



Vitamin A Orange Sweet Potato (OSP)

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Table 1. Summary of Vitamin A OSP

Target Micronutrient		Vitamin A	
Target Countries		Uganda (HarvestPlus), Southern Africa (CIP)	
Baseline (parts per million, ppm)		2 ppm	
Target Increment		+30 ppm	
Target Level in Crop		32 ppm	
Nutrition Factors		Original Assumption	Measured/ Revised ¹
Sweet potato Consumption, grams/day (fresh weight)	Women	200 g/d	200 g/d
	Children	100 g/d	75 g/d
β-carotene Retention (%)		50%	75% (boiled)
β-carotene Absorption (%)		8%	7%
Absorbed Vitamin A as % of EAR		50%	>90%
Releases			
Full Target Varieties	+39-95	Uganda: 2004, 2007 (See chart below for additional releases)	

¹Uganda

Breeding to Date

Sweet potato is widely consumed in Africa south of the Sahara (1). Conventionally bred orange sweet potato (OSP) containing vitamin A was the first biofortified crop released by HarvestPlus and its partners. Plant breeders have produced several OSP varieties with provitamin A content of 30–100 ppm, exceeding the target level of 32 ppm. Analytical methods for sweet potato were developed; in orange and salmon-fleshed sweet potatoes, high-performance liquid chromatography (HPLC) and spectrophotometric screening resulted in similar quantifications of beta-carotene (2). Breeding research in Uganda is conducted by the National Crops Resources Research Institute (NaCRRI) with the support of the International Potato Center (CIP). Breeding for provitamin A OSP at both NaCRRI and CIP has assumed full operational scale. The full breeding pipeline consists of both locally developed germplasm and introductions from CIP. NaCRRI is engaged in testing biofortified candidate varieties and providing other technical support to seed systems. As the provitamin A trait is mainstreamed in breeding populations, ongoing OSP breeding concentrates on tolerance to biotic and abiotic stress while maintaining/enhancing provitamin A levels. HarvestPlus coordinates with NaCRRI and CIP to ensure a continuous flow of improved varieties for Uganda. In addition to the two landraces (Ejumula and Kakamega), which were identified and released prior to the start of the HarvestPlus activities in Uganda, two OSP varieties with the full provitamin A target were released in 2007. In 2013, two clones (SPK004/2006/1136 and NAS7/2006/292) were pre-released.

Future Releases

New OSP varieties are subject to both on-station and multi-location treatment as part of the release process. These will be further taken for on-farm trials with farmers participating in the project so that palatability and acceptance tests can be conducted before release and bulking of vines. Biofortified varieties are now being introduced in many parts of Africa and South America, as well as China. In 2009, CIP launched its Sweet Potato for Profit and Health Initiative (SPHI), which seeks to deliver OSP to 10 million households in Africa by 2020. Eight countries in Africa have released 46 improved sweet potato varieties since 2009, of which 31 are OSP. Helen Keller International (HKI) has integrated biofortification into programs to combat vitamin A deficiency, promoting OSP through nutrition education and homestead food production. Varieties have been released in Angola, Brazil, Burkina Faso, China, Ethiopia, Ghana, Kenya, Madagascar, Malawi, Mozambique, Nicaragua, Niger, Nigeria, Rwanda, Senegal, South Africa, Syria, Uganda, and Zambia.

Highlights & Challenges

- OSP is a widely supported intervention throughout Africa south of the Sahara, and farmers are adopting OSP varieties.
- Extensive evidence on the impact of consuming OSP on vitamin A intake and status of women and children has been produced.
- Dry matter content for OSP varieties is somewhat low compared to local preference.

Table 2. Released Varieties of Vitamin A OSP

Variety Name	Mean Yield(tons/hectare)	Dry Matter (%)	Beta-carotene (ppm)
Ghana			
Cri-Bohye	22	31	3760–7230
Madagascar			
199062.1 Cri-Bohye In Ghana	22	31	3760–7230
Ejumula	14.7	33.0	7760–14370
Resisto	15.8	24	24900
Zambezi	15.1	28.5	10900
Malawi			
Ana Akwanire	25	29.0	55
Kadyaubwerere	35	31.1	89
Kaphulira	35	30	32

Mathuthu	25	29	29
Zonden	8–16	30–32	90
Mozambique			
199062.1 Cri-Bohye In Ghana	22	31	38–72
Amelia	17.3	32.1	50
Bela	25.9	27.5	84
Coromex	15.3	22.7	110
Cecilia	18.3	26.7	60
Cn-1424-9	20	27	110
Cn-1448-49	15.7	22.7	45–49
Delvia	23.4	32.8	55
Ejumula	14.7	33.0	78–144
Erica	16.7	25.6	102
Esther	18.6	29.6	49
Gaba Gaba	6.5	23.9	110
Ininda	22.2	29.3	53
Irene	19.6	28.8	83
Jane	21.2	29.2	56
Japon Tresmesino Selecto	14.5	21.6	38–72
Jewel	21	28	110
Kandee	14.5	25.3	110
Lourdes	18.3	25.8	99
Lo-323	13.6	21	55
Melinda	27.1	23.6	57
Namanga	19.3	27	84
Persistente MGCL01	5	37	110
Resisto	15.8	24	249
Sumaia	21.6	25.2	77
Tainung 64	15	23	38–72
Tio Joe	20	26.7	103
Nigeria			
Umuspo/1	63.6	39.3	70
Umuspo/3(Mother's Delight)	31.4	28.7	30
Rwanda			
Ejumula	14.7	33.0	78–144
Kakamega Spk004	16.5	32	38
Rw11-2560	20	21	105
Rw11-2910	20	31.1	41
South Africa			
Impilo	31.1	21.4	29–70
Khano	24.5	18.2	120–156
Resisto	15.8	24	249
W-119	19.5	25	88–130
Ejumula	14.7	33.0	7760–14370
Kakamega Spk004	16.5	32	38
Kenspot-3	18.7	32.5	1380
Kenspot-4	17.1	30.4	3960
Kenspot-5	14.8	25.9	5490
K566632	15–20	25–26	700–800
W151	18	28	10500–14370
Tanzania			
Carrot C	15.0	33.0	123–143
Ejumula	14.7	33.0	78–144
Kakamega Spk004	16.5	32	38
Kiegea Kbh2001/261	13	25–30	73
Matayakbh2001/261	13	25–30	73
Mayai	10	32.5	110
Uganda			
Ejumula	14.7	33.0	78–144
Kakamega Spk004	16.5	32	37
Naspot 8	20	32.5	28
Naspot 10	16	30.5	110
Naspot 12	20	30	72
Naspot 13	18	28	110
Zambia			
Chiwoko	20.0	34	11030
Olympia	25.5	31	TBD
Twatasha	20	31	TBD
Zambezi	15.1	28.5	10900

1. Woolfe, JA. 1992. *Sweet potato: An untapped food source*. Cambridge, UK: Cambridge University Press
2. Kimura, M; et al. 2007. Screening & HPLC methods for carotenoids in sweetpotato, cassava & maize for plant breeding trials. *Food Chemistry* 100(4):1734–1746.