

**NUTRIENT MANAGEMENT OPTIONS FOR ENHANCING PRODUCTIVITY OF
MAIZE AND BEANS UNDER CONSERVATION AND CONVENTIONAL TILLAGE
SYSTEMS**

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**A THESIS SUBMITTED TO GRADUATE SCHOOL IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE AWARD OF A MASTER OF SCIENCE DEGREE
IN AGRONOMY**

**DEPARTMENT OF PLANT SCIENCE AND CROP PROTECTION
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DECLARATION

I declare that this is my original work and has not been presented for an award of a degree in any other university.

Signature.......... Date..... 30/08/2017

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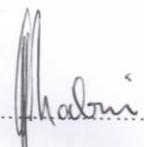
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GENERAL ABSTRACT

Maize (*Zea mays* L.) and dry bean (*Phaseolus vulgaris* L.) are considered the most important food crops in Kenya. However, their productivity has remained low due to climatic, soil and economic constraints. Utilization of no-till with crop residue management, a conservation agriculture practice, has the potential to ameliorate these constraints. A study to develop cost-effective best nutrient management options for enhancing productivity of maize and beans was set up in Busia, Embu and Kirinyaga counties during 2014-2015 growing periods. Experiments were carried out in a maize-bean rotation system under two tillage methods, no-till with crop residues retention (NT+CR) and conventional tillage with no residues retention (CT-CR), and fertilizer regimes (NK, NP, PK, NPK and NPK+CaMgZnBS). The N, P, K, Ca, Mg, Zn, B and S nutrients were applied at the rates of 120, 40, 40, 10, 10, 5 and 26.3 kg/ha respectively. The experiments were laid out in a split plot design with tillage method as the main plot and fertilizer regime as the subplots. Maize was planted in the long rains and subjected to the tillage and fertilizer treatments while dry bean was planted in the short rains in plots from which maize had been harvested. Partial budget analysis was done using production inputs and output cost to compare the profitability of various treatment combination under maize-bean rotation system.

The long rains results showed significantly higher leaf area index (LAI), plant height, aboveground biomass at 30, 60 and 90 days after emergence (DAE), and crop growth rate (CGR) of maize under CT-CR system than under NT+CR system at Alupe and Kirinyaga site. Maize yield under NT+CR was 400 kg/ha higher than under CT-CR in Embu. However, CT-CR produced 300 kg/ha and 600 kg/ha higher grain yields than NT+CR at Alupe and Kirinyaga, respectively. Application of PK and NPK+ZnBMgCaS fertilizer regimes resulted in significantly lower and higher, respectively, dry biomass, LAI, CGR, plant height and maize grain yield than other treatments in both sites. Application of NPK+ZnBMgCaS

fertilizer regime had 500 kg/ha significantly higher grain yield than NPK fertilizer regime at Embu.

In the 2014/2015 short rains, dry bean (a rotation crop) produced higher biomass at 60 DAE, stover, number of pods per plant, number of seeds per pod and 1000-seed weight under NT+CR than under CT-CR in Embu and Kirinyaga. The NT+CR significantly out-yielded CT-CR at Embu and Kirinyaga sites by 200 kg/ha and 140 kg/ha, respectively. In all sites, NPK+ZnBMgCaS and PK residual fertilizer effects yielded significantly the highest and lowest, respectively, dry bean biomass at 60 DAE, number of seeds per pod, 1000-seed weight and grain yields. Both NPK+ZnBMgCaS and NPK residual fertilizer effects out-yielded PK residual fertilizer effect by 600 kg/ha and 370 kg/ha, respectively, in Embu. At Kirinyaga, the former two treatments out-yielded PK residual fertilizer by 710 kg/ha and 330 kg/ha, respectively. Strong and positive relationships were recorded between grain yield and biomass at 60 DAE, number of pods per plant, number of seeds per pod, 1000-seed weight and harvest index. An economic analysis of the maize-bean rotation system showed a generally lower cost of production and higher profits under NT+CR than under CT-CR. In the two sites, the cost of production ranged from Ksh. 55,553 to Ksh. 68,096 for maize and Ksh. 21,425 to Ksh. 31,600 for dry bean. The profits ranged from Ksh. 148,841 under CT-CR to Ksh. 178,410 under NT+CR. Higher benefit to cost ratios of 4.00 and 3.34 under NT+CR than 2.72 and 2.67 under CT-CR at Embu and Kirinyaga, respectively, were recorded under maize-bean rotation system. Based on this study, application of NK fertilizer regime under NT+CR system is more profiting than other treatments, hence could be considered for adoption.