

Predicting Stem Borer Density in Maize Using RapidEye Data and Generalized Linear Models

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Abstract : Maize (*Zea mays* L.) is a major staple food crop in Africa, particularly in the eastern region of the continent. The maize growing area in Africa spans over 25 million ha and 84% of rural households in Africa cultivate maize mainly as a means to generate food and income. Average maize yields in Sub Saharan Africa are 1.4 t/ha as compared to global average of 2.5-3.9 t/ha due to biotic and abiotic constraints. Amongst the biotic production constraints in Africa, stem borers are the most injurious. In East Africa, yield losses due to stem borers are currently estimated between 12% to 40% of the total production. The objective of the present study was therefore to predict stem borer larvae density in maize fields using RapidEye reflectance data and generalized linear models (GLMs). RapidEye images were captured for a test site in Kenya (Machakos) in January and in February 2015. Stem borer larva numbers were modeled using GLMs assuming Poisson (Po) and negative binomial (NB) distributions with error with log arithmetic link. Root mean square error (RMSE) and ratio prediction to deviation (RPD) statistics were employed to assess the models performance using a leave one-out cross-validation approach. Results showed that NB models outperformed Po ones in all study sites. RMSE and RPD ranged between 0.95 and 2.70, and between 2.39 and 6.81, respectively. Overall, all models performed similar when used the January and the February image data. We conclude that reflectance data from RapidEye data can be used to estimate stem borer larvae density. The developed models could to improve decision making regarding controlling maize stem borers using various integrated pest management (IPM) protocols.

Keywords : maize, stem borers, density, RapidEye, GLM

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