SWEETPOTATO GENOTYPES PROPOSED FOR RELEASE

CSIR-CROPS RESEARCH INSTITUTE
P.O. BOX 3785
KUMASI

Mohc

Cemsa-74-228

Kemb 37

199062.1

DEC 2012

TABLE OF CONTENT (edit)

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1. Introduction

Sweetpotato has a huge potential as food, feed and industrial crop in sub-Saharan Africa. In eastern and southern Africa, it is one of the main staples and a major food security crop. In Ghana, it is increasingly becoming one of the important staples and several farmers in the country particularly in the coastal savanna agro-ecology with lots of marginal soils are producing the crop to satisfy local and export markets. It can be produced in all the agro-ecological zones but production and consumption is mainly concentrated in the savanna areas of Ghana especially in Coastal, Volta and Upper East regions. As a food and feed crop for humans and livestock, sweetpotato is rich in nutrients such as energy compounds, beta-carotene, fibre, minerals and several vitamins (including Vitamin C, riboflavin, niacin, etc). The orange-flesh sweetpotato (OFSP) varieties with high levels of beta-carotene (OFSP varieties can be substantial sources of pro-Vita A caroteniods, thereby alleviating health problems associated with Vita A deficiency) have a significant role to play in the fight against Vitamin A deficiency and is particularly recommended for children. Sweetpotato starch and flour are also high premium industrial products. It is therefore a high valued crop with good local and international market potential, and can be important in food security and poverty reduction in Ghana. Sweetpotato could have big advantage over other root and tuber crops because it could be grown twice or even three times a year in Ghana.

Like other food crops, specific varieties of Sweetpotato have to be developed for specific end uses by farmers, consumers and agro-industrialists which are high yielding, resistant to pests and diseases and good for food and industrial products as well as of high nutritive value (high beta-carotene, protein etc.).

This report describes the morphological (botanical), molecular and agronomic characteristics, physicochemical properties, nutritional composition, sensory evaluations and economic assessment of new sweetpotato genotypes proposed for release as varieties to farmers. These are made up of one orange-flesh, one yellow-flesh, one cream and one white sweetpotato genotypes.

These genotypes were originated from the gene banks of the International Potato Centre (CIP) in Peru and Africa. Kemb 37(CIP-Kenya), Mohc (CIP BDI-ISABU) while Cemsa 74-228 and 199062.1 were accessions from CIP-Peru.

2. Breeding Methodology

Table 1. The methodology used in developing the varieties consisted of:

Year	Activity	Location	Assessment
2009	Elite materials obtained from two trials: 1. Nine genotype trial at Fumesua, Ejura, Pokuase and Ohawu and 2. Twenty-two genotype trial at Fumesua and Ejura. Promising elite clones obtained were Mohc; Cemsa 74-228; Kemb 37; 199062.1	• Fumesua • Ejura • Ohawu • Pokuase	Morphological and agronomic characters: • No. of plants established • No. of roots • Root shape and size • Total root yield • Diseases and pest reaction • Overall appearance of root, etc.
2010	Trials repeated with slight modification in 2010. Tested acceptability of selected genotypes in a farmer participatory approach at on-station and on-farm in two separate multilocational trials (12 genotypes evaluated at 4 locations and 9 genotypes evaluated at 3 locations) Sensory evaluation done	• Fumesua • Ejura • Ohawu • Pokuase • Cental region and Volta region	Agronomic and utilization characters: • Good establishment • High root yield • Tolerance to SPVD and weevils • Earliness • Bbeta-carotene content • Acceptable taste • Attractive appearance and
2011	Four elite clones (Mohc; Cemsa 74-228; Kemb 37; 199062.1) evaluated at 5 locations on-station with 8 released varieties as checks. Also on-farm trials conducted	• Fumesua • Ejura • Ohawu • Pokuase • Komenda • Central and Volta regions	Genotypes were thoroughly evaluated for: • Yield • Dry matter content • Disease and pest tolerance • Consumer acceptance qualities • Ecological adaptation Farmers and consumers assessments were crucial in the agronomic and sensory evaluations.
2012	The four genotypes selected and proposed for release as varieties. Demonstration and inspection plots established at Fumesua.		

3. Morphological Characteristics

The four sweetpotato genotypes (Mohc; Cemsa 74-228; Kemb 37; 199062.1) being recommended for release are described in Tables 2 below. The description covers vine, leaf, petiole and root characteristics.

Table 2 Vine, leaf, petiole and root characteristics of four proposed sweetpotato genotypes

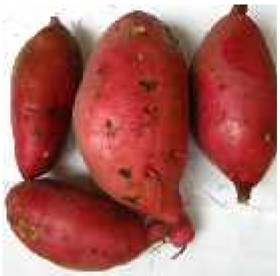
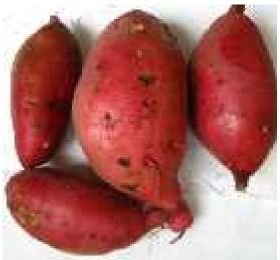
Character	Genotype			
	Mohc	***Cemsa 74-228***	***Kemb 37***	***199062.1***
Twining ability	Non-twining	Non-twining	Non-twining	Non-twining
Plant growth habit	Semi-erect	Spreading	Spreading	Semi-erect
Ground cover	Medium	Medium	Medium	Medium
Vine internode length	Short (3-5 cm)	Intermediate (6-9 cm)	Intermediate (6-9 cm)	Very short (< 3cm)
Vine internode diameter	Thick (10-12 cm)	Intermediate (6-9 cm)	Thin (4-6 mm)	Intermediate (6-9 cm)
Predominant Vine colour	Green	Green	Green with few purple spots	Green
Secondary Vine colour	Purple nodes	Purple nodes	Absent	Absent
Total vine length per plant (cm)	238(223-252.5)	245(200- 300)	178 (127-253)	84.3 (76-92.5)
Mean number of branches per plant	3	7	3(2-4)	8(7-9)
Mean vine length per plant (cm)	141.5(119-164)	45.5(45-46)	139 (131-148)	41.5(37-46)
Mean vine girth at soil level (cm)	1(1-1.1)	1.2(1.2-1.3)	0.5	1
Mean vine length from soil to first tuber (cm)	7.67	4.25	8.67	4.00
Vine apex colour	Purple	Green	Green	Green
Vine Tip Pubescence	Present (sparse)	Absent	Present (moderate)	Present (sparse)

‡ Number in brackets represents the range values.

Character	Genotype			
	Mohc	***Cemsa 74-228***	***Kemb 37***	***199062.1***
Mature leaf shape	Triangular	Lobed (Elliptic)	Triangular	Lobed with Elliptic central lobe
Mature leaf size	Medium (8-15 cm)	Medium (8-15 cm)	Medium (8-15 cm)	Medium (8-15 cm)
Leaf lobe type	Very slight	Deep	Very slight	Deep
Leaf lobe number	1	3	1	3
Shape of central leaf lobe	Toothed	Elliptic	Toothed	Lanceolate
Abaxial leaf vein pigmentation	All veins mostly purple	All veins mostly purple	Green	All veins mostly purple
Mature leaf colour	Green	Green	Green	Green
Immature leaf colour	Green	Green with purple edge	Mostly Purple	Green with purple edge
Petiole length	Intermediate (21-30 cm)	Long (31-40 cm)	Short (10- 20 cm)	Intermediate (21-30 cm)
Petiole pigmentation	Green with purple at both ends	Green with purple at both ends	Green	Green with purple near leaf

Leaf

	Mohc	**Cemsa 74-228**	**Kemb 37**	**199062.1**
Colour of young leaf	 Green	 Green with purple edge	 Purple	 Green with purple edge
Leaf petiole colour	 Green with purple at both ends	 Green with purple at both ends	 Green	 Green with purple near leaf
Leaf vein colour (Abaxial view)	 Purple	 Purple	 Green	 Purple
Leaf shape	 Triangular	 Lobed	 Triangular	 Lobed with elliptic central lobe

Character Roots	**Genotype**			
	Mohc	***Cemsa 74-228***	***Kemb 37***	***199062.1***
Predominant root skin colour	 Dark yellow	 Cream	 Dark purple	 Purple
Root flesh colour	 Dark yellow	 Pale yellow	 White	 Pale orange
Root shape	 Long elliptic	 Round	 Round elliptic	 Obvate
Root surface defects	Shallow longitudinal grooves	Shallow horizontal constrictions	Absent	Absent

7.1. Molecular Characterization:

The molecular characterisation was done to ascertain the genetic relationship between the proposed elite clones, one introduction and three released varieties in Ghana.

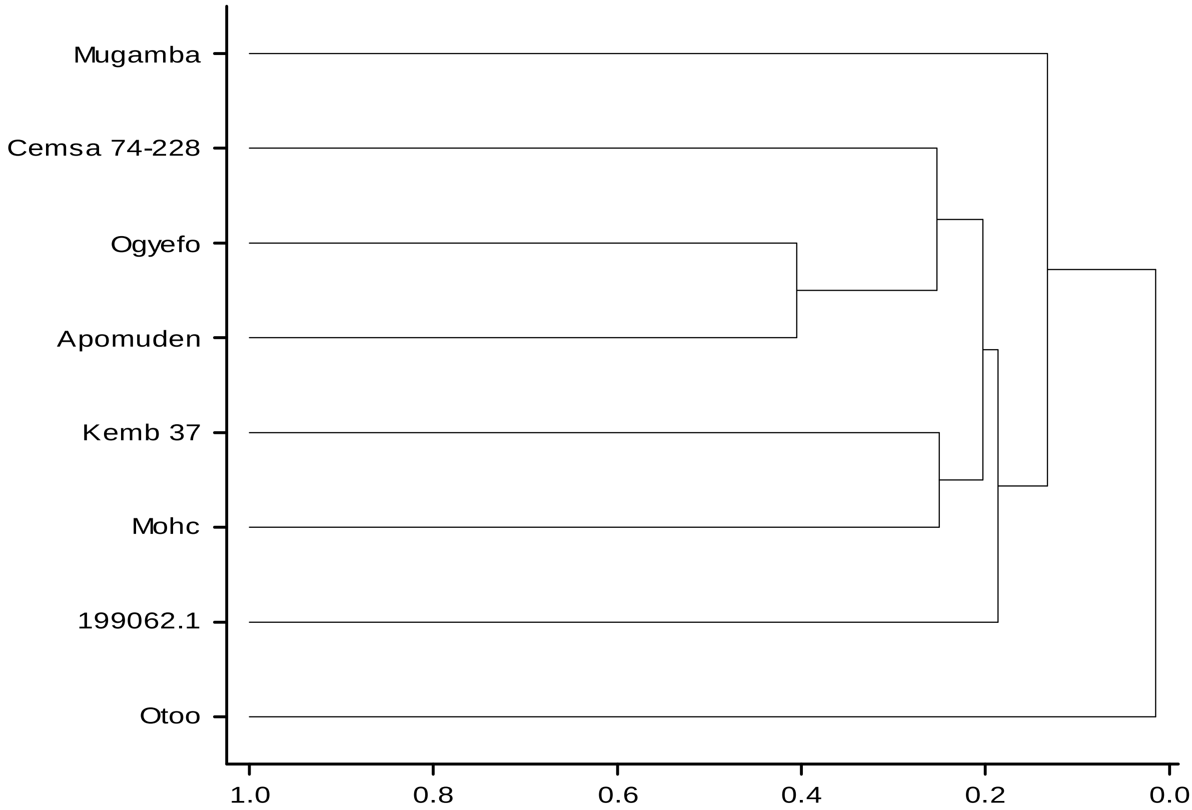


Fig. 1 Dendrogram of 14 SSR markers of four elite, three released and one introduced sweetpotato varieties in Ghana based on Jaccard's coefficient of similarity index using UPGMA.

