

Quality of Ground Water and its Effect on Soil Properties in Samdari-Siwana-Balotra area of Western Rajasthan

N Singh, A S Kolarkar and P C Bohra

Central Arid Zone Research Institute, Jodhpur 342 003, India

Abstract Studies on the quality of ground water in Samdari-Siwana-Balotra region of western Rajasthan revealed, that these waters are moderate to highly saline and sodic with EC range of 240 to 33213 μScm^{-1} and pH from 7.0 to 9.5. These waters have marked concentration of chloride of sodium with high soluble sodium percentages in 97 per cent samples. In all cases, calcium is lower than the magnesium, except in few samples of low salinity of C₁ and C₂ classes. The value of SAR ranges from 1.85 to 96, and 54.5 per cent water samples fall under high to very high SAR classes. The content of RSC in well waters ranges from 0.4 to 38.6 me L⁻¹, and 29.20 per cent waters have RSC more than 5 me L⁻¹. The saline water irrigated soil has pH of 7.1 to 8.5 at the surface and 7.3 to 8.6 in the subsurface, while the EC varies at these locations from 249 to 9565 and 359 to 2123 μScm^{-1} , respectively. The total area affected by the use of such problematic waters is 880.75 km².

Key words salinity, sodicity, residual sodium carbonate, hazards, cation and anion

Availability of water for irrigation in arid region is one of the important factors for development of agriculture for ensured production. Due to low rainfall, the surface water is usually inadequate and the quality of the limited ground water is also generally brackish or saline. In western Rajasthan, several workers (Mehta 1960, Sharma & Jain 1963, Darra *et al.* 1964 and Mehta *et al.* 1970) reported that the quality of ground water is moderate to highly saline in Pali and Jawai catchments. Mondal (1964) classified the ground waters of Jalor, Saila and Siwana development blocks in seven (C₁-C₇) categories. Chatterji & Mondal (1964) categorised the Siwana development block area as over-exploited, sparsely exploited, underexploited and unexploited with Class-II to Class-IV type of ground waters. Eaton (1950) and Wilcox *et al.* (1954) considered ground waters having RSC content of more than 2.5 me L⁻¹ as unsafe for irrigation. However, Gupta (1980) found no adverse effect of RSC in waters upto 10 me L⁻¹ in the rainfall zone of 650-750 mm. Manchanda *et al.* (1982) observed that the waters with RSC ranging from 4.5 to 13.8 me L⁻¹ could be used for wheat and barley cultivation on sandy to loamy sand soils receiving mean annual rainfall of over 400 mm. In the arid region of Rajasthan, irrigation with waters containing

RSC greater than 5 me L⁻¹ is found to create sodicity hazard in the rainfall zone of 200-250 mm per year (Joshi & Dhir 1989).

The flood event of 1979 in the Luni river caused drastic changes in the ground water quality in dug wells of Samdari-Siwana-Balotra region of Barmer district. Detailed survey on quality of ground water and its effect on soil properties has been studied and results are presented.

The study area

The study area covering 1000 km² lies between latitudes 25°32'-25°52' N and longitudes 72°10'-72°45' E and is located about 100 km to the south-west of Jodhpur. The dug wells occur along the banks of the Luni river. The rainfall in the region varies from 200 to 250 mm. The area has five major landforms namely, younger alluvial plain, flat older alluvial plain, sandy undulating buried pediment, sand dune and high granitic hills. The younger alluvial plains have soil texture ranging from sand to loamy sand, sandy loam, loam and even clay loam. The flat older alluvial plain has predominately loamy sand to sandy loam texture, covered with wind deposited sand, except at Tapra and Jasol villages where loam to clay

than 60% in 92.6% samples, indicating sodic hazard of these waters. The SAR of these samples ranges from 2.7 to 80.7. As per Richards' (1954) classification, 12.40% water samples indicate low, 33.9% medium, 21.4% high and 32.3% very high SAR classes (Fig 2), pointing to their sodic nature.

The presence of anions is in the order : chloride > sulphate > bicarbonate > carbonate. Nearly 46.0% samples fall under low, 39.4% medium and 14.6% having high (more than 35 me L⁻¹)

sulphate. Nearly 81.9% water samples are under high chloride class, indicating that the waters are dominantly sodium chloride type.

The residual sodium carbonate (RSC) value ranges from 0.2 to 36.7 me L⁻¹ and 44.7% water samples contain RSC. Out of these 29.2% water samples have more than 5 me L⁻¹ and 15.5% less than 5 me L⁻¹ RSC. However, 55.3% samples have no RSC content, but they do have moderate to severe salinity.

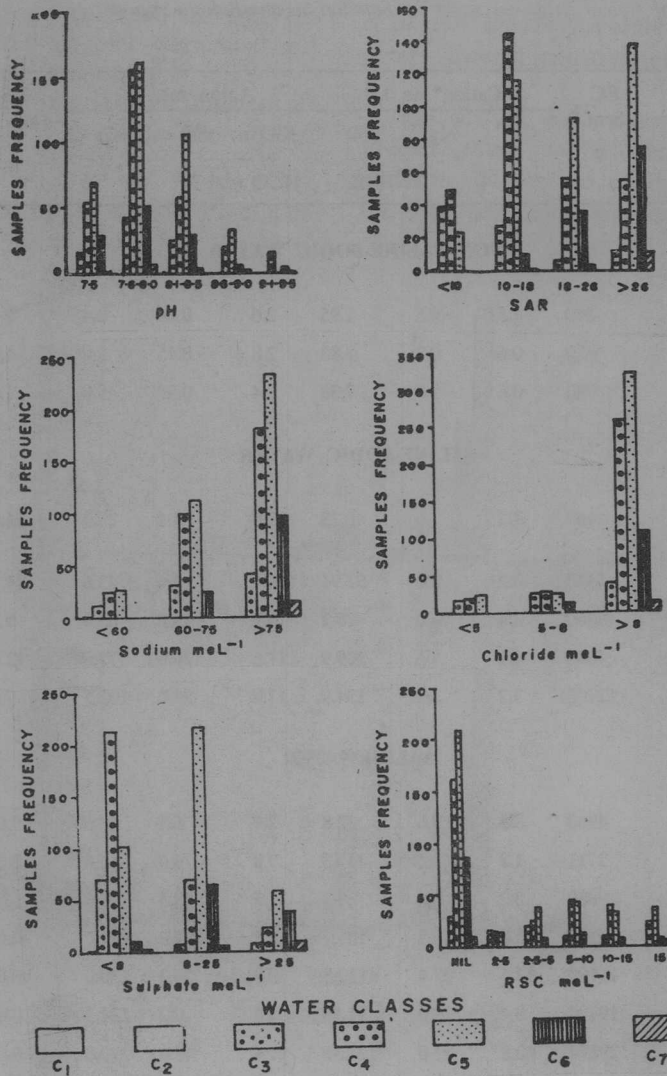


Fig 2 Distribution of water samples under each frequency class of different standards

