



Participatory Breeding and Official Variety Release

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INNOVATION IN ACTION

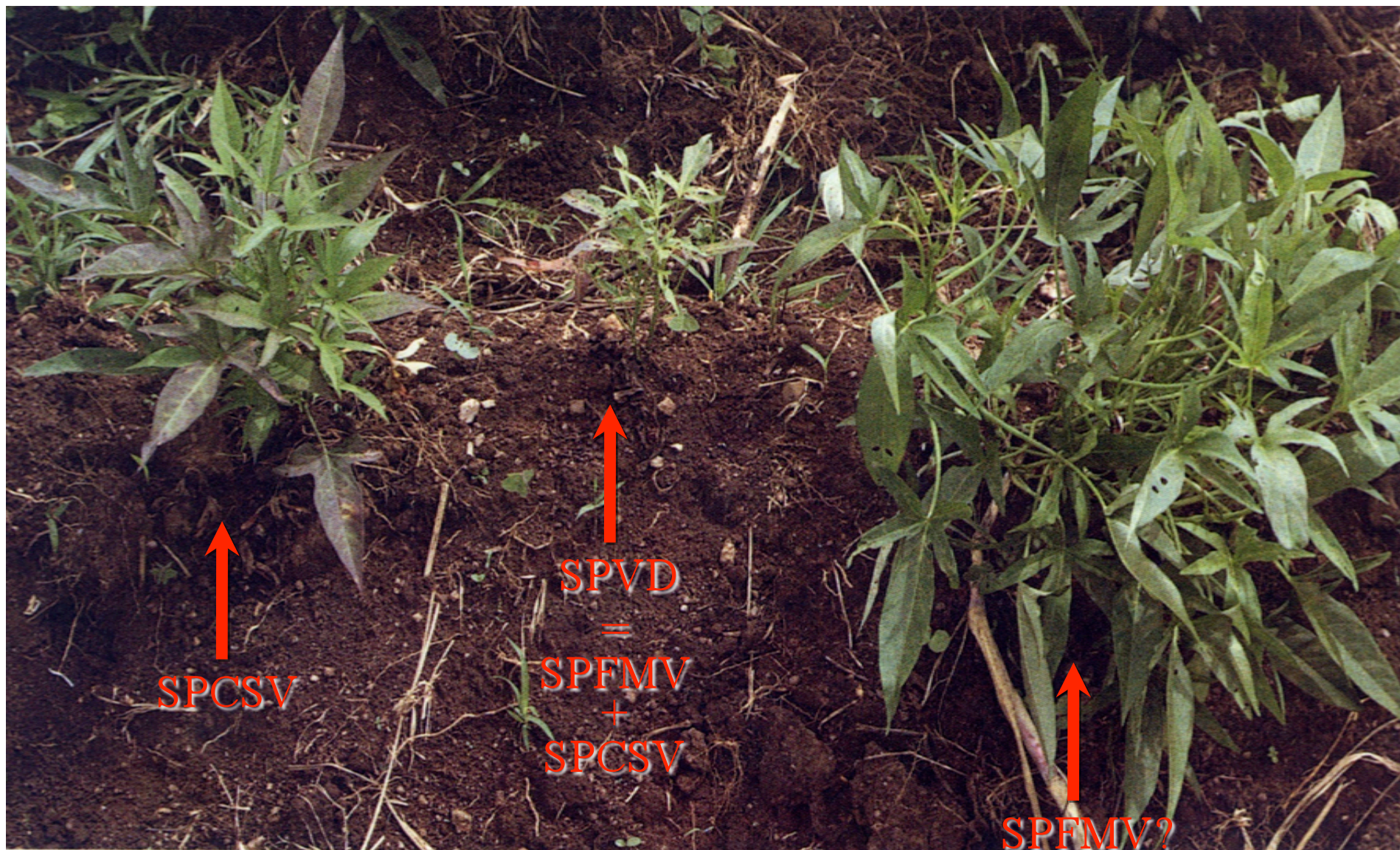




**Sweetpotato clone
NKA1081L selected
through
participatory
breeding**

- INTRODUCTION
- MATERIALS
METHODS
- RESULTS AND
DISCUSSION
- SUMMARY
- NASPOT 10 PPB1

Sweetpotato virus disease



Alternaria stem blight



Participatory Plant Breeding (PPB)