Fourteen (14) Simple Sequence Repeat markers revealed a high genetic diversity among the genotypes studied. The similarity coefficient ranged from 0.1 to 0.4 with an average of 0.25. At a similarity level of 0.23, the varieties were separated into five clusters.

Apomuden, Ogyefo and Cemsa 74-228, an elite clone, are in one cluster while Kemb 37 and Mohc, two elite clones form a cluster. Otoo, Mugamba and 199062.1 formed three single member clusters.

At a similarity coefficient of 0.4, Apomuden and Ogyefo were the most closely related genotypes.

Based on the molecular analysis, Cemsa 74-228, Kemb 37, Mohc and 199062.1 have a low similarity coefficient of 0.2 and are therefore genetically different from each other and the other released varieties used in the study.

5. Multi-locational Evaluation

The elite genotypes (Mohc; Cemsa 74-228; Kemb 37; 199062.1) were evaluated both on-station (forest, forest/savanna transition and coastal savanna) and on-farm (coastal savanna) in Southern Ghana. The yield performances are shown in Tables 5-10.

5.1 On-Station multi-locational evaluation

Fresh Yields

The elite genotypes (Mohc; Cemsa 74-228; Kemb 37; 199062.1) were identified as promising in 2009. The mean fresh root yields across locations were high and comparable to Apomuden (check) in 2009 Tables 3&4). Kemb 37 was outstanding in 2009 at Ejura (Table 4).
Yields were particularly high at Pokuase (Table 5) for the elite materials (13.6 t/ha for Cemsa 74-228 to 20.5 t/ha for Mohc) in 2010. This was reflected in Table 6 for marketable yields and also for vine yields (Table 7). In another trial, 199062.1 had a yield range of 14.5 - 20.7 t/ha while it was 9.3 - 22.5 t/ha for Mohc (Table 8). These were also reflected in marketable yields and vine yields (Tables 9&10).

In 2011, Fresh root yields ranged from 11.1-19.8 t/ha for the elite genotypes at Ejura and Fumesua (Table 11). Marketable and vine yields recorded were also high (Tables 12&13). Mohc yielded 15.1 t/ha.

Percent Plant Establishment

Percent plant establishment at harvest of the genotypes in the various locations are given in Tables 14 & 15. Generally, percent plant establishment was okay at least for the elite genotypes in 2010. In 2011 plant establishment ranged from 66 % to 85 %.

Table 3 Genotype Yields. Sweetpotato Variety Trials. Four distinct locations, 2009.

GENOTYPE	----Total fresh root yield (T/ha)-----				------Fresh Vine yield (T/ha)------------------			
	Fumesua	Ejura	Pokuase	Ohawu	Fumesua	Ejura	Pokuase	Ohawu
1.199062.1	**11.1(DM30)**	**7.0**	**2.0**	**0.8**	**5.6**	**24.3**	**3.6**	**8.4**
2. Tanzania	5.6 (DM53)	1.5	2.1	1.7	5.4	28.4	5.5	23.1
3.Apomuden (check)	**15.6 (DM15)**	**23.5**	**12.1**	**7.1**	**7.5**	**23.2**	**7.5**	**9.1**
4.Ukerewe	5.1(DM44)	2.7	0	0	10.5	39.5	3.5	7.5
5.Gweri	0.7(DM38)	0	0	0	2.2	13.0	2.6	20.8
6.Naspot 1	11.1(DM37)	0	3.7	2.2	13.5	57.4	10.4	24.3
7.Jukwa Orange	12.3(DM48)	6.7	3.0	0	16.5	32.2	3.6	10.6
8.Carrot C	4.1(DM36)	0	0	0	10.0	23.0	0.7	11.9
9.Mohc	**9.8 (DM45)**	**5.2**	**4.2**	**9.7**	**7.8**	**39.2**	**4.5**	**10.7**
Mean	8.4				8.8	31.1	4.7	14.0
p=<0.0001	**SE=2.06**							

Table 4. Total yields of genotypes in mega clone trials at two distinct locations, 2009.

GENOTYPE	-------TRYLD (kg/ha)------			-- CRYLD (T/ha)---		------Fresh Vine yield (T/ha)-	
	Fumesua	Ejura	Across	Fumesua	Ejura	Fumesua	Ejura
1.Jewel	9.3	12.4	10.9	5.7	11.1	10.3	18.6
2.Yanshu 1	13.2	14.9	14.1	10.8	14.0	9.8	27.2
3.Mohc	**5.7**	**14.3**	**10.0**	**4.7**	**12.8**	**18.3**	**56.2**
4.Beauregard	5.3	9.8	7.6	4.6	9.1	7.9	10.0
5.Brondal	7.9	13.0	10.5	6.4	12.1	9.1	16.0
6.Naveto	2.0	8.6	5.3	1.4	7.6	14.3	40.3
7.Xushu 18	0	0.1	-	0	0	1.4	13.0
8.Kemb 37	**8.9**	**22.0**	**15.5**	**6.2**	**19.7**	**12.5**	**36.8**
9.Tanzania	5.8	5.1	5.5	3.9	4.1	20.4	33.2
10.Jonathan	0.9	1.8	1.4	0.3	1.4	7.8	20.1
11.Wagabolige	0	0		0	0	30.7	52.0
12.CRI-Apomuden	**9.9**	**23.7**	**16.8**	**6.2**	**22.3**	**4.1**	**15.0**
13.Blesbok	8.8	8.3	8.5	6.4	7.6	3.6	14.3
14.Ningshu 1	6.1	17.4	11.8	3.6	16.6	5.8	14.4
15.NCSU 1560	9.4	11.6	10.5	4.3	9.1	8.3	13.8
16.Santa Amaro	4.1	0.9	2.5	3.0	0.6	10.8	24.6
17.Zapallo	1.4	4.0	2.7	0.7	3.6	5.7	13.9
18.Cemsa 74-228	**12.7**	**43.7**	**28.2**	**10.9**	**42.6**	**12.8**	**27.4**
19.SPK004 (441768)	2.4	2.0	2.2	1.3	1.5	21.9	48.9
20.Resisto	5.1	-	5.1	2.4	-	6.7	-
21.Zambezi	3.7	1.4	2.6	1.4	0.4	14.1	12.7
22.Humbachero	2.8	4.9	3.9	0.7	3.5	15.5	39.7
Mean	6.3	11.5		4.3	10.0	11.7	26.8
p=<0.0001. SE=	1.6	4.0		1.4	3.9		

Table 5. Fresh tuber yields (t/ha) of sweetpotato genotypes at 4 MAP tested across four locations (Fumesua, Ejura, Pokuase and Ohawu) in 2010.

	Genotype	**Fumesua**	**Ejura**	**Pokuase**	**Ohawu**	**Mean** (Across)
1.	Resisto	2.2	3.4	2.3	0.5	2.1
2.	**Cemsa 74-228**	**4.0**	**11.1**	**13.6**	**10.2**	**9.7**
3.	Jonathan	3.9	3.8	5.4	2.4	3.9
4.	Beauregard	6.1	1.9	10.2	6.8	6.3
5.	Humbachero	3.4	2.8	5.2	1.7	3.3
6.	Ningshu-1	11.3	16.0	15.8	9.8	13.2
7.	**Mohc**	**16.3**	**6.7**	**20.5**	**5.8**	**12.3**
8.	Tanzania	3.6	1.5	2.8	2.0	2.5
9.	Wagabolige	0.5	0.4	1.7	-	0.9
10.	**Kemb 37**	**13.9**	**8.5**	**14.2**	**4.5**	**10.3**
11.	Blesbok	3.1	7.3	4.9	2.0	4.3
12.	SPK004	2.1	0.4	4.4	-	2.3
13.	**Apomuden**	**16.5**	**18.6**	**14**	**12.3**	**15.4**
Mean		6.7	6.3	8.7		
S.E		1.23	1.23	1.23	1.23	

Table 6. Marketable fresh tuber yields (t/ha) of sweetpotato genotypes at 4 MAP tested across four locations in 2010.

	Genotype	**Fumesua**	**Ejura**	**Pokuase**	**Ohawu**	Mean (Across)
1.	Resisto	1.0	2.0	1.6	0.3	1.2
2.	**Cemsa 74-228**	**3.4**	**9.6**	**12.5**	**9.5**	**8.8**
3.	Jonathan	2.6	2.1	4.1	2.1	2.7
4.	Beauregard	5.0	1.1	8.9	3.3	4.6
5.	Humbachero	2.3	1.1	3.1	1.3	2.0
6.	Ningshu-1	9.7	12.3	14.6	8.6	11.3
7.	**Mohc**	**13.8**	**3.9**	**18.6**	**5.1**	**10.4**
8.	Tanzania	2.7	0.6	2.1	1.5	1.7
9.	Wagabolige	0.4	-	0.7	-	.6
10.	**Kemb 37**	**10.2**	**4.1**	**11.9**	**3.2**	**7.3**
11.	Blesbok	2.2	5.7	3.9	1.7	3.4
12.	SPK004	1.8	0.2	3.3	-	1.8
13.	**Apomuden**	**12.8**	**13.0**	**11.7**	**8.8**	**11.6**
Mean		5.2	4.3	7.4	-	
S.E		1.25	1.25	1.25	1.25	

Table 7. Fresh Vine yield (t/ha) of sweetpotato genotypes 4 MAP tested across four locations in 2010.

	Genotype	**Fumesua**	**Ejura**	**Pokuase**	**Ohawu**	**Mean (Across)**
1.	Resisto	1.7	2.9	1.3	4.6	2.6
2.	**Cemsa 74-228**	**1.4**	**10.8**	**8.7**	**8.2**	**7.3**
3.	Jonathan	3.8	11.0	7.0	4.2	6.5
4.	Beauregard	2.3	1.6	3.9	1.6	2.4
5.	Humbachero	7.0	12.1	13.0	8.4	10.1
6.	Ningshu-1	4.1	10.9	10.6	4.6	7.6
7.	**Mohc**	**12.9**	**17.1**	**20.5**	**21.7**	**18.1**
8.	Tanzania	8.2	21.9	10.6	28.6	17.3
9.	Wagabolige	8.6	28.6	24.7	21.2	20.8
10.	**Kemb 37**	**11.9**	**13.9**	**12.5**	**17.0**	**13.8**
11.	Blesbok	1.2	5.6	3.1	1.9	3.0
12.	SPK004	9.0	28.0	30.8	33.7	25.4
13.	**Apomuden**	**4.1**	**10.0**	**7.4**	**13.0**	**8.6**
Mean		5.9	13.4	11.9	13.0	
S.E		3.30	3.30	3.30	3.30	

Table 8. Fresh tuber yields (t/ha) of sweetpotato genotypes at 4 MAP tested across three locations (Fumesua, Ejura, Pokuase) in 2010.

