Biological Forum — An International Journal, **2**(2): 36-37(2010) **ISSN : 0975-1130**

Recharge of saline water aquifers with rain water and its impact on water quality and crop production

Bhu Dayal and R.S Chauhan

R.B.S College, Bichpuri, Agra (UP)

ABSTRACT : In major part of arid and semi arid regions, the major irrigation water resources are ground water aquifers, but due to presence of excess salt in these regions, it had adverse effect on crop productivity. Further due to excess exploitation, it decline alarmingly year after year. So far sustaining the agriculture production we have to maintain the ground water quantitatively and qualitatively. One of the options may be recharging this ground water with run off rain water. The program is being initiated in Odara village under Operational Research Project (ORP), R.B.S College, Bichpuri, Agra in 2008. The 8 farmers were selected and about 0.4 hectares area selected for recharge irrigation on each farmer's field. ECiw (ds/m) and SARiw (mmol/l) ^{½} in the month of June ranged from 10.9 to 15.0 and 12.5-24.0 respectively. The water salinity (ds/m) at 8 recharge tube wells varied from 0.5 to 7.2 at 1st pre-sowing irrigation, 6.4 to 10.8 at 2nd irrigation, 8.0 to 15.0 at 3rd irrigation and 9.4 to 17.0 at 4th irrigation. On 8 farmers field the wheat yield varied from 4.96 to 5.88 t/ha while on other farmers field the yield varied from 4.58 to 5.40 t/ha which used high salinity water. The percent wheat yield increased by 8.1 on recharge farmer's field over other farmer's field.

INTRODUCTION

The major part of arid and semi arid regions, the main irrigation water resources are ground water aquifers, but due to presence of excess salt in these regions, it had adverse on crop productivity. Further due to excess exploitation, it declines year after year. So far sustaining the agriculture production we have to maintain the ground water aquifer quantitatively and qualitatively one of the options may be to recharging this ground water with rain water. Rain water being lighter will over flow the saline aquifers which can be irrigated for early crop growth stages in rabi season crops.

MATERIALS AND METHODS

The ground water recharging work has initiated in 2008. Agra Bharatpur region in the states of Uttar Pradesh and Rajasthan are endowed with poor quality ground water aquifers. Shallow aquifers are relatively more saline (10-15 ds/m) relatively to deeper aquifers (2-6 ds/m). The resource poor farmers of the region who cannot afford to drill deep bores are contented with exploiting the saline aquifers to give one/two life saving irrigation(s) to mustard.

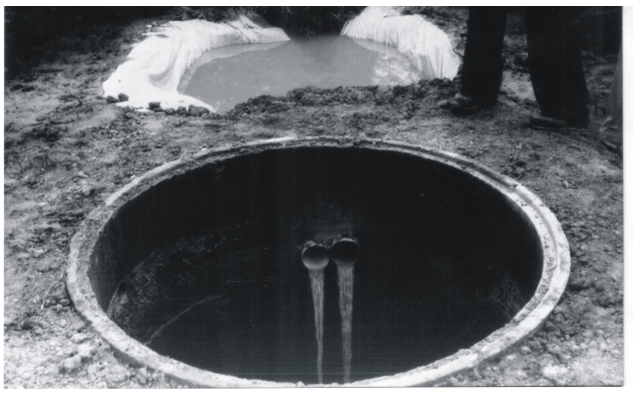

Fig. 1. Low cost recharge technique.

Thus, under such a situation, yields are reduced due to high salinity of the irrigation water. In order to improve crop productivity, at low cost technology based on diluting saline groundwater through artificial recharge has been designed and tested on 8 farmer's fields. The technology consisted of diverting the runoff to these structures for recharge (Fig. 1).

