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**Research Paper**

# Field evaluation of cassava (*Manihot esculenta* Crantz) genotypes for growth characters, yield and yield components in Uyo, Southeastern Nigeria

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***Abstract.*** An experiment was conducted at the University of Uyo Teaching and Research Farm, Use Offot, Uyo, Southeastern Nigeria in 2013 and 2014 cropping seasons. The aim was to evaluate twelve cassava genotypes for growth characters, yield and yield components and identify the most superior genotypes for the area. A land area of 1656 $m^2$ was laid out in a randomized complete block design with four replications. Plant height (cm), number of leaves, leaf area ($cm^2$), number of tubers per plant, tuber length (cm), tuber girth (cm), tuber dry matter content (%) and tuber yield (t/ha) were studied. Significant differences ($P \leq 0.05$) were observed for all the characters. Two varieties: TMS 98/2101 and NR 8082 were superior over other cassava genotypes in two characters each, namely number of leaves and fresh tuber yield and leaf area and tuber girth, respectively. Three cassava genotypes namely, TMS 94/0581, TME 419 and TMS 01/1368 were superior in primary character each, namely tuber dry weight, tuber length and number of tubers, respectively. The two varieties, 98/2101 and NR 8082 were identified as suitable candidates for dissemination to farmers in Uyo, Southeastern Nigeria. The two varieties could be incorporated into breeding programmes as female parents with TME 94/0581, TME 419 and TMS 01/1368 as male parents for production of hybrid varieties for the area.

**Keywords:** Growth characters, yield, yield components, evaluation, *Manihot esculenta*.

## INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is a woody shrub which belongs to the spurge family *Euphorbiaceae* (Gill, 1988). It is extensively cultivated as an annual crop in the tropical and subtropical regions for its edible starchy tuberous roots (Henry, 2006). Cassava is the fourth most important source of food calories for humans in the tropics (Roca and Thro, 1993). Cassava provides a basic diet for over half a billion people (IITA, 1995), supplying very high yields of energy per unit land area, for example about 13 times more than maize and guinea corn (Oke, 1978; Achinewhu and Owamanam, 2001). It plays an important role in food security and also serves as a cash crop (Bassey and Harry, 2013). Cassava is used as a livestock feed substitute instead of grain (Chou and Muller, 1972), the leaves are a good source of about 20% protein (Muller, 1977). Cassava has emerged to be both a staple food and profitable cash crop of industrial significance in the world economy. Its high productivity under adverse conditions, all year round availability as well as wide adaptability to various farming and food systems make it an ideal food security crop and resourceful industrial raw material (Awah and Tumanteh, 2001). For these reasons cassava is sometimes described as the “bread of the tropics” (Adams et al., 2009). It is grown extensively as a food crop in 39 African countries, stretching through a wide belt from Madagascar in the south-east to Senegal in the north-west (IITA, 1990). Cassava provides myriad products such as chips, fufu, garri, starch flour and ethanol, biofuel, medicinal products as well as feed for livestock (Abeygunasekera and Palliyaguruge, 2013).

Africa currently accounts for more than 50% of the world's annual output of 184 million metric tonnes in 2002, rising to 230 million metric tonnes in 2008 with Nigeria being the leading producer (Njoku et al., 2009). Cassava production in Nigeria stood at 45.97 million metric tonnes in 2008 (FAO, 2008), due to the development and distribution of high yielding, pest and disease resistant varieties accompanied by improved production technologies (Ezulike et al., 2013). The current cassava output is still low compared with the rise in population in Nigeria. The local cultivars grown in Nigeria are low tuber yielders (6.4 tons/ha) and late maturers (20 to 24 months) (IITA, 2005). Cassava production is also faced with insufficient quantities of good planting materials which is the reason farmers continue with local cultivars resulting in low yields (Aerni, 2006). It seems that the high economic potential of cassava can be fully exploited to drastically increase production and thus provide enough cassava products for both man and livestock if these constraints are eliminated. It is only when high productive cassava cultivars are cultivated that the food needs could be met and surplus available for feeding livestock. Therefore, the objective of the study was to evaluate growth character, yield and yield components in 12 cassava genotypes and identify those with superior yields and other desirable agronomic traits for farmers in Uyo, Southeastern Nigeria.

