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Effect of Planting Distance and Harvesting Period on the Composition, and Quality Parameters of Orange Fleshed Sweet Potato Varieties (Umuspo-1 and Ex-Onyunga)

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Abstract. The aim of this study was to determine the best planting practices for two biofortified Orange Fleshed Sweet Potatoes (OFSP). The study investigated the effect of spacing (20, 30 and 40 cm) and maturity (12 and 16 weeks) period on the proximate composition, α-amylase, reducing sugar and soluble carbohydrates of two OFSP varieties (Umuspo1 and Ex-Onyunga). The results indicated that Ex-Onyunga variety planted at 40 cm spacing and harvested at the period of 12 weeks had the highest protein content (2.88%) which was significantly different ($p<0.05$) from OFSP harvested at 16 weeks. The α-amylase content at was highest at 12 weeks for Umuspo 1 variety spaced at 30 cm distance (45.65 µg/g) and lowest for Umuspo 1 variety, spaced at 40cm distance (18.94 µg/g). The reducing sugar content ranged from 166.32 to 234.21µg/g under various planting spacing conditions at 12 weeks and 164.21 to 208.07µg/g at 16 weeks maturity period. The soluble carbohydrate content ranged from 43.57 to 51.19µg/g at 12 and 16 - weeks maturity period respectively. Spacing and maturity period had significant ($p<0.05$) effects on the proximate composition and other parameters evaluated. This research has established a frame work for Agriculturists on the best planting spacing to be adopted for optimum nutrient yield of the two OFSP varieties. Maximum yield of alpha-amylase can be obtained within 12 weeks of planting at a distance of 30cm.

1. Introduction

Sweet potato (*Ipomoea batatas*) belongs to the botanical family *Convolvulaceae* (Morning Glory Family). It is a perennial crop that is usually grown annually. Sweet potato was brought to Europe by Christopher Columbus and subsequently introduced to Africa and Asia by the Portuguese and Spanish traders [1]. It grows from underground tuberous roots with trailing, twisting stems that can be as long as 6 m. This tuber crop provides food for most of the world's population. It was the seventh most important food crop in the world by the beginning of the 21st Century [2]. Among the root and tuber crops grown in the world, sweet potato ranks second after cassava [3]. The carbohydrate rich root is used as a subsidiary food after boiling/baking. In some countries, the vine tips are used as vegetables. Vines form an excellent source of green fodder for cattle. The crop grows best at an average temperature of 24˚C (75˚F). Annual rainfall of 750 – 1,000 mm are most suitable with the minimum of 500 mm in the growing season.

Sweet potato yields a high amount of energy per unit area per unit time and is a hunger crop. The comparative short duration coupled with its innate power for tremendous dry matter production has enabled sweet potato to rank as the foremost root crop in respect of calorie value. Orange-fleshed sweet potato varieties can be promoted for their food security, nutritional value and income generating potentials. Sweet potato roots are most frequently used after boiling, baking or frying. It serves as a staple food vegetable (Fleshy roots and tender leaves), snack food, weaning food, animal feed, as well as a raw material for some industries. It is processed into diverse products [4, 5, 6] such as starch, flour or puree to make secondary food products [7]. Ray and Ravi [3] reported that industrial products like, liquid glucose, citric acid, monosodium glutamate and ethanol are produced from sweet potato roots in various countries.

Furthermore, sweet potato has the potential as a feedstock for bio-ethanol production. Varieties with high yields and dry matter content termed Industrial Sweet Potatoes (ISP) have to be developed as bio-fuel crop. North Carolina State University (NCSU) has developed varieties which have as high as 67.8gL^{-1} of ethanol for flour based fermentation and 34.9gL^{-1} for fresh sweet potato sugar fermentation [8, 9]. Studies have shown that sweet potato storage root, carbohydrate and ethanol yields were approximately three times that of corn [10, 11]. However, storage root, carbohydrate and ethanol yields were cultivar dependent.

