Understanding How to Achieve Impact-at-Scale through Nutrition-focused Marketing of Traditional African Vegetables (TAV) and Orange-Fleshed Sweetpotatoes (OFSP)

Final Technical Report
Year 3

Prepared for:
Kilimo Trust

Submitted by:
International Potato Center (CIP)

Contents

KILIMO TRUST
GRANTEES ANNUAL REPORT

PART I: Technical summary for the final report

Project Title:	**Understanding How to Achieve Impact-at-Scale through Nutrition-focused Marketing of African Indigenous Vegetables (AIV) and Orange-Fleshed Sweetpotatoes (OFSP)**		
Lead Organization:	International Potato Center		
Leader:	Dr. Jan Low		
KT Ref: 0407	**Phase:** Year 1–3	**Duration:** 3 Years	**Start date:** April 2007

Background

The partnership action research project was:

- Assessing the contribution of improved market access and technological innovations and skills along value chains of traditional African vegetables (TAV) and orange-fleshed sweetpotatoes (OFSP) to rural incomes;
- Seeking to understand how gender relations within household and markets influence production, marketing and benefit sharing; and
- Determining whether the market-focused approaches of Farm Concern International (FCI) would lead to increased consumption in both rural producer households and urban areas.

The project focuses on up-scaling the commercial village (CV) model used during pilot initiatives by FCI that is aimed at reaching a larger number of farming households to commercialize TAV and OFSP production. It also aimed at understanding and documenting the process, costs, and benefits of achieving collective market access and changing attitudes and behaviors concerning the use of these nutrient-rich foods in order to encourage people to consume/cultivate more of them.

The project was implemented in Arumeru in Tanzania, and in Kiambu, Kabondo, and Busia in Kenya by the International Potato Center (CIP), Farm Concern International (FCI), Urban Harvest (UH), and the World Vegetable Center (AVRDC). It builds on the experience of FCI, UH, and AVRDC with traditional African vegetables (TAV) and CIP and partners with OFSP, which guided the scaling out of project interventions.

Objectives:

1. To increase participation and influence of smallholder farmers and micro-enterprises along selected value networks by expanding commercial villages and enhancing access to business and financial service providers in selected sites
2. To develop sustainable production and seed multiplication systems for TAV and OFSP where feasible through the adoption and application of affordable, improved technologies
3. To establish sustainable market linkages for smallholder farmers and cottage processors through partnership with the private sector (formal and informal markets) across various value networks, including existing processed products.
4. To increase TAV and OFSP consumption for enhanced nutrition through strategic product promotions and awareness campaigns, exploring the most effective way to jointly promote TAV and OFSP (e.g., heritage marketing and nutrition-focused campaign).
5. To evaluate the effectiveness of the CVA approach in improving income, increasing micronutrient intake, and achieving other indicators of well-being of all players and their families along the value chain, with an explicit goal of understanding the process driving expanded and/or sustained participation in CVs
6. To understand the costs and benefits of the commercial village approach in different contexts and develop recommendations for going-to-scale
7. To assess the potential growth in demand and need for quality standards for TAV and OFSP (raw and processed) in Kenya and Tanzania

Progress Against Purpose OVIs achieved in the three years:

Participation of farmers increased. By the end of the project, 2,647 farmers had been mobilized and organized into 99 MSUs and 16 CVs. There were 15,882 direct beneficiaries of project intervention (the average household had 6 members according to the baseline). Through knowledge diffusion and sharing of training materials and germplasm, there were an estimated 47,646 indirect beneficiaries. Access to business and financial service was increased through establishment of linkages and partnership with business development services provider. Commercial production of TAV seeds was strengthened through contractual agreement with private sectors. Market linkages were established between MSUs and formal and informal traders. Estimated sales worth Kshs. 13.6 million (USD $202,880) from direct linkages were recorded across the four project sites.

Progress Against Output OVIs achieved in the year: Please refer to Annexes B–E.

Progress Against Milestones planned to be achieved in the year: Please refer to Table 1, columns 3 and 4.

Table 1. Progress against milestones planned to be achieved in three years

ACTIVITIES [Output number. activity number]	**Responsible**	**Milestones (2007–2009)**	**Outcomes**	**Impacts**
1.1 Mobilization of smallholder farmers and traders into sustainable commercial units	FCI, UH	8,000 farmers, 100 traders mobilized by the end of the project	• 15,882 household members benefitted directly from the project at the four project sites. • 2,647 farmers mobilized and organized in groups. • All the mobilized farmers have been organized into 99 marketing support units (MSU). • 143 traders identified and linked to CVs: - Formal markets (5): Uchumi super market, Zucchini grocery, Macdev grocery, Kamindi supermarket in Kiambu town, Touchstone distributor. - Informal markets: Nyanza Sweetpotato Traders Association (over 70 members), Gikomba market (3 traders), Zimmerman market (1 trader), Korogocho market (4 traders), Busia (16 traders), Kabondo (27 traders), and Arusha (15 traders). - Institutions: Kabondo (2 schools).	Higher adoption and commercialization of TAV among participants than non-participants, where 95% of the participating compared with 75 % of non-participating farmers grew TAV
1.2 Organize farmers into CVs	FCI	At least 40% of the mobilized target groups organized into CVs	• 16 CVs established; four per project site. • All of the direct-beneficiary farmers organized into groups that operate as CVs	Collective action among farming communities established
1.3 Adapting engendered capacity-building modules	FCI, UH	15 training modules adapted	15 capacity-building modules engendered and used for group capacity building	

ACTIVITIES [Output number. activity number]	**Responsible**	**Milestones (2007–2009)**	**Outcomes**	**Impacts**
1.4 Conduct trainings and participatory development of production, value addition, and marketing plans	FCI, UH	• Training in gender mainstreaming for extension agents and others (research assistants, field staff, and COTEs) who will apply the tools and the training materials • At least 1,600 trainings conducted • At least 40% of the target groups trained at each project site	• 1,310 training sessions conducted across the four project sites, which included group capacity building and technical training. • 90% of the direct-beneficiary groups trained on at least 75% of the engendered module.	Farmers capacity built on group management and marketing
1.5 Identify Business Development Service (BDS) providers and link them to the CVs	FCI	At least 12 BDS providers identified per site and 6 linked to the CVs	• Enhanced farmers' access to market and farm inputs. • Enhanced access to financial services by value chain players. This was a result of identification and establishment of partnership with BDS provider. Identified 32 BDS in project sites: 8 in Kabondo, 8 in Busia, 4 in Arusha, and 12 in Kiambu. • 7 partnerships between BDS providers, FCI, and CVs have been established: - 2 formal partnerships established with 2 seed stockists in Kiambu.	Increased revenue for the BDS from sales of seeds and services to farmers

ACTIVITIES [Output number. activity number]	**Responsible**	**Milestones (2007–2009)**	**Outcomes**	**Impacts**
			- 2 partnerships with 2 transporters (1 in Busia and 1 in Kiambu). - 3 informal partnerships established in Kabondo with seed stockist.	
2.1 Validate and disseminate improved production technologies on-farm so as to generate faster adoption	FCI, AVRDC, CIP	At least 2 production technologies adapted and disseminated in each target group	• Harvesting technologies for improved yield of nightshade and spider plant tested and made available. • Improved seed production technologies in vegetable cowpea developed. • Two season evaluation trials on sweetpotato production carried out at AVRDC and two high yielding, good tasting OFSP accessions identified and recommended for promotion. • An on-farm trial for sweetpotato established in Nduruma. • A participatory selection of 6 sweetpotato accessions for leaf consumption only (so-called vegetable varieties) carried out by 23 farmers in Kenyan and 15 Tanzanian farmers. • An organoleptic test of these accessions conducted by 23 Kenyan and 15 Tanzanian farmers for use as vegetable.	• Land under TAV increased by 20% among participating farmers • Increased production of target crop and increased income of direct beneficiary
2.2 Multiplication of quality base seed and OFSP vines for distribution to CVs	AVRDC (TAV) CIP (OFSP)	At least 200 kg of TAV seed (includes cowpea) and 660 kg vines per CV made available to identified seed multipliers	• 245 kg of base of target crops (seed, including African eggplant for Tanzania) produced, cleaned, packed, and distributed in Kenya and Tanzania. • 2 kg of seeds for demonstration plots distributed to 8 commercial villages in year 1. • Training of 24 Kenyan and 16 Tanzanian farmers on seed and vegetable production conducted at	

ACTIVITIES [Output number. activity number]	Responsible	Milestones (2007–2009)	Outcomes	Impacts
			AVRDC-RCA in January and February 2008. • For sweetpotato, see next section.	
2.3 Establish sustainable commercial seed & vines producers within CVs	FCI, UH, AVRDC, CIP	At least 5 seed and 20 vine producers established per project site	• TAV commercialized in all the four project sites and OFSP commercialized in four CV in Busia and one CV in Arusha. • Enhanced availability of TAV seed and OFSP vines among producers in all CVs. • Revenue of USD $2,302 realized from sale of TAV seeds. **TAV seed multiplication** • Fifty six seed multipliers recruited and trained on seed production during the first year in the four project sites as follow: 20 multipliers in Kabondo, 20 in Busia, 6 in Kibera, and 10 in Arumeru. • 23 of these multipliers were engaged in seed multiplication during the first year and all the 56 were engaged in second year. - 164 kilograms of TAV base seeds were distributed to the trained multipliers for seed multiplication during phase 1 and 2 of multiplication. • 528 kgs of seeds processed and sold. All the seed were packed and distributed to vegetable growers across the four project sites through established stockists. • All processed seed were packed for the establishment of demonstration plots in Tanzania. • On 5 September 2009, they hosted Danielle and Bernie of World Watch, Washington, who	• Increased income for the multipliers • Over 25% increase in acreage under OFSP in Busia and one CV in Arusha

ACTIVITIES [Output number. activity number]	Responsible	Milestones (2007–2009)	Outcomes	Impacts
			highlighted the activity in Farming on the Urban Fringe: http://blogs.worldwatch.org/nourishingtheplanet/farming-on-the-urban-fringe.	
			Sweetpotato vine multiplication • 28 vine multipliers established in Kenya and Tanzania: 24 in Kenya and 4 in Tanzania. • Multiplication was carried out in year 1 and 2 in Western Kenya Busia and Kabondo, with at least 2 multipliers per CV who received 75 bags of Vindolo Tamu and vitamin A in year 1. In Tanzania, six bags of varieties Jeshi and Carroti-C were distributed and multiplication started in quarter 5 through establishment of 3 demonstration plots. **Multiplier-farmer linkages** • 300 bags of OFSP vines were distributed to 376 farmers for conventional roots production (40 farmers in Kabondo and 336 farmers in Busia) in years 1 and 2 as follows: - In Kabondo, 40 bags of Vindolo tamu vines were distributed to 40 farmers and evaluation is going on in the field. - In Busia, 260 bags of Vindolo tamu and vitamin A sourced from the multipliers were distributed to 336 households: Asinge Apinge, 85 HH; Nambuku, 81 HH; Siwongo, 78 HH;	

ACTIVITIES [Output number. activity number]	Responsible	Milestones (2007–2009)	Outcomes	Impacts
			and Singi, 72 HH. 20 farmers supplied with 2.5 kg of Ejumula each. • At least 14 vines multiplication demonstration plots have been established in Arusha, Busia, and Kabondo.	
			Partnership Partnerships were established with 3 seed stockists and Sim Law Seed LTD and a contract has been signed by three of these partners. The partnership with Sim Law Seed focused on contracting seeds multipliers in Western Kenya, and this led to sub-contracting of 26 seed multipliers to multiply African nightshade in Kabondo. • 2 kilograms of basic seeds of African nightshade basic seeds were distributed to multipliers. • Partnership with seed stockist in Kiambu and Kabondo enhanced access to seed by vegetable producers in the commercial villages.	
2.4 Establish and train Community-based technical experts (COTEs) on TAV and OFSP production and seed production technologies	FCI, UH	• At least 2 trained COTEs established per CV at end of yr 3 • At least 60% of the COTEs trained by end of year 2	• 31 COTEs were established in the four project sites: 6 in Kiambu, 8 in Busia, 8 in Kabondo and 9 in Arusha. • 27 training sessions were conducted by the COTEs on the CV approach; TAV and sweetpotato production; marketing and business; and participatory development of production and marketing schedules, group dynamics, and finance management for groups. - At least 80 % of the COTEs participated in these trainings.	

ACTIVITIES [Output number. activity number]	**Responsible**	**Milestones (2007–2009)**	**Outcomes**	**Impacts**
			- All COTEs have been trained on TAV and OFSP production technologies, and 73% of the COTEs have been trained on seed production technologies. Training of COTEs has led to all COTEs adopting TF project and over 50% of COTEs engaged in TF implementation activities like farmer mobilization, demo plot establishment, vine multiplication, and group capacity building training in three project sites in Kenya.	
2.5. Facilitate the establishment of demonstration plots, exchange visits and field days	FCI, AVRDC, CIP, UH	• At least 2 demonstration plots established in each CV • At least 1 exchange visit conducted every year within each country • At least 1 field day conducted each year	• Guidelines for the on station establishment of demonstration plots developed in year 1. (See Annex C.) • In Tanzania, 8 continuous demonstration plots on TAV and OFSP were established year round on-station at AVRDC. • 87 on farm demonstration plots were established across the four project sites: - 54 demonstration plots established during year 1, with at least 2 demonstration plots per CV on TAV and OFSP (51% and 43%, respectively). - 33 were established during the second year of implementation with at least 2 demonstration plots per CV per season. 82% of the demonstration plots were demonstrating TAV production, while 18% were on OFSP. - In Kiambu demonstration plots were established in collaboration with Juanco SPS LTD (Agro dealers), with the aim of evaluating the agronomic performance of organic farm	

ACTIVITIES [Output number. activity number]	Responsible	Milestones (2007–2009)	Outcomes	Impacts
			inputs on various varieties of vegetables. This led to adoption of humax and foliar feed as a supplement to fertilizer and Bestox for controlling pests by approximately 30% of vegetable growers in the CVs. • Other demonstration plots were established at the Arusha agricultural show to highlight the importance of TAV and SP. **Field day** Four field days were conducted in Arusha, Kabondo, Kiambu, and Busia. In Kiambu, the field day aimed at promoting commercialization of TAV production based on commercial village, and in Busia, the purpose was to promote commercialization of both OFSP and TAV. Implementation of field days in Kenya was done in collaboration with Equity Bank, Osho Agrochemical, and the Ministry of Agriculture. During the Kiambu field day, assorted TAV seeds worthy Kshs.2950 (USD $38) were sold to farmers, which led to increased cultivation of TAV in the area: 67 farmers of those who attended the field day started growing TAV after the field day. • 19 of these farmers were mobilized into 2 new commercial producers groups (CPG). • The 2 groups in Karura CV were linked to Uchumi supermarket and started selling TAV collectively on a weekly basis and started benefiting from market access financing services being offered by FCI, through invoice	

ACTIVITIES [Output number. activity number]	Responsible	Milestones (2007–2009)	Outcomes	Impacts
			discounting. • 2 group accounts opened with Equity Bank (Thithino and Mwireri in Karura CV). • Assorted TAV seed (amaranthus, nightshade, and spider plant) worth Kshs. 2,950 were sold to individual farmers. **Exchange visit** Three exchange visits organized for project farmers during the implementation period as follows: • One exchange visit conducted in Kenya between Kabondo and Busia sites, which aimed at transfer of sweetpotato farming technology. During this visit, two COTEs from Kabondo CV were facilitated to visit and demonstrate use of draft power in Busia for four days, in each of the four CVs. • The second exchange visit was cross border (Arusha-Kenya), and five farmers from two CVs and an extension officer were facilitated to visit Kiambu CV. - The 5 farmers were drawn from 2 CVs (Olevolosi and Manyire) and they visited two CVs in Kiambu and the Uchumi supermarket. • One inter-CV exchange visit was conducted in Arumeru (Manyire CV), which aimed at exposing farmers to TAV seed production.	
2.6 Develop and disseminate written materials on TAV	FCI, UH, AVRDC, CIP	• At least 1 written material for OFSP for vine	• 1,610 TAV brochures for 5 varieties were developed in year 1.The brochures were 860 English copies and 750 Kiswahili and over 80 %	• Increased production technology among mobilized farmers

ACTIVITIES [Output number. activity number]	Responsible	Milestones (2007–2009)	Outcomes	Impacts
and OFSP		multipliers; 2 for TAV producers • At least 800 copies produced • At least 80% of the material disseminated by end of year 2	of TAV written materials were disseminated to smallholder producers in all CVs in Kenya and Arumeru. • 1,000 OFSP brochures produced by CIP were given to FCI for distribution, and all were distributed to sweetpotato farmers in Kenya and Tanzania.	• Farmers producing OFSP increased by 30% across the four project sites. • TAV production increased by over 65% across the four sites
3.1 Develop and implement market strategy	FC	• Marketing plan developed by end of first 6 months, identifying target market segments • 3 market segments penetrated	• Two market segments penetrated: formal (supermarkets, e.g., Uchumi) and informal (open-air market, e.g., Gikomba and Kangemi). • The new segments penetrated for OFSP in Arusha were formal and informal markets for positioning OFSP. • Formal linkages in Nairobi were increased through new linkages (e.g., Karura CV in Kiambu was linked to Uchumi supermarket, and it supplied assorted vegetables to two branches twice in a week, making sales worth Kshs.100.400 per month. • OFSP flour was repositioned in 2009 through new packaging. Revised packaging was developed and flour was re-packaged and re-introduced in the market in accordance with new labeling and packaging material laws of the Kenyan government. (See Annex F for the new packaging material design.)	The number of different TAV marketed by participant farmers increased significantly (121.3%) compared with that (71.1%) of non-participant farmers.
3.2 Conduct CV-buyer forums to	FCI, UH	• At least 16 partnerships	**Buyer-seller forums** • 5 buyer-seller fora conducted, 2 in Kabondo and 3	• At least one partnership has been established at

ACTIVITIES [Output number. activity number]	Responsible	Milestones (2007–2009)	Outcomes	Impacts
develop market linkages and business partnerships		between new CVs and buyers functioning with conditions in place for sustainability	in Kiambu. The 2 fora in Kabondo were organized for sweetpotato traders from Sondu and Wang'chieng and Kawour CV, respectively, and this led to creation of linkages between CVs and Sondu sweetpotato traders and farmers, increasing marketing skills (negotiation). In Kiambu, the forum was facilitated between Kwaregi MSU and 1 vegetable trader from Gikomba. **Market exposure visits** • To strengthen farmers' marketing skills in formal market, 4 market exposure visits were facilitated. During these visits, 6 farmers in Karura were exposed to formal and informal marketing systems by visiting to Uchumi supermarkets and the Githurai market; 3 marketing representatives from Luma MSU and 1 COTE in Nambuku CV visited Funyula open-air market. In Arusha, 13 MSU leaders drawn from 3 CVs (Manyire, Olevolosi, and Nduruma) had an opportunity to visit formal and informal markets in Arusha. **Rapid appraisal of TAV and OFSP consumers** Rapid market appraisal conducted in Nairobi, and of formal and informal markets in Kiambu, Kabondo, and Busia. OFSP sampling done in Kisumu and Nairobi to establish consumer demand and preference, and a report developed. Six varieties of sweetpotato were sampled: • Control—2 local varieties (Nyathio Odiewo and Bungoma) and target-four OFSP varieties	each project site with traders from open-air markets for each target crop. The linkages and this type of partnership were enhanced mainly through buyer-seller forum at farm level and forum in the market during farmer exposure visit to markets. • 3 market linkages developed: - Karura CV linked to Uchumi, and farmers are supplying assorted vegetables twice per week to two branches and recording on average monthly sales worth USD $1,067(Annex E) - The forum in Kwaregi led to linkages, and the trader started buying at least 1,500 bunches of assorted leafy vegetables per week. - 2 market linkages to informal markets were

ACTIVITIES [Output number. activity number]	Responsible	Milestones (2007–2009)	Outcomes	Impacts
			(Ejumula, K117, Vindolo tamu, and SPK 004). *Methodology* - 50 households sampled per region. Data were collected by questionnaire, and the Hedonic scale was used to rate the samples. - 2 CVs in Kiambu, Githiga, and Lower Lari developed production and marketing plans and implementation of the two plans were tested.	created: Manyire farmers to Kilombero market for African eggplant and okra, and Kwaregi-Gikomba trader. In Arusha, farmers started selling sweetpotatoes and TAV to Kilombero and Soko Kuu markets.
3.3 Establish new and strengthen existing traders business associations	FCI, UH	• 5 trader associations registered • 10 training sessions held for each association	• Existing sweetpotato traders in Gikomba market in Nairobi were strengthened through training on constitution development and management and marketing skills. • 3 new traders associations initiated for traders buying at farm gate from Olevolosi and Manyire and TAV traders in Busia. Interim leaders were elected for the three associations. • Market linkages have been facilitated for the traders in this association to sweetpotato farmers in Kabondo CVs. • Six traders in Nyanza association opened individual saving accounts with Equity Bank during the training workshop. • One business plan was developed by Nyanza sweetpotato traders during the training. • 6 training sessions conducted for the association.	• Market linkages created between sweetpotato farmers in Kabondo and vegetable farmers in Arusha and Busia. • Informal trader capacity strengthened.
3.4 Assess marketing	FCI, CIP	All existing partnerships	• 138 traders from informal market linked to CVs (79 for sweetpotato and 59 for TAV).	• Improved quality of the products supplied to

ACTIVITIES [Output number. activity number]	**Responsible**	**Milestones (2007–2009)**	**Outcomes**	**Impacts**
partnerships prospects for sustainability and modify partnership management and plans, if needed		evaluated for prospect for sustainability and modified as needed	• 2 existing partnerships, which include partnership with Uchumi and Touchstone flour distributors, were assessed during the year 1 to establish prospects for sustainability of the market for farmer groups. This was done through various fora conducted between FCI and partners to review existing agreements. • Market access finance services have been continuously extended by FCI to TAV suppliers to Uchumi, through invoice discounting and credit facilities for transport and seed costs. • Joint promotion of TAV and OFSP products at the Uchumi chain stores.	respective partners. • Sustained orders. • Increased consumption of TAV and OFSP flour due to enhanced accessibility of the products by consumers at retails outlets.
3.5 Participatory development of business/market plan for each major partnership	FCI, UH	At least two business and two marketing plans per CV developed	• 6 production plans and 2 marketing plans that were developed participatory manner include: - 4 business plans developed in Arusha, one for each CV. - 3 production plans developed in Kiambu. • 2 marketing plans developed by existing pilot CVs in Kiambu site.	Increased income as a result of consistent production and marketing of sweetpotatoes and vegetables
4.1 Develop, test and implement joint promotion and branding strategy for TAV s and OFSP, in collaboration with the private sector	FCI, UH, AVRDC, CIP	Joint promotion strategy implemented	1 joint promotion and branding strategy of TAV and sweetpotato developed and tested at Uchumi supermarket (Sarit outlet). The strategy was implemented during consumer awareness promotion campaigns.	
4.2 Design and test	FCI, UH,	2 campaigns	Promotion and branding materials were designed,	Increased consumption of

ACTIVITIES [Output number. activity number]	Responsible	Milestones (2007–2009)	Outcomes	Impacts
promotional materials to be used in urban and rural promotion campaigns, including radio programs	AVRDC, CIP	developed and implemented	including banners, posters, leaflets, aprons, and branding strips, were used during the promotion campaigns developed and tested during the year (i.e., project launch, indoor and outdoor promotions at supermarket outlets, and open-air markets). 6,000 promotion leaflets were designed and developed, 3,000 copies in English and Kiswahili and 3,000 copies in Kiswahili to cater to Kenya rural consumers and producers and all target clients in Arusha.	traditional African vegetables (TAV)
4.3 Conduct promotion campaigns in major urban areas	FCI, UH	2 promotion campaigns in each of 4 rural markets	8 promotional campaigns conducted in urban areas include: • 6 promotion campaigns conducted in Nairobi at Uchumi supermarket during which over 2,000 consumers were directly contacted. • 2 promotion campaigns were conducted in Arusha urban area, and approximately 500 people accessed promotion information at the point of promotion.	Increased consumption of traditional African vegetables (TAV) in urban areas
4.4 Conduct promotion campaigns in rural markets	FCI	18 promotion campaigns in major city conducted	16 promotion campaigns conducted across the four project sites: • In Kabondo, 7 promotion campaigns were conducted in 5 rural markets where nutritional information on TAV and sweetpotato was disseminated through use of promotional materials, such as posters, banners, and leaflets, to consumers and farmers. - 4 promotion campaigns in 4 rural markets in Busia	Increased consumption of traditional African vegetables (TAV) in rural areas

ACTIVITIES [Output number. activity number]	**Responsible**	**Milestones (2007–2009)**	**Outcomes**	**Impacts**
			- 2 rural campaigns in Arusha - 3 promotion campaigns in Kiambu • Over 20,000 consumers were contacted across the four project sites during the implementation of the campaigns.	
4 .5 Assess awareness of nutritional benefits of TAV and OFSP and consumer perception of their acceptability and frequency of consumption among vulnerable groups in the main season. Establish the factors that are affecting demand for TAV and OFSP	AVRDC, CIP, FCI	Consumer awareness, perception, and frequency of consumption of TAV and OFSP in existing and new markets assessed using structured survey	Consumer awareness and perception of TAV and OFSP in existing and new markets were assessed using structured survey, and draft reports were developed.	
5.1. Conduct a baseline survey to document income sources, assets, crop production and commercialization, demographic composition and frequency of TAV and OFSP intake at	CIP (Kenya), AVRDC (Tanzania), UH	• Baseline survey on 640 household level [40 households per CV (16 CVs)], 100 actors in market chain, and 320 nonproducing consumers conducted	• Baseline survey conducted on production, marketing, and consumption of sweetpotato and TAV in Kenya and Tanzania, and results documented. • A survey on “analysis of consumer demand for sweetpotato and TAV in Kenya and Tanzania” was conducted, and results were documented. (See Annex B.)	

ACTIVITIES [Output number. activity number]	Responsible	Milestones (2007–2009)	Outcomes	Impacts
the household level, and the market situation, business development services providers, and value chain players needs in proposed intervention and control (no intervention) households		• Survey tools engendered and pilot-tested		
5.2. Assess the influence of the intervention on household livelihoods, gender relations, and levels of young child consumption of TAV and OFSP at the end of the study	CIP (Kenya), AVRDC (Tanzania), UH	• In year 3, evaluation of the influence of intervention on household livelihoods, gender relations, and levels of consumption of TAV and OFSP among young children and their mothers at the end of the study. • Survey tools engendered and pilot-tested.	• Project evaluation survey was conducted in Kenya and Tanzania; 676 households were interviewed. • Evaluation survey targeting producers, traders, and consumers was conducted and results were documented. (See Annexes C, D, and E.) **Findings** • Increased consumers eating any of the 5 TAV (amaranth, nightshade, spider plant, cowpea, and sweetpotato leaves) was observed during the intervention period. • A marginal increase in consumption of sweetpotato was observed as follows: OFSP from 3.8% to 4.6%; YFSP from 15.3% to 24.6%; and WFSP from 10.4% to 22.4%. • Female respondents increased consumption of OFSP from 3.7% to 4.8%. • There was an improvement in awareness and	

ACTIVITIES [Output number. activity number]	Responsible	Milestones (2007–2009)	Outcomes	Impacts
			attitude on nutritional benefits of TAV and sweetpotato. • There was higher adoption and commercialization of TAV among participants than nonparticipants, where 95% of participating farmers compared with 75% of non-participating farmers grew TAV. There were slight differences in the types of TAV grown between the participating and non-participating farmers. • About 40% of participating farmers ranked TAV as their most important source of income among farm enterprises compared with only 18% of the non-participating farmers. • Only participating farmers grew OFSP in both Kenya and Tanzania. • A high percentage of participants received production and marketing information from the project. • About 24 % of the participants kept records on budgets compared with only 10 % of the non-participants; however, record keeping remained a challenge for most farmers in Kenya and Tanzania. • A significantly higher percentage of participants in both countries belonged to savings schemes than the non-participants. About 68% of participants in Kenya and 57% in Tanzania belonged to savings schemes compared with only 47 % of non-participants in Kenya and 10 % in Tanzania.	

ACTIVITIES [Output number. activity number]	**Responsible**	**Milestones (2007–2009)**	**Outcomes**	**Impacts**
6.1. Determine the benefit-cost ratios for intervention in different contexts	CIP, AVRDC	At the end of project, cost-benefit analysis completed for different sites, and for different lengths of intervention	Investment in the value chain of target crops is profitable. See the impact section of Annex C for details.	The Internal Rate of Return is estimated at 66% and Net Present Value over 8 years is USD $455,448
7.1 To assess the market potential regarding the introduction of grades and standards as well as processed products of TAV and OFSP.	AVRDC	• Market potential for raw and processed TAV and OFSP is assessed in informal and formal urban markets • Establish the need for quality standards	Given that basic information on grades and standards was captured as part of the final consumer survey, it was decided that funds would be more effectively spent on the production of a video entitled “Traditional Crops for Health and Wealth.” This change was approved by Kilimo Trust.	

Annex A

Technical Report Detail

Understanding How to Achieve Impact-at-Scale through Nutrition-focused Marketing of Traditional African Vegetables (TAV) and Orange-Fleshed Sweetpotatoes (OFSP)

Lead Institution: International Potato Center

Project Leaders: Dr. Jan Low and Nancy Karanja

Project Implementers: Farm Concern International, International Potato Center, Urban Harvest, and World Vegetable Center

Project Reference No.: KT Ref. 0407

Phase and Duration: 3 years

Start Date: April 2007

Contents

ABBREVIATIONS AND ACRONYMS

AVRDC	World Vegetable Center
BDS	Business development service
CIP	International Potato Center
COTE	Community-based technical expert
CV	Commercial village
CVA	Commercial village approach
FCI	Farm Concern International
HH	Household
MFI	Microfinance institution
MSU	Marketing support unit
MACFIN	Market access financial service
MOA	Ministry of Agriculture
OFSP	Orange-fleshed sweetpotato
SP	Sweetpotato
TF	Traditional Foods project
TAV	Traditional African vegetable
UH	Urban Harvest
WFSP	White-fleshed sweetpotato
YFSP	Yellow-fleshed sweetpotato

GENERAL INTRODUCTION

This report is an overview of the major findings of the Traditional Foods (TF) project for the period April 2007–March 2010. The project was implemented by four institutions, namely, the World Vegetable Center (AVRDC), the International Potato Center (CIP), Farm Concern International (FCI), and Urban Harvest (UH) at four sites (Arusha, Busia, Kabondo, and Kiambu) in Kenya and Northern Tanzania. CIP was the lead institution. This report presents information on commercialization and expanding markets of OFSP and TAV; technology development and dissemination; seed and vine multiplication; commercialization and distribution through the commercial village approach; and project impact.

PROJECT OBJECTIVES

Projects objectives are as follows:

1. Increase participation and influence of smallholder farmers and micro-enterprises along selected value networks through expanding commercial villages and enhancing access to business and financial service providers in selected sites
2. Develop sustainable production and seed multiplication systems for TAV and OFSP where feasible through the adoption and application of affordable, improved technologies
3. Establish sustainable market linkages for smallholder farmers and cottage processors through partnership with the private sector (formal and informal markets) across various value networks, including existing processed products
4. Increase TAV and OFSP consumption for enhanced nutrition through strategic product promotions and awareness campaigns, exploring the most effective way to jointly promote of TAV and OFSP (e.g., heritage marketing and nutrition-focused campaigns)
5. Evaluate the effectiveness of the process of the CVA approach in improving incomes, increasing micronutrient intake, and other indicators of well-being of all players and their families along the value chain, with an explicit goal of understanding the process driving expanded and/or sustained participation in CV
6. Understand the costs and benefits of the commercial village approach in different contexts and develop recommendations for going-to-scale
7. Assess the potential growth in demand and need for quality standards for TAV and OFSP (raw and processed) in Kenya and Tanzania

ACHIEVEMENTS

1. ***Output 1: Increased participation and influence of smallholder farmers and micro-enterprises along selected value networks through expanding commercial villages and enhancing access to business and financial service providers in selected sites.***

1.1. *Farmer mobilization*

Successful community mobilization of farmers for collective production and marketing of TAV and OFSP resulted to recruitment of 2,647 direct beneficiaries who were organized into 99 marketing support units (MSU) across the four project sites. The direct beneficiaries were 15,882 household members. All MSUs were clustered into 16 commercial villages (CV), four CVs per project site.

Through training and technical support from project officers at the sites, all MSUs established a leadership structure composed of executive officers and four sub-committees (marketing, production, finance, and welfare). This was followed by registration of the MSU with the social and cultural services ministry in the respective countries to enhance good governance. Also established were commercial village co-ordination units (executive and sub-committee) in the 16 CVs (Fig. 1). Another key activity carried out to enhance good governance and cohesiveness at CV and group level was the development of a constitution: all MSUs developed a group constitution, and five CVs developed a constitution.

1.2. *Adapting engendered capacity-building modules*

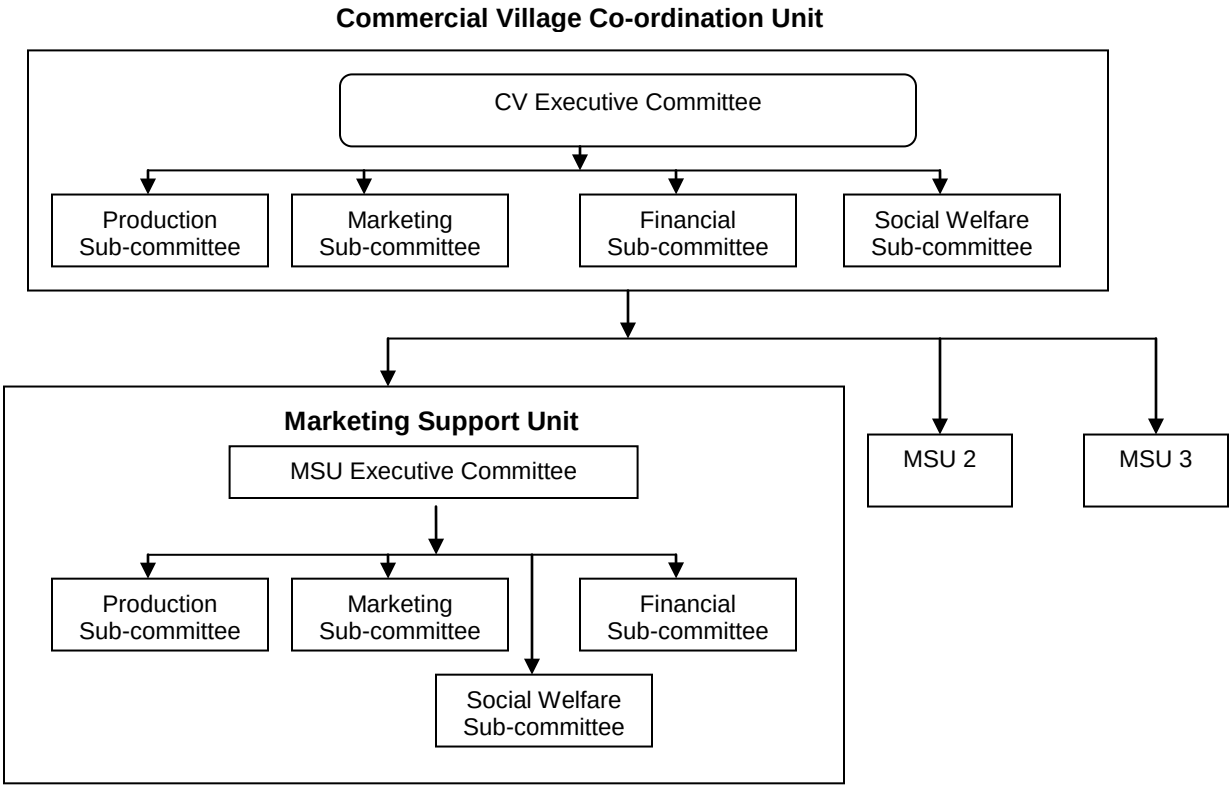
Urban Harvest and Farm Concern participated in developing 15 modules that were used for group capacity building. Urban Harvest assured that the modules were “engendered”, that is that the training modules explicitly addressed different roles and needs of both men and women.

1.3. *Group capacity building*

Capacity constraints were identified among value chain actors at the beginning of the project and during the interaction with traders through need assessment conducted by project officers. Some of the constraints identified were lack of synchronizing production with market requirements, lack of business and financial management skills, and lack of group management skills. To address these constraints, FCI adapted the engendered modules and undertook capacity-building strategies, including organizational development, sustainable production techniques, and marketing training, among the CVs. The major methodologies used during this period were:

- Participatory group training by project officers (using the 15 modules developed in year 1)
- Training of community-based technical experts (COTE), a key feature of the exit strategy
- Partnership with Ministry of Agriculture (MOA) officials in technology dissemination

Fig. 1. Leadership Unit for the CV and MSU



- Distribution of production brochures (TAV and OFSP)
- Establishment of farm demonstration plots in MSUs
- Field days
- Awareness campaigns
- Exchange visits organized to enhance farmers' capacity on collective marketing, bulk procurement of inputs, and positioning in the marketplace

Capacity building started with training in the mainstreaming of a gender-aware extension approach for extension agents and others (research assistants, field staffs, and COTEs) who were to apply the tools and training materials. Through the above strategies, 1,310 training sessions were conducted across the four project sites, which included group capacity building and technical training. Of the direct beneficiary groups, 90% were trained on at least 75% of the engendered modules.

1.4. *Value chain integration*

Strategic approaches were employed to enhance farmers' access to business development services (BDS), which included identifying and linking BDS providers to farmers and offering market access financial services (MACFIN). The key BDS providers identified at the inception stage included seed stockists, transporters, financial institutions, and agrochemical suppliers. A

total of 32 BDS were identified in the project sites: 8 in Kabondo, 8 in Busia, 4 in Arusha, and 12 in Kiambu. Seven partnerships were established between BDS providers and FCI and CVs. Partnerships established included the following:

- Two formal partnership with two seed stockists in Kiambu
- Two partnerships with two transporters (one in Busia and one in Kiambu)
- Three informal partnerships with seed stockists in Kabondo
- One partnership with Equity Bank
- One partnership with agrochemical supplier (Juanco SPS LTD)
- One partnership with Sim Law Seed LTD (formalized)

The rising production costs due to high farm inputs and transportation costs, coupled with delays in payment from supermarkets and seed stockists, have been major drawbacks for smallholder farmer participation in the TF project. To address these issues, FCI offered market financial services (MACFIN)[1] to the following beneficiaries:

- TAV seed growers in Kibera, Arumeru , Kabondo, and Busia
- Vegetables growers in Kiambu
- Supermarkets (through invoice discounting for their suppliers)
- Transporters (through payment on behalf of suppliers)
- Kiambu vegetable growers to purchase manure

1.5. *Strengthening saving and credit schemes*

With improved earnings, farmers need systems that can enable them to manage their incomes efficiently. To strengthen the capacity of farmers to manage income generated from TAV and sweetpotatoes, FCI facilitated establishment of commercial village banking. It mobilized group members to make savings deposits, trained groups on record keeping and financial management, and linked groups to financial institutions. The scheme was aimed at helping members access credit and start saving. Other services were offered by partnering institutions linked to the CV as they trained and advised groups.

[1] MACFIN is a financed by another donor and serves several projects in which Farm Concern is involved.

General characteristics of the credit and savings scheme established across all CVs were:

- CV banks mobilize financial resources from group members in form of
    - Savings deposits
    - Time deposits (weeding or planting labor contribution from group members to individual farms or others)
    - Forced/compulsory savings (i.e., Kshs. 50–400 worth of sales or weekly/monthly contribution)
- Credit to group members (group revolving fund)
- Operating bank account
- Ownership of member passbook for recordkeeping purposes

Over 80% of the mobilized groups have opened bank accounts with microfinance institutions (MFI) or commercial banks, and members are contributing weekly or monthly towards group saving. In Arusha, over 60% of the groups have established credit delivery services to members through group revolving funds (HISA). Individual contributions toward the revolving fund or savings deposit depended on the group bi-laws, which varied across CVs, but on average, the contribution was between Kshs.50 (USD $0.64) and Kshs.100 (USD $1.28).

2. *Output 2: Sustainable production and seed multiplication systems for TAV and OFSP developed through adoption and application of affordable improved technologies*

2.1.1. Technology development on TAV

Spider plant is not cultivated as a commercial crop in most parts of the world. For years it has been a semi-domesticated volunteer crop in home gardens in many parts of Sub-Saharan Africa, where its leaves are eaten as spinach. It is used as both food and medicine. Production is still largely at subsistence level, with a few farmers in peri-urban areas going commercial. Yield improvement will boost the productivity and attract more commercial farmers. An experiment was conducted at AVRDC-World Vegetable Center, Regional Center for Africa, in Arusha, Tanzania, from April to August 2009 to determine the performance of 29 accessions under colder conditions than under which it normally is produced. The experimental design used was randomized complete block (RCBD) with three replications in two ridges/rows measuring 6 m long. Seeds were sown directly at a spacing of 20 cm between plants and 60 cm between rows. The experiment was weeded as required. No insecticides or fungicides were applied. An amount of 50 Kg N (urea)/ha was applied in two splits three weeks apart, whereas 50 Kg/ha NPK (20-10-10) was applied once a week after germination. Irrigation was done by furrow when required. Harvesting was done by hand, and leaves and tender shoots were weighed using a weighing balance (Camri and Globe, China).

The data was subjected to analysis of variance (ANOVA), using CoStat software (CoHort Software, Minneapolis, MN, USA). There were significant differences in the leaf yields with ST 94-3 (P3) giving the highest yield (59.13 t/ha), whereas CLME-SP had the lowest yield (23.86

t/ha). However, there were no statistically significant differences in seed yields of the tested lines (Table 1). Other lines with high yields that could be considered for seed increase and distribution were GS1, GS8, PS-5 (SP-2), and ST 24 (Table 1).

Table 1. Leaf and seed yields of spider plant lines evaluated at AVRDC-RCA between April and August 2009 in Arusha, Tanzania

Accession	Leaf Yield	Leaf Yield	Seed Yield	200 Seed Weight	Seed Yield	Seed Yield
	g/plant	*t/ha*	*g/plot*	*G*	*kg/ha*	*t/ha*
GS 1	641.98ab	53.49a	39.8a	1.1a	2653.33a	2.65a
5IP-26	405.55abc	33.79bc	53.63a	1.03a	3575.55a	3.57a
ST 93 (BABIKI 8-1)	443.29bcd	36.94bc	38.8a	1.1a	2586.66a	2.58a
CLME-SP	286.38cde	23.86d	57.9a	1.1a	3860.00a	3.86a
G8P	404.73bcd	33.72bc	68.23a	1.06a	4548.88a	4.54a
GPS	372.76bcde	31.06bc	65.26a	1.1a	4351.11a	4.35a
IP11(GS GP2B3)	482.88bcd	39.59bc	39.8a	1. 1a	2653.33a	2.65a
GS-2	404.12bcd	33.67bc	45.76a	1.13a	3051.11a	3.05a
GS-8	606.27ab	50.52a	51.73a	1.06a	3448.88a	3.44a
IP10 R2	351.97bcde	29.33cd	48.33a	1.16a	3222.22a	3.22a
IP11 NO2	473.06bcd	39.42bc	51.66a	1.13a	3444.44a	3.44a
IP10-4	400.66bcd	33.38bc	58.63a	1.16a	3908.88a	3.90a
IP3	408.12bcd	34.01bc	64.9a	1.13a	4326.66a	4.32a
IP4(3)	351.66bcde	26.38cd	54.5a	1.1a	3633.33a	3.63a
IP7	350.65bcde	29.22bcd	52.13a	1.03a	3475.55a	3.47a
IP8	392.80bcde	32.73bc	42.3a	1.06a	2820a	2.82a
IP3-3(3/P-5)	390.25bcde	32.52bc	73.7a	1.06a	4913.33a	4.91a
IP5-6(S/P-7)	423.58bcd	35.29bc	62.96a	1.16a	4197.77a	4.19a
IP8-F1	380.63bcde	31.71bc	37.53a	1.13a	2502.22a	2.50a
P8PS94-1	522.81abc	43.56ab	44.7a	1.13a	2980a	2.98a
PS-3(S/P-6)	392.77bcde	33.56bc	73.7a	1.06a	4913.33a	4.91a
PS-5 S/P-4	590.03abc	49.16ab	60.43a	1.13a	4028.88a	4.06a
PS-5(SP-2)	684.42ab	57.03a	51.06a	1.13a	3404.44a	3.40a
ST73-(3-6-P4(PS))	461.1bcd	38.45bc	52.96a	1.1a	3531.11a	3.53a
ST 93-1(GS)	423.88bcd	35.32bc	61.03a	1.2a	4068.88a	4.06a
ST 94-3 (PS)	390.35bcde	30bc	54.96a	1.1a	3664.44a	3.66a
ST 94-3 (P3)	710.74a	59.13a	44.93a	1.1a	2995.55a	2.99a
ST T3-3(PS)	436.37bcd	36.36bc	45.36a	1.06a	3024.44a	3.02a
ST 24	610.96ab	50.91a	49.36a	1.1a	3291.11a	3.29a
F-TEST	***	***	NS	NS	NS	NS
CV	47.2	47.45	33.22	9.39	33.22	33.22

NS, non-significant; *significant ($p < 0.05$); **highly significant ($p < 0.01$); ***highly significant ($p < 0.001$). Means within the same column followed by the same letter(s) are not significantly different at 5% probability level based on DMRT.

AVRDC carried out evaluation trials of OFSP at its experimental farm in Arusha, Tanzania, from 12 February to August 19, 2009. The area lies at an elevation of 1,290 m above sea level and is located at latitude 48°S and longitude 37°E. The farm soil is clay loam. Two experiments were laid out separately in RCBD with three replications. Eight varieties/accessions (RCA1, RCA2, RCA3, RCA4, Hellena, SPK 004, Japan Tremesino, and Zapallo) of sweetpotato were evaluated for leaf and root yield and morphological characteristics. Each treatment was laid out in four rows/ridges each 6 m long. Plant materials of each accession were prepared by cutting 30 cm length of the vines. The spacing between plants was 30 cm and between rows 60 cm. Planting were done by burying 1/3 of the vines on one side of the ridges. Furrow irrigation was carried out once or twice a week and manual weeding done as needed. There were no fertilizers or chemicals used during experimentation, to mimic farmer practice.

Data collection included fresh leaf yield, dry matter yield, root yield, and their characteristics. For the leaf yield experiment, harvesting was carried out in two inner rows once a week or once after two weeks, depending on the sprouting of new leaves. The first harvest was on 15 April 2009, and the last was on 8 August 2009, for a total of six harvests. With the root yield experiments, all treatments were harvested on 19 August 2009. ANOVA on cumulative leaf yield and root yield data were carried out using CoStat (CoHort Software). Statistical significance was determined using the F-test, and for root characteristics, the descriptor list from Bioversity International was used. Lines RCA4 and RCA3 gave the highest mean fresh and dry matter leaf yields compared with other lines (Table 2). Zapallo and Japan Tremesino gave the highest marketable root yields (Table 3) as well as the highest non-marketable root yields (Table 4).

Table 2. Means of fresh leaf yield and dry matter yield of selected sweetpotato accessions evaluated at AVRDC-RCA from February to August 2009

Accession/Variety	Leaf Yield	Leaf Yield	Dry Matter	Dry Matter	Leaf Length	Leaf Width	No. of Leaflets per Leaf
	g/plant	*t/ha*	*g/plant*	*t/ha*	*cm*	*Cm*	
RCA1	414.815d	23.045d	45.102bc	2.506bc	11.896a	8.781bc	4.852b
RCA2	558.796cd	31.044cd	30.524c	1.696c	8.804b	5.941d	5.741a
RCA3	753.519ab	41.862ab	62.424a	3.468a	14.126a	9.907b	4.926b
RCA4	773.148a	42.953a	48.428ab	2.69ab	14.256a	6.963cd	5.815a
Hellena	496.296cd	27.572cd	50.726ab	2.818ab	13.219a	14.826a	—
SPK 004	488.426cd	27.135cd	41.355bc	2.297bc	13.941a	7.878bcd	4.815b
Japan Tremesino	600.926c	33.385c	40.403bc	2.245bc	13.322a	6.578cd	4.148c
Zapallo	617.129bc	34.285bc	48.449ab	2.692ab	13.329a	n6.233d	3.481d
$LSD_{.05}$	143.888	7.994	15.247	0.847	2.172	2.224	0.603
F-test	***	***	*	*	**	***	***
CV (%)	13.976	13.976	18.958	18.958	9.643	15.142	8.154

NS, non-significant; *significant ($p < 0.05$); **highly significant ($p < 0.01$); ***highly significant ($p < 0.001$). Means within the same column followed by the same letter(s) are not significantly different at 5% probability level based on DMRT.

Table 3. Marketable roots yield characteristics of eight sweetpotato accessions evaluated at AVRDC–World Vegetable Center in Arusha, Tanzania, from 12 February 2009 to 19 August 2009

Accession/Variety	Small Root	Small Root Weight	Medium Root	Medium Root Weight	Large Root	Large Root Weight	Total Root Weight	Total Root Yield	Total Root Yield
	no/plant	*g/plant*	*no/plant*	*g/plant*	*no/plant*	*g/plant*	*no/plant*	*g/plant*	*t/ha*
RCA1	1.104abc	86.458ab	0.825c	149.792d	0.208cd	107.708cd	2.138b	343.958d	19.109d
RCA2	0.667bc	40.833b	0.788c	143.125d	0.313bc	130cd	1.767bc	313.958de	17.442de
RCA3	0.475c	38.125b	1.033bc	245.417bc	0.313bc	187.917c	1.821bc	471.458cd	26.192cd
RCA4	0.804bc	33.542b	0.346d	52.917e	0.054d	17.083d	1.204d	103.542f	5.752f
Hellena	1.05bc	70.208b	0.438d	63.958e	0.1d	36.042	1.588cd	170.208ef	9.456ef
SPK 004	1.696a	132.708a	0.938bc	215c	0.208cd	192.917c	2.842a	540.625bc	30.035bc
Japan Tremesino	0.65bc	51.667b	1.138b	287.083b	0.417b	322.917b	2.204b	661.667b	36.759b
Zapallo	1.192ab	80.208ab	1.483a	382.292a	0.604a	479.375a	3.279a	941.875a	52.326a
$LSD_{.05}$	0.568	57.259	0.261	62.3678	0.176	112.938	0.501	153.596	8.533
F-test	**	*	***	***	***	***	***	***	***
CV (%)	33.975	49.007	17.039	18.506	36.367	35.003	13.592	19.78	19.78

Table 4. Non-marketable roots yield characteristics of eight sweetpotato accessions evaluated at AVRDC–World Vegetable Center in Arusha, Tanzania, from 12 February 2009 to 19 August 2009

Accession/Variety	Small Root	Small Root Weight	Medium Root	Medium Root Weight	Large Root	Large Root Weight	Total Root	Total Root Weight	Total Root Yield
	no/plant	*g/plant*	*no/plant*	*g/plant*	*no/plant*	*g/plant*	*no/plant*	*g/plant*	*t/ha*
RCA1	0.021a	1.875a	0.125ab	18.333b	0.004a	2.917b	0. 15ab	23.125bc	1.284bc
RCA2	—	—	0.025b	5.208b	0.004a	2.5b	0.029b	7.708c	0.428c
RCA3	0.008a	0.833a	0.067b	18.542b	0.029a	16.667ab	0.104ab	36.042bc	2.002bc
RCA4	0.042a	2.917a	0.029b	33.333ab	0.017a	5.625b	0.088ab	41.875abc	2.326abc
Hellena	0.054a	4.583a	0.3a	56.667ab	0.058a	24.792ab	0.413a	86.042abc	4.780abc
SPK 004	0.046a	3.958a	0.108ab	18.542b	0.029a	12.917ab	0.183ab	35.417bc	1.968bc
Japan Tremesino	0.075a	9.583a	0.229ab	84.792a	0.063a	55.208ab	0.367a	149.583a	8.31a
Zapallo	0.1a	11.25a	0.146ab	50ab	0.067a	59.958a	0.313ab	121.208ab	6.734ab
$LSD_{.05}$	0.100	11.178	0.185	58.089	0.061	47.36	0.301	101.101	5.617
F-test	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	132.564	145.903	82.295	92.975	103.654	119.808	83.599	92.187	92.187

NS, non-significant; *significant ($P < 0.05$); **highly significant ($P < 0.01$); ***highly significant ($P < 0.001$). Means within the same column followed by the same letter(s) are not significantly different at 5% probability level based on DMRT.

