

## Samalkha block

Samalkha, a block in Panipat District of Haryana State is located at 29.2405° N latitude and 77.0113° E longitude with its headquarter at Samalkha town and belongs to Rohtak Division. It is located at 21 km towards south from District headquarter Panipat. It is 197 km away from State capital Chandigarh. Samalkha Tehsil is surrounded by Ganaur (Sonepat) Tehsil towards south, Bapoli Tehsil towards north, Chhaprauli (Sonepat) Tehsil towards east and Israna tehsil towards west. Samalkha block consist of 33 villages covering 220 km<sup>2</sup> area and 25,347 households.

A total of 230 water samples were collected (1 km x 1 km) from all over the Samalkha block of Panipat district. Groundwater EC of the tested water samples ranged from 0.23 dS/m (village Haldana, 29.1900° N latitude 77.0281° E longitude) to 5.96 dS/m (village Jattipur 29.2942° N latitude 76.9628° E longitude) with a mean value of 1.30 dS/m (Table 20).

**Table 20. Range and values of water quality parameters in Samalkha block**

Sl. No.	Parameters	Range	Mean
1.	EC (dS/m)	0.23–5.96	1.30
2.	pH	7.00–8.80	7.81
3.	CO <sub>3</sub> <sup>2-</sup> + HCO <sub>3</sub> <sup>-</sup> (me/l)	3.8–17.0	9.1
4.	Ca <sup>2+</sup> + Mg <sup>2+</sup> (me/l)	1.8–18.6	7.2
5.	RSC (me/l)	Nil–9.5	2.4
6.	Na <sup>+</sup> (me/l)	0.9–27.7	6.7
7.	SAR (m mol/l) <sup>½</sup>	0.4–12.2	3.7
8.	Cl <sup>-</sup> (me/l)	0.4–12.2	3.6
9.	SO <sub>4</sub> <sup>2-</sup> (me/l)	BDL–46.5	10.2
10.	PO <sub>4</sub> <sup>2-</sup> (me/l)	BDL–2.8	0.2
11.	F <sup>-</sup> (ppm)	BDL–4.7	0.8
12.	NO <sub>3</sub> <sup>-</sup> (ppm)	0.1–43.0	8.7

BDL: Below Detectable Limit

**Table 21. Chemical composition of groundwater samples of Samalkha block against different EC class**

EC class (dS/m)	No. of samples	EC dS/m	CO <sub>3</sub> <sup>2-</sup> + HCO <sub>3</sub> <sup>-</sup> me/l	Cl <sup>-</sup> me/l	SO <sub>4</sub> <sup>2-</sup> me/l	Ca <sup>2+</sup> + Mg <sup>2+</sup> me/l	Na <sup>+</sup> me/l	RSC me/l	F <sup>-</sup> ppm	NO <sub>3</sub> <sup>-</sup> ppm	SAR (m mol/l) <sup>½</sup>
<2	200	1.12	8.96	3.0	8.1	6.8	5.9	2.5	0.8	8.4	3.5
2–4	29	2.40	10.40	5.6	16.4	10.0	11.6	1.78	0.6	9.6	5.4
4–8	1	5.96	9.0	12.2	46.5	18.6	27.7	Nil	1.3	12.5	9.1
Total*	230	1.30	9.14	3.6	10.2	7.2	6.7	2.41	0.8	8.7	3.7

\*represents weighted mean for each parameter

About 87% of the collected water samples had EC <2 dS/m (average EC~1.12 dS/m), the permissible limit of using saline groundwater for irrigation. Salinity was quite critical in 13% of the collected samples; out of which almost all were characterized with EC between 2–4 dS/m (average EC~2.40 dS/m) except one (Table 21).

