crops. Such an approach would lead not only to improved WUE, but also minimize undue pressure on use of water for agriculture.