

Groundwater Management in Haryana and Emerging Issues

R.K. Khullar

IAS, Director, Agriculture, Haryana

Haryana has only 1.4% of India's geographical area, yet it is the second largest contributor to the central food grains pool. Practically every single inch of the cultivable land is sown, and 84% area is irrigated. Safe and piped drinking water is available in every village. Haryana is a water deficit state. The surface water available for utilization is extremely limited. The main perennial rivers of the composite Punjab, viz., the Sutlej, the Beas and the Ravi do not pass through the state of Haryana. The meager share of Haryana in the water in these rivers is being utilized through Bhakra Canal. The other source of surface water supply is river Yamuna, which is also shared with the U.P. The requirement of water in the state has been estimated as 31.90 million-acre feet (MAF) at 62% intensity against which the availability of water from all foreseeable resources i.e., surface and groundwater is 18.75 MAF, out of which 13.81 MAF is in use.

Ground water is the largest available source of fresh water. At present there are 6.07 lacs shallow and 3191 deep tube wells. Unfortunately more than half the underground water is brackish, which cannot be used for irrigation or drinking purposes. Only 35% of area is such where all the formations bear fresh water. This area under shallow conditions fluctuates from 10 to 15% as per the fluctuation in monsoon and flow in the canals and drains. This forms a floating layer over saline belts.

The state has varied hydro-geological characteristics due to which groundwater potential differs from place to place (Table 1). Increasing urbanization and growing dependence on groundwater for irrigation in the state has called for judicious and planned exploitation of the groundwater resources.

In June 2005, 48% of the area of the state fell within 10 m of depth to water table below ground level and 31% were between 10-20 m. The water-logged area with the shallow water table depth up to 3.00 m in the state was 2,59,429 hectares.

Groundwater levels are being monitored by the groundwater cell through its 2105 grid observation points. In general the average water level in the state from June 1974 to June 2005 has declined to 3.88 m whereas in the fresh belt areas the average decline is 6.80 m. The average rise in saline areas is 4.08 m. Districtwise historical depth to water variation for the period June 1974 to June 2005 is given in Table 2.

As regards quality, 48% area of the state falls under fresh, 8% under saline and rest under sub-marginal to marginal category of ground water during June 2005 based on the Electrical Conductivity values. The districtwise area under different quality zones (June 2005) is given in Table 3:

Table 1. Districtwise area under different depth zones of ground water

Sl. No.	District	Total geographical area (hectare)	Outcrop area (hectare)	Average depth to water (m)	Area under different depth zones (hectare) (depth in m)						
					0-1.5	1.5-3	3-10	10-20	20-30	30-40	>40
1.	Ambala	159585	300	8.17	766	5878	106416	36769	9456	-	-
2.	Bhiwani	487072	4661	16.58	3061	32090	141924	134631	54187	35718	80800
3.	Faridabad	174566	8717	9.12	-	1258	108254	50607	5730	-	-
4.	Fatehabad	249110	-	10.52	445	7648	76279	129111	35627	-	-
5.	Gurgaon	124933	3789	18.16	-	172	12294	49032	50213	6844	2589
6.	Hisar	386052	-	7.43	10501	39198	229978	106375	-	-	-
7.	Jhajjar	186770	-	5.83	2303	29490	139301	13662	2014	-	-
8.	Jind	273600	-	9.24	-	6498	153092	110014	3996	-	-
9.	K.shetra	168253	-	24.47	-	-	985	31645	134273	1350	-
10.	Kaithal	228406	-	13.48	-	1780	79024	92459	38809	16334	-
11.	Karnal	247112	-	12.25	-	-	65123	177703	4286	-	-
12.	M.garh	193947	4646	39.59	-	-	2188	13837	21621	4688	104774
13.	Mewat	185961	14029	9.05	1656	25571	98805	38507	7393	-	-
14.	Panchkula	78915	35300	12.90	-	-	22715	14817	1749	278	4056
15.	Panipat	124988	-	13.10	-	-	52708	50504	20511	1895	-
16.	Rewari	155900	2308	20.80	-	-	22918	57361	39860	15811	7642
17.	Rohtak	166777	-	4.88	3253	31944	125028	6552	-	-	-
18.	Sirsa	427600	-	11.48	1684	12396	190022	166227	37199	13750	6322
19.	Sonepat	226053	-	7.43	1307	40530	122277	50586	11353	-	-
20.	Y.Nagar	175600	15300	10.09	-	-	102555	52931	4683	131	-
	Total	4421200	89050	-	24976	234453	1851256	1393330	482960	138992	206183
	State %age		2		1	5	42	31	11		5

