

# Sweetpotato Speedbreeders

## Progress in developing a low sweet sweetpotato for West Africa



### INTRODUCTION

- The signature focus of the Sweetpotato Support Platform for West Africa, in Ghana, is on quality, specifically developing low sweet varieties for staple, processing, and other uses.
- Ghanaian breeding program active since 1990s
  - Sweetpotato is less important here than many parts of E. and S. Africa, but it is increasing in importance
  - Must have lowland tropical adaptation (virus resistance in southern zones; earliness in northern zones). Drought tolerance is desirable.
  - Sweetpotato quality (including sweetness) is affected by genotype, cooking method, and postharvest treatment
  - Previous work has shown that consumers like most of our advanced selections, but we are still refining our understanding of quality attributes required, and the most efficient method for phenotyping
  - We routinely use NIRS on raw, freeze dried samples, and cooked taste tests
  - We used NIRS and taste tests on raw and cooked samples from an advanced trial to characterize selections, and tested use of refractometer as a faster throughput method

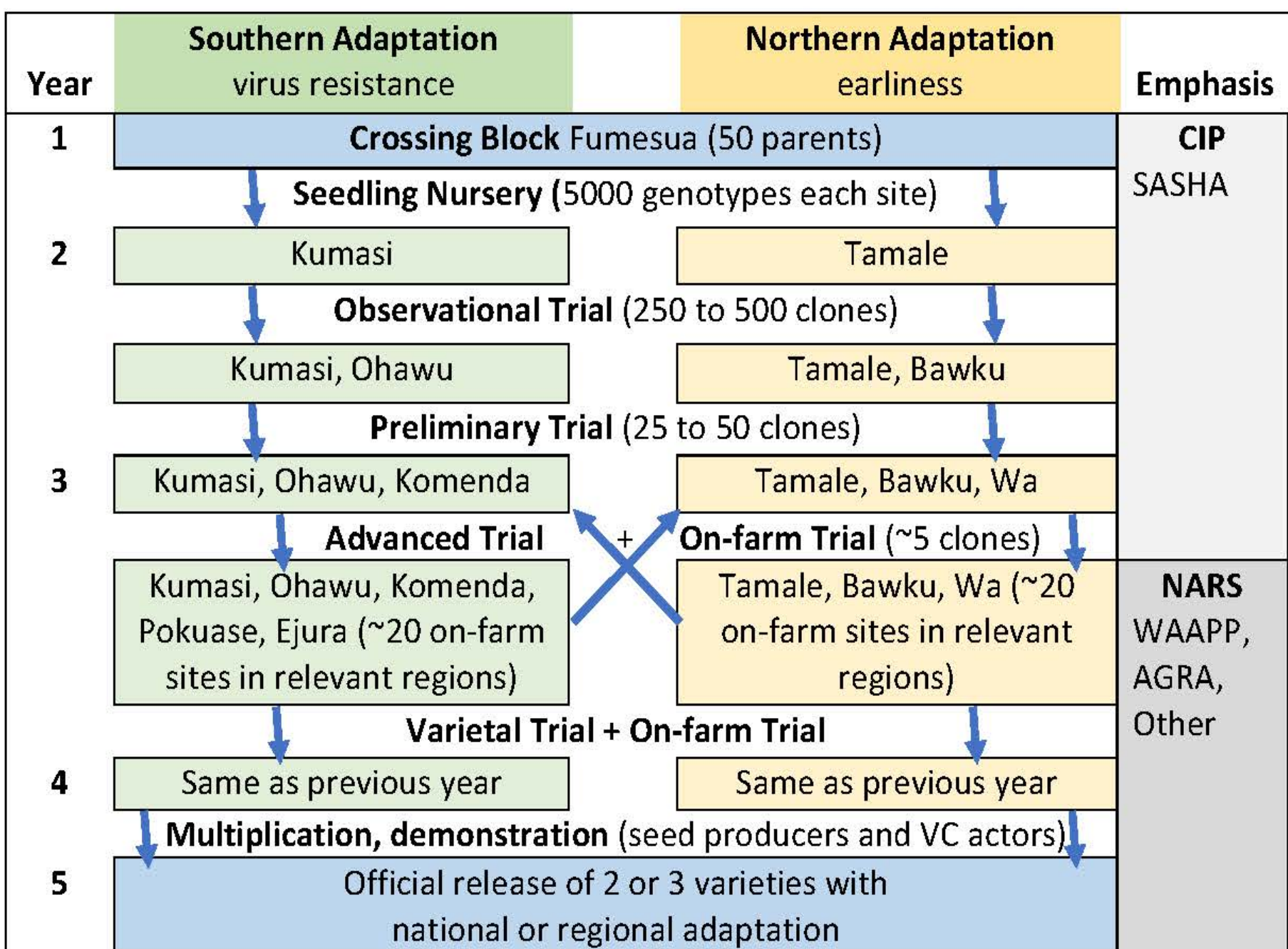
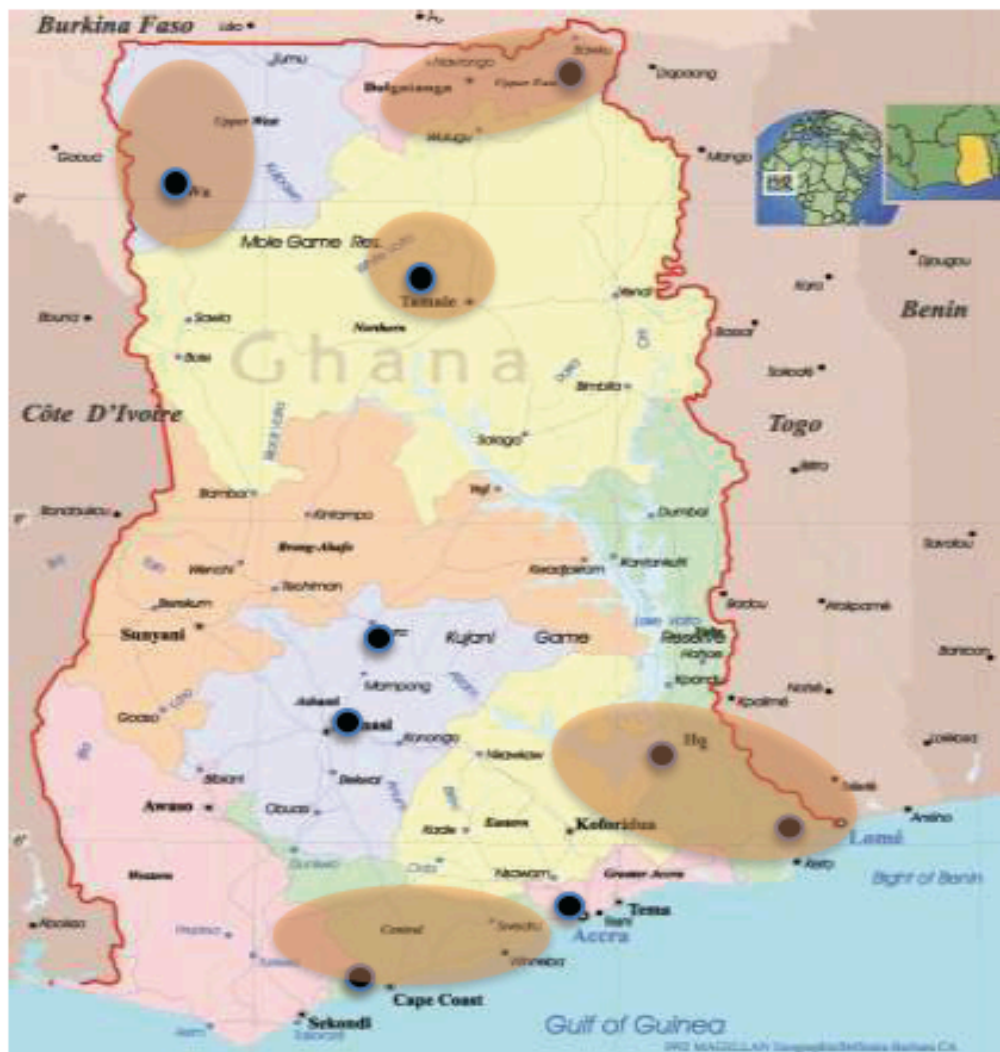


Fig 1. Sweetpotato breeding location and scheme in Ghana

### METHODS

- Evaluated freshly harvested roots (7 entries and 3 checks) from advanced trial from Tamale (northern Ghana)
- Determined sugars, starch and dry matter content of raw and boiled roots using NIRS and previously-developed calibrations
- Sucrose equivalent (SE) calculated: non-sweet  $\leq 12$ , low 12-20, moderate 21-28, high 29-37, very high  $\geq 38\%$  on dry or fresh basis
- Used sensory panel to evaluate sweetness, cooked taste (liking), and aroma
- Used refractometer to determine soluble solids in liquid expressed from grated raw and cooked samples