- Involves farmers selecting genotypes from segregating populations or generations
- Farmers raise seedlings and monitor performance in the field – e.g. drought tolerance, disease resistance, yield, vigor, maturity period, size of roots



Objectives of Sweetpotato PPB in Uganda

- National Sweetpotato Breeding Program (NSPBP) takes 7-8 years to release a variety
- In 2003 NSPBP + NRI/UK+ Ugandan and Tanzanian farmer groups initiated PPB trials (Gibson et al. 2008), Objectives:
 - Estimating time to deliver improved varieties to farmers
 - Assessing any other advantages of PPB

Materials and Methods

- **Seedling Nurseries:** Established by 3 farmer groups in Luwero, Mpigi, and Kiboga (Central Uganda) and 3 in Kyaka, Nyungwe, and Maruku (Lake Zone, Northern Tanzania)
- 2,000-6000
Pre-germinated
Seeds/group of
2 families –minimum
(New Kawogo and
Bunduguza)
- Planting
 - 1 m-wide raised seed beds, seed spaced 10 cm x 20 cm



Materials And Methods Cont'd

■ Clonal Evaluation (2006/2007)

- ❑ Ridges, 1 m x 1 m (0.3 m between plants on ridge)
- ❑ Checks: Dimbuka, NASPOT 1
- ❑ No. of ridges: 1-3 (50 plants/ridge)
- ❑ No of farms: 9 (Luwero), 15 (Mpigi), 1 (Kiboga)
- ❑ Normal field practice (weeding) done



Materials And Methods Cont'd

■ Taste Tests

- ❑ 12 farmers (8 female, 4 male) – Luwero
- ❑ 15 farmers (13 female, 2 male)- Mpigi
- ❑ 9 farmers (8 female, 1 male)- Kiboga



■ PPB Trial Evaluation On-station (Namulonge, Kachwekano, Ngetta, Serere)

- ❑ Routine on-station procedure used to generate data for variety release
- ❑ 4 ridges (5.4 m x 1 m ridges, 0.3 m between plants), 18 plants/ridge
- ❑ Design: RCBD, 4 REPS
- ❑ SPVD and Alternaria blight scored at 2 months after planting
- ❑ Dry matter, oven drying at 65°C

Results and Discussion

Table 1. Selection of sweetpotato (SP) clones (C) from seedlings (S) by farmers in PPB breeding trials in Central Uganda and Northern Tanzania, 2003-2007, showing C rescued from drought (RFD), and destroyed by monkeys (M) at single site (SS) or rep

Year	Central Uganda (District/Site)			Northern Tanzania			Number of sites (Replications)
	Mpigi	Luwero	Kiboga	Kyaka	Nyungwe	Maruku	
	Kitutuntu	Manyama	Watuba				
2003	6,000 S	6,000 S	6,000 S	2000 S	2000 S	2000 S	1
	553 C	2,382 C	902 C	0 (M)	0 (D)		1 (1)
	117 C	163 C	126 C	0 (M)	0 (D)		1 (1)
2004	25 C	68 C	67 C	0	0	398	1 (1)
	21 C	14 C	67 C	0	0		1 (1)
2005	11 C	13 C	40 C	0	0	36	1 (3)
2006A	3 C	4 C	8 C (RFD)	0	0	0	1 (4)
2006B	7 C	7 C	8 C (SS)	0	0	0	10-15 (10-15 farms)
2007	7 C	7 C	7 C	0	0	0	10-15 (10-15 farms)
Selection (%) 2005	0.18	0.22	0.67	0	0	1.8	

Performance on-station in 2008/2009 of sweetpotato clones previously selected in PPB trials