## MATERIALS AND METHODS

The experiment was conducted at the University of Uyo Teaching and Research Farm, Use Offot in 2013 and 2014 cropping seasons. Uyo is located within latitude 05°17' and 05°27' North and longitude 07°27' and 07°56' East of the Greenwich Meridian and altitude 38 m above sea level (Edem et al., 2008). It lies in the humid high rainfall area of over 2,500 mm per annum, with daily photoperiod of 3.5 h. The temperature is generally high, ranging from 23 to 34°C throughout the year. The average relative humidity is about 76%, with the lowest and highest values in January/December and July, respectively (Ekpeh, 1994).

The experimental site was mechanically ploughed, harrowed and ridged. A land area of 1656 $m^2$ was laid out in a randomized complete block design (RCBD) with four replications. There were 12 plots in a replicate, each measuring 6 m × 5 m with six ridges. Twelve cassava genotypes studied were TMS 92/0326, NR 87/184, NR 8082, TMS 94/0581, TMS 98/2101, TMS 30572, TMS 95/0166, TMS 98/0505, TME 419, TMS 97/0162, TMS 01/1368 all obtained from the National Root Crops Research Institute, Umudike, Abia State, Nigeria and one local cultivar *obubit okpo* from the University of Uyo Teaching and Research Farm, Use Offot, Uyo, Akwa Ibom State.

The cassava stems were cut 25 cm long with at least 5 nodes (Eze and Ugwuoke, 2009) and put into well labeled separate boxes for easy identification and planting. The cassava stems were inserted at about 45° on the crest of the ridges and spaced 1 m apart. Two stem cuttings were planted per stand, giving 60 plants per plot and 2880 plants in the field, equivalent to 20,000 plants per hectare. The cassava cuttings were planted on Monday 8$^{th}$ April, 2013 and Monday 7$^{th}$ April, 2014. Weeding was manually done three times using the West African hoe and hand pulling. Cross bars were constructed in June each year to control erosion and conserve soil moisture. Fertilizer NPK 15:15:15 was applied uniformly in May, each year at 400 kg/ha. Ten cassava plants were randomly selected and tagged at the centre of each plot for data collection. Plant attributes studied were: plant height (cm), number of functional leaves, leaf area ($cm^2$), number of tubers per plant, tuber length (cm), tuber circumference (cm), dry matter content (%) and tuber yield (t/ha). Growth characters were recorded monthly and for eight months while yield components were recorded at harvest on 8$^{th}$ December, 2013 and 7$^{th}$ December, 2014. Analysis of variance was conducted and significant means separated with the least significant difference (LSD) at 5% probability level.

## RESULTS

Significant differences ($P \leq 0.05$) for plant height were observed among the cassava genotypes for all the months under investigation. The tallest plants were of NR 87/184, followed by TMS 94/0581 and NR 8082, while the shortest were TMS 97/0162 plants (Table 1). Similarly, variability for number of functional leaves were observed among the cassava genotypes ($P \leq 0.05$). The variety, TMS 98/2101 had the highest number of functional leaves (81.10), followed by TMS 97/0162 (76.81) and TMS 01/1368 (72.15), while the lowest was given by TME 419 (58.39) for all the eight months under study (Table 2). Largest leaf areas were recorded for NR 8082 (174.46 cm), followed by TME 419 (169.96 $cm^2$) and TMS 98/0505 (154.20) while the smallest leaf area was given by obubit okpo (105.14 $cm^2$) (Table 3).

The result also showed significant differences ($P \leq 0.05$) for number of tubers per plant, the largest being recorded for TMS 01/1368 (9.62), followed by TMS 97/0162 (8.40) and TMS 98/0505 (97.50), while the lowest number of tubers was given by TMS 419 (2.16), lower than that of the check, *obubit okpo* (2.84). It was interesting to note that Obubit okpo was superior over TMS 95/0156 (2.46) for the character (Table 4). Variability for tuber length in cassava was significant ($P \leq 0.05$), the longest tubers were produced by TME 419(60.52 cm), followed by TME 30572 (45.60 cm) and NR 87/184 (41.84 cm). The shortest tubers were produced by NR 8082 (22.16 cm). It was interesting to observe that the local check produced tubers longer than