	Genotype	**Fumesua**	**Ejura**	**Pokuase**	**Mean (Across)**
1	**199062.1**	**20.7**	**14.5**	**15.9**	**17.0**
2	Tanzania	6.0	3.1	4.8	4.6
3	**Apomuden**	**18.3**	**25.2**	**9.9**	**17.8**
4	Ukerewe	3.2	3.4	9.7	5.4
5	Gweri	1.1	1.3	22.6	8.3
6	NASPOT-1	8.2	3.6	5.1	5.6
7	Jukwa Orange	7.3	7.5	8.4	7.7
8	Carrot C	1.5	1.2	25.2	9.3
9	**Mohc**	**18.0**	**9.3**	**22.5**	**16.6**
10	**Cemsa 74-228**	**9.5**	**10.2**	**6.7**	**8.8**
Mean		9.4	8.0	12.9	
S.E		1.46	1.46	6.16	

Table 9. Marketable fresh tuber yields (t/ha) of sweetpotato genotypes at 4 MAP tested across three locations in 2010.

	Genotype	**Fumesua**	**Ejura**	**Pokuase**	(Across)
1	**199062.1**	**18.3**	**11.6**	**13.4**	**14.4**
2	Tanzania	4.4	1.8	3.9	3.4
3	**Apomuden**	**10.0**	**19.1**	**7.4**	**12.2**
4	Ukerewe	2.4	1.1	8.4	4.0
5	Gweri	0.7	0.7	3.0	1.5
6	NASPOT-1	6.3	1.7	3.1	3.7
7	Jukwa Orange	4.5	1.8	6.6	4.3
8	Carrot C	0.7	0.7	5.6	2.3
9	**Mohc**	**15.5**	**5.6**	**24.4**	**15.2**
10	**Cemsa 74-228**	**7.9**	**6.6**	**8.5**	**7.7**
Mean		7.1	5.1	7.2	
S.E		1,37	1.37	2.37	

Table 10. Fresh Vine yield (t/ha) of sweetpotato genotypes 4 MAP tested across three locations in 2010.

	Genotype	**Fumesua**	**Ejura**	**Pokuase**	(Across)
1	**199062.1**	**16.9**	**17.7**	**6.8**	**13.8**
2	Tanzania	11.1	22.7	20.4	18.1
3	**Apomuden**	**4.4**	**20.8**	**3.3**	**9.5**
4	Ukerewe	14.0	25.9	30.3	23.4
5	Gweri	13.3	11.1	1.6	8.7
6	NASPOT-1	21.7	35.9	28.9	28.8
7	Jukwa Orange	11.8	22.0	13.7	15.8
8	Carrot C	3.5	13.7	0.7	6.0
9	**Mohc**	**12.3**	**19.9**	**37.4**	**23.2**
10	**Cemsa 74-228**	**3.4**	**9.4**	**6.1**	**6.3**
Mean		11.2	19.9	13.6	
S.E		2.28	2.28	2.86	

Table 11. Total root yields of Sweetpotato Variety Trial (SPVT) for 13 sweetpotato genotypes at five locations (1.=Fumesua, 2.=Ejura, 3.=Pokuase, 4.=Ohawu and 5.=Komenda), major season, 2011

	-----------Total root yields (t ha^{-1})------------------------------						
	Fumesua	**Ejura**	**Across**	**Pokuase**	**Ohawu**	**Komenda**	**Across**
Santom Pona	14.4	20.2		11.0	16.1	7.8	13.9
Otoo	8.0	14.7		7.7	9.0	5.3	8.9
Hi-Starch	6.6	10.3		6.5	5.0	5.5	5.0
199062.1	**13.8**	**19.8**		**7.2**	**7.0**	**8.2**	**11.2**
Tek Santom	3.7	4.1		4.7	3.6	3.1	3.8
Apomuden	22.0	20.5		9.0	11.8	6.1	13.9
Cemsa 74-228	**14.1**	**18.4**		**7.6**	**6.0**	**4.6**	**10.1**
Ogyefo	10.1	12.6		4.2	8.8	8.6	8.9
Faara	12.5	12.1		6.3	6.4	4.0	8.3
Sauti	6.9	3.2		2.1	2.6	3.4	3.6
Mohc	**15.1**	**16.7**		**4.0**	**9.5**	**11.3**	**11.3**
Okumkom	9.0	16.1		7.3	5.3	7.1	9.0
Kemb 37	**9.9**	**11.1**		**4.9**	**6.7**	**8.9**	**8.3**
Standard Error	1.61	1.61		1.61	1.61	1.61	

Table 12. Marketable root yields of Sweetpotato Variety Trial for 13 Sweetpotato genotypes at five locations (1.=Fumesua, 2.=Ejura, 3.=Pokuase, 4.=Ohawu and 5.=Komenda),major season, 2011

	-----------Marketable root yields (t ha^{-1})------------------------------					
	Fumesua	**Ejura**	**Pokuase**	**Ohawu**	**Komenda**	**Across**
Santom Pona	11.4	18.4	8.3	13.4	6.4	11.6
Otoo	5.7	9.8	6.9	6.3	4.3	6.6
Hi-Starch	4.6	7.7	5.6	4.2	3.3	5.1
199062.1	**10.6**	**17.4**	**4.7**	**4.9**	**6.6**	**8.8**
Tek Santom	1.5	0.1	3.0	2.0	2.0	1.7
Apomuden	19.3	13.8	7.3	7.9	3.8	10.4
Cemsa 74-228	**11.6**	**17.1**	**6.1**	**4.2**	**3.6**	**8.5**
Ogyefo	6.7	10.3	3.3	6.7	7.3	6.9
Faara	9.1	10.3	5.0	4.0	2.9	6.3
Sauti	4.9	1.8	1.6	1.3	2.2	2.4
Mohc	**10.2**	**10.3**	**2.5**	**6.7**	**8.6**	**7.7**
Okumkom	6.5	13.2	6.1	3.7	5.4	7.0
Kemb 37	**5.9**	**7.0**	**3.2**	**4.3**	**6.6**	**5.4**
Standard Error	1.43	1.43	1.43	1.43	1.43	

Table 13. Vine yields of Sweetpotato Variety Trial (SPVT) for 13 sweetpotato genotypes at five locations (1.=Fumesua, 2.=Ejura, 3.=Pokuase, 4.=Ohawu and 5.=Komenda), major season, 2011

	Vine yield (t ha^{-1})					
	Fumesua	**Ejura**	**Pokuase**	**Ohawu**	**Komenda**	**Across**
Santom Pona	13.2	29.3	6.6	13.3	7.6	14.0
Otoo	9.2	22.0	9.2	9.4	4.8	11.7
Hi-Starch	6.2	27.2	9.6	9.9	5.7	11.7
199062.1	**8.6**	**13.9**	**7.9**	**7.3**	**3.8**	**8.3**
Tek Santom	34.6	37.1	28.9	22.2	16.6	27.9
Apomuden	12.4	18.5	6.7	9.1	4.3	10.2
Cemsa 74-228	**10.0**	**23.7**	**8.1**	**5.6**	**3.6**	**10.2**
Ogyefo	27.0	27.3	10.8	22.4	8.8	19.3
Faara	21.3	42.1	11.6	12.6	7.3	19.0
Sauti	20.9	27.9	9.8	13.9	8.9	16.3
Mohc	**14.7**	**19.0**	**5.6**	**7.8**	**8.0**	**11.0**
Okumkom	6.1	19.6	5.6	3.1	3.0	7.5
Kemb 37	**24.0**	**24.5**	**7.1**	**8.9**	**4.7**	**13.8**
Standard Error	2.75	2.75	2.75	2.75	2.75	

Table 14. Percent plant establishment at harvest of sweetpotato genotypes tested across four locations in 2010.

	Genotype	**Fumesua**	**Ejura**	**Pokuase**	**Ohawu**	(Across)
1.	Resisto	62	40	43	16	40
2.	**Cemsa 74-228**	**84**	**86**	**88**	**79**	**84**
3.	Jonathan	93	91	78	66	82
4.	Beauregard	68	29	74	36	52
5.	Humbachero	97	89	88	78	88
6.	Ningshu-1	99	84	89	87	90
7.	**Mohc**	**98**	**92**	**91**	**83**	**91**
8.	Tanzania	49	69	46	43	52
9.	Wagabolige	62	77	59	72	68
10.	**Kemb 37**	**94**	**76**	**92**	**59**	**80**
11.	Blesbok	76	66	74	52	67
12.	SPK004	70	72	61	78	70
13.	Apomuden	93	81	78	86	85
Mean		80	73	74	64	
S.E		9.2	9.2	9.2	9.2	

Table 15. Percent plant establishment at harvest of sweetpotato genotypes tested combined for five locations (1.=Fumesua, 2.=Ejura, 3.=Pokuase, 4.=Ohawu and 5.=Komenda), major season, 2011

	Genotype	Mean
1	Santom Pona	72
2	Otoo	79
3	Hi-Starch	71
4	**199062.1**	**85**
5	Tek Santom	77
6	Apomuden	70
7	**Cemsa 74-228**	**76**
8	Ogyefo	82
9	Faara	74
10	Sauti	66
11	**Mohc**	**79**
12	Okumkom	71
13	**Kemb 37**	**78**
	Standard Error	1.8

Pests and Diseases

Sweetpotato virus complex disease (SPVD)

Resistance/Tolerance to SPVD under field conditions was scored on a 9-point scale developed by CIP:

1 – No visible SPVD symptoms on all plants
2 –Unclear virus symptoms
3 –Clear virus symptoms <5% of plants per plot
4 - Clear virus symptoms at 6 to 15% of plants per plot
5 - Clear virus symptoms at 16 to 33% of plants per plot
6. Clear virus symptoms at 34 to 66% of plants per plot (more than 1/3, less than 2/3)
7. Clear virus symptoms at 67 to 99% of plants per plot (2/3 to almost all)
8. Clear virus symptoms in all plants per plot (not stunted)
9. Severe virus symptoms in all plants per plot (stunted)

SPVD scores of replicated field trials at various locations in different years are shown in Tables 16-18. Tolerance was variable in 2010 (Tables 16 and 17) and severity was similar in 2011 (Table 18.).

Cylas sp. Infestation

Weevil (Cylas) infestation was insignificant (Table 19-21).

