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Evaluation of Intra Family Variations Existing among Progenies from Half and Full-Sib Families of Sweetpotato (*Ipomoea Batatas* (L.) Lam) Genotypes.

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ABSTRACT

A research was conducted in Umudike in 2014 and 2015 to know the intra family variations that exist among the progenies of half and full-sib families of segregating populations of sweetpotato genotypes developed from Sweetpotato Research Center Mozambique. A highly significant relationship (P<0.05) was observed among the root descriptor traits measured within the half and full-sib families. From the result obtained from the half-sib and full-sib families, the number of marketable root had a strong positive association with the marketable roots . Half-sib progenies like A017 (6.91t/ha), BO17 (7.18t/ha) C029 (4.03t/ha), DO57 (4.88t/ha) all had better performance in yield in tons per hectare. They also had better marketable weight (kg/ha) and marketable root number than other half-sib progenies considered. Also from the result the progenies of the full-sib families like F010, G007, I017, ZD003, M004, M002, Z15003 where all better than other full-sib families in terms of yield in tons per hectare (t/ha), marketable weight (kg/ha) and marketable root number.

Key-Words: Root Descriptors, progenies, Half-Sib, Full-Sib, Sweetpotato, phenotypic variation, Genotypic Variation, Heritability, marketable root, unmarketable root, root yield.

INTRODUCTION

Sweetpotato (*Ipomoea batatas* L. (Lam) is a tropical American crop belonging to the family Convolvulaceae. It is a hexaploid (2n = 6x = 90) (Austin and Human, 1996) and is an important food crop in tropical and sub-tropical regions of the world. It is a herbaceous dicotyledonous plant widely grown throughout the tropics and warm temperate regions of the world (Shukla,1976; Halm, 1977; Burke, 1982; Jane 1982). Worldwide, sweetpotato is the seventh most important food crop after rice, wheat, potatoes, maize, yam and cassava (Loebenstein, 2009). It is grown on about 8.2 million hectares worldwide, yielding about 102 million tons, with an average yield of about 12.1 tons/ ha (faostat, 2010). The crop is mainly grown in developing countries, which account for over 95% of world production. Sweetpotato has low input requirements, it is easy to cultivate and able to produce under adverse weather and soil conditions. Sweetpotato root is an excellent source of vitamin A, the orange fleshed genotypes are noted for their high accumulation of beta-carotene, the precursor of vitamin A, Vitamin C, vitamin B6, riboflavin, copper, pantothenic acid and folic acid are also contained in sweetpotato (Woolfe, 1992). Awareness of sweetpotato as a healthy food crop is increasing, especially the orange – fleshed sweetpotato which is rich in pro-vitamin A carotenoids (Woolfe, 1992). It is one of the most important food crops due to its high yield and nutritive value (Data Franico, 1987). The utilization of sweetpotato as a food security crop and source of protein, vitamin A for malnourished children has greatly enhanced the production of the crop in diverse locations. In sub-Saharan Africa, sweetpotato is the third most important root crop after cassava *(Manihot esculenta*) and yam (*Dioscorea spp*) (Well and Muturu, 1994).

The use of descriptors in the characterization of sweetpotato is very necessary because they generally correspond to characteristics whose expressions are easy to measure, record or evaluate. They therefore permit relatively easy discrimination between phenotypes. Descriptors related to phenotypic appearance mostly correspond to the morphological descriptor of the plant and its architecture.

MATERIALS AND METHODS

Newly produced genetic materials, developed from seeds imported from CIP-Mozambique Sweetpotato breeding Platforms were used for this experiment. These new materials' were developed from poly cross and controlled crosses. Because the families have different number of seeds, half sib families with up to twenty progenies and full sib-families with up to ten progenies were included in the study. The experiment was carried out in 2014 in Umudike Abia state. Incomplete block design was used with the introduction of some check varieties in the different blocks.

Agronomic Practices

Land in the experimental site was cleared, ploughed, harrowed and ridged. The prepared land was made into plots of $3m^2$ (2m x 1.5m). The total land area for the experiment was $180m^2$.

The data were collected on the following attributes: Number of marketable roots, Number of unmarketable roots ,Total number of roots ,Weight of marketable roots. Weight of unmarketable roots , Total weight of roots ,Variability of storage root size Storage, root formation, Total yield (tons/hectare), virus disease and virus incidence.