Monday [12] reported that the variety X -1617 and Beauregard produced the highest root and ethanol yield, respectively. Nyiawung et al.[13] reported that the ideal dry matter content, starch, and amylase/amylo-pectin ratio that a sweet potato variety should have for maximum ethanol yield are 30-33%, 20-24%, 23-30%/70-77% and 0.27-0.46, respectively. Sweet potato is high in nutritive value, outranking most carbohydrate foods in vitamins, minerals, protein and energy content [14, 15]. It is believed that planting spacing may have significant effects on the composition of Orange Fleshed sweet potato (OFSP). This study is being carried out to determine the effects of planting space on the nutrient composition of two orange fleshed sweet potatoes varieties grown in the South-East Nigeria

2. Materials and Methods

2.1. Sample Collection

Two types of Orange Fleshed Sweet Potatoes (OFSP) (Umuspo1 and Ex-Onyunga) were used for the study. Orange Fleshed Sweet Potatoes was cultivated in National Root Crops Research Institute (NRCRI), Umudike Farm, Abia State. The field work was carried out by the agronomy students of Michael Okpara University of Agriculture, Umudike. The sweet potato varieties (Umuspo 1 and Ex-Onyunga) were planted at the National Root Crops Research Institute, the experimental farm, Umudike, Abia State, Nigeria. Umudike is situated between latitude 05°29N and longitude 07°33 E and 122m altitude. The soil is sandy loam. The tubers were harvested at twelve (12) and sixteen (16) weeks. Each sample had three replicates described as US_1, US_2, US_3 and ES_1, ES_2, ES_3 planted in different spacing as 20 cm, 30 cm and 40 cm respectively.

2.2. Proximate Analysis

Proximate analysis of OFSP roots was carried out using the method of AOAC [16].

2.3. Determination of Alpha Amylase Activity

The agar diffusion method was used for the determination of α-amylase activity [17]. A stock solution was prepared with 0.1786 g of α-amylase from *Aspergillus oryzae* in 1 mL of 20 mM phosphate buffer with 6 mM NaCl, pH 6.9 and diluted serially. The medium for enzymatic activity assay was prepared with 0.5 g of starch and 1.0 g of agar dissolved in 50 mL of 6 mM NaCl, pH 6.9. Thirty-six plates containing 25 mL of agar-starch were prepared. Each plate, contained 20 µL of the highest and the lowest concentration of α-amylase solutions (7,500 and 2.4 U.mL^{-1}) and were inoculated with alpha amylase. Clear diffusion zones were formed after 4 hours of incubation at 20 °C. Three plates per hour were treated with Lugol solution to verify the reliability and reproducibility of the clear zones resulting from the enzymatic activity. Purified α-amylase from barley (EC 3.2.1.1., Sigma-Aldrich Co., St Louis, USA) prepared under the same condition, was used as the control. µµ

2.4. Determination of Reducing Sugars

The presence of reducing sugars was qualitatively determined by using Fehling's solution as described by Ramalingam [18]. The absorbance was read at 620nm in a spectrophotometer to determine the content of reducing sugars. A reddish brown coloured precipitate indicated the presence of reducing sugars.

2.5. Soluble Carbohydrates

The total soluble carbohydrate content was determined according to the method of McCseady [19].

An amount of 0.2g of the sample was accurately weighed into different test tubes in triplicates; 0.8ml of distilled water was then added. 5% phenol (0.5 ml) was added to each test tube and mixed and 2.5 ml of concentrated Sulphuric acid added for colour development. The samples were allowed to cool and the absorbance was measured using spectrophotometer (Spectrum Lab 22, USA) at 490nm.

2.6. Statistical Analysis

Data obtained from this research were expressed as means ± standard deviation and were subjected to analysis of variance (ANOVA) at 0.05 probability level. Values that were significantly different were separated by Duncan's multiple range test using IBM SPSS version 17.

3. Results and Discussion

3.1. Effect of planting distance on Proximate Composition of Umuspo1 and Ex-onyunga Varieties of OFSP at 12 Weeks Harvesting Period

The effects of spacing on proximate composition of orange fleshed sweet potato varieties at 12 weeks harvesting period is shown in Table 1. The results of proximate composition showed that there were significant differences ($p<0.05$) in moisture contents of OFSP. The highest moisture content (82.67 %±0.21) was observed in Ex-Onyunga OFSP with a planting distance of 30 cm which was significantly different ($p<0.05$) from the moisture content of all other samples. This was followed by the moisture content (80.83 **µ**g/g) of Ex-Onyunga planted at 40 cm spacing. Moisture contents of Umuspo varieties were significantly ($p<0.05$) lower than that of ExOnyunga. The lowest moisture content (68.30 % ±0.21) was observed in Umuspo 1 sweet potato variety planted at 40 cm spacing. These values were higher than the values reported by Oboh *et al.* [20] and Onuh *et al.* [15], who reported the moisture content of OFSP as 64.0µ g/g and 63.0µg/g respectively. The differences observed could be due to differences in planting spacing adopted in this study.