Table 2. Districtwise variation of groundwater table

Sl.No.	Name of district	Period June, 1994	Period June, 2005	Depth to water variation in m (June 1974 through June 2005)
1.	Ambala	5.79	8.17	-2.38
2.	Bhiwani	21.24	16.58	+4.66
3.	Faridabad	5.94	9.12	-3.18
4.	Fatehabad	10.48	10.52	-0.04
5.	Gurgaon	6.64	18.16	-11.52
6.	Hisar	15.47	7.43	+8.04
7.	Jind	11.97	9.24	+2.73
8.	Jhajjar	6.32	5.83	+0.49
9.	K.shetra	10.21	24.47	-14.26
10.	Kaithal	6.28	13.48	-7.20
11.	Karnal	5.72	12.25	-6.53
12.	M.garh	16.11	39.59	-23.48
13.	Mewat	5.50	9.05	-3.55
14.	Panchkula	7.58	12.90	-5.32

<i>Sl.No.</i>	<i>Name of district</i>	<i>Period June, 1994</i>	<i>Period June, 2005</i>	<i>Depth to water variation in m (June 1974 through June 2005)</i>
15.	Panipat	4.56	13.10	-8.54
16.	Rewari	11.75	20.80	-9.05
17.	Rohtak	6.64	4.88	+1.76
18.	Sirsa	17.88	11.48	+6.40
19.	Sonepat	4.68	7.43	-2.75
20.	Y.Nagar	6.26	10.09	-3.89
	Average	9.35	13.23	-3.88

Table 3. Districtwise area under different quality zones

<i>Sl.No.</i>	<i>District</i>	<i>Geographical area (hectare)</i>	<i>Out crop area</i>	<i>Electrical conductivity (EC) in μmhos/cm</i>			
				<i>0-2000 (Fresh)</i>	<i>2000-4000 (Sub-marginal)</i>	<i>4000-6000 (Marginal)</i>	<i>Above 6000 (Saline)</i>
1.	Ambala	159585	300	149768	9507	-	-
2.	Bhiwani	487072	4661	177054	214479	58140	32738
3.	Faidabad	174566	7817	78716	63250	17447	6436
4.	Fatehabad	249110	-	151908	76884	12592	77265
5.	Gurgaon	124933	3789	96119	17416	5029	2580
6.	Hisar	386052	-	114230	181462	51430	38930
7.	Jhajjar	186770	-	25229	42370	54253	64918
8.	Jind	273600	-	49284	150396	44446	29474
9.	K.shetra	168253	-	168253	-	-	-
10.	Kaithal	228406	-	146311	69115	8365	4715
11.	Karnal	247112	-	238878	6019	2215	-
12.	M.garh	193947	4646	86182	68753	26126	8240
13.	Mewat	185961	14029	47337	66912	36478	21202
14.	Panchkula	78915	35300	43615	-	-	-
15.	Panipat	124988	-	109821	14356	811	-
16.	Rewari	155900	2308	40147	76159	26583	10703
17.	Rohtak	166777	-	28766	60030	45974	32007
18.	Sirsa	427600	-	-	-	-	-
19.	Sonepat	226053	-	105493	68433	28404	23723
20.	Y. Nagar	175600	15300	160300	-	-	-
	Total	4421200	89050	2130210	1346203	485822	369915
	State %age		2	48	30	11	8

As per the latest groundwater assessment based on the guidelines of Groundwater Estimation Committee (GEC), Govt. of India, the present groundwater development in the state is 108%. Out of 114 blocks, 55 blocks are categorized as over-exploited and 43 blocks fall in safe category whereas five are semi-critical and 11 are critical. The blocks falling under safe category are virtually underlain by saline water in the deeper aquifers and fresh to marginal quality waters float over the saline water. So the assessment of dynamic groundwater resources indicated no scope for further extraction of ground water till balance is maintained between withdrawals and recharge.