Table 5. Root characteristics of eight accessions and varieties of sweetpotato

Accession/Variety	Root Shape	Surface Defect	Skin Color	Flesh Color	Skin Thickness	Root Length	Root Width
					mm	*cm*	*cm*
RCA1	Long irregular or curved	Shallow horizontal constriction	White	White	3.335ab	12.876cd	4.704cd
RCA2	Long irregular or curved	Deep horizontal constriction	Cream	White	3.711a	14.624abc	5.729bc
RCA3	Long irregular or curved	Deep horizontal constriction	Orange white	Orange white	3.399ab	15.611a	6.469ab
RCA4	Long irregular or curved	Shallow horizontal constriction	Yellow white	White	3.133ab	12.916cd	4.138d
Hellena	Ovate	Deep horizontal constriction	Grayed yellow	Cream yellow	2.445c	9.62e	5.52bcd
SPK 004	Long irregular or curved	Veins	Purple	Pale orange	2.911bc	15.028ab	5.189bcd
Japan Tremesino	Ovate	Shallow horizontal constriction	Orange	Orange	3.778a	12.189d	7.371 a
Zapallo	Ovate	Shallow horizontal constriction	Orange	Orange	3.578ab	13.493bcd	7.304 a
$LSD_{.05}$	—	—	—	—	0.643	1.785	1.302
F-test	—	—	—	—	**	***	***
CV (%)	—	—	—	—	11.173	7.665	12.815

NS, non-significant; *significant ($P < 0.05$); **highly significant ($P < 0.01$); ***highly significant ($P < 0.001$). Means within the same column followed by the same letter(s) are not significantly different at 5% probability level based on DMRT.

2.2. Multiplication of quality base seed and OFSP vines for distribution to CVs

A total of 245 kg of base seed of the target crops (including African eggplant for Tanzania) were produced, cleaned, packed, and distributed in Kenya and Tanzania during the first year.

2.3. Establishment of sustainable commercial seed and vine producers in CVs

To achieve this output, the first step was identification of 40 TAV seed multipliers from all project sites using selection criteria developed by the project team at the inception stage. The 40 multipliers were selected from Kenya (24) and Tanzania (16). The next step was training the 40 multipliers on seed and vegetable production. Training was conducted at AVRDC-RCA in January and February 2008. The number of multipliers was later scaled up to 56 during the second phase of vine multiplication. A total 33 kg of base seed received in year 1 was distributed to seed multipliers in Kenya, who produced 243 kg. Total revenue of USD $2,302 was realized from sale of TAV seeds.

Also established were 28 OFSP vine multipliers in Kenya (24) and Tanzania (4). The multipliers were trained on multiplication and marketing of vines. Multiplication was carried out in years 1 and 2 in western Kenya, Busia and Kabondo, with at least two multipliers per CV receiving 75 bags of Vindolo Tamu and Vitamin A in year 1. In Tanzania, six bags of varieties Jeshi and Carroti-C were distributed, and multiplication was carried out in quarter 5 through establishment of three demonstration plots.

This output led to high commercialization of TAV at all four project sites and OFSP at four CVs in Busia and one CV in Arusha. There was also enhanced availability of TAV seed and OFSP vines among producers in all CVs. For sustainability, a partnership and formal agreement was later established with Simlaw Seed Company, which led to sub-contracting 26 farmers in Kabondo to produce African nightshade seeds during quarter 9.

2.4. Establishment and training of community-based technical experts on TAV and OFSP production and seed production technologies

The establishment of COTEs was aimed at ensuring sustainability of the project beyond the project period. During the project, 31 COTEs were established at the four project sites: 6 in Kiambu, 8 in Busia, 8 in Kabondo, and 9 in Arusha. The capacity of the COTEs was built through 27 training sessions conducted by the project officers. Topics included the CV approach; TAV and sweetpotato production; marketing and business; participatory development of production and marketing schedules, group dynamics; and finance management for groups. On the basis of the assessment done, approximately 80 % of COTEs participated in all trainings. Training led to all COTEs adopting the TF project, and over 50% of COTEs engaged in TF implementation activities, such as farmer mobilization, demo plot establishment, vine multiplication, and group capacity-building training at three project sites in Kenya.

2.5. Establishing demonstration plots and organizing of exchange visits and field days

Establishment of on-farm demonstrations plots was aimed at enhancing technology transfer on TAV and OFSP production. This was a participatory activity with group members at the MSU or CV level, and at other times, in collaboration with MOA and agro-chemical companies. A total of 87on-farm demonstration plots were established across the four project sites. The major partner in establishment of demonstration plots in Kiambu was Juanco SPS (agro dealer), and this aimed at evaluating the agronomic performance of organic farm inputs on various varieties of vegetables. This led to adoption of humax and foliar feed as supplement to fertilizer and Bestox for controlling pests by approximately 30% of vegetable growers in the CVs.

For on-station demonstration plots, a guideline for establishment was developed in year 1 at AVRDC in Tanzania, and eight year-around demonstration plots on TAV and OFSP were established at AVRDC.

To increase the outreach of this project, field days were conducted in Arusha, Kabondo, Kiambu, and Busia. In Kiambu, the field day was aimed at promoting commercialization of TAV production based on commercial villages, and in Busia, the purpose was to promote commercialization of both OFSP and TAV. The implementation of the field days in Kenya was done in collaboration with Equity Bank, Osho Chemical (agrochemical company), and the MOA.

Exchange visits were a means of capacity building. Three exchange visits were organized for the project farmers during the implementation period:

- One four-day exchange visit, which was conducted in Kenya between the Kabondo and Busia sites, aimed at transferring sweetpotato farming technology. Two COTEs from the Kabondo CV demonstrated the use of draft power at each of the four Busia CVs.
- One cross-border exchange visit between Arusha, Tanzania and Kiambu, Kenya). Five farmers from two CVs and an extension officer from Tanzania visited the Kiambu CV. The five farmers were from the Olevolosi CV and Manyire CV, and they visited two CVs in Kiambu, as well as the Uchumi supermarket.
- One inter-CV exchange visit was conducted at the Manyire CV in Arumeru, to expose farmers to TAV seed production.

The exchange visits stimulated emulation by the newer farmer's groups and were felt to be an extremely successful strategy for knowledge exchange. If more resources had been available to support additional exchange visits, the project would have undertaken many more cross-border exchange visits.

3. *Output 3: Enhancement of market linkages through partnerships*

Two market segments (formal and informal) were targeted for positioning TAV and OFSP in Kenya and Tanzania. The informal segment comprised open-air markets in urban and rural areas, and the formal segment comprised supermarkets, groceries, and private distributors. FCI facilitated establishment of marketing alliances with private sector companies, informal market

traders, and distribution networks to enhance sustainability of commercial activities in the established CVs. Overall, informal marketing proved more easily accessible to small-scale producers than formal markets, but inefficiency along the value chain and trading systems frequently led to exploitation of farmers. FCI embarked on a diversified approach of providing advice to help farmers cope with changing market dynamics and establish linkages with wholesalers, with the aim of reducing the number value chain players and increasing farm gate prices. This initiative led to identification of 138 traders for both TAV (59) and sweetpotatoes (79), and the establishment of direct linkages with 47% of the mobilized traders, and nine informal partnerships.

The two main methods used to identify traders and linkages to CVs were holding buyer-seller fora and conducting market exposure visits for farmers. Five buyer-seller fora were conducted; two in Kabondo and three in Kiambu. The buyer-seller fora led to creation of linkages between CVs and sweetpotatoes/TAV traders. Farmers' negotiation and marketing skills increased. Four market exposure visits were facilitated in Kenya, in which six farmers in Karura were exposed to formal/informal marketing system by visiting Uchumi supermarket branches and Githurai market. Three marketing representatives from the Luma MSU and one COTE from the Nambuku CV visited the Funyula open-air market.

4. *Output 4: Increased consumption of TAV and OFSP among consumers through nutrition-based promotion and awareness campaigns.*

FCI conducted nutrition-based awareness campaigns and image building for TAV and OFSP in rural and urban markets to create awareness and demand among producing and non-producing consumers. This activity involved development of promotion materials and conducting awareness campaigns during field days and in the markets.

Promotion and branding materials were designed, including banners, posters, leaflets, aprons, and branding strips, and used in all promotion campaigns. Promotion methods used in supermarkets and open-air markets included product sampling, distribution of leaflets/brochures, and raw product display. A total of 8 urban and 16 rural campaigns were conducted.

Among the results realized through the campaigns were:

- Increased sales volume of TAV and OFSP tubers and flour in the supermarket during the promotion period. Several market audits conducted in Nairobi and the final consumer survey in several markets revealed that consumer awareness of TAV has increased. Sales in sampled Uchumi branches in Kenya have increased over time.
- Increased number of traders trading TAV in informal markets in Nairobi and Kabondo due to increased TAV demand and production.
- Increased sales of seeds and vines as consumers have contacted FCI and ordered the above.
- Increased awareness about traditional food.

5. *Output 5: Evaluate the effectiveness of the CVA approach in improving income, increasing micronutrient intake, and achieving other indicators of well-being of all players and their families along the value chain, with an explicit goal of understanding the process driving expanded and/or sustained participation in CVs*

5.1. Consumer demand analysis in Kenya and Tanzania[2]

This study examined consumer demand for traditional Africa vegetables (TAV) and sweetpotato (SP) in Kenya and Tanzania. The general objective of the study was to examine empirically the demand structure and consumption pattern for TAV and sweetpotato and their determinants among households in Kenya and Tanzania. The specific objectives were to (i) assess consumer knowledge and demand for TAV and SP, including awareness of nutritional benefits; (ii) assess perception of acceptability and frequency of consumption of TAV and SP; (iii) assess the need for grades and standards for raw or processed TAV and SP; and (iv) identify the constraints faced by consumers in purchasing TAV and SP.

The study used cross-sectional data collected from sample traders and household consumers in Nairobi, Kenya, and Arusha, Tanzania. Two sets of structured questionnaires were administered to traders and household consumers at market points of purchase in June and July 2009. A stratified random sampling procedure was used in selection of household consumers, retailers, and supermarkets in Nairobi and Arusha. In Nairobi, the study area was stratified according to perceived socioeconomic status of target consumers for TAV and SP, as implied from their lifestyle, residential areas, and where they shop. Three market segments, based on a category of consumers that patronize the markets and their geographical (residential) locations, were sampled. A sampling frame of markets in Nairobi was provided by FCI. The market segments are described below.

Upper class. This market segment is composed primarily of supermarkets and convenience/grocery stores mainly located in shopping malls. They are accessible to relatively high-income consumers, largely due to location, convenience, and price differential compared with other markets.

Middle class. This market segment comprises grocery and roadside shops (kiosks). They are located mainly in residential areas of middle-income consumers (e.g., South B, Buruburu in Nairobi). Some supermarkets are also in this segment.

Lower class. This market segment is composed predominately of open-air markets and road side/street markets. They are located in low-income residential areas (e.g., Kibera, Mathare) and accessible to low-income consumers. Prices are relatively lower in these markets.

In the second stage, three markets were selected from each market segment. Finally, there was a random selection of sample consumers, supermarkets, and retailers from the selected markets. In the upper-class market, 40 consumer households and 12 supermarket and high-end grocery

[2] For more detail, see Annex B.

operators were interviewed. In the middle- and lower-class markets, 89 consumer households and 24 retailers were interviewed. This gave a total sample of 209 household consumers and 98 supermarkets and retailers in Nairobi. A sample selection framework is presented in Table 3 of Annex E.

In Arusha, the markets were fairly homogenous, and there were no distinct differences among consumers who visited different markets where TAV and SP were sold. All categories of consumers visited major markets that sold TAV and SP. There was only one supermarket (Shoprite) where TAV and SP were sold. As a result, four major open-air, retail markets were randomly chosen and the only supermarket (Shoprite) was chosen to sample consumers and traders. In the four retail markets, 34 traders (1 supermarket and 33 retailers) and 105 consumers were randomly sampled for data collection. The data were entered using Excel and analyzed using SSPS. The tools of analysis used were mainly descriptive statistics involving use of percentages and mean values. Excel was also employed for graphical analysis.

Compared with 5 years ago, the study results reveal a trend of increased TAV consumption among 64% and 88% of consumers in Kenya and Tanzania, respectively, suggesting increased market demand. Consumer knowledge that TAV and SP have the potential to improved health and nutrition is the major factor that influenced 74% and 70% (TAV) and 35% and 50% (SP) of households in Kenya and Tanzania, respectively. Grading and value addition were found to be important among 69% and 77% of TAV traders and 40% and 71% of SP traders in Kenya and Tanzania, respectively. The advantages of grades and standards influence sales among 62% and 74% of traders in Kenya and Tanzania. Grading facilitates handling and ease of transportation to markets. Based on the results of the analysis carried out in this study, the following recommendations are suggested to address the existing gaps in commercialization of TAV and SP and to create a wider impact that leads to improved livelihoods.

Grades and standards

Consumers of TAV in both Kenya (89%) and Tanzania (73%) have expressed preference to purchase TAV in packed form. TAV and sweetpotato traders acknowledged the positive contribution of TAV and SP packaging in attracting more customers, increasing sales, and obtaining higher prices. This indicated that there was high market potential for grades and standards as well as processed products of TAV and SP. Efforts should target improving grades and standards, including value additions to TAV and SP.

Quality TAV and SP

A major factor that influences consumer buying behavior is the quality of TAV and sweetpotato. Thus, awareness should be created among both producers and traders on the significance and potential of producing and marketing good quality TAV and SP in influencing consumer demand.

Regularity of TAV and SP supply

Because the supply of TAV and SP are limited during the dry season, prices are relatively high during this period. Efforts should be made to explore feasible options to increase the supply of TAV and SP, especially during the dry season or short rains. For instance, using supplementary irrigation as well as drought-resistant or early maturing varieties of TAV and SP could be explored to increase a year-around supply.

Strengthening trader organization or association

The majority of traders in Kenya and Tanzania do not belong to any trader organization or association. Traders stand to benefit from membership in organizations or associations. There is the need to strengthen existing organizations and create awareness among traders on the advantages of membership in an organization or association.

Improvement in market facilities

Cleanliness of selling points was identified as a major factor that influenced consumer purchasing behavior for TAV and SP. Policies should encourage the provision of clean and friendly market facilities that facilitate market transactions.

5.2. Producer impact report[3]

The TF project aimed at increasing productivity, utilization, and marketing of traditional African vegetables and sweetpotatoes (specifically, orange-fleshed sweetpotatoes) in Kenya and Tanzania. The purpose was to streamline efficiency of TAV and SP value chains and to improve the health, nutrition, and income of vulnerable groups. The project promoted sweetpotatoes and six traditional African vegetables: amaranth (*Amaranthus spp*.), African nightshade (*Solanum scabrum/villosum/americanum)*, spider plant (*Cleome gynandra*), cowpeas (*Vigna unguiculata*), sweetpotato leaves, and African eggplant (*Solanum aethiopicum*).

Objectives and methodology

The objective of this study was to evaluate the impact of project interventions by examining and comparing incomes, adoption, consumption, and marketing of target crops between participant and non-participant farmers before and after project interventions. A baseline survey was used to understand household characteristics, production, marketing practices, and consumption behavior of farmers in target areas at the beginning of the project to be able to evaluate intervention effects at the end of the project using an impact survey. A baseline survey was conducted in September–October 2007, and the adoption survey was conducted in November–December 2009. The two surveys (structured questionnaires) gathered information on cultivation, consumption, and marketing of TAV and sweetpotato in households. The study

[3] For more detail, see Annex C.

compared farmers in target villages ("participants") with farmers in control villages ("non-participants").

For the baseline survey, 723 farmers were interviewed, of which 400 were participants and 323 non-participants. For the impact survey, 676 farmers were interviewed, of which 392 were participants and 284 non-participants. There was high attrition among the participant farmers due to the baseline sample being selected before the MSU groups were fully formed. This resulted in the high loss of participant farmers between the surveys; out of the 400 participant farmers sampled in baseline, only 112 (28.0%) continued with the project and were included in impact survey. For non-participant farmers, a high percentage (87.9%) of the initial households were interviewed in both surveys. Data collected were analyzed using ANOVA and Chi-square to compare changes in participants and non-participants before and after project implementation.

Household characteristics

The households of participants and non-participants were similar in many characteristics apart from gender and age of household heads. On average, household heads had 7.5 years of schooling. The mean household size was 6.2; farmers in Kenya had slightly bigger families compared with non-participants. Of participant households, 41% were headed by females; of non-participant households, 17 % were headed by females. Many of the farmers groups had been formed prior to the onset of this project and this difference reflects recruiting practices of Farm Concern.

Adoption and marketing of target crops

Generally, there was higher adoption and commercialization of TAV among participants than non-participants; 94.9% of participating and 75.0% non-participating farmers grew TAV. The diversity of TAV grown by participants (3.3) was also significantly higher than that of non-participants (2.7). However, there were no differences between the two groups of farmers from the observations made during baseline and impact surveys. Generally, participant farmers grew TAV on about 0.415 ha compared with non-participants with 0.0163 ha. Changes on land under TAV were relative; during the intervention period, an increase of 19.0% total occurred for participating farmers while for non-participating farmers, a decline of 43% was recorded. During the period in which TAV interventions were introduced, the country experienced a prolonged drought, which may have affected adoption as a result of water shortage.

A significantly higher percentage of participants (40.2%) had commercialized TAV than non-participants (25.5%). On average, participants sold 2.3 types of TAV while non-participants sold 1.1 types of TAV. This increase in commercialization was also confirmed after evaluating changes of participants and non-participants selling TAV during baseline and impact surveys. The number of different TAVs marketed by participant farmers increased significantly (121.3%) compared with that of non-participant farmers (71.1%). This high difference in increased selling of target crops between participants and non-participant meant that interventions were successful in improving market access and, hence, commercialization of TAV.

In Kenya, 99% of both participants and non-participants in Kabondo and Busia were growing sweetpotato, while in Tanzania only 21.3% were growing them. In Tanzania, adoption of sweetpotato showed a significant difference between participants (34.1%) and non- participants (6.4%), with a difference in adoption level of 27.7% between the two groups. As 90.0% of both participant and non-participant farmers in Busia and Kabondo grew sweetpotato during the baseline and impact surveys, no change in number of producers was observed. OFSP was mainly grown by participants in Kenya, and there was 21.9% difference in level of adoption between participants (47.3%) and non-participants (25.4%), while in Tanzania only participants were growing OFSP (48.4%). Note that OFSP was completely new in Tanzania and was just getting established in the last year of the project.

There were highly significant difference between participants (61%) and non-participants (41.3%) in the level of commercialization of sweetpotato in both countries. However, the main change occurred in Busia where commercialization was low at the beginning of the project compared with Kabondo where farmers were already commercialized.

Training and record keeping

Over 80% of participant farmers had been trained by FCI extension staff, and more than 90% of both participants and non-participants were aware of the health benefits that accrued from consumption of TAV. About 43.1% of participants and 29.2% of non-participants in Kenya knew that TAV helps strengthen the body's immunity. Similarly, 72.4% participants and 44.4% of non-participants were aware of the health benefits of consuming OFSP. Enhancing the capacity of farmers through training of COTEs showed positive results, as 40.0% of participants and 8.0% of non-participants reported that they had received training from COTEs. Record keeping remained a challenge for most farmers; only a minority of farmers in Kenya and Tanzania kept records. However, significantly more participants (24.2%) than non-participants (9.9%) kept budgets records, and more participants (28.8%) than non-participants (7.5%) kept sales records.

Savings and credit

About 68.1% and 57.1% of participants belonged to savings schemes compared with 47.1% and 10.3% of non-participants in Kenya and Tanzania, respectively. In Kenya, a significantly higher percentage of participants (52.0%) than of non-participants (27.2%) were saving some of the money from sales of TAV and/or sweetpotato. In Tanzania, 14.1% of participants and 1.4% of non-participants made similar savings. Over 60% of credits in Kenya were received by female members of households, whereas in Tanzania, male members of households received most credits for non-participants (54.5%). For participant farmers in Tanzania, females received over 60% of the credits. Income from the sales of TAVs was used to purchase basic food by about 50% of farmers, to pay school fees by 14.8%, and to purchase livestock by 8.4%. Similarly, income from the sale of sweetpotato was spent on school fees by 33.7% of farmers, on basic food by 29.6%, and on livestock purchases by 16.9%.

Consumption of target crops

About 90.8% of participant farmers consumed TAV compared with 84.2% of non-participant farmers. Impact evaluation confirmed positive changes that could be attributed to interventions as follows: amaranth (4.2%), spider plant (3.5%), and sweetpotato leaves (7.6%). However, increases in the proportion of non-participants consuming nightshade and cowpea leaves exceeded that of participants. This phenomenon may be due to spillover effect, as some of interventions to create awareness were not restricted to areas of participant farmers. In Kenya, 21.9% of participants and 9.7% of non-participants reported having eaten OFSP, while in Tanzania only 4% had eaten OFSP.

The project interventions involved enlightening farmers about the importance of feeding children aged 2–5 years with the target crops, which provided important minerals and vitamins. Generally, higher a proportion of participant than non-participants farmers fed children with TAV. In Kenya, a significantly high proportion of participants (95.7%) fed children with all target crops compared with 86.3% of non-participants In Tanzania, a higher proportion of participants fed children all types of target crops except cowpea leaves.

Collective action

Collective action was observed where 11.5% of participants 1.1% of non-participants sourced TAV inputs collectively. Similarly, a slightly higher proportion of participants (6.4%) than non-participants (0.4%) sold TAV collectively. Kiambu had the highest proportion of participant farmers who sourced TAV inputs (25.0%) and marketed TAV (24.0%) collectively. This possibly helped more participant farmers from Kiambu access formal markets than other sites.

For sweetpotato, about 19.3% of participants had sourced inputs collectively compared with 2.3% of non-participants, whereas about 5.4% of participants and 0.9% of non-participants sold sweetpotato collectively. However, collective action increased for sweetpotato but declined for TAV. Collective marketing in Kiambu declined after increased transportation cost resulted from high fuel prices, leading to emergence of greater farm gate trading than formal market trading.

Gains from interventions

There were benefits totaling USD $230,812 to participating farmers through an increase in production of the target crops. The fact that these benefits were observed after the second year of project implementation and after prolonged drought conditions is an indication that the project interventions have potential due to increased awareness, commercialization, consumption, and crop area. A benefit/cost analysis, assuming current conditions prevail in future, indicated that investment in the value chain of the target crops was profitable, with an estimated internal rate of return (IRR) of 66% and a net present value (NPV) of USD $455,448 for a period of eight years.

5.3. Trader impact report[4]

A study was undertaken to identify the impact of the interventions on actors in the TAV and sweetpotato value chains. Despite the fact that the survey was carried out only one and half years into project implementation, important indicators of positive impact were identified and are presented below.

Methodology

The baseline survey was conducted between April and May 2008, and the impact survey was carried out between October 2009 and January 2010. A total of 163 traders were interviewed for the baseline survey, and 105 traders were interviewed for the impact survey. The interviewed traders represented farmers-retailers, brokers, retailers, transporters, wholesalers, and supermarkets from major towns selling the target crops from intervention areas. Data collected included sources of sweetpotato and vegetables; quantities bought and sold; and prices and packaging.

Characteristics of sweetpotato and TAV traders

About 80% of traders in the baseline and impact surveys were women had been trading for an average of 8.7 years. However, over 87% had not had any training on vegetable or sweetpotato trading. About half of the traders sold vegetables or sweetpotato. It was observed that more than 80% of traders had not accessed any type of financial credit to improve their businesses.

Although project interventions were expected to change consumers' preferences so that nutrition and the orange-colored sweetpotato flesh would be important factors when purchasing roots, there was no significant change on these two aspects between the baseline and impact survey. The skin color of sweetpotato was an important attribute that over 60.0% traders looked for, and red skin was the most preferred by 83% of traders. Yellow-fleshed roots were preferred by over 65% of traders. The percentage of traders who sold OFSP before the project (5.5%) increased after the interventions (17.5%). The increase may have resulted from an OFSP nutritional promotion that was carried out in markets and supermarkets. The dry matter content in OFSP roots that were introduced in Kenya posed an adoption challenge, but new varieties (namely, SPK 004/6 and SPK 004/6/6) disseminated in the last year of the intervention that combine the two preferred qualities of red skin and high dry matter have high potential of adoption and acceptability in the market. There was a slight change in nutritional awareness, and the proportion of traders for whom nutrition was a consideration increased by 13.2%, while the proportion of traders who identified sweetpotato as a good source of energy rose by 28.8%. These slight changes in nutritional awareness are likely to translate to greater impact with time.

The flour processing facility in Busia produces OFSP flour, which is then transported to Nairobi for packaging and distribution, mainly to supermarkets. As a result, small volumes are handled,

[4] For more detail, see Annex D.

and this value added activity is characterized by monopolistic tendencies. The project intervened by improving farm-gate prices for farmers, providing new packaging that was more attractive and in accordance with new quality guidelines from the Kenya Bureau of Standards, and streamlining processing activities between the farmers and the miller, as well as the distributor. It was observed that 75% of the TAV business was done by women, and men's presence was noticeable in the wholesale markets. Reasons for this change in gender involvement might have been caused by need for capital investment or travel to correct sufficient volumes. Also men have been shown to get interested in women-dominated businesses when they start to generate larger incomes.

There were no significant differences between the number of traders selling various types of vegetables between baseline and impact survey except for nightshade (a 12.9% increase). Trading of sweetpotato leaves was important only in Tanzania, where it was sold by more than 30% of traders. The time spent in bulking TAV to make required volume increased by 3.3 hours as traders in Kenya switch to buying more produce at farm gate because of scarcity of the vegetables being brought to more central locations due to drought in the 2nd year of intervention. The proportion of traders purchasing from farmer groups increased by 13.8%, which showed that there was an improvement in market access resulting from strengthened linkages with traders. A decline in TAV traded between baseline and impact surveys for all traders was from 2043.2 kg/month to 1829.0 kg/month, which again may be associated with shortage of irrigation water.

General findings

Traders continued to fix prices for sweetpotato and TAV, which meant that farmer groups and associations were unable to negotiate better prices. Other forces, such as frequent hikes on fuel prices, raised transportation costs to a point where farmers had no choice but to accept offers from the few traders who managed to show interest in their produce.

The high involvement of men at wholesale level may be associated with several factors: the high capital investment required to purchase and transport large volumes of produce; the need to travel long distances to areas with larger acreages under production; the ability to haggle with other actors, especially brokers; the ability to lift heavy items; and finally, conducting wholesale-level transactions with large sums of money (income). These factors have attracted men to many traditionally women-dominated enterprises.

5.4. Consumer impact report[5]

The TF project aimed at increasing productivity, utilization, and marketing of traditional African vegetables and sweetpotatoes (specifically, orange-fleshed sweetpotatoes (OFSP)) in Kenya and Tanzania. Project interventions included increasing consumer awareness of the nutritional benefits accrued from consuming TAV and OFSP, thereby strengthening market access for producers. This report examines changes in consumer knowledge and consumption between the baseline and impact surveys.

[5] For more detail, see Annex E.

Methodology

The baseline survey was conducted in April–May 2008, and the impact survey was conducted in December 2009. The baseline survey collected information on sweetpotato and TAV purchasing and consumption behavior and nutrition knowledge of non-producing consumers in targeted markets. The impact study examined changes in these aspects after project interventions. A total of 326 consumers (214 from Kenya and 112 from Tanzania) were randomly selected from the Nairobi, Kiambu, Busia, Kisumu, and Rachuonyo districts in Kenya and the Arusha district in Tanzania, which are known to sell sweetpotato and TAV from intervention areas. In Kenya, consumers were grouped into two categories, those in urban areas, which included Nairobi, Kiambu, and Kisumu, and those in rural districts, which included Rachuonyo and Busia. Consumers were classified as poor, medium, and better-off based on their monthly incomes.

Household characteristics

Although baseline and impact samples were randomly selected among new groups of consumers purchasing either TAVS or SP at the same markets, the characteristics of the consumers were generally similar. There were more women than men in both baseline (84.3% women) and impact (82.8% women) surveys. There were no major differences in education of the respondents in the two surveys: the majority of respondents had primary and elementary education (41.8% for baseline; 48.5% for impact), and about one-third of respondents in both surveys had secondary education. However, the average age of respondents and household heads in the impact study were significantly lower (by two years and one year, respectively).

TAV consumption

There were increases in the proportion of consumers eating any of the five TAVs (amaranth, nightshade, spider plant, cowpea, or sweetpotato leaves) during the project period. However, as the proportion of consumers eating any type of vegetable (exotic or TAV) remained the same (about 81%), the increase in TAV consumption was a result of consumers either shifting away from exotic vegetables or diversifying their diets.

The increase in TAV consumption in urban Kenya and Arusha and simultaneous decrease in rural areas may have been caused by drought that reduced the availability of TAV in rural areas. It also suggests that promotional messaging may have been more effective in urban than rural areas. However, there was no significant variation in consumption of TAV between different wealth categories, indicating that wealth was not a major influence driving any changes in consumption patterns.

Sweetpotato consumption

The proportion of consumers eating each type of sweetpotato increased marginally, with OFSP consumption increasing from 3.8% to 4.6%, YFSP from 15.3% to 24.6%, and WFSP from 10.4% to 22.4%. Consumption frequencies of all types of sweetpotato also increased generally, with OFSP frequency increasing from 27.0% to 28.4%, YFSP from 50.2% to 62.4%, and WFSP from 43.3% to 69.0%. Although there was a general increase in consumption of all types of

sweetpotato among female respondents, the slight increase in consumption of OFSP (from 3.7% to 4.8%) was favorable, especially if maintained, as orange-fleshed varieties provide important nutrients to pregnant women and children. Increases in the proportion of consumers who ate OFSP in urban than rural Kenya and Tanzania means more consumers had been made aware of the benefits of OFSP in urban areas. This may indicate that promotional campaigns were more effective in urban areas.

Knowledge, information, and attitudes

There was an increase in the proportion of consumers who had gotten information on the nutritional benefits of TAV and sweetpotato during the project period. Although consumer awareness of general nutritional benefits of TAV may not have changed much, there was increased awareness that TAV contributes to a balanced diet by having many vitamins and minerals. Similarly, more consumers knew that OFSP has high nutritional benefits. Increases in the proportion of consumers who ate OFSP in urban Kenya and Tanzania means more urban consumers had been made aware of the benefits of OFSP. This may also indicate that promotional campaigns were more effective in urban than rural areas. The significant increase in consumers offering sweetpotato to visitors means more consumers had changed their attitude about sweetpotato.

TAV and sweetpotato consumption by gender

There were more changes in consumption among women than men, with more women than men increasing their consumption of nightshade, spider plant, cowpea leaf, sweetpotato leaf, and WFSP. Although there was a general increase in consumption of all types of sweetpotato among the female respondents, the slight increase in consumption of OFSP (from 3.7% to 4.8%) was favorable, especially if maintained, as orange-fleshed varieties provide important nutrients to pregnant women and children.

Conclusions

It was evident that participant farmers benefited from project interventions through improved awareness, consumption, commercialization, and increased area under target crops. Farmers spent incomes from target crops to purchase basic food, pay school fees and purchase livestock. Similarly, more participants saved income from target crops. In general, a higher percentage of participants fed children with target crops than did non-participants. Interventions also helped more women access credit in Kenya and Tanzania. Benefits from increased income was due to an increase in area under TAV production and commercialization of both TAV and sweetpotato. A benefit-cost analysis indicated that the investment in project interventions is potentially profitable in the long run.

The study recorded increases in traders who sold OFSP, which reflected demand that resulted from consumers' being aware of the nutritional benefits of OFSP. Increased quantities of sweetpotato sold in supermarkets indicated an increased consumption of roots by middle- to upper-income groups, which reflected a change of attitude. However, over 65% of the traders preferred the yellow-fleshed roots, which means more awareness is required to see positive

change in this area. The most recently disseminated OFSP varieties, which combine the two preferred qualities of red skin and high dry matter, have high potential of adoption and acceptability in the market as consumers continue to value these qualities.

The study clearly shows there were many outcomes that could be attributed to project interventions. Although the two-year period of project implementation was short for any audit to produce tangible evidence of project impact, the findings of this study show strong positive outcomes that, if combined with evidence from the producer and trader studies, would be possible to attribute to project interventions. The increase in the proportion of medium- and well-off consumers in the sample and the significantly lower mean age of head of household respondents indicates that the attitude of wealthier, younger families had been influenced to consume sweetpotato and TAV. The findings show an increase in the proportion of consumers eating the five TAVs as a result of shifting away from exotic vegetables or diversifying their diets. Although there was a general increase in consumption of all types of sweetpotato among the female respondents, the slight increase in consumption of OFSP (from 3.7% to 4.8%) was favorable, especially if maintained, as orange-fleshed varieties provide important nutrients to pregnant women and children. An increased proportion of consumers were aware of the nutritional benefits of TAV and sweetpotato, indicating that promotions and awareness campaigns were effective. These attributes were manifested through influence on traders' sourcing behavior.

Production of TAV was negatively affected by drought, which resulted in scarcity of irrigation water and, hence, reduced volumes of TAV traded in Kenya. TAV production in Tanzania was sustained due to availability of irrigation water; the volumes traded doubled, which indicated increased consumption of TAV in Tanzania.

LESSONS LEARNED

Group formation and CV structuring

- Drop out of some participating farmers was experienced at different sites and was associated with a number of factors.
- The project was introduced to existing FCI farmers while mobilization of new groups embarked on a recruitment drive. Although the team had criteria of who should be recruited, a preference was given to existing farmer groups that had been formed for socioeconomic purposes other than commercialization of agricultural produce. It was felt the TF project may have inherited problems (mistrust, jealousy, etc.) from these groups, which resulted in members not being interested in or leaving TAV/OFSP production.
- Farmers recruited for involvement in commercialization of a crop should share a common interest and work on a common crop. Where possible, identifying visionary leaders would help in encouraging farmers.
- Project objectives and activities needed to be presented and discussed in a forum with representation from farmers, traders, business providers, and the private sector. Such a platform would have enhanced networks while ensuring ownership of the project among all stakeholders.

- It would take at least four years for a CV to be ready to operate without significant assistance from Farm Concern and continue with producing and selling TAV.

Collective marketing

- The TF project addressed both formal and informal markets. What came out was that fresh produce markets are very dynamic in terms of customer needs and types and qualities of TAV and sweetpotato, including prices. Different marketing strategies for the market segments need to be developed to cater to the needs of both farmers and consumers.
- Sufficient volumes of production are necessary if collective marketing is to achieve impact. For example, TAV (amaranth, nightshade, and spider plant) in Arusha and OFSP at most of the sites were produced in small quantities, which made it difficult for collective marketing.
- Buyer-seller fora were very effective in creating good working relationships and building trust between farmers and buyers. It also improved the margins that farmers received from the "brokers."

Technology

- Uptake of intervention varied among the MSU members. A small percentage of farmers were early adopters, a high percentage were medium adopters, and a low percentage were late adopters. Technology adoption variations at MSU level delayed CV graduation because it affected production and collective marketing. It was felt that at some sites, farmer preferences and culture and type of technology needed to be more taken into consideration when choosing crops to introduce. Inception workshops would have been helpful to sort these issues.
- Farmers are most sceptical about interventions, especially at project inception, that they thought it would be labor-intensive. It would be useful to have comparative labor use information for different crops to discuss with farmers at the inception of the project.
- For commercialization to succeed, fully tested crop varieties need to be in place. For example, lack of well-adapted OFSP and spider plant varieties to introduce to farmers at the very beginning of the project slowed down the speed of technology uptake and commercialization in some areas.
- The adoption of some new improved lines has been carried out by the target groups. However, seed production of the new lines/varieties is still lagging behind. Some farmers are still producing their own seeds, which are not necessarily the best quality. More interaction with seed companies is needed to make seed supply sustainable. The constant interaction with seed companies and their inclusion in participatory demonstration and evaluation trials has been very effective in sensitizing them and convincing them to release and commercialize improved lines of TAVs.

- Production of vegetables in East Africa is largely through irrigation. However, access to water for farming has been a big challenge at all project sites, which means this needs to be taken into consideration during the development and inception of a crop-based (especially vegetable) project. For example, farmer's lost potential seed markets from seed companies and NGOs that had continuously expressed interest in contracting them to produce seeds because they were unable to produce a regular supply.
- Field days and demonstrations were very effective for technology dissemination. Use of print/electronic media in promoting a product would ensure that a wider audience is reached. Inter- and intra-country exchange visits by farmers contributed a lot to commercialization. Practical training was very effective in disseminating needed information. Farmers and extension staff members who have been trained through the project have been able to adopt and transmit the practical skills they learned, which has been seen in increased production and marketing of the target crops in Kenya and Tanzania.
- The use of mobile phones in linking groups to supermarkets (receiving and delivering orders) is efficient in marketing of the TAVs.
- Farmers in the MSUs appreciate the need for production calendars for vegetables and OFSP roots so they can synchronize market demands. This was not the case for seed producers, and an oversupply of amaranth as well as shortage of spider plant seed were experienced in Kenya. To establish sustainable TAV seed systems, a production and marketing plan is needed for the seeds.

Partnerships

- Strong and well-coordinated partnerships among farmers, traders, and transporters ensured a sustainable supply of produce to the markets.
- The involvement of BDS providers (Equity Bank, Simlaw Seed, Uchumi supermarketm and agro-input stockists) played a major role in the success of the planned activities and ensured sustainability of commercialized crops.
- Participatory planning and the frequent dialogue among the members of the multidisciplinary TF team guided by Dr Jan Low ensured that activities were implemented as scheduled and that reports were output-oriented.

Approaches and methods

- Organizing farmers into business support groups helped raise market volumes and reduce costs of marketing, which attracted traders and increased farmers' chances of penetrating formal markets.
- Markets exposure visits for the MSU marketing subcommittee have proven very effective in improving collective marketing skills for farmers.

- The marketing service provided by Farm Concern in which FCI paid farmers when they provided the produce to the supermarket, in lieu of having to wait for the payment (often a month long) from the supermarkets or see stockist helped small-scale farmers' ability to provide consistent supply to the markets.
- The two crops (TAV and OFSP) were attractive to women who are the major players in production/marketing.

Annex B

Analysis of Traditional African Vegetables and Sweetpotato Consumer Demand in Kenya and Tanzania

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October 2009

Traditional FOODS
For wealth & health

Contents

Acknowledgements

The successful accomplishment of this study has been possible as a result of the contribution of many individuals. First and foremost, we wish to express our gratitude to Farm Concern International as a partner in this study for facilitating data collection, supervision, and data entry. Special mention goes to Mumbi Kimathi for her support and to Phyllis Maturi-Mungai and Janet Magoiya for their roles in coordination. We also thank the Arusha coordinating team composed of Mel Oluoch (AVRDC), Takemore Chagomoka (AVRDC), Inviolate Mosha (AVRDC), and Irene Mathenge (FCI).

In addition, we appreciate the contributions of the following interviewers in data collection: In Kenya, we thank Elizabeth Kimondo, Adocan Lizeth, Bernard Kariuku, and John Gatundu. In Tanzania, our appreciation goes to Peter Kabelo, Boniface Kipomela, Adelade William, Ndaisaba Michael, and Simon George.

We appreciate the role of the data entry team composed of Anne Watitu, Collete Achieng, and David Kimotho at the FCI Nairobi head office for their untiring work entering data from Kenya and Tanzania.

Acronyms and abbreviations

AVRDC	World Vegetable Center
CBO	Community-based organization
FCI	Farm Concern International
Ksh	Kenyan shilling
NGO	Non-governmental organization
OFSP	Orange-fleshed sweetpotato
SP	Sweetpotato
TAV	Traditional African Vegetable
Tsh	Tanzanian shilling
USD	United States dollar
WFSP	White-fleshed sweetpotato
YFSP	Yellow-fleshed sweetpotato

Introduction

Farm Concern International (FCI) since 2003 has implemented, in collaboration with other partners, separate pilot projects which focused on linking orange-fleshed sweetpotato (OFSP) farmers and traditional African vegetable (TAV) producers to major urban markets. The pilot projects promoted six TAVs: Amaranthus (Amaranthus spp.), African nightshade (Solanum scabrum/villosum/americanum), African eggplant (Solanum aethiopicum), spider plant (Cleome gynandra), cowpea (Vigna unguiculata) and okra (Abelmoschus spp.).

TAVs are a very good source of micronutrients. They are also high in antioxidants and anti-microbial phytochemicals (AVRDC, 2004). However, they have been neglected by the scientific and development communities, and their use by farmers has declined. TAVs collected from the wild contribute to food security and safety in times of hunger, civil unrest, and war (Lockett and Grivetti, 2000). Some studies have indicated that TAVs have high market potential and contribute substantially to household incomes (Gockowski et al., 2003; Weinberger and Msuya, 2004).

Sweetpotato (SP) is an important cash crop in Kenya and Tanzania. A market study carried out in Nairobi in 2006 established that sweetpotato is a relatively high-value crop with an estimated annual market value of Ksh 3,888 million (USD $51.8 million) and generating Ksh 1,695 million (USD $22.6 million) in annual gross profits in the urban trading systems (FCI and UH, 2006).

Remarkable contrasts exist between TAVs and SP. TAVs are generated from seed, whereas SP is generated from vines, which results in different requirements for sustained seed system development. OFSP has a distinct color and, for some varieties, taste compared with the white- and yellow-fleshed sweetpotato varieties that dominate East African markets.

While both TAVs and sweetpotato suffer from the image of being crops consumed by the poor, use of particular TAVs has varied among ethnic groups but there is nothing “new” about them.

Farm Concern International (FCI) has made significant investment in both TAVs and SP by organizing farmers into collective units, identifying formal and informal buyers, and linking them to markets. Intensive promotional and image-building campaigns were conducted to raise consumer awareness of the nutritional benefits of TAVs and SP.

The pilot project to increase TAV cultivation and effectively link producers to markets was quite successful, especially in Kenya. Given the success of the pilot project, there is justification for scaling up the project to achieve a wider impact. First, expansion of the intervention would likely lead to increased income for a greater percentage of the population in the project areas. Secondly, continued investment in TAV and SP market development and promotion would lead to increased consumption of TAVs and SP, particularly by youth, young children, and their mothers. This would greatly improve nutrition of these vulnerable groups, particularly in terms of vitamin A, iron, and zinc intake. Thirdly, increased income from commercialized sales of TAV and SP would improve livelihoods, and therefore, reduce poverty. Finally, there is high potential for TAVs and SP to be widely adopted by farmers. The pilot experiences have shown

that by providing appropriate business development services, smaller-scale farmers can successfully exploit emerging business opportunities offered by TAV and SP, with women farmers as active participants.

To address the existing gaps in commercialization of TAVs and SP and create impact at-scale, a gender-sensitive project is proposed to (a) increase TAV and SP consumption for enhanced nutrition, and (b) assess the potential growth in demand and need for quality standards for both raw and processed TAV and SP in Kenya and Tanzania.

Objectives of the study

The study examined consumer demand for traditional Africa vegetables (TAVs) and sweetpotato (SP) in Kenya and Tanzania. The general objective of the study was to empirically examine the demand structure and consumption pattern for TAVs and sweetpotato and their determinants among households in Kenya and Tanzania. The specific objectives were to (i) assess consumer knowledge and demand for TAVs and SP, including awareness of nutritional benefits; (ii) assess perception of acceptability and frequency of consumption of TAVs and SP; (iii) assess the need for grades and standards for raw or processed TAVs and SP; and (iv) identify the constraints faced by consumers in purchasing TAVs and SP.

Survey methodology

Study area and market segments

The study areas are Nairobi (Kenya) and Arusha (Tanzania). In Nairobi, the study area was stratified according three market segments based on the category of consumers that patronize the markets and their geographical (residential) locations. A sampling frame of markets in Nairobi was provided by FCI.

The market segments were:

- *Upper class.* This market segment is composed primarily of supermarkets and convenience/grocery stores mainly located in shopping malls. They are accessible to relatively high-income consumers, largely due to location, convenience, and price differential compared with other markets.

- *Middle class.* This market segment comprises grocery and roadside shops (kiosks). They are located mainly in residential areas of middle-income consumers (e.g., South B, Buruburu in Nairobi). Some supermarkets are also in this segment.

- *Lower class.* This market segment is composed predominately of open-air markets and road side/street markets. They are located in low-income residential areas (e.g., Kibera, Mathare) and accessible to low-income consumers. Prices are relatively lower in these markets.

Types and sources of data

The study used mainly primary data. The relevant primary data were obtained through consumer survey of households and surveys of supermarkets and retailers conducted between June and July 2009. Data was gathered using well-structured questionnaires administered by trained interviewers to consumers at households, supermarkets, and grocery stores, and to retailers at open markets, kiosks, and roadside stands.

A two-day training was conducted with the survey team composed of four interviewers each in Kenya and Tanzania, two supervisors each in Kenya and Tanzania, and two data entry staff, all provided by FCI. The purpose of the training was to acquaint those involved in data collection, supervision of interviewers, and data entry to be fully conversant with the survey objectives and to familiarize them with the survey questionnaire and data collection procedures.

Training was followed by a pilot test of the survey instruments. In the pilot, 12 household consumers and 10 different focus groups of retailers were interviewed. The responses obtained from the pilot were used to effect changes in the design of the questionnaires used in data collection.

The range of data collected from consumer households included consumption patterns of TAVs and SP, consumer expenditures, consumer behavior, factors that influence consumer buying at a particular point, and problems related to purchase of TAVs and SP. In addition, data were collected on household level socioeconomic and demographic variables (age and level of education of household head, household size, etc.).

The data collected from supermarkets and retailers was through a structured focused group survey. The range of data collected included marketing activities in relation to TAVs and SP, grades and standards, value addition, and marketing information. Socio-demographic information (age and level of education of household head, membership in organizations, etc.) were collected.

Secondary data were obtained from Farm Concern International, the Kenya Bureau of Statistics, and the Ministry of Agriculture. The secondary data covered information on the prices of TAVs and SP in previous years, population, and population growth rate. The secondary information was required for forecasting market demand for TAVs and SP among Nairobi consumers.

Sample selection

A stratified random sampling procedure was used to select household consumers, retailers, and supermarkets in Nairobi and Arusha. In Nairobi, three markets were selected from each market segment, followed by a random selection of consumer households, supermarkets, and retailers from the selected markets. The total sample consisted of f 209 households and 98 traders (supermarkets and retailers) in Nairobi.

In Arusha, information was obtained from the only one supermarket (Shoprite) and selected retail markets. This gave a total sample of 105 household consumers and 34 traders (supermarket and retailers) in Arusha.

Analytical techniques and models

The statistical tools used in this study were descriptive statistics and the Almost Ideal Demand System (AIDS) model. The expenditure elasticity, Marshallian, and Hicksian price models were derived from the AIDS system and were used to estimate expenditure or income elasticity, own-price elasticity, and cross-price elasticity of demand.

Linear approximate almost ideal demand system (LA-AIDS) model

The objective of the demand model was to estimate household expenditure on TAVs and SP, including elasticity of demand. The model also estimated the budget shares of different food categories.

The linear approximate almost ideal demand system (LA-AIDS) model was used to determine the food demand of respondents. The estimates of household demand for the food groups were obtained by estimating the Engel curves expressed in budget share terms (w_i) in the almost ideal demand system (AIDS) of Deaton and Muellbauer (1980).

AIDS model

The AIDS model developed by Deaton and Muellbauer (1980a) and adapted by Molina (1994), Abdulai et al. (1999), and Mazzocchi (2003) was used to capture the AIDS functions in expenditure (budget) share form to analyze the budget share of consumption of various food categories.

The model is specified as:

$$w_{it} = \alpha_i + \sum_i \Upsilon_{ij} \log P_{jt} + \beta_i \log (Y_t/P_t^*) \quad (1)$$

Where:

W_{it} = budget share of food commodity ith in period t (in Ksh or Tsh)

P_{jt} = food prices in period t in Ksh or Tsh per kg

Y_t = total expenditure on all food commodities in the system in (in Ksh or Tsh)

P_t^* = Stone price index defined as $\log P_t^* = \sum_{j=1}^{n} wj_t \log P_{jt}$

α_i , Υ_{ij} , β_i = parameters to be estimated

Υ_{ij} = estimated coefficient of prices

β_i = estimated expenditure/income coefficient

The advantage of the AIDS model is that it is flexible. It enables homogeneity and symmetry conditions to be tested or imposed during estimation, and it is indirectly non-additive. Thus, it does not impose the severe substitution limitations as do other additive models, such as the Linear Expenditure System (LES).