Table 16. SPVD1Month Before harvest of sweetpotato genotypes tested across four locations in 2010.

	Genotype	**Fumesua**	**Ejura**	**Pokuase**	**Ohawu**	(Across)
1.	Resisto	4	7	3	5	4
2.	**Cemsa 74-228**	**9**	**8**	**5**	**6**	**7**
3.	Jonathan	8	8	8	5	7
4.	Beauregard	8	9	4	4	6
5.	Humbachero	8	7	6	5	7
6.	Ningshu-1	8	8	8	4	7
7.	**Mohc**	**5**	**6**	**4**	**5**	**5**
8.	Tanzania	5	6	6	5	6
9.	Wagabolige	2	5	4	2	3
10.	**Kemb 37**	**4**	**5**	**7**	**5**	**5**
11.	Blesbok	8	8	8	9	8
12.	SPK004	3	5	3	1	3
13.	Apomuden	3	6	6	3	5
Mean		6	7	5	4	
S.E		0.8	0.8	0.8	0.8	

Table 17 SPVD scores 1MBh of sweetpotato genotypes tested across two locations in 2010.

	Genotype	**Fumesua**	**Ejura**	(Across)
1	**199062.1**	**8**	**8**	**8**
2	Tanzania	6	6	6
3	Apomuden	2	6	4
4	Ukerewe	3	7	5
5	Gweri	5	7	6
6	NASPOT-1	2	4	3
7	Jukwa Orange	3	6	5
8	Carrot C	9	8	8
9	**Mohc**	**4**	**7**	**5**
10	**Cemsa 74-228**	**8**	**8**	**8**
Mean		5	6	
S.E		0.4	0.4	

Table 18 Incidence and severity of sweet potato virus disease complex on some Sweetpotato lines at Komenda, Fumesua and Ejura in 2011.

Genotype	Komenda		Fumesua		Ejura		Across locations	
	Mean % infection	Mean severity scores (1-9)	Mean % infection	Mean severity scores (1-9)	Mean % infection	Mean severity scores (1-9)	Mean % infection	Mean severity scores
Sauti	13	3.3	5.0	3.3	9.0	5.3	9.0	4.0
Tek Santom	10	3.7	11.0	3.0	9.0	3.6	10.0	3.4
199062.1*	**7**	**2.7**	**70.0**	**8.0**	**71.0**	**6.7**	**49.3**	**5.8**
Apomuden	7	3.3	17.0	3.7	16.0	4.3	13.3	4.1
Okumkom	57	6.7	58.0	7.0	63.0	6.6	59.3	6.7
Ogyefo	5	2.3	7.0	3.0	12.0	4.3	8.0	3.2
Kemb 37*	**19**	**5.0**	**38.0**	**5.3**	**52.0**	**6.3**	**36.3**	**5.5**
Santom Pona	0	1.0	2.0	2.3	11.0	4.0	4.3	2.4
Faara	21	5.0	7.0	3.3	33.0	4.6	20.3	4.3
Ningshui 1	75	7.0	33.0	4.3	-	-	54.0	5.7
Otoo	19	5.0	24.0	5.0	16.0	4.7	16.3	4.9
Mohc*	**14**	**4.0**	**12.0**	**4.0**	**23.0**	**6.6**	**16.3**	**6.2**
Cemsa 74-228*	**20**	**5.0**	**56.0**	**6.3**	**48.0**	**6.3**	**41.3**	**5.9**
Hi-starch	30	6.0	25.0	5.0	39.0	5.3	31.3	5.4

* Elite lines earmarked for release.

Table 19 Weevil Incidence at harvest of sweetpotato genotypes tested across two locations in 2010.

	Genotype	**Fumesua**	**Ejura**	**(**Across)
1	**199062.1**	**2**	**1**	**2**
2	Tanzania	2	1	2
3	Apomuden	3	1	2
4	Ukerewe	1	1	1
5	Gweri	1	1	1
6	NASPOT-1	2	1	2
7	Jukwa Orange	2	1	2
8	Carrot C	1	1	1
9	**Mohc**	**2**	**1**	**2**
10	**Cemsa 74-228**	**2**	**1**	**2**
Mean		2	1	
S.E		0.2	0.2	

Table 20 Weevil incidence at harvest of sweetpotato genotypes tested across four locations in 2010

	Genotype	Fumesua	Ejura	Pokuase	Ohawu	(Across)
1.	Resisto	2	2	1	2	2
2.	**Cemsa 74-228**	**2**	**2**	**1**	**1**	**2**
3.	Jonathan	2	2	2	2	2
4.	Beauregard	4	1	1	3	2
5.	Humbachero	2	2	2	2	2
6.	Ningshu-1	2	2	2	2	2
7.	**Mohc**	**3**	**1**	**2**	**2**	**2**
8.	Tanzania	3	2	2	2	2
9.	Wagabolige	2	1	3	=	2
10.	**Kemb 37**	**3**	**1**	**2**	**3**	**2**
11.	Blesbok	2	2	2	2	2
12.	SPK004	2	1	2	-	2
13.	Apomuden	4	2	3	3	3
Mean		2	1	2		
S.E		0.3	0.3	0.3	0.3	

Table 21. Weevil infestation score for 13 sweetpotato genotypes combined for five locations (1=Fumesua, 2.=Ejura, 3.=Pokuase, 4.=Ohawu and 5.=Komenda), major season, 2011

	Genotype	Mean score
1	Santom Pona	2
2	Otoo	2
3	Hi-Starch	2
4	**199062.1**	**2**
5	Tek Santom	1
6	Apomuden	3
7	**Cemsa 74-228**	**2**
8	Ogyefo	1
9	Faara	1
10	Sauti	2
11	**Mohc**	**2**
12	Okumkom	2
13	**Kemb 37**	**2**
	Standard Error	.2

4.2 On-Farm multi-locational evaluation

In 2010, combined on-farm results indicated that the farmers variety performed better compared to the two eilte materials tested (Table 22). This may be due to its tolerance to virus, though the tolerance level was comparable to that of Mohc (Table 23).

In 2011, the elite genotypes did well with 199062.1 and Kemb 37 yielding 10 t/ha compared to 8 t/ha of the farmer's variety in the Central region (Table 24). The weevil infestation score and plant establishment showed similar trend. The yield of the farmer's variety was however better in the Volta region (Table 25).
In 2012 yields were good for the elite genotypes in Central region especially for Cemsa 74-228 (Table 26). Volta region recorded low yields in 2012 but Kemb 37 performed well (Table 27).

Virus infestation was similar for elite genotypes Mohc, 199062.1 and the farmer's variety in 2011 (Table 28). In 2012, virus infestation were similar in Central (Table 29) and Volta regions (Table 30)

Table 22 Combined analysis of mean root yields and other components in Sweetpotato Variety Trial (SPVT) for five sweetpotato genotypes from five on-farm locations in Central and Volta regions+, major season, 2010

	Genotype	Vine yield ($t\ ha^{-1}$)	Marketable root yield ($t\ ha^{-1}$)	Total root yield ($t\ ha^{-1}$)	Harvest Index	Weevil incidence	Plant Establishment (%)
1	Jukwa Orange	14.1	2.7	3.9	0.17	11	52
2	**199062.1**	**7.3**	**7.5**	**9.2**	**0.55**	**6**	**88**
3	NASPOT-1	21.1	3.1	4.2	0.17	15	70
4	**Mohc**	**11.8**	**7.8**	**8.8**	**0.42**	**10**	**81**
5	Farmer Variety	12.4	9.6	11.8	0.51	5	86
	Standard Error	1.7	1.3	1.4	0.03	1.7	5.4

Five on-farm locations +=Krobo Kwanim, Komenda, Nkontrado, Gomoa Potsin all in Central region; Dimakope in Volta region.

Table 23 SPVD 1MBH for five sweetpotato genotypes from five on-farm locations in Central and Volta regions+, major season, 2010

	Genotype	R1	R2	R3	R4	R5	Across
1	Jukwa Orange	3	5	3	3	3	3
2	**199062.1**	**8**	**9**	**8**	**8**	**8**	**8**
3	NASPOT-1	3	3	3	1	3	3
4	**Mohc**	**4**	**6**	**4**	**3**	**3**	**4**
5	Farmer Variety	4	3	3	4	5	4
	Standard Error	0.9	1.1	1.0	1.2	1.0	0.9

Five on-farm locations +=R1=Krobo Kwanim,;R2= Komenda,; R3= Nkontrado;R4=, Gomoa Potsin all in Central region; R5=Dimakope in Volta region

Table 24**.** Combined analysis of mean root yields and other components in Sweetpotato Variety Trial (SPVT) for five sweetpotato genotypes from six on-farm locations in Central region+, major season, 2011

	Genotype	Vine yield (t ha^{-1})	Marketable root yield (t ha^{-1})	Unmarketable root yield (t ha^{-1})	Total root yield (t ha^{-1})	Harvest Index	Weevil incidence	Plant Establishment (%)
1	Mohc	4.9	4.3	2.7	6.9	0.6	8	72
2	Cemsa 74-228	8.7	6.0	1.5	7.5	0.5	6	70
3	Kemb 37	11.4	6.7	2.9	9.6	0.5	5	79
4	199062.1	8.1	7.3	2.6	9.9	0.5	6	68
5	Farmer Variety	9.1	5.9	2.4	8.3	0.5	6	67
	Standard Error	2.42ns	1.42ns	0.67ns	1.97ns	0.04ns	1.4	5.7

Six on-farm locations + = on-farm trial.
Farmer as reps. R1=Esikwaa,R2=GomoaPotsin,R3=Nsuekyir,R4=GomoaAfranse,R5=Nkontrado,R6=Komenda in Central region.

Table 25 Combined analysis of mean root yields and other components in Sweetpotato Variety Trial (SPVT) for five sweetpotato genotypes from five on-farm locations in Volta region+, major season, 2011

	Genotype	Vine yield (t ha^{-1})	Marketable root yield (t ha^{-1})	Total root yield (t ha^{-1})	Harvest Index	Weevil Incidence	Plant Establishment (%)
1	Mohc	8.6	2.4	4.0	0.3	9	70
2	Cemsa 74-228	2.3	1.6	3.0	0.5	14	48
3	Kemb 37	5.4	2.6	4.7	0.5	6	65
4	199062.1	4.2	2.5	4.2	0.5	7	78
5	Farmer Variety	6.8	8.3	9.7	0.5	12	69
	Standard Error	1.19*	1.29*	1.44	0.04ns	2.5	4.3

Six on-farm locations + = on-farm trial. Farmer as reps. Onfarm R1=Klukoo,R2=Wute,R3=Xife,R4=Kudzordzikope,R5=Weta2011 in Volta region

Table 26 Combined analysis of mean root yields and other components in Sweetpotato Variety Trial (SPVT) for five sweetpotato genotypes from six on-farm locations in Central region+, major season, 2012

	Genotype	Vine yield (t ha^{-1})	Marketable root yield (t ha^{-1})	Unmarketable root yield (t ha^{-1})	Total root yield (t ha^{-1})	Harvest Index	Incedent Weevil	Plant Establishment (%)
1	Mohc	5.0	4.7	2.8	7.5	0.6	6	83
2	Apomuden	5.4	4.4	4.6	9.0	0.6	4	81
3	199062.1	8.1	6.1	2.8	9.0	0.5	3	84
4	Kemb 37	5.4	5.4	3.0	8.4	0.6	4	79
5	Farmer Variety	13.2	9.6	3.3	12.9	0.5	4	83
6	Cemsa 74-228	9.4	12.1	4.1	16.2	0.6	3	86
	Standard Error	1.5*	1.3**	0.6*	1.6**	0.04**	0.7 ns	2.4ns

Six on-farm locations + = on-farm trial. Farmer as reps:. FR1=Amotoe; FR2=Amoada; FR3=Gomoa Afranse; FR4=Gomoa Potsin; FR5=Gomoa; FR6=Amangoase in Central region.