### RESULTS

- Cooking effects accounted for much of the variance in SE (Table 1)

Table 1. Analysis of variance of sweetness of cooked and raw genotypes (treatment) from 2017 advanced trial in Tamale

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Genotype	9	914	101.6	25.28	< 0.001
Treatment	1	1583	1582.8	393.80	< 0.001
Genotype x Treatment	9	321	35.6	8.86	< 0.001
Residuals	31	125	4.0		

- On dry weight basis, SE values of cooked samples ranged from high to low, while values of raw samples ranged from moderate to non-sweet. Changes in SE between cooked and raw samples varied significantly among genotypes (Table 2, tier 1)

- On fresh weight basis, SE values of all raw and cooked samples were non-sweet, with changes in SE between cooked and raw samples ranging from 0 to 5% (Table 2, tier 2)
- The checks (Apomuden, Bohye and Ligri) were ranked as sweetest by taste panelists, Ligri and Bohye had the best taste, while Apomuden had highest Aroma. PGA14351-4, with lowest sweetness and aroma scores, was not ranked high on taste (Table 2, tier 3)

Table 2. Sucrose equivalent (SE) of raw and cooked sweetpotato clones on dry weight (tier 1) and fresh weight (tier 2) basis, and sensory assessment of sweetness, liking and aroma (tier 3)

Raw samples			Cooked samples			Difference (cooked-raw)		
Genotype	SE		Genotype	SE		Genotype	SE	
Apomuden	27.05	a	PGA14442-1	35.64	a	Ligri	18.11	a
PGA14010-5	20.18	b	Apomuden	35.39	a	PGA14442-1	16.82	a
PGA14011-43	19.85	b	PGA14010-5	32.65	ab	PGA14398-4	14.16	ab
PGA14442-1	18.81	b	PGA14011-43	31.69	ab	PGA14372-3	14.00	abc
PGA14351-4	17.12	b	Ligri	28.77	b	PGA14010-5	12.47	abcd
PGA14008-9	16.46	bc	PGA14398-4	28.16	bc	PGA14011-43	11.84	bcd
Bohye	16.34	bc	PGA14372-3	27.00	bcd	PGA14008-9	9.17	cd
PGA14398-4	14.00	cd	PGA14008-9	24.21	cd	Apomuden	8.34	d
PGA14372-3	13.00	de	Bohye	23.12	d	Bohye	6.77	d
Ligri	10.65	e	PGA14351-4	16.70	e	PGA14351-4	-0.42	e

Raw samples			Cooked samples			Difference (cooked-raw)		
Genotype	SE		Genotype	SE		Genotype	SE	
Apomuden	6.77	a	Ligri	8.76	a	Ligri	5.17	a
PGA14010-5	6.00	ab	PGA14010-5	8.46	ab	PGA14372-3	3.95	ab
PGA14011-43	5.75	b	PGA14372-3	8.31	ab	PGA14398-4	3.25	bc
PGA14008-9	5.26	bc	PGA14442-1	7.91	ab	PGA14442-1	3.23	bc
PGA14351-4	5.26	bc	PGA14011-43	7.87	ab	PGA14010-5	2.45	bcd
Bohye	4.86	cd	PGA14398-4	7.72	ab	PGA14011-43	2.12	cd
PGA14442-1	4.69	cd	Apomuden	7.26	bc	Bohye	1.70	cd
PGA14398-4	4.47	d	Bohye	6.57	bc	PGA14008-9	0.80	de
PGA14372-3	4.36	d	PGA14008-9	5.96	cd	Apomuden	0.48	de
Ligri	3.59	e	PGA14351-4	4.93	d	PGA14351-4	-0.33	e

Sweetness score			Cooked taste score			Aroma score		
Genotype	(1 low to 9)		Genotype	(1 best to 9)		Genotype	(1 low to 9)	
Apomuden	6.67	a	PGA14010-5	6.00	a	Apomuden	7.00	a
Bohye	6.00	ab	PGA14442-1	5.50	a	PGA14008-9	6.00	ab
Ligri	6.00	ab	PGA14351-4	4.50	ab	Bohye	5.33	bc
PGA14008-9	5.67	abc	Apomuden	4.00	bc	PGA14010-5	5.00	bcd
PGA14372-3	5.67	abc	PGA14008-9	4.00	bc	PGA14398-4	5.00	bcd
PGA14010-5	5.00	abcd	PGA14372-3	3.33	cd	PGA14442-1	5.00	bcd
PGA14442-1	5.00	bcd	PGA14398-4	3.33	cd	Ligri	4.67	bcd
PGA14398-4	4.33	cd	PGA14011-43	2.67	de	PGA14372-3	4.00	cd
PGA14011-43	3.67	d	Bohye	1.67	ef	PGA14011-43	3.33	de
PGA14351-4	3.00	d	Ligri	1.00	f	PGA14351-4	2.00	e

