SAPTAPADI (seven steps) IN GROUNDWATER IRRIGATION

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In this note, let us make a modest attempt to make our farmers and policy makers understand and appreciate how important our groundwater resource is, especially of interest of farmers / consumers in hard rock areas of India, which form 65% of the country's area. In Karnataka, hard rock forms 99% of state area. What is important for the farmers is to note that the recharge to groundwater from rainfall is hardly 10% in hard rock areas. Specifically this means that if we receive a rainfall of 750 mm, only 75 mm is the natural recharge and the rest drains away. Let us attempt to analyze the complexity of groundwater recharge further using basic arithmetic.

One acre of land is 4000 square meters. Say this land receives a rainfall of around 750 mm per year which is roughly the rainfall in the Eastern dry agroclimatic zone. Let us now find how much of this rainfall actually contributes to groundwater in relation to how much we pump for our irrigation through the saptapadee lessons.

Step 1: Convert 750 mm to meter using 750 mm = 75 cms = 0.75 meter

Step 2: Multiply the rainfall of 0.75 meter with 4000 sq meters of land which received that rainfall = 0.75M X 4000 Sq M = 3000 cubic meters

Step 3: One cubic meter is = 1000 litres of water. Therefore 3000 cubic meters = 3000000 litres of water

Step 4: one gallon of water = 4.54 litres. Therefore 3000000 litres of water = 660793 gallons

Step 5: Therefore 660793/22611 = 29 acre inches given 1 acre inch = 22611 gallons of water

Step 6: Thus, 1 acre with 750 mm of rainfall will have received 29 acre inches of rainwater. But only 10% enters as groundwater = 2.9 acre inches

Step 7: One irrigation well roughly extracts around 100 acre inches of water. This irrigation well may be serving say 3 acres on an average. Thus, for three acres, the total recharge is say 2.9 acre inches X 3 acres = 8.7 acre inches or approximately 9 acre inches. Thu, by contributing hardly 9 acre inches of water, towards recharge, farmer is pumping out 100 acre inches of water per well on an average every year leaving a gap of around 91 or say approximately 90 acre inches to be recharged by other areas consciously or unconsciously.

So what are the Spatha Padee measures for our farmers and policy makers?

Step 1 .We need to educate that a farmer withdrawing around 100 acre inches of groundwater from one irrigation well, is in fact getting groundwater from at least another 30 acres of land, since each acre recharges only around 3 acre inches of water per year.

Step 2: Unless groundwater recharge programs are undertaken on a massive scale, groundwater wells will face premature, / initial failures. And as these cannot be borne by small and marginal farmers, they continue to suffer due to lack of access to groundwater. Thus we need to educate and encourage the farmer to have groundwater recharge structure for his/her borewell on the farm by proper training and giving incentives. In addition, we can give benefits from different governmental programs to only such farmers who adopt groundwater recharge methods as given by experts in agricultural engineering.

Step 3: Draw lessons from the studies in the Dept of Agricultural Economics, UAS Bangalore funded by the Ford Foundation since 1995 till 2005. These indicate that (1) probability of well failure in eastern dry zone is around 0.4; (2) open wells/dug wells have virtually vanished due to the advent of deeper borewells over time (3) the amortized cost of groundwater per acre inch ranges from Rs. 300 to Rs. 400 without considering electricity cost (4) To lift one acre inch of groundwater, the electricity cost is around Rs. 100, which implies Rs. 10,000 per year per well for 100 acre inches (5) The total cost of groundwater inclusive of electricity ranges Rs. 400 to Rs. 500.

Step 4: What are the implications? (1) Our farmers and our Government, if they are really concerned about the precious and scarce groundwater should first think whether it is ethical for them to cultivate paddy / sugarcane using groundwater? (2) If they still decide to cultivate, they should realize that they are in fact using (40 acre inches X Rs. 500 per acre inch =) Rs. 20,000 worth of groundwater for every acre of paddy they cultivate and double that = Rs. 40,000 worth of groundwater for every acre of sugarcane they cultivate. These costs may vary for other parts of Karnataka, but still they may not vary substantially, since 99 % of Karnataka's aquifers are hard rock aquifers and the situation is alarming. Thus, instead of cultivating paddy and sugarcane using groundwater, they should think of low water crops which are even more economically viable than these two water giant but low profit crops.

Step 5: What is the solution? Farmers should realize that they are drawing a precious resource more than gold (since gold cannot be consumed) and hence use the groundwater in such a way that they make a 'wise' use rather than 'beneficial' use (as Ciriacy-Wantrup puts it). This means, farmers can use groundwater not for paddy, not for sugarcane, but for other crops, but not through flood or furrow or surface irrigation, but through micro or drip or sprinkler irrigation.

Step 6: The Government has virtually no scheme or program towards Irrigation Extension. They only have agriculture extension by the Agri /Hort Departments. Even Agri Extension efforts are dwindling since 'Gramsevaks' have vanished from Karnataka. The Government can make use of our Agri Engineering graduates including Diploma in Agri Engineering graduates by offering them hands on training in groundwater, linking them with the Dept of Mines and Geology which handles Groundwater. The Government must offer benefits from Developmental programs to only those farmers who comply with disciplined groundwater use such as benefits from different Governmental programs such as subsidies from Agri Dept / Horti Dept, and all other schemes. The disciplined groundwater use needs

to be certified by the Agri Engineering graduates / diploma holders who are certified as trained, and cross checked by Agri Dept officials including Dept of Mines and Geology.

Step 7: India is the largest pumper of groundwater in the world, pumping twice that of the USA and 6 times that of Western Europe. India has the largest number of irrigation wells being 25 million pumping around 75 acre inches of water per well. At present, groundwater resource is meeting 80% of the irrigation needs of India, while surface water meets the balance 20%. Even with the Dept of Mines and Geology, Irrigation Department, Minor Irrigation Department, BWSSB, Urban water supply Board, and all the laws such as Irrigation Act of 1965, Karnataka land reforms Rules of 1974, and the latest Groundwater Regulation and Control Act of 2011, groundwater resource has been treated as an 'orphan' since there is no agency to practically conserve (like Forest Department which exclusively deals with forestry). Dept of Mines and Geology is more concerned with Mines, since minerals are more 'valuable' than 'groundwater'. The state should develop a body (though it has initiated the Groundwater Regulatory Authority, with little teeth at ground level) to effectively address groundwater resource use similarly to how it addressed 'Agriculture' during the 'Green revolution', educating and creating awareness among farmers, measuring groundwater use using water meters (not electrical meters) and helping the farmer to understand the true value of groundwater so that s/he will use it efficiently, effectively, sustainably.