Table 27 Combined analysis of mean root yields and other components in Sweetpotato Variety Trial (SPVT) for five sweetpotato genotypes from six on-farm locations in Volta region+, major season, 2012

	Genotype	Vine yield (t ha^{-1})	Marketable root yield (t ha^{-1})	Total root yield (t ha^{-1})	Harvest Index	Weevil Incidence	Plant Estab-lishment (%)
1	Cemsa 74-228	6.3	2.0	2.9	0.3	3	60
2	Mohc	13.1	2.0	4.4	0.3	2	80
3	Farmer Variety	25.9	6.5	9.0	0.3	3	83
4	Apomuden	11.9	2.2	4.5	0.3	3	72
5	Kemb 37	13.1	4.2	7.1	0.4	3	69
6	199062.1	12.1	1.1	1.7	0.2	3	80
	Standard Error	3.4**	1.4*	1.70*	0.03**	0.4 ns	5.7 ns

Six on-farm locations + = on-farm trial. Farmer as reps. On-farm FR1=Robert Azagla; FR2=WEta; FR3=Live; FR4=Vume; FR5=Kudzordzikope; FR6=Xife in Volta region

Table 28 SPVD 1MBH for five sweetpotato genotypes from six on-farm locations in Central region major season, 2011

	Genotype	R1	R2	R3	R4	R5	R6	Across
1	Mohc	3	2	3	4	3	4	3
2	Cemsa 74-228	7	7	5	7	6	7	7
3	Kemb 37	5	6	7	5	6	7	6
4	199062.1	4	2	4	4	2	4	3
5	Farmer Variety	3	3	3	5	2	4	3
	SE	0.7	1.0	0.7	0.5	0.9	0.7	0.9

Six on-farm locations + = on-farm trial.

Table 29 . SPVD1MBh for five sweetpotato genotypes from nine on-farm locations in Central region, major season, 2012

	Genotype	R1	R2	R3	R4	R5	R6	R7	R8	R9	Across
1	Mohc	3	5	5	6	6	6	7	6	6	6
2	Cemsa 74-228	4	5	4	3	3	3	3	3	5	4
3	Kemb 37	7	6	7	5	6	6	6	6	6	6
4	199062.1	5	8	8	8	6	8	6	5	7	7
5	Apomuden	4	5	7	5	4	6	4	4	5	5
6	Farmer Variety	5	4	6	3	4	5	4	4	5	4
	SE	0.6	0.6	0.6	0.8	0.5	0.7	0.6	0.5	0.3	0.5

R1=Amotoe,R2=Sesem,R3=Anomako,R4=Amoanda,R5=Nkontrado,R6=Akyeadze,R7=Potsin,R8=Mangoase,R9=Afranse in Central region

Table 30 SPVD1MBh Virus five sweetpotato genotypes from nine on-farm locations in Volta region major season, 2012

	Genotype	R1	R2	R3	R4	R5	R6	R7	R8	R9	Across
1	Mohc	5	6	6	4	5	6	5	5	3	4
2	Cemsa 74-228	7	8	9	8	6	6	6	5	6	7
3	Kemb 37	6	7	6	6	4	5	5	4	6	5
4	199062.1	8	8	8	8	5	8	7	8	7	7
5	Apomuden	3	5	7	5	4	4	4	5	5	5
6	Farmer Variety	5	4	8	4	4	5	3	4	4	5
	SE	0.7	0.7	0.5	0.7	0.3	0.6	0.6	0.6	0.6	0.5

+R1=Weta,R2=Agorve,R3=Ohawu,R4=Xetorlogo,R5=Vume,R6=KudzordziKope,R7=Devego,R8=Klukpo,R9=Xife in Volta region

5.0 Sensory evaluations

Cemsa 74-228 was highly preferred at Ejura (Table 32) whereas Kemb 37 was preferred in the Volta region (Table 33)

Table 31 Acceptance studies of boiled sweetpotato roots at 4 months harvest by 20 consumers at Ejura, 2010

	Sweetness				Texture		
Variety	Not	Average	very sweet		Moist	Average	Dry
199062.1	**7**	**9**	**4**		**7**	**9**	**4**
Ukerewe	5	6	9		8	7	5
Naspot.1	12	6	2		16	1	3
Gweri	0	6	14		0	7	13
Jukwa Orange	1	7	12		5	5	10
Carrot C	10	7	3		8	8	4
Mohc	**7**	**5**	**8**		**7**	**5**	**8**
Apomuden	7	4	9		1	6	13
Cemsa 74-228	**5**	**8**	**7**		**4**	**7**	**9**

Table 32 Acceptance studies of boiled sweetpotato roots at 4 months harvest by 20 consumers at Ejura, 2010

	Taste				Appearance		
Variety	Bad	Average	Excellent		Bad	average	excellent
199062.1	**4**	**9**	**7**		**4**	**3**	**13**
Ukerewe	4	6	10		8	5	7
Naspot.1	9	9	2		7	3	10
Gweri	0	7	13		1	6	13
Jukwa Orange	2	3	15		4	3	13
Carrot C	10	8	2		14	3	3
Mohc	**4**	**9**	**7**		**5**	**4**	**11**
Apomuden	1	6	13		4	7	9
Cemsa 74-228	**0**	**6**	**18**		**1**	**6**	**13**

Table 33. Taste and acceptability at harvest, 2010, with 18 sweetpotato farmers at Ohawu

Variety	Best		Average		Reject	
	Women	Men	Women	Men	Women	Men
Humbichero	6	5	2	4	1	-
Tanzania	5	7	4	2	-	-
Jonathan	7	8	2	-	1	-
Mohc	**6**	**3**	**3**	**3**	**-**	**3**
SPK004	3	6	4	3	2	-
Blesbok	7	3	1	6	1	-
Ukerewe	2	3	7	5	1	-
Kemb 37	**8**	**8**	**-**	**1**	**1**	**-**
Jukwa orange	-	1	3	-	6	8
Cemsa 74-228	**3**	**3**	**5**	**3**	**1**	**3**
Naspot-1	3	2	3	6	3	1
Ningshu-1	5	4	3	4	1	1
Beauregard	4	8	5	1	-	-
Apomuden	6	4	2	5	1	-
199062.1	**2**	**4**	**6**	**5**	**1**	**-**

2012 Sensory evaluation of elite clones (On-farm)

The consumer acceptance tests were repeated in 2012 and conducted at Ohawu and Komenda in the Volta and Central regions respectively. The consumer panels were 60 and comprised farmers, teachers and school pupils with equal representation of male and female in each consumer group evaluated six sweetpotato genotypes namely 199062.1, Ogyefo, CEMSA-74, Mohc, Santom Pona and Kemb 37. It should be noted that Ogyefo and Santom Pona were used as checks or controls for the other four sweetpotato genotypes in the test samples.

The samples evaluated were chunk fried rather than boiled. This is to minimize leaching of sugars that usually occur during boiling thus affecting sweetness. Chunk frying also affords the advantage of having sweetpotato samples with inner cooked texture similar to boiled samples and outer crispy texture similar to fried chips. The attributes evaluated were colour, flavour (aroma), taste and overall acceptability. A 5-point hedonic scale was used to measure acceptability of each attribute (where 1= dislike very much, 2= dislike moderately, 3= neither like nor dislike, 4= like moderately and 5=like very much). Sensory mean scores below 3 are considered negative or dislike category end while mean scores above 3 are considered positive or like category while 3 represent neither like nor dislike. ANOVA was performed on the sensory analysis data with means separation conducted using Kruskal-Wallis and Mann-Whitney tests on SPSS (V.16).

From the results (Table 34), Ogyefo, CEMSA-74 and Kemb 37 had consistently better acceptability for colour, flavour, taste and overall acceptability while Mohc Santom Pona and 199062.1 performed well in some attributes and poorly in others. Generally, the results in Table 35 indicated that Ogyefo, CEMSA-74, Kemb 37 and Mohc are liked and acceptable to consumers when chunk fried. It is important to note that poor acceptance of Santom Pona and 199062.1 in chunk fried form does not suggest that they will be poorly acceptable when used in a different product or when processed in a different form.

Table 34 Consumer Acceptance Mean Scores for Sweetpotato Chunk Fried Products*, 2012

Sample	**Colour**	**Flavour(aroma)**	**Taste**	**Overall Acceptance**
199062.1	4.02^a	3.12^a	2.52^a	2.60^a
Ogyefo	4.20^a	4.00^b	4.31^b	4.00^b
CEMSA-74	3.90^a	3.37^b	4.00^b	3.71^b
Mohc	4.00^a	3.00^a	3.08^a	3.38^b
Santom Pona	2.84^b	2.98^a	2.40^a	2.37^a
Kemb 37	3.58^a	3.38^b	4.05^b	3.80^b

***means in the same column with different letters are significantly different at P≤0.05

Table 35 Percentage Totals for Consumer Acceptance of Sweetpotato Chunk Fried Products, 2012

	Overall Accceptance			**Total**
Sample	Dislike	Neither Like nor Dislike	Like	
199062.1	56	9	45	100
Ogyefo	14	18	68	100
CEMSA-74	25	12	63	100
Mohc	38	2	60	100
Santom Pona	60	16	24	100
Kemb 37	24	5	71	100

FOOD PRODUCT SENSORY EVALUATION (On-station)

METHODOLOGY:

A ten (10) member semi-trained panel was used for the assessment of selected quality attributes of four (4) elite sweetpotato clones and a check (Otoo) at CSIR-CRI Post-Harvest laboratory.

The following quality attributes were objectively assessed:

- Colour intensity
- Aroma intensity
- Sweetness intensity
- Steamed product mouth feel
- Fried crisps quality

The score sheets employed for the study had unstructured scales. Samples were coded with a blind coding system and presented in a completely randomized order. Panelists were provided with water to rinse their mouths in-between samples.