Residual alkalinity in groundwater (RSC) ranged from 0 to 9.5 me/l with an average value of 2.4 me/l (Table 20). The highest RSC~9.5 me/l was recorded in Nariana village (29.3720° N latitude, 76.9757° E longitude). Out of total 230 samples, about 54% samples were characterized with RSC <2.5 me/l (average RSC~0.6 me/l) (Table 22). Nearly 30% samples had RSC 2.5–5 me/l (average RSC~3.5 me/l) and rest 16% with RSC between 5–10 me/l (average RSC~6.5 me/l).

The sodium adsorption ratio (SAR) ranged from 0.4 to 12.2 with a mean value of 3.7 (Table 20). The lowest SAR was observed in village Nariana (29.2743° N latitude, 76.9584° E longitude) and the highest in village Jattipur (29.2969° N latitude, 77.0181° E longitude). As such, the SAR of groundwater remained <10 in 96% of the tested water samples (Table 23) while only 4% samples had critically higher SAR range between 10–20. None of the sample was identified with SAR >20.

**Table 22. Chemical composition of groundwater samples of Samalkha block against different RSC class**

RSC class (me/l)	No. of samples	RSC me/l	EC dS/m	CO <sub>3</sub> <sup>2-</sup> + HCO <sub>3</sub> <sup>-</sup> me/l	Cl <sup>-</sup> me/l	SO <sub>4</sub> <sup>2-</sup> me/l	Ca <sup>2+</sup> + Mg <sup>2+</sup> me/l	Na <sup>+</sup> me/l	F <sup>-</sup> ppm	NO <sub>3</sub> <sup>-</sup> ppm	SAR (mmol/l) <sup>½</sup>
<1.25	93	0.24	1.44	8.2	4.0	10.8	9.2	5.8	0.5	12.9	2.8
1.25–2.5	31	1.82	1.05	8.5	3.2	5.4	6.7	6.0	0.7	4.8	3.2
2.5–5	70	3.46	1.18	9.4	3.3	10.0	6.0	6.3	0.8	4.4	3.7
5–10	36	6.51	1.42	11.6	3.1	10.9	5.1	10.2	1.3	6.4	6.4
>10	–	–	–	–	–	–	–	–	–	–	–
Total*	230	2.41	1.30	9.1	3.56	10.2	7.2	6.74	0.8	8.7	3.7

\*represents weighted mean for each parameter

**Table 23. Chemical composition of groundwater samples of Samalkha block against different SAR class**

SAR class (mmol/l) <sup>½</sup>	No. of samples	SAR (mmol/l) <sup>½</sup>	RSC me/l	EC dS/m	CO <sub>3</sub> <sup>2-</sup> + HCO <sub>3</sub> <sup>-</sup> me/l	Cl <sup>-</sup> me/l	SO <sub>4</sub> <sup>2-</sup> me/l	Ca <sup>2+</sup> + Mg <sup>2+</sup> me/l	Na <sup>+</sup> me/l	F <sup>-</sup> ppm	NO <sub>3</sub> <sup>-</sup> ppm
<10	221	3.42	2.28	1.28	9.1	3.6	10.1	7.3	6.3	0.7	9.1
10–20	9	11.10	5.76	1.90	11.4	3.4	12.1	5.7	18.5	1.1	0.2
>20	–	–	–	–	–	–	–	–	–	–	–
Total*	230	3.72	2.41	1.30	9.1	3.5	10.2	7.2	6.7	0.8	8.7

\*represents weighted mean for each parameter

Spatial variability for EC (Fig. 10a) indicated that majority (93%) of the area (205 km<sup>2</sup>) in Samalkha block had very low salinity (EC <2 dS/m) problem. Marginal salinity (EC between 2–4 dS/m) representing 7% area was encountered only in small patches mostly in western parts of the block. Nearly 65% area had very low no problem of residual alkalinity in underground water (RSC <2.5 me/l). About 31% area is dominated by RSC range between 2.5–5 me/l and only 4% area had RSC between 5–10 me/l (Fig. 10b). Majority of RSC affected area was confined to south–eastern parts of Samalkha block touching Chhaprauli and Ganaur Tehsils of Sonapat district. There was very low problem of SAR in groundwater as 100% area had SAR <10 (Fig. 10c).

