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# Agronomic Performance of Kenyan Orange Fleshed Sweet Potato Varieties

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**Abstract**

Sweet potato is one of the most important staple crops in Sub-Sahara Africa because of its supply of carbohydrates, vitamin A and C, fiber, iron, potassium and protein. The objective of this study was to determine phenotypic variation in diverse sweetpotato varieties for marketable roots, fresh root yield, fresh biomass weight, harvest index, beta carotene content and root dry matter content. Twenty five sweet potato genotypes were evaluated at two sites in two seasons in Kenya using a randomized complete block design of three replications. The results indicated that there were highly significantly variations for genotypes and sites for all the traits studied. There were no significant differences for genotype x site x season effects for the traits except for the number of marketable roots and fresh root yield. The mean fresh root was 32.19 t/ha, with the genotype Ininda expressing the highest fresh root yield of 54.79 t/ha. Genotypes, Naspot 13, Ejumula, Kabode, Vitaa and Tio-Joe gave the highest beta carotene content ranging between 11.830 and 10.040 mg/100g; with a mean of 5.384 mg/100g. The mean root dry matter content was 24.84 % with clones Amelia and Melinda showing the highest and lowest root dry matter content of 30.62 and 16.52 % respectively. Ten genotypes including Ininda, Erica, Jane, Naspot 13, Ejumula, Kabode, Vitaa, Tio-Joe, Amelia and Mayai were recommended as potential parents for sweet potato breeding program in Kenya.

**Keywords:** beta carotene content, genotypes, phenotypic variation, sweet potato

## 1. Introduction

**S**weet potato, the seventh most important staple food globally, produces more edible energy per hectare per day than wheat, cassava or rice (Woolfe, 1992). Orange fleshed sweet potato varieties provide carotene, a precursor for vitamin A, that reduces vitamin A deficiency (VAD) in children and lactating mothers (Low et al., 2001). The crop is consumed as fresh roots or as leaves and is also processed into animal feed, starch, flour, candy and alcohol (Chiona, 2009). According to Woolfe (1992) sweet potato can be substituted for wheat in bread, cereals and in many tasty, nutritious recipes.

Unlike cereals, sweet potato is harvested all year-round providing a long term solution for vitamin A deficiency (Mwanga & Ssemakula, 2011). The crop is adaptable to diverse environments because it tolerates high temperatures, low fertility soils, can grow in areas with low annual rainfall and is easy to propagate (Stathers et al., 2013).

Despite these advantages, sweet potato production is hampered by constraints, such as low yields resulting from lack of improved planting materials, poor root storage, weevil damage and unfavourable root shape (Belehu, 2003). In addition, most Kenyan sweet potato varieties are white-fleshed, therefore lacking in the essential beta carotene content (Low et al., 2017)

Orange fleshed sweet potatoes offer an alternative means of addressing vitamin A deficiency because they contain high levels of beta carotene. It has been shown that a regular intake of about 100 gm of orange fleshed

sweet potato roots per day provides the recommended daily amount of vitamin A for children, effectively protecting them from blindness (Mukherjee & Ilangantileke, 2002). This study sought to identify the phenotypic variation for yield, yield components, beta carotene content and dry matter content of orange fleshed sweet potato varieties grown in Kenya.

## 2. Materials and Methods

### *2.1 Experimental Sites*

Field experiments were conducted at two sites, namely, KALRO-Kiboko and Kabete field station of the University of Nairobi. The KALRO-Kiboko research station (2 °15 ' S, 37 °45 ' E and 993 m asl) is located in Agro-ecological Zone 5, in Makueni county, 187 km East of Nairobi. The station receives bimodal precipitation with short rains season beginning in late October to December (330 mm) and long rains from March to May (230 mm). The average annual temperature is 24 ℃. The soil is rhodic ferrosols (Kivuva, 2013). Kabete Field Station of University of Nairobi (1 ° 15’ S, 36 °44’ E and 1930 m asl) is located in Nairobi county at about 15 km to Nairobi city and receives binomial rainfall with the short rain season beginning in October to December and the long rain season occurring between March to May. The annual rainfall is 1006 mm and the overage annual temperature is 18 ℃. The soil is well drained, deep, darkish brown to dark red and is humic nitrisol type (Onyango et al., 2012)

### *2.2 Planting Materials*

Twenty five varieties varying in yield and in beta carotene content as shown in Table 1 were selected for agronomic evaluation in two locations and seasons.