Co	Name of	Locations				Mean across sites					Root color	
de	clone	Namulonge	Kachwekano	Ngetta	Serere	Yield (t/ha)		Dry matter	SP	Alter	Skin	Flesh
		Storage root yield (t/ha)				Root	Biomass	(%)	VD ¹	naria		
1	NKA259L	21.8	39.7	18.2	29.6	27.3	54.3	33.6	1.8	1.6	Purple-red	Cream
2	NKA103M	39.4	46.1	15.7	37.7	34.7	61.1	32.8	1.4	1.3	Purple-red	Cream
3	NKA102M	35.6	36.2	15.2	13.4	25.1	58.1	32.3	1.7	1.4	Cream	Cream
4	NASPOT 1	47.9	57.0	22.0	28.0	38.7	78.0	32.8	1.9	2.0	Cream	Cream
5	Magabari	20.9	33.2	8.1	21.9	21.0	50.7	33.3	1.7	1.6	Cream	Cream
6	NKA1081L	48.6	46.4	20.8	49.5	41.3	78.5	31.9	1.6	1.1	Purple-red	Cream
7	NKA318 L	24.0	45.5	5.7	10.9	21.5	58.1	32.3	1.4	1.3	Purple-red	Cream
8	Dimbuka	35.9	48.6	19.0	44.6	37.0	70.3	32.6	2.1	1.9	Cream	Cream
9	BND145L	36.5	29.4	12.4	28.9	26.8	58.0	32.5	1.4	1.3	Purple-red	Cream
10	New Kawogo	24.3	47.5	1.5	2.6	19.0	76.9	30.9	1.6	1.8	Purple-red	Cream
Mean		33.5	43.0	13.8	26.7	29.3	64.3	32.5	1.7	1.3	NA	NA
LSD _{0.05}		12.0	13.3	7.0	10.2	5.2	9.4	NA	0.3	0.3	NA	NA
CV (%)		24.6	21.4	34.7	26.7	25.6	20.8	NA	25.2	29.1	NA	NA
¹ SPVD = sweetpotato virus disease; SPVD and other scored traits, rating scale = 1-5:												
1 = no apparent damage			2 = very little damage		3 = moderate damage			4 = considerable damage				
5 = severe damage			NA = not applicable									

Sweetpotato PPB trial planted at NaCRRI in April, harvested at 5.5 months

Code	Name of clone	Dry matter %	Yield (t/ha)		SPVD ¹	Alternaria
			Total root	Biomass		
1	NKA259L	34.4	21.8	38.9	2.8	2.3
2	NKA103M	33.2	39.4	61.3	2.0	1.5
3	NKA102M	34.4	35.6	59.2	2.0	1.5
4	NASPOT 1	32.3	47.9	76.8	3.0	3.5
5	Magabari	30.7	20.9	34.7	3.5	3.0
6	NK1081L	30.5	48.6	77.9	2.0	1.3
7	NKA318 L	33.2	24.0	48.7	2.0	1.8
8	Dimbuka	34.1	35.9	59.5	2.8	2.0
9	BND145L	34.4	36.5	64.0	2.3	2.0
10	New Kawogo	33.5	24.3	99.5	2.0	2.3
Mean		29.6	33.5	62.0	2.4	2.1
LCD _{0.05}		NA	12.0	18.7	0.5	0.8
CV (%)		NA	24.6	20.7	14.1	24.9

¹Disease severity: 1 = no apparent damage 2 = very little damage
3 = moderate damage 4 = considerable damage 5 = severe damage

Average storage root yield and estimates of 4 stability of regression analysis and Tai stability test (2 seasons, 4 sites (Namulonge, Kachwekano, Ngetta and Serere 2007-2009

