

# Genotype x Environment Interactions and Yield Stability of Orange Fleshed Sweetpotato Varieties Grown in Ethiopia

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# INTRODUCTION

- Ethiopia is located in Eastern Africa
  - ▶ Area - 1,100,000 Km<sup>2</sup>
  - ▶ Estimated population- over 79 000,000 Million
  
- The principal root and tuber crops grown in Ethiopia are:
  - Enset (*Ensete ventricosum*)-
  - Potato (*Solanum tuberosum*)
  - Sweetpotato (*Ipomoea batatas* Lam.)
  - Taro (*Colocasia esculenta* Schott.)
  - Cassava (*Manihot esculanta*)
  - Yam (*Dioscorea* spp.)
  - Ethiopian dinich' (*Coleus edulis*) &
  - Tannia (*Xanthosoma* spp.).
  
- Among root and tuber crops, sweet potato is the third important root crop next to Enset and Potato at national level

and second to Enset in Southern Ethiopia

■ In 2008

Area covered by sweet potato : 33,070 ha

Total Production – 262,853.8 t

Average national yield- 8 t/ha

- Vitamin A deficiency (VAD) and food insecurity are the major public issues in Ethiopia.
- to control VAD food diversification programs represent one of the possible strategies
- Six OFSP varieties have been released in Ethiopia. particularly, for southern part of the country
- their root yield performance varies across different environments

- there is no information on GXE interactions and storage root yield stability of released as well as promising sweet potato varieties in Ethiopia.
- Hence this study was undertaken as part GXE Regional OFSP Variety Trial in East and Central Africa In collaboration with VITAA

- **Specific Objective**

To identify stable and adapted orange fleshed sweet potato varieties for major sweet potato growing areas of Ethiopia.

# Materials and Methods

- Treatments: Fourteen sweet potato varieties introduced from CIP along with one standard check
- Locations: Awassa, Gofa, Bako and Chanomile
- Duration: Two consecutive years (2007 & 2008)
- Design: RCB replicated three times
- Plot size: 3X3m                      Spacing: 60cmX30cm
- Data: On yield, yield components, dry matter, beta carotene content , insect pest & disease incidence

- Total carotenoids content- estimated using spectrophotometer method Harvest plus
- Beta-carotene content- Assessed using open column chromatography and spectrophotometer method Harvest-plus
- Combined analysis of variance was carried out for root yields using MSTAT.
- Analysis of stability- Eberhart and Russell (1966)

## RESULTS AND DISCUSSION

- There were significant differences among the clones for both marketable and total root yields.
  - ▶ significant variation in the genetic yield potential among the tasted clones
- Genotype by location (GXE) interaction was also highly significant
  - ▶ differential variatal response for storage root yield across locations

Table 1. Combined analysis of variance for storage root yields (t/ha) of 15 OFSP clones evaluated at four locations in 2007 & 2008

Source	Degree of freedom	Mean square	
		Marketable yield	Total yield
Year	1	24.24**	49.63**
Location	3	114.30**	50.26**
YL	3	4.42**	12.28**
R(LY)	16	0.59*	0.94**
Genotype( G)	14	18.08**	23.15**
YG	14	1.65**	1.73**
LG	42	2.08**	3.02**
YLG	42	1.41**	1.45**
Error	224	0.29**	0.42**
CV(%)		15.9	16.40

\*,\*\* significant at 5% and 1% probability level, respectively.

**Table 2. Mean total storage root yields (t ha<sup>-1</sup>) of 15 OFSP clones tested at four locations during 2007 and 2008**

