

EFFECT OF N AND K MINERAL FERTILIZERS ON GROWTH AND YIELD OF WATER YAM (*DIOSCOREA ALATA*) *

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INTRODUCTION

Yam tuber (*Dioscorea* spp.) of the family Dioscoreaceae, is a staple food for over a billion people in the tropical nations of Africa, Asia, the Caribbean and the Pacific regions. Yams are known to respond to high levels of soil fertility and nutrients to concentrate on in yams are N and K as tuber exports large amounts of these elements from the field. Potassium is essential for photosynthesis, translocation of photosynthates and for protein synthesis while Nitrogen is essential for photosynthates production and protein synthesis. It has a strong impact on foliage production as well. There is little or no work has been done on the impact of different N and K and organic matter input on root growth and yield of *D. alata* until now. Thus, this present study was conducted to identify crop growth parameters which would specifically be affected by N and K of mineral fertilizers and how these influences could explain the tuber yield of *D. alata*.

MATERIALS AND METHODS

The study was conducted at the Field Crops Research and Development Institute (FCRDI), Mahalluppallama, Sri Lanka for consecutive two years. The experiment was laid with 4 replicates in Randomized Complete Block Design. Planting was done at 1 m x 1m spacing. Each treatment had 40 plants per plot. There were 6 N:K mineral fertilizer ratios added as follows: T1 (0 N:0 K) Control,

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T2 (90 N:0 K), T3 (0 N:105 K), T4 (90 N:105 K), T5 (180 N:105 K), T6 (90 N:210 K) (kg/ ha) and mineral fertilizers were broadcasted equally at vegetative stage (50 Days After Planting (DAP)) and tuber initiation stage (100 DAP) as described by Hgaza (2011). In data collection destructive sampling was done at four stages of the crop growth. Leaf area index (LAI), shoot (leaves and vine) dry weight, root dry weight and tuber dry weight were determined at all sampling stages. At all sampling dates the plant parts were dried at 60 °C to a constant weight and weighed. These data, was used to calculate the following growth parameters as leaf area ratio (LAR), crop growth rate (CGR) and tuber growth rate (TGR).

RESULTS AND DISCUSSION

The highest LAR 4.6 was observed at the time of harvesting in 1st season and 5.2 in the 2nd season, in 180 N: 105 K treatment, where supplied with double rate of N fertilizer. The lowest LAI was 1.8 recorded in 0 N: 105 K in the 1st season, 0.8 recorded in 0 N: 0 K in the 2nd season, where no N fertilizer added at the time of harvesting. When a well-developed canopy was shown, resulting greater productivity due to more efficient capture of incident radiation (da Silva *et al.*, 2009). Results confirm the LAI previously measured for this yam species (Diby *et al.*, 2011; Rodr guez-Montero *et al.*, 2001).

Mean Leaf Area Ratio (LAR) was 108.1 cm² leaf area / g biomass and 91.6 cm² leaf area/g biomass respectively in two seasons. The LAR was increasing up to 5-6 months and there after started to decrease. Mean LARobserved is in agreement with LAR reported for *D. alata* by Diby *et al.* (2011). The mean crop growth rate (CGR) values of *D. alata* in 180N: 105K and 0N:0K treatments were 5.17 g/m²/day and 3.03 g/m²/day in 1st season and 3.7 g/m²/day and 2.46 g/m²/day in 2nd season. There was a decrease in mean crop growth during 2nd season in all the treatments; due to anthracnose leaf spot disease infection at the tuber bulking stage (100-240 DAP). Mean CGR values in 0 N:0 K and 0 N:105 K treatments were lower than other, treatments in both seasons.

The mean TBR reached 3.9 g/m²/day and 3.1 g/m²/day in 180 N:105 K and 0 N:0 K treatments respectively in 1st season and 3.05 g/m²/day and 2.35 g/m²/day in 180 N:105 K and 0 N:0 K treatments, respectively in 2nd season. The tuber bulking rate observed in this experiment was similar to that was reported by Diby *et al.* (2011) in Savanna soil for *D. alata*.

The high yielding ability of 180 N:105 K treatment over the 0 N:0 K treatment in *D. alata* in both seasons. There were 34% and 28% yield drop in 0N:0K treatment, respectively in two seasons compared with 180 N:105 K treatment. The lower tuber yields observed in low nutrient contained soil (0 N:0 K and 0 N:105 K) confirms that yams require nutrients rich soils in order to produce higher yields as mentioned by Diby, *et al.* (2011); Orkwor and Asadu (1998) and Kowal and Kassam (1976). The difference in FTY between treatments corresponded to the differences observed in crop growth pattern. 180 N: 105K treatment reached a greater mean LAI, mean LAR, mean CGR and TBR, thus it produced higher tuber yields than T1 treatment in both seasons.

This work confirmed that the fresh tuber yields of *D. alata* lower under low N and K contents. However *D. alata* species clearly showed the potential for producing sound yields even under no addition of N or K as mineral fertilizers for consecutive two seasons. The lower yields resulted in both seasons in 0 N:0 K and 0 N:105 K treatments were explained by decrease in LAI and increased their LAR. This study is the first study which describes the growth reaction of *D. alata* species to different N and K ratios supplied by mineral fertilizers.

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