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Effects of enhancing sweet potatoes variety diversity in increasing yield and quality of tuber

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Abstract

Sweet potato is a tuber crop which is grown for both its tubers and vines. The tubers are used as human food while the vines are used as livestock feed. It is a crop that is able to resist drought conditions and will take a short time to mature hence plays a big role in food security in Kenya.

There are many different varieties of sweet potatoes in the world and in Kenya which differ in growth and yield characteristics. Since most of the population in Embu West Sub County is made up of small scale farmers who undertake farming as an economic activity, it is necessary for them to adopt the variety that produces the highest yield.

A study was carried out to determine effects of enhancing suit potatoes variety diversity in increasing yield and quality of tuber of SPK004, Kenspot 3 and Kenspot 4.Data on specific growth and yield parameters was collected in two seasons , summarized using excel then analysed using SPSS version 23, α=0.05.

The study showed significant growth and yield potential difference in all yield parameters among the three sweet potato varieties with Kenspot 4 being the highest producer of and biomass above the ground and widest tuber diameter.

Keywords: Sweet potato variety; Vine length; Tuber yield; Above the ground Biomass

1. Introduction

Sweet potato is a nutritive root crop that holds significant quantities of roughage, beta carotene and vitamin C, mostly in cultivars with colored roots. Sweet potato is also a treasured source of vitamins A, B, and E, and it holds reasonable intensities of iron and zinc (Kareem et al., 2020; Kays, 2016; Brandenberger et al., 2014).

Among the six very essential food crops, sweet potato is ranked as the sixth after rice, wheat, potatoes, maize and cassava. It is however ranked the fifth key food crop in the developing countries (FAO, 2015). Production data for the sweet potato in the world have not changed for over the past 40 years hence do not show a hopeful picture. The total production has stagnated at roughly 137 million metric tons, despite the fact that the total number of people in the world has in actual fact doubled up (Kays, 2016).

Sweet potato can grow at height above sea level ranging from 0 -2,500 meters. It requires smaller quantity of inputs and less labor than other crops such as maize, and put up with marginal growing circumstances (e.g., dry spells, poor soil) (Oswald et al., 2009). Many farmers in the world are gradually seeing the importance of producing sweet potato As postulated by Lirag (2019) sweet potato is trading well in the worldwide market, doing better in terms of trade

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outperforming other main food crops because its desirable for consumption by man and it's also a fast source of earnings.

Various reasons can cause the Yields of sweet potato to differ considerably including location, soil factors, climate and crop's genetic constitution. Under ultimate settings, very great harvests can be achieved, but more probable harvests will vary between 300 to 350 bushels (bushel=50 lbs.) per acre (Brandenberger et al., 2014). In the USA 22.8 tons per hectare were recorded while Japan, produced a weight of 21.7 tons per hectare (FAO, 2015).In sub-Saharan Africa, yields obtained are normally less than 10 tons per hectare wet weight (FAO, 2015).

When choosing the variety to plant, various factors should be considered including what consumers prefer, how much they can resist pests, the quality of produce and their ability to produce propagation materials for slip production (Monostori & Szarvas, 2015). As with all vegetal crops, marketplace demand is a great aspect in choosing a cultivar to produce, and the possibility for a cultivar to give high yields. New varieties should also be tried on the farms first before being introduced to farmers after which farmers should try them so that they can be able to judge whether they should adopt them or not.

Ochieng (2019) carried out a study on sweet potato genotypes that grow in various environmental areas in Kenya under Morphological Characterization. The study was carried out in October 2013 and April 2014 in Miyare Agricultural Training College in Migori county and KALRO in Embu County. 68 genotypes, which were frequently grown by farmers in western, Nyanza and Eastern Regions of Kenya were used among them SPK004, Kenspot 3 and Kenspot 4.Randomized complete block design was used in planting the sweet potatoes with 3 replications. Above ground characters such as vine length, internode length, diameter of internode, and length of petiole were used. Underground characters such as length of storage root, diameter of largest root, root yield in Mt/ha were assessed. This study reported that effect of site and genotype significantly affected all agro morphological variables except length and diameter of vine internodes and weight of largest tubers.

2. Material and methods

2.1. Location of the Study

The research was carried out in Embu west sub county, Embu county Kenya in KALRO farm located at Kangaru. This County receives an average rainfall quantity of 1250 mm per annum with a mean temperature of 21˚C.There are two distinct rain seasons in Embu County.

2.2. Experimental Procedure

Land for planting sweet potato was prepared manually and harrowed to medium tilth. Using Randomized complete block design, land was divided into three blocks each having twelve plots which measured three meter by three meters. Sweet potato variety treatments were randomly assigned to the experimental units. The vines used for propagation were sourced from KARLO Embu. The vines were planted at a spacing of 50 by 100cm.Management practices such as weeds, pests and diseases control was carried out in all plots throughout the growing season.

2.3. Data Collection and Analysis

Every plot in each block had 4 rows, each having 7 plants. Two inner rows from each plot were sampled then then three plants from each of the two rows were selected and tagged for data collection. Data on growth and yield parameters from the tagged plants was collected and recorded throughout the experimental time. Growth parameters used were length of vines and number of vine branches while yield parameters were above the ground biomass and tuber diameter.

