OPTIMISING LOCALLY AVAILABLE RESOURCES FOR NUTRIENT MANAGEMENT TO IMPROVE BANANA PRODUCTIVITY IN THE FARMING SYSTEMS IN ROMBO DISTRICT, KILIMANJARO REGION

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EXTENDED ABSTRACT

Banana is an important staple food in East Africa and an essential cash crop in the national and local economies. In Kagera and Kilimanjaro regions of Tanzania, banana is cultivated by more than 70% of smallholder farmers as a staple food in home gardens ranging from 0.5 to 2 hectares. Decline in banana yield has been reported in banana farming systems as a result of abiotic constraints (nutrient deficiencies and drought stress) and biotic constraints (pests and diseases). Decline in soil fertility and the ensuing nutrient deficiencies are among the major causes of the decline in banana yield. In the banana farming systems, nutrient removal most times exceeds their input, along with years of continuous cultivation results into negative yield trends. Most smallholder farmers are resource-constrained and thus limited in use of inorganic fertiliser due to cost, availability and usage. In this study the aim was to evaluate soil nutrient factors that affect banana production in order to identify localized soil nutrient management practices tailored to the biophysical and socioeconomic conditions of the smallholder farmer improve crop productivity. In evaluating soil fertility status in the banana farming systems, adequate indicators were employed, namely, physico-chemical and nutrient analysis, spatial analysis, crop yield and critical nutrient levels, limiting nutrients and nutrient balances.

A survey approach was employed, involving sample collection in farmers' banana fields. Using the Probability Sampling Technique, six wards (namely: Aleni, Mamsera, Manda, Mengeni, Mengwe and Shimbi) were selected in a systematic random manner based on banana production areas. Then from the six wards, a total of 100 sites were selected in a stratified random manner and geo-referenced. Allometric measurements, namely: girth at base (G_{base}), girth at 1-m height (G_{1m}), number of *hands*, and number of banana *fingers* on the bottom row of the second last hand were taken from among three selected mats with a

banana plant at fruiting stage per farm site. Analysis considered three banana cultivars, namely, *Malindi*, *Matoke* and *Mshare* that were dominant in the sites and had higher number of observations. Allometric data were used to determine banana bunch weights (*Bwt*) and above ground biomass (*AGB*). Results indicated that *Matoke* had significantly ($P \leq 0.05$) higher G_{base}, G_{1m} and *AGB* than *Malindi* and *Mshare*, whereas *Malindi* had significantly ($P \leq 0.05$) more number of *hands*. There was no significant difference (ns) ($P \leq 0.05$) for number of *fingers* and *Bwt* among the cultivars. Soil and plant samples were collected from every site and analysed for physicochemical properties and nutrients concentrations. Boundary line analysis was used to determine plant critical nutrient values. Results indicated critical levels were 2.39, 0.15, 1.5, 0.35 and 0.3% for N, P, K, Ca and Mg, respectively. Results from descriptive statistics, geo-statistics and nutrients maps, coefficient of variation diminished in the order P>Cu>K>Zn>Mn>S.

A survey was carried out to identify agronomic management practices and production constraints. Survey data were used to categorise farmers into wealth classes based on resources owned (Resource-rich *L3*, medium *L2* and poor *L1* households) as well as classes based on cattle ownership. Soil samples were collected from each farm at a depth of 30 cm and nutrient concentrations analysed. The aim was to determine most-limiting yield nutrients in the farms using nutritional index (*NI*). Bunch weight was compared to optimum attainable bunch weight of 28 kg and 69 low-yield farms were obtained. The major nutrient deficiencies were K>Mn>P=Zn>Cu in 40, 35, 34 and 32% of low-yield areas, respectively. *L3* owned more land area under banana than *L2* and *L1* households by 8% (ns). Yet L3 had significantly ($P \leq 0.05$) higher banana *Bwt*. Survey data along with data from nutrient analysis were used for estimating partial nutrient balances in home gardens across household classes. Large nutrient input observed was by farmyard manure application and removal by crops harvested and their residues. Higher negative N and K balances were obtained in home

gardens of less resource households and those with few (≤ 2) cattle, while positive P balances were obtained for home gardens across all household classes indicating less P-removal,. Positive NPK balances were obtained for households with more (>2) dairy cattle, but these were just a few representation of households. Hence, indicating the need to employ an integrated nutrient management approach using other nutrient sources, other than farmyard manure, in order to increase nutrients input and thereby increase and sustain banana yield.

DECLARATION

I, Rutazaha JoanPaula Elliseus, do hereby declare to the Senate of Sokoine University of Agriculture, that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

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DEDICATION

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