Co de	Clone	Root yield t/ha	Regression analysis ¹				Tai test ²						
			b^3	Proba bility	S^2d^4	Prob.	α^5	Prob.	Sign.	Lower	λ^6	Upper	Prob.
1	NKA259L	31.8	0.72542	<.0001	196.2	<.0001	0.62618	0.96523	ns	0.26193	5.62	3.8178	0.00476
2	NKA103M	33.8	0.72538	<.0001	172.4	<.0001	0.62614	0.81173	ns	0.26193	3.97	3.8178	0.02157
3	NKA102M	27.6	0.81296	<.0001	172.4	<.0001	0.71383	0.48613	*	0.26193	1.43	3.8178	0.24474
4	NASPOT 1	39.0	0.92925	<.0001	135.6	<.0001	0.83026	0.42073	*	0.26193	1.07	3.8178	0.34724
5	Magabari	19.1	0.1703	<.0001	130.4	<.0001	0.07039	0.44939	ns	0.26193	1.22	3.8178	0.29967
6	NKA1081L	39.7	0.92939	<.0001	132.6	0.4217	0.37075	0.44939	ns	0.26193	1.22	3.8178	0.29967
7	NK318 L	26.3	0.72548	<.0001	222.2	<.0001	0.62624	1.10897	ns	0.26193	7.42	3.8178	0.00096
8	Dimbuka	32.1	0.77436	0.0001	151.8	0.0001	0.67518	0.6496	*	0.26193	2.55	3.8178	0.08307
9	BND145L	28.1	0.65488	0.0031	140.4	0.0031	0.55556	0.53942	*	0.26193	1.76	3.8178	0.17766
10	New Kawogo	22.3	0.92077	<.0001	241.9	<.0001	0.82177	1.20676	ns	0.26193	8.79	3.8178	0.00029

Significance at $P < 0.05$ (*); ns is not significant. ¹Eberhart and Russel stability criteria: $b = 1.0$ and $S^2d = 0$, at 5% of probability. ²Tai's test stability criteria: $\alpha = 0$ and $\lambda = 1.0$, a 5% probability. ³Regression coefficient of the i -th variety. ⁴Deviation from regression of the i -th variety on the environmental indices. ⁵Linear response of the i -th variety on the environmental effects. ⁶Deviation from the linear response in terms of the magnitude of the error variance.