Data Analysis

The data collected were subjected to Analysis of Variance (ANOVA) using the Genstat Discovery Edition 3. The Least Significant Difference(LSD) was used for separation of means.

Table 4.1:Mean performance of half-sib progenies in 2014

Progenies	Family	Yield (t/ha)	Marketable root Weight (kg/plot)	No. of marketable Roots (kg/plot)
A027	HS	1.82	0.68	3.80
A098	HS	0.76	0.24	2.92
A003	HS	4.62	2.50	14.68
A017	HS	7.18	0.15	11.50
A031	HS	4.72	4.07	14.50
A019	HS	3.32	0.87	6.24
B050[b]	HS	6.23	1.64	7.62
B017	HS	7.18	2.94	5.15
B046	HS	1.78	2.82	6.02
B053	HS	0.73	1.93	4.42
B090	HS	4.86	1.30	1.21
C027	HS	2.16	0.62	3.14
C067	HS	3.72	0.34	12.88
C029	HS	4.03	0.38	6.71
C039	HS	1.67	0.48	3.14
C023	HS	0.92	0.78	2.24
D082	HS	2.62	0.12	3.36
D003	HS	2.78	0.88	2.84
D058	HS	0.56	0.84	3.83
D108	HS	2.24	0.77	1.58
D057	HS	4.88	0.21	4.46
D094	HS	4.87	0.38	6.31
E082	HS	2.02	0.86	3.81
E064	HS	1.08	0.05	2.95
E027	HS	0.98	0.07	4.86
E004	HS	0.24	0.21	3.78
E070	HS	1.36	0.86	2.66

Root yield of some sweetpotato Full-Sib progenies

Table 4.4 shows the marketable roots weight and number of marketable roots of sweetpotato progenies from the selected full-sib progenies in 2014. From the result, a marketable root weight of 1.30kg/ha was obtained as the highest and 0.21kg/ha as the lowest in F010 and F006 respectively. F010 had the highest number of marketable roots of 7.4 and F006 had the lowest number of marketable roots of 1.28. A look at the performance of progenies from family-G revealed that G007 had the highest value (2.23t/ha) while G002 had the lowest value (0.86t/ha). The number of marketable root ranged from 6.10 to 0.41 and marketable root weight ranged from 0.51kg to 0.41kg. The values from family-I showed that I017 had 4.83t/ha while I013 had the lowest value of 0.82t/ha. I017 had the highest number of marketable roots (11.34) while I013 had the lowest number of 2.10. In all the full-sib progenies selected, I017 had the highest yield (4.83t/ha) while P002 had the lowest yield of 0.23t/ha. The highest marketable weight value of 4.32kg/ha and lowest marketable weight value of 0.03kg/ha were observed in ZD003 and I013 respectively. On the whole the progenies H007, H008, I017 J002, K003, M004, M002, ZB003 and ZD003 were better than other full-sib progenies considered in terms of number of marketable roots though may not be better than other progenies In terms of yield in tons per hectare and marketable root weight.

Table 4.2: Mean Performance of Selected Full-Sib families

Progenies	Type of Family	Yield (kg/ha)	Marketable weight(kg/plot)	Mkbl number (kg/plot)
F010	FS	2.86	0.18	7.4
F006	FS	0.62	0.06	1. 26
G002	FS	0.86	0.46	1.26
G008	FS	1.26	0.72	3.11
G006	FS	1.33	0.81	4.64
G007	FS	2.23	0.41	6.36
H007	FS	4.32	1.28	6.10
H008	FS	0.16	0.06	5.24
H006	FS	3.36	0.98	4.32
I013	FS	0.82	0.03	2.10
I006	FS	0.92	0.30	3.02
I014	FS	1.92	0.12	5.34
I003	FS	3.38	1.46	7.32
I017	FS	4.83	2.86	11.34
J002	FS	1.32	3.07	6.14
J003	FS	0.94	0.26	3.15
K002	FS	0.62	0.24	3.33
K003	FS	1.44	0.89	7.46
L002	FS	0.44	0.26	3.18
L001	FS	0.13	0.04	2.96
M004	FS	1.84	0.86	6.11
M002	FS	2.13	1.04	5.84
N001	FS	0.68	0.98	3.31
N004	FS	0.78	0.65	3.89
$O001_a$	FS	0.21	0.16	4.06
O001	FS	0.48	0.32	2.07
P002	FS	0.23	0.13	2.87
$P001^b$	FS	0.71	0.41	3.62