We, then, clearly are aware of the need to conserve every single drop of this precious resource. We are promoting rainwater harvesting and artificial recharge of ground water. Some of the major policy decisions taken in this regard are delineated below.

1. It is mandatory for all government buildings and all private houses in HUDA estates as well as in all municipal areas having roof top surface area of 100 sq.m. or more to have a Rain Water Harvesting structure.
2. It is mandatory for all government buildings to provide 8-litre capacity flushing cistern instead of the popular 10/12.5/15 litre capacity.
3. The water tariff in Urban Estates in Haryana is graded.
4. In the least endowed area of Mewat, the Public Health Deptt. has already dug 157 injection wells. Another 126 would be drilled in 2006-07 to recharge the aquifers. Three Ranney wells are being dug in the plains of Yamuna and water would be transported at a cost of Rs. 205.91 crores under the Rajiv Gandhi Drinking Water Augmentation Project.
5. We have initiated a scheme called Dadupur Nalvi Canal at a cost of Rs. 267 crores. Along with providing irrigation to 83,720 hectares area: it will recharge the fertile areas of 347 villages in Ambala, Yamunanagar and Kurukshetra.
6. We have also initiated work on a Rs.125 crores Bass Hisar Ghaggar multipurpose drain that would recharge the ground water of 3,38,485 acres in Kaithal, Jind, Hisar, Fatehabad and Sirsa.
7. Five major water bodies in the state are being renovated in near future for effective rainwater harvesting and groundwater recharging. These are Bibipur Lake in Kurukshetra, Kotla Lake in Gurgaon, Ottu Lake in Sirsa, Massani barrage in Rewari and Bhindawas Lake in Jhajjar. Together they have a storage capacity of around 12,000 hectares metres.
8. In the last one and half years water courses have been lined in an area of 49,350 hectares under CADA.
9. In the last one and a half years, Forest Department has created nine new water harvesting dams, and repaired 26 existing ones at a cost of Rs. 3.71 crores.
10. In the year 2005-06 we introduced a State Plan Scheme called Accelerated Groundwater Recharge Scheme with a budgetary provision of Re 1 crore for construction of artificial injection wells in deficit areas.
11. We have successfully weaned away farmers from cultivation of summer paddy. This crop transplanted in the month of May is a water guzzler consuming 5500 litres of water for every kilogram of rice produced. By motivating the farmers we have brought down area under summer paddy from 40,000 hectares to 1264 hectares during 2006. A separate write-up is enclosed (Annexure I).
12. During 2006-07, there is a scheme for conjunctive use of canal water with saline groundwater by constructing tanks. This water will be used through sprinklers and rip system.

However, some critical management issues in terms of regulation of groundwater resources must be faced. The first of these is whether and to what extent does the growth of tube wells cause a decline of water table when draft remains the same? We also cannot overlook the fact that the decline of water table has been in the areas where depth to water table was already deep, basement was shallow and the thickness of the alluvium was limited. Decline of water table in the flood plain of Yamuna is much less when compared to the area forming part of the same block. Decline of water table in some of the southern districts of the state has been accelerated due to decreased flow in the streams sharing their catchments with adjacent state. Sahibi, Krishnawati and Dohan are suffering from the drastic cut in flow due to watershed development programme and damming of torrent in the upper watershed areas falling in Rajasthan.

Government of Haryana does not wish to be merely a regulating body. We are working sincerely to explore possibility of increasing ground water recharge and reducing ground water extraction through awareness generation and collective action. Our experience so far has shown that for sustainable management of Groundwater participatory approach can do wonders. Working with the existing grass-root institutions and capacity building of these institutions is bound to yield positive results.

Annexure I

WEANING FARMERS AWAY FROM THE WATER GUZZLING SUMMER PADDY

Background

Farmers in five districts of Haryana took to cultivation of an early maturing but water guzzling variety of paddy during the late nineteen eighties. It was sown as a lucrative quickie crop between the wheat and paddy crops. It would fetch the farmers anything between Rs. 5000 to Rs. 9000 per acre from unscrupulous rice millers who use it either to adulterate expensive Basmati rice or to replace illegally off-loaded government stocks. Govind, the official name of the variety developed by Pantnagar University for rain-fed hilly terrains, became popular as Saathi in Haryana under the mistaken belief that it matured in only sixty days. It is transplanted in May when the evaporation losses are the highest. Consequently, it consumes 5500 litres of water for every kilogram of rice. Widespread cultivation of Saathi led to an alarming recession in the groundwater table in Karnal, Kurukhstra, Kaithal, Yamunanagar and Fatehabad, the only districts having freshwater aquifers in Haryana.