RESULTS:

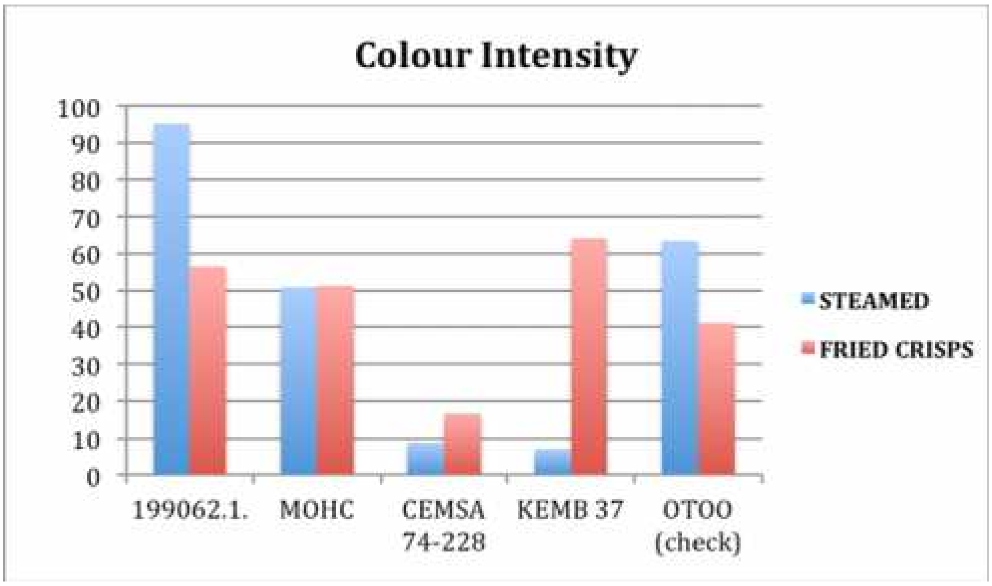


Fig. 2 Colour intensity scores for two product types (steamed pieces and fried crisps) prepared from elite clones

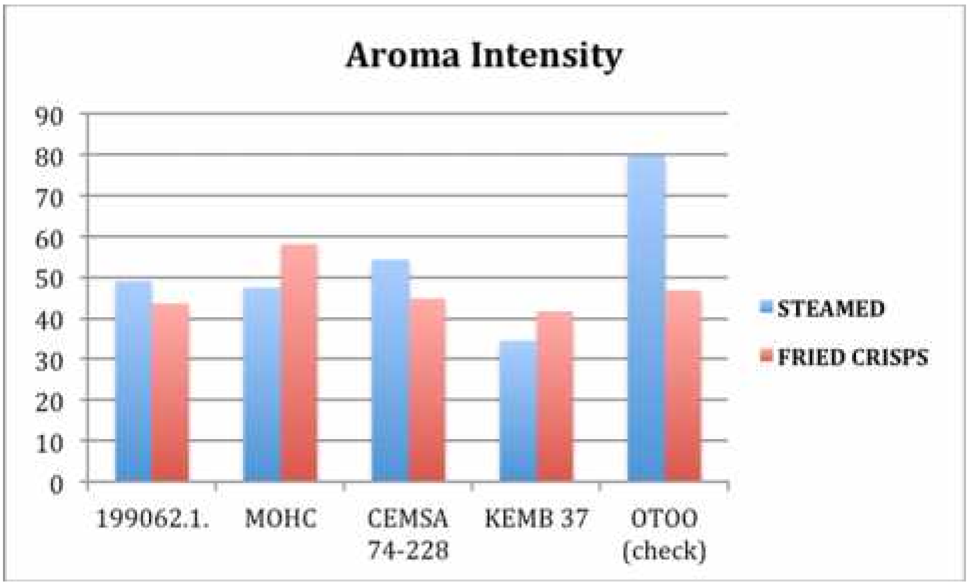


Fig. 3 Aroma intensity scores for two product types (steamed pieces and fried crisps) prepared from elite clones

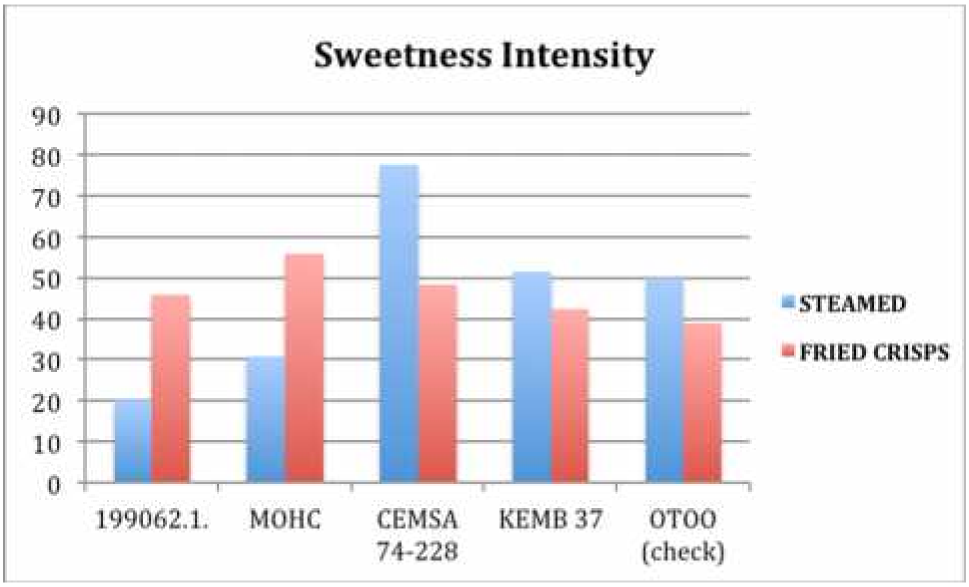


Fig. 4 Sweetness intensity scores for two product types (steamed pieces and fried crisps) prepared from elite clones

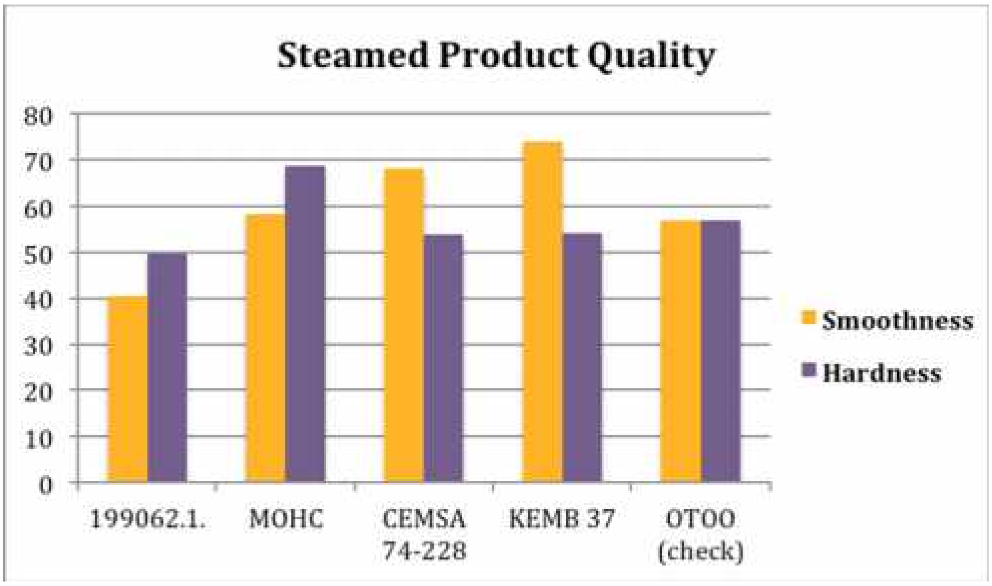


Fig 5 Mouthfeel (smoothness, hardness) of steamed product prepared from elite clones

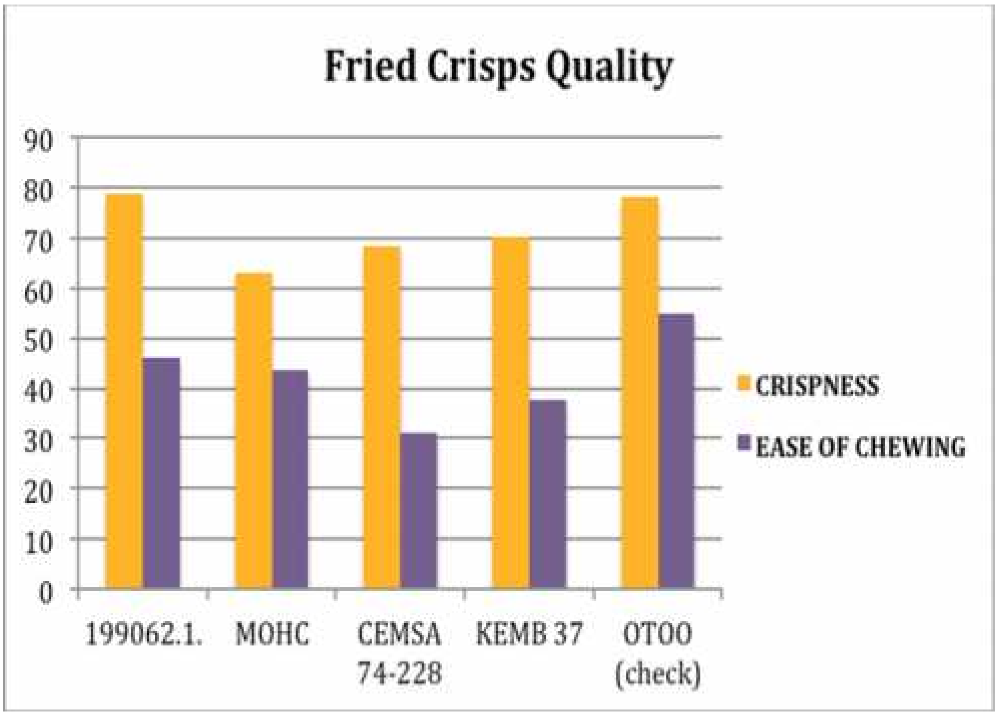


Fig. 6 Quality of fried crisps (smoothness, hardness) prepared from elite clones

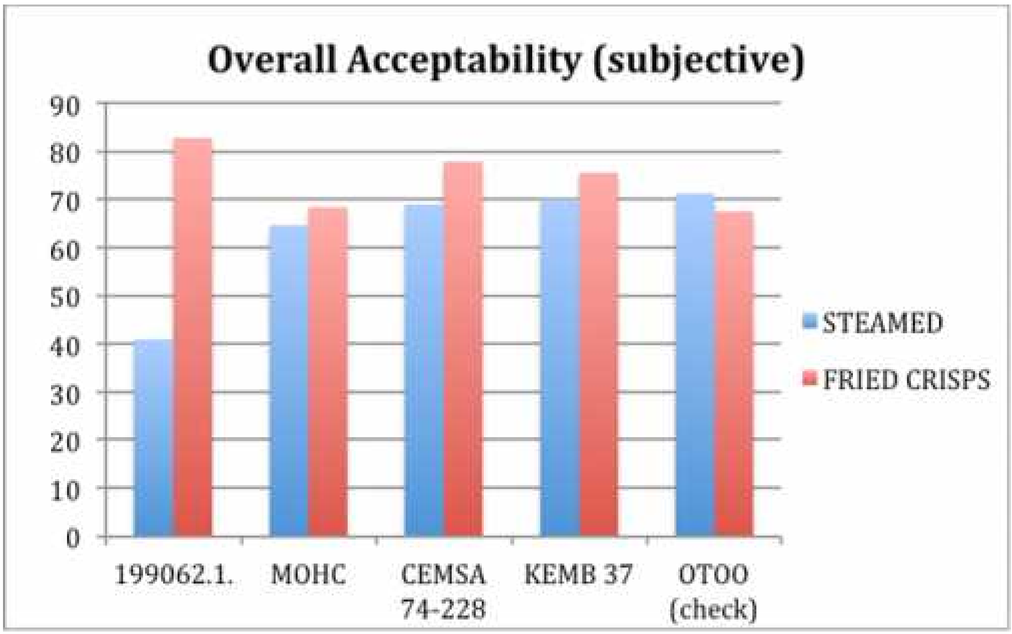


Fig. 7 Overall acceptability scores for two product types (steamed pieces and fried crisps) prepared from elite clones

Steamed product from 199062.1 had the lowest perceived sweetness intensity among the clones, and fried crisps for that same clone had the highest score for overall acceptability.

