

Evaluation of Suitability of Some Soils in the Forest-Savanna Transition and the Guinea Savanna Zones of Ghana for Maize Production

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Abstract

Suitability of four soils located in the Forest-Savanna Transition zone and four others located in the Guinea Savanna zone of Ghana were evaluated for maize production using Soil Quality Index (SQI), Decision Support System for Agrotechnology Transfer (DSSAT) yield simulations and the Multi-Criteria Analysis (MCA). Wenchi (Ferric Dystric Leptosol), Ejura (Haplic Lixisol), Damongo (Dystric Nitisol) and Lima series (Eutric Gleysol) were located in the Forest-Savanna Transition agro-ecological zone whereas Kpelesawgu (Eutric Plinthosol), Varempere (Ferric Luvisol), Mimi (Haplic Lixisol) and Kupela (Eutric Gleysol) series were located in the Guinea Savanna agro-ecological zone. The study sites in the Forest-Savanna Transition zone were located in the Brong-Ahafo region whereas those in the Guinea Savanna zone were in the Northern region of Ghana. Properties used for the SQI rating included bulk density, pH, organic carbon, total nitrogen, available phosphorus, texture and water holding capacity. For the DSSAT, 1980 – 2010 weather variability impacts in addition to soil and management effects were used. The MCA evaluation included factors such as price, input and labour costs, distance to market, soil erosion and conservation factors. The three approaches gave different rankings of the soils for maize production. The SQI results rated the soils in the order: Wenchi > Damongo > Mimi > Ejura > Kupela > Lima > Varempere > Kpelesawgu. From the DSSAT simulations, the order was Varempere > Kpelesawgu > Damongo > Ejura > Kupela > Mimi > Lima > Wenchi. From the MCA, the rankings under different soil management options was in the order: Damongo > Mimi > Ejura > Wenchi > Lima > Varempere > Kupela > Kpelesawgu. Whereas both the SQI and the MCA ranked Kpelesawgu series as the least suitable for maize production, the DSSAT ranked it as the second most suitable. From the results, the soils in the Forest-Savanna Transition zone were more suitable for maize production than those in the Guinea Savannah zone. The soils with negligible gravel content could generally be considered as more suitable for intensive maize production. Although the SQI and the DSSAT yield simulations gave less desirable outcomes than the MCA simulations, they should be considered as useful basis for evaluating and designing the MCA criteria.