"MAIZE YIELD WEATHER MODELING AIMED AT FORECASTING AT KATUMANI."

BY

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Declaration

This thesis is my original work and has not been presented for a degree in any other University.

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ABSTRACT

The effects of weather on maize (Zea mays L.) yield in Katumani for the period 1974-1992 were studied by using three methods namely correlation analysis, Caprio (1966) and Principal Component Analysis (PCA) method. The crop and meteorological data were obtained from the Kenya Meteorological Department headquarters in Dagoretti Corner, Nairobi.

Results obtained from correlation analysis indicated that interphase rainfall and evaporation were the most important meteorological parameters affecting the maize growth and the subsequent yield. These two interphase meteorological parameters plus the linear trend in the yield data series were used to develop a Yield Weather Technology model. This model accounted for 83.0 % of the yield variation and was capable of predicting the maize yield two months in advance.

In the second approach crop weather dependence was analyzed using Caprio's (1966) method which employed the χ^2 statistic and was thereafter quantified by regression on Principal Components (PCs). The yield data was generally classified into three categories namely: good, normal and poor yield years and the climatic conditions in the good and poor years compared to those of the normal years. The degree of disproportionate was tested by using the χ^2-statistic.

Good yield years were characterized by abundance of days with high rainfall during planting, emergence to

ninth leaf appearance and grain filling interphases. The same interphase periods were characterized by deficit of days with high evaporation and maximum temperature. Poor yield years on the other hand were characterized by a deficit of days with high rainfall, excess of days with high evaporation and excess of days with high maximum temperature during the floral-initiation stage when the plants demand for water was high.

The climatic variables obtained from the Zones of Significant Assosiation (ZSA) were subjected to PCA. By applying the Kaiser's (1961) criterion of eigenvalue of one or more four principal components were found to be significant and explained 78.3% and 77.4% of the variance in 15 and 11 raw variables during the long and short rains season respectively. These components were loaded heavily on rainfall and maximum temperature during the beginning of the crop growing season and during vegetative growth. When the principal component were subjected to Stepwise Multiple Regression Analysis (SMRA) the ones with heavy loadings on rainfall and maximum temperature were selected first and the ones with heavy loadings on minimum temperature were omitted. The order of selection of components into the regression model depended on the magnitude of the correlation coefficient between the yield and the PCs. The resulting regression model for the short and long rains season explained 76.6% and 72.9% of the yield variance respectively.