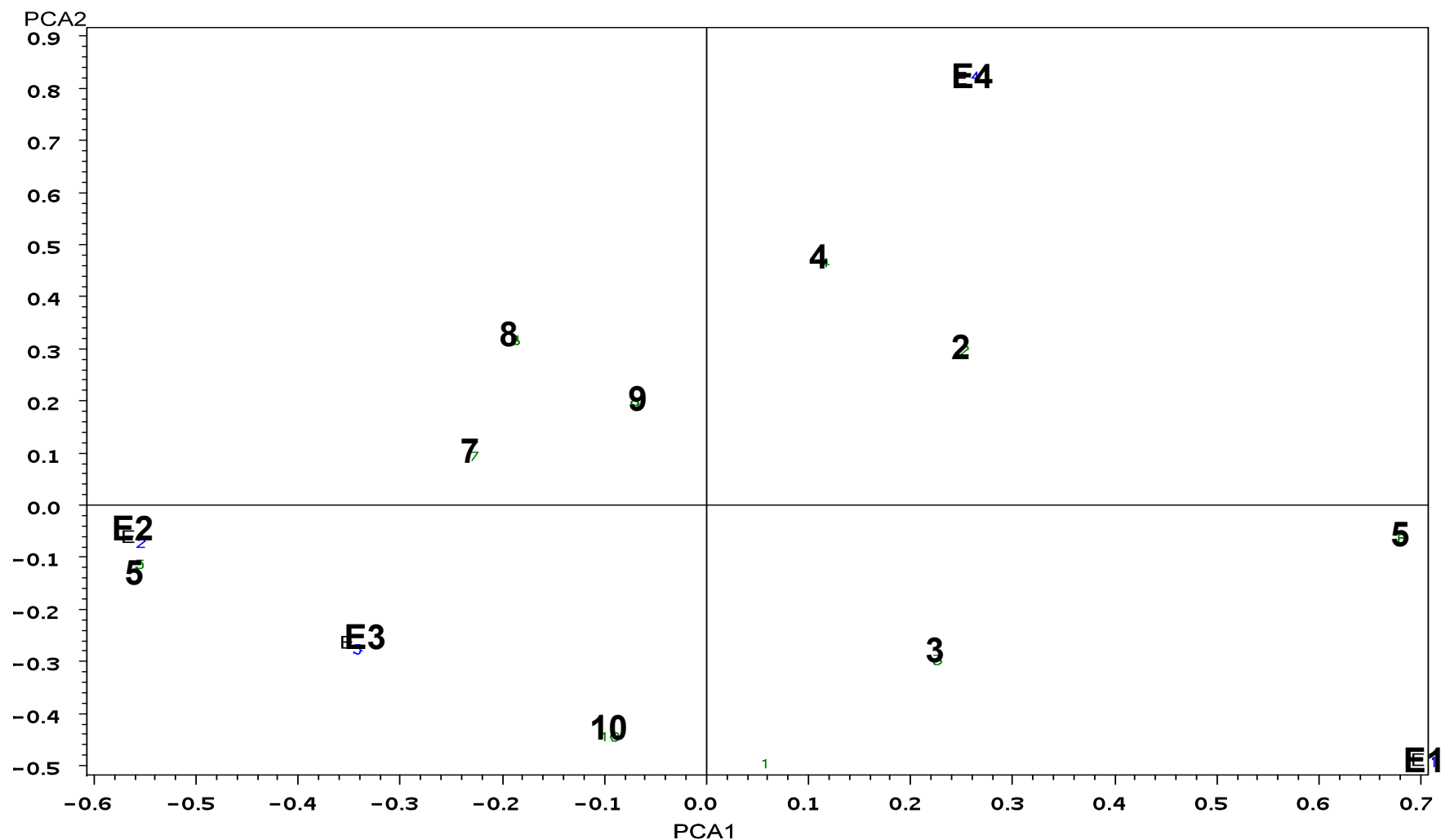


Fig. 1. Biplot of principal components analysis (PCA) axis 2 vs axis 1 for mean root yield (t/ha) for 10 sweetpotato clones grown in two, 2007/2008 and 2008/2009 in four sites [environments (E)]: E1 = Namulonge, E2 = Kachwekano, E3 = Ngetta, and E4 = Serere. Relatively stable clones are clustered close to the center of the biplot. Proximity of some clones to certain environments indicates positive correlation for this trait. Unstable clones appear distant from all environments indicating lack of correlation with any particular environment, whereas stable ones appear closer to one of the environments. Clones: 1 = NK A259L, 2 = NKA103M, 3 = NKA102M, 4 = NASPOT 1, 5 = Magabari, 6 = NKA1081L, 7 = NKA318 L, 8 = Dimbuka, 9 = BND145L, 10 = New Kawogo.