Three restrictions (adding up, homogeneity, and symmetry) were required for the model to be theoretically consistent. The following restrictions on the demand parameters were imposed on the demand system as part of the maintained hypothesis. As the budget share sums to 1, the following parameters should satisfy Equation 1:

Adding up	$\Sigma\ \alpha_i = 1, \Sigma\ \beta_i = 0, \Sigma\ y_{ij} = 0$
Homogeneity	$\Sigma\ y_{ij} = 0$
Symmetry	$y_{ij} = y_{ji}$ where $i \neq j$

The income elasticities, own-price elasticities, and cross-price elasticities can be computed from the AIDS model by using the following formulae (Nicholson, 1992) as follows:

Income elasticity	$e_{ih} = \beta_i / w_{ih} + 1$	(2)
Own-price elasticity	$e_{iih} = 1 + \gamma_{ii} / w_{ih}) \beta_i$	(3)
Cross-price elasticity	$e_{ih} = \gamma_{ij} \beta_i (w_{jh} - \beta_j (\ln (\chi_h / p_h)) / w_{ih}$	(4)

Income (expenditure) elasticity is defined as the percentage change in quantity demanded with respect to a one percent change in income. Price elasticity is defined as the percentage change in quantity demanded for some good with respect to a one percent change in the price of the good (own-price elasticity) or of another good (cross-price elasticity). Price elasticity ***greater than one is called price elastic and price elasticity smaller than one is called price inelastic.*** A given percentage increase in the price of an elastic good will reduce the quantity demanded for the good by a higher percentage than for an inelastic good. Cross-price and own-price elasticities were derived from the Marshallian demand equation or the Hicksian demand equation. The Marshallian demand equation is obtained from maximizing utility subject to budget constraint. Elasticities derived from Marshallian demand are called Marshallian or uncompensated elasticities (Nicholson, 1992; Gravelle and Rees, 1992).

This analysis used actual household expenditure as a proxy for household income collected once. Therefore, the study was based on household consumption data on total consumption expenditure of food items consumed in the last week prior to the survey and household characteristics. Consumption from own production, purchase, and receipts in kind were valued at prices prevailing locally at the period the data were collected.

In this study, the AIDS model was applied to 14 food groups[1]: TAV (four), SP (three), cereals, other roots and tubers, legumes, animal protein, other vegetables, fruits; and fat and oils. Demographic variables considered include gender, age, marital status, household size, and educational level.

Expenditure elasticity model

Expenditure elasticities, computed following Abdulai et al. (1999), is specified as:

$$e_i = 1 + \beta_i / w_i \qquad (5)$$

Where:

e_i = expenditure elasticity of food item i

β_i = expenditure coefficient of food item i

w_i = budget share of food items i

Marshallian and Hicksian price models

Following Abdulai et al. (1999), the Marshallian (uncompensated) price elasticity, and Hicksian (compensated) price elasticity were computed.

The Marshallian (uncompensated) price elasticity, conditional on food expenditure, was specified as:

$$e^m_{ij} = \frac{\Upsilon_{ij}}{w_i} - \frac{\beta_i w_j - \delta_{ij}}{w_i} \qquad (6)$$

Where:

e^m_{ij} = Marshallian (uncompensated) price elasticity

Υ_{ij} = food price coefficient

w_i = budget share of food item i

w_j = budget share if food item j

β_i = expenditure coefficient of food item i

$\delta_{ij} = 1$, when i = j, otherwise $\delta_{ij} = 0$

[1] The classification departs from other food classifications used in the literature, where individual TAVs were classified into four groups and SP into three groups.

Using the Slutsky equation, the Hicksian (compensated) price elasticity was computed as:

$$e^{h}_{ij} = e^{m}_{ij} + w_j e_i \quad (7)$$

Where:

e^{h}_{ij} = Hicksian (compensated) prices elasticity
e^{m}_{ij} = Marshallian (uncompensated) price elasticity
w_j = budget share of food item j;
e_i = expenditure elasticity of food item i

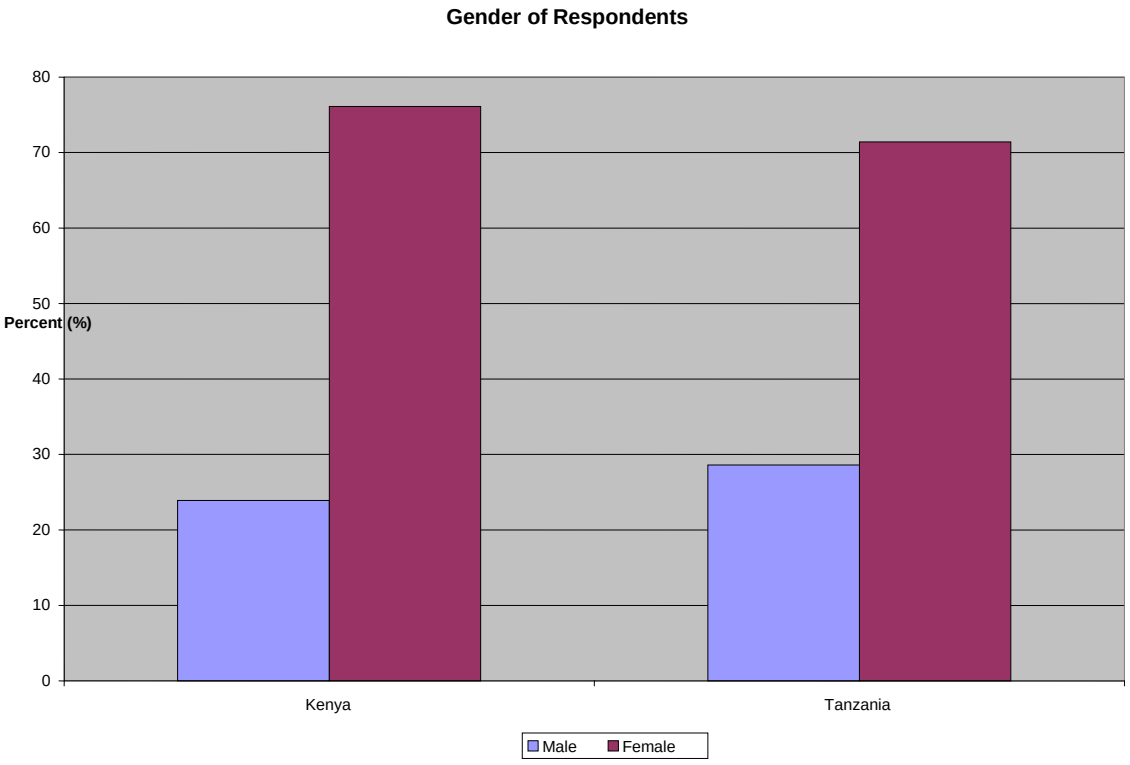
Results and discussion

Characteristics of household consumers

This section examines the major socioeconomic characteristics of sampled household consumers of TAVs and SP. The characteristics described include gender of respondent, type of respondent, age, educational level, household size, and household income. The need for this analysis is predicated on the fact that household consumer demand for TAVs and SP is largely a function of the social and economic characteristics of consumers.

The gender distribution of respondents is presented in Fig.1. It could be observed that the pattern of gender distribution of respondents was similar in both countries surveyed. But in relative terms, the percentage of female respondents was marginally higher in Kenya (76%) compared with Tanzania (71%). This tends to be in conformity with the socio-cultural situation in East Africa, where females are primarily responsibility for purchasing food from markets, as consumer data were collected in markets at the point of purchase.

Fig. 1. Gender of respondents



Type of respondents

Table 1 contains information on the type of respondent households in the sample. A majority of the respondents in Kenya (54%) and Tanzania (49%) are married females. This finding maybe linked to the primary responsibility of married women for purchase of food required for household consumption.

Table 1. Type of respondents

Respondent Type	Kenya (N=209)	Tanzania (N=105)
	(%)	(%)
Wife	54.1	48.6
Husband	15.8	18.1
Son/daughter	10.5	18.1
Maid/cook	5.3	5.7
Single person	7.2	7.6
Relative	7.2	1.9

Age of respondents

Table 2 presents the age structure of the household respondents in the sample. There seems to be a dominance of relatively young respondents (21–50 years of age) among males and females in both Kenya and Tanzania.

Table 2. Age of respondents by gender

	Kenya (N=209)		Tanzania (N=105)	
Age	Male (%)	Female (%)	Male (%)	Female (%)
<20 yrs	2.0	8.8	10.0	2.7
21–31 yrs	40.8	43.4	50.0	49.3
31–40 yrs	26.5	28.3	33.3	29.3
41–50 yrs	18.4	15.7	3.3	17.3
51–60 yrs	6.1	3.1	3.3	1.3
>60 yrs	6.1	0.6	0.0	0.0

Household size

The significance of household size hinges on the fact that it influences the household food demand, including TAVs and SP. At a given level of price and expenditure, relatively larger households are expected to spend more on food. The mean household size in both Kenya and Tanzania is approximately four persons per household.

Table 3. Household size

Number of Persons in Household	Kenya (N=209)	Tanzania (N=105)
	%	%
1–2	17.7	17.1
3–4	44.0	45.7
5–6	28.2	31.4
7–8	8.6	3.8
>8	1.4	1.9

The majority of the respondents had a household size of three or four persons, constituting 44% and 46% in Kenya and Tanzania, respectively (Table 3). This was followed by five or six persons, representing 28% (Kenya) and 31% (Tanzania). Larger households are expected to be more responsive to changes in prices of food. Thus, as the price of food increases, they may be compelled to adjust their consumption patterns by substituting relatively cheap food. Cheaper foods are typically lower in vitamins, minerals and protein, resulting in poor quality diets for low-income households.

Education level of respondents

The level of education in terms of the number of years of schooling may have significant influence on the consumption of food, including TAVs and SP. The educational level of household respondents (Table 4) indicates that the majority in both Kenya (99%) and Tanzania (83%) attained at least primary education. This finding clearly indicates that the level of formal education of consumers purchasing food in markets is relatively high, especially in Kenya. It is likely that the educational level offers opportunity for consumers to earn higher incomes and could influence the demand for food, including TAVs and SP.

Table 4. Education level of respondents

Educational Level	Kenya (N=209)	Tanzania (N=105)
	%	%
None	1.0	17.1
Standard 1–8	24.4	45.7
Form 1–4	31.8	31.4
A level	5.3	3.8
College/university	37.8	1.9

Household income[2]

Income is one of the major factors influencing food demand, and it varies among households. The income distribution of the households is presented in Table 5.

The income of Kenya consumers is higher than that for Tanzania consumers, with 99% of the Tanzanian households earning less than or equal to USD $200 per month compared to only 22% of Kenyan households. It is hypothesized that consumer demand for TAVs and SP, including the frequency of consumption of TAV and SP, will be higher among the relatively high-income households.

Table 5. Household income per month

Household Income per Month	Kenya (N=209)	Tanzania (N=105)
In USD	%	%
≤200	21.5	99.0
201–400	29.2	1.00
401–600	27.8	0.0
601–800	6.7	0.0
801–1000	7.2	0.0
>1,000	7.7	0.0

TAV and SP consumption patterns

Frequency of consumption

The frequency in consumption of TAVs is similar among households in Kenya and Tanzania, where 56% and 59% of the households, respectively, consume TAVs two to four times per week. Approximately 29% of households in both Kenya and Tanzania consume TAV daily. The proportion of households that never consume TAVs or households that consume once per week or less than a fortnight was very low. The picture that emerges from the frequency of TAV consumption reveals the importance of TAV in the diet of consumers in both Kenya and Tanzania. This finding might have been influenced by consumers' increased nutritional awareness of TAV and SP as a result of FCI promotion.

[2] Converted to USD using prevailing exchange rates during survey (1 USD = 76 Ksh and 1 USD = 1,325 Tsh).

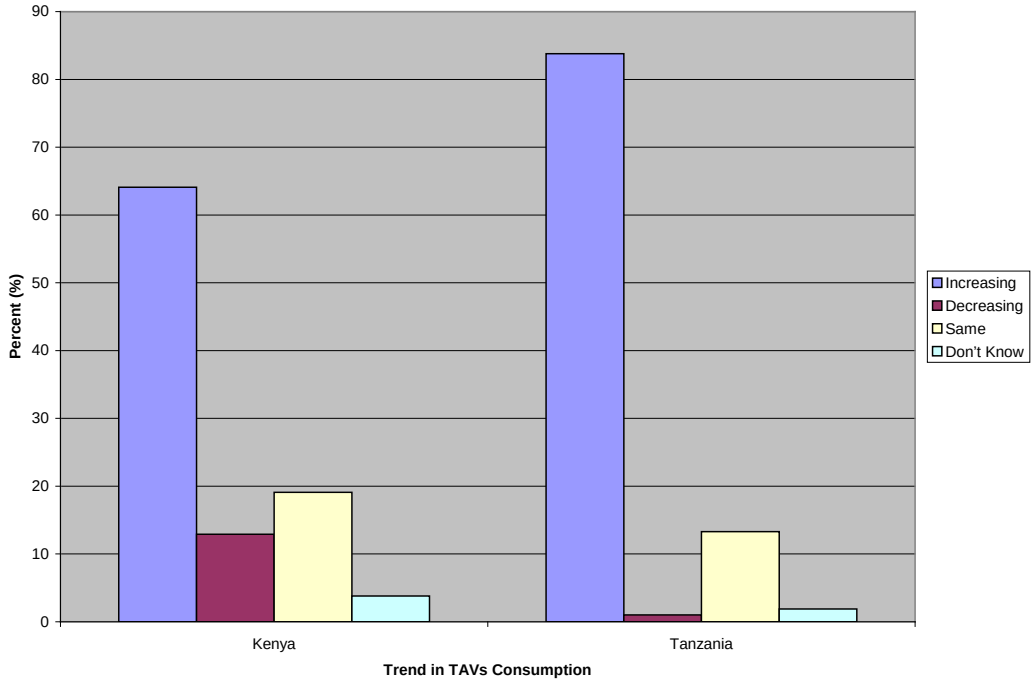
The frequency of SP consumption, unlike TAVs, reveals the relatively greater importance of SP consumption in Tanzania than in this urban sample in Kenya. Approximately, 38% and 10% of consumers in Kenya and Tanzania, respectively, never consume SP.

Table 6. Frequency of household consumption of TAV and SP

	Kenya (N=209)		Tanzania (N=105)	
Consumption of TAV/SP	**TAV (%)**	**SP (%)**	**TAV (%)**	**SP (%)**
Never	3.3	37.8	1.9	9.5
<1 time per week	4.3	14.4	3.8	29.5
1 time per week	7.2	17.2	6.7	29.5
2–4 times per week	56.0	24.4	59.0	21.0
5–7 times per week	29.2	6.2	28.6	10.5

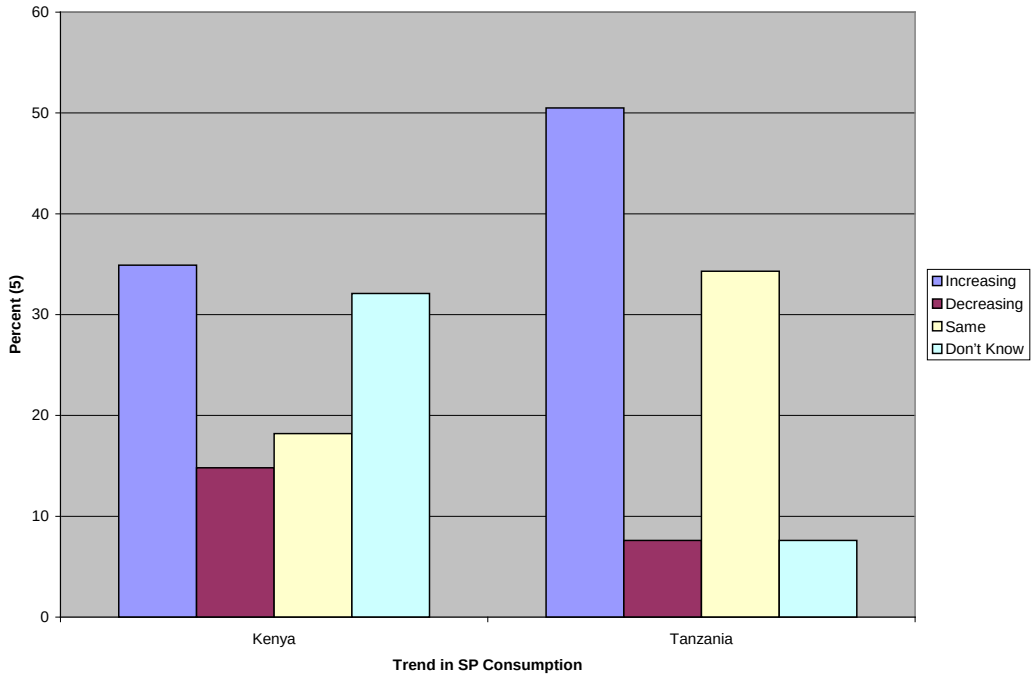
A comparison of the current consumption trend of TAVs compared to five years ago reveals an increasing trend among 64% and 84% of consumers in Kenya and Tanzania, respectively (Fig. 2). This finding suggests that the market demand for TAVs has increased substantially over the past five years. Such increased demand might have been influenced by changes in price, consumer income, taste and preferences of consumers, etc. For instance, increased awareness of the nutritional benefits of TAVs might have influenced changes in consumer taste and preferences over the past five years. On the contrary, 13% and 10% of the households in Kenya and Tanzania have decreased their consumption of TAVs. It is likely that such households have substituted TAVs with consumption of other vegetables, possibly due to changes in household income, consumer prices, etc.

Fig. 2. Trend in TAV consumption



SP consumption has increased for only 35% and 51% of household consumers in Kenya and Tanzania, while its consumption has declined among 15% and 8% of consumers in Kenya and Tanzania, respectively. It is plausible that households may have substituted other food types for SP due to changes in price and/or income.

Fig. 3. Trend in SP consumption

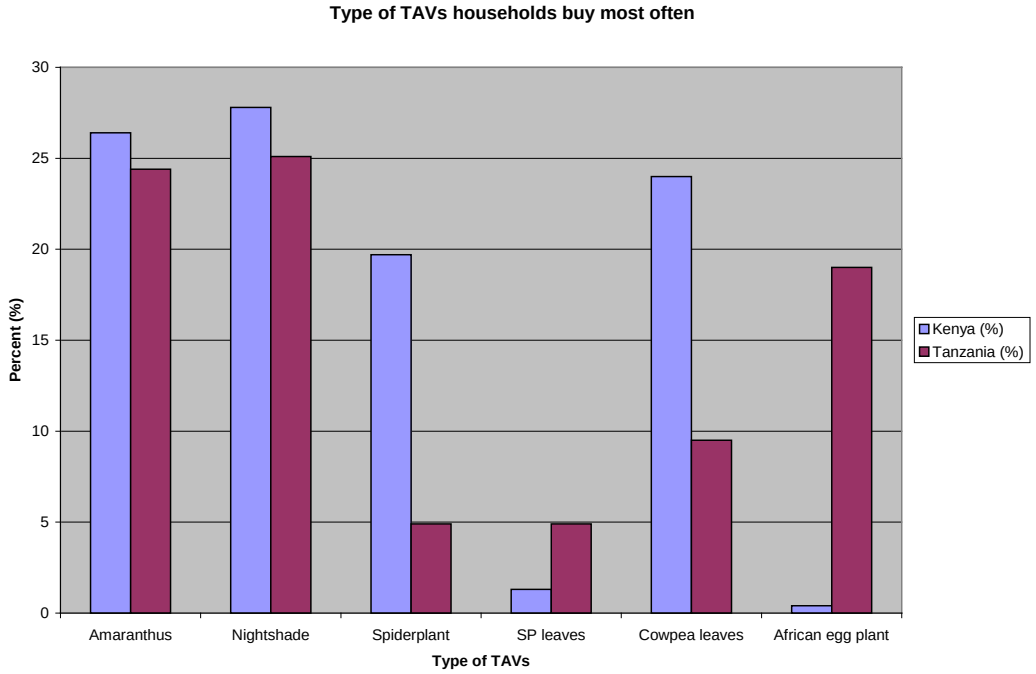


Consumer preferences for TAVs and sweetpotato

Type of TAV and SP households buy most often

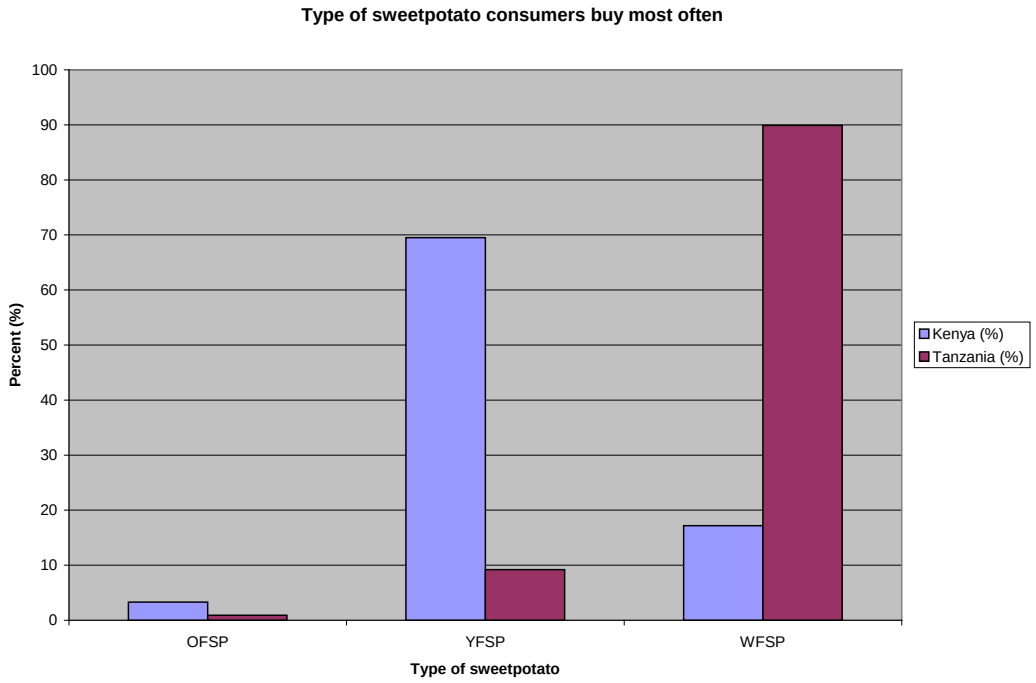
Among TAV, nightshade is the vegetable most preferred by 28% of households in Kenya and 26% of households in Tanzania, followed closely by amaranthus, which was purchased by 26% and 25% of households in Kenya and Tanzania, respectively (Fig. 4). Consumers in Kenya (24%) prefer cowpea leaves compared with consumers in Tanzania (10%), while African eggplant is preferred by consumers in Tanzania (19%) compared with those in Kenya (less than 1%).

Fig. 4. Type of TAV households buy most often



Among the SP types, 70% of Kenya consumers purchase yellow-fleshed sweetpotato (YFSP) most often, while white-fleshed sweetpotato (WFSP) is purchased most often by 90% of households in Tanzania. These patterns may be associated with availability of the different types as well as socio-cultural factors rather than price.

Fig. 5. Type of SP households buy most often



The popularity of nightshade is further revealed by its frequency of consumption, which is at least two to four times per week by 74% and 81% of consumers in Kenya and Tanzania, respectively. This is followed closely by amaranthus, which is consumed at least two to four times per week by 67% and 78% of households in Kenya and Tanzania, respectively (Table 7).

Table 7. Cross-tabulation of type of TAV/SP by frequency of consumption per week

	Kenya (N=209)				Tanzania (N=105)			
	Never	About once/wk	2–4/wk	5–7/wk	Never	About once/wk	2–4/wk	5–7/wk
TAV/SP	%	%	%	%	%	%	%	%
Amaranthus	17.7	14.8	48.3	19.1	9.5	12.4	60	18.1
Nightshade	13.9	12	53.6	20.6	4.8	14.3	62.9	18.1
Spiderplant	37.8	12	32.1	18.2	82.9	11.4	4.8	1
Cowpea leaves	23.4	16.7	40.2	19.6	64.8	18.1	15.2	1.9
SP leaves	99	NA	1	NA	43.8	26.7	27.6	1.9
African eggplant	99.5	NA	NA	0.5	100	NA	NA	NA
SP								
OFSP	95.7	1	2.9	0.5	100	NA	NA	NA
YFSP	44.5	21.1	28.2	6.2	93.3	1.9	4.4	NA
WFSP	79.9	7.2	8.1	4.8	10.5	54.3	21.9	13.3

The trend in SP consumption is similar in Kenya and Tanzania. While YFSP is preferred by consumers in Kenya, WFSP is preferred by consumers in Tanzania.

Demand elasticities for TAVs and SP (Kenya)

Expenditure elasticity (Kenya consumers)

An expenditure of demand measures the degree of responsiveness (in percentage) of household demand for a particular food group to a unit percentage change in the household income. Elasticity coefficients for the expenditure are presented in Tables 8. Income elasticity values are positive for all food items. The values show that amaranthus nightshade, cowpea leaves, YFSP, WFSP, cereals, animal protein, and fat and oils are necessities, each with an elasticity value less than 1 (inelastic). These food groups constitute the basic diet of consumers in Kenya. With regards to TAV, amaranth, nightshade, and cowpea leaves are the leading TAV, commonly consumed at least two to four times per week by households. Other roots and tubers, spiderplant, other vegetables, OFSP, legumes, and fruits are luxuries, each with an elasticity value slightly greater than 1 (elastic). A 1% increase in household income will increase demand for each of the food items by a percentage equivalent to its respective expenditure elasticity value presented in Table 8.

The food groups, which are income elastic, are spider plant, other vegetables[3], OFSP, other roots and tubers[4], legumes and fruits, being more than unity is luxury goods. The budget share for these food groups will likely increase as household income level rises. As income increases, Kenya consumers' shifts consumption in favor of these food groups, all other factors remaining constant. The other TAVs (amaranthus, nightshade and cowpea leaves) are food groups, which were income inelastic, with expenditure elasticities less than one and normal goods. As income rises, say by 1%, spending on a necessity (normal goods) rises, but the proportion of income spent is less than 1%. Its consumption rises with total spending, but not as fast. None of the food groups are inferior goods.

Table 8. Kenya household expenditure elasticity estimates

Commodity	Expenditure Elasticities
Amaranthus	0.99852
Nightshade	0.99925
Spider plant	1.00018
Cowpea leaves	0.99865
Other vegetables	1.0047
OFSP	1.00068
YFSP	0.99932
WFSP	0.99957
Other root and tubers	1.00059
Cereals	0.99839
Legumes	1.00005
Animal protein	0.99983
Fat and oils	0.99822
Fruits	1.00237

[3] Includes mostly vegetables (cabbage, carrots, lettuce, cucumber, etc.)
[4] Mainly potatoes.

Own-price and cross-price elasticities

Own-price and cross-price elasticities are shown in Tables 9 and 10. Uncompensated elasticity measures the total income and substitution effect (price) on food expenditure, while compensated elasticity measures the effect of price alone (substitution effect). Own-price elasticities show that if the price of each food item is increased by 1%, demand for each will increase by a percentage equivalent to its respective uncompensated value. Uncompensated elasticity is less than compensated for all food items, implying a higher price effect (substitution effect). Therefore, the substitution effect is higher than the income effect, which indicates that the pure price effect of a decrease in price of any food commodity leads to an increase in the demand for any other food commodity.

The negative sign of the elasticity coefficients indicates that as the price of a food type increases, the relative share (in percentage) of food expenditure decreases. Own-price elasticities are expected to be negative, as one would expect that as the price of a food goes up, less of it will be demanded, and its overall share in the food budget will decline. The Marshallian and Hicksian own-price elasticities for all the food groups are negative, which is consistent with consumer demand theory.

Generally, the own-price elasticities are high. The price elasticities of these food items could be expected to be low if prices and supplies remained normal and stable. If consumers were to eat enough food to satisfy their appetites, one would expect that price elasticity of demand would be high, as the population has low incomes.

The size of the price elasticity is also affected by the availability of substitutes (Hill and Ingersent, 1982). Most of the food groups, such as TAVs and SP, have close substitutes, are important constituents of diets, and might be expected to have high price elasticities. Most of the TAVs (except amaranthus and cowpea leaves) and SP (except OFSP) have own-price elasticities less than 1, indicating that as the price rises, demand falls at a slower rate than the price increase.

Cross-price elasticity

Tables 9 and 10 show the full matrices of the uncompensated and compensated cross-price elasticities, respectively. The compensated cross-price elasticities have both positive and negative signs. Positive cross-price elasticity suggests that two commodities are substitutes, while negative cross-price elasticity implies that they complement one another. Cross-price relationships show that most of the TAV types are substitutes, which is expected. Thus, a relative rise in the price of a particular TAV, say amaranthus, will lead consumers to substitute consumption with nightshade, spider plant, or cowpea leaves. On the other hand, most of the TAVs are complementary to other food types. For instance, Amaranthus is complementary to OFSP, YFSP, WFSP, cereals, fat and oils, and fruits. Also, nightshade would substitute spider plant and other vegetables, while YFSP, other root and tubers, legumes, animal protein, and fruits are complements.

It is observed that the values of uncompensated cross-price elasticities are lower that the corresponding compensated elasticities. The difference can be attributed to an income effect, due to the relatively low level of incomes for this particular sample.

Table 9: Own-price and uncompensated cross-price elasticities of TAV and SP for Nairobi consumers[a]

	Amaranthus	Nightshade	Spider plant	Cowpea leaves	Other vegetables	OFSP	YFSP	WFSP	Other root and tubers	Cereals	Legumes	Animal protein	Fat and oils	Fruits
Amaranthus	**-1.0959**	0.1593	0.11752	0.13267	-0.01295	-0.14831	-0.07881	-0.02339	0.054145	-0.24393	0.054355	0.35812	-0.00919	-0.0039
Nightshade	0.12607	**-0.88275**	0.014471	-0.05761	0.078675	-0.05183	0.019736	-0.08904	-0.0782	-0.36745	0.17951	0.19268	-0.27383	-0.17771
Spider plant	0.16615	0.038053	**-0.87036**	-0.22527	0.067128	-0.29303	-0.0087	-0.01977	-0.04211	-0.29555	0.23139	0.51106	-0.07739	-0.11701
Cowpea leaves	0.23525	-0.09477	-0.08534	**-1.03354**	0.059731	-0.18154	-0.04515	-0.00243	-0.16662	-0.12714	0.29547	0.10643	0.08061	0.019432
Other vegetables	0.042461	-0.07562	0.051705	0.027627	**-1.11665**	0.17065	0.05065	0.014289	-0.02548	-0.00258	0.18519	-0.87921	-0.00158	0.11221
OFSP	0.017011	-0.02457	-0.02229	-0.00355	0.00871	**-1.00616**	-0.00162	0.012853	0.066418	0.017812	-0.07654	0.072216	0.033628	-0.03093
YFSP	0.024694	-0.00455	-0.03436	0.013358	0.027357	0.053262	**-0.95162**	-0.03803	0.001851	-0.02548	0.068414	0.053713	-0.00772	-0.02535
WFSP	-0.02803	0.060488	-0.01075	-0.0166	-0.00898	0.052715	0.026919	**-0.9337**	-0.00891	0.13153	0.036791	0.042146	-0.02508	-0.03401
Other root and tubers	0.006391	-0.02193	-0.02986	-0.00801	0.00927	0.052082	-0.0019	0.018672	**-1.042**	0.023328	0.013509	0.082987	-0.01202	0.090122
Cereals	-0.07469	-0.07961	0.001137	0.014702	0.011019	-0.01692	-0.00368	-0.01266	-0.00282	**-0.8465**	-0.0962	-0.32678	0.01844	-0.05041
Legumes	-0.02318	-0.0137	0.055346	0.015159	-0.01223	-0.02407	-0.03285	-0.02717	0.044614	-0.00675	**-1.0232**	-0.04392	0.016682	0.057728
Animal protein	-0.01718	0.063108	-0.01269	-0.01516	-0.01464	-0.0085	0.00501	0.027153	0.008827	-0.02388	-0.01848	**-0.8476**	-0.01698	-0.0559
Fat and oils	0.038696	-0.03639	-0.02121	-0.00573	0.005923	-0.00789	-0.00425	0.003913	-0.03127	-0.01271	0.00094	-0.13506	**-0.9545**	0.035043
Fruits	0.018222	-0.00756	-0.01598	0.023791	0.026313	0.031056	0.002642	-0.01448	0.023248	0.024144	0.058234	0.21833	0.018989	**-0.9523**

[a]Bolded numbers show the own-price elasticity.

Table 10: Own-price and compensated cross-price elasticities of TAV and SP for Nairobi consumers[a]

	Amaranthus	Nightshade	Spider plant	Cowpea leaves	Other vegetables	OFSP	YFSP	WFSP	Other root and tubers	Cereals	Legumes	Animal protein	Fat and oils	Fruits
Amaranthus	**-1.129**	0.1955	0.14979	0.17606	0.078897	-0.11874	0.062035	0.035719	0.22548	0.021535	0.36718	0.94487	0.12815	0.21334
Nightshade	0.15908	**-0.9190**	0.046765	-0.01419	0.17059	-0.02224	0.16068	-0.02989	0.093265	-0.1018	0.49257	0.77986	-0.03427	0.072375
Spider plant	0.19919	0.074316	**-0.9027**	-0.18181	0.15913	-0.26341	0.13238	0.039444	0.12951	-0.02964	0.54474	1.09879	0.13798	0.13331
Cowpea leaves	0.26824	-0.05856	-0.05307	**-1.0771**	0.15159	-0.15197	0.095716	0.056695	0.004741	0.13836	0.60834	0.69326	0.29566	0.26937
Other vegetables	0.075646	-0.03919	0.084175	0.071282	**-1.2082**	0.2004	0.19237	0.073768	0.14692	0.26453	0.49995	-0.28882	0.21477	0.36366
OFSP	0.050063	0.011708	0.010055	0.039929	0.10076	**-1.0358**	0.13953	0.072094	0.23813	0.28385	0.23696	0.66024	0.24911	0.21951
YFSP	0.057702	0.031681	-0.00207	0.05678	0.11928	0.082851	**-1.0928**	0.02113	0.17333	0.24019	0.38149	0.64094	0.20747	0.22475
WFSP	0.00499	0.096729	0.021551	0.026832	0.082968	0.082311	0.16791	**-0.9930**	0.16261	0.39727	0.34995	0.62952	0.19017	0.21615
Other root and tubers	0.039441	0.014345	0.002481	0.035467	0.10131	0.081708	0.13924	0.077908	**-1.2135**	0.28934	0.32699	0.67096	0.20345	0.34054
Cereals	-0.04171	-0.04341	0.033403	0.058083	0.10286	0.012645	0.13714	0.04645	0.1685	**-1.1128**	0.21659	0.25989	0.23343	0.19946
Legumes	0.009857	0.022564	0.087666	0.058613	0.07976	0.005542	0.10821	0.032038	0.21622	0.25912	**-1.3364**	0.54374	0.23203	0.30801
Animal protein	0.015842	0.099358	0.019623	0.028289	0.077333	0.0211	0.14604	0.086344	0.18039	0.24193	0.29476	**-1.4354**	0.19832	0.19434
Fat and oils	0.071667	-0.0002	0.011049	0.037647	0.097743	0.021668	0.13655	0.063008	0.14002	0.25267	0.31367	0.45151	**-1.1703**	0.28487
Fruits	0.05133	0.028785	0.016416	0.067345	0.11852	0.060735	0.14403	0.044856	0.19525	0.29063	0.37227	0.80735	0.23484	**-1.2020**

[a]Bolded numbers show the own-price elasticity.

Demand elasticities for TAVs and sweetpotato (Tanzania)

Expenditure (income) elasticity (Tanzania consumers)

The expenditure elasticity of household consumers in Tanzania is presented in Table 11. The expenditure elasticity can be interpreted as the percentage change in quantity demanded of a food commodity when income changes by 1%, holding every other variable constant. Income elasticity values are positive for all food items. The values show that amaranth, nightshade, sweetpotato leaves, eggplant, WFSP, other root and tubers, animal protein, and fruits are necessities with each elasticity value less than 1 (inelastic). On the contrary, cowpea leaves, cereals, legumes, and fat and oils are luxuries with each elasticity value slightly greater than 1 (elastic). However, given that all these values are very close to 1, basically a 1% increase in household income will increase demand for each food item by about 1% percent. This lack of variation reflects the limited time period over which the expenditure data were collected and the relative low income levels of the consumers in the sample.

Table 11. Expenditure elasticity of Tanzania consumers

Commodity	Expenditure Elasticities
Amaranthus	0.99829
Nightshade	0.98865
Sweetpotato leaves	0.99653
Cowpea leaves	1.00425
Eggplant	0.99672
WFSP	0.9946
Other vegetables	0.99978
Cereals	1.00254
Legumes	1.00796
Animal protein	0.99887
Fat and oils	1.00057
Fruits	0.99592

Own-price and cross-price elasticities of Tanzania consumers

Own-price and cross-price elasticities are shown in Tables 12 and 13. Uncompensated elasticity measures the total income and substitution effect (price) on food expenditure, while compensated elasticity measures the effect of price alone (substitution effect). Own-price elasticities show that if the price of each food item is increased by 1%, demand for each will increase by a percentage equivalent to its respective uncompensated value. Uncompensated elasticity is less than compensated for all food items, implying a higher price effect (substitution effect). Therefore, the substitution effect is higher than the income effect, which indicates that the pure price effect of a decrease in price of any food commodity leads to an increase in the demand for any other food commodity.

Cross-price elasticity

Tables 12 and 13 show the full matrices of the uncompensated and compensated cross-price elasticities, respectively. The compensated cross-price elasticities have both positive and negative signs. Similarly, a negative sign implies complementary effect while a positive sign implies a substitution effect. Cross-price relationships show that amaranth is complemented by sweetpotato leaves, cowpea leaves, other root and tubers, legumes, and fat and oils and is a substitute for other food items. The values of uncompensated cross-price elasticities are lower that the corresponding compensated elasticities. The difference can be attributed to income effect, due to the low level of income of households in the sample.

Table 12. Own-price and uncompensated cross-price elasticities of foods for Tanzania consumers[a]

	AMA	NIG	SWE	COW	EGG	WHI	ORT	CER	LEG	ANI	FAT	FRU
Amaranthus	**-0.3730**	0.46706	-0.02424	-0.17191	0.034307	0.34208	-0.399	0.58904	-1.73336	0.27643	-0.5828	0.7008
Nightshade	0.18852	**-0.1333**	-0.13564	-0.05936	-0.0643	0.87751	-0.37007	-1.68734	0.063531	-1.73546	1.74879	-0.02108
Spider plant	1.86315	1.41556	**-1.6149**	-0.05685	1.87736	5.5569	-1.87649	-4.76805	4.91279	-9.49823	2.29787	-1.82261
Cowpea leaves	0.14695	-0.63118	-0.33136	**-1.1163**	-0.15771	3.86289	-0.75883	1.26076	1.76025	-0.22589	-2.61783	-1.98171
Other vegetables	-0.00092	0.10531	-0.05185	-0.02937	**-0.7479**	-0.1558	-0.22184	-0.35103	-0.21621	-0.20063	0.74335	0.088283
OFSP	-0.1247	-0.08708	-0.0345	0.003691	-0.04081	**-0.7479**	0.12435	0.18092	-0.19565	0.17195	-0.13031	-0.09213
YFSP	0.037611	0.071785	-0.13616	0.008682	0.16903	0.28423	**-1.3453**	0.67483	0.01178	-0.49183	-0.08613	-0.28498
WFSP	-0.09249	-0.07205	-0.04848	0.000783	-0.13126	-0.04332	-0.14795	**-1.3453**	0.19336	-0.19618	-0.04154	-0.24327
Other root and tubers	0.012157	0.026451	0.006938	-0.02414	0.047215	0.14503	-0.08561	-0.71397	**-0.3604**	-0.15936	0.014768	0.036896
Cereals	-0.07038	-0.07654	-0.0444	0.005119	-0.07532	-0.05853	0.1597	0.46565	0.013303	**-0.7623**	-0.35523	-0.15853
Legumes	-0.14106	0.16949	-0.0255	0.004061	0.015542	-0.07433	0.005415	-0.14279	0.25474	-0.08114	**-1.0087**	-0.02937
Animal protein	0.072428	-0.00229	0.028832	0.024119	0.073382	0.022609	0.026776	-0.1668	-0.11815	-0.26568	-0.00704	**-0.7089**

[a]Bolded numbers show the own-price elasticity.

Table 13. Own-price and compensated cross-price elasticities of foods for Tanzania consumers[a]

	Amaranthus	Nightshade	Spider plant	Cowpea leaves	Other vegetables	OFSP	YFSP	WFSP	Other root and tubers	Cereals	Legumes	Animal protein
Amaranthus	**-0.4040**	0.50027	-0.00459	-0.15766	0.063345	0.42834	-0.32334	0.89617	-1.61827	0.5288	-0.45512	0.78379
Nightshade	0.21911	**-0.1670**	-0.11618	-0.04524	-0.03554	0.96294	-0.29514	-1.38318	0.17751	-1.48552	1.87524	0.061098
Spider plant	1.89398	1.44871	**-1.6344**	-0.04262	1.90635	5.64301	-1.80097	-4.46146	5.02767	-9.2463	2.42533	-1.73978
Cowpea leaves	0.17802	-0.59777	-0.31159	**-1.1305**	-0.1285	3.94966	-0.68271	1.56973	1.87602	0.027985	-2.48939	-1.89823
Other vegetables	0.02991	0.13847	-0.03223	-0.01514	**-0.7771**	-0.06967	-0.1463	-0.04438	-0.1013	0.051344	0.87083	0.17113
OFSP	0.09393	-0.05399	-0.01492	0.017892	-0.01188	**-0.8213**	0.19973	0.48692	-0.08099	0.42339	-0.0031	-0.00946
YFSP	0.06854	0.10505	-0.11648	0.022957	0.19811	0.37062	**-1.4211**	0.98242	0.12704	-0.23908	0.041742	-0.20187
WFSP	0.06147	-0.0387	-0.02875	0.015097	-0.1021	0.043309	-0.07197	**-0.5136**	0.30895	0.057262	0.086687	-0.15994
Other root and tubers	0.04334	0.059983	0.026777	-0.00975	0.076534	0.23213	-0.00921	-0.40387	**-0.4747**	0.095459	0.14369	0.12068
Cereals	-0.03947	-0.04331	-0.02474	0.019381	-0.04627	0.027787	0.2354	0.77296	0.12846	**-0.4747**	-0.22747	-0.0755
Legumes	-0.1101	0.20277	-0.00581	0.018348	0.044646	0.012133	0.081248	0.16505	0.37009	0.1718	**-1.1365**	0.053805
Animal protein	0.10324	0.030844	0.048435	0.038338	0.10235	0.10867	0.10226	0.1396	-0.00333	-0.0139	0.12034	**-0.7924**

[a]Bolded numbers show the own-price elasticity.

Factors that influence regular consumption of TAVs and SP

Household consumers expressed several reasons for their regular consumption of TAVs and SP. The leading factor that influences TAV consumption among households in Kenya is the knowledge that TAV has the potential to improve health and nutrition. Approximately 45% of households indicated that TAVs have the potential to improve health; hence, their regular consumption (Fig. 6). This factor is followed by consumer taste and preference (24%). In Tanzania, consumer taste was identified as the leading reason for TAV consumption among 58% of households, while TAV contribution to nutrition/health and high availability were identified as the second and third leading reasons, respectively (Fig. 7). The taste and preferences of consumers could be attributed to both price and non-price factors, such as culture or tradition.

This result suggests that campaigns have resulted in increased consumer awareness of the nutritional benefits of TAV among Kenya consumers compared with consumers in Tanzania. Note that such campaigns by FCI and others have been in existence longer in Kenya than in Tanzania. In addition, the relatively higher level of education among households in Kenya could have enhanced consumer knowledge.

Fig. 6. Consumer reasons for regularity of TAV consumption (Kenya)

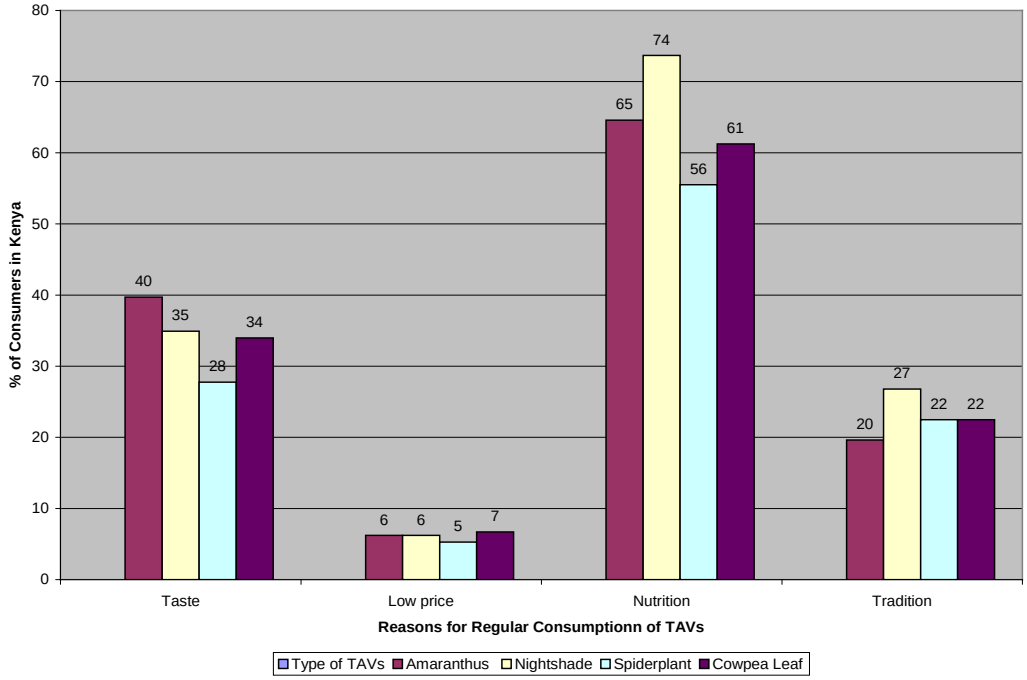
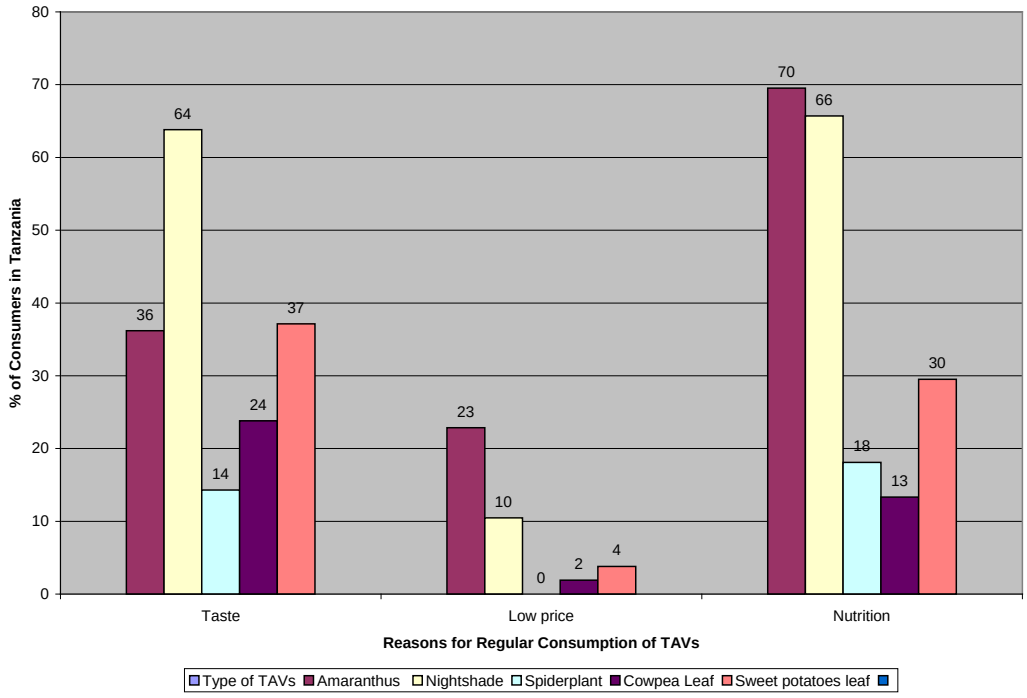


Fig. 7. Consumer reasons for regularity of TAV consumption (Tanzania)



Similarly, Fig. 8 reveals that household consumers in Kenya have expressed that they consume sweetpotato for nutrition/health improvement (35%), taste (20%), and tradition (13%), while consumers in Tanzania have identified taste (60%), improved health/nutrition (50%), and high availability (10%) as the leading reasons for regular consumption (Fig. 9).

Fig. 8. Consumer reason for regularity of SP consumption (Kenya)

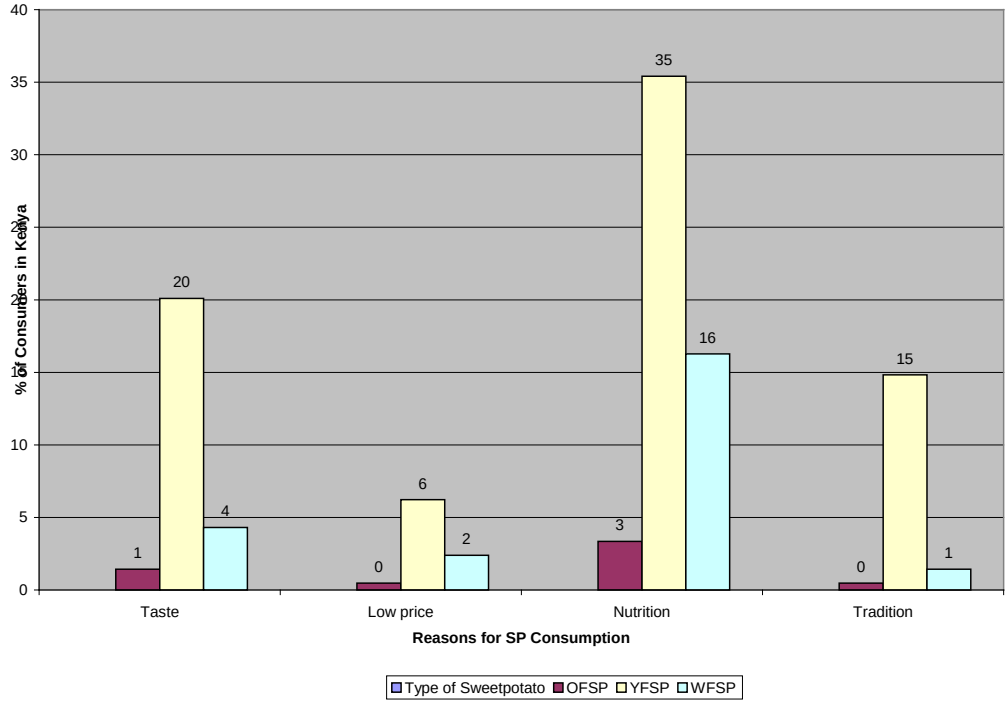
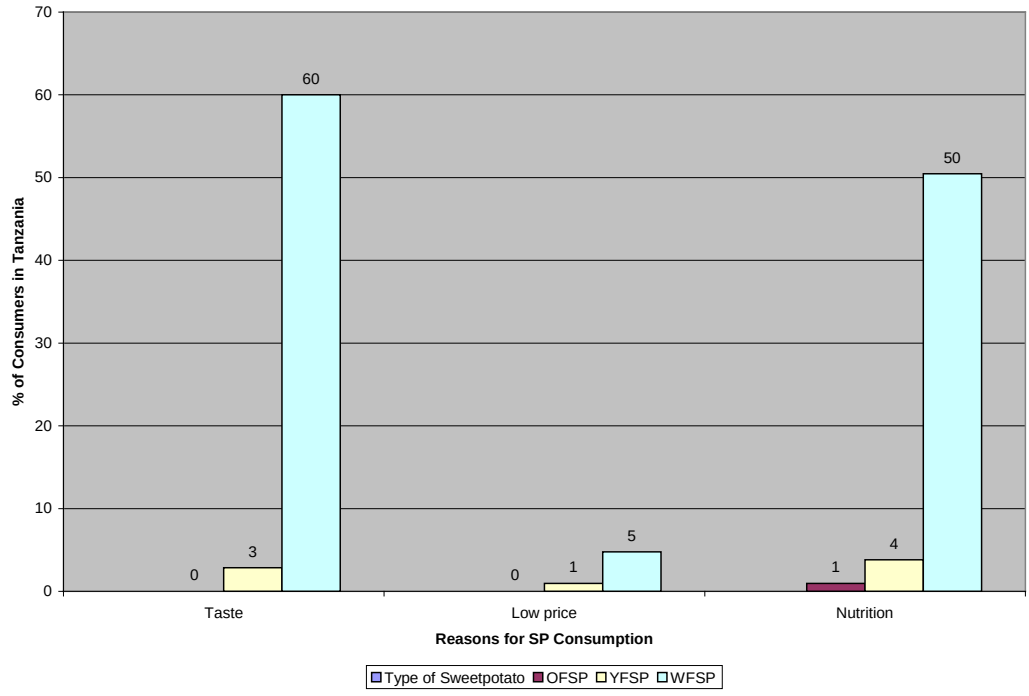


Fig. 9. Consumer reason for regularity of SP consumption (Tanzania)



Where TAVs and SP are purchased

TAV and SP are predominately purchased from open markets in both Kenya (67% for TAV, 61% for SP) and Tanzania (95% for TAV, 88% for SP). Markets in Nairobi (Kenya) are relatively segmented and more diverse compared to markets in Arusha (Tanzania). The segmented nature of the markets in Kenya evidently accounts for the purchase of TAV and SP from supermarkets and groceries by 20% of consumers, while only 5% of consumers purchase from the only supermarket in Tanzania (Table 14).