Table 1. Sweet potato clones, local names, origin, flesh color and skin color evaluated at Kiboko and Kabete

| Name | Origin | Flesh color | Skin color | References |
|---|---|---|---|---|
| Kenspot 5 | Kenya | Orange | Purple | Tumwegamire et al. (2014) |
| Mayai | Tanzania | Yellow | Brownish orange | Tumwegamire et al. (2014) |
| Kakamega | Kenya | Intermediate orange | Purple | Tumwegamire et al. (2014) |
| Lourdes | Mozambique | Intermediate orange | Cream | Tumwegamire et al. (2014) |
| Tio Joe | Mozambique | Dark orange | Light purple | Tumwegamire et al. (2014 |
| Naspot 1 | Uganda | Cream | Purple red | Mwanga et al. (2003) |
| Amelia | Mozambique | Orange | Pink | Kapinga et al. (2010) |
| Ejumula | Uganda | Deep orange | Purple red | Mwanga et al. (2003) |
| Naspot 2 | Uganda | Cream | Cream | Kapinga et al. (2010) |
| Ininda | Mozambique | Orange | Purple red | Kapinga et al. (2010) |
| Melinda | Mozambique | Light orange | Purple red | Kapinga et al. (2010) |
| Kabode | Uganda | Deep orange | Purple red | Kapinga et al. (2010) |
| Cecilia | Mozambique | Pale orange | Cream | Kapinga et al. (2010) |
| Naspot 8 | Uganda | Intermediate orange | Brown | Mwanga et al. (2003) |
| Jane | Kenya | Intermediate orange | Cream | Kapinga et al. (2010) |
| Erica | Kenya | Yellow orange | Purple red | Kapinga et al. (2010) |
| Sumaia | Uganda | Deep orange | Purple red | Tumwegamire et al. (2014) |
| Gweri | Uganda | Intermediate orange | Purple red | Mwanga et al. (2003) |
| Naspot 12 | Uganda | Intermediate orange | Cream | Tumwegamire et al. (2014) |
| Delvia | Mozambique | Orange | Purple red | Tumwegamire et al. (2014) |
| Vitaa | Uganda | Deep orange | Purple red | Tumwegamire et al. (2014) |
| Irene | Mozambique | Orange | Purple red | Tumwegamire et al. (2014) |
| Naspot 13 | Uganda | Deep orange | Cream | Tumwegamire et al. (2014) |
| Kenspot 4 | Kenya | Orange | Cream | Tumwegamire et al. (2014) |
| Tanzania | Tanzania | Yellow | Brown | Mwanga et al. (2003) |

### *2.3 Experimental Design*

The two trials were laid out in field at KARI-Kiboko and Kabete Field Station between July and November 2016, and a second set of trials was conducted in the same sites between November 2016 and March 2017. All the experiments were laid out in a randomized complete block design (RCBD) with three replications. Each replication was composed of 25 plots corresponding to 25 clones used as treatments. All clones were planted in a quadruple row of 1.2 m long for four plants per genotype per row at spacing of 30 cm within the row and 90 cm

between rows. The plot had 4.32 $m^2$ (3.6 m x 1.2 m) as dimensions.