Fig. 8 Displayed Steamed products of elite clones

Fig. 9 Displayed Fried crisps of elite clones

6.0 Dry matter and Starch contents

Dry matter and starch contents are key parameters in sweetpotato quality. Products such as sweetpotato flour and gari require high DM, while other commercially viable products such as custard, modified starches, glucose and maltose syrups, etc, require appreciably high starch contents. High DM is required in staple food preparations in West Africa. Dry Matter of elite genotypes were similar to that of the released varieties (except Apomuden, the lowest and Hi-starch the highest) and therefore very acceptable (Tables 36-38). Starch values were also similar while total sugars apart from Apomuden were also similar (Table 39)

Table 36. DM (%) sweetpotato genotypes tested across three locations in 2010.

	Genotype	Fumesua	Ejura	Pokuase	(Across)
1.	Resisto	34	33	28	32
2.	**Cemsa 74-228**	**33**	**29**	**31**	**31**
3.	Jonathan	29	29	26	28
4.	Beauregard	27	22	21	23
5.	Humbachero	35	32	30	32
6.	Ningshu-1	27	29	29	28
7.	**Mohc**	**35**	**31**	**30**	**32**
8.	Tanzania	31	33	32	32
9.	Wagabolige	35	36	35	35
10.	**Kemb 37**	**33**	**33**	**29**	**32**
11.	Blesbok	24	21	23	23
12.	SPK004	29	29	31	30
13.	Apomuden	19	18	16	18
Mean		31	29	28	
S.E		2.0	2.0	2.0	

Table 37 DM (%) sweetpotato genotypes tested across two locations in 201

	Genotype	Fumesua	Ejura	(Across)
1	199062.1	28	26	27
2	Tanzania	32	34	33
3	Apomuden	16	21	19
4	Ukerewe	42	37	40
5	Gweri	37	-	37
6	NASPOT-1	38	35	37
7	Jukwa Orange	33	30	32
8	Carrot C	37	-	37
9	Mohc	34	32	33
10	Cemsa 74-228	34	31	33
Mean				
S.E		1.3	1.3	

Table 38**.** DM (%) of roots of Sweetpotato Variety Trial (SPVT) for 13 sweetpotato genotypes at five locations (1.=Fumesua, 2.=Ejura, 3.=Pokuase, 4.=Ohawu and 5.=Komenda), major season, 2011

		DM(%)					
		Fumesua	Ejura	Pokuase	Ohawu	Komenda	Across
1	Santom Pona	35.2	36.8	34.5	32.6	35.6	34.9
2	Otoo	36.6	34.8	32.2	34.6	32.3	34.1
3	Hi-Starch	45.8	46.2	43.7	44.2	44.2	44.8
4	**199062.1**	**33.2**	**32.9**	**31.3**	**30.1**	**28.7**	**31.2**
5	Tek Santom	-	35.1	34.8	33.7	31.5	33.8
6	Apomuden	21.5	20.3	20.6	17.9	21.2	20.3
7	**Cemsa 74-228**	**38**	**36.5**	**36.2**	**33.2**	**33.4**	**35.4**
8	Ogyefo	42.1	36.7	37.4	40.0	36.6	38.6
9	Faara	40.6	36.9	37.8	38.1	36.9	38.1
10	Sauti	40.4	35.5	37.1	39.8	37.9	38.1
11	**Mohc**	**36.0**	**35.6**	**34.2**	**32.9**	**32.5**	**34.2**
12	Okumkom	34.8	35.2	33.2	28.5	31.3	32.6
13	**Kemb 37**	**38.9**	**34.4**	**32.8**	**33.6**	**32.8**	**34.5**

Table 39. Protein, Fe, Zn, Starch, Raw Fructose, Raw Glucose, Raw Sucrose, Raw Maltose and Raw Total Sugars, of roots of Sweetpotato Variety Trial (SPVT) for 13 sweetpotato genotypes at **Pokuase**, one out of the **five locations (1.=Fumesua, 2.=Ejura, 3.=Pokuase, 4.=Ohawu and 5.=Komenda)**, major season, 2011

		Protein (%)	Fe ----(mg/100g)DW---	Zn	Starch (%)	Fructose (%)	Glucose (%)	Sucrose (%)	Maltose (%)	Total Sugars (%)
1	Santom Pona	4.07	1.42	.96	70.11	1.44	2.9	8.53	.08	12.95
2	Otoo	3.47	1.51	.79	68.03	1.03	2.27	12.36	.24	15.9
3	Hi-Starch	3.23	1.25	.84	75.15	.47	2.10	7.85	.09	10.52
4	**199062.1**	**3.44**	**1.52**	**.96**	**68.09**	**1.13**	**2.56**	**11.22**	**.31**	**15.21**
5	Tek Santom	3.39	1.58	.98	64.82	1.16	2.74	13.98	.25	18.13
6	Apomuden	4.43	2.26	1.41	47.01	4.67	7.79	23.35	.86	36.67
7	**Cemsa 74-228**	**3.38**	**1.27**	**.95**	**69.53**	**1.19**	**2.71**	**10.57**	**.22**	**14.69**
8	Ogyefo	2.74	1.25	.96	74.13	.20	1.56	8.21	.09	10.06
9	Faara	3.28	1.45	.99	70.21	1.39	3.11	9.25	.15	13.90
10	Sauti	3.87	1.38	1	69.26	.7	2.3	9.56	.15	12.71
11	**Mohc**	**7.53**	**2.99**	**1.69**	**69.35**	**1.75**	**4.33**	**23.45**	**.4**	**14.97**
12	Okumkom	3.46	1.68	.96	65.86	2.50	4.31	10.17	.32	17.31
13	**Kemb 37**	**4.29**	**1.73**	**1.04**	**68.01**	**1.68**	**3.65**	**9.54**	**.24**	**15.11**

*Starch content on dry weight basis

STARCH CHARACTERISATION

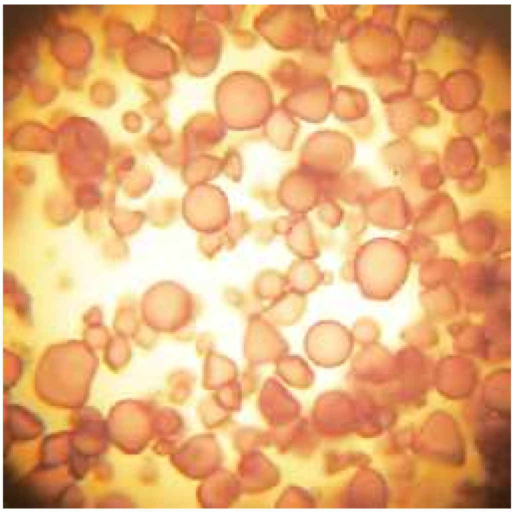
Table 40 Starch pH, amylose content and granule morphology of elite sweetpotato clones

Clone	pH	% Amylose	Dominant Granule shapes
199062.1	4.8	20.0	Round; Polygonal
Mohc	5.0	19.8	Elongated domes; Polygonal
Kemb	5.2	17.0	Large elongated domes; Polygonal
Cemsa	5.0	18.3	Round; Small-sized polygonal
Otoo (check)	5.10	18.9	Medium polygonal; Large domes

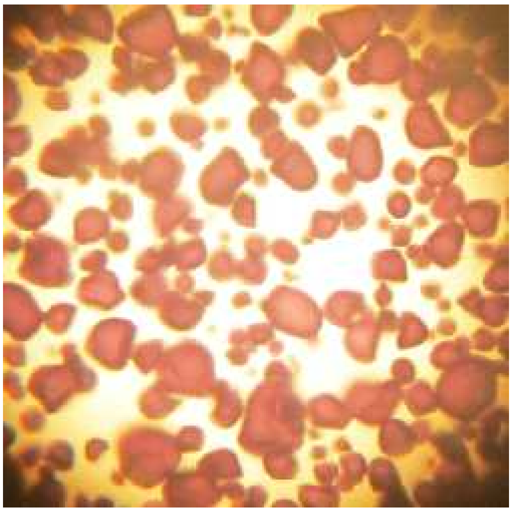
Fig 10 Gel strength of 8% starch pastes from elite sweetpotato clones (and ‘Otoo’ [check]); retention of the mould shape indicates higher retrogradation tendency (Wosiacki & Cereda, 1989)

Starch retrogradation tendency was tested by assessing gel strengths at 6%, 7% and 8% starch concentration. It was found to be moderate for all the clones as the mould shapes were all not perfectly retained at even the highest starch concentration of 8%. KEMB showed the least signs of retrogradation, and this is highly desirable in various food and industrial applications.