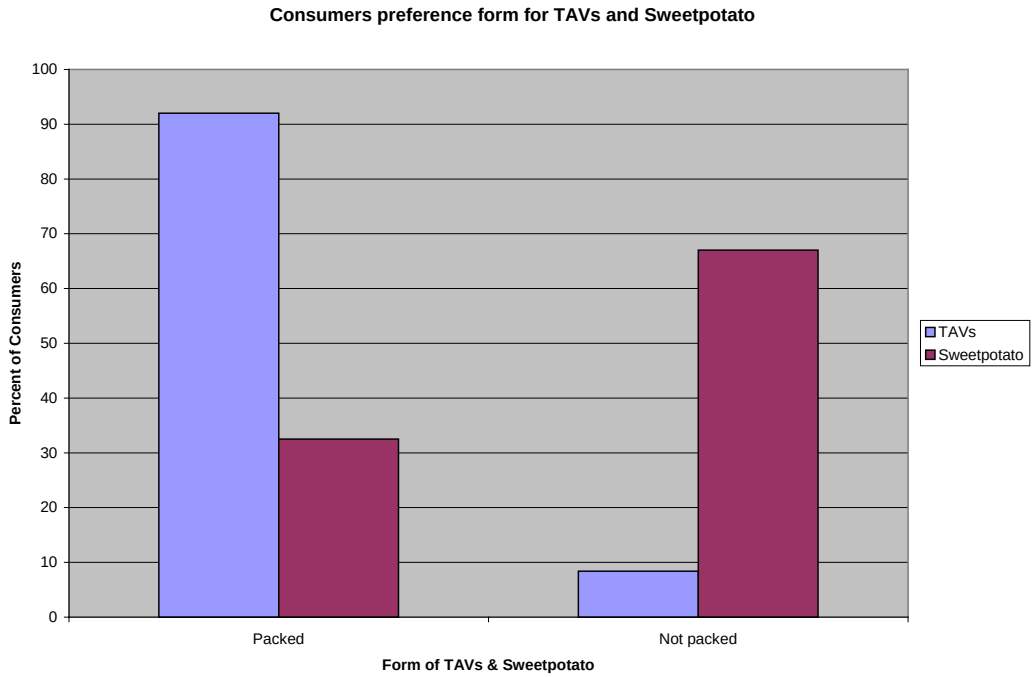
Table 14. Place where TAV and SP are purchased by household

	Kenya (N=209)		Tanzania (N=105)	
Place of Purchase for TAV/SP	**TAV (%)**	**SP (%)**	**TAV (%)**	**SP (%)**
Open-air market	67.0	60.5	95.2	87.6
Supermarket	12.9	7.0	4.8	2.9
Grocery	6.8	4.1	0.0	0.0
Roadside	10.0	5.1	0.0	1.9
Neighbor	0.0	1.0	0.0	1.9
Does not buy	3.3	22.3	0.0	5.7

The type of markets from which consumers purchase TAV and SP are largely influenced by the diverse nature of consumers, their income levels, and socioeconomic status, among many other factors. Consumers in Nairobi are more diverse in terms of their socioeconomic status. This factor tends to influence consumer buying behavior and type of markets from which they purchase TAV and SP.

In Kenya (89%) and Tanzania (67%), consumers prefer TAVs in packed form. On the contrary, only 33% of consumers in Kenya and 67% in Tanzania preferred to buy SP in packed form.

Fig. 10. Consumer-preferred form of TAV and SP in Kenya and Tanzania



Important factors consumers consider when buying TAVs and SP

A number of factors were identified that influence consumer buying behavior of TAVs and SP. For consumers in Kenya, quality of TAV (29%), cleanliness of selling point (28%), and higher quantity per selling unit (11%) are the leading factors (Table 10). These same leading factors tend to influence consumer buying of SP.

Table 15. Factors influencing consumer behavior in buying TAV and SP

	Kenya (N=209)		Tanzania (N=105)	
Factors	**TAV (%)**	**SP (%)**	**TAV (%)**	**SP (%)**
Cleanliness of selling point	27.97	23.10	29.11	28.47
Here I get the best price	7.52	8.66	16.10	15.33
They have the nicest package	2.92	1.08	1.37	1.82
Quality is the best	28.81	32.13	27.05	25.55
Selling unit contains greater quantity	11.27	16.25	15.41	19.34
Convenience of going there	8.56	8.30	6.51	6.93
Safety reasons	1.67	1.44	1.71	1.09
Range of varieties is wider	5.64	3.61	2.40	1.09
Other[a]	5.65	5.41	0.34	0.36

[a]Includes health benefits, customer care, availability, and high nutritional value.

Similarly, cleanliness of selling point (29%), quality of the TAVs, and competitive prices (16%) are the major considerations by consumers in Tanzania.

Constraints faced by consumers in purchasing TAVs and SP

Consumers in Nairobi and Tanzania have identified the constraints they faced in purchasing TAVs and SP (Table 17). High price is the leading constraint faced by consumers in purchasing TAVs and SP in both Kenya (27%) and Tanzania (29%). The high price is related to the limited supply of TAVs, especially during the dry season. Thus, given a relatively stable demand and low supply, prices tend to rise during this period. The price for TAVs over the past three years revealed that retail market prices were relatively high during the dry months from December to April. Also, the prices of some TAVs, especially spider plant and cowpea leaves, are high during the unfavorable cold season (July through August), which limits their production. The second major constraint in purchasing TAVs and SP was low availability, which is closely associated with high price. Poor quality of TAVs and SP was the third major constraint. The poor quality may be due to the varieties of TAV and SP produced or poor handling by marketers.

Table 17. Constraints faced by consumers in purchasing TAV and SP

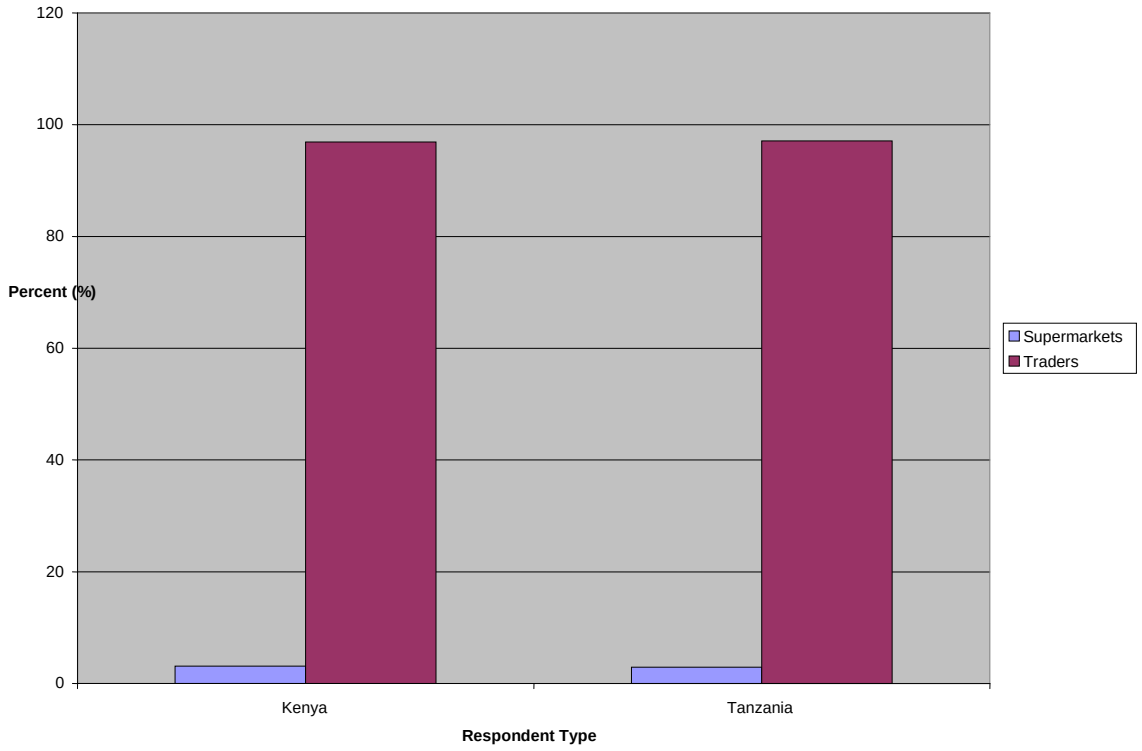
	Kenya (N=209)		Tanzania (N=105)	
Constraints	**TAV (%)**	**SP (%)**	**TAV (%)**	**SP (%)**
Poor shelter, so we are affected by rain	11.0	11.2	11.3	10.0
Poor quality	20.4	29.2	20.4	14.8
High price	27.4	21.3	28.5	35.9
Low availability	24.4	27.5	9.0	10.5
Marketplace/environment is too dirty	10.7	9.0	11.8	11.5
Far distance to market	0.9	0.0	17.2	16.3
Other[a]	5.2	1.7	1.8	1.0

[a]Includes bad opening hours, poor display, and limited variety of choice.

Characteristics of TAVs and SP suppliers

In terms of absolute numbers, traders in Kenya are more diverse in their market operations. There were more traders selling TAV in supermarkets, open-air markets, road side stands, and grocery stores. This is a further reflection of the segmented nature of the markets in Nairobi and the diverse nature of consumers. In both Kenya and Tanzania, approximately 3% of traders/retailers operate from supermarkets, while 97% are traders in the open-air markets, roadside stands, and groceries stores (Fig.11).

Fig. 11. Type of respondent



The gender distribution of traders indicates that in both Kenya and Tanzania, females are the slight majority among traders selling of TAV and SP by 52% and 56%, respectively (Table 18). The majority of traders are under 40 years old, with a proportion of 80% and 65% in Kenya and Tanzania, respectively.

Table 18. Age range of traders by gender (male and female)

	Kenya (N=98)		Tanzania (N=34)	
Age (Years)	**Male (%)**	**Female (%)**	**Male (%)**	**Female (%)**
<30	22.7	8.2	11.8	5.9
30–39	21.6	27.8	23.5	23.5
40–49	3.2	9.3	8.8	23.5
50–59	1.0	2.1	0.0	2.9
≥60	0	4.1	0.0	0.0
Total	**48.5**	**51.5**	**44.1**	**55.8**

The majority of traders in Kenya (98%) and Tanzania (97%) had attained some level of formal education. The level of education attained is relatively higher in Kenya, where 55% of traders attained at least secondary or high school education, while in Tanzania the proportion was 32%. (Table 19). The relatively higher level of education among traders in Kenya may have implications on their market performance.

Table 19. Highest educational level of traders by gender

	Kenya (N = 98)		Tanzania (N = 34)	
Education Level	**Male (%)**	**Female (%)**	**Male (%)**	**Female (%)**
None	0	2.1	0	2.9
Primary	13.4	22.7	23.5	38.2
Secondary/ High school	27.8	26.8	20.6	11.8
College/ University	4.1	2.1	0	2.9
Technical	0	0	0	0
Total	**46.4**	**54.6**	**44.1**	**55.8**

Most of the traders have less than 10 years of trading experience in TAV and SP (Table 20), which is not surprising given the majority of them are relatively young. This also reflects that the promotion of trading TAVs and SP is a relatively recent phenomenon.

Table 21. Years of trading experience in TAV and SP

	Kenya (N=98)		Tanzania (N=34)	
Years of Trading TAV and SP	**TAV (%)**	**SP (%)**	**TAV (%)**	**SP (%)**
1–5	37.1	24.7	29.4	26.5
6–10	21.6	11.3	26.5	26.5
11–15	7.2	3.1	11.8	14.7
16–20	2.1	2.1	5.9	5.9
21–25	1.0	0.0	0.0	2.9

Membership in organization/association

The majority of traders in Kenya and Tanzania do not belong to any organization or association. In Kenya (39%) and Tanzania (35%) of traders indicated that they belong to an organization or association. The associations to which these traders belong are trader organizations, cooperatives, women's groups and community-based organizations (CBOs). Approximately 24% and 3% of traders belong to a trader group in Kenya and Tanzania, respectively (Table 22), while 11% of traders in Kenya and 15% of traders in Tanzania belong to a women's group. Only 1% in Kenya and 17% in Tanzania belong to cooperatives.

Table 22. Membership by type of organization

Organization Type	**Kenya (N=98) (%)**	**Tanzania (N=34)(%) (%)**
Trader organization	23.7	2.9
Cooperative	1.0	14.7
Women's group	11.3	14.7
CBO	2.1	0.0
None	61.9	67.6
Total	100.0	100.0

Given that the majority of traders in both Kenya and Tanzania do not belong to an association or organization suggests that they act as individuals. This assumption has implications for market conduct, especially when dealing with government or market regulatory agencies. A number of advantages can be derived by being a member of an organization or association. First, traders can benefit from economies of scale, such as delivery of TAV and SP to markets. Second, it is easier to disseminate improved practices or knowledge when traders belong to a group. Third, as an organization or association, traders have the potential to influence policymakers and appropriate authorities to provide improved market infrastructures that enhance their marketing activities.

Types of TAVs and SP traded commercially

Among the TAV traded, amaranthus, nightshade, cowpea leaves, and spider plant are the four leading types traded in Kenya and Tanzania. These four types of TAV account for 76% and 61% of all traded TAV in Kenya and Tanzania, respectively. (Table 23).

Table 23. Types of TAV and SP traded commercially

Commercially traded TAV and SP	Kenya (N=98) (%)	Tanzania (N=34) (%)
TAV		
Amaranthus	19.4	18.2
Nightshade	19.8	15.4
Spider plant	18.4	4.2
Sweetpotato	0.8	13.9
Cow pea leaves	18.6	13.3
African eggplant	1.8	11.8
Pumpkin leaves	5.2	0.0
Jute mallow	4.9	0.0
Other vegetables[a]	11.1	23.2
SP		
OFSP	11.4	16.5
YFSP	68.1	25.5
WFSP	25.5	58.0

[a]Includes majaniya mabasa, saro, and chinigi.

In both Kenya and Tanzania, amaranthus and nightshade are the two leading TAVs traded. This finding agrees the survey results among household consumers, where amaranthus and nightshade were the two leading TAVs purchased by households (see Fig. 4). This finding further suggests the existence of high market demand for both amaranthus and nightshade in Kenya and Tanzania.

Among the types of SP traded commercially, YFSP and WFSP are the leading types in Kenya (68%) and Tanzania (58%), respectively. This finding also agrees with type of SP consumers buy most often, where the preference is YSFP and WFSP in Kenya and Tanzania, respectively.

Factors that influence trading of TAVs and SP

The reasons for trading TAVs and SP are presented in Table 24. As expected, good profit is the leading reason for trading TAVs and SP. This factor is influenced by growing market demand in both Kenya and Tanzania. The growing demand may have been influenced largely by population and changes in consumer taste and preference, which in turn may be attributed to increased consumer knowledge of the nutrition/health benefits of TAV and SP that have been promoted in recent years. These results confirm findings from the consumer survey indicating increasing trends in consumption of TAVs and SP over the past 5 years.

Table 24. Reasons for trading TAV and SP

	Kenya (N=98)		Tanzania (N=34)	
Reason	**TAV (%)**	**SP(%)**	**TAV (%)**	**SP(%)**
Good Profit	28.5	27.7	31.5	34.9
Growing demand	24.6	26.2	13.0	9.3
Contract with grower	1.4	0.8	1.9	2.3
Marketing experience	10.1	13.1	14.8	16.3
Available Market	15.0	16.2	18.5	16.3
Availability of Supply	10.6	13.8	13.0	14.0
Cultural reasons to TAV	4.8	0.8	3.7	0.0
Other[a]	4.9	1.5	3.8	7

[a]Includes low competition, lack of alternative jobs, and medicinal value.

Available markets, the third major reason for trading in TAVs and SP, are implicitly related to good profit and growing market demand. Available market and good profit are complementary and are major factors that influence increased and sustained trading of TAVs and SP.

Supply availability is the fourth major factor that influences TAV and SP trading in Kenya and Tanzania. This implies that traders have access to a supply of TAV and SP from producers and suggests that production of TAV and SP is increasing. It further re-enforces the interdependence between the production and marketing of TAV and SP. Producers are motivated to produce commercially when they are assured of a market outlet and price (or profit).

Grades and standards

TAVs and SP are often heterogeneous in quality, mainly due to differences in types and handling. Grading is the process of sorting into lots according to quality characteristics, such as size, color (in the case of SP), etc. Approximately 69% and 77% of TAV traders in Kenya and Tanzania, respectively, grade or undertake value addition to TAVs. In the case of SP traders, 40% in Kenya and 71% in Tanzania undertake grading or value addition. These high percentages reflect consumer preferences to purchase graded or processed TAV and SP (in the case of consumers in Tanzania).

For TAVs, the degree of grading reported by traders is mainly washing/cleaning and removal of petioles or parts of the stem (Table 25). Only 16% of traders in Kenya and 21% in Tanzania add value by chopping vegetables into small pieces. The type of grading or value addition by traders may also reflect consumer preferences. Grading can be a benefit to both buyers and sellers of TAVs and SP. Whereas buyers can increase their satisfaction by obtaining the qualities they prefer, sellers can increase their return by taking the maximum advantage of buyers' quality preferences. In other words, grading enables sellers to tap into different segments of the market.

Table 25. Types of grading and value addition

	Kenya (N=98)		Tanzania (N=34)	
Grading/Value Addition	**TAV (%)**	**SP (%)**	**TAV (%)**	**SP (%)**
Wash /clean	45.1	7.6	42.9	54.3
Remove petioles or parts of stem	30.6	NA	35.7	NA
Chop vegetables into small pieces	16.0	NA	21.4	NA
Sort by size	NA	75.8	NA	42.9
Roast/cook	NA	16.7	NA	2.9
Tie into bundles	4.2	NA	NA	NA
Refrigerate	2.8	NA	NA	NA
Quality	1.4	NA	NA	NA

NA = not applicable.

SP grading is largely done by sorting according to size in Kenya (76%) and washing/cleaning in Tanzania (54%), followed by sorting (43%). The influencing factors may reflect consumer preferences in the respective markets. Grading has several advantages: (1) it may reduce market spoilage by separating poorer and higher quality TAVs and SP; and (2) it can contribute to market competition and pricing efficiency. The product homogeneity resulting from grading TAVs and SP can also encourage price competition between sellers and reduce abnormal profit.

Value addition to TAV is undertaken by 65% and 71% of traders in Kenya and Tanzania, respectively. The packaging is mainly tying vegetables in bundles, which facilitates handling and ease of transport to markets. A majority of traders indicates that packaging TAV in bundles influences sales in Kenya (62%) and Tanzania (74%). The nature of the influence on sales is attracting more customers; increasing the quantity of TAV sold, and retaining existing customers (Table 26).

Table 25. How packaging influences sale of TAV and SP

	Kenya (N=98)		Tanzania (N=34)	
Influence on Sales	**TAV (%)**	**SP (%)**	**TAV (%)**	**SP (%)**
Increased quantity sold	25.9	19.8	25.5	23.7
Higher prices	0.0	0.0	21.3	26.3
Attract customers	43.4	50.6	46.8	42.1
Retain customers	17.5	24.7	6.4	7.9
Extra expenses	1.4	0.0	0.0	0.0
Convenience during selling	5.6	2.5	0.0	0.0

Others influences include: saves time, easy identification, and expensive polythene bags.

The picture that emerges is that there exists a high market potential for TAVs and SP when value addition is undertaken in the form of packaging and presentation. Traders that add value to TAV and SP are likely to attract more customers and, therefore, increase their volume of sales. This in turn has led to increased revenue and profit.

TAV and SP "dumping"

In general, vegetables are highly perishable. They remain fresh for only a few hours and start to deteriorate unless refrigerated. At the end of the market day, if traders were unable to sell their TAV, they might be forced to dump them. Dumping means throwing TAVs away, giving it away for free, etc. Dumping implies lost revenue that would otherwise have accrued to traders from their trading activities. The average percentage of TAV and SP dumped per day and per week by traders is presented in Figs. 12 and 13.

Fig. 12. Average percentage of TAV and SP dumped by traders in Kenya

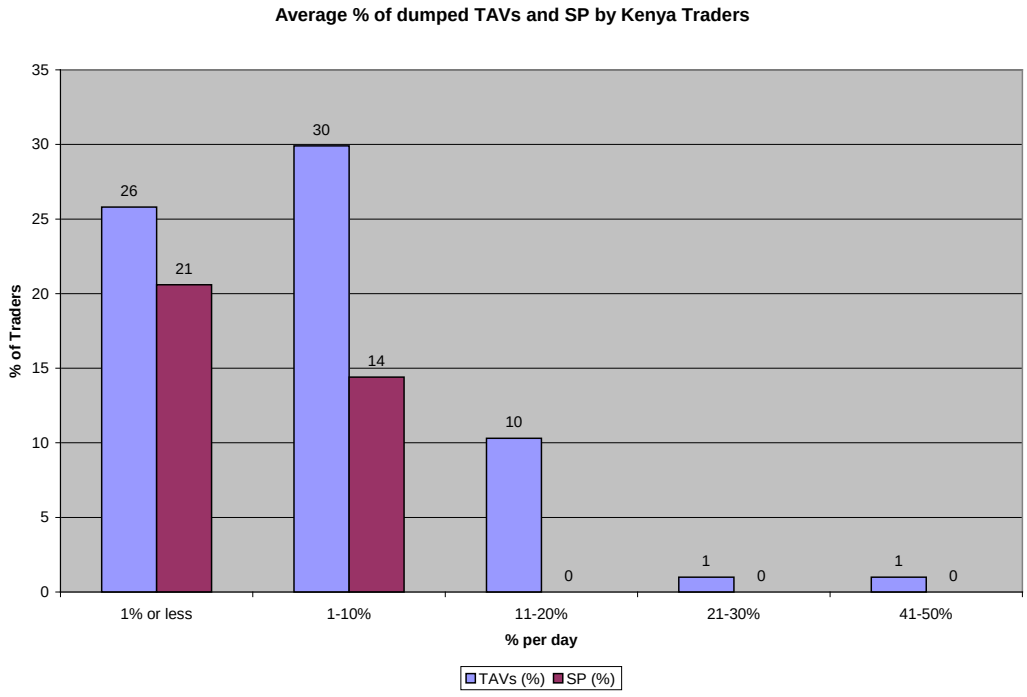
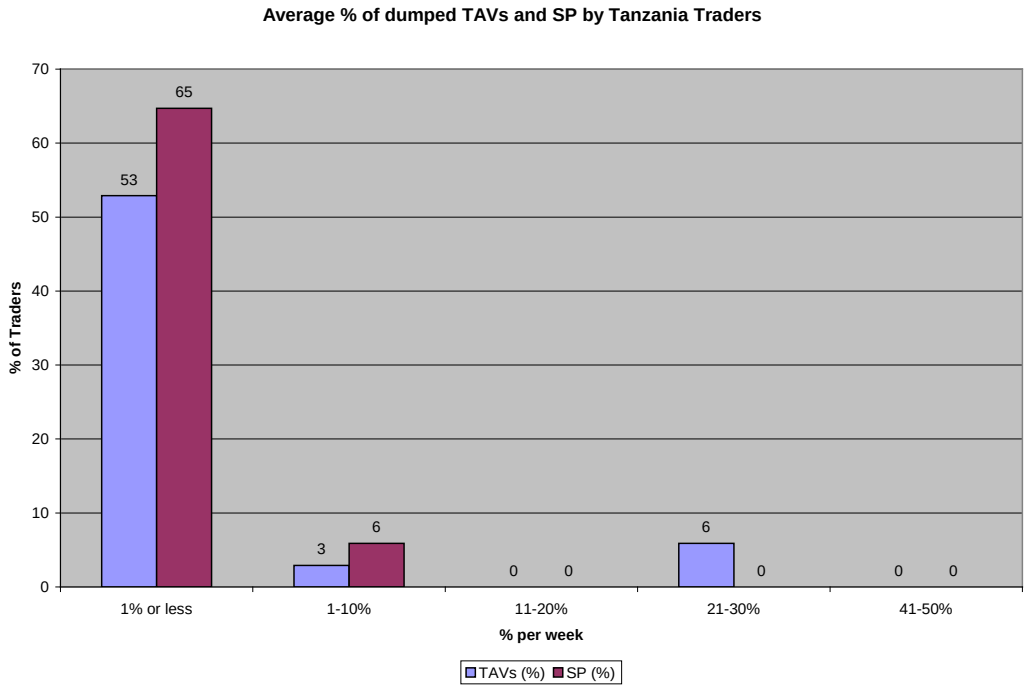


Fig. 13. Average percentage of TAV and SP dumped by traders in Tanzania



Of the 1% or less of TAV dumped per week, the percentage of traders in Tanzania (53%) is higher than the percentage of traders in Kenya (26%). Of the 1% or less of SP dumped per week, the percentage of traders in Tanzania (65%) is higher than the percentage of traders in Kenya (21%). But more traders in Kenya reporting dumping higher percentages (1-10%) of TAVs and SP than did traders in Tanzania. This may indicate that Tanzanian traders are better at predicting the total amounts that they can sell within a given period of time.

Recommendations

Based on the results of the analysis carried out in this study, the following policy implications and recommendations are suggested to address existing gaps in commercialization of TAV and SP and to create a wider impact for improved livelihoods.

1. Increase awareness of the nutritional benefits of TAV and SP

The findings of this study revealed limited consumer knowledge of the nutritional benefits of TAVs, especially among households in Tanzania. There should be increased promotion of the nutrition/health benefits of TAV consumption. Increasing consumer awareness could potentially increase consumer demand, which in turn could stimulate increased production, leading to increased sales and revenue for producers and traders.

2. **Improve grades and standards**

Consumers of TAV in both Kenya (89%) and Tanzania (73%) have expressed preference to purchase TAVs in packed form. TAV and SP traders have acknowledged the positive contribution of packaging in attracting more customers, increasing sales, and obtaining higher prices. This indicates that there is high market potential regarding the introduction of grades and standards, as well as processed TAV and SP products. Efforts should target undertaking simple improvements grades and standards to add value to TAVs and SP.

3. **Promote quality TAV and SP**

A major factor that influences consumer buying behavior is the quality of TAVs and SP. Thus, awareness should be created among producers and traders on the significance and potential of producing and marketing good quality TAVs and SP in influencing consumer demand.

4. **Ensure regularity of TAV and SP supply**

The supply of TAVs and SP is limited during the dry season, so prices are relatively high during this period. Efforts should be made to explore options of increasing the supply of TAVs and SP during the dry season or short rains. For instance, using supplementary irrigation as well as drought resistant or early maturing varieties of TAV and SP could be explored to increase year-around supply.

5. **Strengthen trader organizations/associations**

The majority of traders in Kenya and Tanzania do not belong to a trader organization or association. Traders stand to benefit from membership in an organization or association. There is the need to strengthen existing organizations and create awareness among traders on the advantages of membership.

6. **Improve market facilities**

Cleanliness of selling points was identified as a major factor that influences consumer buying behavior for TAVs and SP. Policies should encourage the provision of clean and friendly market facilities to encourage market transactions. Traders should be made aware that having clean selling sites is likely to increase their business.

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Annex C

Impact on Production, Marketing, and Consumption of Traditional African Vegetables and Sweetpotato in Kenya and Tanzania

Elaborated by
Wachira Kaguongo

June 2010

Traditional FOODS
For wealth & health

Contents

Definitions

Commercialization. Percentage of farmers selling surplus of target crops from a group of participants or non-participants.

Adoption. Percentage of farmers cultivating a target crop from a group of participants or non-participants.

Difference in level of adoption/commercialization. Difference between percentage of participant and non-participant farmers adopting/commercializing one or more target crops.

Participant farmers/participants. Farmers who were involved in project interventions and who composed "treatment" group in impact analysis.

Non-participant farmers/non-participants. Farmers who were not involved in project interventions and who composed "control" or comparison group in impact analysis.

Abbreviations and acronyms

AVRDC	World Vegetable Center
CIP	International Potato Center
CV	Commercial village
FAO	Food and Agricultural Organization
FCI	Farm Concern International
KARI	Kenya Agricultural Research Institute
KSH	Kenya shilling
MSU	Marketing support unit
MoA	Ministry of Agriculture
OFSP	Orange-fleshed sweetpotato
SP	Sweetpotato
TAV	Traditional African vegetable
TSH	Tanzania shilling
USD	United State dollar
WFSP	White-fleshed sweetpotato
YFSP	Yellow-fleshed sweetpotato

Introduction

The Traditional Foods (TF) project aimed at increasing productivity, utilization, and marketing of traditional African vegetables and sweetpotato (specifically, orange-fleshed sweetpotato) in Kenya and Tanzania. The purpose was to streamline efficiency of traditional African vegetable (TAV) and sweetpotato (SP) value chains and to improve the health, nutrition, and income of vulnerable groups. The project promoted sweetpotato and six traditional African vegetables: amaranth (*Amaranthus spp*.), African nightshade (*Solanum scabrum/villosum/americanum)*, spider plant (*Cleome gynandra*), cowpeas (*Vigna unguiculata*), sweetpotato leaves, and African eggplant (*Solanum aethiopicum*).

The project specifically focused on cultivation, consumption, and marketing of orange-fleshed sweetpotato (OFSP), a particularly promising food because of the high level of pro-vitamin A carotenoids. Furthermore, sweetpotato has potential of contributing to food security in Sub-Saharan Africa because it often survives when other crops (e.g., maize) fail. It is less labor intensive compared with other staple crops, it is vegetatively propagated, and it can be planted over a range of time without considerable yield loss. Most varieties in Sub-Saharan Africa are white-fleshed, which lack beta-carotene, the precursor of vitamin A.[1]

To ensure that efforts in commercialization and marketing benefitted targeted households, Farm Concern International (FCI) used the commercial villages approach (CVA). Targeted villages were designed to increase the village cash economy through commercialization of crops and further enhance household food security and nutrition.

This study evaluated impact of the interventions by examining and comparing adoption, consumption, and marketing of TAV between participant and non-participant farmers before and after project interventions. The baseline survey was conducted in September–October 2007, and the adoption survey was conducted in November–December 2009. The two surveys (structured questionnaires) gathered information on cultivation, consumption, and marketing of TAV in households. The study compared farmers in target villages ("participants") with farmers in control villages ("non-participants").

Objectives of the impact study

The objective of this study was to evaluate the impact of project interventions by examining and comparing incomes, adoption, consumption, and marketing of target crops between participant and non-participant farmers before and after project interventions. A baseline survey was used to understand household characteristics, production, marketing practices, and consumption behavior of farmers in target areas at the beginning of the project to be able to evaluate intervention effects using an impact survey at the end of the project. The study also examined the

[1]Stathers, T., S. Namanda, R.O.M. Mwanga, G. Khisa, and R. Kapinga. 2005. Manual for Sweetpotato Integrated Production and Pest Management Farmer Field Schools in sub-Saharan Africa. International Potato Center, Kampala, Uganda.

base scenario of targeted beneficiaries and non-beneficiaries to allow contrasting the two groups on aspects of input sourcing, production, marketing, and consumption of target crops after interventions.

Methodology

The impact study comprised a baseline, which was conducted at the start of the project, and an impact survey, which was conducted at the end of the project. The two surveys employed structured questionnaires that were developed in collaboration with socio-economists, agronomists, breeders, nutritionists, and specialists in gender and value chain approaches from CIP, FCI, UH (Kenya), AVRDC (Tanzania), and Cornell University (USA). The surveys were pre-tested with farmers, traders, and consumers in each country, and then revised using feedback from the field to help capture information relevant to the study.

Sampling and data collection for baseline and adoption surveys

Data for the producer baseline survey was collected between 23 September and 11 December 2007 from the four intervention areas: Kiambu, Kabondo, and Busia in Kenya, and Arumeru in Tanzania. Each site had four commercial villages (CV), and each CV comprised about six farmer groups with an average of 19 participants per group. Representatives of participant farmers (beneficiaries) and non-participant farmers (non-beneficiaries) were interviewed for the baseline and impact surveys. The non-participants farmers, who acted as a control group for the study, were sampled from villages with characteristics similar to the villages of participating farmers. Data for the producer adoption survey was conducted in November–December 2009 and covered the same sites where baseline survey was carried out.

During the impact survey, a total of 676 farmers were interviewed, of which 392 were participants and 284 were non-participant farmers (Table 1). There was high attrition among the original participant farmer group—out of 400 sampled participants interviewed for the baseline survey, only 112 (28.0%) continued with the project. An additional 280 participants were randomly selected from current lists of participants to construct the final survey sample. Among the 400 non-participants interviewed for the baseline survey, 87.9% were interviewed for the impact survey.

Data analysis was conducted in two steps. The first step compared participants (392) with non-participants (284) using impact survey data. The results of this step comprises section one, which gives details about the characteristics of participants and non-participants and evaluates differences in production, knowledge, consumption, and marketing of the target corps. The second step compared the sub-group of participants (112) and non-participants (284) who participated in both the baseline and impact surveys to see differences between the two groups and between year 1 and year 2. This step comprises section two of the report, which details the characteristics of this sub-group and examines changes in differences between them over time on

knowledge, production, consumption, and marketing of the target crops using difference in differences (D in D) method.

The D in D methodology used in this study recognizes that the treatment group (participants) and comparison group (non-participants) did not have same values for the outcomes being evaluated prior to treatment; therefore, the double difference method was preferred. This approach takes into account that the treatment group may have had superior outcomes prior to the project interventions and better performance post-intervention should not be attributed to intervention. The double difference method, which is the difference in the changes of the treatment and comparison during the project period, removes the time invariant differences in factors influencing the outcomes between participants and non-participants[2]. Table 2 shows the framework of impact analysis.

Data collected was entered and cleaned using CSPro, and SPSS was used for processing and analysis. The study used descriptive statistics, ANOVA, and Chi-square to compare activities of participants and non-participants before and after project implementation. Level of significant was tested at 5%.

Results

Farm descriptions

Household characteristics

One-third of the households were headed by females, and the mean age of household head for the whole sample was 47.2 years (Table 8). Household heads of participants in Kenya and Tanzania were slightly older than non-participants. In Kenya, more households of participant farmers were headed by females (40.5%) compared to those of non-participant farmers (17.0%). The project worked with farmer groups, and some of the existing farmer groups were made up of widows. On average, household heads had 7.5 years of education, which was the same between participants and non-participants in all sites. The mean household size for the entire sample was 6.2, and there was no statistical difference between participants and non-participants. However, farmers in Kenya had slightly bigger families compared to non-participants.

Housing materials

Metal sheets were the predominant roofing material (82.5% of all roofs). Most houses had walls build of mud, stone, or bricks. There was no significant difference between participants and non-participants.

[2]The World Bank-http://www.worldbank.org/ieg/ecd/ dated Feb 2010

Electricity

Most households did not have electricity. Only 18.2% and 20.7% of participants and non-participants, respectively, had electricity.

Latrine

Nearly all households visited had a latrine, although in Kenya about 6% of households did not have latrines. There was no significant difference between participants and non-participants. All farmers in Tanzania had latrines.

Source of drinking water

In all Kenyan districts, springs and wells/boreholes were the main sources of drinking water. Surprisingly, 50% of the farmers in Tanzania had access to piped water, while only about 5% of farmers in Kenya had piped water. There were no significant difference between participants and non-participants in each country.

Ownership of equipment and tools

Farmers in Kenya had more equipment and tools than farmers in Tanzania; hence they could be viewed as slightly wealthier. More farmers in Kenya had TVs, mobile phones, radios, irrigation pumps, tube wells, and wheel barrows than farmers in Tanzania (Table 10). Radios and mobile phones, which are important for obtaining crop production and marketing information, such as commodity prices, were the most common equipment owned by 81.5% and 73.4% of farmers in Kenya and Tanzania, respectively. There were no significant differences between participants and non-participants who owned radios and mobile phones in Kenya, although in Tanzania a high number of non-participants owned mobile phones. TVs, which are also important for obtaining information, were owned by 36% of the farmers, and there were no significant difference between the participants and non-participants. Slightly more participants than non-participants had more equipment and tools used for production of TAV, such as hand sprayers and watering cans.

Income sources

The main source of income was selling food crops (ranked by more than 60% of respondents as most or second-most important), followed by wages or salaries and livestock products (each ranked by over 30%) (Table 12). A significantly higher percentage of participants (40.1%) than non-participants (17.6%) ranked TAV as the first and second important sources of income among farm enterprises.

Farm and farming activities

The average size of agricultural land owned by each household in both Kenya and Tanzania ranged between 0.95 and 1.25 ha (2.4 and 3 acres). (Table 10). Cattle were an important part of the farming system, and over 70% of households had at least one head of cattle (Table 9). On average, farmers had an average of three heads of cattle per household; although non-participants had an average of two and participants had an average of three, the difference was not statistically significant. Poultry was another important livestock owned by over 75% of the farmers.

Major crops grown in each site

More than 90% of all farmers grew maize, and 80% grew beans (Table 11). TAVs were grown by over 70% of surveyed farmers, while sweetpotato were grown by over 50%. Other important crops were cassava, kale, bananas, sorghum, and potatoes. Among the target crops (TAV), the most commonly grown were nightshade (70.0%), amaranth (62.9%), cowpea (63.9%), spider plant (53.1), and sweetpotato (58.4%). Sweetpotato leaves and African eggplant were less common.

Adoption and commercialization of target crops

Assessment of impact of the project through adoption of cultivation of target crops and market access was challenging due to the short period of project implementation and the prolonged drought experienced in most of the sites in both countries. Thus evaluation of impact of the interventions relied more on percent adoption rates and less on area under cultivation with the target crops and the volumes marketed at each season. Since majority of farmers had crop failure in a number of seasons preceding impact assessment to overcome this challenge this study considered targets crops grown within the four seasons of project life. However, for 75% of both participants and non-participants one season before the impact survey was the last time they had successful crop of TAVs (Table 14).

Cultivation and selling of TAVs

There was higher adoption and commercialization of TAV among participants than non-participants (Table 13). Significantly more participant (94.9%) than non-participant farmers (75.0%) grew TAVs. The diversity of TAVs grown by participants (3.3) was also higher than for non-participants (2.7).

More participants (40.2%) had commercialized TAVs compared to 25.5% of non-participants. Participants sold an average of 2.3 types of TAVs, whereas non-participants sold on average of 1.1 types of TAVs.

In both Kenya and Tanzania, 74.0% of participants grew amaranth compared with 47.5% of non-participants. More participants also sold amaranth (47.2%) compared with non-participants

(17.3%). Nightshade, which was grown by more participants (79.6%) than non-participants (56.7%), was also more commercialized by participants (60.7%) than non-participants (23.9%), indicating a group difference of 36.8% in commercialization (Table 13). Similarly, the group difference between participants and non-participants in adoption of spider plant was 21.1%; for cowpea, 14.9%; for sweetpotato leaves, 9.1%; and for African eggplant, 11.5%. The group difference in commercialization of spider plant was 30.6%; for sweetpotato, 4.7%; and for African eggplant, 7.8%.

These results indicate TAVs were more highly adopted by participants than non-participants during the impact survey. However, to evaluate the impact of project interventions, status at the impact survey is compared with status at baseline survey in the last section.

Area under TAVs

The mean area under all kinds of TAVs in Kenya was 0.0257 ha, and in Tanzania, 0.0466 ha (Table 15). In Kenya, participant farmers had statistically more acreage under TAV (0.0311 ha) than did non-participants (0.0178 ha), and similar trend was observed in Tanzania. Participating farmers in Kenya grew more amaranth, nightshade, spider plant, and cowpea than did non-participants. In Tanzania, participants had more land under different types of TAVs than did non-participants. This difference in area was possibly because non-participants were growing TAV mainly for home use, while participants were more commercialized.

Producing and marketing sweetpotato

The three sites where sweetpotato interventions were introduced were Kabondo and Busia in Kenya and Arusha in Tanzania. In Kenya, 99% of participating and non-participating farmers interviewed in Kabondo and Busia grew sweetpotato, while in Tanzania, only 21.3% grew sweetpotato (Table 17).

In Tanzania, adoption of sweetpotato showed a significant difference between participants (34.1%) and non-participants (6.4%). There was high level of commercialization of sweetpotato in both countries, with a 19.8% difference in level of commercialization, with 61.1% of participants and 41.3% of non-participants selling sweetpotato.

Over 90.0% of both participants and non-participants in Kenya had grown sweetpotato one season before the survey (Table 18). In Tanzania, about 60.0% of the few participants (34.1%) growing sweetpotato had grown it one season before the survey, whereas 60.0% of the few non-participants (6.4%) had last grown sweetpotato two seasons before the survey.

OFSP production was done by only 38.9% of farmers. There were significant differences in the number of participants (47.3%) and non-participants (25.4%) who grew OFSP in Kenya, while in Tanzania, only participants (48.4%) grew OFSP. There was a 21.9% difference in the level of adoption between participants (47.3%) and non-participants (25.4%) who grew OFSP in Kenya.

Commercialization of OFSP was also higher among the participants (21.6%) than non-participants (5.2%).

These results show that project interventions improved access to markets for sweetpotato and that adoption of OFSP production improved due availability of markets. However, more analyses were conducted to examine changes attributable to interventions (section two).

Area under sweetpotato

In Kenya, the area under sweetpotato for participants was 0.182 ha per household, and for non-participants, 0.178 ha per household. In Tanzania, the area under sweetpotato for participants was 0.588 ha per household, and for non-participants, 0.632 ha per household (Table 19). However, sweetpotato yields were slightly higher for participants (13,104 kg/season) than for non-participants (12,083 kg/season).

In both countries, the area under OFSP was higher among participants than non-participants. Participants in Kenya grew an average of 0.072 ha of OFSP, and non-participants grew an average of 0.056 ha. Participants in Tanzania were grew an average of 0.253 ha.

The area under sweetpotato and quantities harvested between participant and non-participant farmers increased slightly, which could be associated with project interventions.

Marketed sweetpotato

There was no significant difference in quantity of sweetpotato sold per season per household by participants (848.2 kg) and non-participants (802.7 kg) in Kenya and Tanzania (Table 20). Similarly, the proportion of sweetpotato marketed by participants (21.55%) and non-participants (20.8%) was not significantly different. However, when the high level of commercialization by participants (61.1%) is compared with that of non-participants (41.3%), the quantity of sweetpotato marketed by participants is higher.

Information dissemination, training, and group membership

Training and extension service

A high number of participant farmers benefited in the production and market information disseminated by the project. There was a significant difference between the proportion of participants and non-participants who received training or information in the 12 months preceding the impact survey (Table 22). While more than 75% of participant farmers had received information on new varieties of TAV and sweetpotato, less than 50.0% of non-participants had received such information. FCI distributed information about new varieties and prices of commodities among the participating farmers in Kenya and Tanzania. Friends and neighbours were second important sources of such information. AVDRC was also an important

source of similar information for a third of both participants and non-participants in Tanzania. About 45% of participants had received some agricultural training from AVRDC within one year preceding the survey.

Although radio is assumed to be a major media source for disseminating agricultural production and marketing information, in this case, only 10% of both participants and non-participants had received information through radio.

About 80.0% of participant farmers in Kenya and Tanzania reported they had been trained by FCI extension staff, whereas only 8% of non-participants said they had received training from FCI. The trainings were on market-oriented production, farmer groups, and finances and saving.

The training of community-based technical experts (COTE) had a positive effect, as 40.0% of participant farmers and 8.0% of non-participants reported having received training from COTEs. Trainings from COTEs were mainly on marketing and production of TAV and sweetpotato.

Group membership and group activities

While all participant farmers in Kenya and Tanzania belonged to at least one farmer group or agricultural association, less than 20.0% of non-participants were members of such groups (Table 22). More farmers belonged to non-agricultural groups in Kenya (46.0%) than in Tanzania (9.5%). There was a significant difference between participant farmers and non-participant farmers who belonged to groups

Record keeping

Record keeping remained a challenge for most farmers: few farmers in Kenya and Tanzania kept records. However, there was a significant difference between participants (24.2%) and non-participants (9.9%) who kept budget records (Table 22). Another small proportion of farmers (28.8% of participants and 7.5% of non-participants) kept sales records. More participants than non-participants kept sales records in Kenya and Tanzania, and 31.2% of participants and 6.7% of non-participants kept financial records for TAV or sweetpotato.

Savings and credit

The project involved educating farmers on the importance of savings and operating saving accounts with banks, micro-finances, and other saving institutions to help save incomes from sales of target crops. The farmers were also linked to financial institutions to help them access credits. A greater number of participant farmers in both countries belonged to savings schemes compared with non-participant farmers; 68.1% of participants in Kenya and 57.1% in Tanzania belonged to savings schemes compared with 47.1% of non-participants in Kenya and 10.3% of non-participants in Tanzania (Table 23).

In Kenya, 66.5% of participants belonged to farmer groups with bank accounts compared with 33.5% of non-participants. A similar trend was observed in Tanzania, where 31.4% of participants operated bank accounts compared with 25.0% of non-participants.

The percentage of participant farmers who had individual bank accounts (44.1%) was slightly higher than that of non-participants (31.7%), although the difference was not statistically different. A very small proportion of both participant and non-participant farmers had individual bank accounts in Tanzania (9.5%). About 44.7% of individual bank accounts in Kenya and 46.3% in Tanzania were opened within the project period, but there was no significant difference between participants and non-participants.

In Kenya, a significantly higher percentage of participants (52.0%) were saving some income from TAV or sweetpotato than were non-participants (27.2%). In Tanzania, although only 8.1% of the entire sample was saving from target crops, a significantly higher number of participants (14.1%) than non-participants (1.4%) were saving.

Farmers benefiting from sales of target crops used the money to purchase basic food (50%), pay school fees (14.8%), and buy livestock (8.4%). Income from sweetpotato was used to purchase the same products and services.

About 22.8% of farmers had received credit within one year; significantly more participants (28.3%) than non-participants (15.1%) had received credit. Over 60% of credit in Kenya was received by household females, while in Tanzania, household males received the most credit of non-participants (54.5%). For participant farmers in Tanzania, over 60% of credit was received by females. This finding means that female participants in Tanzania benefited from the project through increased access to credit.

Farmer associations (35.4%), self-help groups (27.7%), and banks (23.1%) were the most important sources of credits. Starting small businesses (34.8%) was the most common purpose for obtaining credit, followed by purchase of livestock (28.3%) and paying school fees (27.5%).

Knowledge and consumption

Project interventions involved creating awareness about the nutritional importance of TAVs and sweetpotato and raising consumption of the target crops. After improving their nutritional awareness, participant farmer households were expected to increase their consumption of target crops.

Knowledge

About 83.4% of the farmers had heard about vitamin A; there was no significant difference between participants and non-participants in Kenya. In Tanzania more participants (89.0%) than non-participants (71.8%) had this knowledge (Table 24). A significantly higher percentage of participants (80.2%) than non-participants (60.7%) in Tanzania knew that vitamin A protects the

body. Although about 50% of participants and non-participants in Tanzania knew that vitamin A is important for vision, only 32.6% of farmers in Kenya had such knowledge. A higher proportion of participants (37.5%) than non-participants (25.6%) in Kenya knew that that vitamin A was important for vision.

About 60% of participants and non-participants in Kenya had heard about iron compared with a significantly higher percentage of participants (82.4%) than non-participants (57.7%) in Tanzania. Significantly more participants in Tanzania knew that iron helps prevent anaemia and is found in blood compared to non-participants. In Kenya, there was no significant difference between participants and non-participants who knew about the contribution of iron in blood formation and anaemia control.

Over 90% of both participants and non-participants knew there were some health benefits from consuming TAV. A significantly higher percentage of participants in (43.1%) than non-participants (29.2%) in Kenya knew that TAVs help strengthen the body's immunity. Most farmers (over 80%) in both countries believed that TAVs have medicinal properties.

There was a significant difference between the proportion of participants (72.4%) and non-participants (44.4%) who knew about the health benefits of consuming OFSP. Significantly high percentages of participants in both countries also knew that OFSP is rich in vitamin A.

Consumption

When the types of food consumed by households in the seven days preceding the survey were evaluated, it emerged that a significantly higher percentage of participants in Kenya consumed TAVs (95.7%) than did non-participants (86.3%) (Table 25). Although not significant, more participants (85.7%) than non-participants (79.5%) consumed TAVs in Tanzania. In Kenya, significantly more participants than non-participants consumed amaranth, nightshade, and spider plant. In Tanzania, more participants than non-participants ate amaranth, cowpea leaves, nightshade, and spider plant.

During the seven days preceding the survey, over 65% of both participating and non-participating farmers in Kenya had consumed sweetpotato. However, in Tanzania only 28.6% of participants and 19.2% of non-participants had consumed sweetpotato. Interventions included promotional messages on the importance of feeding children ages 2–5 years with the target crops, which provide essential minerals and vitamins. As a result, a higher proportion of participant than non-participant farmers fed their children TAV (Table 26). In Tanzania, a higher proportion of participants fed children with all type of target crops except cowpea.