The diluted groundwater is then pumped to irrigate mustard/wheat. The salinity of the groundwater is reduced in most cases to less than 4 ds/m but eventually reaches to its original value during 3rd or 4th irrigation . The irrigation with low quality water at initial growth stage boosts the yield to normal level in the case of mustard and wheat. The water quality parameters pertaining to tube well water of at 8 selected farmers in the month of June are given in Table 1.

Table 1 : Water quality of farmers tube well.

Name of the farmer	EC_{iw}(dS/m)	RSC(meq/l)	SAR(mmol/l)$^{1/2}$
Balveer Singh	11.8	—	13.9
Ram Bharose	15.0	—	19.0
Hari Prasad	13.5	—	12.5
Lal Hans	10.9	—	16.2
Dinesh Chand	11.0	—	17.0
Mukesh Kumar	13.8	—	24.0
Ranveer Singh	11.1	—	15.4
Jagan Singh	12.6	—	15.5

RESULTS AND DISCUSSION

The tube well boring was used for recharging of ground water by diverting the run off at farmers field. The wheat crop was sown on eight selected farmer's field in about 0.4 ha area. Four to five regular irrigations were applied through bore well. The water salinity measurement of recharge water was also made at each irrigation (Table 2). It is clear at the time of first irrigation i.e. in month of November- December

average ECiw (ds/m) was varied from 0.5 to 7.2 at first pre sowing irrigation; 6.4 to 10.8 at 2nd irrigation; 8.0 to 15.0 at 3rd irrigation and 9.4 to 17.0 at 4th irrigation.

Table 2 : Water salinity fluctuations at different irrigations on recharge sites.

Name	1st irrigation	2nd irrigation	3rd irrigation	4th irrigation
Balveer Singh	0.5	7.7	10.3	13.7
Hari Prasad	6.1	10.5	16.1	17.0
Jagan Singh	0.5	8.3	9.3	9.4
Mukesh Kumar	4.7	10.2	14.1	15.0
Ranveer Singh	6.5	10.6	12.7	13.0
Ram Bharosee	7.2	10.8	15.0	16.5
Lal Hans	5.0	10.2	12.2	13.0
Dinesh Chand	1.4	6.4	8.0	9.5

The recharge ground water was used for irrigation safely at early growth stages. Further the water salinity increased at 3rd and 4th irrigations. The soil salinity and SAR was also monitored at harvest of wheat crop (Table 3).

Table 3 : Effect of recharge saline water on grain yield of wheat and soil characteristics (0-30 cm) at harvest.

Name	O.R.P yield t/hat/ha	Farmers yield (dS/m)	% increase	EC_e	pH_2	SAR
Balveer Singh	5.56	5.15	8.0	9.9	7.7	14.1
Hari Prasad	5.33	4.95	7.7	14.7	7.2	17.5
Jagan Singh	5.88	5.43	8.4	13.5	7.3	15.5
Mukesh Kumar	5.25	4.83	8.7	5.3	7.3	14.1
Ranveer Singh	5.41	5.03	7.5	13.6	7.4	24.6
Ram Bharosee	5.40	5.02	7.6	15.0	7.5	25.3
Lal Hans	4.96	4.58	8.3	13.9	17.6	25.2
Dinesh Chand	5.12	4.71	8.5	7.5	7.9	19.9
Overall			8.1			

On 8 farmers field the wheat yield varied from 4.96 to 5.88 t/ha while on other farmers field yield varied from 4.58 to 5.40 t/ha which used high salinity water. The percent wheat yield increased by 8.1 on recharge farmer's field over other farmer's field. Bhu Dayal (2009), Panda *et al.*, (2009), Patil *et al.*, (2009), Singh *et al.*, (2009), who observed a general increase in crop yield with recharge water and improvement in quality of irrigation water with rain water.

CONCLUSIONS

The overall study clearly indicates that recharge saline water used safely at early crop growth stages which enhance the germination and filtering. Further water salinity of recharge water increased at later growth stages. The percent wheat yield increased by 8.1 with recharge water as compare to those which were used the high salinity water.

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