- Total sugars determined by refractometer correlated with SE in raw, but not in cooked samples.

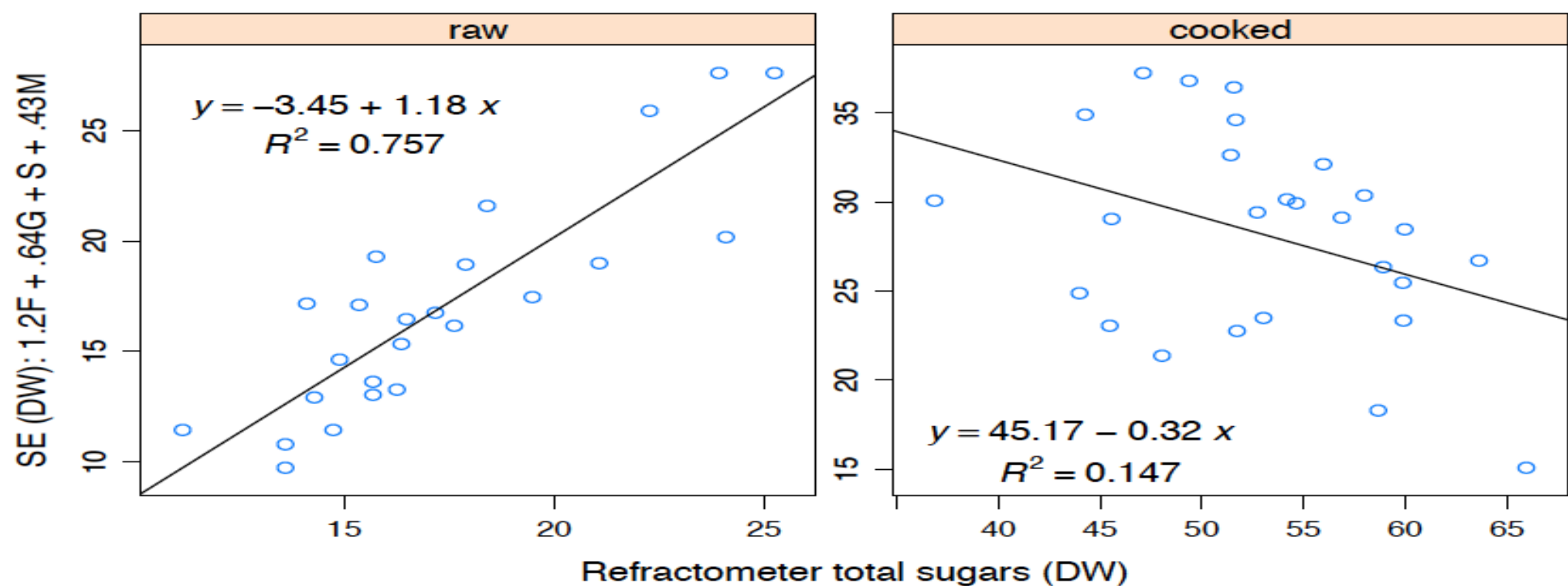


Fig 2. Refractometer vs sucrose equivalent in raw (left) and cooked (right)

Table 3. Quality characteristics of recently released varieties in Ghana

	AP3A	442162
dry matter (%)	35.90	32.92
sucrose (%DM)	6.20	8.66
fructose (%DM)	1.74	1.92
glucose (%DM)	2.85	3.14
starch (%DM)	66.96	65.28
sweetness equivalent (%DM)	10.11	12.97
sweetness equivalent (%FW)	3.63	4.24
cooked taste (1 best to 9)	4.50	3.50



### CONCLUSIONS

- Adapted non- and low-sweet clones developed in Ghana
- NIRS and taste are currently necessary to identify amylase variants
- Assessment following curing and storage is needed
- Understanding of user preferences and requirements is needed



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Roots, Tubers  
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