It was also found that the communities involved in the project regarded TAVs and sweetpotato as inferior food; in most cases, they were not considered among the best foods to offer visitors. To gauge whether farmers' perception had changed, farmers were asked if they offered the two target crops to their visitors. In both countries, more participants (90.0%) than non-participants

(74.2%) offered TAV to visitors. Similarly, more participant (77.7%) than non-participant farmers (62.9%) offered sweetpotato to visitors.

Collective action

Farmers were expected to benefit through collective action producing and marketing TAVs and sweetpotato. Collective action in input sourcing and selling target crops was expected to reduce transaction cost and, hence, increase the net income of farmers. Collective action was also expected to help farmers access markets by enabling them to achieve the minimum volumes required by wholesalers and other bulk buyers.

It was found out that 11.5% of the participant farmers sourced inputs for production of TAV collectively (compared to only 1.1% non-participants (Table 27). Similarly, a slightly higher proportion of participant farmers (6.4%) sold TAV collectively compared to non-participant farmers (0.4%).

The Kiambu area had the highest proportion of participant farmers sourcing inputs (25.0%) and marketing (24.0%) TAV collectively (Table 28). This could be one of the reasons why a higher proportion of participant farmers in Kiambu than at other sites were able to access formal markets.

About 19.3% of participants who grew sweetpotato sourced inputs, such as vines, collectively compared to 2.3% of non-participants. Similarly, more participants (5.4%) than non-participants (0.9%) had sold sweetpotato collectively.

Impact evaluation

The sub-group of participants who participated in both the baseline and impact surveys (112) were compared with the non-participants who participated in both surveys (284) to see any differences between the two groups and between year 1 and year 2.

Although impact evaluation may require examination of adoption and commercialization by site due to the heterogeneity of sites (cultural differences, agro-ecological characteristics, and proximity to big, urban towns), the high attrition of participant farmers meant that sample sizes were too low at some sites to allow drawing any meaningful statistical inferences. The number of participants involved in both surveys was reduced to 112 (55 from Busia, 29 from Kabondo, 18 from Kiambu, and 10 from Arumeru) compared with the number of non-participants, which remained high, with a total of 284 (69 from Busia, 66 from Kabondo, 71 from Kiambu, and 78 from Arumeru) (Table 1). Due to this constraint, impact analysis was mainly conducted at aggregated level.

Household characteristics of impact sub-samples

About quarter of the households was female-headed, and the mean age of household head for the sub-sample was 43.9 years (Table 3). Participants were relatively older than non-participants (50 and 41 years old, respectively), and farmers in Tanzania (39 years) were slightly younger than farmers in Kenya (45 years).

On average, household heads had 7.8 years of schooling; there was no significant difference between participants and non-participants. The mean household size for the sub-sample was 6.3 (range, 6.1–6.6); there was no statistical difference between participants and non-participants in Kenya and Tanzania.

All farmers in Tanzania had latrines, whereas in Kenya 6.0% did not. About 50% of farmers in Tanzania had piped water, while in Kenya only 6% did. This finding could be due to the fact that the majority of farmers in Tanzania were from the peri-urban areas of Arusha. In Kenya 46.8% had shallow wells compared to only 8% in Tanzania. Less than 20% of the entire sample had electricity.

Cultivation of target crops

Adoption of TAV and sweetpotato

On average, no major changes occurred in the number of farmers growing at least one type of TAV or sweetpotato (Table 4), nor were there major differences in changes of growing target crops that could be attributed to project interventions. This finding means that interventions possibly led to increased intensification or commercialization. However, the number of farmers growing OFSP increased by 23.6% for participants, which was 18.1% higher than the 5.5% of non-participants.

Commercialization of TAV generally increased for all farmers, but that of participants increased by 27.3%, which was 12.45% above the 14.9% of non-participants. Similarly, there was a higher increase in commercialization of sweetpotato for participants (23.7%) compared to non-participants (9.4%). A similar difference was seen between participants and non-participants in commercialization of OFSP.

These observations support the earlier findings that indicated participant farmers benefited from project interventions mainly through commercialization of target crops and growing OFSP.

Evaluation of adoption of target crops by site showed that although the proportion of participants growing target crops in Kiambu was higher than that of non-participants by 24.1%, the proportion of participants growing different target crops had decreased by between 5.6% for cowpea and 33.4 for spider plant (Table 31). This reduction in growing target crops by participants in Kiambu is conspicuous because all participants were growing at least one target crop at a subsistence level during the baseline survey. For non-participant farmers, growing

target crops increased marginally by between 2.8% for cowpea and 9.9% for spider plant. Similarly, the results indicated that sales of different types of target crops reduced by between 5.6% and 22.2%. However, due to the small sample size of participants, it may be erroneous to draw any sweeping conclusions about the site based on these results.

In Arusha, as in Kiambu, the proportion of participants growing target crops was higher than that of non-participants during baseline and impact surveys. Although the proportion of participants growing TAV increased by 20%, the proportion of non-participants growing TAV also increased by 16.7%. The proportion of participants who grew spider plant and sweetpotato leaves had a higher increase than that of non-participant farmers, while for amaranth, nightshade, and cowpea, the increase in proportion of participants who grew these crops was lower than that of non-participants. Similarly, although the proportion of participants selling different types of TAV remained higher than that of non-participants, the increase for participants was not uniform for the five different types of TAV, with selling of some TAV, like nightshade and cowpea, decreasing. However, as noted earlier, the sample size of participants did not allow us to confidently make inferences for the whole site.

In Busia, there was increased growing of all kinds of TAV, and the increased proportion of participants who grew each type of TAV was higher than that of non-participants, except for spider plant and sweetpotato (Table 32). The difference in adoption between participants and non-participants was marginal and ranged from negative 9% for spider plant to positive 7.4% for nightshade. However, for most crops, the difference in commercialization between participants and non-participants was positive and ranged between 14.2% for cowpea and 35.3% for nightshade. Only sweetpotato had a negative difference between the proportion of participants and non-participants growing and selling them. The changes in adoption and commercialization of TAVs in Busia may be extrapolated to the whole site because the sample size of participants (55) was sizeable compared with that of non-participants (69). These results show that although adoption of cultivation of TAV did not show a significant difference between participants and non-participants possibly due to the combinations of factors, such as short implementation time, spillover effect, and drought, interventions clearly increased commercialization and would eventually have a substantial impact.

In Kabondo, there was increase in proportion of participants growing all TAV and the increase was higher than for non-participants from that of nightshade (Table 32). The differences in increases in proportions growing between participants and non-participants ranged between 2.9% for cow pea to 21.1% for amaranth. For commercialization, there were high differences between participants and non-participants for most of crops, ranging between 16.1% for cowpea to 39.9% for nightshade. Only sweetpotato had a small difference of 3.6% in proportion of participants and non-participants commercializing between baseline and impact survey. These results show there was increased adoption of cultivation and marketing of TAVs among participants which can be attributed to the project interventions. However, the combinations of factors, such as short implementation period, spill over effect and drought may result to tendency of underestimating outcomes of the interventions.

Evaluation of sweetpotato growing by site did not show much change in Busia and Kabondo sites where over 90.0% of both participants and non-participants were growing sweetpotato during the baseline and impact surveys (Table 37). However, there was very high change in marketing of sweetpotato in Busia where commercialization was low at the beginning of the project. However, in Kabondo where commercialization was already high at the start of the project the change in marketing was not significant. Another important change was seen in growing and marketing of OFSP in Busia. A significantly high proportion of participants in Busia adopted growing and selling of OFSP compared to non-participants. However, in Kabondo, there was no major change in growing and marketing of OFSP.

In Arusha, there was increased growing and marketing of OFSP for participants farmers although the sample size was too small to represent the participants in the whole site.

Area under TAVs and sweetpotato

There was no significant difference between total area under TAV for participants (0.042 ha) and non-participants (0.040 ha) during the baseline survey (Table 5). However, during the adoption survey, the total area under TAV for participants (0.050) was significantly higher than that for non-participants (0.023 ha). Although the total area under TAV for participants increased only by 19.0%, the total area under TAV for non-participants decreased by 42.5%, making the difference between the two groups as high as 61.5%. Apart from sweetpotato leaves, the areas under different TAVs for non-participants decreased between the baseline and adoption survey. However, for participant farmers, the area under most TAV increased marginally apart from the area under nightshade and cowpea. This decrease in area under TAVs for non-participants and marginal increases for participants despite project interventions may have been occasioned by the severe drought that affected intervention areas during the project.

The number of different types of TAV grown by participant farmers increased by 27.8%, while those grown by non-participants increased by 30.9% (Table 35). The fact that increases in number of TAV grown by participant farmers was not as high as that of non-participant farmers might mean that interventions mainly led to participant farmers primarily intensifying production, commercializing crops, and increasing consumption.

On the other hand, there was a high increase in the number of different TAV marketed by participant farmers (121.3%) compared to non-participant farmers (71.1%) with a percentage difference of 50.2%. This high difference in increases of selling of target crops between participants and non-participants indicated that project interventions were highly successful in improving market access.

For participants and non-participants, there was no significant change in the area growing sweetpotato between the baseline and impact survey. Although the area under OFSP increased for both groups, the increase for participants was not as high as that for non-participants.

Quantities of TAV harvested and sweetpotato sold

The quantities of different types of TAV harvested for both participant and non-participant farmers increased between the baseline and impact surveys; the increases for participant farmers were more pronounced than those for non-participants (Table 40). Increases in quantities of TAV harvested by participant farmers ranged between 35.8% (for cowpea) and 187.3% (for spider plant). Quantities of sweetpotato leaves harvested increased from 1.5 kg to 288 kgs. Increases in quantities harvested by non-participant farmers ranged between 12.5 for amaranth to 76.3 kgs for cowpea, whereas growing sweetpotato leaves declined from 99.1 kgs to 30.1 kgs.

Yields of TAV improved between the baseline and impact surveys; there was no significant difference between yields of TAVs grown by participant farmers and non-participants (Table 42). This finding is possibly because project interventions increased the quality of seeds in the market, and these seeds were available to both participants and non-participants.

The proportions of TAVs sold increased for both participants and non-participants, which indicates that the two groups were producing more than they could consume. The increased proportions of TAV sold may also be a response by both participants and non-participants to increased demand for TAVs that was created by project interventions.

Collective action

There was increase in collective action in input sourcing for participant farmers between the baseline and impact surveys. While the proportion of non-participant farmers who had sourced sweetpotato inputs collectively remained at 1.8%, participant farmers who had sourced inputs collectively increased from 15.3% to 25.9% (Table 26). Similarly, participant farmers who had marketed sweetpotato collectively increased from 2.7% to 6.3%.

The proportion of participant farmers who had sourced TAV input collectively did not change significantly between the baseline (12.6%) and adoption (11.6%) studies, but it remained higher than that of non-participants between the baseline (0.0%) and adoption (1.1%) studies. The number of participant farmers selling TAV collectively declined from 12.6% in the baseline study to 7.1% in the adoption study.

Impact evaluation using the baseline and impact surveys indicated that collective action increased for sweetpotato but declined for TAV. Interventions contributed to 10.6% change in input sourcing and 2.9% change in collective marketing of sweetpotato. However, during the same period, collective marketing of TAV declined, and participants decreased by 2.6% in input sourcing and 5.9% in collective marketing.

Collective marketing may have declined due to increased transportation costs, thereby reducing the number of participant farmers who conveyed target crops to urban centers. These farmers may have opted for farm-gate traders.

Knowledge and consumption

The proportion of farmers that had heard about vitamin A during the baseline survey was high for both participants (80.4%) and non-participants (80.4%). Although the proportions for the two groups increased marginally, there was no significant difference between the two groups (Table 47). Although the proportion of farmers saying vitamin A is important in protecting the body against disease did not change significantly between the baseline and adoption surveys, there was a significant increase in the proportion who said that vitamin A is important in protecting or improving vision. The number of participants (17.4%) and non-participants (10.5%) who mentioned vision increased significantly to 47.4% and 31.9%, respectively, which might indicate that a spillover effect from promotional campaigns increased the awareness of non-participants.

The proportion of participants and non-participants saying they knew what "iron" is increased from below 40% to about 60%; there was no significant difference between the two groups. This may again point to spillover of awareness campaigns to non-participants. However, a significantly higher percentage of participants (50.0%) who said they had heard about iron knew that it is found in the blood.

Over 90% of both participants and non-participants knew that consumption of TAVs has health benefits. However, the proportion of participants (47.2%) and non-participants (30.9) who said TAVs protect the body against disease did not change significantly between the two surveys.

The proportion of participants (64.9%) and non-participants (23.5%) who said they knew benefits of consuming OFSP increased for both participants (83.9%) and non-participants (44.3%). A significantly higher proportion of participants (48.9%) than non-participants (27.8%) knew that OFSP has vitamin A during the adoption survey; these proportions had increased from baseline level. This finding again shows the possibility of spillover or influence of awareness campaigns.

Consumption

Impact evaluation confirmed the earlier findings on high consumption of TAVs but showed varying results on the changes attributable to interventions for various TAVs. Positive changes attributable to interventions were seen in amaranth (4.2%), spider plant (3.5%), and sweetpotato leaves (7.6%). However, the increase in proportion of non-participants consuming nightshade and cowpea leaves exceeded that of participants (Table 48). This phenomenon may be due to spillover effect, as some interventions that created awareness were not restricted to participants.

Changes in percentages of participants who would offer TAVs and sweetpotato to visitors exceeded that of non-participants by 7.6% and 19.3%, respectively. This confirms that interventions helped change the attitude of participants and that more participants had stopped regarding TAVs and sweetpotato as inferior food.

When the type of food consumed by households in the seven days preceding the survey was evaluated, it emerged that over 65% of farmers in Kenya had consumed sweetpotato; there was no significant difference between participants and non-participants. However, in Tanzania only 28.6% of participants and 19.2% of non-participants had consumed sweetpotato. In Kenya, a higher proportion of participants (21.9%) than non-participants (9.7%) reported eating OFSP, while in Tanzania, 4% of participants and no non-participants had eaten OFSP during that period.

Although a high percentage of farmers in Kenya (82.4%) compared to Tanzania (38.7%) said they offered sweetpotato to visitors, there were significant differences between participants and non-participants in the two countries. Just like TAV, offering sweetpotato to visitors is an indication that farmers do not regard it as inferior food meant for the poor.

Gains from interventions

Gains from increased area under target crops

Participant farmers benefited from project interventions mainly through changes in area under TAVs and commercialization and consumption of TAVs and sweetpotato. Although there were changes in the percentage of participants growing some target crops, the changes were not significant. Therefore, participants were expected to gain from increased production emanating from increased area under amaranth, spider plant, cowpea, and sweetpotato leaves, which had positive changes relative to those of non-participants. Participants also benefited from income resulting from increased commercialization of target crops and improved nutrition.

To assess gains from project interventions and perform a benefit-cost analysis, we estimated the benefits derived from increased area under TAVs. After we estimated the benefits from extra crops grown between participants and non-participants, the gross margins were projected against the cost of project implementation. The four types of TAVs (amaranth, nightshade, spider plant, and cowpea), which were consistently grown at the four sites, and sweetpotato were used to estimate the gains from the project.

First, the differences in areas of the five crops grown by participants and non-participants were estimated to get the differences in changes between the two groups (Table 6). The gross margin per year of each crop was then calculated using the value of the extra crops harvested and the production cost per kilogram. To calculate the total gains to direct beneficiaries, the gains per year per crop were multiplied by total number of project participants (1,916) and then summed.

Note that the estimated short-term gains of USD $230,812 resulted after the second year of project implementation and after a prolonged period of drought, which was prevalent throughout the project; hence, project interventions hold potential for greater impact in the long term run as seen from positive outcomes, such as increased awareness, commercialization, and consumption.

Benefit-cost analysis

Benefits

Benefits are mainly derived from increased area under different target crops. The proportion growing target crops either remained the same or did not change significantly for participants and non-participants between the baseline and impact surveys; hence, no gains were expected from increased adoption. The survey results indicated that participant farmers gained from increased area under TAV by about 61.5%. The increased crop harvested resulted in an estimated total participant farmers net gain of USD $230,812 per year.

Costs

Costs consist mainly of group mobilization, commercial village formation, and extension costs, which constituted FCI budget expenditures during the 2.5 years of project implementation. As some activities complementing the project were funded from other sources and a few groups existed before the start of the project, this study assumes that funds from Kilimo Trust covered 75% of the total budget expenditure required and 25% was funded from other sources. The costs of production at farm level, such as acquisition of seeds, vines, and hired labor, were captured when calculating the net returns of individual farmers.

The analysis assumes that 50% of intervention-observed changes in the area grown occurred by the end of second year and that the differences between participants and non-participants will be sustained for at least five years after the project period.

Results

The net present value (NVP) was calculated using a discount rate of 15% and internal rate of return (IRR) to gauge the investment worth of the project. The results indicate that investment in the value chain of target crops is profitable. The IRR is estimated at 66% and NPV is USD $455,448 for the eight years under consideration (Table 50), which is reasonable compared to other documented agricultural projects and given the short period of implementation and prevailing drought.

Conclusion

The widespread drought in the two countries since the last long season of 2008 (April–September) greatly affected farming of target crops, which in turn affected the short-term impact of project interventions. Hence, the project evaluation mainly relies on outcomes of the project.

The households of participants and non-participants were similar in many characteristics apart from gender and age of household head. On average, household heads had 7.5 years of schooling, and the mean household size was 6.2. Participant farmers in Kenya had slightly bigger

families compared to non-participants. In Kenya, more households of participants were female-headed (40.5%) compared to those of non-participants (17.0%).

Metal sheets were the predominant roofing material (82.5% of all roofs), and most houses had walls of mud, stone, or brick. Only 18.2% of participants and 20.7% of non-participants had electricity. A small proportion of households in Kenya (6%) did not have latrines; there was no significant difference between participants and non-participants.

Farmers in Kenya had more equipment and tools than farmers in Tanzania and, hence could be viewed as slightly wealthier. More farmers in Kenya had TVs, mobile phones, radios, irrigation pumps, tube wells, and wheel barrows than farmers in Tanzania. The amount of equipment and tools, such as hand sprayers and watering cans, used for production of TAVs was slightly higher among participants than non-participants.

The most important income source was selling food crops, which was ranked as first or second in importance by more than 60% of respondents; a significantly high percentage of participants (40.1%) compared to non-participants (17.6%) ranked TAVs as the first- and second-most important sources of income among farm enterprises.

Generally, there was higher adoption and commercialization of TAV among participants than among non-participants. Significantly more participants (94.9%) than non-participants (75.0%) cultivated TAV. The diversity of TAVs grown by participants (3.3) was also significantly higher than that of non-participants (2.7), with the two means differing by 20.7%. However, evaluation of changes of percentage of participants and non-participants growing target crops between the baseline and impact surveys showed that the changes that could be attributed to interventions was minimal.

Generally, participant farmers had larger areas of land under TAVs, and they grew more of each type of TAV than non-participants. Participant farmers had statistically more acreage under TAV (0.415 ha) than non-participants (0.0163 ha). Analysis of area changes for participants and non-participants between the baseline and impact surveys showed that participants had increased land under TAVs in relative terms. Although the total area under TAV for participants increased by only 19.0%, the total area under TAV for non-participants decreased by 42.5%, making the difference between the two groups as high as 61.5%. This decrease in area under TAV for non-participants and marginal increases for participants may have been caused by the severe drought that affected the intervention areas during the project.

A significantly higher percentage of participants (40.2%) had commercialized TAV than had non-participants (25.5%). On average, participants sold 2.3 types of TAVs, while non-participants sold 1.1 types of TAVs. The increase in commercialization was confirmed by evaluating changes between participants and non-participants selling TAV during the baseline and impact surveys. The number of different TAVs marketed by participant farmers increased significantly (121.3%) compared to that of non-participant farmers (71.1%), with a percentage difference of 50.2%. This large difference in increase of selling of target crops between

participants and non-participants indicates that project intervention was highly successful in improving market access.

In Kenya, 99% of both participants and non-participants in Kabondo and Busia were growing sweetpotato, while in Tanzania only 21.3% were growing it. In Tanzania, adoption of sweetpotato showed significant difference between participants (34.1%) and non-participants (6.4%), with a difference in adoption level of 27.7% between the two groups. Because over 90.0% of both participants and non-participants were growing sweetpotato during the baseline and impact surveys in Busia and Kabondo, there were no major changes in percentage of growers over the project period. OFSP was mainly grown by participants in Kenya, and there was a 21.9% difference in the level of adoption between participants (47.3%) and non-participants (25.4%), whereas in Tanzania, only participants were growing OFSP (48.4%).

There was highly significant difference between participants and non-participants in the level of commercialization of sweetpotato in both countries; the entire sample had a 19.8% difference in the level of commercialization, with 61.1% of participants and 41.3% of non-participants selling sweetpotato. However, the main change in the level of commercialization occurred in Busia, where commercialization was low at the beginning of the project, compared with Kabondo, where farmers were already highly commercialized.

Most participants (over 80%) had been trained by FCI extension staff. Over 90% of both participants and non-participants knew there were health benefits in consuming TAV. A higher percentage of participants (43.1%) than of non-participants (29.2%) in Kenya knew that TAV helped strengthen the body's immunity, and higher proportion of participants (72.4%) than of non-participants (44.4%) was aware of the health benefits of consuming OFSP.

The efforts of FCI to improve the capacity of farmers as trainers (COTEs) to be able to train other farmers were effective, as seen from 40.0% of participants and 8.0% of non-participants who reported receiving some training from COTEs.

Record keeping remained a challenge for most farmers: only a minority in Kenya and Tanzania kept records. However, significantly more participants (24.2%) than non-participants (9.9%) kept budgets records. Similarly, more participants (28.8%) than non-participants (7.5%) kept sales records.

A significantly higher percentage of participants than non-participants in both countries belonged to savings schemes. About 68.1% of participants in Kenya and 57.1% in Tanzania belonged to savings schemes, compared to only 47.1% of non-participants in Kenya and 10.3% in Tanzania. In Kenya, a significantly higher percentage of participants (52.0%) than non-participants (27.2%) were saving some income from TAV or sweetpotato. In Tanzania, 14.1% of participants and 1.4% of non-participants were saving similarly. Over 60% of credit in Kenya was received by female members of households, while in Tanzania, male members of households received the most credit of non-participants (54.5%). For participant farmers in Tanzania, over 60% of credit

was received by females. This finding means the project helped female participants to access credit in Tanzania.

Farmers benefiting from sales of target crops used the income for various purposes. About 50% of the entire sample had used income from TAV to purchase basic food, 14.8% to pay school fees, and 8.4% to buy livestock. Income from sweetpotato was used by 33.7% to pay school fees, 29.6% to purchase basic food, and 16.9% to buy livestock.

A significantly higher percentage of participants consumed TAV (90.8%) compared to non-participants (84.2%). Impact evaluation confirmed positive changes attributable to interventions on consumption of amaranth (4.2%), spider plant (3.5%), and sweetpotato leaves (7.6%). However, increases in the proportion of non-participants consuming nightshade and cowpea leaves exceeded that of participants. These phenomena may be due to a spillover effect, as some of interventions to create awareness were not restricted to areas of participating farmers. In Kenya, a higher proportion of participants (21.9%) than non-participants (9.7%) reported eating OFSP, whereas in Tanzania, 4% of farmers had eaten OFSP.

The project interventions involved enlightening farmers about the importance of feeding target crops to children 2–5 years of age to provide important minerals and vitamins. Generally, a higher proportion of participants than non-participants fed children TAV. In Kenya, a significantly higher proportion of participants (95.7%) fed children with all target crops than did non-participants (86.3%). In Tanzania, a higher proportion of participants fed children with all type of target crops except cowpea.

Collective action was high among participant farmers; a higher proportion of participants (11.5%) than non-participants (1.1%) sourced TAV inputs collectively. Similarly, a slightly higher proportion of participants (6.4%) than non-participants (0.4%) sold TAV collectively. Kiambu had the highest proportion of participant farmers sourcing TAV inputs (25.0%) and marketing TAV (24.0%) collectively, which possibly helped more participant farmers in Kiambu than farmers at other sites to access formal markets.

For sweetpotato, about 19.3% of participants had sourced inputs collectively compared to 2.3% of non-participants; about 5.4% of participants and 0.9% of the non-participants had sold sweetpotato collectively. However, examining changes over the project period revealed that collective action had increased for sweetpotato but declined for TAVs. Collective marketing, which was mainly in Kiambu, declined after transportation costs increased. Participant farmers may have opted for farm-gate trading instead of transporting TAV to urban centers.

The benefit-cost analysis indicated that investment in the value chain of target crops is potentially profitable, with an estimated IRR of 66% and NPV of USD $455,448 for eight years, taking into account that these results were obtained after a short period of project implementation and under conditions of widespread drought.

Tables

Table 1. Summary of impact survey data by sites

	Busia	Kabondo	Kiambu	Arumeru	Total
Baseline survey	**180**	**183**	**183**	**177**	**723**
Participants	100	103	100	97	400
Non-participants	80	80	83	80	323
Impact survey	**168**	**172**	**167**	**169**	**676**
Participants	99	106	96	91	392
Baseline and impact	55	29	18	10	112
Impact only (new)	44	77	78	81	280
Non-participants	69	66	71	78	284

Table 2. Framework of impact analysis

Surveys	Non-participants	Participants	Difference between Participants and Non-participants
Step one analysis			
Impact data year 2	$NonP2_{(284)}$	$P2_{(392)}$	$P2_{(392)} - NonP2_{(284)}$
Step two analysis			
Baseline year 1	$NonP1_{(284)}$	$P1_{(112)}$	P1 – NonP1
Impact year 2	$NonP2_{(284)}$	$P2_{(112)}$	P2 – NonP2
Difference in two years	$NonP2_{(284)} - NonP1_{(284)}$	$P2_{(112)} - P1_{(112)}$	D in D

Abbreviations: D in D, difference in differences; NPY1, non-participants in year 1; NPY2, non-participants in year 2; PY1, participants in year 1; PY2, participants in year 2.

Table 3. Household characteristics of impact sub-sample

		Kenya			Tanzania			Total		
		Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal	Non-participant	Participant	Total
Total hh members	Mean	6.3	6.5	6.4	6.1	6.6	6.1	6.2	6.5	6.3
	Std	2.5	3.3	2.8	3.9	2.2	3.7	3	3.2	3
Age of hh head	Mean	42.3	51.1	45.2	38.5	41.5	38.9	41.3	50.2	43.9
	Std	13.3	12.1	13.5	8.9	13.4	9.5	12.4	12.5	13
Years of education	Mean	8.45	7.53	8.12	6.92	7.6	7	7.97	7.54	7.84
	Std	4.52	5.11	4.75	3.53	2.27	3.4	4.29	4.89	4.47
Gender of hh head	Male	82.6	72.3	79.2	87	90	87.4	83.8	73.9	81
	Female	17.4	27.7	20.8	13	10	12.6	16.2	26.1	19
Has		22.2	12.9	19.2	7.7	0	6.8	18.2	11.7	16.4
Has latrine		93.7	95	94.2	100	100	100	95.4	95.5	95.5
Well/borehole-water source		47.3	45.5	46.8	9.1	0	8	37	41.4	38.2
Piped water-main water source		8.2	2	6.2	54.5	30	51.7	20.8	4.5	16.2
Metal sheets roofing		83.6	75.2	80.8	78.2	90	79.5	82.1	76.6	80.6
Concrete block/brick wall		18.4	18.8	18.5	33.3	40	34.1	22.5	20.7	22
Mud walls		46.4	57.4	50	44.9	50	45.5	46	56.8	49
Concrete floor		40.1	29.7	36.7	25.6	50	28.4	36.1	31.5	34.8
Mud floor		59.4	70.3	63	71.8	50	69.3	62.8	68.5	64.4
Sample size		**206**	**102**	**308**	**78**	**10**	**88**	**284**	**112**	**396**

Table 4. Adoption of target crops by sub-sample farmers

	Baseline		Impact		Change in Two Years		D
	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	D in D
Grow TAV	68.8	96.4	75.4	94.6	6.6	-1.8	-8.3
Sell TAV	24.2	45.0	39.1	72.3	14.9	27.3	12.4
Grow amaranth	33.5	55.4	48.2	72.3	14.8	17.0	2.2
Sell amaranth	7.4	20.5	17.3	45.5	9.9	25.0	15.1
Grow nightshade	35.2	52.7	57.0	75.0	21.8	22.3	0.5
Sell nightshade	14.1	25.9	24.3	60.7	10.2	34.8	24.6
Grow spider plant	28.2	55.4	40.8	70.5	12.7	15.2	2.5
Sell spider plant	9.2	23.2	13.7	50.0	4.6	26.8	22.2
Grow cowpea	51.1	75.0	55.3	77.7	4.2	2.7	-1.5
Sell cowpea	13.0	20.5	19.4	41.1	6.3	20.5	14.2
Grow SP leaves	14.1	17.0	7.7	19.6	-6.3	2.7	9.0
Sell SP leaves	1.1	2.7	.4	5.4	-.7	2.7	3.4
Sample size	**284**	**112**	**284**	**112**			
Grow SP	63.1	93.5	65.4	94.6	2.3	1.1	-1.2
Sell SP	32.2	51.6	41.6	75.3	9.4	23.7	14.3
Grow OFSP	10.4	35.5	15.9	59.1	5.5	23.6	18.1
Sell OFSP	0.5	14	5.1	37.6	4.6	23.6	19.0
Sample size[a]	**213**	**94**	**213**	**94**			

Table 5. Area grown target crops by the sub-samples (ha)

		Baseline			Impact			Change in Two Years			
Area under Target Crops		**Non-participant**	**Participant**	**Subtotal**	**Non-participant**	**Participant**	**Subtotal**		**Non-participant**	**Participant**	**D in D**
All TAV	Mean	0.040	0.042	0.040	0.023	0.05	0.032	mean∆	-0.017	0.008	0.025
	Std	0.062	0.064	0.063	0.035	0.093	0.063	%∆	-42.5	19.0	61.5
	Valid N	177	100	277	169	90	259				
Amaranth	Mean	0.013	0.012	0.012	0.006	0.013	0.009	mean∆	-0.007	0.001	0.008
	Std	0.024	0.022	0.023	0.012	0.029	0.021	%∆	-53.8	8.3	62.2
	Valid N	78	55	133	96	67	163				
Nightshade	Mean	0.018	0.029	0.022	0.009	0.015	0.011	mean∆	-0.009	-0.014	-0.005
	Std	0.033	0.058	0.044	0.02	0.032	0.025	%∆	-50.0	-48.3	1.7
	Valid N	88	50	138	117	65	182				
Spider plant	Mean	0.012	0.008	0.01	0.006	0.01	0.008	mean∆	-0.006	0.002	0.008
	Std	0.022	0.01	0.018	0.016	0.02	0.017	%∆	-50.0	25.0	75.0
	Valid N	66	52	118	97	63	160				
Cow pea	Mean	0.054	0.047	0.052	0.013	0.023	0.017	mean∆	-0.041	-0.024	0.017
	Std	0.117	0.084	0.106	0.027	0.053	0.038	%∆	-75.9	-51.1	24.9
	Valid N	135	80	215	119	66	185				
Sweetpotato leaves	Mean	0.005	0.007	0.006	0.012	0.039	0.026	mean∆	0.007	0.032	0.025
	Std	0.011	0.005	0.009	0.007	0.062	0.045	%∆	140.0	457.1	317.1
	Valid N	11	8	19	11	11	22				
Sweetpotato	Mean	0.139	0.182	0.156	0.181	0.223	0.197		0.042	0.041	-0.001
	Std	0.171	0.392	0.282	0.247	0.341	0.286				
	Valid N	121	83	204	132	79	211				
OFSP	Mean	0.033	0.075	0.061	0.052	0.082	0.071		0.019	0.007	-0.012
	Std	0.048	0.099	0.087	0.083	0.129	0.114				
	Valid N	8	16	24	20	34	54				

Table 6. Differences in area grown target crops per season (kg/season)

	Baseline			Impact			Change in Two Years		
	Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal	Non-participant	Participant	D in D
Amaranth	0.013	0.012	0.012	0.006	0.013	0.009	-0.007	0.001	0.008
Nightshade	0.018	0.029	0.022	0.009	0.015	0.011	-0.009	-0.014	-0.005
Spider plant	0.012	0.008	0.01	0.006	0.01	0.008	-0.006	0.002	0.008
Cowpea	0.054	0.047	0.052	0.013	0.023	0.017	-0.041	-0.024	0.017
Sweetpotato leaves	0.005	0.007	0.006	0.012	0.039	0.026	0.007	0.032	0.025
Sweetpotato	0.1386	0.1821	0.1563	0.1807	0.2231	0.1966	0.042	0.041	-0.001

Table 7. Gains from extra crops harvested per year

Target crop	Extra Quantity Harvested (kg/year)	Value of Extra Crop (USD)	Production cost (USD)	Gross Margin (USD/season)	Gain by Participants in Sub-sample (USD/year)	Estimated Gain by Participants in Project
Amaranth	189.7	49.3	7.4	41.926	3,395	58,079
Nightshade	-163.1	-40.1	4.6	-35.562	-2,987	-51,103
Spider plant	207.1	57.6	5.8	51.784	4,089	69,949
Cowpea	411.1	99.5	8.2	91.267	7,942	135,872
Sweetpotato leaves	338.3	58.2	2.0	56.165	1,233	21,092
Sweetpotato	-27.5	-1.9	0.2	-1.698	-180	-3,077
TOTAL	955.7	222.5	19.1	203.9	13,492	230,812

Table 8. Household characteristics

		Kenya			Tanzania			Total		
		Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal
Total hh members	Mean	6.52	5.95	6.18*	6.21	6.48	6.36	6.43	6.07	6.22
	Standard deviation	2.41	2.81	2.67	3.8	2.33	3.09	2.86	2.71	2.78
Age of hh head in 2009	Mean	44.4	51.47	48.54*	40.51	45.05	42.95*	43.35	50.03	47.2
	Standard deviation	13.3	13.33	13.76	8.89	11.37	10.52	12.41	13.18	13.27
Gender of hh head	Female	17	40.5	30.8*	13	17.6	15.4	15.9	35.4	27
What is the marital status of the head of the household?	Single	2	2	2	2.6	2.2	2.4	2.1	2	2.1
	Married (monogamy), living with spouse	76.1	60.7	66.9*	84.4	73.6	78.6	78.4	63.7	69.8
	Married (polygamy), living with spouse	6.3	10.3	8.7	9.1	13.2	11.3	7.1	11	9.4
	Married (monogamy), spouse not present	2.9	5	4.2	0	4.4	2.4	2.1	4.9	3.7
	Married (polygamy), spouse not present	0.5	2.3	1.6	1.3	1.1	1.2	0.7	2	1.5
	Divorce/separated	0.5	0.3	0.4	0	0	0	0.4	0.3	0.3
	Widow/widower	11.7	19.3	16.2	2.6	5.5	4.2	9.2	16.1	13.2
Household has electricity	Yes	22.3	24.9	23.9	7.7	6.6	7.1	18.3	20.7	19.7
Household has a latrine	Yes	93.7	94.3	94.1	100	100	100	95.4	95.7	95.6
What is the main source of drinking water for your household?	Lake or pond	1.5	2.3	2	0	1.1	0.6	1.1	2	1.6
	River or stream	19.9	20.9	20.5	33.8	48.4	41.7	23.7	27.3	25.8
	Spring	20.4	24.9	23.1	2.6	4.4	3.6	15.5	20.2	18.2
	Well/borehole	47.6	47.2	47.3	9.1	0	4.2	37.1	36.2	36.6*
	Rainfall capture	1.9	2.3	2.2	0	0	0	1.4	1.8	1.6
	Piped	8.3	2	4.5	54.5	46.2	50	20.8	12.2	15.9
	Other	0.5	0.3	0.4	0	0	0	0.4	0.3	0.3
What kind of roofing material does the main house have?	Cement	0	0.7	0.4	1.3	1.1	1.2	0.4	0.8	0.6
	Tiles	1	1.3	1.2	7.7	4.4	5.9	2.8	2	2.4
	Metal sheets	83.5	81.1	82.1	78.2	89	84	82	82.9	82.5

		Kenya			Tanzania			Total		
		Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal
	Wood	0	0	0	0	1.1	0.6	0	0.3	0.1
	Grass/cane/palm leaves(thatch)	15.5	16.9	16.4	12.8	4.4	8.3	14.8	14	14.3
	Other	0	0	0	0	0	0	0	0	0
What materials are the walls of the main house made of?	Concrete block/bricks	18.4	22.3	20.7	33.3	28.6	30.8	22.5	23.7	23.2
	Mud	46.1	47.2	46.7	44.9	51.6	48.5	45.8	48.2	47.2
	Metal sheets	16.5	11	13.2	1.3	0	0.6	12.3	8.4	10.1
	Wood	9.2	9.3	9.3	1.3	3.3	2.4	7	7.9	7.5
	Mud/stone/wood mix	9.7	10.3	10.1	19.2	16.5	17.8	12.3	11.7	12
	Other	0	0	0	0	0	0	0	0	0
What materials is the floor of the main house made of?	Cement/concrete	40.3	41.9	41.2	25.6	18.7	21.9	36.3	36.5	36.4
	Mud	59.2	57.8	58.4	71.8	79.1	75.7	62.7	62.8	62.7
	Tile/linoleum	0.5	0.3	0.4	2.6	2.2	2.4	1.1	0.8	0.9
	Wood	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0
TOTAL		206	301	507	78	91	169	284	392	676

[a]Sweetpotato analysis excludes Kiambu site.

Table 9. Percentage of farmers owning livestock and equipment

	Kenya			Tanzania			Total		
	Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total
Cattle	68.6	74.7	72.2	84.6	78	81.1	73	75.4	74.4
Goats	29.5	39.3	35.3*	76.9	74.7	75.7	42.5	47.6	45.4
Sheep	18.8	23	21.3	51.3	45.1	47.9	27.7	28.1	28
Pigs	15.9	16	16	0	1.1	0.6	11.6	12.5	12.1
Poultry	79.2	81.3	80.5	67.9	69.2	68.6	76.1	78.5	77.5
Donkey	0	4.7	2.8*	0	2.2	1.2	0	4.1	2.4
Motorcycles	2.4	1.7	2	9	2.2	5.3	4.2	1.8	2.8
Car	4.8	7.3	6.3	2.6	3.3	3	4.2	6.4	5.5
Tractor	1.4	0.3	0.8	0	1.1	0.6	1.1	0.5	0.7
Bicycle	52.7	52.3	52.5	55.1	44	49.1	53.3	50.4	51.6
TV	32.9	39.7	36.9	6.4	5.5	5.9	25.6	31.7	29.1
Refrigerator	5.8	7	6.5	1.3	0	0.6	4.6	5.4	5
Mobile	78.7	75.3	76.7	73.1	54.9	63.3*	77.2	70.6	73.4
Radio	87.9	85	86.2	74.4	61.5	67.5	84.2	79.5	81.5
Ox-plough	16.4	20	18.5	28.2	35.2	32	19.6	23.5	21.9
Cart	1.9	3	2.6	10.3	13.2	11.8	4.2	5.4	4.9
Irrigation pump	6.3	16.7	12.4*	0	0	0	4.6	12.8	9.3
Tube well	27.1	30	28.8	3.8	1.1	2.4	20.7	23.3	22.2
Sprinkler	2.9	2.3	2.6	0	0	0	2.1	1.8	1.9
Sprayer	15.9	28.7	23.5*	11.5	22	17.2	14.7	27.1	21.9
Wheelbarrows	33.8	44	39.8*	26.9	20.9	23.7	31.9	38.6	35.8
Watering can	25.6	39.7	33.9*	6.4	16.5	11.8*	20.4	34.3	28.4
Axe	63.3	73.7	69.4*	82.1	79.1	80.5	68.4	74.9	72.2
TOTAL	**207**	**300**	**507**	**78**	**91**	**169**	**285**	**391**	**676**

Table 10. Land, livestock, and equipment owned by farmers

		Kenya			Tanzania			Total		
		Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal
Total land owned	Mean	.95	1.20	1.00	1.25	.96	1.21	.95	1.20	1.00
	Standard deviation	.89	.95	1.04	1.18	.93	1.00	.89	.95	1.04
Total cultivated land	Mean	.83	1.00	.96	1.18	.86	1.04	.83	1.00	.96
	Standard deviation	.74	.77	.83	1.12	.76	.87	.74	.77	.83
Cattle owned by household	Mean	2	3	2	3	4	3	2	3	3
	Standard deviation	2	3	3	3	4	4	3	3	3
Goats owned by household	Mean	1	1	1	5	4	5	2	2	2
	Standard deviation	2	2	2	6	6	6	4	4	4
Sheep owned by household	Mean	1	1	1	2	2	2	1	1	1
	Standard deviation	2	2	2	3	3	3	2	3	3
Chicken and ducks owned by household	Mean	10	12	11	5	8	7	9	11	10
	Standard deviation	24	28	27	6	17	13	21	26	24
Donkeys owned by household	Mean	0	0	0	0	0	0	0	0	0
	Standard deviation	0	1	1	0	1	1	0	1	1
Bicycle	Mean	1	1	1	1	0	1	1	1	1
	Standard deviation	1	1	1	1	1	1	1	1	1
Mobile phone	Mean	1	1	1	1	1	1	1	1	1
	Standard deviation	1	1	1	1	1	1	1	1	1
Radio	Mean	1	1	1	1	1	1	1	1	1
	Standard deviation	1	1	1	1	1	1	1	1	1
Watering can	Mean	0	0	0	0	0	0	0	0	0
	Standard deviation	1	1	1	0	0	0	1	1	1
Axe	Mean	1	1	1	1	1	1	1	1	1
	Standard deviation	1	0	0	1	1	1	1	1	1
Total N		207	300	507	78	91	169	285	391	676

Table 11. Crops grown by participant and non-participant farmers

	Kenya			Tanzania			Total		
	Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total
Sweetpotato	71.4	71.4	71.4	6.4	34.1	21.3*	53.5	62.8	58.9
TAV	79.1	97	89.7*	64.1	87.9	76.9*	75	94.9	86.5
Maize	0	18.2	13.3	0	0	0	0	18.2	13.3
Beans	0	18.2	13.3	0	0	0	0	18.2	13.3
Cassava	0	27.3	20	0	0	0	0	27.3	20
Kales	50	0	13.3	0	0	0	50	0	13.3
Bananas (starchy)	0	18.2	13.3	0	0	0	0	18.2	13.3
Potatoes	0	9.1	6.7	0	0	0	0	9.1	6.7
Avocado	25	18.2	20	0	0	0	25	18.2	20
Spinach/chard	25	0	6.7	0	0	0	25	0	6.7
Mango	0	18.2	13.3	0	0	0	0	18.2	13.3
Cabbage	0	9.1	6.7	0	0	0	0	9.1	6.7
Tomato	25	9.1	13.3	0	0	0	25	9.1	13.3
Sample size	**207**	**300**	**507**	**78**	**91**	**169**	**285**	**391**	**676**

Table 12. Important sources of incomes

		Kenya		Tanzania		Total	
		Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
Source of Income	**Rank**	**%**	**%**	**%**	**%**	**%**	**%**
Sale of food crops	1	40.8	56.8	67.9	78.0	48.2	61.7
	2	20.4	26.2	15.4	12.1	19.0	23.0
Sale of livestock/livestock products	1	13.6	10.6	3.8	5.5	10.9	9.4
	2	23.3	25.9	26.9	33	24.3	27.6
Wages or salaries in cash	1	31.6	16.3	12.8	6.6	26.4	14.0
	2	24.8	19.9	3.8	7.7	19	17.1
Remittances or pension (J3 and J4)	1	1.9	1	0	0	1.4	0.8
	2	4.4	4.7	0	0	3.2	3.6
Sale of cash crops	1	5.8	6	1.3	0	4.6	4.6
	2	3.9	3.7	5.1	5.5	4.2	4.1
Cereal crops	1	15.5	13	35.9	26.4	21.1	16.1
	2	10.7	16.6	5.1	20.9	9.2	17.6
Legumes	1	4.4	2.7	2.6	2.2	3.9	2.6
	2	6.3	3.7	20.5	12.1	10.2	5.6
Livestock	1	19.4	15	9	7.7	16.5	13.3
	2	14.1	11.3	12.8	16.5	13.7	12.5
TAV	1	4.4	14	17.9	37.4	8.1	19.4
	2	9.2	21.6	10.3	17.6	9.5	20.7
Sweetpotato	1	30.6	34.2	2.6	13.2	22.9	29.3
	2	8.3	9.6	0	6.6	6	8.9
Exotic vegetables	1	6.8	4.7	10.3	4.4	7.7	4.6
	2	4.9	14	2.6	4.4	4.2	11.7
Permanent cash crops	1	3.9	5.6	3.8	0	3.9	4.3
	2	4.4	2.7	1.3	0	3.5	2

Table 13. Cultivation and commercialization of TAV by participant and non-participant farmers

		Kenya			Tanzania			Total			
		Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total	Group Difference
No. of TAV grown	Mean	2.87	3.34	3.17*	2.33	3.2	2.87*	2.74	3.31	3.1	20.7
	Standard deviation	1.23	1.08	1.16	1.14	1.66	1.54	1.23	1.23	1.26	
Types of TAV sold	Mean	1.04	2.3	1.85*	1.56	2.26	2.03*	1.13	2.29	1.89	102.1
	Standard deviation	1.29	1.49	1.55	0.99	1.79	1.6	1.26	1.55	1.56	
Grow TAV		79.1	97	89.7*	64.1	87.9	76.9*	75	94.9	86.5	19.9
Sell TAV		39.3	77.4	61.9*	39.7	64.8	53.3*	39.4	74.5	59.8	35.1
Grow amaranth		48.1	76.1	64.7*	46.2	67	57.4*	47.5	74.0	62.9	26.4
Sell amaranth		14.6	50.5	35.9*	24.4	36.3	30.8	17.3	47.2	34.6	29.9
Grow nightshade		60.2	84.1	74.4*	47.4	64.8	56.8*	56.7	79.6	70	22.9
Sell nightshade		23.3	66.1	48.7*	25.6	42.9	34.9*	23.9	60.7	45.3	36.8
Grow spider plant		54.9	73.4	65.9*	3.8	24.2	14.8*	40.8	62	53.1	21.1
Sell spider plant		18.9	53.5	39.4*	1.3	15.4	8.9*	14.1	44.6	31.8	30.6
Grow cowpea		64.1	73.4	69.6*	32.1	59.3	46.7*	55.3	70.2	63.9	14.9
Sell cowpea		23.3	43.9	35.5*	9	27.5	18.9*	19.4	40.1	31.4	20.7
Grow SP leaves		5.8	11	8.9*	12.8	36.3	25.4*	7.7	16.8	13	9.1
Sell SP leaves		0	2.3	1.4*	1.3	14.3	8.3*	0.4	5.1	3.1	4.7
Grow African eggplant		1	6.3	4.*	10.3	44	28.4*	3.5	15.1	10.2	11.5
Sell African eggplant		0.5	1.7	1.2	6.4	37.4	23.1*	2.1	9.9	6.7	7.8

Table 14. Last season TAV were grown and sold (%)

	Kenya		Tanzania		Total	
	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
Grew amaranth						
Season 1-09 (Apr 09-Sep 09)	79.0	79.9	83.3	75.4	80.3	78.9
Season 2-08 (Oct 08-Mar 09)	16.9	10.0	11.0	18.1	15.4	11.8
Season 1-08 (Apr 08-Sep 08)	2.0	5.3	5.6	4.9	2.9	5.1
Season 2-07 (Oct 07-Mar 08)	2.0	4.9	0.0	1.6	1.5	4.2
Sold amaranth						
Season 1-09	75.0	91.6	94.0	100.0	82.8	93.3
Season 2-08	16.4	6.7	0.0	0.0	9.7	5.3
Season 1-08	8.6	1.7	6.0	0.0	7.6	1.3
Season 2-07	0.0	0.0	0.0	0.0	0.0	0.0
Grew nightshade						
Season 1-09 (Apr 09-Sep 09)	79.1	83.7	78.3	81.3	79.0	83.3
Season 2-08 (Oct 08-Mar 09)	10.4	9.9	5.5	13.6	9.3	10.6
Season 1-08 (Apr 08-Sep 08)	8.1	3.2	10.7	1.7	8.6	2.9
Season 2-07 (Oct 07-Mar 08)	2.5	3.2	5.5	3.4	3.2	3.3
Sold nightshade						
Season 1-09	94.6	93.5	94.0	97.0	94.3	93.9
Season 2-08	5.4	3.6	6.0	0.0	5.7	2.9
Season 1-08	0.0	2.3	0.0	3.0	0.0	2.5
Season 2-07	0.0	0.5	0.0	0.0	0.0	0.6
Grew spider plant						
Season 1-09 (Apr 09-Sep 09)	82.3	83.7	66.7	100.0	81.9	85.2
Season 2-08 (Oct 08-Mar 09)	10.6	7.2	0.0	0.0	10.3	6.6
Season 1-08 (Apr 08-Sep 08)	4.4	4.1	33.3	0.0	5.1	3.7

	Kenya		Tanzania		Total	
	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
Season 2-07 (Oct 07-Mar 08)	2.7	5.0	0.0	0.0	2.7	4.5
Sold spider plant						
Season 1-09	88.2	92.7	0.0	92.9	87.9	92.4
Season 2-08	8.8	6.6	0.0	7.1	8.9	6.8
Season 1-08	2.9	0.7	0.0	0.0	3.2	0.8
Season 2-07	0.0	0.0	0.0	0.0	0.0	0.0
Grew cowpea						
Season 1-09 (Apr 09-Sep 09)	93.9	93.2	80.0	76.4	91.7	89.8
Season 2-08 (Oct 08-Mar 09)	3.0	3.7	15.9	18.2	5.1	6.5
Season 1-08 (Apr 08-Sep 08)	2.3	1.8	4.1	1.8	2.5	1.8
Season 2-07 (Oct 07-Mar 08)	0.8	1.4	0.0	3.6	0.7	1.8
Sold cowpea						
Season 1-09	85.1	94.2	100.0	84.2	86.8	92.7
Season 2-08	12.7	5.8	0.0	15.8	11.1	7.3
Season 1-08	0.0	0.0	0.0	0.0	0.0	0.0
Season 2-07	2.2	0.0	0.0	0.0	2.1	0.0
Grew sweetpotato leaves						
Season 1-09 (Apr 09-Sep 09)	83.1	93.6	60.2	66.7	71.8	80.4
Season 2-08 (Oct 08-Mar 09)	0.0	0.0	10.2	24.2	5.1	11.9
Season 1-08 (Apr 08-Sep 08)	8.5	0.0	29.7	3.0	17.9	1.8
Season 2-07 (Oct 07-Mar 08)	8.5	6.4	0.0	6.1	5.1	6.0
Sold sweetpotato leaves						
Season 1-09	0.0	100.0	100.0	77.8	100.0	86.8
Season 2-08	0.0	0.0	0.0	22.2	0.0	13.2
Season 1-08	0.0	0.0	0.0	0.0	0.0	0.0