Diammonium phosphate (DAP) fertilizer was applied two weeks after the time of sowing at a rate of 115 kg/ha. Cut worms were controlled with insecticide, IMAX 200SC which was applied every week until the establishment of the crop at a rate of 10ml in twenty liters of water. The clones were regularly irrigated to maintain growth and weeded by hand when it was necessary to do so.

*2.4 Data Collection*

Fresh roots were harvested 120 days after planting using hand hoe and data were collected on eight plants within a harvested plot of 2.16 $m^2$. Yield and yield components were measured as follows: total number of marketable roots per plant (NMR) was determined from counting roots weighing between 100 and 500 grams. Fresh root yield (FRY) was measured in kilograms as the combined harvested root on each plot using a balancing scale and the recorded weight per plot unit was extrapolated to tonnes per hectare basis (tonnes/ha). Fresh biomass weight (WB) was measured in kilograms as the harvested root together with fresh cut vines per plot and was extrapolated to tonnes per hectare (t/ha). Harvest index (HI) was estimated as the ratio of the fresh root yield and fresh biomass weight and expressed in percentage. Root dry matter content (RDMC) was determined as the percent of the ratio of root dry weight and fresh root weight. Beta carotene content (BCC) was estimated using the method described by Burgos et al. (2014) in mg per 100 gm of fresh weight.

*2.5 Data Analysis*

The data for number of marketable roots (NMR), fresh root yield (FRY), fresh biomass weight (WB), harvest index (HI), beta carotene content (BCC) and root dry matter content (DMC) across the two sites and seasons were subjected to the analysis of variance using GENSTAT 15$^{th}$ edition. Means were compares with the Fisher's protected least significant differences (LSD) test at 5% significance level. Pearson correlation coefficient analysis was done to determine the association between the traits studied.

## 3. Result

*3.1 Field Trial*

Table 2 presents the mean squares of the yield components in the twenty five sweet potato genotypes across the two sites and in two seasons. The combined ANOVA showed highly significant effects for genotypes and for sites in all the traits ($p < 0.001$). Seasons, showed highly significant differences for number of marketable roots, fresh biomass weight, and harvest index and beta carotene content ($p < 0.001$), whereas no significant differences were observed for fresh root yield and dry matter content ($p > 0.05$). There were no significant differences for the genotype x sites x season effect for many traits again except for weight of marketable roots (significant difference, $p < 0.05$), fresh root yield and biomass weight (very high significant difference, $p < 0.001$).

Table 2. Mean squares for yield and yield related parameters and nutrient contents among twenty five sweet potato genotypes across sites and seasons

| Source of variation | d.f. | NMR | FRY | WB | HI | BCC | DMC |
|---|---|---|---|---|---|---|---|
| Blocks | 2 | 0.21 | 1281 | 290 | 2295 | 0.13 | 3.57 |
| Genotypes | 24 | 1.68*** | 932*** | 1937*** | 563*** | 174.81*** | 212.96*** |
| Sites | 1 | 99.67*** | 132775*** | 170675*** | 75913*** | 2.51*** | 367.13*** |
| Seasons | 1 | 6.49*** | 18$^{ns}$ | 19414*** | 1015*** | 0.52** | 0.55$^{ns}$ |
| Genotypes x Sites | 24 | 1.87*** | 774*** | 1106*** | 369*** | 0.09$^{ns}$ | 15.68*** |
| Genotypes x Seasons | 24 | 0.38$^{ns}$ | 469*** | 562*** | 225*** | 0.07$^{ns}$ | 0.16$^{ns}$ |
| Sites x Seasons | 1 | 0.76$^{ns}$ | 12987*** | 79677*** | 2$^{ns}$ | 0.05$^{ns}$ | 0.04$^{ns}$ |
| Genotypes x Sites x Seasons | 24 | 0.52* | 440*** | 692*** | 116$^{ns}$ | 0.02$^{ns}$ | 0.72$^{ns}$ |
| Error | 198 | 0.28 | 60 | 243 | 82 | 0.06 | 0.73 |
| Total | 299 | | | | | | |

Note: ***, **, * and $^{ns}$ = very high and high significant and no significant differences; d.f. = degrees of freedom, NMR= number of marketable roots; FRY= fresh root yield; WB= weight of biomass; HI= harvest index; BCC= beta carotene content and DMC= dry matter content.