**Table 1.** Cassava height for 2013 and 2014 cropping seasons.

| Cassava genotype | Months after planting (MAP) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | |
| | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 |
| TMS 92/0326 | 29.16 | 30.04 | 67.42 | 68.16 | 75.40 | 76.06 | 96.82 | 97.06 | 107.59 | 107.96 | 127.86 | 127.89 | 149.84 | 149.87 | 159.02 | 159.16 |
| NR 87/184 | 28.91 | 28.98 | 77.02 | 77.68 | 95.94 | 95.98 | 119.50 | 119.67 | 126.65 | 126.61 | 142.69 | 142.46 | 154.72 | 154.64 | 174.65 | 174.56 |
| NR 8082 | 28.64 | 28.10 | 75.67 | 75.50 | 80.87 | 80.42 | 112.46 | 112.18 | 118.72 | 118.45 | 132.75 | 132.60 | 144.72 | 144.61 | 264.75 | 264.59 |
| TMS 94/0581 | 49.10 | 48.95 | 79.87 | 79.42 | 88.34 | 89.01 | 93.86 | 93.96 | 110.82 | 110.92 | 130.84 | 130.91 | 145.86 | 145.92 | 165.89 | 165.92 |
| TMS 98/2101 | 25.82 | 26.06 | 58.43 | 58.79 | 83.14 | 83.64 | 87.56 | 87.71 | 100.48 | 100.52 | 114.17 | 114.64 | 129.54 | 129.60 | 149.20 | 149.80 |
| TMS 30572 | 26.71 | 26.96 | 68.07 | 68.68 | 97.10 | 97.46 | 83.0 | 83.42 | 111.45 | 111.67 | 146.10 | 146.24 | 125.18 | 125.50 | 145.09 | 145.36 |
| TMS 95/0166 | 22.92 | 23.0 | 50.07 | 50.82 | 64.06 | 64.41 | 67.26 | 67.49 | 81.85 | 81.91 | 108.85 | 108.88 | 123.86 | 123.90 | 143.89 | 143.93 |
| TMS 98/0505 | 25.51 | 25.88 | 54.94 | 54.97 | 76.34 | 76.82 | 90.76 | 90.96 | 94.86 | 94.94 | 121.84 | 121.96 | 136.85 | 136.94 | 156.85 | 156.92 |
| TME 419 | 27.08 | 27.01 | 63.65 | 63.70 | 81.60 | 81.51 | 92.73 | 92.69 | 108.42 | 108.54 | 128.46 | 128.62 | 143.45 | 143.62 | 163.48 | 163.67 |
| TMS 97/0162 | 28.11 | 28.91 | 35.11 | 35.91 | 68.70 | 68.84 | 95.58 | 95.87 | 115.30 | 115.47 | 120.12 | 120.42 | 122.18 | 122.47 | 126.12 | 126.46 |
| TMS 01/1368 | 23.75 | 24.02 | 32.40 | 33.16 | 61.34 | 61.17 | 101.34 | 101.96 | 145.60 | 145.76 | 132.75 | 132.78 | 132.98 | 133.04 | 139.79 | 140.20 |
| Obubit Okpo | 32.40 | 32.65 | 68.87 | 68.96 | 95.40 | 95.56 | 114.07 | 114.60 | 125.65 | 125.68 | 127.65 | 127.70 | 130.65 | 130.69 | 140.61 | 140.62 |
| LSD (P≤0.05) | 2.12 | 2.13 | 2.19 | 2.19 | 2.65 | 2.66 | 3.01 | 3.01 | 3.14 | 3.14 | 3.25 | 3.26 | 3.33 | 3.33 | 3.35 | 3.35 |

