

Yield of Maize and Cowpea Under Variable Seasonal Rainfall, Land form, Tillage and Weed Management on the Vertisols of Ghana

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Abstract

The effects of seasonal rainfall pattern, tillage and weed management on the yield of maize and cowpea grown on two land forms (Camber beds and flat plots), on the Vertisols (Akuse series) in the Accra Plains were examined over a 3-year period (1997-1999). Camber beds, tilled plots, and glyphosate-treated plots gave significantly ($P < 0.001$) higher crop yields than flat, non-tilled and hoe-weeded plots respectively, in seasons with normal or above-average rainfall. Maize yields of 1.97 and 2.3 t ha⁻¹ on camber beds were 17.9% and 47.4% higher than those on flat plots (1.7 and 1.6 t ha⁻¹) in 1997 and 1999 respectively. The seasonal rainfall amounts in the 2 years were 129% and 91% respectively of the seasonal average. However, in 1998 when rainfall in the major season (489 mm) was almost 37.8% below average, maize yields on camber beds (1.3 t ha⁻¹) were 34% lower than those on flat plots (1.95 t ha⁻¹). Cowpea yield on camber beds (0.54 t ha⁻¹) was 21% higher than that on flat plots (0.44 t ha⁻¹) in 1999, but the difference in yield between 0.29 t ha⁻¹ for camber and 0.28 t ha⁻¹ for flat plots was not significant in 1998. However, in 1997 when rainfall was 80.6 mm, about 19.4% below average, cowpea yield of 0.18 t ha⁻¹ on camber beds were 22% lower than that on flat plots of 0.22 t ha⁻¹. Notwithstanding the variations in seasonal rainfall, application of herbicide glyphosate (G2) over the 3 years, increased yields of maize (7.85 t ha⁻¹) and cowpea (1.25 t ha⁻¹) on camber beds by 180% and 85.3% respectively over the 2.8 t ha⁻¹ for maize and 0.67 t ha⁻¹ for cowpea on hoe-weeded flat plots.

Introduction

The climate of the Accra Plains in Ghana with its characteristic low and erratic rainfall regimes coupled with high intensities requires efficient soil water management practices for crop production. Kranjac-Berisavljevic (1994) analyzed the rainfall pattern at the University of Ghana, Agricultural Research Station (ARS), Kpong in the Accra Plains over a 37-year period and compared it with 79 years of data from Akuse, a nearby (8 km) synoptic station. The climatic pattern revealed variations in the number of dry and

humid days during a cropping season causing appreciable differences in soil moisture storage. The rainfall pattern in a typical year is bi-modal with a mean annual total of 1,120 mm with a coefficient of variation of 24%. About 60% of this annual total occur in the major season, 30% in the minor season and the rest in the off-season. Dependable annual rainfall available at 75% probability amounts to only 633 mm.

Of the 183,000 ha of Vertisols in Ghana, about 90% (163,000 ha) occur on the Accra Plains (Brammer, 1967). These soils are