

Modeling precipitation use efficiency of winter wheat using climatic parameters, soil properties and topographic indices in a semiarid region, Khodabandeh County, Iran

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Improved understanding of the impact of crucial factors affecting on rainfed wheat precipitation use efficiency (PUE), is needed to cope with increasing demands for sustainable agriculture in semiarid regions. The present research has assessed the effects of climatic parameters, soil physiochemical characteristics and topographic indices on wheat gain yield (WGY), PUE and effective precipitation use efficiency (PUEe) of rainfed winter wheat in a research over rainfed wheat croplands of Khodabandeh County. Therefore, 289 soil samples were collected from rainfed winter wheat croplands in two replicates, totally 578 soil samples, within the county of Khodanbandeh, in (2013-2014). Also, the WGY was measured in each cropland that year. Environmental variables including some soil physiochemical characteristics, topographic indices derived from digital terrain analysis and climatic parameters including growth season precipitation and air temperature were analyzed to develop a proper model to represent WGY, PUE and PUEe. Similar to the first study, the data was divided into two dataset: model (n=238) and test dataset (n=60) and the decision tree was used to develop the best suitable model to describe WGY, PUE and PUEe. The results indicated that CK using slope as auxiliary variable played as the best model to describe the spatial variation of WGY (n=60, R²=0.92, RMSE= 77.78 kg ha⁻¹). Although, MLR combining principal component analysis (PCA) was able to describe PUE significantly (n=238, R²=0.28, P<0.01), however all the applied methods appeared poor in spatially modeling of PUE (n=60, R²<0.05, RMSE> 1.34 kg ha⁻¹ mm⁻¹). Similarly, PUEe was modeled significantly (n=238, R²=0.25, P<0.01) using MLR combining PCA but the model goodness was really poor over Khodabandeh county (n=60, R²=0.11, RMSE= 1.23 kg ha⁻¹ mm⁻¹). In general, it can be concluded that slope was the most crucial affecting parameter on WGY. In addition to, organic matter is the most important soil properties in PUE determination. Among all models Kr and CK performed better than other spatial interpolation models. In order to the lacking of reliable climatic data especially in small scales, and complexity of effective parameters, accurate spatially modelling of PUE and PUEe appears difficult.