**Table 2.** Number of functional leaves of cassava genotypes for 2013 and 2014 cropping seasons.

| Cassava genotype | Months after planting (MAP) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | |
| | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 |
| TMS 92/0326 | 17.02 | 16.94 | 31.33 | 31.02 | 40.12 | 40.06 | 48.13 | 48.10 | 63.03 | 63.0 | 64.08 | 64.16 | 65.25 | 65.36 | 69.01 | 69.00 |
| NR 87/184 | 19.61 | 19.68 | 26.15 | 26.22 | 31.25 | 31.90 | 36.18 | 36.22 | 42.18 | 42.12 | 53.06 | 53.42 | 59.16 | 59.10 | 63.22 | 63.72 |
| NR 8082 | 27.18 | 27.41 | 38.18 | 38.20 | 49.71 | 50.0 | 50.75 | 51.01 | 52.13 | 52.42 | 58.06 | 58.02 | 67.12 | 67.38 | 69.31 | 70.03 |
| TMS 94/0581 | 16.43 | 16.22 | 29.02 | 30.02 | 36.52 | 36.36 | 39.38 | 39.98 | 48.60 | 49.11 | 66.18 | 66.41 | 60.17 | 60.06 | 62.21 | 62.19 |
| TMS 98/2101 | 18.43 | 18.30 | 36.11 | 36.10 | 39.12 | 38.94 | 42.51 | 42.41 | 45.35 | 45.20 | 66.81 | 66.56 | 70.31 | 70.39 | 80.63 | 81.10 |
| TMS 30572 | 17.33 | 17.46 | 30.62 | 30.50 | 38.71 | 38.66 | 45.33 | 45.36 | 48.33 | 48.46 | 53.04 | 53.10 | 59.52 | 60.06 | 62.88 | 62.61 |
| TMS 95/0166 | 10.45 | 10.74 | 25.15 | 25.00 | 29.11 | 29.30 | 34.47 | 34.40 | 40.31 | 40.11 | 48.31 | 48.22 | 54.88 | 54.41 | 60.88 | 60.75 |
| TMS 98/0505 | 36.12 | 36.06 | 49.92 | 50.06 | 52.33 | 52.19 | 58.14 | 58.22 | 63.63 | 63.90 | 51.67 | 51.96 | 55.33 | 56.02 | 59.60 | 60.10 |
| TME 419 | 11.51 | 11.46 | 28.33 | 29.02 | 30.11 | 30.18 | 35.13 | 35.19 | 41.17 | 41.06 | 45.15 | 45.30 | 50.50 | 50.19 | 58.39 | 58.22 |
| TMS 97/0162 | 23.11 | 23.91 | 25.31 | 25.36 | 45.66 | 45.42 | 51.22 | 52.10 | 59.12 | 60.00 | 61.22 | 61.65 | 64.18 | 64.96 | 76.81 | 76.76 |
| TMS 01/1368 | 14.77 | 14.60 | 18.10 | 18.08 | 30.48 | 30.32 | 44.18 | 44.12 | 56.11 | 56.02 | 58.45 | 58.21 | 67.16 | 67.64 | 72.15 | 72.11 |
| Obubit Okpo | 20.05 | 21.08 | 26.13 | 26.16 | 29.61 | 29.78 | 38.58 | 38.60 | 49.51 | 50.00 | 54.12 | 54.38 | 57.17 | 57.10 | 60.33 | 60.28 |
| LSD (P≤0.05) | 1.46 | 1.45 | 2.06 | 2.07 | 2.12 | 2.12 | 2.42 | 2.43 | 2.47 | 2.47 | 2.71 | 2.71 | 3.10 | 3.10 | 3.22 | 3.23 |

**Table 3.** Leaf area ($cm^2$) of cassava genotypes for 2013 and 2014 cropping seasons.

| Cassava genotype | Months after planting (MAP) 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 |
| TMS 92/0326 | 101.81 | 102.62 | 103.30 | 103.45 | 104.70 | 104.73 | 110.10 | 111.42 | 122.20 | 122.40 | 124.09 | 124.09 | 126.29 | 126.26 | 128.09 | 128.11 |
| NR 87/184 | 132.76 | 132.75 | 139.16 | 139.62 | 142.26 | 142.28 | 167.10 | 167.30 | 169.72 | 169.75 | 171.50 | 171.56 | 173.08 | 173.10 | 174.40 | 174.46 |
| NR 8082 | 113.20 | 113.50 | 113.72 | 113.81 | 115.90 | 115.92 | 119.28 | 119.34 | 123.96 | 124.00 | 126.96 | 126.98 | 128.96 | 128.98 | 130.96 | 130.99 |
| TMS 94/0581 | 100.54 | 116.48 | 101.64 | 101.76 | 102.09 | 102.10 | 102.20 | 102.42 | 102.78 | 102.94 | 105.18 | 105.62 | 109.18 | 109.41 | 111.18 | 111.24 |
| TMS 98/2101 | 116.40 | 110.69 | 117.02 | 117.00 | 117.10 | 117.25 | 117.50 | 117.54 | 118.58 | 118.56 | 118.66 | 118.64 | 121.58 | 121.76 | 136.58 | 136.58 |
| TMS 30572 | 111.30 | 111.36 | 117.50 | 117.48 | 118.40 | 118.26 | 118.62 | 118.60 | 119.68 | 119.64 | 119.73 | 119.71 | 119.63 | 119.80 | 120.33 | 120.36 |
| TMS 95/0166 | 110.11 | 110.09 | 110.56 | 110.68 | 112.00 | 112.28 | 112.80 | 112.76 | 113.18 | 113.25 | 113.68 | 113.71 | 114.38 | 114.39 | 115.58 | 115.62 |
| TMS 98/0505 | 139.24 | 139.56 | 141.28 | 141.62 | 144.20 | 114.38 | 146.72 | 146.98 | 148.34 | 148.52 | 151.34 | 151.72 | 152.14 | 152.18 | 154.19 | 154.20 |
| TME 419 | 142.57 | 142.61 | 149.20 | 148.92 | 151.78 | 151.68 | 162.53 | 162.70 | 164.21 | 164.46 | 166.01 | 167.01 | 168.01 | 168.40 | 169.81 | 169.96 |
| TMS 97/0162 | 113.48 | 113.49 | 114.25 | 114.32 | 116.47 | 116.52 | 117.18 | 117.20 | 119.76 | 119.68 | 120.46 | 120.48 | 121.31 | 121.36 | 123.10 | 123.42 |
| TMS 01/1368 | 105.28 | 105.25 | 106.49 | 106.47 | 108.26 | 108.10 | 110.46 | 110.40 | 111.76 | 111.72 | 113.26 | 113.27 | 114.00 | 114.06 | 114.33 | 114.60 |
| Obubit Okpo | 100.18 | 100.41 | 100.98 | 100.95 | 102.46 | 102.44 | 103.26 | 103.21 | 103.96 | 103.95 | 104.06 | 104.03 | 104.24 | 104.22 | 105.14 | 105.12 |
| LSD ($P \le 0.05$) | 2.16 | 2.17 | 2.41 | 2.42 | 2.62 | 2.62 | 3.44 | 3.45 | 3.78 | 3.78 | 4.11 | 4.10 | 4.12 | 4.12 | 4.14 | 4.15 |

