

Studies on Potassium requirements for maize in Nyamira County, Kenya

Omanga, Kenya

A research Thesis Submitted in Partial Fulfilment of the Requirements for the Award of the Degree of Masters of Science (Chemistry) in the School of Pure and Applied Sciences of Kenyatta University.

University Supervisors

Dr. Harun M. Mbuvi- Kenyatta University

Dr. Jackson M. Muthengia- Embu University College

Abstract

In Kenya, Maize is a key cereal crop and a major staple food in most Kenyan families. Most maize farmers mainly apply nitrogenous and phosphorous fertilizers to improve on maize yields in the country and Nyamira county in particular. However, acreage yields have been declining yearly despite their use. Application of potassium (K) fertilizers in the region is limited yet it is the third major nutrient required by maize crop in large quantities for optimum growth and yields. Consequently, it is no longer wise to assume that the soils in the region have enough K levels for good growth and yields. The present study was planned to determine the soils nutrient status and evaluate whether K fertilizers use can play a role to improve maize yield in the region. The field experiments were set and conducted in Gachuba location in Nyamira county. Equilibrium K concentrations were determined by flame photometry from filtrate of 2.5g soil in 25ml solutions of various potassium concentrations (0, 25, 50, 75, 100, 125, 150, 175, 200, 225 and 250 mgL⁻¹) after shaking the mixtures for 24 hours to achieve steady state condition. Adsorption data obtained from the various soil solutions of K were fitted into Langmuir, Freundlich, Temkin and Van Haul equations. The data fitted Best in Freundlich isotherm model and were further used to calculate acreage doses. Maize was grown under same doses of nitrogenous and phosphorus fertilizer and ten different doses of potassium in plots of 6m by 5m at two farm sites, that is Gachuba (farm site 1) and Kiang'ede (farm site 2). Maize performance with site and dosage application were determined and growth parameters as well as yield parameters recorded. The study found that maize growth parameters of plant height and stem girth and its yield parameters of ear weight, ear length and grain yields increased steadily as potassium doses were increased and reached their optimum values at potassium doses of 155.84 and 144.76 kg ha⁻¹ giving yields of 3315.27kg ha⁻¹ and 3340.50 kg ha⁻¹ for farm sites 1 and 2 respectively. The concentration levels of available potassium in the soils ranged from 57 to 70 mg kg⁻¹ and with a mean value of 60[±] 5.542 mg kg⁻¹. The water soluble potassium ranged from 1.8 to 2.2 mg kg⁻¹

and gave mean of $2.02 \pm 0.16 \text{ mg kg}^{-1}$. Nitric acid extracted potassium had a mean of $149 \pm 2.306 \text{ mg kg}^{-1}$. The mean value energy of replacement, was found as $-3572 \pm 44.98 \text{ cal mol}^{-1}$. The study indicated insufficiency of potassium in the soil for optimum maize production in the region. Also, it established that potassium doses significantly affected concentrations of Phosphorus and nitrogen in the tissues. The findings of this research will create awareness the extent to which potassium has been depleted in soils in the region to both farmers and policy makers and hence appropriate action taken. Also, the information is expected to help extension officers and Farmers to use correct K doses for optimum yields.