Clone	2007					2008					Mean GXL
	Awassa	Gofa	Bako	Chano M.	Mean	Awassa	Gofa	Bako	Chano M.	Mean	
Ukerewe	7.47	26.77	24.85	6.60	16.42	14.75	26.93	21.81	22.53	21.51	18.96C
K 118	0.50	13.43	11.04	8.89	8.47	15.35	15.17	27.3	3.473	15.32	11.89D
Ejumula	10.58	22.92	23.41	11.68	17.15	20.49	26.8	24.59	7.33	19.80	18.48C
<b>199062.1</b>	24.36	34.72	36.96	44.10	35.04	19.38	50.53	26	51.58	36.87	<b>35.95A</b>
<b>Naspot 1</b>	10.76	38.96	22.48	14.68	21.72	34.76	22.4	30.59	23.07	27.71	<b>24.71B</b>
K135	1.24	12.85	10.85	2.28	6.80	15.48	15.7	21.44	7.147	14.94	10.87D
K566632	6.17	34.34	13.6	17.31	17.86	16.81	29.29	17.41	29.74	23.31	20.58C
Resisto	6.03	19.87	4.297	27.09	14.32	11.71	13.01	44.15	46.21	28.77	21.55C
Gweri	0.43	9.647	2.593	0.23	3.23	3.88	11.64	6.483	6.133	7.03	5.13E
Pipi	1.52	12.46	12.56	1.84	7.10	14.59	19.28	21.15	6.017	15.26	11.18D
Zambezi	7.51	36.03	14.19	21.61	19.84	12.59	19.08	13.63	18.29	15.90	17.87C
Carrot C	2.90	18.91	12.67	3.55	9.51	13.11	14.35	21.63	7.26	14.09	11.80D
Mayai	8.85	30.86	19.52	9.44	17.17	16.10	25.16	20.93	9.103	17.82	17.50C
Spkoo4	5.49	21.49	15.63	1.58	11.05	15.09	18.48	26.11	4.477	16.04	13.54D
<b>Kero</b>	9.95	47.88	25.22	17.35	25.10	26.67	43.56	28.33	32.48	32.76	<b>28.93B</b>
CV (%)	18.13	21.01	25.30	33.13		19.50	23.5	36.37	24.93		16.40
LSD (0.05)	2.11	8.93	7.05	6.95		5.45	9.19	14.27	15.39		

**Table 3 Mean storage root yields and estimates of stability for total root yields of 15 OFSP clones evaluated at four locations during 2007& 2008**

Genotypes	Mean yield (t.ha <sup>-1</sup> )	Stability parameters		
		Regression coefficient (b)	Deviations from linearity(S <sup>2</sup> d)	Coefficient of determination(r <sup>2</sup> )
Ukerewe	18.97	1.33	-3.32	0.97
K 118	11.89	0.77	21.32**	0.50
Ejumula	18.48	1.04	26.29**	0.60
199062.1	35.96	1.00	151.59**	0.22
Naspot 1	24.71	0.77	6.49	0.69
K135	10.88	0.71	13.74*	0.54
K566632	20.64	1.21	48.43**	0.55
Resisto	21.55	0.14	204.78**	0.00
Gweri	5.13	0.64	-2.10	0.85
Pipi	11.18	0.88	17.66*	0.60
Zambezi	17.87	1.08	29.88**	0.60
Carrot C	11.80	0.91	11.07*	0.69
Mayai	17.50	1.39	12.99*	0.83
Spkoo4	13.54	1.15	43.38**	0.55
TIS-8250	28.93	1.99	23.94**	0.86
Mean	17.93			
S.E	3.91			

**Table 4 Dry matters, Beta-carotene content and other parameters of 15 OFSP clones evaluated at Awassa in 2007& 2008**

Genotypes	Dry matter content in %	Total carotenoid $\mu$ /gram	Beta-carotene $\mu$ g/g	Root flesh color	Virus disease score (1-9)	A. blight disease score (1-5)
Ukerewe	35.3	6.2	4.3	Pale yellow	3	0.8
K 118	28.7	27.2	21.7	Pale orange	3	0.0
Ejumula	32.5	135.1	112.6	Orange	3	0.0
199062.1	20.7	26.1	21	Pale orange	4	0.3
Naspot 1	30.7	9.3	5.6	Cream	2	0.0
K135	29.3	25.7	18.9	P-Orange	3	0.3
K566632	23.7	126.8	115.4	D. orange	4	2.0
Resisto	20.2	238.3	196.1	D. orange	4	1.7
Gweri	32.8	23.5	17.6	Pale orange	2	0.8
Pipi	34.3	5.3	-	cream	2	0.0
Zambezi	27.9	68.8	59.3	D. orange	3	1.5
Carrot C	32.6	88.5	80.1	D. orange	3	0.0
Mayai	30.3	134.5	125.8	D. orange	2	0.3
Spkoo4	31.8	29.4	22.9	Pale orange	2	0.0
TIS-8250	20.0	4.2	2.8	Pale yellow	2	0.0

# CONCLUSION

- NASPOT 1 and Ukerewe were found to be stable clones
  - ▶ mean total storage root yield above the grand mean
- NASPOT 1 gave root yields comparable with the standard check with additional merit of having best consumers preference.
  - ▶ Hence selected for on farm verification for release
- Most of the OFSP clones were found sensitive to environmental changes. Their wider adaptability and stability to fluctuating growing conditions across locations were considerably low.
- Hence, not discarding the possibility of obtaining clones with wider adaptation, the national sweet potato improvement program should also focused on development of varieties for specific adaptation and maximum yield in the major sweet potato growing areas of Ethiopia.

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