*3.2 Phenotypic Performance of Sweet Potato Genotypes*

The results of the means for all variables are presented in Tables 3 and 4. For the number of marketable roots, genotypes, Ininda (2.6), Sumaia (2.3) Naspot12 (2.1) and Erica (2.0) had the highest number of marketable roots

(NMR). The lowest number of marketable roots was given by genotypes, Gweri, Naspot 2 and Kakamega with 0.8, 1.1 and 1.2 values respectively (Table 4). For fresh root yield (FRY), genotypes, Ininda (54.79 t/ha), Erica (46.70 t/ha) and Jane (45.03 t/ha) had the highest root yield whereas clones, Kakamega (19.10 t/ha), Gweri (17.63 t/ha) and Naspot 2 (20.00 t/ha) had the lowest root yield (Table 4). With regard to fresh biomass weight (WB), genotypes, Ininda (94.56 t/ha), Naspot 12 (85.26 t/ha), Erica (83.65 t/ha) and Jane (79.01 t/ha) had the highest biomass weight whereas genotypes, Amelia, Kakamega and Ejumula had the lowest biomass weight with 41.51 t/ha, 47.33 t/ha and 50.01 t/ha values respectively. The highest average harvest index was recorded by genotypes Amelia (52.2 %), Ininda (51.0 %), Ejumula and Vitaa (49.3 %), Naspot8 (48.3 %) and Erica (47.4 %) but genotypes, Gweri (20.4%), Naspot1 (32.2%), and Kakamega (34.1 %) had the lowest HI. With respect to the sites, the genotypes grown at KALRO-Kiboko had high values for most of the yield and yield parameters compared to these grown at Kabete (Table 3)

Genotypes, Naspot13, Ejumula, Kabode, Vitaa, Tio-Joe and Lourdes had the highest beta carotene concentration that ranged between 9.853 and 11.830 mg/ 100 g. but genotypes, Naspot2, Naspot1, Mayai, Tanzania and Gweri had the lowest beta carotene content (Table 4). With regard to dry matter content, clones Naspot1, Amelia, Ejumula, Gweri, Naspot12, Kenspot4 and Tanzania had the highest dry matter content that ranged between 27.54 and 29.13%. Genotypes, Erica, Melinda, Lourdes, Sumaia and Ininda had the lowest dry matter content that ranged between 16.54 and 21.88 %. Genotypes grown at Kabete had higher beta carotene content than those grown at KALRO-Kiboko with 5.476 and 5.293 mg/ 100g values respectively. For dry matter content, clones from KALRO-Kiboko had higher dry matter concentration than those at Kabete Field Station (Table 3).

Table 3. Mean performance for the number of marketable roots, fresh root yield and fresh biomass weight among sites across seasons

| Sites | NMR (n º) | FRY (t.ha$^{-1}$) | WB (t.ha$^{-1}$) | HI (%) | BCC (mg/100g) | DMC (%) |
|---|---|---|---|---|---|---|
| Kabete | 1.1 | 11.15 | 40.94 | 27.07 | 5.476 | 23.72 |
| KALRO Kiboko | 2.3 | 53.22 | 88.64 | 58.88 | 5.293 | 25.93 |
| MEAN | 1.7 | 32.19 | 64.79 | 42.97 | 5.384 | 24.83 |
| LSD | 0.12 | 1.76 | 3.55 | 2.07 | 0.055 | 0.19 |
| C.V | 31.71 | 24.05 | 24.04 | 21.11 | 4.460 | 3.45 |

L.S.D. = Least significant difference; C.V. = Coefficient of variation; NMR= number of marketable roots per plant; NUR=number of unmarketable roots per plant; NSR=number of storage roots per plant, FRY=fresh root yield (t/ha) and WB= fresh biomass weight (t/ha) BCC= beta carotene content (mg/100g) and DMC= dry matter content (%).