	Kenya		Tanzania		Total	
	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
Season 2-07	0.0	0.0	0.0	0.0	0.0	0.0
Grew eggplant						
Season 1-09 (Apr 09-Sep 09)	100.0	63.5	74.8	67.5	77.8	65.6
Season 2-08 (Oct 08-Mar 09)	0.0	0.0	0.0	7.5	0.0	5.3
Season 1-08 (Apr 08-Sep 08)	0.0	4.8	12.6	10.0	11.1	8.6
Season 2-07 (Oct 07-Mar 08)	0.0	31.7	12.6	15.0	11.1	20.5
Sold eggplant						
Season 1-09	0.0	0.0	100.0	83.3	100.0	81.3
Season 2-08	0.0	0.0	0.0	0.0	0.0	0.0
Season 1-08	0.0	0.0	0.0	16.7	0.0	18.8
Season 2-07	0.0	0.0	0.0	0.0	0.0	0.0

Table 15. Area under TAV by country (ha)

		Kenya			Tanzania			Total		
		Participant or Not			Participant or Not			Participant or Not		
		Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal
All TAV	Mean	0.0178	0.0311	0.0257	0.0124	0.076	0.0466	0.0163	0.0415	0.0309
	Standard deviation	0.0432	0.0607	0.0546	0.0367	0.1112	0.0908	0.0415	0.0776	0.0661
	Valid N	206	301	507	78	91	169	284	392	676
Amaranth	Mean	0.0047	0.01	0.0083	0.0196	0.0219	0.0212	0.0058	0.011	0.0093
	Standard deviation	0.007	0.0192	0.0164	0.0361	0.0468	0.0432	0.012	0.0229	0.0202
	Valid N	88	183	271	7	17	24	95	200	295
Nightshade	Mean	0.0087	0.0102	0.0097	0.0059	0.0391	0.0285	0.0086	0.0121	0.0109
	Standard deviation	0.0207	0.0191	0.0197	0.005	0.053	0.0461	0.0201	0.0238	0.0226
	Valid N	109	214	323	7	15	22	116	229	345
Spider plant	Mean	0.0059	0.0081	0.0073	.	0.0059	0.0059	0.0059	0.008	0.0073
	Standard deviation	0.0134	0.0139	0.0138	.	0.0043	0.0043	0.0134	0.0138	0.0137
	Valid N	97	183	280	0	5	5	97	188	285
Cowpea leaves	Mean	0.0096	0.015	0.0129	0.0036	0.0146	0.011	0.0094	0.015	0.0128
	Standard deviation	0.0097	0.0249	0.0204	0.0024	0.0139	0.0123	0.0096	0.0246	0.0202
	Valid N	116	177	293	3	6	9	119	183	302
Sweetpotato leaves	Mean	0.0247	0.0314	0.0292	0.008	0.016	0.0133	0.0222	0.029	0.0267
	Standard deviation	0.0339	0.0556	0.0489	0.0023	0.0111	0.0096	0.0316	0.0514	0.0454
	Valid N	11	22	33	2	4	6	13	26	39
Total area under eggplant	Mean		0.0256	0.0256	0.0951	0.1561	0.1452	0.0951	0.1241	0.12
	Standard deviation		0.0349	0.0349	0.0552	0.0945	0.0913	0.0552	0.1009	0.096
	Valid N	0	12	12	8	37	45	8	49	57

Table 16. Area under different types of TAV by district (ha)

		District/Site (S)									
		Busia		Kabondo		Kiambu		Arumeru		Total	
		Participant or Not		Participant or Not		Participant or Not		Participant or Not		Participant or Not	
		Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
All TAV	Mean	0.0261	0.0523*	0.0166	0.0241*	0.0107	0.0169	0.0124	0.076*	0.0163	0.0415
	Standard deviation	0.0309	0.0956	0.0163	0.027	0.0645	0.0259	0.0367	0.1112	0.0415	0.0776
	Valid N	69	99	66	106	71	96	78	91	284	392
Amaranth	Mean	0.0047	0.0135*	0.0032	0.0052	0.0065	0.0102	0.0196	0.0219	0.0058	0.011
	Standard deviation	0.0049	0.0281	0.0039	0.0053	0.0138	0.0101	0.0361	0.0468	0.012	0.0229
	Valid N	54	74	19	55	15	54	7	17	95	200
Nightshade	Mean	0.0081	0.0144	0.0065	0.007	0.0187	0.0115	0.0059	0.0391	0.0086	0.0121
	Standard deviation	0.0129	0.03	0.0063	0.0069	0.0505	0.0183	0.005	0.053	0.0201	0.0238
	Valid N	41	60	53	99	15	55	7	15	116	229
Spider plant	Mean	0.008	0.0131	0.0039	0.0045	0.0012	0.0067	.	0.0059	0.0059	0.008
	Standard deviation	0.0185	0.021	0.0027	0.0041	0.0007	0.0091	.	0.0043	0.0134	0.0138
	Valid N	49	64	44	73	4	46	0	5	97	188
Cowpea leaves	Mean	0.0108	0.0188*	0.0085	0.0124	0.0011	0.0078	0.0036	0.0146	0.0094	0.015
	Standard deviation	0.0088	0.0287	0.0107	0.0219	.	0.0089	0.0024	0.0139	0.0096	0.0246
	Valid N	61	83	54	80	1	14	3	6	119	183
Sweetpotato leaves	Mean	0.0282	0.0995	0.0163	0.0162	0.0379	0.0023	0.008	0.016	0.0222	0.029
	Standard deviation	0.0463	0.0809	0.0093	0.0281	.	0.0021	0.0023	0.0111	0.0316	0.0514
	Valid N	6	5	4	11	1	6	2	4	13	26
Total area under eggplant	Mean	.	0.0277	.	0.0278	.	0.0018	0.0951	0.1561	0.0951	0.1241
	Standard deviation	.	0.0358	.	0.0434	.	.	0.0552	0.0945	0.0552	0.1009
	Valid N	0	8	0	3	0	1	8	37	8	49

Table 17. Adoption and commercialization of sweetpotato

	Kenya			Tanzania			Total			
	Participant or not			Participant or not			Participant or not			
	Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total	Diff
Grow sweetpotato	99.3	99	99.1	6.4	34.1	21.3*	65.3	79.1	73.3	13.8
Sell sweetpotato	63	77.6	71.8*	3.8	24.2	14.8*	41.3	61.1	52.8	19.8
Grow OFSP	25.4	47.3	38.6*	0	48.4	41.7*	24.5	47.4	38.9	23.0
Sell OFSP	8.1	25.9	18.8*	0	12.1	6.5*	5.2	21.6	14.7	16.5

Table 18. The last season farmers grew and sold sweetpotato (%)

	Kenya		Tanzania		Total	
	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
Grew sweetpotato						
Season 1-09 (Apr 09-Sep 09)	94.8	91.1	20.3	61.3	92.2	87.1
Season 2-08 (Oct 08-Mar 09)	2.2	6.4	59.4	16.1	4.3	7.7
Season 1-08 (Apr 08-Sep 08)	1.5	2.0	0.0	9.7	1.4	3.0
Season 2-07 (Oct 07-Mar 08)	1.5	0.5	20.3	12.9	2.1	2.1
Sold sweetpotato						
Season 1-09 (Apr 09-Sep 09)	78.0	77.7	0.0	85.7	78.1	78.4
Season 2-08 (Oct 08-Mar 09)	17.1	15.5	0.0	14.3	17.2	15.4
Season 1-08 (Apr 08-Sep 08)	2.5	4.0	0.0	0.0	2.3	3.7
Season 2-07 (Oct 07-Mar 08)	2.5	2.8	0.0	0.0	2.3	2.6

Table 19. Sweetpotato production area and quantities harvested

		Kenya		Tanzania		Total	
		Participant or Not		Participant or Not		Participant or Not	
		Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
Total SP harvested in kg in short season	Mean	1780.88	2245.63	14466.00	7993.78	2032.07	2570.99
	Standard deviation	3292.39	4993.54	20271.34	6396.29	4229.28	5230.89
	Valid N	99	150	2	9	101	159
Total area under all sweetpotato (ha)	Mean	.1778	.1822	.6323	.5879	.1865	.2047
	Standard deviation	.2513	.1950	.8235	.4350	.2690	.2324
	Valid N	103	153	2	9	105	162
Yields of sweetpotato	Mean	12061.88	12733.03	13176.00	19422.20	12083.10	13104.65
	Standard deviation	12234.13	11404.54	14900.15	17486.81	12204.66	11846.93
	Valid N	103	153	2	9	105	162
Total OFSP harvested per season	Mean	201.52	404.62	.	5300.00	201.52	676.59
	Standard deviation	201.90	549.04	.	5641.06	201.90	1704.16
	Valid N	25	68	0	4	25	72
Area under OFSP (ha)	Mean	.0557	.0720	.	.2533	.0557	.0865
	Standard deviation	.0893	.1129	.	.1750	.0893	.1267
	Valid N	17	46	0	4	17	50
Yield of orange flesh per season	Mean	12659.62	8169.68	.	19000.93	12659.62	9091.48
	Standard deviation	14376.02	9123.51	.	10181.79	14376.02	9596.59
	Valid N	14	43	0	4	14	47

Table 20. Sweetpotato sold per season and mode of selling

		Kenya			Tanzania			Total		
		Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal
Total sweetpotato sold (kg/	Mean	756.06	729.57	740.1	2052	1625.08	1684.38	802.67	848.2	831.24
	Standard deviation	1205.6	922.65	1043	2845	2706.04	2687.74	1301.6	1332	1319
	Valid N	134	203	337	5	31	36	139	234	373
Proportion of sweetpotato sold	Mean	21.08	21.96	21.61	14.0	18.82	18.15	20.82	21.55	21.28
	Standard deviation	30.18	29.56	29.77	21.91	31.66	30.28	29.89	29.8	29.79
	Total N	135	205	340	78	91	169	213	296	509
Selling distance	Mean	2.74	11.76	8.58	0	26.6	19	2.6	12.78	9.24
	Standard deviation	3.05	32.81	26.75	0	30.71	28.23	3.03	32.69	26.83
	Total N	135	205	340	78	91	169	213	296	509
Sold at farm gate (%)		36.3	49.8	44.4*	2.6	18.7	11.2*	23.9	40.2	33.4
Sold at village market (%)		16.3	18	17.4	0	2.2	1.2	10.3	13.2	12
Sold at district market (%)		3	6.3	5	0	2.2	1.2	1.9	5.1	3.7
Sold at roadside (%)		1.5	3.9	2.9*	0	0	0	0.9	2.7	2
Why did you not sell sweetpotato in the last 2 seasons? (%)	Produced enough for home use only	90	87.8	88.9	100	66.7	72.7	90.4	84.5	87.3
	Lack of buyers	2	2	2	0	0	0	1.9	1.7	1.8
	Low prices	0	0	0	0	0	0	0	0	0
	Poor quality produce	6	10.2	8.1	0	33.3	27.3	5.8	13.8	10
	Other	2	0	1	0	0	0	1.9	0	0.9
	Total N (count)	135	205	340	78	91	169	213	296	509

Table 21. Quantities and proportion of sweetpotato sold by sites (kg/season per household)

		District/ Site (S)								
		Busia			Kabondo			Arumeru		
		Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal
Total sweetpotato sold	Mean	318.5	443.3	391.9	1,206.9	991.5	1,074.1	2,052.0	1,625.1	1,684.4
	Std	904.4	815.2	852.6	1,313.1	940.9	1,100.0	2,844.9	2,706.0	2,687.7
	Valid N	68	97	165	66	106	172	5	31	36
Proportion of SP sold	Mean	6.5	5.2	5.7	36.2	37.3	36.8	14.0	18.8	18.2
	Std	16.5	14.4	15.2	33.6	31.6	32.3	21.9	31.7	30.3
	Total N	69	99	168	66	106	172	78	91	169
Selling distance	Mean	3.7	6.8	5.9	2.1	17.8	11.3	0.0	26.6	19.0
	Std	3.1	19.6	16.6	2.9	43.3	33.8	0.0	30.7	28.2
	Total N	69	99	168	66	106	172	78	91	169
Sold at farm gate (%)		15.9	27.3	22.6	57.6	70.8	65.7	2.6	18.7	11.2*
Sold at village market (%)		15.9	28.3	23.2	16.7	8.5	11.6	0	2.2	1.2
Sold at district market (%)		4.3	6.1	5.4	1.5	6.6	4.7	0	2.2	1.2
Sold at road side (%)		0	0	0	3	7.5	5.8	0	0	0
Sold individually (%)		36.2	45.5	41.7	78.8	89.6	85.5*	2.6	18.7	11.2*
Sold as group (%)		0	11.1	6.5*	3	1.9	2.3	0	3.3	1.8
	Total	69	99	168	66	106	172	78	91	169
Why did you not sell sweetpotato in the last 2 seasons? (%)	Produced enough for home use only	90.2	86.5	88.5	88.9	91.7	90.5	100	66.7	72.7
	Lack of buyers	2.4	2.7	2.6	0	0	0	0	0	0
	Low prices	0	0	0	0	0	0	0	0	0
	Poor quality produce	7.3	10.8	9	0	8.3	4.8	0	33.3	27.3
	Other	0	0	0	11.1	0	4.8	0	0	0

Table 22. Training, information and group membership (%)

		Kenya			Tanzania			Total		
		Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total
Is anyone in the household a member of a farmer group/agricultural	yes	19.4	100	67*	7.7	100	57.4*	16.2	100	64.8
Is anyone in the household a member of any other non-agricultural group	yes	41.7	49.5	46	10.4	8.8	9.5	33.2	40.1	37.2
Does the household have a budget/record book of expenses and	yes	12.6	26.2	21*	2.6	17.6	10.7*	9.9	24.2	18.2
Does the household have a sales record book/ sheet for TAV	yes	9.9	32.4	23*	1.3	16.7	9.6*	7.5	28.8	19.9
Does your household keep financial records for TAV or sweet	yes	9.3	34.4	25*	0	20.2	11*	6.7	31.2	21.2
During the last 2 years, have you received any information	yes	47.6	78.1	66*	3.8	76.9	43.2*	35.6	77.8	60.1
Most important sources of agricultural prices	No source	17.3	5.8	10	34.2	12.6	22.5	22	7.4	13.4
	Friends, neighbors	47.6	31.6	38	26	17.2	21.3	41.7	28.3	33.8
	Businessmen	11.5	15.5	14	58.9	27.6	41.9	24.6	18.3	20.9
	Extension staff	3.1	2.1	2.5	5.5	10.3	8.1	3.8	4	3.9
	Ministry of agriculture	6.8	10.3	8.9	0	0	0	4.9	7.9	6.7
	Farm concern staff	5.2	42.6	28	2.7	47.1	26.9	4.5	43.7	27.6
	AVDRC staff	0	1.4	0.8	1.4	18.4	10.6	0.4	5.3	3.3
	Commercial village	0	7.6	4.6	0	0	0	0	5.8	3.4
	Other farmer's association/cooperative	6.3	9.3	8.1	2.7	1.1	1.9	5.3	7.4	6.5
	Radio	15.7	10.3	12	5.5	12.6	9.4	12.9	10.8	11.7
	Going to market	34.6	30.9	32	32.9	31	31.9	34.1	31	32.2
Most important sources of new varieties-TAV and SP	No source	5.7	7.5	7	0	1.4	1.4	5.6	6.1	5.9
	Friends, neighbors	58.6	23.8	33	33.3	12.9	13.7	57.8	21.2	29.7
	Businessmen	1.1	0.9	1	0	1.4	1.4	1.1	1	1
	Extension staff	11.5	6.2	7.6	33.3	20	20.5	12.2	9.4	10.1

		Kenya			Tanzania			Total		
		Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total
	Ministry of agriculture	17.2	17.2	17	0	1.4	1.4	16.7	13.5	14.2
	Farm concern staff	17.2	76.2	60	66.7	85.7	84.9	18.9	78.5	64.6
	AVDRC	0	1.3	1	33.3	37.1	37	1.1	9.8	7.8
	Commercial village	8	4.8	5.7	33.3	2.9	4.1	8.9	4.4	5.4
	Other farmers association/cooperative	19.5	15.4	17	0	12.9	12.3	18.9	14.8	15.8
	Radio	16.1	9.7	12	33.3	4.3	5.5	16.7	8.4	10.3
	Going to market	9.2	3.1	4.8	0	1.4	1.4	8.9	2.7	4.1
Has anyone in the household had training from FCI	Yes	8.7	81.1	52*	5.1	82.4	46.7*	7.7	81.4	50.4
Received training on market-oriented production	Yes	94.4	92.2	92	100	98.7	98.7	95.5	93.7	93.8
Received training on farmer groups	Yes	72.2	86.5	86	100	97.3	97.5	77.3	89	88.3
Received training on finance and saving	Yes	55.6	82.8	81*	75	90.7	89.9	59.1	84.6	83
Received training on inputs use	Yes	33.3	76.2	73*	75	82.7	82.3	40.9	77.7	75.4
Received training on nutrition	Yes	83.3	85.7	86	50	85.3	83.5	77.3	85.6	85
Have you received any another training	Yes	5.6	7	6.9	0	0	0	4.5	5.3	5.3
Have you received any training or services from COTEs?	Yes	11.2	41.9	29*	1.3	34.4	19*	8.5	40.2	26.8
Trained on how to market TAV/Sweetpotato (COTEs)	Yes	87	88.1	88	0	87.1	84.4*	83.3	87.9	87.3
Trained on seeds/ vines production (COTEs)	Yes	82.6	80.2	81	100	80.6	81.3	83.3	80.3	80.7
Trained on TAV/ Sweetpotato production (COTEs)	Yes	73.9	79.4	79	100	80.6	81.3	75	79.6	79
Trained on how to source inputs (COTEs)	Yes	34.8	57.1	54*	0	77.4	75	33.3	61.1	57.5
Trained on TAV/Sweetpotato cooking (COTEs)	Yes	65.2	61.9	62	0	74.2	71.9	62.5	64.3	64.1

		Kenya			Tanzania			Total		
		Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total
Have you received any another training from COTEs	Yes	4.3	9.5	8.7	0	0	0	4.2	7.6	7.1
During the last 12 months, have you received agricultural training	Yes	0	0	0	0	44.9	24.1	0*	44.9	24.1

Table 23. Savings and credit

		Kenya			Tanzania			Total		
		Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total
Are you in any group saving scheme?	Yes	47.1	68.1	59.6*	10.3	57.1	35.5*	37	65.6	53.6
Does the group have a bank account?	Yes	33.7	66.5	56*	25	31.4	30.5	33	59.4	51.8
Does any member of the household have a bank account	Yes	41.3	53.8	48.7*	6.4	12.1	9.5	31.7	44.1	38.9
If yes, was any of the bank account opened in the last 2 years	Yes	40	47.2	44.7	40	63.6	56.3	40	48.3	45.4
Do you save any money from sale of TAV or Sweetpotato	Yes	27.2	52	42.7*	1.4	14.1	8.1*	19.7	43.7	34.1
In the last three seasons, for what special activity have you used incomes from TAV	Purchase seeds	4.9	5.6	5.4	3	6.4	5	4.4	5.8	5.3
	Purchase fertilizers	0	2.6	1.8	3	0	1.3	0.9	2.1	1.7
	Purchase pesticides	0	0.5	0.4	0	0	0	0	0.4	0.3
	Rent additional land	0	1	0.7	0	6.4	3.8	0	2.1	1.4
	Small business	2.5	3.6	3.2	3	6.4	5	2.6	4.1	3.6
	Expand crop area	0	3.1	2.2	0	0	0	0	2.5	1.7
	Buy construction material	2.5	1	1.4	0	8.5	5	1.8	2.5	2.2
	Purchase livestock	8.6	5.1	6.1	24.2	10.6	16.3	13.2	6.2	8.4
	Improve water system	0	3.1	2.2	0	0	0	0	2.5	1.7
	Pay school fees	18.5	15.3	16.2	3	14.9	10	14	15.2	14.8
	Purchase basic food	56.8	48	50.5	54.5	46.8	50	56.1	47.7	50.4
	Other	6.2	11.2	9.7	9.1	0	3.8	7	9.1	8.4
In last three seasons for what special activity have you used income from SP	Purchase seeds	1.4	0.7	0.9	0	0	0	1.3	0.6	0.8
	Purchase fertilizers	0	4.2	2.8	0	0	0	0	3.6	2.5
	Purchase pesticides	0	0	0	0	0	0	0	0	0
	Rent additional land	1.4	2.8	2.4	0	0	0	1.3	2.4	2.1

		Kenya			Tanzania			Total		
		Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total
	Small business	7.1	5.6	6.1	0	8.7	6.5	6.4	6.1	6.2
	Expand crop area	0	3.5	2.4	0	4.3	3.2	0	3.6	2.5
	Buy construction material	4.3	0.7	1.9	0	30.4	22.6	3.8	4.8	4.5
	Purchase livestock	11.4	14.8	13.7	75	26.1	38.7	17.9	16.4	16.9
	Improve water system	0	0	0	0	0	0	0	0	0
	Pay school fees	35.7	38	37.3	0	13	9.7	32.1	34.5	33.7
	Purchase basic food	35.7	28.9	31.1	25	17.4	19.4	34.6	27.3	29.6
	Other	2.9	0.7	1.4	0	0	0	2.6	0.6	1.2
How much is your contribution to the group savings per	Mean	628	320	419	15750	3902	5508	1791	1037	1255
	Standard deviation	2059	785	1336	13047	3714	7012	5646	2295	3609
Proportion Saved from sale of TAV (1)	Mean	25	33	31	30	67	64	25	35	33
	Standard deviation	23	22	22	.	21	22	23	23	24
	Total N	206	301	507	78	91	169	284	392	676
Proportion saved from sale of SP	Mean	32	35	34	.	20	20	32	34	34
	Standard deviation	23	21	21	.	40	40	23	22	22
Has any household member received credit in the last 12 month	yes	15.5	26.6	22.1*	14.1	34.1	24.9*	15.1	28.3	22.8
If yes, Among the household members, who received credit?	male	25	32.5	30.4	54.5	29	35.7	32.6	31.5	31.8
	female	62.5	61.3	61.6	45.5	61.3	57.1	58.1	61.3	60.4
	both	12.5	6.3	8	0	9.7	7.1	9.3	7.2	7.8
Credit sources	bank	16	24.2	22	45.5	17.9	25.6	25	22.3	23.1
	farmers association	24	25.8	25.3	27.3	71.4	59	25	39.4	35.4
	other self-help group	56	27.3	35.2	27.3	3.6	10.3	47.2	20.2	27.7
	NGOs	0	3	2.2	9.1	0	2.6	2.8	2.1	2.3
	family	4	4.5	4.4	0	0	0	2.8	3.2	3.1

		Kenya			Tanzania			Total		
		Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total
	Own farmer group (MSU-HISA)	4	21.2	16.5	0	10.7	7.7	2.8	18.1	13.8
Purpose of credit	to purchase seeds	9.7	15.7	13.9	11.1	10.7	10.8	10	14.3	13
	to purchase fertilizer	19.4	15.7	16.8	11.1	7.1	8.1	17.5	13.3	14.5
	to purchase pesticides	0	2.9	2	0	7.1	5.4	0	4.1	2.9
	to rent additional land	0	2.9	2	11.1	3.6	5.4	2.5	3.1	2.9
	small business	22.6	34.3	30.7	55.6	42.9	45.9	30	36.7	34.8
	To expand crop area	12.9	14.3	13.9	33.3	7.1	13.5	17.5	12.2	13.8
	To buy construction material	9.7	8.6	8.9	11.1	3.6	5.4	10	7.1	8
	To purchase livestock	32.3	27.1	28.7	11.1	32.1	27	27.5	28.6	28.3
	To improve water system	0	1.4	1	0	0	0	0	1	0.7
	To pay school fees	19.4	31.4	27.7	55.6	17.9	27	27.5	27.6	27.5
	To purchase basic food	3.2	2.9	3	44.4	28.6	32.4	12.5	10.2	10.9
Repay credit with money from sale of TAV	yes	20.7	56.6	46.7*	9.1	69	52.5*	17.5	60	48.3
Repay credit with money from sale of sweetpotato	yes	41.4	40	40.4	0	3.4	2.5	30	29.8	29.9
Repay credit with money from other crops	yes	50	57	55	45.5	42.9	43.6	48.8	53.3	52
Repay credit with money from sale of livestock/ livestock products	yes	46.4	36.7	39.3	45.5	13.8	22.5*	46.2	30.6	34.7
Repay credit using salary	yes	13.8	13	13.2	45.5	0	12.5*	22.5	9.4	13

Table 24. Farmer awareness of nutrition (%)

		Kenya			Tanzania			Total		
		Participant or Not			Participant or Not			Participant or Not		
		Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total
Have you heard of Vitamin A?	Yes	85.4	83.4	84.2	71.8	89	81.1	81.7	84.7	83.4
Mentioned Vitamin A protects the body	Yes	22.2	23.5	23	60.7	80.2	72.3	31.5	37.3	34.9
Mentioned that vitamin A protects the eyes or vision	Yes	25.6	37.5	32.6	51.8	51.9	51.8	31.9	41	37.2
Have you heard of iron?	Yes	63.1	59.1	60.7	57.7	82.4	71	61.6	64.5	63.3
Mentioned that it prevents anemia	Yes	13.1	15.7	14.6	26.7	46.7	39.2	16.6	24.9	21.5
Mentioned that it is found in the blood	Yes	40	39.9	39.9	37.8	57.3	50	39.4	45.1	42.8
Mentioned that it prevents fatigue	Yes	4.6	3.9	4.2	4.4	4	4.2	4.6	4	4.2
Are there health benefits of consuming TAV?	Yes	94.7	98.7	97	97.4	96.7	97	95.4	98.2	97
	Don't know	0.5	0	0.2	0	0	0	0.4	0	0.1
Mentioned that protect the body or strengthen immunity	Yes	29.2	43.1	37.6	42.7	53.4	48.5	33	45.5	40.3
Mentioned that contain vitamin A	Yes	8.2	9.8	9.1	46.7	59.1	53.4	18.9	21	20.2
Mentioned that contain iron	Yes	6.2	7.7	7.1	18.7	39.8	30.1	9.6	15.1	12.8
Mentioned that contribute to balanced diet/have many vitamin	Yes	13.3	11.8	12.4	4	17	11	10.7	13	12.1
Mentioned that have medicinal properties	Yes	16.4	21.9	19.7	2.7	5.7	4.3	12.6	18.2	15.9
Are there any health benefits of consuming OFSP?	No	20.9	15.3	17.6	6.4	6.6	6.5	16.9	13.3	14.8
	Yes	51	72.8	63.9	26.9	71.4	50.9	44.4	72.4	60.7
	Never heard of OFSP	27.7	11.6	18.1	65.4	20.9	41.4	38	13.8	24
	Don't know	0.5	0.3	0.4	1.3	1.1	1.2	0.7	0.5	0.6
Mentioned that OFSP protects the body or strengthens immunity	Yes	20	16.4	17.6	61.9	40.6	45.9	27	21.9	23.5
Mentioned that OFSP contains vitamin A	Yes	25.7	36.5	33	38.1	62.5	56.5	27.8	42.4	37.9
Mentioned that OFSP has medicinal	Yes	2.9	3.7	3.4	0	6.3	4.7	2.4	4.2	3.7

		Kenya			Tanzania			Total		
		Participant or Not			Participant or Not			Participant or Not		
		Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total
properties										
Mentioned that OFSP contributes to a balanced diet/has vitamins	Yes	8.6	10.5	9.9	9.5	20.3	17.6	8.7	12.7	11.5

Table 25. Consumption of TAV and sweetpotato (%)

	Kenya			Tanzania			Total		
	Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total
Eats any TAV	85.9	92.4	89.7*	79.5	85.7	82.8	84.2	90.8	88
Consumes amaranth	56.8	75.4	67.9*	64.1	68.1	66.3	58.8	73.7	67.5
Eats sweetpotato leaves	1	3.3	2.4	16.7	24.2	20.7	5.3	8.2	7
Eats nightshade	56.3	74.4	67.1*	55.1	69.2	62.7	56	73.2	66
Eats spider plant	33	50.5	43.4*	12.8	14.3	13.6	27.5	42.1	35.9
Eats cowpea leaves	59.2	57.1	58	28.2	28.6	28.4	50.7	50.5	50.6
Do you offer traditional leafy vegetables when visitors come	81	92	87.5*	56.4	83.3	70.8*	74.2	90	83.4
Consumes any sweetpotato	68.4	67.1	67.7	19.2	28.6	24.3	54.9	58.2	56.8
Eat OFSP	9.7	21.9	17*	0	4.4	2.4	7	17.9	13.3
Do you offer sweetpotato when visitors come to your home?	77.6	85.7	82.4*	24.4	51.1	38.7*	62.9	77.7	71.5

Table 26. Feeding of target crops to children ages 4–7 years

	Kenya		Tanzania		Total	
	Participant or Not		Participant or Not		Participant or Not	
	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
	%	%	%	%	%	%
Has reference child of 4–7 years	95.6	49.8	98.7	83.5	96.5	57.7
Any TAV	88.8	98.0	79.5	87.9	86.3	95.7
Amaranth	53.3	69.3	66.2	67.1	56.9	68.6
Nightshade	53.8	66.0	55.8	65.8	54.4	65.9
spider plant	33.0	52.0	13.0	13.2	27.4	38.9
Cowpea	56.9	69.3	27.3	23.7	48.5	54.0
SP leaves	.0	2.7	15.6	23.7	4.4	9.7
Sweetpotato	64.0	71.3	14.3	32.9	50.0	58.4
OFSP	7.1	30.0	.0	5.3	5.1	21.7

Table 27. Collective marketing by country

	Kenya			Tanzania			Total		
	Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total
	%	%	%	%	%	%	%	%	%
Sourced TAV inputs individually	56.8	57.8	57.4	39.7	25.3	32.0	52.1	50.3	51.0
Sourced TAV inputs in a group	1.5	14.0	8.9	.0	3.3	1.8	1.1	11.5	7.1
Sold TAV individually	35.4	68.4	55.0	39.7	53.8	47.3	36.6	65.1	53.1
Sold TAV in a group	.5	8.0	4.9	.0	1.1	.6	.4	6.4	3.8
Sample size	**206**	**301**	**507**	**78**	**91**	**169**	**284**	**392**	**676**
Sourced SP inputs individually	68.1	60.0	63.2	1.3	22.0	12.4	43.7	48.3	46.4
Sourced SP inputs in a group	3.7	22.9	15.3	.0	11.0	5.9	2.3	19.3	12.2
Sold SP individually	57.0	68.3	63.8	2.6	18.7	11.2	37.1	53.0	46.4
Sold SP in a group	1.5	6.3	4.4	.0	3.3	1.8	.9	5.4	3.5
Sample size	**135**	**205**	**340**	**78**	**91**	**169**	**213**	**296**	**509**

Table 28. Collective marketing by site

	District/ Site (S)							
	Busia		Kabondo		Kiambu		Arumeru	
	Participant or Not		Participant or Not		Participant or Not		Participant or Not	
	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
	%	%	%	%	%	%	%	%
Sourced TAV inputs individually	66.7	52.5	71.2	57.5	33.8	63.5	39.7	25.3
Sourced TAV inputs in a group	2.9	14.1	1.5	3.8	.0	25.0	.0	3.3
Sold TAV individually	39.1	68.7	42.4	71.7	25.4	64.6	39.7	53.8
Sold TAV in a group	.0	.0	.0	.9	1.4	24.0	.0	1.1

Table 29. Production and marketing of TAV by country

		Kenya		Tanzania		Total	
		Participant or Not		Participant or Not		Participant or Not	
		Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
TAV harvested per season							
Amaranth	Mean	97.35	159.68*	114.20	171.58	101.89	162.11
	Valid N	95	218	35	56	130	274
Nightshade	Mean	151.36	401.86	137.78	601.87	148.24	438.78
	Valid N	114	243	34	55	148	298
Spider plant	Mean	68.16	189.64*	24.14	65.09	66.85	178.67
	Valid N	98	207	3	20	101	227
Cowpeas	Mean	207.07	241.32	54.17	99.09	184.77	217.32
	Valid N	123	202	21	41	144	243
SP leaves	Mean	10.99	49.00	37.31	186.38	30.13	140.58
	Valid N	3	13	8	26	11	39
Eggplant	Mean	.	54.30	133.17	666.55	133.17	504.12
	Valid N	0	13	8	36	8	49
Fraction of TAV sold							
Amaranth	Mean	83.95	81.00	84.22	82.93	84.04	81.29
Nightshade	Mean	80.93	83.80	85.14	77.47	82.15	82.95
Spider plant	Mean	86.42	83.99	100.00	75.27	87.01	83.45
Cowpea	Mean	76.32	73.95	66.53	71.60	75.00	73.66
SP leaves	Mean	.	75.00	.	80.48	.	79.70
Egg plant	Mean	.	73.81	58.09	81.37	58.09	80.39
Prices of TAV (USD/kg)							
Amaranth	Mean	.262	.276	.340	.388	.283	.286
Nightshade	Mean	.246	.239	.286	.355	.253	.250

		Kenya		Tanzania		Total	
		Participant or Not		Participant or Not		Participant or Not	
		Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
Spider plant	Mean	.299	.288	.	.229	.299	.286
Cowpea	Mean	.212	.236	.241	.223	.213	.235
SP leaves	Mean	.	.062	.	.244	.	.192
Eggplant	Mean	.	.265	.121	.272	.121	.271

Table 30. Production and marketing of TAV by site

		District/ Site (S)									
		Busia		Kabondo		Kiambu		Arumeru		Total	
		Participant or Not		Participant or Not		Participant or Not		Participant or Not		Participant or Not	
		Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
TAV harvested per season											
Amaranth	Mean	88.17	154.63	40.54	86.82	166.79	214.17	114.20	171.58	101.89	162.11
	Valid N	55	84	18	54	22	80	35	56	130	274
Nightshade	Mean	149.27	235.62	94.08	85.47	290.56	915.13	137.78	601.87	148.24	438.78
	Valid N	40	70	52	93	22	80	34	55	148	298
Spider plant	Mean	65.14	136.74	59.13	81.12	140.86	366.07	24.14	65.09	66.85	178.67
	Valid N	52	76	39	67	7	64	3	20	101	227
Cowpeas	Mean	277.26	369.31	127.74	153.51	17.55	52.08	54.17	99.09	184.77	217.32
	Valid N	66	93	56	86	1	23	21	41	144	243
SP leaves	Mean	10.56	53.54	.	61.91	11.20	3.08	37.31	186.38	30.13	140.58
	Valid N	1	6	0	5	2	2	8	26	11	39
Eggplant	Mean	.	11.21	.	147.25	.	27.30	133.17	666.55	133.17	504.12
	Valid N	0	8	0	4	0	1	8	36	8	49
Fraction of TAV sold											
Amaranth	Mean	73.60	69.22	90.00	92.13	90.23	85.03	84.22	82.93	84.04	81.29
Nightshade	Mean	63.68	69.82	86.75	93.57	87.85	86.67	85.14	77.47	82.15	82.95
Spider plant	Mean	72.62	69.77	100.00	91.96	91.67	90.78	100.00	75.27	87.01	83.45
Cowpea	Mean	66.13	65.22	89.20	79.93	92.31	88.26	66.53	71.60	75.00	73.66
SP leaves	Mean	.	75.00	.	.	.	.	.	80.48	.	79.70
Egg plant	Mean	.	100.00	.	50.00	.	71.43	58.09	81.37	58.09	80.39

		District/ Site (S)									
		Busia		Kabondo		Kiambu		Arumeru		Total	
		Participant or Not		Participant or Not		Participant or Not		Participant or Not		Participant or Not	
		Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
Prices of TAV (USD/ kg)											
Amaranth	Mean	.297	.288	.188	.196	.291	.315	.340	.388	.283	.286
Nightshade	Mean	.342	.355	.215	.203	.275	.249	.286	.355	.253	.250
Spider plant	Mean	.352	.363	.260	.194	.338	.340	.	.229	.299	.286
Cowpea	Mean	.328	.316	.160	.143	.172	.338	.241	.223	.213	.235
SP leaves	Mean	.	.062	.	.	.	.	.	.244	.	.192
Egg plant	Mean	.	.	.	.265	.	.	.121	.272	.121	.271

Table 31. Adoption of target crops by sub-sample farmers in Kiambu and Busia

	Kiambu							Arumeru						
	Baseline		Impact		% change in 2 years		Diff	Baseline		Impact		% change in 2 years		Diff
	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant		Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	
Grow TAV	38	100	43.7	77.8	5.7	-22.2	-27.9	47.4	60	64.1	80	16.7	20	3.3
Sell TAV	18.3	88.9	23.9	72.2	5.6	-16.7	-22.3	17.9	30	39.7	60	21.8	30	8.2
Grow Amaranth	25.4	94.4	32.4	72.2	7	-22.2	-29.2	23.1	10	46.2	30	23.1	20	-3.1
Sell Amaranth	7	77.8	14.1	66.7	7.1	-11.1	-18.2	12.8	10	24.4	10	11.6	0	-12
Grow nightshade	28.2	100	32.4	77.8	4.2	-22.2	-26.4	19.2	20	47.4	30	28.2	10	-18
Sell nightshade	15.5	83.3	19.7	72.2	4.2	-11.1	-15.3	10.3	20	25.6	10	15.3	-10	-25
Grow Spider plant	5.6	77.8	15.5	44.4	9.9	-33.4	-43.3	3.8	0	3.8	20	0	20	20
Sell Spider plant	4.2	55.6	8.5	44.4	4.3	-11.2	-15.5	0	0	1.3	10	1.3	10	8.7
Grow cowpea	2.8	5.6	5.6	0	2.8	-5.6	-8.4	20.5	40	32.1	50	11.6	10	-1.6
Sell cowpea	1.4	5.6	2.8	0	1.4	-5.6	-7	3.8	10	9	0	5.2	-10	-15
Grow SP leaves	0	0	2.8	5.5	2.8	11.1	8.3	16.7	20	12.8	50	-3.9	30	33.9
Sell SP leaves	0	0	0	0	0	0	0	2.6	0	1.3	20	-1.3	20	21.3
Sample size	**71**	**18**	**71**	**18**				**78**	**10**	**78**	**10**			

Table 32. Adoption of target crops by sub-sample farmers in Busia and Kabondo

	Busia							Kabondo						
	Baseline		Impact		% change in 2 years		Diff	Baseline		Impact		% change in 2 years		Diff
	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant		Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	
Grow TAV	98.6	100	100	100	1.4	0	-1.4	95.5	100	95.5	100	0	0	0
Sell TAV	11.6	25.5	49.3	69.1	37.7	43.6	5.9	50.7	60.7	46.3	89.3	-4.4	28.6	33
Grow Amaranth	63.8	69.1	82.6	90.9	18.8	21.8	3	22.4	21.4	29.9	50	7.5	28.6	21.1
Sell Amaranth	4.3	9.1	18.8	49.1	14.5	40	25.5	4.5	10.7	10.4	39.3	5.9	28.6	22.7
Grow nightshade	29.0	27.3	65.2	70.9	36.2	43.6	7.4	68.7	82.1	85.1	96.4	16.4	14.3	-2.1
Sell nightshade	1.4	0	18.8	52.7	17.4	52.7	35.3	29.9	42.9	32.8	85.7	2.9	42.8	39.9
Grow Spider plant	44.9	52.7	81.2	80	36.3	27.3	-9	64.2	64.3	68.7	89.3	4.5	25	20.5
Sell Spider plant	5.8	10.9	24.6	50.9	18.8	40	21.2	28.4	35.7	23.9	67.9	-4.5	32.2	36.7
Grow cowpea	95.7	94.5	100	100	4.3	5.5	1.2	92.5	92.9	89.6	92.9	-2.9	0	2.9
Sell cowpea	7.2	10.9	34.8	52.7	27.6	41.8	14.2	41.8	53.6	32.8	60.7	-9	7.1	16.1
Grow SP leaves	0	7.3	4.3	10.9	4.3	3.6	-0.7	0	3	10.4	32.1	10.4	29.1	18.7
Sell SP leaves	0	5.5	0	3.6	0	-1.9	-1.9	0	0	0	3.6	0	3.6	3.6
Sample size	**69**	**55**	**69**	**55**				**66**	**29**	**66**	**29**			

Table 33. Growing and selling of TAVS between baseline and impact (%)

	Participant or not					
	Non-participant			Participant		
	Baseline	Impact	Total	Baseline	Impact	Total
Grow TAV	68.8	75.1	71.9	96.4	94.6	95.5
Sell TAV	24.2	39.6	31.9*	45	73.9	59.5*
Grow Amaranth	33.3	47.7	40.5*	55.9	72.1	64*
Grow Nightshade	35.4	56.8	46.1*	52.3	74.8	63.5*
Grow Spider plant	28.4	40.7	34.6*	55	71.2	63.1*
Grow SP leaves	14	7.7	10.9*	17.1	19.8	18.5
Grow cowpea	51.2	55.4	53.3	74.8	77.5	76.1
Sell cowpea	13	19.3	16.1*	20.7	41.4	31.1*
Sell SP leaves	1.1	0.4	0.7	2.7	5.4	4.1
Sell Amaranth	7.4	17.2	12.3*	20.7	45.9	33.3*
Sell Nightshade	14	24.2	19.1*	26.1	60.4	43.2*
Sell Spider plant	9.1	14	11.6	23.4	50.5	36.9*

Table 34. Percentage of farmers growing different types of TAV by sites (%)

	Busia				Kabondo				Kiambu				Arumeru			
	Baseline		Impact		Baseline		Impact		Baseline		Impact		Baseline		Impact	
	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
Grow TAV	98.6	100	100	100	95.5	100	95.5	100	38	100*	43.7	77.8*	47.4	60	64.1	80
Sell TAV	11.6	25.5*	49.3	69.1*	50.7	60.7	46.3	89.3*	18.3	88.9*	23.9*	72.2	17.9	30	39.7	60
Grow SP leaves	0	7.3*	4.3	10.9	40.3	46.4	10.4	32.1*	0	0	2.8	11.1	16.7	20	12.8	50*
Sell SP leaves	0	5.5*	0	3.6	1.5	0	0	3.6	0	0	0	5.6*	2.6	0	1.3	20*
Grow amaranth	63.8	69.1	82.6	90.9	22.4	21.4	29.9	50	25.4	94.4*	32.4	72.2*	23.1	10	46.2	30
Sell Amaranth	4.3	9.1	18.8	49.1*	4.5	10.7	10.4	39.3*	7	77.8*	14.1	66.7*	12.8	10	24.4	10
Grow nightshade	29	27.3	65.2	70.9	68.7	82.1	85.1	96.4	28.2	100*	32.4	77.8*	19.2	20	47.4	30
Sell nightshade	1.4	0	18.8	52.7*	29.9	42.9	32.8	85.7*	15.5	83.3*	19.7	72.2*	10.3	20	25.6	10
Grow spider plant	44.9	52.7	81.2	80	64.2	64.3	68.7	89.3*	5.6	77.8*	15.5	44.4*	3.8	0	3.8	20*
Sell spider plant	5.8	10.9	24.6	50.9*	28.4	35.7	23.9	67.9*	4.2	55.6*	8.5	44.4*	0	0	1.3	10
Grow cowpea	95.7	94.5	100	100	92.5	92.9	89.6	92.9	2.8	5.6	5.6	0	20.5	40	32.1	50
Sell cowpea	7.2	10.9	34.8	52.7*	41.8	53.6	32.8	60.7*	1.4	5.6	2.8	0	3.8	10	9	0
Grow eggplant	0	0	1.4	12.7*	0	0	0	7.1*	0	0	1.4	0	0	0	10.3	20
Sell eggplant	0	0	1.4	3.6	0	0	0	3.6	0	0	0	0	0	0	6.4	20

Table 35. Number of different types of TAV grown (%)

		Baseline or Impact						
		Baseline		Impact		% change in 2 years		
		Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	D in D
Types of TAV grown	Mean	1.62	2.55	2.12	3.25	30.9	27.5	-3.4
	Standard deviation	1.44	1.1	1.58	1.34			
Types of TAV sold	Mean	0.45	0.94	0.77	2.08	71.1	121.3	50.2
	Standard deviation	0.92	1.22	1.16	1.59			
	Total N	**284**	**112**	**284**	**112**	**568**	**224**	

Table 36. Proportion of farmers growing sweetpotato during baseline and impact surveys (%)

	Participant or not					
	Non-participant		Participant		Total	
	Baseline or Impact		Baseline or Impact		Baseline or Impact	
	Baseline	Impact	Baseline	Impact	Baseline	Impact
Grow sweetpotato	63.1	65.4	93.5	94.6	72.3	74.3
Sell sweetpotato	51.1	41.6	55.2	75.3*	52.7	51.8
Grow OFSP	16.2	24.3	37.5	62.5*	24.6	39
Sell OFSP	0.5	5.1*	14	37.6*	4.6	15
Sample size	**284**	**112**	**284**	**112**	**568**	**224**

Table 37. Proportion growing sweetpotato by site (%)

	District/ Site (S)																	
	Busia						Kabondo						Arumeru					
	Non-participant		Participant		Total		Non-participant		Participant		Total		Non-participant		Participant		Total	
	Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact
Grow sweetpotato	92.8	98.6	94.5	98.2	93.5	98.4	95.5	100	100	100	96.8	100	9.0	6.4	70	60	15.9	12.5
Sell sweetpotato	13	39.1*	29.1	67.3*	20.2	51.6	83.6	88.1	96.4	100	87.4	91.6	5.1	3.8	50	50	10.2	9.1
Grow OFSP	29	46.4*	43.6	81.8*	35.5	62.1	1.5	3	32.1	28.6	10.5	10.5	1.3	0	0	20	1.2	2.3
Sell OFSP	1.4	14.5*	16.4	52.7*	8.1	31.5	0	1.5	14.3	14.3	4.2	5.3	0	0	0	20	0	2.3
Sample size	**69**	**69**	**55**	**55**	**124**	**124**	**66**	**66**	**29**	**29**	**95**	**95**	**78**	**78**	**10**	**10**	**88**	**88**

Table 38. Changes in area grown different TAV in Kiambu and Arusha (ha)

		Kiambu							Arusha						
		Baseline		Impact					Baseline		Impact				
		Participant or Not		Participant or Not					Participant or Not		Participant or Not				
		Non-participant	Participant	Non-participant	Participant				Non-participant	Participant	Non-participant	Participant			
All TAV	Mean	.010	.026	.008	.011	-.002	-.015	-.012	.057	.056	.022	.058	-0.0351	0.0027	0.0378
	Standard deviation	.023	.037	.011	.009				.057	.064	.033	.075			
	Valid N	22	17	27	5				25	2	11	2			
Amaranth	Mean	.006	.013	.007	.008	.001	-.006	-.006	.037	0	.020	.008	-0.0169	0.0079	0.0248
	Standard deviation	.016	.031	.013	.009				.044	.	.037	.004			
	Valid N	11	17	16	5				14	0	7	2			
Nightshade	Mean	.006	.009	.006	.003	.000	-.007	-.006	.043	.202	.009	.094	-0.0337	-0.1081	-0.0744
	Standard deviation	.014	.009	.006	.002				.042	.000	.010	.			
	Valid N	14	17	15	4				12	2	8	1			
Spider plant	Mean	.006	.002	.003	.004	-.002	.001	.004	.040	0	0	0	-0.0396	0.0000	0.0396
	Standard deviation	.008	.003	.004	.004				.053	.	.	.			
	Valid N	4	12	4	2				3	0	0	0			
Cowpea	Mean	.003	.002	.001	0	-.001	-.002	.000	.254	.228	.003	0	-0.2509	-0.2277	0.0232
	Standard deviation	.	.	.	.				.282	.127	.002	.			
	Valid N	1	1	1	0				11	4	4	0			
Sweetpotato leaves	Mean	.015	.004	0	.000	-.015	-.004	.011	.001	.010	.008	.006	0.0067	-0.0036	-0.0103
	Standard deviation	.020	.005	.	.				.001	.	.002	.			
	Valid N	3	5	0	1				8	1	2	1			

Table 39. Changes in area grown different TAV in Busia and Kabondo (ha)

		Busia							Kabondo						
		Baseline		Impact		Changes in 2 years			Baseline		Impact		Changes in Two Years		
		Participant or Not		Participant or Not					Participant or Not		Participant or Not				
		Non-participant	Participant	Non-participant	Participant				Non-participant	Participant	Non-participant	Participant			
All TAV	Mean	.021	.023	.030	.068	0.0096	0.0447	0.0351	.063	.084	.021	.024	-0.0422	-0.0599	-0.0177
	Standard deviation	.029	.032	.044	.116				.085	.094	.029	.021			
	Valid N	66	53	69	54				63	29	62	29			
Amaranth	Mean	.005	.009	.005	.016	-0.0002	0.0074	0.0076	.018	.031	.003	.007	-0.0144	-0.0242	-0.0098
	Standard deviation	.004	.013	.005	.034				.020	.021	.004	.007			
	Valid N	42	33	54	46				11	5	19	14			
Nightshade	Mean	.005	.003	.012	.021	0.0074	0.0177	0.0103	.020	.035	.006	.008	-0.0139	-0.0270	-0.0131
	Standard deviation	.007	.001	.033	.042				.037	.063	.006	.006			
	Valid N	17	8	41	32				44	24	53	27			
Spider plant	Mean	.004	.007	.009	.015	0.0046	0.0078	0.0032	.015	.011	.004	.004	-0.0113	-0.0073	0.0040
	Standard deviation	.004	.008	.022	.025				.024	.012	.003	.003			
	Valid N	22	20	49	37				36	21	44	24			
Cowpea	Mean	.018	.033	.014	.027	-0.0044	-0.0061	-0.0018	.058	.045	.012	.015	-0.0456	-0.0302	0.0154
	Standard deviation	.035	.080	.026	.061				.087	.049	.028	.022			
	Valid N	64	49	60	47				58	27	54	19			
Sweetpotato leaves	Mean	0	.012	.009	.102	0.0093	0.0901	0.0808	0	0	.016	.004	0.0163	0.0040	-0.0123
	Standard deviation	.	.005	.004	.067				0	0	.009	.002			
	Valid N	0	2	5	4				0	0	4	5			

Table 40. Quantities harvested and sold impact sub-sample

		Baseline or Impact					
		Baseline		Impact		Total	
		participant or not		participant or not		participant or not	
		Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
TAV harvested per season (kg)							
Amaranth	Mean	90.57	64.97	101.89	167.83*	98.08	129.36
	Valid N	66	46	130	77	196	123
Nightshade	Mean	112.12	137.67	148.24	395.47	135.88	300.06
	Valid N	77	47	148	80	225	127
Spider plant	Mean	55.23	70.66	66.85	149.34*	62.52	121.04
	Valid N	60	41	101	73	161	114
Cowpeas	Mean	106.92	196.65	188.54	266.98	150.13	233.67
	Valid N	128	72	144	80	272	152
SP leaves	Mean	99.11	1.54	30.13	288.96	56.96	235.07
	Valid N	7	3	11	13	18	16
Fraction of TAV sold (%)							
Amaranth	Mean	42.40	58.16	84.04	75.20	72.61	70.46
Nightshade	Mean	27.88	48.59*	82.15	73.62	68.19	67.36
Spider plant	Mean	23.97	67.60*	87.01	75.67	70.74	74.35
Cowpea	Mean	19.30	15.75	75.00	62.85	49.17	40.14
SP leaves	Mean	50.17	0.0	0.0.	75.96	50.17	75.96
Prices of TAV (USD/ kg)							
Amaranth	Mean	.316	.244	.283	.260	.297	.255
Nightshade	Mean	.617	.388	.253	.246	.412	.301
Spider plant	Mean	.678	.400	.299	.278	.473	.326
Cowpea	Mean	.593	.276	.213	.242	.400	.257
SP leaves	Mean	.443	.	.	.172	.443	.172

Table 41. Quantities of TAV harvested and sold by site

		Busia				Kabondo				Kiambu				Arumeru			
		Baseline		Impact		Baseline		Impact		Baseline		Impact		Baseline		Impact	
		Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
TAV harvested per season (kg)																	
Amaranth	Mean	92.2	68.9	88.2	166*	51.6	51.3	40.5	184	28	61	167	180	135	.	114	65.3
	Valid N	39	28	55	46	10	4	18	14	4	14	22	14	13	0	35	3
Nightshade	Mean	29.3	23.8	149	221	105	167	94.1	90.5	129	144	291	417	255	149	138	923
	Valid N	15	7	40	37	44	23	52	26	8	15	22	14	10	2	34	3
Spider plant	Mean	28.3	43.2	65.1	158	73.4	96	59.1	63.3	31.5	53.4	141	309	52.8	.	24.1	249
	Valid N	20	14	52	41	34	20	39	22	3	7	7	9	3	0	3	1
Cowpeas	Mean	57.7	247*	285	344	178	132	128	146	15	45	17.6	.	29.2	106	54.2	41.1
	Valid N	62	42	66	51	55	26	56	25	1	1	1	0	10	3	21	4
SP leaves	Mean	.	1.56	10.6	81	.	.	.	76.4	.	.	11.2	3.36	99.1	1.48	37.3	641
	Valid N	0	2	1	3	0	0	0	4	0	0	2	1	7	1	8	5
Eggplant	Mean	.	.	.	8.37	.	.	.	.	.	.	.	.	.	.	133	881
	Valid N	0	0	0	7	0	0	0	0	0	0	0	0	0	0	8	2
Fraction of TAV sold (%)																	
Amaranth	Mean	8.33	25	73.6	71.4	5	.	90	71.7	75.9	60.5	90.2	83.6	39.2	.	84.2	.
Nightshade	Mean	.	.	63.7	67.8	5.63	.	86.8	76	31.7	51.1	87.9	85.3	32.9	11.1	85.1	29
Spider plant	Mean	.	.	72.6	71.6	6.68	7.5	100	71.9	52.8	76.2	91.7	92.3	.	.	100	.
Cowpea	Mean	24.1	20.4	66.1	66.1	14.5	11.5	89.2	34.2	60	50	92.3	.	44.4	16.7	66.5	98.7
SP leaves	Mean	.	.	.	75	.	.	.	.	.	.	.	.	50.2	.	.	76.5
Egg plant	Mean	.	.	.	100	.	.	.	.	.	.	.	.	.	.	58.1	4.83

		Busia				Kabondo				Kiambu				Arumeru			
		Baseline		Impact		Baseline		Impact		Baseline		Impact		Baseline		Impact	
		Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
Prices of TAV (USD/ kg)																	
Amaranth	Mean	0.11	0.11	0.3	0.29	0.32	0.3	0.19	0.19	0.24	0.25	0.29	0.26	0.38	.	0.34	0.52
Nightshade	Mean	.	.	0.34	0.33	0.7	0.59	0.22	0.2	0.24	0.22	0.28	0.25	0.69	0.37	0.29	0.56
Spider plant	Mean	0.2	0.11	0.35	0.38	0.76	0.59	0.26	0.18	0.36	0.23	0.34	0.35	.	.	.	.
Cowpea	Mean	0.16	0.07	0.33	0.33	0.66	0.36	0.16	0.16	0.25	0.4	0.17	.	0.48	0.41	0.24	.
SP leaves	Mean	.	.	.	0.12	.	.	.	.	.	.	.	.	0.44	.	.	0.22
Egg plant	Mean	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.12	.