**Table 4.** Number of tubers/plant, length of tubers, circumference of tubers, tuber dry matter content and fresh tuber yield of cassava for 2013 and 2014 cropping seasons.

| Cassava genotypes | Number of tubers/plant | | Length of tubers (cm) | | Circumference of tubers (cm) | | Tuber dry matter content (%) | | Fresh tuber yield (t/ha) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 | 2013 | 2014 |
| TMS 92/0326 | 4.42 | 4.38 | 32.06 | 32.19 | 17.71 | 17.50 | 29.96 | 29.66 | 28.43 | 28.30 |
| NR 87/184 | 4.81 | 4.80 | 41.72 | 41.84 | 13.68 | 13.72 | 29.16 | 29.06 | 31.56 | 32.11 |
| NR 8082 | 5.17 | 5.26 | 22.18 | 22.16 | 47.27 | 47.62 | 32.36 | 32.39 | 20.73 | 21.00 |
| TMS 94/0581 | 4.55 | 4.58 | 25.58 | 25.42 | 19.66 | 19.84 | 40.36 | 40.32 | 38.76 | 38.92 |
| TMS 98/2101 | 6.16 | 6.14 | 38.26 | 39.06 | 15.56 | 15.30 | 38.42 | 38.40 | 49.16 | 49.42 |
| TMS 30572 | 3.72 | 3.68 | 45.57 | 45.60 | 14.17 | 14.11 | 30.91 | 30.90 | 18.68 | 18.49 |
| TMS 95/0156 | 2.46 | 2.48 | 42.46 | 42.40 | 17.40 | 17.68 | 31.72 | 31.63 | 12.72 | 13.06 |
| TMS 98/0505 | 7.42 | 7.50 | 25.36 | 25.32 | 11.65 | 11.81 | 36.74 | 36.70 | 23.65 | 23.74 |
| TME 419 | 2.19 | 2.16 | 60.50 | 60.52 | 14.66 | 14.60 | 39.28 | 39.20 | 27.76 | 28.02 |
| TMS 97/0162 | 8.22 | 8.40 | 39.74 | 40.02 | 17.06 | 17.24 | 38.85 | 38.85 | 36.94 | 36.46 |
| TMS 01/1368 | 9.62 | 9.60 | 28.96 | 28.82 | 13.46 | 13.29 | 34.52 | 34.50 | 34.74 | 34.60 |
| Obubit Okpo | 2.80 | 2.84 | 26.74 | 26.60 | 15.67 | 15.61 | 28.92 | 28.64 | 13.79 | 13.60 |
| LSD ($P \le 0.05$) | 1.06 | 1.06 | 2.16 | 2.16 | 1.74 | 1.74 | 2.21 | 2.20 | 2.11 | 2.12 |