The ash content of Ex-Onyunga variety planted at a spacing of 30 cm had the highest concentration of 1.16 µg/g, which was significantly different ($p<0.05$) from Umuspo1 OFSP varieties planted at 20 cm, 30 cm and 40 cm planting distances. These values were lower than the values reported by Amajor *et al.* [21], who reported the ash contents of OFSP as between 11.1µg/g and 12.0µg/g. The decrease in ash contents may be attributed to leaching during steeping. Table 1 also shows that there were significant differences in fibre, crude protein and carbohydrate contents of OFSP varieties.

3.2. Effect of Spacing on Proximate Composition of Umuspo1 and Ex-Onyunga Varieties of OFSP at 16 Weeks Harvesting Period

Table 2 shows the proximate composition of OFSP varieties at 16 weeks as affected by planting space. The results showed that the highest moisture content (74.67 **µ**g/g) was observed in Ex-Onyunga at a planting distance of 30 cm apart, while the lowest moisture content of 63.73 µg/g was observed in Umuspo1 sweet potato variety planted at 40 cm. These values were higher than the values reported by Onuh *et al.* [15] and Oboh *et al.* [20]. These researchers reported moisture content of OFSP varieties to be 63.00µg/g and 64.00**µ**g/g respectively.

The ash content of Ex-Onyunga OFSP variety with a spacing distance of 30 had the highest concentration (1.03 **µ**g/g) and was significantly different ($p<0.05$) from ash content of all other samples. The fat content increased with increasing planting space. Ex-Onyunga variety planted at 30cm had the highest fibre content (3.77 **µ**g/g ±0.35). The fibre content is important because it affects the contents of the gastrointestinal tract and by changing how other nutrients and chemicals are absorbed by humans.

The protein content of Ex-Onyunga OFSP planted at 20 cm, 30 cm and 40 cm and harvested at 16 weeks were 2.12 **µ**g/g, 1.88 **µ**g/g and 1.94 **µ**g/g respectively. The protein content of UMUSPO with a spacing distance of 30 cm was the highest (2.44 µg/g) and was significantly different ($p<0.05$) from the protein content of all the other samples. This was followed by the protein content of Ex-Onyunga planted at 40 cm spacing which was also slightly higher than that of Ex-Onyunga sweet potato planted at 20 cm.

The lowest value (1.58 **µ**g/g) was observed for Umuspo1 sweet potato variety with 40 cm spacing distances. The observed decrease in protein content may be attributed to denaturation of the endogenous protein in the OFSP during processing or exposing the pulp to heat during analysis. This protein is lower compared to the average protein value reported by Ravindran *et al.* [22]. The carbohydrate content of Umuspo1 with a spacing distance of 20 cm was the highest (30.07 µg/g) and was significantly different ($p<0.05$) from the carbohydrate content of all the other samples. This was followed by the carbohydrate content of Umuspo1 planted at 40 cm spacing which was also significantly higher than other samples. Carbohydrate content of Ex-Onyunga variety was lower than that of Umuspo1. The lowest carbohydrate content was observed in Ex-Onyunga sweet potato variety planted with 30 cm spacing. The carbohydrate content was high in OFSP indicating that OFSP is a good source of energy to man.

3.3. Effect of Harvesting Period on Proximate Composition of Umuspo1 and Ex-onyunga Varieties of OFSP

The proximate composition as affected by maturity period (in weeks) is shown in Table 1. The results (Table 1) showed that maturity period had a significant effect on the proximate composition of OFSP. The highest moisture content ($82.67\pm0.21\%$) was observed at 12 weeks maturity period for Ex-Onyunga variety planted at spacing 30 cm. However, the maturity period had no significant effect on ash and protein contents of OFSP varieties. More so, there was a significant difference ($p<0.05$) in fibre content. The highest fibre content ($4.41\pm0.12\%$) was obtained at 12 weeks in Ex-Onyunga variety planted at 40 cm spacing. The result of carbohydrate content showed that the highest value of $30.07\pm0.49\%$ was obtained at 16 weeks in Umuspo1 variety planted at 20 cm. On the other hand, OFSP variety US_1 planted at 20 cm spacing and harvested at 16 weeks had the highest carbohydrate content ($30.07\pm0.49\%$). This result clearly shows that the maturity period had a significant effect on the proximate composition of OFSP. Sweet potato tubers are harvested traditionally at about 90 days (13 weeks). This informed the 12 week and 16 week harvests for this tuber.