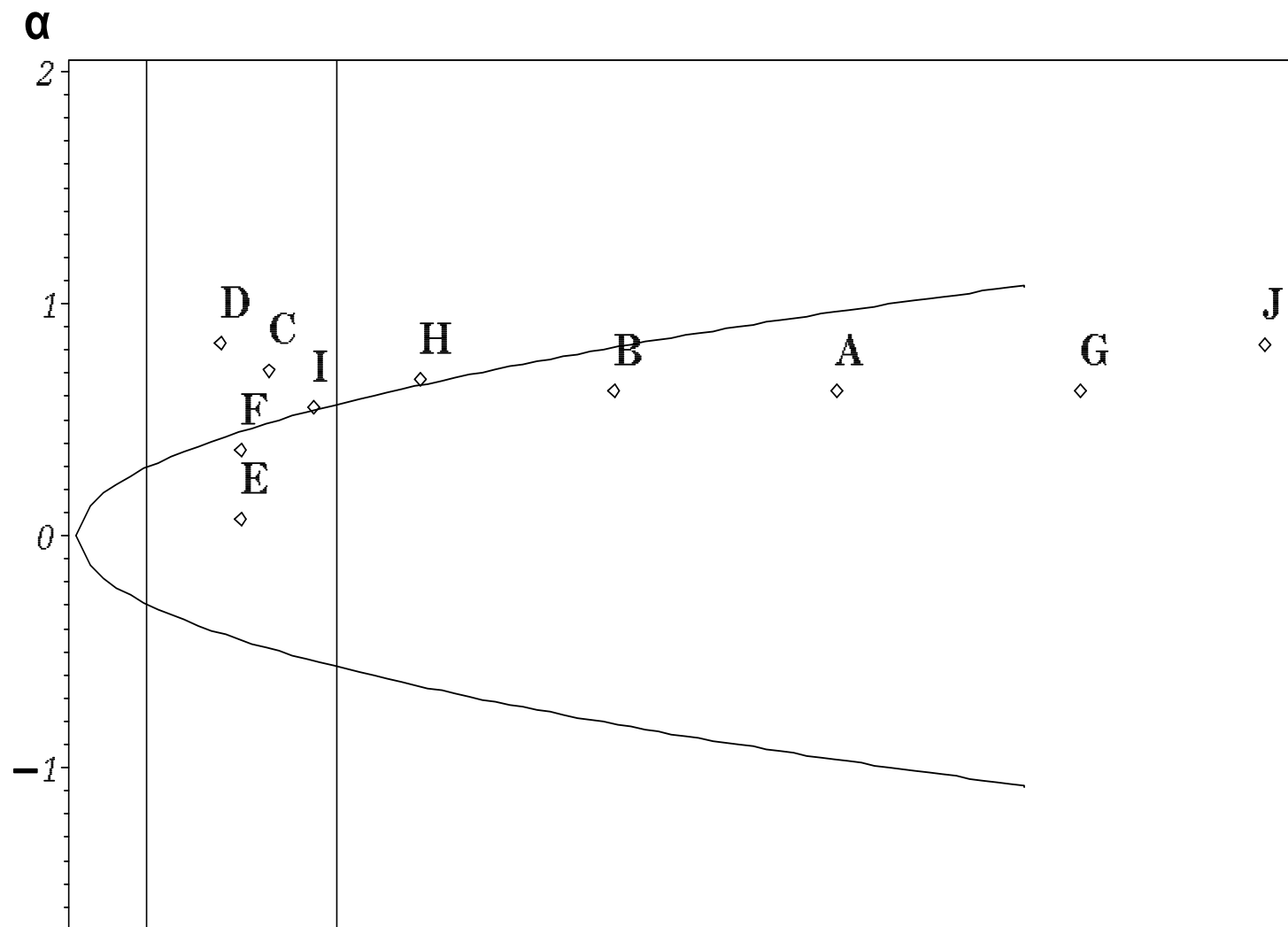


Fig. 3. Distribution of Tai's statistics of root yield (t/ha) for 10 sweetpotato clones grown in 2007/2008 and 2008/2009, in four locations for two seasons. Tai's average stability region is defined by the intersection area of the hyperbola representing a 95% prediction interval for $\alpha = 0$; and the vertical lines that limit a 95% confidence interval for $\lambda = 1$. Genotypes within this intersection area are considered stable. Tai stability analysis produces a plot distribution statistics α and λ that shows a region of average stability ($\alpha = 0$ and $\lambda = 1$). A perfectly stable variety has $(\alpha, \lambda) = (-1, 1)$. Clones showing acceptable values of α , but very high (or very low) values of λ , are regarded as stable but with lower reliability. Other clones that have large PCA scores are well outside the stability region. Clones: A = NKA259L, B = NKA103M, C = NKA102M, D = NASPOT 1, E = Magabari, F = NKA1081L, G = NKA318 L, H = Dimbuka, I = BND145L, J = New Kawogo.

Summary of main traits of NKA1081L and the local check

Character	Score (description) of character of variety	
	NKA1081L	Dimbuka-Bukulula
Storage root skin color	Purple-red	2 Cream
Flowering habit	3 Sparse	5 Moderate
Stigma exertion	1 Inserted (shorter than longest anther)	1 Inserted (shorter than longest anther)
Seed capsule set	1 Scarce	5 Moderate
Storage root dry mater (%)	33.5 (range 29.6-36)	32.4 (range 26.9-35.9)
Storage root yields (t/ha)	26.5 (3.7-48.2)	23.3 (3.6-34.79)
Sprouting ability in beds	8 Very good	8 Very good
Firmness of boiled root	4 Firm	4 Firm
Mealiness	4 Mealy	3 Moderately mealy
Sweetness of boiled root	3 Moderately sweet	3 Moderately sweet
Pest reaction	Susceptible to sweetpotato weevil (SPW)	Susceptible to SPW
Disease reaction	High resistance to Alternaria blight	Moderately resistant to Alternaria blight
	Moderately resistant to SPVD	Susceptible to SPVD

NKA1081L on average performance out yielded checks by:
 11.6% Dimbuka-Bukulula
 6.7% NASPOT 1

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