Employing weather-based disease model and machine learning techniques for optimal control of wheat stripe rust in Morocco

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Wheat stripe rust (WSR, caused by *Puccinia striiformis* Westend) is among the most important crop diseases causing a continuous threat to wheat production worldwide. In most seasons in temperate countries, environmental conditions during spring and early summer are conducive to the production of large quantities of spores of *P. striiformis*, which are dispersed from distances of a few centimeters to thousands of kilometers, where they might reach a susceptible host plant. Weather-based systems, or weather-based systems combined with other disease or agronomic variables have been implemented in decision-support systems (DSS) to determine whether fungicide sprays should be applied to prevent the risk of epidemics that might otherwise lead to yield loss. Given WSR is becoming a major threat in wheat-producing regions in Morocco, a DSS integrating a disease risk model would help limiting potentially harmful side effects of fungicide applications while ensuring economic benefits. The main objective of this study is to develop a threshold-based weather model for predicting in-season WSR progress in selected wheat-producing regions (i.e., Sais, Gharb, Middle Atlas, Tadla, Zair, Zemmour, Pre-Rif, High Atlas and Oasis) in Morocco. The threshold-based weather modelling approach has been successfully applied for predicting WSR in Belgium and Luxembourg. Data collected during two consecutive crop seasons in 2010-2011 at the selected sites will be used to test the modelling approach in Morocco. Machine learning techniques including Random Forest, Multivariate Adaptive Regression Splines, and Naïve Bayes Algorithm will also be investigated to improve the model. The reproducibility of area-specific modelling approaches is often a hurdle for their application in operational disease

warning system at a regional scale. As such, this study is a validation case study of the threshold-based weather modelling approach. Moreover, it explores the potential utility of coupling artificial intelligence algorithms with plant disease models in decision support systems as an effort to improve sustainable wheat production in Morocco.