3.4. Effect of Spacing on α-Amylase, Reducing Sugar & Total Soluble Carbohydrate of Umuspo1 and Ex-Onyunga Varieties of Orange Fleshed Sweet Potatoes.

The effects of spacing on α-amylase, reducing sugar and total soluble carbohydrate of orange fleshed sweet potato varieties at 12 and 16 weeks maturity period are shown in Table 2. At 12 weeks, the α-amylase content of Umuspo1 OFSP variety with a spacing distance of 30 cm had the highest concentration (45.64**µ**g/g) and was significantly different ($p<0.05$) from α-amylase content of all other samples. This was followed by the α-amylase of Umuspo1 planted at 20 cm spacing and Ex-Onyunga planted at 20 cm spacing with the concentrations 42.12 **µ**g/g and 40.62 **µ**g/g respectively. The lowest α-amylase concentration was observed in Umuspo1 sweet potato varieties planted at 40 cm distance spacing. On the other hand, at 16 weeks, the α-amylase content of Ex-Onyunga OFSP variety with a spacing distance of 20 cm had the highest concentration
(43.46 **µ**g/g) which was significantly different ($p<0.05$) from the α-amylase content of every other sample. This was followed by α-amylase concentration (39.40 **µ**g/g) of Ex-Onyunga OFSP planted at 30 cm and Umuspo1 OFSP concentration (38.25 **µ**g/g) planted at 30 cm spacing which were also significantly ($p<0.05$) higher than that of Ex-Onyunga planted at 40 cm and Umospo1 varieties planted at 40 cm and 20 cm respectively. While α-amylase content of Ex-Onyunga OFSP variety planted at 40cm with the concentration (32.34 **µ**g/g) and Umuspo1 OFSP variety with concentration (30.25 **µ**g/g) planted at 40 cm had no significant differences ($p>0.05$). The lowest α-amylase concentration (19.21 **µ**g/g) was observed in Umuspo1 sweet potato variety planted at 20 cm spacing.

The α-amylase has medical applications in the use of Pancreatic Enzyme Replacement Therapy (PERT). It is one of the components in sollpura (Liprotamase) which helps in the breakdown of carbohydrate into simple sugars [11].

Table 1: Effect of Maturity Period and spacing on the Proximate Composition of Orange Fleshed Sweet Potato (Umospo1 and Ex-Onyunga) OFSP varieties

Sample		Proximate composition				
12 weeks	Moisture	Ash (%)	Fat (%)	Fibre (%)	Protein (%)	Carbohydrate (%)
US20	70.40±0.30^{g}	0.77±0.06^{a}	0.47±0.23^{c}	0.41±0.23^{f}	1.96±0.05^{a}	25.86±0.42^{c}
US30	70.37±0.06^{g}	0.47±0.06^{a}	0.8±0.20^{c}	0.95±0.31^{def}	1.96±0.01^{a}	25.46±0.36^{c}
US40	68.30±0.21^{h}	0.80±0.10^{a}	0.67±0.64^{c}	2.15±0.12^{bcd}	1.88±0.03^{a}	26.47±0.72^{bc}
ES20	75.23±0.32^{c}	1.07±0.06^{a}	1.60±2.20^{b}	1.88±0.12^{bcde}	2.66±0.25^{a}	17.56±0.07^{e}
ES30	82.67±0.21^{a}	1.16±0.10^{a}	2.00±0.35^{b}	1.68±0.12^{bcde}	1.95±0.01^{a}	10.52±0.57^{g}
ES40	80.83±0.21^{b}	0.93±0.06^{a}	3.13±0.64^{a}	4.41±0.12^{a}	2.88±0.20^{a}	7.67±0.49^{k}
16 weeks						
US20	65.17±0.15^{j}	0.80±0.10^{a}	0.47±0.23^{c}	1.41±0.1^{cde}	1.96±0.17^{a}	30.07±0.49^{a}
US30	67.77±0.15^{i}	0.67±0.06^{a}	0.80±0.20^{c}	1.02±0.12^{def}	2.44±0.01^{a}	26.31±0.66^{bc}
US40	63.73±0.12^{k}	0.63±0.06^{a}	0.67±0.64^{c}	0.87±0.12^{ef}	1.58±0.04^{a}	27.85±0.41^{b}
ES20	70.83±0.21^{f}	0.87±0.06b^{a}	1.60±0.20^{b}	2.61±0.12^{bc}	1.94±0.01^{a}	22.88±0.6^{d}
ES30	74.67±0.15^{d}	1.03±0.06^{a}	2.00±0.35^{b}	3.77±0.35^{b}	1.88±0.04^{a}	13.32±0.47^{f}
ES40	72.67±0.23^{e}	0.93±0.06^{a}	3.13±0.64^{a}	1.80±0.12^{bcde}	2.12±0.16^{a}	18.95±0.59^{e}

