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GENOMIC-ENABLED PREDICTION IN DURUM WHEAT BREEDING POPULATIONS

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Several durum wheat data sets were analyzed with the objective of predicting unobserved durum wheat lines in the field for several traits. For one data set comprising 230 durum wheat in multiple-environment genomic best linear unbiased predictor (GBLUP) model was used including genomic × environment interaction and adding two covariables. In addition, the prediction using for neural network architecture employing deep learning (DL) was examined. The basic structure of this network consists of an input layer, an output layer and multiple hidden layers between the input and output layers. The correct choice of number of layers, number of units (neurons), number of epoch, type of regularization penalty, and type of activation function among others is challenging in DL models. For this reason, for the choice of the required number of neurons and epoch we used the grid search method for the selection of this hyperparameters. For comparison, we implemented the DL model using the predictors corresponding to each of the models described for the GBLUP. In general results shown that the predictions accuracy of GBLUP were slightly superior to those computed from DL methods. Another data set from ICARDA had 536 durum wheat lines evaluated for several traits (including quality traits) in several environments using a GBLUP with G×E. For this data sets predictions accuracy for several traits in environments were high achieving a value around 0.6 for several environments and traits. GBLUP models were used in a CIMMYT durum wheat panel grown under yield potential, drought stress, and heat stress conditions. Plant height had the highest prediction accuracy (0.68), whereas grain yield shows moderate prediction accuracy values. The results indicated that genomic selection models incorporating G × E interaction show great promise for forward prediction and application in durum wheat breeding to increase genetic gains.

ABSTRACT