Q001	FS	1.46	0.66	3.84
R002	FS	1.86	0.53	3.93
S001	FS	0.94	0.49	4.10
U001	FS	0.82	0.68	5.12
V001	FS	0.49	0.78	4.10
W004	FS	0.52	0.65	4.05
W002	FS	0.32	0.13	2.11
X002	FS	0.42	0.62	2.86
Y001	FS	2.69	0.58	3.96
ZD003	FS	3.47	4.02	8.14
ZB003	FS	4.32	3.37	11.62
ZD001	FS	2.62	2.00	4.32
LSD=5%		1.56	0.92	3.60

Root Performance, virus incidence and severity of some selected Half-sib progenies

Presented in table 4.5 are the number of marketable roots, total number of roots, total root weight, virus incidence and severity of the sweetpotato roots in 2014. From the Table, the highest value of number for marketable roots was7.64 and 1.36 being the lowest (B034).The total number of roots ranged between 24.92 and 3.64 as in B053[a] and D095 respectively. But on the whole the number of marketable root weight and total number of marketable roots were mainly high for nearly all the selected progenies. The total roots weight ranged between 4.45kg and 0.30kg. C082 had significantly higher roots weight than other progenies in family–C and other families. The virus incidence ranged between 7.00 and 0.20 and virus severity varied between 7.21 and 0.25.On individual basis, B053 had a higher number of marketable roots (14.62), total number of roots (24.62) and total roots weight(4.8kg). This may have accounted for their higher performance. A087 had fairly high number of good marketable root number (9.00), total number of roots of 18.32 and total roots weight of 1.02kg with low virus incidence and severity values. C082 had high value for number of marketable roots (7.28), high total number of roots (19.01),root weight (4.45kg) and very low virus incidence and severity. High virus incidence and severity values were observed in E034 with score of 7.00 and 7.21 respectively. These may have accounted for their low mean values in number of marketable roots, roots weight and total number of roots.

Table 4.3: Root Performance, virus incidence and severity of Half-Sib progenies

Progenies	**Type of Family**	**Number of marketable root**	**Total number roots**	**Total weight of roots**	**Virus incidence**	**Virus severity**
A121	HS	4.31	8.71	0.90	0.20	0.25
A176	HS	2.50	6.34	2.20	0.60	0.76
A087	HS	9.00	18.32	1.34	1.02	1.24
B050[b]	HS	5.5	9.00	0.60	1.50	1.46
B053[a]	HS	14.62	24.62	3.37	0.62	0.74
B049	HS	7.64	16.82	1.52	1.42	1.32
C015	HS	1.82	4.26	0.74	0.42	0.46
C078	HS	3.94	8.38	2.05	0.21	0.66
C082	HS	7.28	19.01	4.45	0.64	0.78
D058	HS	3.32	6.78	3.24	1.25	2.00
D013	HS	4.67	10.11	3.86	1.38	4.00
D095	HS	0.24	3.64	2.01	2.52	5.00
E004	HS	0.89	4.78	0.30	3.64	4.00

E034	HS	1.36	6.38	1.4	7.00	7.21
E013	HS	6.84	18.21	3.46	2.00	4.05

Table 4.4: Root Performance and virus incidence and severity in selected progenies of Full-Sib Families

Progenies	Type of Family	Marketable number of root	Total number of root	Total root weight (kg/ha)	Virus incidence	Virus severity
F002	**FS**	**12.62**	**24.86**	**3.25**	**1.08**	**5.00**
F009	**FS**	**11.86**	**18.43**	**2.25**	**1.28**	**2.00**
G004	**FS**	**8.06**	**10.72**	**1.98**	**0.95**	**1.01**
H001	**FS**	**3.78**	**9.83**	**1.20**	**2.50**	**2.80**
H009	**FS**	**4.42**	**6.42**	**2.28**	**5.02**	**5.45**
I013	**FS**	**0.84**	**3.68**	**1.05**	**7.65**	**8.10**
M005	**FS**	**6.46**	**7.00**	**3.05**	**2.54**	**3.05**
M003	**FS**	**7.86**	**8.49**	**4.35**	**0.81**	**3.16**
N002	**FS**	**9.94**	**20.50**	**2.46**	**1.42**	**4.76**
P001[a]	**FS**	**10.78**	**18.00**	**3.08**	**1.02**	**3.78**
P001[b]	**FS**	**4.28**	**7.00**	**1.85**	**5.53**	**4.68**
ZB005	**FS**	**2.32**	**6.34**	**1.96**	**6.32**	**7.10**
ZA002	**FS**	**11.68**	**16.32**	**2.46**	**1.23**	**4.32**
ZC001	**FS**	**1.72**	**4.39**	**2.29**	**6.53**	**7.95**
ZB002	**FS**	**9.90**	**22.46**	**6.89**	**1.29**	**5.04**