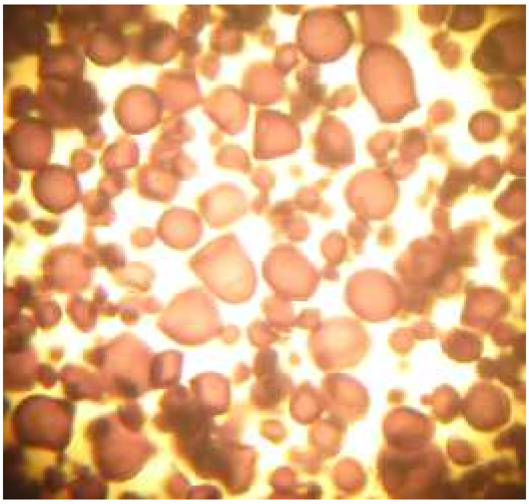
Starch Granule Morphologies of Elite Sweetpotato Clones



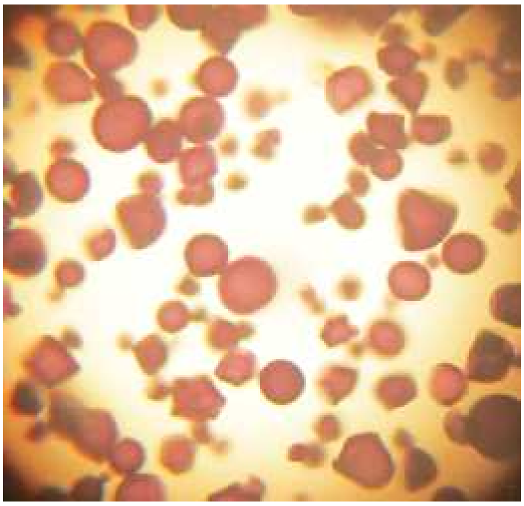
199062.1



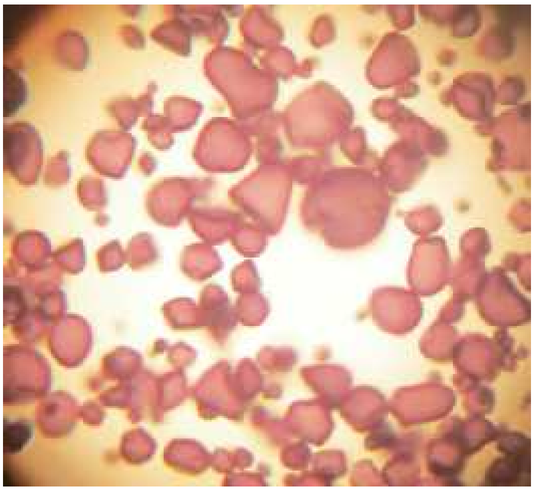
MOHC



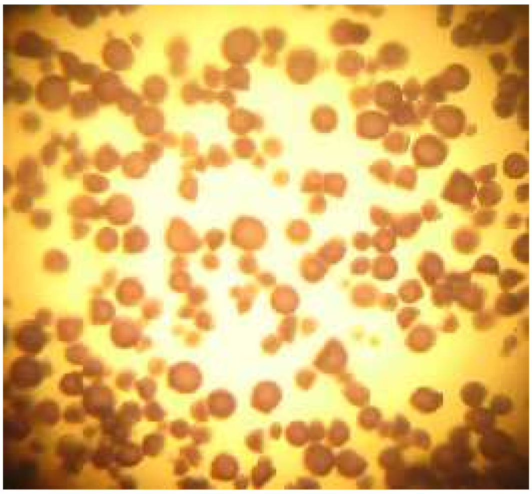
KEMB 37



CEMSA



OTOO (check)



CASSAVA (check)

Fig. 11 Iodine-stained starch granules showing granule shape variations and size distributions. Magnification: x400

7.0 Beta carotene levels

Two of the genotypes proposed for release have some amount of Beta (β)-carotene but nowhere compared to Apomuden (Table 41)

Table 41. Beta (β)-carotene contents of fresh tubers of sweetpotato genotypes and some other crops, major season, 2011

	Genotype	**Beta (β)-carotene level (µg /100g sample)**	**Root Flesh Color**
1	Mohc	2800	Dark yellow
2	Cemsa 74-228	400	Pale yellow
3	Kemb 37	300	White
4	199062.1	5500	Pale orange
5	*Apomuden****	32800-46000	Dark orange
6	*Otoo****	1500	Yellow
7	Palm Oil	3000-4200	
8	Carrots	2850-19572	
9	Mangoes	1980-2862	
10	Papaya	384-1044	

*** Released varieties

8. Socio-Economic Assessment

Partial budget and cost benefit analysis of on farm trial of proposed sweet potatoes varieties and farmer's variety in the Volta and Central region

Table 42 Partial budget and benefit cost ratio of sweet potatoes trials the Volta region, 2011

	Mohc	**Cemsa74-228**	**Kemb37**	**199062.1**	**Farmer**
Gross benefits					
average yield(t/ha)	9.5	6	6.7	7	5.3
adjusted yield(t/ha)[1]	8.55	5.4	6.03	6.3	4.77
Farm gate price(₵/t)	1000	1000	1000	1000	1000
Total gross benefit(₵)	**8550**	**5400**	**6030**	**6300**	**4770**
Variable cost					
cost of slashing(₵/ha)	75	75	75	75	75
cost of planting material(₵/ha)	100	100	100	100	100
cost of ploughing(₵/ha)	150	150	150	150	150
cost of planting(₵/ha)	50	50	50	50	50
cost of ridging(₵/ha)	200	200	200	200	200
cost of weeding(₵/ha)	100	100	100	100	100
cost of harvesting(₵/ha)	100	100	100	100	100
cost of carting(₵/ha)	212.5	212.5	212.5	212.5	212.5
Total cost that vary(₵)	**987.5**	**987.5**	**987.5**	**987.5**	**987.5**
Net benefits (₵/ha)	**7562.5**	**4412.5**	**5042.5**	**5312.5**	**3782.5**
Benefit cost ratio (BCR)	**8.65**	**5.46**	**6.10**	**6.37**	**4.83**

[1] Average yield was adjusted 10% down to copy what farmers would get if they adopted the variety and go through the same production practices.

Table 42 shows the partial budget and Benefit cost ratio of on-farm trails of four sweet potatoes Varieties and a farmer's variety from the Volta region. The highest net benefit value of ₵7562.5 was obtained from Mohc variety followed by 199062-1 with a value of ₵5312.5 and Kemb37 with a value of ₵5042.5 respectively. Benefit cost ratio analysis also show that the proposed varieties compared with the farmer's varieties are more beneficial. Variety Mohc had a benefit cost ratio of 8.65:1. Implying that if a farmer invested ₵1.00 in planting a hectare of Mohc variety, he would recoup his ₵1.00 plus an additional ₵7.65p. Likewise if he invested the same ₵1.00 in planting an hectare of 199062-1 he would recoup his ₵1.00 and an additional ₵5.37p. Though the farmer would not lose by planting his own variety, compared with the proposed varieties he would receive less. The benefit cost ratio of 4.83:1 is less than that of all the proposed varieties. Meaning that for a hectare of farmer variety, if he invested the same ₵1.00 he would receive back his ₵1.00 plus an additional ₵3.83p which is lower than benefits from all the three proposed varieties.

In the Central region variety 199062-1 gave the highest net benefit value of ₵8804.5 (Table 42). kemb37 gave a value of ₵8480.5 and the farmer variety gave ₵7076.5 which is better than the Mohc and cernsa74-228 which are proposed varieties. The benefit cost ratio analysis revealed that 199062-1 is more beneficial compared with all the others (Table 2). The benefit cost ratio of 5.66:1 implies that if ₵1.00 is invested in a hectare of 199062-1, the ₵1.00 will be regained in addition to ₵4.66p whilst the same invested in the farmers variety would give ₵3.74p

Table 43. Partial budget and benefit cost ratio of sweet potatoes trials the Central region, 2011

	Mohc	Cemsa74-228	Kemb37	199062.1	Farmer
Gross benefits					
average yield(t/ha)	6.9	7.5	9.6	9.9	8.3
adjusted yield(t/ha)[1]	6.21	6.75	8.64	8.91	7.47
Farm gate price(₵/t)	1200	1200	1200	1200	1200
Total gross benefit(₵)	**7452**	**8100**	**10368**	**10692**	**8964**
Variable cost					
cost of planting material(₵)	312.5	312.5	312.5	312.5	312.5
cost of slashing(₵/ha)	175	175	175	175	175
cost of ploughing(₵/ha)	125	125	125	125	125
cost of planting (₵/ha)	125	125	125	125	125
cost of ridging(₵/ha)	625	625	625	625	625
cost of weeding(₵/ha)	200	200	200	200	200
cost of harvesting(₵/ha)	200	200	200	200	200
cost of carting(₵/ha)	125	125	125	125	125
Total cost that vary(₵)	**1887.5**	**1887.5**	**1887.5**	**1887.5**	**1887.5**
Net benefit (₵/ha)	**5564.5**	**6212.5**	**8480.5**	**8804.5**	**7076.5**
Benefit cost ratio (BCR)	**3.94**	**4.29**	**5.49**	**5.66**	**4.74**

[1] Average yield was adjusted 10% down to copy what farmers would get if they adopted the variety and go through the same production practices.

Table 42 has shown that all the proposed varieties had advantage over the farmer variety in the Volta region.
In the central region however, only two (199062.1 and Kemb37) out of the four proposed varieties had advantage over the farmer variety.

The recommendations from the above analysis are that the proposed genotypes should be promoted in the Volta region for farmers to take advantage of them. In the Central region (Table 42) the two most promising varieties (199062.1 and Kemb37) must be promoted.

9.0
Conclusion

Summary of Outstanding Characteristics and Uses of Sweetpotato Genotypes Proposed for Release

Kemba 37	Cemsa 74-228
• Medium yields (Potential ~ 18t/ha). • Maturity: 4-5 months • High Dry Matter (35%). • High Starch content (68 % mg/100g DW) and excellent starch properties. • Mild sweetness • Excellent for ampesi. • Good quality flour – flour products • Promote it for fufu and industrial starch production. • Tolerant to SPVD • Tolerant to C*ylas sp.*	• High yields (Potential ~ 22t/ha) • Maturity: 4-5 months • High Dry Matter (35 %) • High starch content (69.5 % mg/100g DW) • Mild sweetness • Excellent for ampesi • High vine yield • Moderately tolerant to SPVD • Tolerant to C*ylas sp.*
Mohc	**199062.1**
• High yields (Potential ~ 20t/ha) • Maturity: 4-5 months • High Dry Matter (34 %) • Beta-carotene level 2800 µg /100g • Highest vine yield - produces huge amount of biomass/foliage. Good for livestock and a weed control crop. • Good plant establishment • Sweetpotato virus disease (SPVD) tolerant. • Excellent for ampesi (boiled) and deep-fried (chips). • High starch content (69.4 % mg/100g DW) • Tolerant to C*ylas sp*	• High yields (Potential ~ 22t/ha) • Maturity: 4-5 months • High Dry Matter (31 %) • Excellent for ampesi (boiled) (ampesi) and deep-fried (chips) and French fries. • Good quality flour – flour products. • High starch content (68.1 %) • Beta-carotene level 5500 µg /100g • Moderately tolerant to SPVD • Tolerant to C*ylas sp.* .

Based on the above, we propose that the genotypes presented in this report be released as varieties under the following local names.

PROPOSED LOCAL NAMES AND MEANINGS FOR THE SWEETPOTATO GENOTYPES PROPOSED FOR RELEASE

Table 45

Genotype	Local name	Language	Meaning
Mohc	CRI-‘Patron’	French	Strong leader
199062.1	CRI- ‘bohye’	Twi	Promise
Kemb 37	CRI- ‘dadanyuie’	Ewe	Good mother
Cemsa 74-228	CRI- ‘ligri’	Guruni	Cash