Value (means) with different superscripts are significantly different from one another ($p<0.05$), US_{20} = Umuspo1 planted at 20cm, US_{30} = Umuspo1 planted at 30cm, US_{40} = Umuspo1 planted at 40cm, ES_{20} = Ex-Onyunga planted at 20cm, ES_{30} = Ex-Onyunga planted at 30cm, ES_{40} = Ex-Onyunga planted at 40cm, MP = Maturity Period

The reducing sugar content of OFSP at 12 weeks is shown in Table 2. Reducing sugar contents of Ex-Onyunga OFSP variety with a planting distance of 40 cm and Umuspo1 OFSP variety with a planting distance of 20 cm were not significantly different ($p< 0.05$) from each other. The highest value of 234.21 µg/g was observed in US_1 variety of OFSP. The lowest value 166.32 µg/g was observed for the Ex-Onyunga OFSP variety planted at 30 cm which was not significantly different from US_2 and ES_1. The result of reducing sugar contents of OFSP variety at 16 weeks are presented in Table 2. The result shows that Ex-Onyunga of OFSP planted at 30 cm spacing had the highest reducing sugar concentration (208.07µg/g) and was significantly different ($p<0.05$) from reducing sugar content of other samples except sample ES_1. There was no significant different ($p>0.05$) in reducing sugar content between Ex-Onyunga OFSP variety concentration (164.21 µg/g) planted at 40 cm and Umuspo1 OFSP varieties concentration of 167.89 µg/g, 173.69 µg/g, 178.25 g/µg planted at 20 cm, 30 cm and 40 cm distance spacing respectively. Reducing sugars contain free aldehyde or ketone groups along with hydroxyl (OH) group on the carbon adjacent to these groups. It is transferred to body cells through blood. Slow combustion of glucose in body cells provides the energy necessary for our body functions.

Furthermore, at 12 weeks maturity period, the total soluble carbohydrate content of Umuspo1 OFSP variety planted at distance of 20 cm was the highest (51.69 µg/g) and was significantly different ($p<0.05$) from the total soluble carbohydrate content of all other samples. This was followed by the total soluble carbohydrate of Ex-Onyunga planted at 20 cm spacing with the concentration 48.57 µg/g and Umospo1 OFSP variety planted at 40 cm spacing with the concentration 47.38 g/g which were significantly different ($p<0.05$) from other samples. Total soluble carbohydrates content of Ex-Onyunga OFSP varieties and Umuspo1 OFSP variety had the lowest values with no significant differences ($p>0.05$). This value was higher than the values reported by Ikanone and Oyekan [23] on Irish sweet potato (Raw = 3.50±0.01 mg/100ml, boiled = 3.43±0.01 mg/100ml and fried = 3.40±0.00 mg/100ml).

On the other hand, at 16 weeks of maturity, the total soluble carbohydrate content of Umuspo1 OFSP variety planted at distance of 20 cm had the highest concentration (51.19 µg/g) which was significantly different ($p<0.05$) from the total soluble carbohydrate content of all other samples. This was followed by the soluble carbohydrate of Ex-Onyunga OFSP variety planted 20 cm apart, which had a concentration of 48.57 µg/g and Umuspo1 OFSP variety planted at 40 cm spacing with the concentration of 47.38 µg/g which were significantly different ($p<0.05$) from all other samples. Soluble carbohydrate content of Ex-Onyunga OFSP varieties with the values (43.57 µg/g and 43.57 µg/g) planted at 30 cm and 40 cm and UMUSPO1 OFSP variety with the value (44.28 µg/g) were observed as the lowest values obtained from the study with no significant differences amongst samples ($p>0.05$). Carbohydrates provide heat and energy for all forms of body activity. Carbohydrate deficiency can cause the body to divert proteins and body fat to produce needed energy, thus leading to depletion of body tissues [24].