4.5: Mean Performance of selected Half – Sib Progenies and Some check varieties

Progeny	**Marketable no**	**Marketable weight(kg/ha)**	**Yield in ton/hec.**	**Storage root size**
A033	14.68	2.50	4.62	2.05
A031	14.50	4.07	4.72	2.00
B053	4.42	1.93	0.73	1.24
B046	6.02	2.82	1.78	1.98
B017	5.15	2.94	7.18	0.97
C067	12.88	0.34	3.72	1.24
C039	3.14	0.48	1.67	2.25
D082	3.36	1.20	2.62	0.65
D058	3.83	0.84	0.56	1.25
D057	4.46	0.21	4.88	0.84
TIS87/0087[blk1]	12.68	3.32	2.86	1.21
UMUSP03[blk1]	16.10	6.34	4.74	2.2
UMUSP01[14]	25.89	8.20	5.98	3.49

TIS87/0087^{blk13}	8.29	3.60	2.94	1.28
TIS87/0087^{9}	4.11	1.42	0.64	0.98
UMUSP03^{9}	0.21	4.32	3.36	1.24
UMUSP03^{7}	3.88	1.02	1.06	0.84
UMUSP03^{10}	7.92	4.31	2.88	1.93
UMUSP03^{12}	12.36	5.08	3.14	1.20
LSD=5%	4.82	2.01	0.91	0.62

Performance of Selected Full-Sib Progenies and check varieties

Indicated in Table 4.8 is the performance of some selected full-sib progenies and some check varieties. From the table, the number of marketable roots ranged from 15.72 -0.84, with the marketable roots weight ranging from 4.82kg/ha – 0.12kg/ha. The yield in tons/hectare ranged from 3.62t/ha – 0.15t/ha and the storage roots size ranging from2.09 – 0.11. TIS87/0087 in row 12 produced the highest number of marketable roots with I013 producing the lowest. The highest marketable roots weight was produced by ZB002(6.72) while UMUSP03 in row 6 gave the lowest marketable roots weight(0.66kg/ha). The yield in tons/hectare was highest in F002(3.62t/ha) but lowest in UMUSP03 row 4 (0.15t/ha). The highest storage root size was produced by TIS87/0087 in row 3(2.09) while F002 produced the lowest(0.11).

4.6: Mean Performance of selected Full – Sib Progenies and check varieties

Progenies	Family/Variety	Number of marketable roots per plot	Weight of marketable roots per plot (kg)	Yield (t/ha)	Storage root size
F009	**FS**	**11.86**	**3.62**	**3.02**	**0.24**
F002	**FS**	**12.6**	**2.84**	**3.62**	**0.11**
G004	**FS**	**8.06**	**2.16**	**1.41**	**0.61**
H009	**FS**	**4.42**	**2.89**	**0.86**	**0.16**
I013	**FS**	**0.84**	**0.46**	**0.33**	**0.21**
M003	**FS**	**7.86**	**3.01**	**1.32**	**0.22**
P001^{a}	**FS**	**10.78**	**3.96**	**1.46**	**0.46**
ZA002	**FS**	**11.68**	**4.82**	**2.79**	**1.10**
ZB002	**FS**	**9.90**	**6.72**	**2.08**	**1.21**
ZB005	**FS**	**2.32**	**0.46**	**0.28**	**1.31**
TIS87/0087^{3}	**Check varieties**	**14.86**	**4.13**	**3.49**	**2.09**
TIS87/0087^{12}	**Check varieties**	**12.78**	**3.90**	**2.50**	**1.66**
TIS87/0087	**Check varieties**	**15.72**	**4.13**	**3.32**	**1.67**
UMUSP03^{4}	**Check varieties**	**1.34**	**4.12**	**0.15**	**0.62**
UMUSP01^{6}	**Check varieties**	**10.56**	**3.46**	**2.15**	**1.72**
TIS87/0087^{blk1}	**Check varieties**	**11.80**	**2.98**	**1.86**	**1.82**
TIS87/0087$^{bik\ 1}$	**Check varieties**	**8.73**	**2.11**	**0.98**	**1.67**
TIS87/0087$^{bik\ 8}$	**Check varieties**	**9.81**	**1.98**	**1.64**	**0.72**
UMUSP01^{5}	**Check varieties**	**5.10**	**1.31**	**0.60**	**0.62**
UMUSP0	**Check varieties**	**4.03**	**0.66**	**1.32**	**1.13**

RESULTS AND DISCUSSION

Root yield of some Sweetpotato Half-Sib Progenies in 2014.