Table 42. Yields of TAV during baseline and impact surveys (kg/ha)

		Baseline or Impact			
		Baseline		Impact	
		Participant or not		Participant or not	
		Non-participant	Participant	Non-participant	Participant
Amaranth	Mean	8673.85	7789.01	13484.63	11857.03
	Standard deviation	8664.15	11519.39	14727.49	12872.82
	Valid N	56	37	82	56
Nightshade	Mean	10849.26	12544.56	13744.82	16313.06
	Standard deviation	16602.63	17929.64	14629.72	15059.54
	Valid N	63	43	96	57
Spider plant	Mean	6728.44	7862.77	12180.24	12946.12
	Standard deviation	6088.85	9542.34	12672.75	13390.93
	Valid N	52	38	77	56
Cowpea	Mean	4867.34	6917.98	12989.55	12091.51
	Standard deviation	5163.33	7153.66	13048.24	13477.38
	Valid N	100	57	94	56
SP leaves	Mean	4458.33	.	3744.79	6766.91
	Standard deviation	200.35	.	1571.84	412.83
	Valid N	2	0	2	2
African eggplant	Mean	.	.	2004.89	1756.40
	Standard deviation	.	.	521.44	370.72
	Valid N	0	0	4	5

Table 43. Production of sweetpotato during baseline and impact studies for participants and non-participants

		Participant or not					
		Non-participant		Participant		Total	
		Baseline	Impact	Baseline	Impact	Baseline	Impact
Total SP harvested in kg per season	Mean	2537.4	2920.95	2777.11	2828.09	2629.51	2883.99
	Standard deviation	4353.4	6188.2	6974.26	4575.8	5494.4	5590.3
	Valid N	125	124	78	82	203	206
Total area under sweetpotato (ha)	Mean	0.1383	0.1807	0.183	0.2231	0.1563	0.1966
	Standard deviation	0.1699	0.2471	0.3941	0.3413	0.2822	0.286
	Valid N	122	132	82	79	204	211
Yields of sweetpotato (kg/ ha)	Mean	9083.5	12083.10*	7944.04	12506.64*	8660.27	12252.52
	Standard deviation	7110.9	12204.66	6661.05	11118.44	6949.84	11751.37
	Valid N	110	105	65	70	175	175
Total harvest of OFSP per season (kg)	Mean	87.22	189.82*	436.37	604.58	300.98	443.86
	Standard deviation	65.81	205.14	600.07	985.95	498.72	804.97
	Valid N	19	31	30	49	49	80
Area under OFSP (ha)	Mean	0.0325	0.0522	0.075	0.0815	0.0608	0.0706
	Standard deviation	0.0478	0.0829	0.0994	0.1291	0.087	0.1142
	Valid N	8	20	16	34	24	54
Yield of OFSP (kg/ ha)	Mean	4894.7	11925.42	11246.4	8004.05	9037.08	9340.88
	Standard deviation	3805	14141.9	17744	8921.06	14646.93	10976
	Valid N	8	15	15	29	23	44

Table 44. Quantities of sweetpotato harvested and sold

			Baseline or Impact					
			Baseline			Impact		
			Participant or not			Participant or not		
			Non-participant	Participant	Subtotal	Non-participant	Participant	Subtotal
Total SP harvested per season	Mean		2243.05	1875.48	2104.42	2032.07	2305.89	2142.25
	Standard deviation		2871.93	2619.46	2777.51	4229.28	3635.00	3991.82
	Valid N		109	66	175	101	68	169
Total area under SP in ha	Mean		.15	.17	.16	.19	.19	.19
	Standard deviation		.18	.25	.21	.27	.23	.26
	Valid N		109	66	175	105	70	175
Yields of sweetpotato	Mean		9012.02	8079.35	8660.27	12083.10	12506.64	12252.52
	Standard deviation		7103.93	6700.40	6949.84	12204.66	11118.44	11751.37
	Valid N		109	66	175	105	70	175
Total SP sold	Mean		1279.96	1158.69	1237.45	1278.62	1015.00	1159.57
	Standard deviation		1217.50	1095.76	1171.94	1415.54	1261.34	1349.16
	Valid N		63	34	97	68	56	124
Proportion of SP sold	Mean		35.30	37.54	36.07	46.10	30.50	40.17
	Standard deviation		17.94	18.28	17.99	29.92	27.11	29.73
	Valid N		61	32	93	57	35	92
Sold SP individually	0	%	73.9	58.9	69.7	14.1	20.0	16.8
	1	%	26.1	41.1	30.3	85.9	80.0	83.2
Sold SP in a group	0	%	100.0	97.3	99.2	97.8	90.1	94.4
	1	%	.0	2.7	.8	2.2	9.9	5.6
	Total	Count	284	112	396	90	71	161

Table 45. Area growing sweetpotato by site

		Busia				Kabondo				Arumeru			
		Baseline		Impact		Baseline		Impact		Baseline		Impact	
		Participant or not		Participant or not		Participant or not		Participant or not		Participant or not		Participant or not	
		Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant	Non-participant	Participant
Total SP harvested per season	Mean	444	559	696	644	3,712	3,709	2,761	4,499	.	1,480	14,466	8,960
	Std	423	447	1,605	977	3,173	3,294	4,055	4,544	.	1,188	20,271	5,431
	Valid N	49	37	47	41	60	27	52	25	0	2	2	2
Total area under SP in ha	Mean	.043	.047	.067	.104	.237	.239	.287	.289	.	1.350	.632	.778
	Std	.042	.039	.074	.118	.195	.144	.311	.259	.	.000	.823	.597
	Valid N	49	37	51	43	60	27	52	25	0	2	2	2
Yields of sweetpotato	Mean	7,603	7,952	10,556	10,123	10,163	8,831	13,539	15,996	.	281	13,176	20,136
	Std	6,428	6,998	10,993	9,211	7,468	6,256	13,281	12,580	.	182	14,900	22,443
	Valid N	49	37	51	43	60	27	52	25	0	2	2	2
Total SP sold	Mean	128	113	910	758	1,424	1,535	1,350	963	.	.	5,760	5,600
	Std	119	135	1,414	953	1,216	1,043	1,257	821	.	.	.	1,131
	Valid N	7	9	21	31	56	25	46	23	0	0	1	2
Proportion of SP sold	Mean	19.3	20.2	31.3	20.9	37.4	44.3	51.6	31.6	.	.	20.0	71.9
	Std	13.1	19.2	23.6	24.8	17.5	12.8	30.4	25.3	.	.	.	30.9
	Valid N	7	9	14	11	54	23	42	22	0	0	1	2
Sold SP individually	%	13.0	23.6	86.2	70.7	89.4	96.6	89.7	89.7	7.7	50.0	66.7	100.0
Sold SP in a group	%	.0	3.6	.0	18.9	.0	3.4	3.4	.0	.0	.0	.0	.0

Table 46. Farmers sourcing inputs and selling collectively

	Baseline or Impact								
	Baseline			Impact			Differences in Two Years		
	Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	D in D
Sourced SP inputs individually	30.5	44.1	34.3*	32.7	42	35.4	2.2	-2.1	-4.3
Sourced SP inputs in a group	1.8	15.3	5.6*	1.8	25.9	8.6*	0	10.6	10.6
Sold SP individually	26.3	40.5	30.3*	27.8	53.6	35.1*	1.5	13.1	11.6
Sold SP in a group	0	2.7	.8*	0.7	6.3	2.3*	0.7	3.6	2.9
Sourced TAV inputs individually	51.2	64	54.8*	52.1	44.6	50	0.9	-19.4	-20.3
Sourced TAV inputs in a group	0	12.6	3.5*	1.1	11.6	4.0*	1.1	-1	-2.1
Sold TAV individually	23.5	34.2	26.5*	36.6	65.2	44.7*	13.1	31	17.9
Sold TAV in a group	0	12.6	3.5*	0.4	7.1	2.3*	0.4	-5.5	-5.9

Table 47. Farmer knowledge and awareness

		Baseline or Impact								
		Baseline			Impact			Total		
		Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Total
Have you heard of Vitamin A?		80.4	82.9	81.1	81.7	86.6	83.1	81	84.8	82.1
Mentioned Vitamin A protects the body		24.5	31.5	26.5	31.5	30.9	31.3	28	31.2	28.9
Mentioned that vitamin A protects the eyes or vision		10.5	17.4	12.5	31.9	47.4	36.5*	21.3	32.8	24.6
Have you heard of iron?		46.3	41.4	44.9	61.6	62.5	61.9	54	52	53.4
Mentioned that it prevents anemia		3.8	2.2	3.4	16.6	20	17.6	11	12.9	11.6
Mentioned that it is found in the blood		13.6	19.6	15.2	39.4	50	42.4	28.3	37.9	31
Mentioned that it prevents fatigue		4.5	0	3.4	4.6	5.7	4.9	4.6	3.4	4.3
Are there any health benefits of consuming TAV?		93	95.5	93.7	95.4	99.1	96.5	94.2	97.3	95.1
Mentioned that protect the body or strengthen immunity		30.9	47.2	35.6*	32.8	45.9	36.6*	31.9	46.5	36.1
Mentioned that contain vitamin A		6.4	5.7	6.2	18.8	15.3	17.8	12.7	10.6	12.1
Mentioned that contain iron		1.1	2.8	1.6	9.6	7.2	8.9	5.4	5.1	5.3
Mentioned that contribute to balanced diet/have many vitamin		6.4	4.7	5.9	10.7	13.5	11.5	8.6	9.2	8.8
Mentioned that have medicinal properties		10.9	8.5	10.2	12.5	19.8	14.7	11.8	14.3	12.5
Are there any health benefits of consuming OFSP?	yes	23.5	64.9	35.1*	44.4	83.9	55.6*	33.9	74.4	45.3
	never heard of OFSP	57.2	22.5	47.5	38	5.4	28.8	47.6	13.9	38.1
	Don't know	1.1	2.7	1.5	0.7	0	0.5	0.9	1.3	1
Mentioned that OFSP protects the body or strengthens immunity		14.3	6.8	10.5	27	18.1	23.2	22.4	13.2	18.2
Mentioned that OFSP contains vitamin A		12.9	35.6	24.*5	27.8	48.9	36.8*	22.4	43.1	32
Mentioned that OFSP has medicinal properties		0	0	0	2.4	1.1	1.8	1.5	0.6	1.1
Mentioned that OFSP contributes to a balanced diet/has vitamins		1.4	2.7	2.1	8.7	9.6	9.1	6.1	6.6	6.3

Table 48. Consumption of TAV and sweetpotato

	Baseline or Impact								
	Baseline			Impact			Differences in Two Years		
	Non-participant	Participant	Total	Non-participant	Participant	Total	Non-participant	Participant	Di n D
Consumes amaranth	55.4	70.3	59.6*	59.5	78.6	64.9*	4.1	8.3	4.2
Eat nightshade	39.6	54.1	43.7*	56.7	68.8	60.1*	17.1	14.7	-2.4
Eat spider plant	27.4	46.8	32.8*	27.1	50	33.6*	-0.3	3.2	3.5
Eat cowpea leaves	43.2	64	49.0*	50.7	68.8	55.8*	7.5 0	4.8 0	-2.7 0
Eat sweetpotato leaves	10.2	4.5	8.6	4.6	8.9	5.8	-5.6	4.4	10
Do you offer traditional leafy vegetables when visitors come	70.5	75.7	71.9	76.4	89.2	80.1*	5.9	13.5	7.6
Consumes any sweetpotato	56.1	74.2	61.6*	58.7	77.7	64.5*	2.6	3.5	0.9
Eat OFSP	10.3	23.7	14.3*	6.6	37.2	16.0*	-3.7	13.5	17.2
Do you offer sweetpotato when visitors come to your home?	75.1	75.7	75.3	66.7	86.6	72.6	-8.4	10.9	19.3

Table 49. Active groups and members

CV1	MSU Code	Sum	N
Githiga	Mugima	13	1
	Mahuru	16	1
	Kagikima	12	1
	Mutamaiyu	15	1
	Iriga	22	1
	Githima	10	1
	Total	88	6
Lower lari	Kwaregi	17	1
	Kagwe	11	1
	Gachoire	24	1
	Kamuchege	12	1
	Kimunjo	21	1
	Matimbei	20	1
	Mukanga	17	1
	Kiruiru	33	1
	Total	155	8
Kahuho	Ruku	28	1
	Kaimba	17	1
	Kiiga	18	1
	Chura	24	1
	Mwirimiri mugunda	12	1
	Kiangotho	15	1
	Mweteta	14	1
	Gatumumu	19	1
	Total	147	8
Karura	Kihara wenadani	21	1
	Kianumira	14	1
	Thithino	18	1
	Kihara mushroom	17	1
	Total	70	4
Kasewe A	Fahari	21	1
	Umbrella	10	1
	Nyalenga	22	1
	St. Mahad	20	1
	Kitem	19	1
	Komala	13	1
	Upper Kisii	15	1
	Total	120	7
Kasewe B	Maka SHG	20	1
	Korok	18	1
	Kasewe widows	15	1
	Molar	17	1
	Otang P.h	10	1
	Kakoche	25	1
	Total	105	6

CV1	MSU Code	Sum	N
Wangchienge	Kabola	14	1
	Anyona Konyir	20	1
	Othoro FF	15	1
	Othoro disa	18	1
	Chamluchi	17	1
	Pawanda	25	1
	nyangi omolo	15	1
	Total	124	7
Kawol	Lwanda FFS	20	1
	Ojola youth group	18	1
	Heritage	15	1
	Orangchare	10	1
	Owoor	11	1
	Pecilia	20	1
	St Agnes	7	1
	Hera	11	1
	Let Chongs	14	1
	Wouth Ogik	21	1
	Dockesia	7	1
	Total	154	11
Singigire	Singingire	15	1
	Namalenga	21	1
	Didikhura	20	1
	Bidii	17	1
	Khabondi	19	1
	Siteko	16	1
	Total	108	6
Siwongo	Siwongo D	21	1
	Alungoti SW	15	1
	Alungoti CMC	13	1
	Alungoli Y	15	1
	Esimuma	18	1
	Msamaria	22	1
	Total	117	7
Nambuku	Edakha	20	1
	Adule	20	1
	Nalungosi	18	1
	Khoya	16	1
	One sisters	19	1
	Icha Hube	20	1
	Luma SHG	20	1
	Total	133	7

CV1	MSU Code	Sum	N
Asinge-Apigei	Eluu comm	17	1
	Ativait cot	22	1
	Ngako women group	15	1
	Nakakoton	11	1
	Edolore	20	1
	Osipat W	16	1
	Bahatika	60	1
	Total	161	7
Manyire	Vukani	15	1
	Ufugaji	20	1
	Maarifa	30	1
	Mkombozi	22	1
	Mshikamano	49	1
	Mgombani	8	1
	Total	144	6
Olevolosi	Juhudi	24	1
	Umoja	24	1
	Total	48	2
Nduluma	Ushandaweni	26	1
	samaria	44	1
	Maroroi	23	1
	Champion	20	1
	Enyoito	20	1
	Total	133	5
Shamarai Burka	Mkombozi	15	1
	Maendeleo	20	1
	Nguvu kazi	18	1
	Engoryon A	18	1
	Engoryon B	15	1
	Mwamko	36	1
	Total	122	6
TOTAL		**1,916**	**103**

Table 50. Returns on investment in value chain interventions of TAV and sweetpotato

Year	Cost (USD)[a]	Participant Gains (USD)	Net Benefit (USD)
2007	157,440	0	-157,440
2008	136,413	115,406	-21,007
2009	79,480	230,812	151,332
2010	0	230,812	230,812
2011	0	230,812	230,812
2012	0	230,812	230,812
2013	0	230,812	230,812
2014	0	230,812	230,812
		IRR=0.66	

[a]2009 prices used.

Annex D

Sweetpotato and Vegetable Marketing in Kenya and Tanzania: Trader Impact Assessment

Elaborated by
Wachira Kaguongo

June 2010

Traditional FOODS
For wealth & health

Contents

Introduction

Marketing structure plays an important role in determining the growth of trading of an agricultural commodity. Examination of changes in market structure and behavior of traders helps in understanding impact of value chain interventions on market players, volumes of commodities traded, and any value additions along channels. The impact study was particularly important because the Traditional Foods (TF) project interventions aimed at increasing market access for target crops by enhancing farmer knowledge and consumer demand. A gender-responsive trader baseline study helped us plot the marketing channels and understand and document the operations and profitability of traders in each marketing segment so we could plan interventions and assess their impact at the end of the project. This report used baseline and impact survey data to measure changes that occurred during the project that could be attributed to project interventions.

Following are terms used in this report:

- **Farmer-retailers** are farmers who doubled as both producers and retailers. They sold produce from their farms and purchased more produce from other farmers.
- **Brokers** operated between farmers and retailers and/or wholesaler where they earned commissions.
- **Wholesalers** sold commodities to either retailers or to other wholesalers.
- **Retailers** bought commodities from farmers, brokers, or wholesalers and resold them to consumers.
- **Supermarkets** sold sweetpotato or TAV, among other commodities, to consumers. Some retailers bought TAV from supermarkets and resold them to consumers.

Methodology

The baseline survey was conducted between April and May 2008; the impact survey was carried out between October 2009 and January 2010. A total of 163 traders were interviewed in Kenya and Tanzania for the baseline survey, and 105 traders were interviewed for the impact survey (Table 1). The impact survey targeted specific markets and traders in channels that included areas of intervention. The traders represented farmer-retailers, brokers, retailers, transporters, wholesalers, and supermarkets from major towns selling target crops from areas of intervention in Kenya and Tanzania. During the baseline survey, 81 traders sold sweetpotato (SP), 64 traders sold traditional African vegetables (TAV) and 18 sold both SP and TAVs, while during the impact survey, 51 traders sold SP, 45 traders sold TAVs, and 9 sold both TAVs and SP. Retailers were sub-categorized into farmer-retailer and retailer based on where or from whom they obtained their commodities.

Attempts were made to randomize the selection of traders, particularly where there were more than three trading the same commodity in a market; however, most were not willing to be interviewed. Traceability of some interviewees who participated in the baseline was difficult due to their relocation to other areas. Data collected from traders include sources of sweetpotato and vegetables, quantities bought and sold, prices, and type of packaging.

Data entry and cleaning was done using Census and Survey Processing software (CSPro), and data was analyzed using Statistical Package for Social Scientists (SPSS). ANOVA and Chi-square were used for evaluation before and after project implementation.

Socioeconomic and demographic characteristics of traders

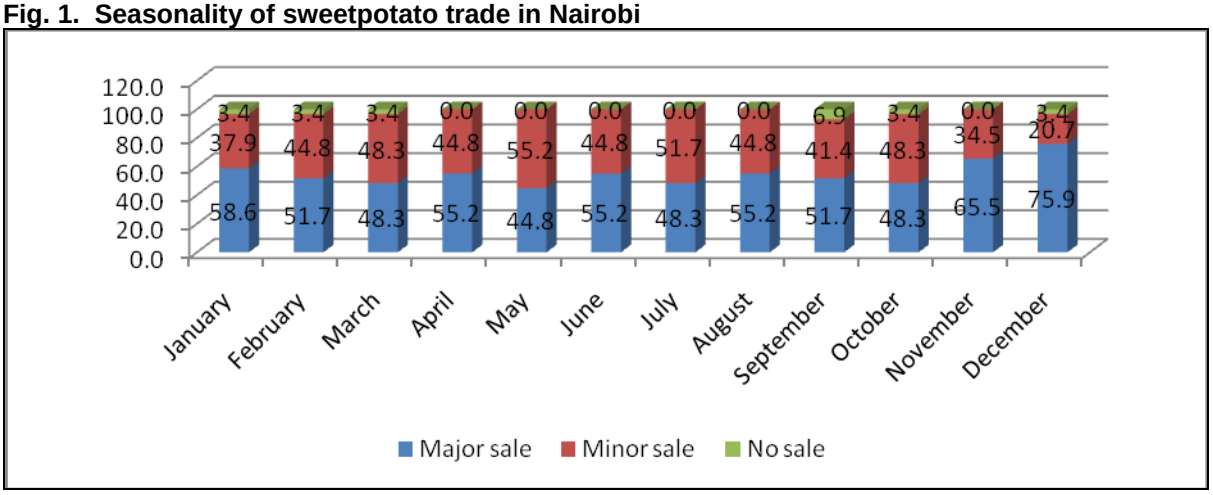
During both baseline and impact surveys (Table 2), at least 80% of the traders in both Kenya and Tanzania were women. The average age of traders was 39.3 years. A total of 52.0% of them had attained upper primary school education. Traders had an average of 8.7 years of trading; more than 87% had not had any training on trading vegetables or sweetpotato. About 50% of the traders sold only vegetables or sweetpotato. More than 80.0% of traders had not accessed any form of financial credit to improve their businesses.

Sweetpotato trade

Trading pattern

Nairobi remained the most important market for sweetpotato produced in different parts of Kenya. Therefore, the sweetpotato trade did not fluctuate much over the months because roots from various districts converged in Nairobi (Fig. 1). This was because seasonality of sweetpotato production in a year varied from one district to another. However, there was a small peak in December when most Nairobi traders (76%) had major sales.

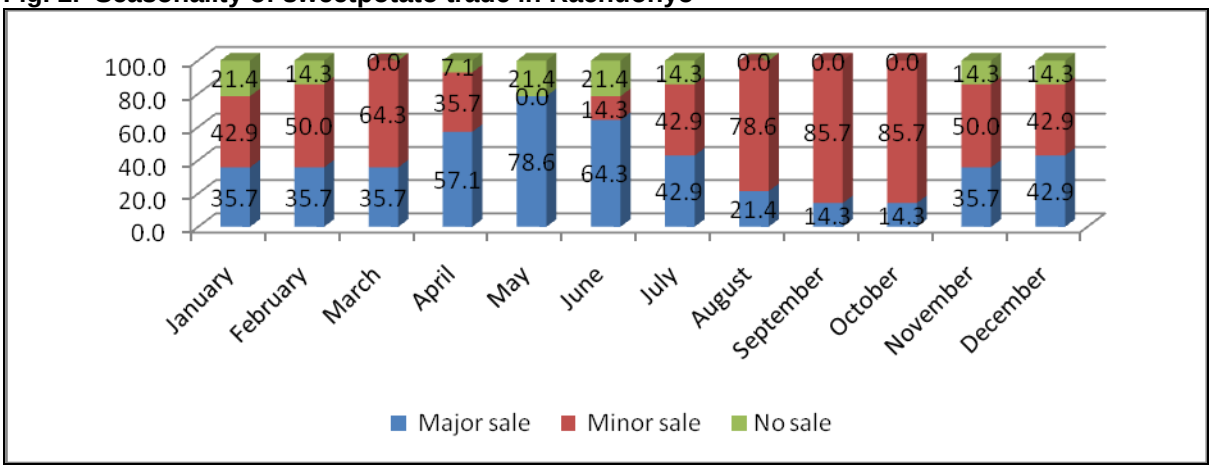
Fig. 1. Seasonality of sweetpotato trade in Nairobi



In Rachuonyo, the most important source of marketed sweetpotato, the proportion of traders with major sales increased from 36% in January to 79% in May and then decreased to a low of 14% in August and October (Fig. 2). However, only few months of the year had more than 20% of

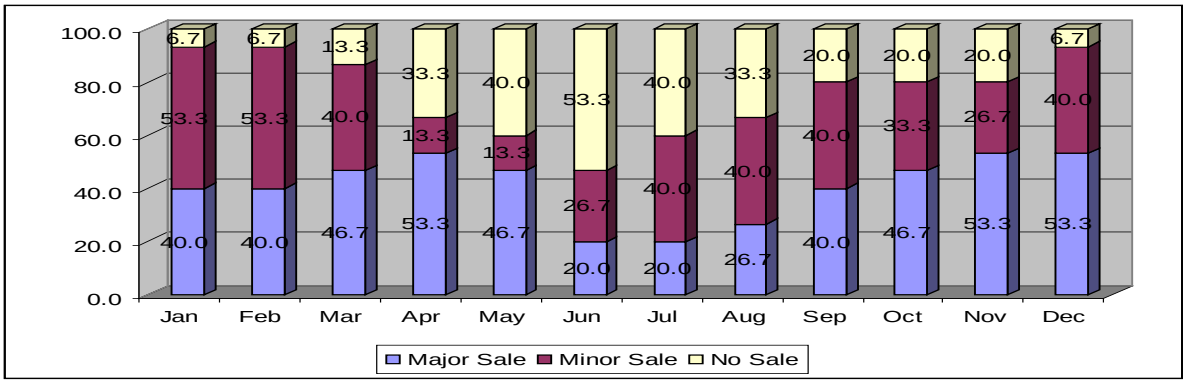
traders with no sales, indicating that sweetpotato is generally traded in the district throughout the year, although quantities varied by season.

Fig. 2. Seasonality of sweetpotato trade in Rachuonyo



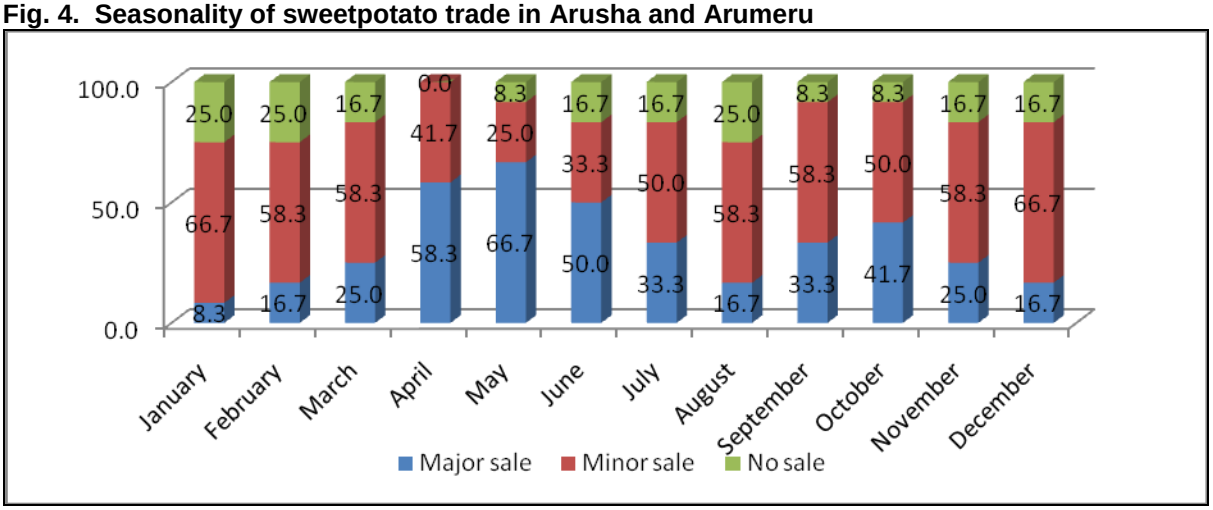
In Busia, the peak for sweetpotato sales was between December and February (Fig. 3).

Fig. 3. Seasonality of sweetpotato trading in Busia



Traders in Tanzania recorded increased sales from January, attained a peak of 67% in May, and then another peak in October when 42% of traders reported major sales (Fig. 4).

Fig. 4. Seasonality of sweetpotato trade in Arusha and Arumeru



Factors influencing sweetpotato traders' buying decision

The aim of the project interventions was to change consumer preferences so that nutrition and color of OFSP would be important considerations when purchasing sweetpotato. However, results of the main attributes considered by traders did not reflect any change between the baseline and impact surveys. Table 15 shows the factors traders considered important when purchasing during baseline and impact surveys.

The skin color of sweetpotato remained very important for the majority of traders (over 60.0%) during baseline and impact surveys, and red skin was color the most preferred by a majority of traders (over 83%). The flesh color also remained very important for a majority of traders (over 63.0%), and yellow was the most preferred color (over 65%). Although the proportion of traders preferring OFSP had increased marginally, the proportion remained low (less than 7%) after intervention. This finding could be due to the short intervention period, given that there is always a lag between intervention and change of habit.

Root sizes were considered important by more than 74% of traders, and medium-sized tubers were most preferred (over 73%). The traders preferred freshly harvested roots bearing no weevil damages. Postharvest damage was an important consideration by more than 75% of the traders, and 60% checked for roots free from weevil infestation.

The texture of roots remained important during the baseline and impact surveys. Over 70% of traders considered high dry matter to be important or very important, and most traders (over 86%) preferred high powdery texture, which is associated with high dry matter.

Root prices played an important role in deciding of where to buy the roots. Producer price was considered important by majority of traders (over 80%). A total of 58% of traders preferred to buy from sources with the lowest prices, although a few traders (over 21%) preferred fixed prices.

To many traders, nutritional qualities did not influence their decision when purchasing sweetpotato roots, which may reflect lack of customer knowledge on nutritional benefits.

However, there was a slight change in nutritional awareness in an increase in the proportion of traders who mentioned nutrition as an important to very important consideration. The proportion of those identifying sweetpotato as a good source of energy increased from 54.5% to 83.3%. These changes in nutritional awareness could be due to the project interventions.

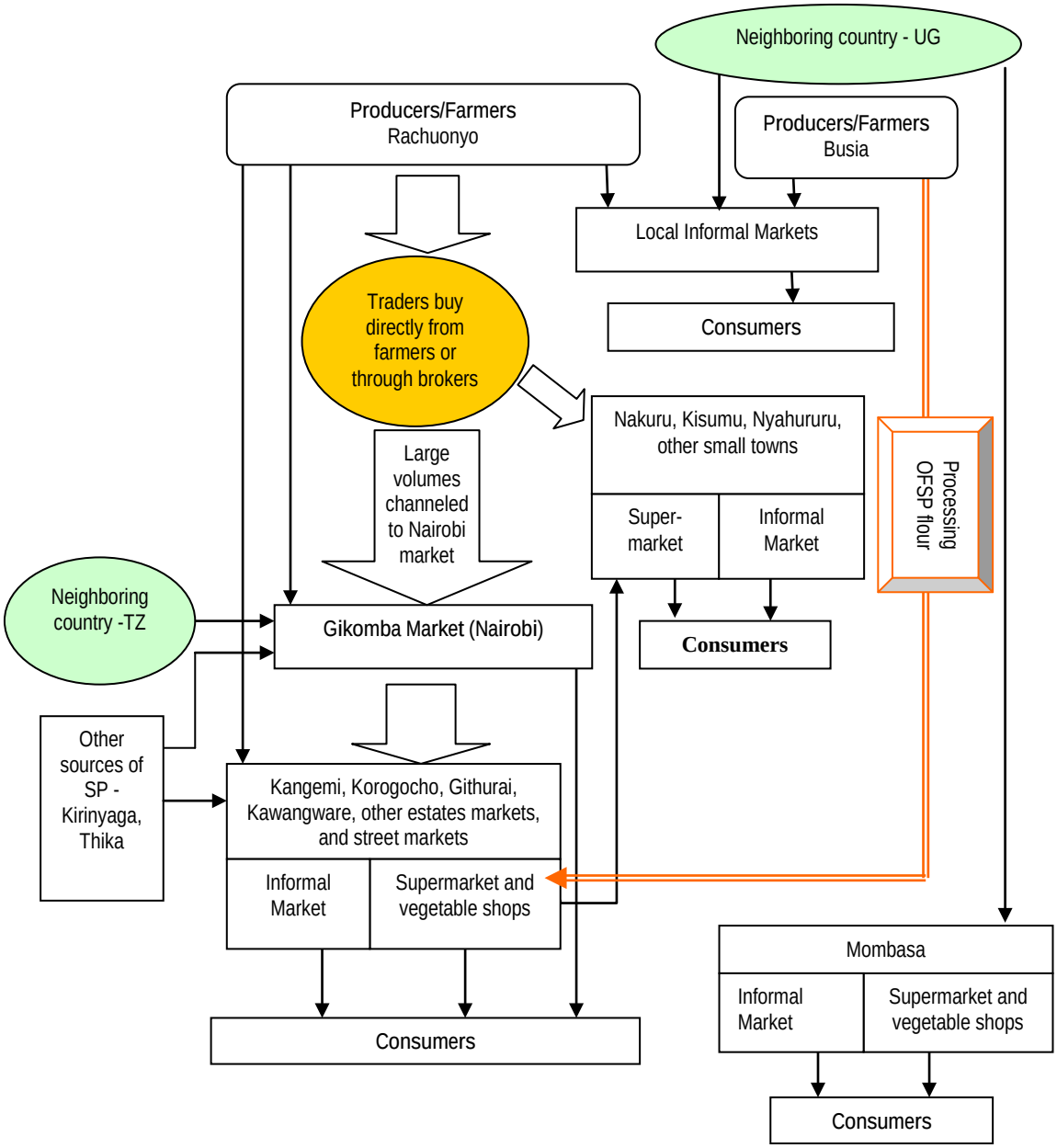
There was a significant increase in traders who considered duration of roots after maturity important; the proportion increased from 61.6% to 82.7% (Table 15).

Consumer preference also played an important role in deciding which sweetpotato to buy, as indicated by 90.4% traders; 61.5% of traders listened to what consumers asked for.

Types of traders and their roles

In the sweetpotato sub-sector, there are different types of market players who operate at different scales depending on the location and level of the market channel. Based on the main roles played, sources of roots, and target markets, traders were grouped into five categories: farmer-retailer, broker, retailer, wholesaler, and supermarket. Within the five main trader categories, there were big differences in the nature of businesses, even within one category, in terms of quantities handled, distances traveled, direction of travel, from whom they bought, to whom they sold, and countries of operation. These complexities within some of the main categories necessitated sub-categorization for in-depth understanding of operations and plausible evaluation. The five main categories were broken into 12 sub-groups. Table 19 shows details about the sub-groups, and Fig. 5 shows the movement of sweetpotato in distribution channels.

Fig. 5. Distribution channels of sweetpotato



Disaggregation of traders by gender in Kenya and Tanzania

Most of the traders at each level of the sweetpotato marketing channel were women, although the presence of men at the wholesale level was recorded in Kenya. The high involvement of men at wholesale level could be associated with the capital required and the need to travel for long distances to source large volumes of commodities (Table 4).

Types of packages for sweetpotato and mode of transport

The most popular packages for trading were 260 kg, 160 kg, and 110 kg bags. The 260 kg bag was made up of two or more ordinary bags joined together to make one big, extended bag (Fig. 6). Similarly, the 110 kg bags comprised at least two small bags joined to make one extended bag.

Fig. 6. Packing bags and containers

Mtoro

Mfuko

Prime

The practice of buying roots using extended bags led to traders getting supernormal profits. Traders sometime ended up breaking extended bags into two smaller bags before selling them at the next market level. The 260 kg bag had a mean price of USD $7.80 in Rachuonyo and a mean price of USD $35.30 in Nairobi (Table 5). The second-most important packages were the 160

bag, with a mean price of USD $9.38 in Rachuonyo and USD $24.11 in Nairobi. Other containers were 110 kg bags and 20 liter cans.

Sweetpotato was transported using lorries (28.5%), public transportation (22.3%), carts (20.0%), and manually (19.5%). There were notable changes in the use of pickups and lorries: the proportion of traders using pickups declined, while those using lorries increased after intervention. The other transport methods did not change significantly (Table 6).

Sweetpotato sources and market outlets

Rachuonyo was the most important source of sweetpotato for the majority of traders, followed by Arumeru, then Busia (Table 17; see also Fig. 5). Sweetpotato from Rachuonyo was transported to towns, such as Nakuru, Nyahururu, Kisumu, and Nairobi. The bulk of sweetpotato leaving Rachuonyo headed to different markets in Nairobi through the Gikomba wholesale market. Some of the sweetpotato sold in Nairobi came from Arusha, Tanzania.

The sweetpotato from the Busia district was consumed within the district, while sweetpotato from Uganda was either sold in Busia town or transported to Nairobi or Mombasa.

Varieties of sweetpotato traded

The majority of traders (over 60%) sold yellow-fleshed varieties (Table 7); however, white-flesh varieties were more popular in Busia (65%) and the Tanzanian markets (100%). An increased number of traders sold orange-fleshed sweetpotato. This finding was possibly an early effect of project intervention that indicated traders and consumers had started appreciating the nutritional importance of orange flesh. Orange-fleshed varieties were mainly traded in Busia (30%), and a few farmers in Nairobi (5.9%) and Tanzania (less than 30%) sold it.

Quantities of sweetpotato traded

The quantities traded by all categories per month increased from 9,994.8 kg to 11,555.4 kg, although the increase was not statistically important (Table 16). The total roots purchased from intervention area per trader per month increased from 10,714.2 kg to 25,230.8 kg, a result of increases in quantities purchased by both retailers and wholesalers. The quantities traded by retailers from the intervention areas increased from 3,241.3 kg to 4,335.4 kg. However, these changes in root quantities do not necessarily reflect increases in quantities produced in these areas, but they indicate increases in quantities handled by each category of trader.

Marketing channels

Informal market for fresh roots

The bulk of sweetpotato roots from Kabondo division in Rachuonyo district were marketed in Nairobi. Other important sources of sweetpotato for Nairobi were Kirinyaga and Arusha in Tanzania. Sweetpotato from Rachuonyo district were sold in other areas, including Kisumu, Nakuru, and Nyahururu. A schematic flow chart of the marketing channels of sweetpotato from

the areas visited is presented in Fig. 5. Once the sweetpotato reached the wholesale markets in Gikomba, Nairobi, the second level of wholesalers purchased and transported it to other markets in the Nairobi district, such as Kangemi, Wakulima, Githurai, and Kawagware, or to other districts, such as Kangundo, where they sold it to retailers. Retailers bought and sold roots to consumers in the same markets or distributed them to other markets in the same district or other districts.

Most of sweetpotato from Busia district were sold to consumers within the district. However, some sweetpotato from Ugandan was sold in Kenyan, and some was transported to Nairobi and Mombasa. Sweetpotato from Ugandan affected sweetpotato prices in Busia district, making sweetpotato production in Busia less competitive.

Formal marketing of fresh roots

Supermarkets, such as Nakumatt and Uchumi in Nairobi, constituted the formal marketing channel, though they handled very low volumes per month. Their sales increase doubled between the baseline survey and end of the project interventions. This increase in quantities traded implied that there was change of attitude towards consumption of sweetpotato by middle- to upper-income consumers.

Some supermarkets had a central purchasing system, which involved buying sweetpotato at the head office in Nairobi and distributing it to all their branches in Nairobi and rural towns. While this may have advantages of accounting, the freshness of produce was compromised due to the time lag between when it was purchased and when it reached final outlets. The central purchasing system led to sweetpotato moving long distances and, in some cases, in the opposite direction of normal flow in the marketing channel. One supermarket in Nakuru bought sweetpotato at USD $46.90 per 100 kg and sold it at USD $70.30 per 100 kg, and in Kisumu, bought it at USD $45.30 per 100 kg and sold it at USD $76.60 per 100 kg. In Nairobi, the same supermarket bought it at USD $60.00 per 100 kg and sold it at USD $95.00 per 100 kg. These price ranges were high compared to those in the informal market, and it would be difficult to associate these price differences to quality and standards.

Formal sweetpotato flour markets

There was one flour production channel that was involved in chipping and milling OFSP into flour and transporting it from Busia to Nairobi. OFSP varieties Ejumula or SPK004 were purchased from farmers in Busia, chipped, and then delivered to supermarkets and other formal outlets in Nairobi through a distributor. The channel handled very low volumes and was characterized by monopolistic tendencies. Although the farm gate price received by farmers from the channel (USD $8.11 per 100 kg) was higher than from other channels (USD $6.59 per 100 kg), farmers complained about delayed payment and thus preferred selling fresh roots. During the project intervention, the market players agreed to adjust the prices to be competitive with other channels, and the farm gate price increased to at least USD $13.51 per 100 kg bag.

Time spent bulking sweetpotato

Traders spent different amounts of time gathering (bulking) roots per trip depending on the type of traders, quantity handled, and level at which they were operating. Although not statistically important, the quantities purchased per trip and time spent in bulking roots per trip increased for all the traders combined (see Table 17).

In Busia, although quantities purchased per trip decreased from 155.0 kg to 52.63 kg, possibly due to drought, the time spent bulking 100 kg of roots decreased from 2.6 to 0.54 hours, possibly due to linkages between farmers and traders to improve market access.

Traditional African vegetables trade

Type of TAV traders

Traders were categorized as farmer-retailer, broker, wholesaler, retailer, or supermarket (Table 8) based on where and from whom they bought commodities, as well as to whom they sold them. Farmer-retailers sold produce from their farms and sometimes bought produce from other farmers. Brokers operated between farmers and retailers and/or wholesalers. Wholesalers sold commodities to either retailers or other wholesalers, while retailers sold commodities to the final consumers. In Kenya, there were five supermarkets selling both sweetpotato and TAV.

Based on the main role played by traders, the five main categories were divided into sub-categories as shown in Table 22. In Kenya, 12 farmer-retailers, 2 brokers, 69 retailers, 29 wholesalers, and 8 supermarkets were interviewed, and in Tanzania, 5 farmer-retailers, 1 broker, 9 retailers, and 28 wholesalers were interviewed. The brokers in Tanzania obtained TAV from farmers and transported it to the roadside where it was sold to either wholesalers or retailers who then transport it to other districts for sale. In each of above categories, there were differences in the quantities handled, distances traveled, direction of travel, from whom they bought, and to whom they sold.

Gender disaggregation of TAV traders

More than 70% of traders at each level of TAV marketing channel were women, but the number of men at the wholesale level increased in Kenya.

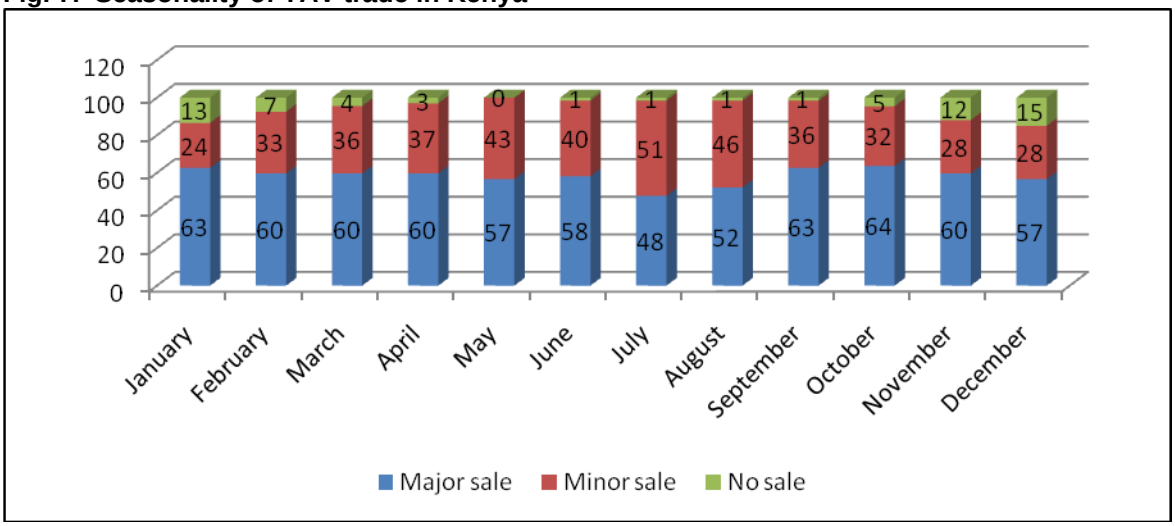
Types of vegetables traded

Generally, the proportion of traders selling each type of TAV increased between the baseline and impact studies (Table 10). The most commonly traded vegetable was nightshade, followed by amaranth, and then cowpea and spider plant. There was a significant increase in the amount of nightshade traded, from 77.8% to 90.7% (Table 10). Exotic vegetables were traded by less than 20% of the traders interviewed, which indicated a tendency to specialize in selling either TAVs or exotic vegetables. Sweetpotato leaves were traded only in Tanzania.

Trading calendar

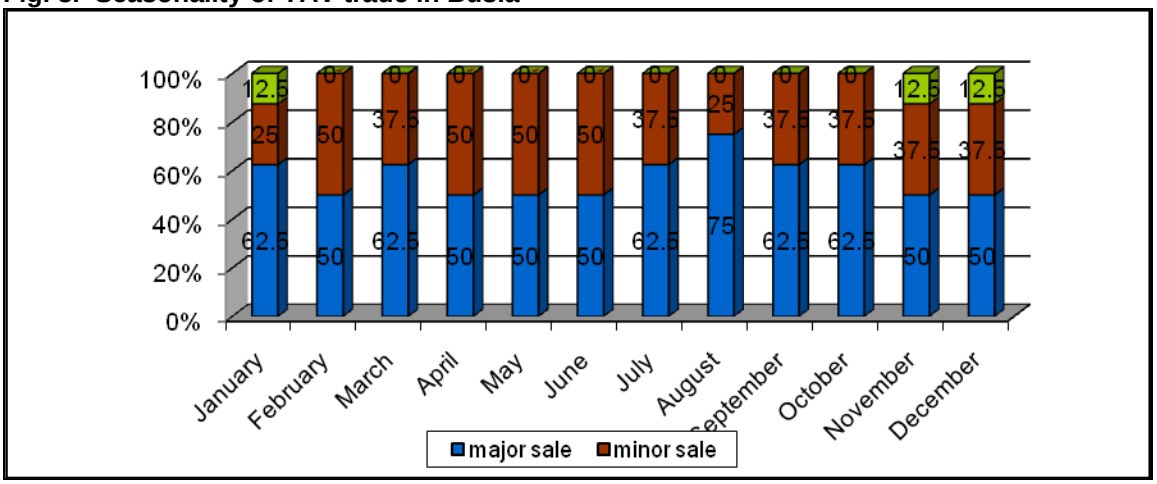
TAV trading occurred throughout the year in Kenya, as they were sourced from different parts of the country where they were produced in different seasons (Fig. 7).

Fig. 7. Seasonality of TAV trade in Kenya



Supply and trading in Busia took place throughout the year due to supply of TAV from different parts of the region, including Uganda, which cushioned the effect of drought (Fig. 8).

Fig. 8. Seasonality of TAV trade in Busia



In Tanzania, there were two distinct peak periods, which occurred in April-June and September-November (Fig. 9).