Table 4. Mean performance for number of marketable roots, fresh root yield and fresh biomass weight among twenty five sweet potato genotypes across sites and seasons

| Genotype | NMR (nº) | FRY (t/ha) | WB (t/ha) | HI (%) | BCC (mg/100g) | DMC (%) |
|---|---|---|---|---|---|---|
| Amelia | 2.0 | 24.05 | 42.29 | 53.11 | 4.261 | 30.62 |
| Cecilia | 1.7 | 29.88 | 56.00 | 43.77 | 5.776 | 23.45 |
| Delvia | 1.7 | 37.35 | 75.06 | 42.3 | 4.671 | 27.12 |
| Ejumula | 1.3 | 28.02 | 51.06 | 49.47 | 11.209 | 29.83 |
| Erica | 2.0 | 46.56 | 83.65 | 47.37 | 1.648 | 16.88 |
| Gweri | 0.8 | 17.63 | 61.17 | 20.45 | 0.864 | 29.57 |
| Ininda | 2.6 | 54.79 | 94.56 | 50.97 | 4.945 | 22.52 |
| Irene | 1.8 | 37.32 | 65.40 | 48.73 | 7.832 | 21.78 |
| Jane | 1.4 | 45.03 | 79.01 | 45.04 | 4.956 | 17.43 |
| Kabode | 1.8 | 25.74 | 50.94 | 43.78 | 10.785 | 29.05 |
| Kakamega | 1.2 | 19.10 | 47.33 | 34.14 | 3.537 | 27.37 |
| Kenspot 4 | 1.7 | 33.79 | 71.05 | 38.42 | 3.739 | 28.36 |
| Kenspot 5 | 1.7 | 29.97 | 53.00 | 42.22 | 5.115 | 27.13 |
| Lourdes | 1.7 | 34.63 | 68.24 | 39.37 | 9.853 | 22.26 |
| Mayai | 1.8 | 27.45 | 56.60 | 44.70 | 0.000 | 29.73 |
| Melinda | 1.6 | 36.95 | 66.66 | 46.66 | 4.993 | 16.52 |
| Naspot 1 | 1.6 | 25.38 | 69.59 | 33.58 | 0.000 | 29.02 |
| Naspot 12 | 2.1 | 38.33 | 85.26 | 44.11 | 7.913 | 24.08 |
| Naspot 13 | 1.3 | 23.26 | 59.45 | 36.93 | 11.83 | 22.99 |
| Naspot 2 | 1.1 | 23.54 | 53.34 | 41.02 | 0.000 | 23.62 |
| Naspot 8 | 1.6 | 26.61 | 59.13 | 48.52 | 2.636 | 26.33 |
| Sumaia | 2.3 | 32.18 | 65.10 | 43.02 | 7.062 | 21.90 |
| Tanzania | 1.7 | 41.35 | 71.08 | 48.26 | 0.446 | 28.75 |
| Tio Joe | 1.9 | 33.96 | 74.23 | 40.32 | 10.040 | 21.9 |
| Vitaa | 1.7 | 31.81 | 60.53 | 48.09 | 10.501 | 22.47 |
| MEAN | 1.70 | 32.19 | 64.79 | 42.97 | 5.384 | 24.83 |
| LSD | 0.43 | 6.23 | 12.54 | 7.30 | 0.193 | 0.69 |
| C.V. (%) | 31.71 | 24.05 | 24.04 | 21.11 | 4.460 | 3.45 |

L.S.D. = Least significant difference; C.V. = Coefficient of variation; NMR= number of marketable roots per plant; NUR=number of unmarketable roots per plant; NSR=number of storage roots per plant, FRY=fresh root yield (t/ha) and WB= fresh biomass weight (t/ha) BCC= beta carotene content (mg/100g) and DMC= dry matter content (%).