Presented on Table 4.3 are the yield, marketable root weight and number of marketable roots of the half-sib sweetpotato progenies in 2014.The yield ranged between 6.91t/ha and 0.24t/ha. The half-sib progeny B017 gave the highest with a value of 7.18 t/ha. Whereas E004 recorded the lowest value of 0.24 t/ha. Also the half-sib progenies from family A017 had the highest value6.91t/hawhile A098 had the lowest value of 0.76t/ha among the A- progenies. Other A-progenies such as A003 also gave high yield value4.62t/ha (Table 4.3).The performance of progenies from the family- B (MUSG 0614-22-B) also can be seen on table 4.2.1. the lowest value was observed in B053 of 0.7t/ha. The performance of progenies from family-C can also be seen on Table 4.3 with C029 having the highest yield in tons/hectare (4.03t/ha) as against C023 with 0.92t/ha.In family-D, the D057 gave the highest value while D.056 gave the lowest value. The family-E had the progeny E082 having the highest value of 2.0t/ha while E024 had the lowest value of 0.24t/ha. The marketable roots weight and number of marketable roots are also presented on table 4.3 for all the selected progenies in each of the families.A031 gave a high marketable roots weight value of 4.07kg with a high corresponding value of 14.50 number of marketable roots while A098 gave the lowest marketable roots number of 2.92 marketable roots weight of 0.24kg . The marketable roots weight value varied from 2.94kg in B017 to 1.30kg in B090, B080b recorded the highest number of marketable roots (7.62) while B090 recorded the lowest number of marketable roots (1.21).The result obtained from C progenies showed a high marketable roots weight in C023 with a value of 0.78kg and a low marketable roots weight of 0.34k in C067. Although the number of marketable roots in C was highest in C067 with 12.88value and lowest in C023 with a value of 2.24, the performance of progenies from family-C (MUSG0608-61) was below that obtained from progenies in both A and B families. The marketable roots weight and number of marketable roots in progenies from D and E families has D082 having the highest marketable roots weight of 1.20kg and D057 with the value of 0.21kg having the lowest. The number of saleable roots was highest in D094(6.31) and lowest in D108(1.58). Also the highest marketable roots weight value in family E was seen in E070 with a weight of 0.86kg and lowest in the E064 with a weight 0.05kg. On the whole, the performance of the progenies from family-A tends to be better in the root descriptor traits considered when compared to the progenies from other half-sib families.

CONCLUSION

This study evaluated the intra family variations that exist between half and full-sib progenies of sweetpoato genotypes. From the result obtained from the analysis of mean performance of the root descriptors, the performance of the progeny A017 was highest among the A- family progenies in terms of yield in tons/hectare. Apart from having the highest value of yield in tons/ hectare, other progenies from A-family also performed higher than their counterparts. Half –sib progenies like B017, C029, D057, and E082 had better performances in most of the root descriptor attributes measured.. The progenies A031, Bo50^{b}, C067, D092 and E027 all had good marketable root weight and number of marketable roots which can form a good basis for selection for future yield trials. The performance of the full-sib progenies revealed that selection can equally be carried out on them. The results revealed good performances in terms of yield in tons per hectare, marketable root weight and number of marketable roots. The progenies F010, G007, I017, ZD003, M004, M002, ZB003 were all better than other full-sib families based on the measured root descriptor attributes. This is a good indication of the existence of considerable genetic variation among the genotypes used for this study and suggests the possibility of improving these traits through selection (Nwofia and Ojimelukwe, 2012).

Conclusively, this study has shown that there exist strong intra family variations among the progenies used in this study. Many of the progenies from the half-sib families had better performances in terms of total number of roots, total root weight marketable number of roots, marketable weight and very low virus incidence level. These measured characters/traits can form the basis for more yield trials to be carried out on these progenies.

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