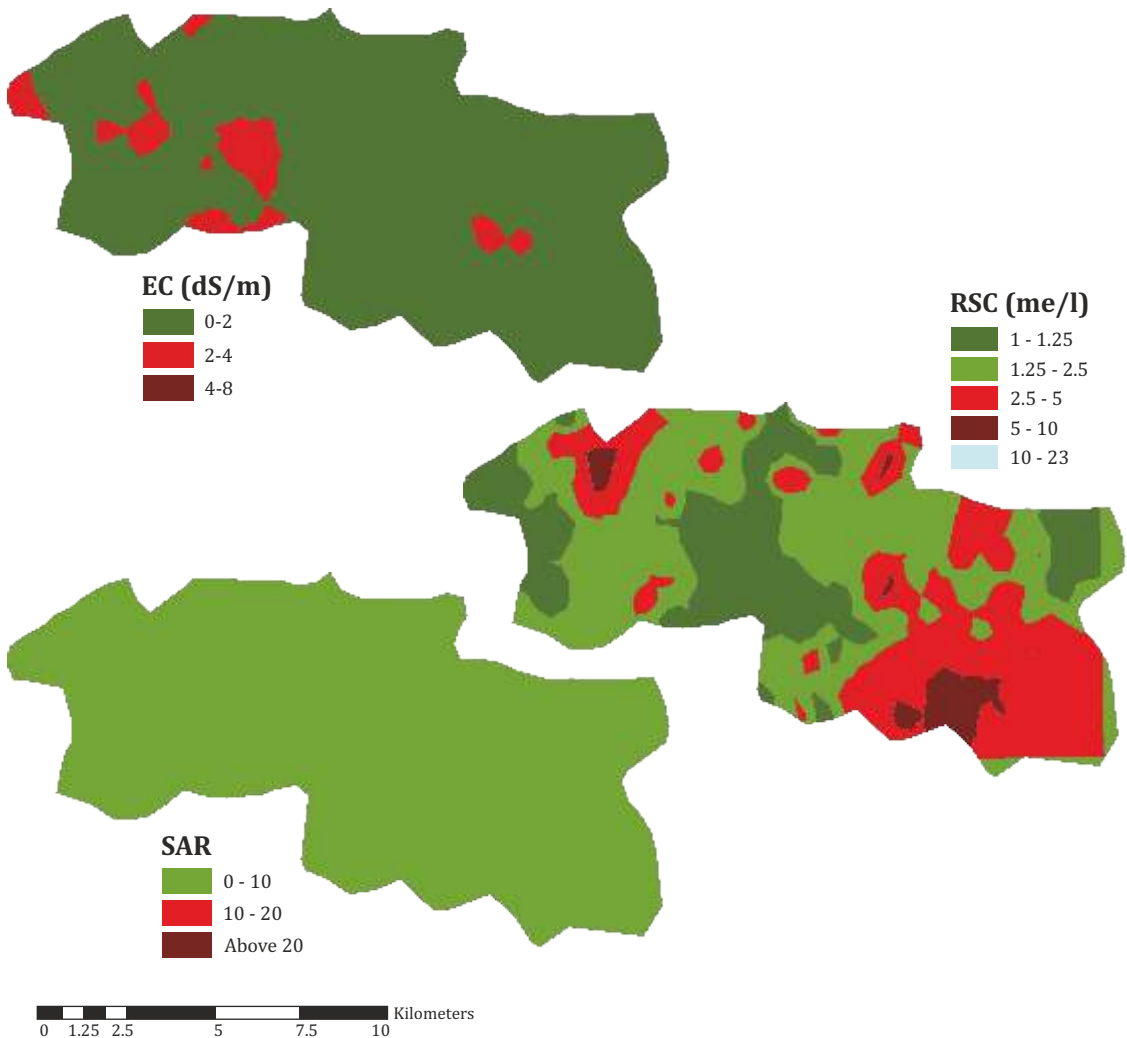


Fig. 10. Distribution of (a) electrical conductivity (EC); (b) residual alkalinity (RSC) and (c) sodium adsorption ratio (SAR) in groundwater of Samalkha block