### *3.3 Phenotypic Correlation between Traits Studied*

Fresh root yield was positively significantly correlated with all the traits (r = 0.821 for HI, r = 0.750 for NMR and r = 0.875 for WB) but was negatively insignificantly correlated with beta carotene and dry matter content (r = -0.031 and r = 0.033), respectively (Table 5). There was negatively significant association between beta carotene and root dry matter content (r = -0.199) (Table 5).

Table 5. Combined table showing correlation between parameters for twenty five sweet potato genotypes for two sites

| Traits | HI | NMR | WB | FRY | BCC |
|---|---|---|---|---|---|
| NMR | **0.736*** | | | | |
| WB | **0.538*** | **0.591*** | | | |
| FRY | **0.821*** | **0.750*** | **0.875*** | | |
| BCC | $0.041^{ns}$ | $0.064^{ns}$ | $-0.031^{ns}$ | $-0.007^{ns}$ | |
| DMC | 0.117* | $0.072^{ns}$ | $0.018^{ns}$ | $0.033^{ns}$ | -0.199* |

$^{ns}$ and *= no significant and significant correlation;, NMR= number of marketable roots; FRY= fresh root yield; WB= weight of biomass; HI= harvest index; BCC= beta carotene content and DMC= dry matter content.

## 4. Discussion

There were significant differences among the genotypes, sites, seasons, site x season effect and genotype x site x seasons in respect to yield and yield components (Table 2). Phenotypic variability in sweet potato nutrient contents was observed among genotypes and site (Table 2). The number of marketable roots varied from 0.80 to 2.60 roots per plant. Fresh root yield varied from 54.79 t/ha to17.63 t/ha while biomass weight varied from 94.56 to 42.29 t/ha. Harvest index varied from 53.11 % to 20.45 % (Table 4). The average root yield at KALRO-Kiboko was higher than at Kabete at 44.47 t/ha and 11.15 t/ha respectively (Table 3). Variability among genotypes for marketable root number, fresh root yield and biomass weight might have been due to both genetic and environmental factors. Vinaja & Babu (2006) and Yadeta et al. (2011) reported that while variability for most of the yield components in sweet potato is attributable to genetic factors, environmental factors do play a part. Hafekamp (1988) indicated that rainfall, temperature, light and soil nutrients are the main factors affecting sweet potato growth and productivity. During the time these trials were conducted, environmental conditions were favourable at KALRO-Kiboko than at Kabete; because there was supplemental irrigation at Kiboko which was not the case at Kabete. At KALRO-Kiboko the trials were irrigated three times per week at seedling stage but irrigated once per week thirty days after planting. Lower performance by all genotypes at Kabete compared to those grown at KALRO-Kiboko may be explained by the temperature factor. Meteorological data from the two stations during the experimentation period showed that Kabete was characterized by cold temperatures of 22.5 ℃ and 13 ℃ day and night temperature respectively, whereas Kiboko had warmer temperatures with an average day and night temperature of 31.2 ℃ and 17.8 ℃ respectively. Sedioka (1964) stated, sweet potato yields were five to six times higher when day and night temperature of 25 ℃ and 20 ℃ were observed than at 15 ℃ and 13 ℃ day and night temperatures occurred respectively. Mandal (2006), also reported that low night temperatures of less than 20 ℃ negatively affected tuber formation and development, but day temperatures of between 25℃ to 30℃ were ideal for more tuber formation and development. In addition, altitude influences yield and yield components in sweet potato. , KALRO-Kiboko is situated at a lower altitude of 993 m above sea level whereas Kabete has an altitude of 1930 m above sea level. Lower yield and yield components at Kabete may be have been obtained because as reported elsewhere, lower temperatures are expected at higher altitudes compared to higher temperatures of lower elevation at KALRO-Kiboko. Negeve et al. (1992) observed that in the tropics, sweet potato yields declined with increasing altitudes as did the number of roots and the proportion of marketable roots. Negeve et al. (1992) also observed that the increasing altitude delays sweet potato maturity and Lebot (2009) reported that sweet potato root yield and yield components could be determined by the length of the growing period. These observations were also supported by Tairo et al. (2008) who observed that the number of storage roots, weight of storage roots, fresh weight per plant and dry matter content of sweet potatoes differed significantly among and within agro-ecological zones. In the present study, in addition to genotypic variability, there was variations due to sites and seasons which might have significantly influenced yield and yield components.

