Abstract

Maize lethal necrosis (MLN) is a severe disease in maize that significantly reduces yields by up to 90% in maize-growing regions such as Kenya and other countries in Africa. The disease causes chlorotic mottling of leaves and severe stunting which leads to plant death. The spread of MLN in the maize-growing regions of Kenya has intensified since the first outbreak was reported in September 2011. In this study, the RapidEye (5 m) imagery was combined with field-based data of MLN severity to map three MLN severity levels in Bomet County, Kenya. Two RapidEye images were acquired during maize stem elongation and inflorescence stages, respectively, and thirty spectral indices for each RapidEye time step were computed. A two-step random forest (RF) classification algorithm was used to firstly create a maize field mask and to predict the MLN severity levels (mild, moderate, and high). The RF algorithm yielded an overall accuracy of 91.0%, representing high model performance in predicting the MLN severity levels in a complex cropping system. The normalized difference red edge index (NDRE) was highly sensitive to MLN detection and demonstrated the ability to detect MLN-caused crop stress earlier than the normalized difference vegetation index (NDVI) and the green normalized difference vegetation index (GNDVI). These results confirm the potential of the RapidEye sensor and machine learning to detect crop disease infestation rates and for use in MLN monitoring in fragmented agro-ecological landscapes.