NR 8082, TM 94/0581 and TMS 98/0505 in that environment (Table 4). Similarly, variability for tuber girth was significant ($P \leq 0.05$) among the cassava genotypes, with NR 8082 taking a lead with 47.27 cm, followed by TME 94/0581, TMS 92/0326, TMS 95/0166 and TMS 97/0162 all of which were not significantly different ($P < 0.05$). The smallest tuber girth was given by TMS 01/1368 (13.46 cm) and NR 87/184 (13.72 cm) which were not significantly different ($p < 0.05$). The dry matter content of cassava genotypes were high and significant ($P \leq 0.05$), TMS 94/0581 had the highest dry matter content (40.36%) followed by TME 419 (39.28%) and TMS 01/1368 (38.85%), while the lowest dry matter content was recorded for *Obubit Okpo* (28.64). Similarly, fresh tuber yields of the cassava genotypes were significantly different ($P \leq 0.05$), with TMS 98/2101 producing the highest fresh tuber yield (49.42t/ha), followed by TMS 94/0581 with 38.92 t/ha and TMS 97/0162 with 36.94 t/ha. The lowest fresh tuber yield was produced by *Obubit Okpo* (13.79 t/ha), the check (Table 4).

## DISCUSSION

Significant differences were observed among the cassava genotypes ($P \leq 0.05$) for all the characters studied. Plant height is an important attribute in cassava. The result showed that tall cassava genotypes, for examples NR 87/184, TMS 94/0581 and NR 8082 recorded superior performances in other desirable traits. NR 87/184 which was the tallest cassava plant had good tuber length; TMS 94/0581 which produced second tallest plants had largest tuber girth, highest tuber dry matter and high fresh tuber yield. Similarly, NR 8082 which recorded third in height had the largest leaf area and largest tuber girth. Singh et al. (1996) established a positive correlation between plant height in okra and fruits per plant and seed yield. Therefore, since tallness is positively associated with yield parameters, the need to select cassava for such trait is important. Secondly, the need to secure adequate planting materials for planting requires that the varieties so selected to produce the next generation must have large, vigorous stems.

Some cassava varieties produced higher number of functional leaves than others. In this study, TMS 98/2101 which produced the highest number of functional leaves also produced the highest fresh tuber yield. Similarly, TMS 97/0162 which was the second highest producer of functional leaves was also second for number of tubers and third for tuber girth and fresh tuber yield, while TMS 01/1368 which was third in high number of functional leaves produced the highest number of tubers and third for tuber dry matter. Chang (1971) noted that all dry matter of higher plants originates from photosynthesis, whose site is the leaf. Bassey and Harry (2013) regarded the power of the source (leaf) as a major determinant of photosynthates, which may directly correlate with the sink capacity in cassava. For example, the local check, *Obubit okpo* with fewer leaves also had lowest leaf area and tuber dry matter. Similarly, NR 8082 produced the largest leaves, followed by TME 419 and TMS 98/0505 while smallest leaves were produced by *Obubit Okpo;* NR 8082 with largest leaves also produced largest tuber girth. Similarly, TME 419 which was ranked second for leaf area had the longest tubers with high tuber dry matter, while TMS 98/0505 which was ranked third largest leaf area produced high number of cassava tubers. These suggest a kind of correlation between growth characters and yield components in cassava. Githunguri et al. (2000) noted that leaf area duration is the integral of leaf area index over the whole growth period and dry biomass is likely to correlate with it. Similarly, Austin et al. (1988) establish an association between grain yield and leaf area in wheat. According to them, the leaves which persist until the grain filling stage, together with other green surfaces provide the photosynthetic capacity for carbon fixation and hence the supply of carbohydrate to the grain.

The high yielding genotypes (TMS 98/2101, TMS 94/0581, TMS 97/0162, TMS 01/1368 and NR 87/184 produced fresh tuber yields which were more than three times higher than the local cultivars, *obubit okpo*. This agrees with IITA (2005) which reported that local cultivars were generally low yielding and late maturing types and should be replaced with high yielding varieties to increase the productivity of the crop. Also, good cassava varieties should possess desirable attributes such as earliness, high tuber yields and high dry matter and starch accumulation.

## CONCLUSION

Two cassava varieties (TMS 98/2101 and NR 8082) which were superior over others in two characters each, namely number of leaves and fresh tuber yield and leaf area and tuber girth could be recommended for rapid stem multiplication and distribution for farmers in Uyo, Akwa Ibom State. Similarly, TMS 94/0581, TME 419 and TMS 01/1368 which were superior in one character each could be incorporated into breeding programmes as male parents with TMS 98/2101 and NR 8082 as female parents to produce high yielding varieties for the area. However, the local cultivar, *obubit okpo* should be replaced with these high yielding cassava varieties to boost crop yield in the area.

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