HERITABILITY ANALYSIS OF DROUGHT ADAPTATION TRAITS IN SWEETPOTATO

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DECLARATION

I, **Mwije Anthony** hereby affirm that this thesis contains my original research and all literature reviewed in this thesis has been correctly cited from the relevant sources.

Signed …….. Date……..

I thus, submit this thesis for examination with the approval of the following as supervisors.

Signed…….. Date ……..

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Signed……. Date ……..

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DEDICATION

I dedicate this piece of work to all persons working with sweetpotato for livelihood improvement in Uganda.

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It is my prayer that God rewards all of you abundantly.

ABSTRACT

Sweetpotato is a key food security crop in Uganda whose per capita consumption is third to bananas and cassava. Drought is among the major constraints to sweetpotato production in Uganda. Apart from decreasing tuber and vine yields, resulting into shortage of food and planting material, drought stress also increases weevil attack as well as limiting adoption of novel varieties. The increasing risk of drought occurrence due to climate change phenomenon calls for development of drought tolerant sweetpotato genotypes. This is highly pertinent since many farmers in Uganda cannot afford relevant inputs like irrigation. However, the knowledge on selection and genetics of drought tolerance traits in this crop is limited. Therefore, this study was carried out with the main objective of generating knowledge on the genetic control and selection criterion for drought adaptation traits for use in developing improved sweetpotato genotypes in Uganda. Five cultivars (*New Kawogo*, *Munyeera*, *Semanda*, *Tanzania* and *Beauregard*) were crossed following diallel method 4, model 1 of Griffing, 1956. Ten clones randomly selected from each progeny family were evaluated in the field for tuber yield, crop vigor and canopy cover. The same clones were also evaluated on two water regimes of 80% field capacity watering and no watering at all for leaf senescence, leaf retention, leaf rolling, chlorophyll levels and root pulling resistance traits under glasshouse conditions. Combining ability analyses using data from these two experiments revealed that GCA effects and additive gene action were most important. This was characterized by high values of GCA to SCA ratios as well as high values of narrow sense heritability. Superior combiners for respective drought adaptation traits were determined. In addition, four genotypes (*New Kawogo*, *Munyeera*, *KSP 1101* and *Beauregard*) were established in a glasshouse on three water regimes of 80, 40 and 20% field capacity. Differential expression of nine traits (leaf senescence, leaf rolling, leaf retention, chlorophyll levels, leaf water potential, relative water content, number of branches and leaves) was studied. Analysis of variance with orthogonal contrasts revealed significant interaction effects between susceptible and tolerant genotypes with water regimes for traits, leaf rolling ($P < 0.01$) and senescence ($P < 0.05$) and number of branches ($P < 0.05$). Based on these three traits and ANOVA contrasts, precise rapid drought screening is possible. However, if the genotypes are too many, a principal component or cluster analysis platform can be used, whereby all clones that cluster with a reference genotype are selected as drought tolerant.