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Impact of water quality and irrigation management on soil salinization in the Drâa valley of Morocco.

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Under the arid climatic conditions of the Drâa valley in southern Morocco, irrigation is essential for crop production. Two sources of water are available to farmers: (1) moderate salinity water from the Oued Drâa (classified as C3-S1 in the USDA irrigation water classification diagram) which is available only a few times per year following discrete releases from the Mansour Eddahbi dam, and (2) high salinity water from wells (C4-S2). Soil salinization is frequently observed, principally on plots irrigated with well water. As Oued water is available in insufficient amounts, strategies must be devised to use well and Oued water judiciously, without inducing severe salinization.

The salinization risk under wheat production was evaluated using the HP1 program (Jacques and Šimůnek, 2005) for different combinations of the two main water sources, different irrigation frequencies and irrigation volumes. The soil was a sandy clay loam (topsoil) to sandy loam (40 cm depth). Soil hydrodynamic properties were derived from in situ measurements and lab measurements on undisturbed soil samples. The HP1 model was parameterized for wheat growth and 12 scenarios were run for 10 year periods using local climatic data. Water quality was measured or estimated on the basis of water samples in wells and various Oueds, and the soil chemical properties were determined.

Depending on the scenario, soil salinity in the mean root zone increased from less than 1 meq/100g of soil to more than 5 meq/100g of soil over a ten year period. Salt accumulation was more pronounced at 45 cm soil depth, which is half of the maximum rooting depth, and when well water was preferentially used.

Maximum crop yield (water transpired / potential water transpired) was achieved for five scenarios but this implied the use of well water to satisfy the crop water requirements. The usual Drâa Valley irrigation scenario, with five, 84 mm dam water applications per year, lead to a 25% yield loss. Adding the amount of well water needed to satisfy the crop water requirements as well as the leaching requirement had the lowest impact on soil salinization but resulted in a very low water use efficiency of 0.2 (water transpired / water added). This demonstrates the importance of using larger amounts of water than plant water requirements in this region in order to leach out salt of the root zone. However, in arid region, water is often limited and thus farmers can not afford to waste it. In that case, it is necessary to find a compromise between salinization, sodification and saving water.

References:

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