The collected data was first summarized using excel then ANOVA was done using SPSS version 23 at α=0.05. For treatment means that were significantly different, LSD as a post hoc test was used to separate them.

3. Results and discussion

3.1. Vine Length

ANOVA was used to determine if variety as a treatment had any significant effect on length of vines. The results obtained showed that variety significantly affected the length of vines ($p<0.05$).

To separate the variety means LSD test was carried out and the results are shown in table 1.They showed that Kenspot 3 produced vines with a maximum length of 62.2cm, which were significantly longer than those of Kenspot 4(39cm) and SPK004 (48cm). SPK 004 produced vines which were significantly longer than Kenspot 4. The significant difference in the length of vines among the three varieties can be explained by the genetic variability among the sweet potato varieties. Ochieng (2019) reported that there was high level of genetic variability exhibited in sweet potato .This research also reported a significant difference in vine length between SPK 004, Kenspot 3 and Kenspot 4. Similarly Bonginkhosi et al. (2021) reported significant differences in vine length among sweet potato varieties which may be attributed to difference in genetic makeup in the varieties.

Table 1 LSD Effect of Variety on Vine Length

	SPK 004	**KENSPOT 3**	**KENSPOT 4**
SPK 004		-8.8201*	5.5394*
KENSPOT 3			14.6596*
KENSPOT 4			

* At the Level of 0.05, the mean difference is statistically significant.*

3.2. Branches of Vines per Plant

The six tagged plots were used to determine the number of vine branches per plant. This was done through counting of the vine branches. The summarized results were then analysed using ANOVA and the results show that the number of vine branches differed significantly across the three cultivars used. When the treatment means were separated by use of LSD (table 2) the results showed that SPK 004 gave considerably greater number of vines than Kenspot 3. Kenspot 4 gave significantly greater number of vines than Kenspot 3. SPK 004 produced a slightly higher number of vines than Kenspot 4 but the difference was not significant. This shows that Kenspot 4 and SPK 004 are more suited for production of propagation material since they produce more vines. According to Ochieng (2019), the variability mostly in number of vine strands among the varieties can always be thought to be due to genotypic differences.

Table 2 LSD Effect of Variety on Number of Vines

	SPK 004	**Kenspot 3**	**Kenspot 4**
SPK 004		9.94*	0.17
Kenspot 3			
Kenspot 4		9.78*	

. Only at level of 0.05, the mean difference is statistically significant

3.3. Above ground Biomass

There was a significant difference in biomass above the ground among the three varieties. This study's findings are in agreement with those of (Ochieng, 2019) who disclosed that consolidated ANOVA showed highly significant effect for varieties as well as sites throughout all quantitative characters ($p< 0.05$). The findings of this research agree with that of (Mwololo et al., 2012) who discovered that vine fresh biomass showed significant difference among both seasons, sites, as well as varieties. The LSD test was also used to separate treatment means and thus the outcomes are included in table 3 which shows that above the ground biomass yield obtained from Kenspot 4 was significantly higher(12.8tons per hectare) than that obtained from SPK 004 (8.4tons per hectare).

Table 3 LSD Effect of Variety on Above the Ground Biomass Yield

	SPK 004	**Kenspot 3**	**Kenspot 4**
SPK 004		-1.0025	-2.43387*
Kenspot 3			-1.43362
Kenspot 4			

*The mean difference at 0.05 level is significant.

3.4. Tuber Diameter

ANOVA results show that Tuber diameter varied significantly among varieties ($p<0.05$). LSD was used to separate varieties, and the results are summarized in table4. Table 4 shows that the tuber diameter of SPK 004 (5.15cm) was significantly higher than that of Kenspot 3 (4.6cm).Kenspot 4 produced tubers with a significantly bigger diameter (5.0cm) than Kenspot 3. There was no significant difference in diameter of tubers between SPK 004 and Kenspot 4. The results from this study agree with those of (Bonginkhosi et al., 2021) who reported a significant difference on the diameter of tubers between the sweet potato varieties. This may have been due to genetic differences among cultivars.

Table 4 LSD Effect of Variety on Tuber Diameter

	SPK 004	**KENSPOT 3**	**KENSPOT 4**
SPK 004		0.76175*	0.30275
KENSPOT 3			-.45900*
KENSPOT 4			

The mean difference is significant at the 0.05 level.

Abbreviations

- ANOVA Analysis of Variance
- SPSS Statistical Package for Social Sciences
- LSD Least Significant Difference
- KALRO Kenya Agricultural Livestock Research Organization

4. Conclusion and recommendation

Sweet potato varieties differ in their growth and yield characteristics which may be attributed to their difference in genetic makeup.

Based on the results of this study Kenspot 3 and SPK 004 produced vines which were significantly longer than kenspot4.SPK 004 produced significantly higher number of vines per plant compared to Kenspot 3 hence SPK 004 is recommended for those farmers who want to multiply vines for propagation since it produces significantly higher number and length of vines.

On yield, Kenspot 4 produced the highest biomass above the ground hence it is recommended for farmers who would want to use the sweet potato biomass above the ground as feed for livestock. Kenspot 4 and SPK004 produced tubers of a significantly larger diameter hence they are recommended for commercial purposes tuber production especially where consumers prefer tubers of a larger diameter.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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