Over the years, the farmers and extension workers settled into an inert equilibrium wherein the latter blamed the farmers' avarice and the farmers blamed the government's refusal to put a coercive ban on its cultivation. Meanwhile billions of gallons of precious water were drawn to flood thousand of hectares every year in May/June to harvest paddy that no farmer would eat a grain of.

Priorities and Purpose

A focused group discussion with some farmers at the Directorate in January 2006 revealed that they were too well aware of the ill effects of this crop. It was they who were putting their motors still deeper every year. It was they who had to use increasingly larger doses of urea for the Basmati and wheat crops.

They knew that leaving the land fallow or cultivating leguminous crops like *moong* or *dhaincha* instead of *Saathi* would restore the soil fertility and reduce the requirement of fertilizers. They realized that non-flooding of field of May/June would definitely permit nature to kill the pests that later attacked Basmati in July and consequently reduce their burden of pesticides. Yet no farmer was willing to give it up till he was sure that others would follow suit. Nobody was foolish enough to be left behind while his neighbours made a quick buck at the expense of the common aquifer. To their mind the best way out for the government was to ban it in view of the strong ill effect of the crop.

Strategies Adopted

Eager to find a way out of the helpless stalemate its stakeholders found themselves in, the Directorate decided to change its perception of the problem. It refrained from the past response of passing the buck to the power utilities that did not cut off power supply to tube wells during May/June. Instead,

it chose to view the problem as a collective action problem. It, then, decided to launch a massive awareness generation campaign that would enable farmers to generate a collective solution. Since most farmers began growing nurseries in March, it was also decided to act quickly lest the farmers complain that they had already made investments in growing nurseries of Saathi.

Innovative Methods Used

Beginning from 9th February in Karnal, meeting of Saathi growing farmers and members of PRIs were organized in every district. Earthy idioms with which the farmers could relate, were used to bring home the senselessness of cultivating Saathi. It was pointed out that Govind meant God. Yet, when Nature wanted to kill all pests and insects in May and June, flooding the fields amounted to taking on God. Soil was likened to mother and water to father. With mother being made to work every day through the year and a deeper hole having to be dug to force a reluctant father to meet the mother, how far were the farmers from becoming orphans?

Striking such a deep emotional chord would invariably result in passage of resolution against cultivation of Saathi. Those present would resolve to refrain from sowing Saathi, to educate others in their sphere of influence and to initiate such punitive action against violators that may be decided by the community collectively. It was also agreed that Directorate might obtain data from satellites to monitor cultivation. Effective use of mass media was made for taking the message to sub-district level. The project period was from February 2006 to May 2006.

Positive Outcomes

Thousands of farmers refrained from sowing Saathi. A large majority of them went in for dhaincha, the green manure crop. Abandoning Saathi helped check further recession in ground water. Fertility of thousands of hectares was restored. An unprecedented quantity of 3000 quintals of dhaincha seed was distributed free of cost to the farmers. This resulted in cultivation of green manure in 25000 acres. Area under moong also increased substantially. Around one crore units of power were saved everyday during the month of May/June. Since *girdawari* (crop inspection) is not carried out during May/June the cultivation of Saathi had been escaping the official statistics. ISRO provided authentic data on this killer crop for the first time.

Exceptional Achievements

The campaign soon snowballed into a farmers' movement. Many young farmers ploughed through their nurseries with tractors, having been 'too restless to sleep'. Such local 'heroes' were taken to meetings in other districts where their herotics had already come to be known because of aggressive media campaign. They inspired others to follow suit. The farmers successfully learnt the lesson of positive collective action.

Role/Nature of the Involvement of the Nominee

Director Agriculture led the campaign from the front right from the conception stage. He provided inspirational leadership to the extension staff who for years had lulled themselves into inaction thinking it impossible that farmers could be asked to forgo their incomes. Led from the front, they quickly opened channels of communication to persuade the farmers to act collectively in their own interest. Even when the field reports showed that only less than one per cent farmers had grown nurseries he organized and led a final conversion camp in Karnal on 5th May, 2006.