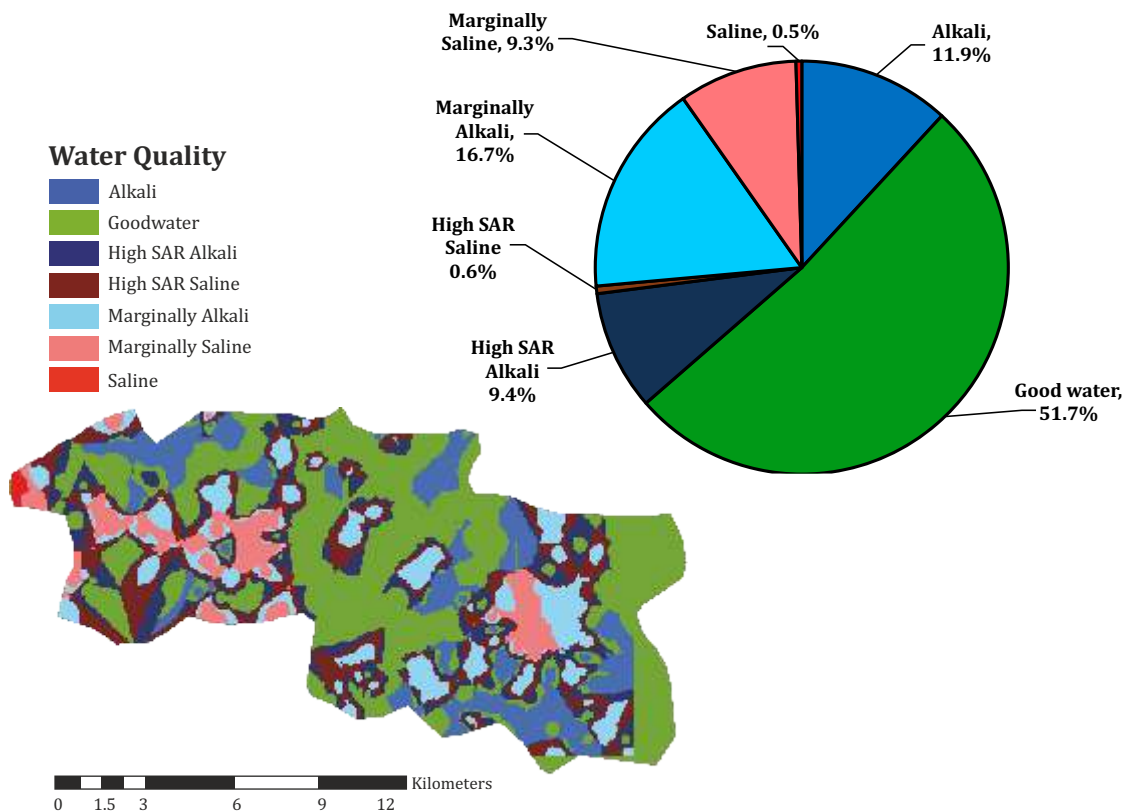


Fig. 11. Distribution characterization of groundwater quality of Samalkha block

In Samalkha block, about 52% area (114 km<sup>2</sup>) represents underground water of good quality (EC <2 dS/m, RSC <2.5 me/l, SAR <10) while 38% area is affected with problem of residual alkalinity (Fig. 11). Salinity was quite critical in only 10% (22 km<sup>2</sup>) of the total block area and that too marginal salinity (9.3%). Residual alkalinity of variable nature represents marginal alkali~16.7% (37 km<sup>2</sup>), alkali~11.9% (26 km<sup>2</sup>) and high SAR alkali~9.4% (21 km<sup>2</sup>) of total block area. SAR problem of variable sodicity (9.4%) and salinity (0.6%) was encountered in 10% of the total area.