3.5. Effect of Maturity Period on α-amylase, reducing sugar and total soluble carbohydrate of Umuspo1 and Ex-onyunga varieties of orange fleshed sweet potato.

The effect of the period of maturity on α-amylase, reducing sugar and total soluble carbohydrate is also shown in Table 2. The results showed that period of maturity had a significant effect on αamylase, reducing sugar and total soluble carbohydrate. The highest α-amylase content (45.64 ± 1.03 m/µg) was obtained at 12 weeks maturity period in variety US_2 which was not significantly different ($p>0.05$) from ES_1 harvested at 16 weeks. The reducing sugar content of

OFSP indicated that US_1 planted at 20 cm spacing and harvested at 12 weeks had the highest amount (234.21 ± 9.08 mg/ml) which was significantly different ($p<0.05$) from OFSP variety harvested at 16 weeks. The results of total soluble carbohydrate of OFSP varieties showed that US_1, US_3, ES_1 harvested at 12 weeks showed no significant differences ($p>0.05$) from US_1, US_3 and ES_1 harvested after 16 weeks. Previous researches have shown that both nutrients and phytochemicals beneficial for human health are affected by fertilizer application, spacing distance and period of maturity in OFSP varieties [25; 26].

Table 2: Effect of Maturity Period and spacing distance on α-amylase, reducing sugar and total soluble carbohydrate of OFSP (Umospo1 and Ex-Onyunga) OFSP varieties

Maturity period (weeks)			
12 weeks	Alpha amylase (µg/g)	Reducing sugar (%)	Soluble carbohydrate (%)
US_{20}	42.12 ± 3.04^{bc}	234.21 ± 9.08^{a}	51.19 ± 0.90^{a}
US_{30}	45.64 ± 1.03^{a}	179.47 ± 10.17^{e}	44.28 ± 0.62^{b}
US_{40}	18.94 ± 1.24^{g}	197.89 ± 5.27^{d}	47.38 ± 0.42^{ab}
ES_{20}	40.62 ± 0.25^{cd}	179.29 ± 8.53^{e}	48.57 ± 1.89^{a}
ES_{30}	36.37 ± 1.35^{e}	166.32 ± 2.41^{g}	43.57 ± 0.72^{b}
ES_{40}	19.27 ± 0.46^{g}	226.67 ± 13.13	43.57 ± 2.34^{b}
16 weeks			
US_{20}	19.21 ± 0.50^{g}	173.69 ± 8.35^{f}	51.19 ± 0.90^{a}
US_{30}	38.25 ± 0.40^{de}	178.25 ± 7.63^{e}	44.28 ± 0.62^{b}
US_{40}	$30.10+1.00^{f}$	167.89 ± 2.41^{g}	47.38 ± 0.42^{ab}
ES_{20}	43.46 ± 1.19^{ab}	200.70 ± 2.19^{d}	48.57 ± 1.89^{a}
ES_{30}	39.40 ± 0.10^{d}	208.07 ± 2.13^{c}	43.57 ± 0.72^{b}
ES_{40}	32.34 ± 5.18^{f}	164.21 ± 1.58^{g}	43.57 ± 2.34^{b}

Value (means) with different superscripts are significantly different from one another ($p<0.05$), US_{20} = Umuspo1 planted at 20cm, US_{30} = Umuspo1 planted at 30cm, US_{40} = Umuspo1 planted at 40cm, ES_{20} = Ex-Onyunga planted at 20cm, ES_{30} = Ex-Onyunga planted at 30cm, ES_{40} = Ex-Onyunga planted at 40cm, MP = Maturity Period

Conclusion

This study has clearly demonstrated the effects of spacing (20, 30 and 40 cm) and maturity period (12 and 16 weeks) on the nutrients, alpha amylase and soluble carbohydrate contents of Orange Fleshed Sweet Potatoes (OFSP) varieties. Umuspo 1 had more reducing sugars and showed higher alpha amylase activity than Ex-Onyunga. Both spacing distance and maturity period (12 and 16 weeks) affected the proximate composition, α-amylase, reducing sugar and total soluble carbohydrate of OFSP varieties. α-amylase activity decreased with an increase in spacing distance. It is recommended that a spacing distance of 30 cm and a harvest period of 12 weeks be employed for maximizing the yield of alpha amylase in UMUSPO1 and a spacing distance of 20cm and a harvest period 16 weeks be employed for the production of alpha amylase in Ex-Onyunga sweet potato variety.

Conflict of Interest.

The authors declare that there is no conflict of interest

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