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برای جزئیات بیشتر و اطلاع از تاریخ های مهم اسکن کنید

ISC

Optimization of Irrigation and Salinity Management Using HYDRUS-1D Model in Semi-Arid Regions: A Case Study of Mahabad Plain

Managing soil moisture and salinity is critical for optimizing agricultural productivity in semi-arid regions like the Mahabad Plain in northwestern Iran. This study applied the HYDRUS-1D model, calibrated using sensor data from a sugar beet field, to simulate water and salt dynamics. The region faces challenges such as salinity, inefficient irrigation, and waterlogging, with annual precipitation of 402 mm and evaporation of 1,560 mm. Sensor data were collected from multiple soil depths (0–100 cm) to calibrate the model. Various irrigation reduction scenarios (10% to 50%) were tested to optimize water use, salinity control, and leaching fraction. Results revealed significant inefficiencies in irrigation practices, with deep soil layers showing over-irrigation. Under normal conditions, the leaching fraction was 0.39, but with a 50% reduction in irrigation, it dropped to 0.14, while a 35% reduction maintained it above 0.2. Despite reduced irrigation, soil salinity stayed below the critical threshold of 2 dS/m, while moisture levels decreased e.g., the 4th layer moisture dropped from 32% to 25% with a 50% reduction. The study emphasizes the importance of leaching fraction management to prevent long-term salt accumulation risks.

Keywords

1. **Soil Salinity**
2. **Soil Moisture**
3. **Leaching Fraction**
4. **Mahabad Plain**
5. **HYDRUS-1D Model**
6. **Water Management Optimization**