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## Modelling Effects of Residual Biochar, Rice Husk and Rice Straw on Productivity of Maize (*Zea mays* L.) for Sustainable Soil Fertility Restoration in the Guinea Savannah Zone

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### Abstract

The International Fertiliser Development Center's (IFDC) concept and approach to integrated soil fertility management as a set of agricultural practices adapted to local conditions to maximise the efficiency of nutrient and water use and improve agricultural productivity on poor fertility soils in the Sudan and Guinea savannah zones of West Africa is innovative to the rural communities. A field experiment was conducted at Nyankpala, near Tamale during the 2014 cropping season and continued during 2015, to investigate the residual effects of available indigenous organic materials (Biochar - partially burnt rice husk, rice husk and rice straw) in combination with supplementary mineral fertiliser N on yield components and grain yield of drought and *Striga* tolerant maize variety “Wang Data”. It was a 3×3×3+1 experiment consisting of the 3 organic materials at 3 rates (2.5, 5 and 7.5 t ha<sup>-1</sup> on dry matter basis) and 3 N fertiliser rates (0, 45 and 90 kg ha<sup>-1</sup>) plus a pure control laid out in a randomised complete block design with four replicates. Results showed increased maize growth and grain production on residual organic material nutrients required supplementary mineral N fertilisation. Best growth parameters, early days to 50 % flowering and highest cob length, cob weight and stover weight, 100 seed weight and grain yield were obtained with 2.5 to 7.5 t ha<sup>-1</sup> Biochar + 45-90 kgN ha<sup>-1</sup>; 5 to 7.5 t ha<sup>-1</sup> rice husk + 45-90 kgN ha<sup>-1</sup> and 7.5 t ha<sup>-1</sup> rice straw + 90 kgN ha<sup>-1</sup>. Biochar provided the least quantitative input of 2.5 t ha<sup>-1</sup> + 45 kgN ha<sup>-1</sup> for maximum maize production and most efficient soil fertility management system. Correlation analysis showed good relationship between grain yield and leaf count (r=0.5699), plant height (r=0.5340), and height of cob attachment (r=0.5164) and cob weight accounted for 69 % of the grain yield. The best prediction model (Eqn. 4) for using Biochar was grain yield = -1414 + 177 (leaf count at 9 WAS) + 5.76 (plant height at 9 WAS).

**Keywords:** Biochar, maize, mineral N fertiliser, rice husk, rice straw