No significant interaction of genotype x site x season was recorded for beta carotene and root dry matter content though the genotypic effect were significant as shown in (Table 2). This indicated that variability in beta carotene and root dry matter was not largely influenced by the environmental effects of sites and seasons but was likely to be genetically determined and the values scored irrespective of site or season could be a basis for selection. High beta carotene contents of between 9.853 and 11.830 mg/100g were shown by clones, Tio-Joe, Vitaa, Kabode, Ejumula and Naspot13 (Table 4). In contrast, clones, Naspot 1, Naspot 2, Mayai, Tanzania and Gweri had low beta carotene concentrations (Table 4) and the root dry matter content varied from 30.62 to 16.56 % (Table 4). The overall beta carotene content was 5.321 mg/100g at Kabete which was higher than that at KALRO-Kiboko

of 5.147 mg/100g (Table 3). There is a possibility that the day and night temperatures observed at Kabete may have contributed to the accumulation of high beta carotene content over and above the genotypic effect. Genotypes grown at KALRO-Kiboko exhibited the highest mean root dry matter content of 25.94 % while those grown at Kabete showed a mean root dry matter of 23.72 % (Table 3) again showing how critical the environmental factors are. Therefore, the wide variability shown by genotypes evaluated here for beta carotene and dry matter content might be mainly due to genetic variance than due to environmental variance but environmental effects for these parameters though small did affect their performance. This suggestion is supported by the works of Dominguaz (1976) who reported that sweet potato beta carotene and root dry matter contents are genetically controlled traits. In this study the highest beta carotene content was observed from the deep to orange fleshed clones, while the white and yellow genotypes yielded the least beta carotene content as also reported by Burgos et al. (2009) and Waniboko & Ogidi (2014). The latter authors also reported a positive association of beta carotene and orange flesh color in sweet potato. In this study beta carotene content and root dry matter content were negatively correlated. This negative correlation may be associated with the fact that both, beta carotene and root dry matter contents are synthesized inside plastids, chromoplast and amyloplast, respectively. Therefore it is possible that chromoplast and amyloplast may be competing for the same organelles as reported by Cervantes-Flores et al. (2011). In addition, beta carotene content was negatively correlated with fresh root yield (Table 5) indicating that selection of genotypes for high beta carotene and root dry matter contents would result in lower fresh root yield because of their negative association existed between them (Woolfe, 1992; Mbusa et al., 2018).

## 5. Conclusion

Genotypes Ininda, Erica, Jane, Tanzania, Naspot 12, Delvia, Irene and Melinda performed well across sites and seasons. Biomass weight and harvest index were higher in the high yielding sweet potato genotypes. Clones Naspot13, Ejumula, Kabode, Vitaa, Tio-Joe, Lourdes, Irene and Sumaia with a deep orange flesh color had the highest beta carotene content with moderately to high dry matter content. White and yellow fleshed sweet potato genotypes had highest dry matter content. This study showed that genotypes with high yield, high ,beta carotene and dry matter contents and , stable across environments could be selected for These genotypes could be tested further in multiple sites to validate their performance or their use as parental lines in breeding programs in order to improve sweet potato productivity.

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