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## Modelling the Effects of Climate Variability and Different Fertiliser Sources on Growth and Yield of Sorghum in the Sudanian Zone of Mali

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### Abstract

Climate variability and low soil fertility are the most severe constraints to smallholder crop production and to sustainable food security. Farmers in semi-arid environments are highly vulnerable to these changes and are incapable of supplying the nutrient requirements of crops through commercial fertilisers. Therefore, integrated nutrient management through the combined use of mineral and organic fertiliser sources is of great importance for the sustainable improvement of soil productivity under changing climatic condition for intensive cropping systems. This study was conducted to assess the effect of the different fertiliser sources (poultry, cow manure and inorganic fertiliser) on the growth and yields of sorghum; and also to evaluate the performance of Decision Support System for Agro-technological Transfer (DSSAT) to predict the yield of sorghum and marginal cost benefit of investment based on long-term climatic conditions. The results revealed significant improvements in the growth and yield of sorghum due to the main and interaction effects of manure and inorganic fertiliser applications. The fertiliser increased dry-matter production by 120%—220 % and grain yield by 18–50 % over control treatment. Model evaluation indicates phenological development was captured with a very high accuracy and provided excellent agreement between simulated and observed values for grain yield and total biomass. On the long-term simulation results, the combined application of micro dose NPK and poultry manure (100g) produced significantly higher yields and gives higher returns on investment and is also the most strategically efficient rate over others for sorghum varieties considered across the locations in Sudan Savannah agro-ecology of Mali

**Keywords:** Grain yield, inorganic fertilisers, integrated nutrient management, poultry and cow manure, sorghum