Fig. 9. Seasonality of TAV trade in Tanzania

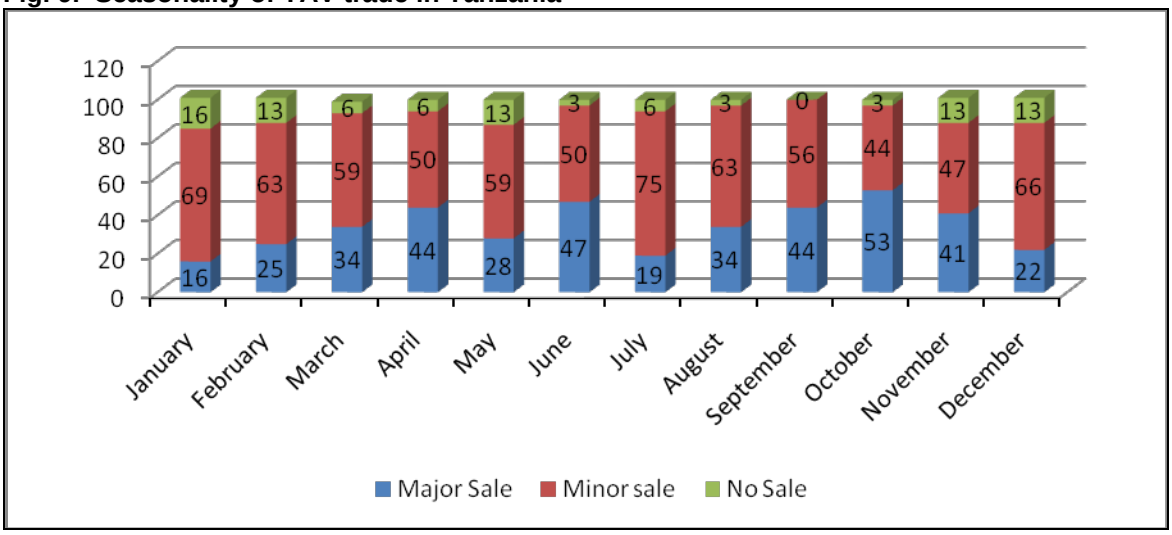


Fig. 10. Seasonality of TAV trade in Nairobi

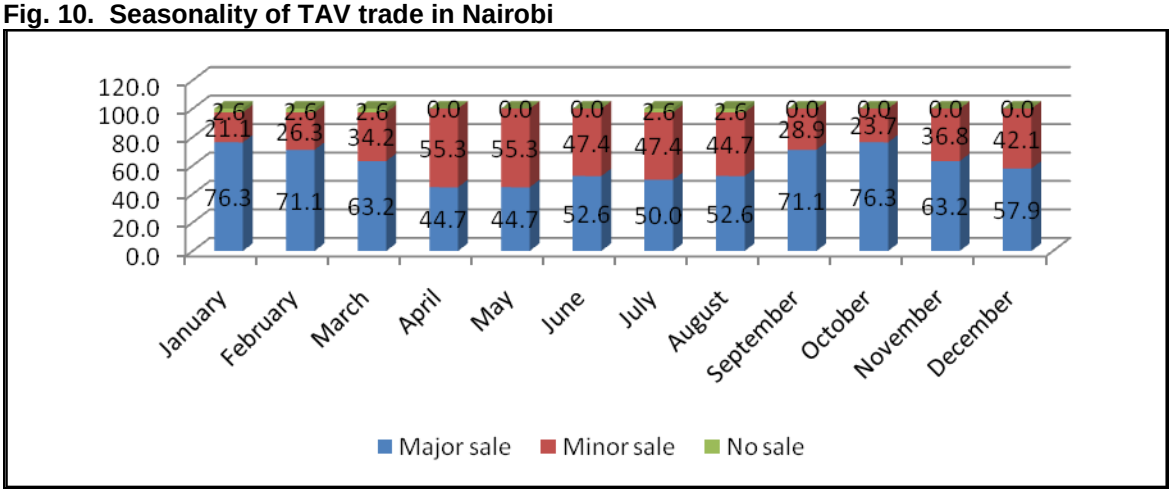


Fig. 11. Seasonality of TAV trade in Rachuonyo

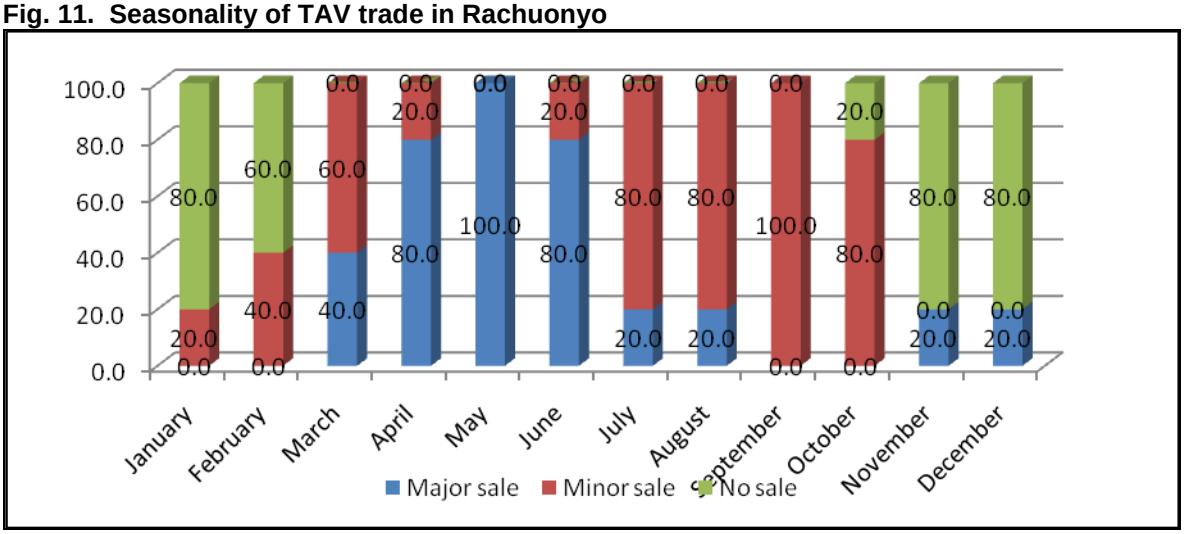
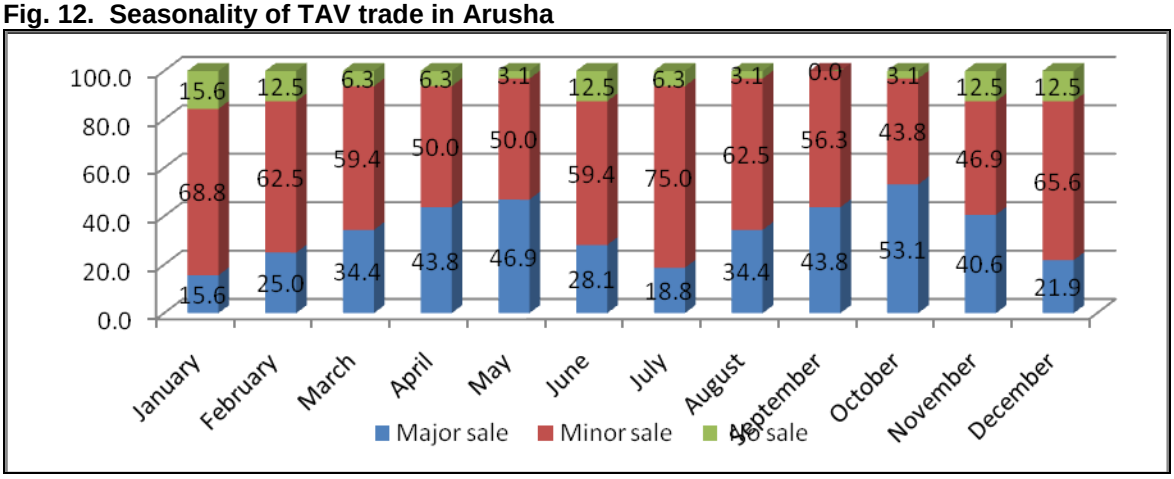


Fig. 12. Seasonality of TAV trade in Arusha



Factors influencing buying decisions of TAV traders

Factors considered by traders when purchasing TAVs included freshness, size of package, post-harvest damage, cleanliness, and price (Table 20).

Freshness of TAVs was very important for business during both the baseline and impact surveys. More than 90.0% of traders said freshness was an important attribute they considered when purchasing TAVs. They all preferred freshly harvested vegetables, and none would purchase vegetables that had stayed for more than three days.

Cleanliness of TAVs was very important during both baseline (69.7%) and impact (84.6%) surveys and majority of traders preferred very clean TAV.

Most traders preferred vegetables with no or minimal post-harvest damage; this consideration remained important during the baseline and impact surveys. Traders also preferred big bundles and heaps, and this preference did not change much over the project period.

Over 90.0% of the traders considered TAV prices when purchasing, and over 50.0% of them preferred when vegetables were cheaper than other type of foods. However, over 25.0% of traders said they set prices.

Quantities available in an area were the other important consideration for 56.0% of traders because this determined the time spent per trip and cost of bulking enough produce. Traders preferred to source produce from areas with plenty of TAVs to minimize the cost of bulking.

Sources of TAVs and mode of transport

The majority of traders bought TAVs directly from farmers; there was no significant change between the baseline (62.6) and impact (55.6%) surveys. Wholesalers supplied TAVs to 40.5% of traders in the baseline and impact surveys (Table 11). There was a significant increase in traders who sourced from farmer groups at the end of project intervention. This result was due to improved linkages that enhanced traders' awareness of the availability of large amounts of high-quality vegetables.

The mode of transport for vegetables was influenced by the scale of operation. For instance, manual transportation was done by 39.2%, and public transportation, which was used by 36.9%, was the most popular (Table 11). Using carts to transport vegetables declined significantly, whereas using pickups increased.

Time spent bulking TAV

There was a significant increase in time spent bulking TAVs by traders buying at farm gates, from a mean of 2.3 hours per trip to 5.7 hours (Table 12). The average time spent bulking 100 kg of TAVs increased from 0.99 hours to 1.88 hours. The big change in time to bulk TAV was mainly observed for wholesalers, who spent more time per trip during the impact survey than during the baseline. This increase may be attributed to the scarcity of TAVs caused by drought, which made it necessary for wholesalers to move from one farmer to another before getting enough TAV for consignment.

Classification by market channel and source of produce

To enable us to evaluate changes over the project period, traders were classified in five channels based on source of TAVs and target markets. To allow us to calculate quantities flowing from areas of intervention and to understand trader-farmer interaction, traders were further divided into those who bought their produce at farm gates in areas of intervention and those who bought from intermediaries. Using these two sub-classifications, we grouped traders into the five channels shown in Table 13.

Quantities of TAV traded

There was a decline in volume of TAV traded from 2,043.2 kg per month to 1,829.0 kg per month between the baseline and impact surveys (Table 14). This finding was possibly due to the drought that was experienced in 2008 in both countries. The volume purchased from farmers at intervention site declined for all TAV except amaranth, which had a marginal increase.

Kiambu-Gikomba remained the most important marketing channel for TAVs between the baseline and impact surveys, and it had the highest amount of TAV sold per trader. There was decline in the quantities of TAVs traded in all channels, except for the Arumeru-Arusha

channel, where quantities traded increased significantly from 809.9 kg per month to 1,662.6 kg per month. The increase in TAV trade in Tanzania is an indication of improved consumption (Table 21).

Although time spent bulking TAVs per trip decreased for traders due to the lower amount of TAVs purchased per trip, the time spent to bulk 100 kg of TAVs increased for all groups of traders. This was a result of the drought, which led to a reduction in area under TAV in most farms and disrupted production.

A reduction in post-harvest losses was observed during the impact survey.

Conclusion

The majority of the traders (at least 80%) in Kenya and Tanzania were women with an average age of 39.3 years and an upper-primary education level. The average years involved in trading was 8.7 years, and over 87% had not had any training on vegetable or sweetpotato trading. Slightly more than half of traders sold either vegetables or sweetpotato. More than 80.0% of traders had no financial support to support their businesses.

The skin color of sweetpotato remained important for traders (over 60.0%) during baseline and impact surveys; red skin was preferred by more than 83% of traders. The flesh color also remained very important; more than 65% preferred yellow-fleshed roots.

There was an increase from 5.5% to 17.5% of traders who sold orange-fleshed sweetpotato due to interventions, such as market promotion and training. This outcome is further supported by increases in area under OFSP and a rise in consumer interest in OFSP.

The recently disseminated OFSP varieties (SPK 004/6 and SPK 004/6/6), which combine the two preferred qualities of red skin and high dry matter, have great potential for adoption and acceptability in Kenya. However, the bias of traders against the orange-fleshed sweetpotato may pose a challenge to the few early adopters of OFSP production. Therefore, promotion should continue until both consumer and trader awareness and preferences are favorable to OFSP.

The number of traders setting prices increased between the baseline and impact surveys. This implied that there was need to empower more farmers through farmer groups or associations by increasing access to information, facilitating dialogue, and improving bargaining power.

There was change in nutritional awareness. The proportion of traders who considered nutrition important increased by 13.2%, and those who identified sweetpotato as a good source of energy increased by 28.8%.

Only one flour-processing channel, which involved milling and packaging of OFSP flour in Busia and transporting it to Nairobi, existed between the baseline and impact surveys. Very

low volumes were traded through this channel, which was characterized by monopolistic tendencies.

Sweetpotato leaves were traded only in Tanzania where 30.0% of traders sold it.

The time spent bulking enough TAVs to make a consignment increased by 3.3 hours for traders buying at farm gates. This finding was possibly caused by the scarcity of TAVs due to drought.

The proportion of traders who purchased from farmer groups increased by 13.8%. This result indicated improved market access for farmers in the intervention groups. However, traders bought vegetables from individual farms and the traders did not reduce the total time spent purchasing vegetables.

The quantity of TAVs traded by all traders between the baseline and impact surveys declined from 2,043.2 kg per month to 1,829.0 kg per month; the decline was mainly in amaranth, nightshade, spider plant, and cowpea.

TAVs and sweetpotato businesses were dominated by women (over 75%); only at wholesale level did the proportion of men increase.

TAVs were the crops most affected by the lack of irrigation water, and volumes of TAV traded declined in Kenya. In Tanzania, the volumes traded doubled, possibly due to availability of irrigation water and market promotions.

Tables

Table 1. Sample sizes by category of trader and crops sold

		Survey		
		Baseline	Impact	Total
		Count	Count	Count
Traders of TAV and SP by category	Farmer retailer	17	5	22
	Broker	3	3	6
	Retailer	78	60	138
	Wholesaler	57	33	90
	Supermarket	8	4	12
Traders by type of crops sold	Sold TAV only	81	45	126
	Sold SP only	64	51	115
	Sold both	18	9	27
	Total	**163**	**105**	**268**

Table 2. Trader characteristics in Kenya and Tanzania

		Baseline	Impact	Total
Gender of trader (%)				
Kenya	Male	17.6	19.0	18.2
	Female	82.4	81.0	81.8
	Total	**108**	**79**	**187**
Tanzania	Male	18.6	13.6	16.9
	Female	81.4	86.4	83.1
	Total	**43**	**45**	**88**
All	Male	17.9	17.8	16.6
	Female	82.1	82.2	82.1
	Total	**151**	**101**	**252**
Age of interviewee (average)		39.26	39.42	39.32
Education level	No formal education	8.7	8.9	8.8
	Lower primary	4.0	8.9	6.0
	Upper primary	52.3	52.7	52.4
	Secondary school	30.2	24.8	28.0
	High school and college	4.7	5.0	4.8
No. of years in business (average)		8.8	8.4	8.7
Had training on vegetable or sweetpotato trading		12.7	9.5	11.4
Trades in vegetables		60.7	51.4	57.1
Trades in sweetpotato		50.3	57.1%	53.1
Trades in Other produce		26.4	19.0	22.9
Had business credit		12.9	9.5	11.6
Sample size		**163**	**105**	**268**

Table 3. Quantities of TAV purchased and bulking time

		Survey		
		Baseline	**Impact**	**Total**
Retailer	Total TAV purchased per month (kg)	1879.58	1712.89	1819.57
	TAV purchased per trip (kg)	48.77	23.49	39.67
	Time spent per trip	2.22	1.12	1.80
	Time spent bulking 100 kg of TAV (hr)	1.27	3.15	1.98
	Losses	2.29	1.56	2.02
	N	16	9	25
Wholesaler	Total TAV purchased per month (kg)	1681.90	1688.81	1684.56
	TAV purchased per trip (kg)	59.05	73.41	64.57
	Time spent per trip	2.42	7.68	4.42
	Time spent bulking 100 kg of TAV (hr)	.35	1.25	.71
	Losses	2.86	1.66	2.42
	N	19	11	30
Supermarket	Total TAV purchased per month (kg)	3727.50	3648.44	3674.79
	TAV purchased per trip (kg)	31.06	36.48	34.68
	Time spent per trip	.	.	.
	Time spent bulking 100 kg of TAV (hr)	.	.	.
	Losses	.00	.00	.00
	N	1	2	3
All categories	Total TAV purchased per month (kg)	1839.73	1885.76	1857.63
	TAV purchased per trip (kg)	53.22	48.50	51.38
	Time spent per trip	2.33	4.72	3.23
	Time spent bulking 100 kg of TAV (hr)	.81	2.15	1.33
	Losses	2.53	1.46	2.12
	N	36	22	58

Table 3. Categories of sweetpotato traders by gender

			Kenya		Tanzania		Total	
			Baseline	Impact	Baseline	Impact	Baseline	Impact
Farmer retailer	Male	%	0	0	0	0	0	0
	Female	%	100	100	100	0	100	100
	Total	Count	6	3	1	0	7	3
Broker	Male	%	0	0	0	0	0	0
	Female	%	100	100	0	0	100	100
	Total	Count	2	2	0	0	2	2
Retailer	Male	%	17.6	11.5	50	16.7	21.1	12.5
	Female	%	82.4	88.5	50	83.3	78.9	87.5
	Total	Count	34	26	4	6	38	32
Wholesaler	Male	%	22.2	37.5	0	66.7	16	42.1
	Female	%	77.8	62.5	100	33.3	84	57.9
	Total	Count	18	16	7	3	25	19
Supermarket	Total	Count	8	4	0	0	8	4
Total	Male	%	16.7	20.4	16.7	33.3	16.7	22.4
	Female	%	83.3	79.6	83.3	66.7	83.3	77.6
	Total	Count	68	53	12	9	80	62

Table 4. Packages used for selling sweetpotato

		Survey		
		Baseline	Impact	Total
Kg	Count	7	7	14
	%	9.7	12.3	10.9
20 L can	Count	8	1	9
	%	11.1	1.8	7.0
25 L can	Count	2	0	2
	%	2.8	0	1.6
90 Kg sack	Count	11	14	25
	%	15.3	24.6	19.4
260 Kg bag (Mtoro/Utajiju)	Count	22	13	35
	%	30.6	22.8	27.1
160 Kg bag	Count	18	22	40
	%	25	38.6	31.0
110 Kg bag	Count	21	4	25
	%	29.2	7	19.4
Heaps	Count	1	6	7
	%	1.4	10.5	5.4
Other	Count	4	5	9
	%	5.6	8.8	7.0
	Count	72	57	129

Table 5. Transport of sweetpotato in Kenya and Tanzania

	Baseline	Impact	Total
Type of Transportation	**%**	**%**	**%**
Manual	18.3	20.3	19.5
Cart	21.1	18.6	20.0
Bicycle	18.3	15.3	16.9
Public transport	26.8	16.9	22.3
Pick up*	16.9	3.4	10.8
Lorry*	21.1	37.3	28.5
Other	0	5.1	2.3
Total	**71**	**59**	**130**

*Indicates significance at 0.05 level.

Table 6. Types of sweetpotato sold in different markets in Kenya and Tanzania

	Survey			Districts Where Interviews Were Conducted						
	Baseline	Impact	Total	Nairobi	Rachuonyo	Kisumu	Busia	Arumeru	Arusha	Total
WFSP	32.9	31.6	32.3	3.9	7.7	25	65	100	100	34.2
YFSP	63	75.4	68.5	92.2	84.6	91.7	35	0	18.2	66.7
OFSP	5.5	17.5	10.8	5.9	0	0	30	10	27.3	11.1
Mixture including orange fleshed	1.4	0	0.8	0	0	0	5	0	0	0.9
Mixture excluding orange fleshed	6.8	1.8	4.6	2	15.4	8.3	0	0	0	3.4
Any type of sweetpotato	2.7	0	1.5	0	0	0	10	0	0	1.7
Sample	**73**	**57**	**130**	**51**	**13**	**12**	**20**	**10**	**11**	**117**

Table 7. Categories of TAV traders in Kenya and Tanzania

		Survey		
		Baseline	**Impact**	**Total**
Categories of traders	Farmer-retailer	14	2	16
	Broker	1	1	2
	Retailer	45	33	78
	Wholesaler	34	14	48
	Supermarket	5	4	9
Total		**99**	**54**	**153**

Table 8. Gender of TAV traders

			Kenya		Tanzania		Total	
			Baseline	Impact	Baseline	Impact	Baseline	Impact
Farmer retailer	Male	%	20.0	.0	25.0	.0	21.4	.0
	Female	%	80.0	100.0	75.0	.0	78.6	100.0
		N	10	2	4	0	14	2
Broker	Male	%	.0	.0	100.0	.0	100.0	.0
	Female	%	.0	100.0	.0	.0	.0	100.0
		N	0	1	1	0	1	1
Retailer	Male	%	8.6	12.0	.0	.0	7.3	9.1
	Female	%	91.4	88.0	100.0	100.0	92.7	90.9
		N	35	25	6	8	41	33
Wholesaler	Male	%	46.2	44.4	19.0	.0	29.4	28.6
	Female	%	53.8	55.6	81.0	100.0	70.6	71.4
		N	13	9	21	5	34	14
All types of traders	Male	%	19.0	18.9	18.8	.0	18.9	13.3
	Female	%	81.0	81.9	81.3	100.0	81.1	86.7
		N	47	30	32	13	95	45

Table 9. Types of vegetables sold (%)

	Kenya		Tanzania		Total	
	Baseline	**Impact**	**Baseline**	**Impact**	**Baseline**	**Impact**
Amaranth	71.6	65.9	53.1	76.9	65.7	68.5
Nightshade	80.6	87.8	71.9	100.0	77.8	90.7
Spider plant	62.7	68.3	3.1	7.7	43.4	53.7
Cowpea	61.2	53.7	18.8	53.8	47.5	53.7
Sweetpotato leaves	.0	.0	31.3	53.8	10.1	13.0
Kales	17.9	31.7	25.0	15.4	20.2	27.8
Spanish	14.9	14.6	.0	15.4	10.1	14.8
Mrenda	20.9	12.2	.0	.0	14.1	9.3
Cabbage	3.0	.0	6.3	7.7	4.0	1.9
Mitoo	7.5	17.1	.0	.0	5.1	13.0
Crotalaria	3.0	2.4	.0	.0	2.0	1.9
Sample size	**67**	**41**	**32**	**13**	**99**	**54**

*Indicates significance at 0.05 level.

Table 10. Sources of TAV and modes of transportation

	Baseline	Impact	Total
Where traders sourced TAV from			
Farms	62.6	55.6	60.1
Wholesalers	40.4	40.7	40.5
Brokers	9.1	7.4	8.5
Other sources	2.0	.0	1.3
Farmer groups	1.0	14.8	5.9
Transport mode for vegetables			
Manual	41	36.2	39.2
Cart*	27.7	8.5	20.
Bicycle	10.8	12.8	11.5
Public transport	43.4	25.5	36.9
Pick up*	6.0	17.0	10.0
Lorry	12	19.1	14.6
Other	2.4	8.5	4.6
n	**83**	**47**	**130**

Table 11. Time spent bulking TAV

			Baseline	Impact	Total
Retailer	Per trip	Mean	1.55	1.56	1.55
		Std	1.78	2.51	2.00
	Per 100 kg of TAV	Mean	1.31	2.78	1.79
		Std	3.97	6.57	4.91
		Count	28	11	39
Wholesaler*	Per trip	Mean	2.91	9.16	5.10
		Std	3.05	6.99	5.60
	Per 100 kg of TAV	Mean	0.63	1.11	.82
		Std	1.19	1.16	1.18
		Count	25	13	38
All traders	Per trip	Mean	2.23	5.68	3.38
		Std	2.56	6.57	4.59
	Per 100 kg of TAV	Mean	.99	1.88	1.31
		Std	3.00	4.49	3.60
		n	53	24	77

*Indicates significance at 0.05 level.

Table 12. Marketing channels and number of traders in each channel

		Baseline	Impact	Total	
Channel		**n**	**N**	**n**	**%**
Buy from intermediaries	Kiambu farmers-Gikomba-other markets	11	9	20	26.7
	Kiambu farmers to Wangige market	2	1	3	4
	Kabondo channel	2	1	3	4
	Arumeru farmers to Arusha markets	11	11	22	29.3
	Busia channel	5	3	8	10.7
	Other channels	12	7	19	25.3
	All channels	43	32	75	100
Buy from farmers	Kiambu farmers-Gikomba-other markets	12	8	20	20
	Kiambu farmers to Wangige market	2	1	3	3
	Kabondo channel	2	3	5	5
	Arumeru farmers to Arusha markets	20	23	43	43
	Busia channel	6	5	11	11
	Other channels	12	6	18	18
	All channels	54	46	100	80

Table 13. Quantities of different types of TAV purchased from farmers (kilograms per month)

			Survey		
			Baseline	**Impact**	**Total**
All traders	Total TAV	Mean	2043.19	1829.03	1960.69
		n	75	47	122
	Amaranth	Mean	793.15	740.47	773.47
		n	52	31	83
	Nightshade	Mean	954.80	903.98	934.65
		n	67	44	111
	Spider plant	Mean	653.34	521.39	597.36
		n	38	28	66
	Cowpea leaves*	Mean	579.46	312.24	470.90
		n	38	26	64
	Sweetpotato leaves	Mean	168.29	73.96	121.13
		n	7	7	14
From farmers in intervention sites to target markets	Total TAV	Mean	1839.73	1885.76	1857.63
		n	33	21	54
	Amaranth	Mean	744.70	873.00	792.35
		n	22	13	35
	Nightshade	Mean	1027.41	971.19	1004.68
		n	28	19	47
	Spider plant	Mean	738.09	455.80	625.17
		n	15	10	25
	Cowpea leaves	Mean	454.88	401.63	421.92
		n	8	13	21
	Sweetpotato leaves	Mean	170.03	20.00	145.03
		n	5	1	6

Table 14. Attributes considered by traders when purchasing sweetpotato

Attribute	Response	Baseline %	Impact %	Total %
Importance of skin color	not important	15.1	5.6	11.0
	somewhat important	20.5	22.2	21.3
	very important	64.4	72.2	67.7
Description of skin color	Red	86.9	83.7	84.7
	Cream/light	13.1	18.0	15.3
Importance of flesh color	not important	12.3	14.8	13.4
	somewhat important	24.7	14.8	20.5
	very important	63.0	70.4	66.1
Description of flesh color	Orange	4.8	6.8	5.6
	Yellow	65.1	72.7	68.2
	White	28.6	20.5	25.2
	Other	1.6	0	0.9
Importance of size	not important	17.8	9.6	14.4
	somewhat important	30.1	46.2	36.8
	very important	52.1	44.2	48.8
Description of size	Small	1.7	4.3	2.8
	Medium	73.3	85.1	78.5
	Large	23.3	10.6	17.8
	Other	1.7	0	0.9
Importance of (post harvest) damages	not important	4.1	1.9	3.2
	somewhat important	20.5	17.3	19.2
	very important	75.3	80.8	77.6
Description of damages	No evidence of weevil	64.3	60	62.5
	Limited weevil damage acceptable	35.7	40	37.5
Importance of freshness	not important	6.8	1.9	4.8
	somewhat important	21.9	30.8	25.6

Attribute	Response	Baseline	Impact	Total
		%	%	%
	very important	71.2	67.3	69.6
Description of freshness	Freshly harvested	66.2	68.6	67.2
	1-3 days harvested	33.8	31.4	32.8
Importance of texture (dry matter content)	not important	27.4	19.2	24
	somewhat important	13.7	15.4	14.4
	very important	58.9	65.4	61.6
Description of texture	Watery	0	14	6.2
	Powdery	100	86	93.8
Importance of producer price	not important	12.3	15.4	13.6
	somewhat important	32.9	19.2	27.2
	very important	54.8	65.4	59.2
Preferred price of produce	Cheaper than other foods	62.5	58.7	60.9
	Same as other foods	9.4	6.5	8.2
	More expensive	6.2	0	3.6
	We fix/set prices	21.9	34.8	27.3
Importance of nutritional qualities	not important	69.9	59.6	65.6
	somewhat important	9.6	9.6	9.6
	very important	20.5	30.8	24.8
Preferred nutritional quality	Contains vitamin A	36.4	12.5	23.9
	Energy-giving/good source of energy*	54.5	83.3	69.6
	Other health benefit	9.1	4.2	6.5
Importance of consumer preference	not important	0	0	0
	somewhat important	9.6	0	9.6
	very important	90.4	0	90.4
Description of consumer preference	What customers ask for	61.5	0	61.5
	What sells faster	38.5	0	38.5
Importance of duration after maturity	not important*	38.4	16.7	29.1
	somewhat important	17.8	24.1	20.5

Attribute	Response	Baseline	Impact	Total
		%	%	%
	very important	43.8	59.3	50.4
Sample size	**Total**	**73**	**54**	**127**
Description of duration of maturity	Up to 1 month after maturity	61.4	82.2	71.9
	Up to 2 months after maturity	27.3	11.1	19.1
	Up to 4 months after maturity	11.4	2.2	6.7
	Up to 6 months after maturity	0.0	4.4	2.2
Sample size	**Total**	**44**	**45**	**89**

*Indicates significance at 0.05 level.

Table 15. Quantities of sweetpotato purchased per month (kgs)

			Survey		
			Baseline	**Impact**	**Total**
All traders					
	Retailer	Mean	6663.46	3469.78	5224.05
		Count	46	35	81
		Std	9715.53	3790.13	7756.54
	Wholesaler	Mean	17619.09	28175.56	22369.50
		Count	25	19	44
		Std	32551.32	33860.90	33145.42
	supermarket	Mean	542.50	1450.00	996.25
		Count	8	4	12
		Std	555.12	1227.41	1006.49
	Total	Mean	9994.84	11555.42	10703.01
		Count	79	58	137
		Std	20882.19	22743.05	21666.60
Traders buying from farm gate					
From intervention area	Retailer	Mean	3241.25	4335.40	3788.33
		Count	9	8	17
		Std	2729.88	6274.10	4708.18
	Wholesaler	Mean	16149.09	43804.44	28594.00
		Count	12	10	22
		Std	30676.81	42096.56	37956.68
	Total	Mean	10714.21	25230.78	17569.26
		Count	21	18	39
		Std	23845.00	36271.78	30787.53
From other areas	Retailer	Mean	4454.93	2560.00	3981.20
		Count	3	1	4
		Std	904.16	.	1201.12
	Wholesaler	Mean	29964.00	25900.00	28802.86
		Count	5	2	7
		Std	53064.76	18526.20	44027.05
	Supermarket	Mean	985.00	1506.67	1298.00
		Count	2	3	5
		Std	374.77	1496.84	1112.21
	Total	Mean	16515.48	9813.33	14002.18
		Count	10	6	16
		Std	38134.74	14999.17	30964.11

			Survey		
			Baseline	**Impact**	**Total**
Total	Retailer	Mean	3572.25	4138.13	3826.90
		Count	12	9	21
		Std	2387.77	5898.65	4211.21
	Wholesaler	Mean	20466.25	40549.09	28648.15
		Count	17	12	29
		Std	37709.59	38787.56	38731.82
	supermarket	Mean	985.00	1506.67	1298.00
		Count	2	3	5
		Std	374.77	1496.84	1112.21
	Total	Mean	12714.65	21208.83	16471.69
		Count	31	24	55
		Std	28997.13	32494.26	30581.97

Table 16. Quantity of sweetpotato purchased per trip and bulking time

			Survey		
			Baseline	**Impact**	**Total**
Rachuonyo	Quantity per month (kg)	Mean	26514.29	32581.82	30222.22
		Std	35250.02	42368.91	38778.49
		Count	7	12	19
	Quantity per trip (kg)	Mean	3525.71	3894.55	3751.11
		Standard Deviation	4396.01	5380.01	4886.81
		Count	7	12	19
	Time per trip (hrs)	Mean	10.69	9.50	9.94
		Standard Deviation	8.17	5.27	6.29
		Count	7	12	19
	Frequency of going to buy per month	Mean	9.71	9.33	9.47
		Standard Deviation	6.87	3.11	4.66
		Count	7	12	19
	Time spent bulking (hrs/100kg)	Mean	1.14	1.46	1.34
		Standard Deviation	1.73	2.63	2.27
		Count	7	12	19
Busia	Quantity per month (kg)	Mean	2290.00	354.40	1460.46
		Std	1426.37	268.12	1453.16
		Count	5	3	8
	Quantity per trip (kg)	Mean	155.00	52.63	111.13
		Standard Deviation	75.94	29.14	78.49
		Count	5	3	8
	Time per trip (hrs)	Mean	4.00	.28	2.60
		Standard Deviation	2.65	.10	2.78
		Count	5	3	8
	Frequency of going to buy per month	Mean	9.60	6.67	8.50

			Survey		
			Baseline	**Impact**	**Total**
		Standard Deviation	4.56	2.31	3.96
		Count	5	3	8
	Time spent bulking (hrs/100kg)	Mean	2.60	.54	1.57
		Standard Deviation	1.03	.19	1.34
		Count	5	3	8
Arumeru	Quantity per month (kg)	Mean		32480.00	7377.00
		Std		10634.89	13706.81
		Count		2	10
	Quantity per trip (kg)	Mean		2100.00	506.00
		Standard Deviation		1272.79	941.93
		Count		2	10
	Time per trip (hrs)	Mean		9.25	4.85
		Standard Deviation		9.55	4.75
		Count		2	10
	Frequency of going to buy per month	Mean		14.00	11.30
		Standard Deviation		2.83	5.54
		Count		2	10
	Time spent bulking (hrs/100kg)	Mean		.37	3.40
		Standard Deviation		.23	2.77
		Count		2	10
Other districts	Quantity per month (kg)	Mean	9664.71	9054.29	9493.79
		Std	28847.17	13838.80	25246.83
		Count	19	7	26
	Quantity per trip (kg)	Mean	740.71	738.57	740.11
		Standard Deviation	2413.69	768.34	2067.43
		Count	19	7	26
	Time per trip (hrs)	Mean	5.62	10.25	6.50

			Survey		
			Baseline	**Impact**	**Total**
		Standard Deviation	5.45	6.75	5.84
		Count	19	7	26
	Frequency of going to buy per month	Mean	13.79	12.57	13.46
		Standard Deviation	8.25	7.21	7.86
		Count	19	7	26
	Time spent bulking (hrs/100kg)	Mean	2.81	.53	2.43
		Standard Deviation	2.29	.44	2.26
		Count	19	7	26
Total	Quantity per month (kg)	Mean	12714.65	21208.83	16471.69
		Std	28997.13	32494.26	30581.97
		Count	31	24	55
	Quantity per trip (kg)	Mean	1332.17	2276.87	1750.01
		Standard Deviation	3050.34	4016.23	3505.85
		Count	31	24	55
	Time per trip (hrs)	Mean	6.56	8.30	7.29
		Standard Deviation	6.18	6.17	6.17
		Count	31	24	55
	Frequency of going to buy per month	Mean	12.19	10.33	11.38
		Standard Deviation	7.56	4.90	6.55
		Count	31	24	55
	Time spent bulking (hrs/100kg)	Mean	2.31	1.08	1.78
		Standard Deviation	2.14	2.08	2.18
		Count	31	24	55

Table 17. Packaging and prices of sweetpotato (USD)

	Nairobi		Busia		Rachuonyo		Kisumu		Arumeru and Arusha	
	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count
Kg	0.56	2	.	0	.	0	0.45	2	.	0
20 L can	.	0	.	0	.	0	.	0	24.77	8
90 Kg sack	.	0	8.99	4	.	.	.	0	340.91	2
260 Kg bag	35.34	13	.	.	7.813	3	26.56	2	.	0
160 Kg bag	24.11	7	8.20	2	9.38	3	17.19	1	.	0
110 Kg bag	33.59	2	7.89	4	8.59	3	16.41	2	.	0

Table 18. Main trader categories and sub-categories in sweetpotato sub-sector market

Trader Type	Role	Characteristics	Location of Operation
1. Producer/farmer-retailer	Growing potato at farm level and retailing	Sometime farmers double as producers and as well as traders and hence they could be selling at farm gate to brokers or directly to traders	Farms in Rachuonyo and Busia
2. Brokers/rural assembler	Collect sp from farm gate and assemble them at a collection center by the road side	Majority (brokers) do not own the produce at any time since they take sweetpotato on credit and pay farmers after getting paid by onwards traders	Between farms and roadside/ collection centers. Are concentrated in Rachuonyo.
3. Wholesalers	Buy and sell sweetpotato in to traders who will resell	This group buy from either farmers, brokers or other wholesalers	Move from one market to another or one district to another
I. Wholesaler 1/ transporters	Traders who buy from farm gate or collection centers (through brokers) and transport in bulk to major towns	Sometimes the group could also be referred to as transporters. Traders in this group buy sweetpotato directly from farmers or from collection centers and go to sell them in markets in the same district or in distant market in other districts.	Rachuonyo (Kabondo) to Rachuonyo, Nairobi, Nakuru, Kisumu, Nyahururu etc
II. Wholesaler 2-trade between markets	Wholesalers who buy sp in bulk from one major market to other markets in the same district	This group buy sweetpotato in bulk from one major market and go to sell in other markets in the same district	Gikomba to Kawagware, Githurai, Kangemi, etc
III. Wholesalers 3	Buy in bulk from one country and sell in bulk in Kenya	This group buy sweetpotato in bulk from neighbouring country and transport to Kenya where they sell in bulk in one of the major markets	Arusha in Tanzania to Gikomba and Busia in Uganda to Mombasa
4. Retailer	Traders who buy roots in bulk and sell to final consumers	Their volumes of sale greatly vary depending on the distances travelled, market and district of operation	Will be found in all sweetpotato markets in all districts
I. Retailers 1- trade within district	Retailers who buy from farmers/ through brokers and sell to consumers in the same district	From farmers/ brokers to consumers in the same district	Within Rachuonyo or Busia
II. Retailers 2- trade between districts	Retailers who buy from farmers/collection canter and sell to consumers in another district	From farmers/brokers to consumers in another district	Rachuonyo to Nakuru, Nyahururu, Gikomba, Kawagware, Githurai, Kangemi, etc
III. Retailers 3- trade within district	Retailers who buy from a major market and sell to consumers in another market in same district	From wholesalers in a major market to consumers in another market in same district	Gikomba to Kawagware, Githurai, Kangemi, etc
IV. Retailers 4- trade within markets	Retailers who buy sp and sell to consumers in the same market	From wholesalers to consumers in the same market	Gikomba, Kawagware, Githurai, Kangemi, etc

Trader Type	Role	Characteristics	Location of Operation
V. Retailers 5- trade between districts	Retailers who buy and sell from different markets in different districts	From one district to another district	Kirinyaga, to Nairobi, Gikomba to Kiambu
VI. Retailers 6-trade between countries	Retailer who buy form one country and sell to customers in another country	From one country to another	Uganda to Busia
5. Super markets/groceries	Buy sp from traders within the same district or from different district	Normally get supplies of sweetpotato from contracted farmers or traders. Constitute the main part of formal market channel	Kisumu, Nakuru, Nairobi

Table 19: Attributes considered by traders when purchasing TAV

		Survey		
Attribute	**Response**	**Baseline**	**Impact**	**Total**
Importance of freshness	Not important	0	0	0
	Somewhat important	6.6	3.8	5.6
	Very important	91.2	96.2	93
	Trader is a farmer	2.2	0	1.4
Description of freshness	Freshly harvested	96.6	84.6	92.2
	1-3 days harvested	3.4	15.4	7.8
Importance of (post-harvest) damages	Not important	3.4	0	2.1
	Somewhat important	15.7	13.5	14.9
	Very important	80.9	86.5	83
Description of damages	No damage	74.4	78	75.7
	Minimal damage	25.6	22	24.3
Importance of size of bundle/quantity packaged	Not important	14.3	7.7	11.9
	Somewhat important	20.9	17.3	19.6
	Very important	62.6	75	67.1
	Trader is a farmer	2.2	0	1.4
Description of size	Small	0	2.1	0.8
	Middle	25	29.2	26.6
	Big	75	68.8	72.6
Importance of produce price	Not important	8.8	13.5	10.5
	Somewhat important	27.5	21.2	25.2
	Very important	61.5	65.4	62.9
	Trader is a farmer	2.2	0	1.4
Description of produce price	Cheaper than other foods	60.5	53.3	57.9
	Same as other foods	13.6	15.6	14.3
	We fix/set the price	25.9	31.1	27.8

Attribute	Response	Survey		
		Baseline	Impact	Total
Importance of cleanliness/ hygiene	Not important	14.6	0	9.2
	Somewhat important	15.7	15.4	15.6
	Very important	69.7	84.6	75.2
Description of cleanliness/ hygiene	Very clean	78.9	78.8	78.9
	Somehow clean	18.4	21.2	19.5
	Dirty	2.6	0	1.6
Quantities available	Not important	-	16	16
	Somewhat important	-	28	28
	Very important	-	56	56
Description of quantities	Should fill consignment in half a day	-	64.3	64.3
	Should fill consignment in one day	-	28.6	28.6
	Others	-	7.1	7.1
Sample size		**99**	**54**	**154**

Table 20: Quantities of TAV traded in different marketing channels (kg/month)

Channel			Survey		
			Baseline	Impact	Total
Kiambu-Gikomba-Other markets	Total TAV	Mean	4418.62	3708.34	4107.87
		Valid N	9	7	16
	Amaranth	Mean	1447.88	1402.70	1430.50
		Valid N	8	5	13
	Nightshade	Mean	2027.22	2069.80	2044.25
		Valid N	9	6	15
	Spider plant	Mean	1183.71	717.32	989.38
		Valid N	7	5	12
	Cowpea	Mean	551.20	979.83	765.52
		Valid N	3	3	6
Kabondo	Total TAV	Mean	1087.20	802.36	916.30
		Valid N	2	3	5
	Amaranth	Mean	80.00	124.32	109.55
		Valid N	1	2	3
	Nightshade	Mean	423.60	212.20	296.76
		Valid N	2	3	5
	Spider plant	Mean	263.60	212.20	232.76
		Valid N	2	3	5
	Cowpea	Mean	720.00	295.08	401.31
		Valid N	1	3	4
Busia	Total TAV	Mean	968.40	252.00	642.76
		Valid N	6	5	11
	Amaranth	Mean	213.30	32.40	183.15
		Valid N	5	1	6
	Nightshade	Mean	318.66	106.20	224.23

Channel			Survey		
			Baseline	Impact	Total
		Valid N	5	4	9
	Spider plant	Mean	376.35	167.40	324.11
		Valid N	6	2	8
	Cowpea	Mean	446.25	93.60	194.36
		Valid N	2	5	7
Arumeru farmers to Arusha markets	Total TAV	Mean	809.93	1662.58	1042.47
		Valid N	16	6	22
	Amaranth	Mean	456.73	810.90	592.95
		Valid N	8	5	13
	Nightshade	Mean	673.49	828.75	725.25
		Valid N	12	6	18
	Spider plant	Mean	.	.	.
		Valid N	0	0	0
	Cowpea	Mean	186.48	464.25	325.37
		Valid N	2	2	4
	Sweetpotato leaves	Mean	170.03	20.00	145.03
		Valid N	5	1	6

Table 21. Main trader categories and sub-categories in the TAV market chain

Trader Type	Role	Characteristics	Location of Operation
1. Producer/Farmer-retailer	Growing TAV at the farm level and retailing	Sometime farmers double as producers as well as traders and hence they could be selling at farm gate to brokers or directly to traders	Farms in Kiambu, Busia, Kabondo and Arumeru
2. Brokers/rural assembler	Collect TAV from farm gate and assemble them at a collection center by the road side	Majority (brokers) do not own the produce at any time since they take TAV on credit and pay farmers after getting paid by onwards traders	Between farms and roadside/ collection centers in Arumeru and sell to traders in Arusha.
3. Wholesalers	Buy and sell TAV to traders who resell	This group buy from either farmers, brokers or other wholesalers	Move from one market to another or one district to another
I. Wholesaler 1/ transporters	Traders who buy from farm gate or collection centers (through brokers) and transport in bulk to major towns	Sometimes the group could also be referred to as transporters. Traders in this group buy TAV directly from farmers or from collection centers and go to sell them in markets in the same district or in distant market in other districts.	From Kiambu, Kisumu and Kirinyaga to Nairobi (Gikomba), From Teso to Busia and From Asembo to Arusha
II. Wholesaler 2:-trade between markets	Wholesalers who buy TAV in bulk from one major market to other markets in the same district	This group buy TAV in bulk from one major market and go to sell in other markets in the same district	Rachuonyo (from Kodada to Sondu), Arumeru (from Seliani, Tengeru, Ngaramtoni to Arusha) and Arusha (from Sombetini, Magereza to Arusha)
III. Wholesalers 3: –trade from the farmer to markets	Buy from the farmer in bulk and sells to markets in the same district.	This group buys TAV at the farm gate in bulk and takes them to major markets in the same district.	Nairobi, Kiambu, Busia, Arumeru, and Arusha.
4. Retailer	Traders who buy TAV in bulk and sell to final consumers	Their volumes of sale greatly vary depending on the distances travelled, market and district of operation	Will be found in all markets selling TAV in all districts
I. Retailers 1- trade within district	Retailers who buy from farmers/ through brokers and sell to consumers in the same district.	From farmers/ brokers to consumers in the same district	Within Kiambu, Rachuonyo, Kisumu, Nakuru and Arusha
II. Retailers 2- trade between districts	Retailers who buy from farmers/collection center and sell to consumers in another district.	From farmers/brokers to consumers in another district	From Kiambu or Kakamega to Nairobi (Zimmerman, Aga khan walk, Kangemi and Githurai)
III. Retailers 3- trade within district	Retailers who buy from a major market and sell to consumers in another market in same district	From wholesalers in a major market to consumers in another market in the same district	Nairobi (Gikomba to Wakulima, Korogocho, etc), Kiambu, Busia, Nakuru and Arusha
IV. Retailers 4- trade within markets	Retailers who buy and sell TAV to consumers in the same market	From wholesalers to consumers in the same market	Nairobi (Gikomba, Githurai), Rachuonyo (Oyugis, Sondu).

Trader Type	Role	Characteristics	Location of Operation
V. Retailers 5- trade between districts	Retailers who buy and sell TAV from different markets in different districts.	From one district to another district	Kirinyaga to Nairobi (Korogocho).
5. Super markets/Groceries	Buy TAV from traders within the same district or from different districts	Normally get supplies of TAV from contracted farmers or traders. Constitute the main part of formal market channel	Nairobi, Nakuru and Kisumu.

Annex E

Consumption of Sweetpotato and Traditional African Vegetables in Kenya and Tanzania: Consumer Impact Assessment

Elaborated by
Wachira Kaguongo

June 2010

Traditional FOODS
For wealth & health

Contents

Introduction

The Traditional Foods (TF) project aimed at increasing productivity, utilization, and marketing of traditional African vegetables (TAV) and sweetpotato (SP), especially orange-fleshed sweetpotato (OFSP). The purpose of the project was to streamline efficiency of traditional African vegetables and sweetpotato value chains and improve health, nutrition, and income in Kenya and Tanzania. The project interventions included increasing consumer awareness of the nutritional benefits of consuming sweetpotato and TAV, thereby strengthening market access for producers. This objective was to be achieved through raising demand for both sweetpotato and TAV, leading to increased sales and income of farmers. It was envisaged that increasing purchase and consumption of nutritious sweetpotato and TAV would result in improving the health of both producers and consumers and their families.

This report examines changes in consumption and knowledge of consumers between the baseline and impact surveys. The baseline survey was conducted in April-May 2008, while the impact survey was conducted in December 2009. The baseline survey collected information on sweetpotato and TAV purchasing and consumption behavior and the nutrition knowledge of non-producing consumers in targeted markets. The impact survey aimed at examining changes in these aspects after project interventions. The report is presented into two major parts: TAV and OFSP.

Sampling and data collection

A total of 326 consumers, 214 from Kenya and 112 from Tanzania, were randomly selected from Nairobi, Kiambu, Busia, Kisumu, and Rachuonyo districts in Kenya and Arusha district in Tanzania. These locations are known to sell sweetpotato and TAV from intervention areas. In Kenya, consumers were grouped into two categories, those in urban areas, which included Nairobi, Kiambu, and Kisumu, and those in the rural districts of Rachuonyo and Busia. In Tanzania, consumers were interviewed in Arusha areas and included those visiting urban and peri-urban markets (Table 1).

Table 1. Sample details

	Regional Categories			
Survey	**Kenya Urban**	**Kenya Rural**	**Tanzania**	**Total**
Baseline	156	73	90	319
Impact	130	84	112	326
Total	286	157	202	645

Consumers characteristics

Consumers were classified into three wealth categories based on their annual monthly income. The categories were (1) the poor category with income of less than USD[1] $270 per month; (2) the middle category with income of USD $270–$1,330 per month, and (3) the better-off category with income of more than USD $1,330 per month.

Gender of respondents

There were more women than men in both baseline (84.3%) and impact (82.8%) surveys, and there was no significant difference in the gender of respondents between the two surveys (Table 2). Gender distribution among the sampled consumers indicated that fewer men (less than 25%) went to market to purchase TAVS and sweetpotato. Women composed the highest proportion of respondents (over 70%) in all regions (Table 2).

Table 2. Gender distribution in regions

	Baseline				Impact				Total		
Gender	Kenya Urban	Kenya Rural	Tanzania	Total	Kenya Urban	Kenya Rural	Tanzania	Total	Kenya Urban	Kenya Rural	Tanzania
	%	%	%	%	%	%	%	%	%	%	%
Male	12.2	15.1	22.2	15.7	25.4	7.1	15.3	17.2	18.2	10.8	18.4
Female	87.8	84.9	77.8	84.3	74.6	92.9	84.7	82.8	81.8	89.2	81.6
Total	156	73	90	319	130	84	111	325	286	157	201

Age of respondents

The ages of both respondent and household head in the impact survey were significantly lower compared to those in baseline survey (Table 3).

Education

There were no significant differences in education categories of the respondents in the baseline and impact surveys. Less than 6.0% of the respondent in both surveys had no formal education. The majority of respondents had primary and elementary education for the baseline (41.8%) and impact (48.5%) surveys, while about one-third of the respondents for both surveys had secondary education (Table 3). Only 16.5% of respondents in the baseline survey and 11.3% of respondents in the adoption survey had attended college or university.

[1] One United States dollar (USD) = 75 Kenya shillings (KSh).

Table 3. Characteristics of households surveyed in Kenya and Tanzania

Attributes	Baseline	Impact	Total
Who is the respondent of the household	*%*	*%*	*%*
Household head	32.7	31.3	32.0
Wife	63.1	63.8	63.5
Husband	10.7	9.2	10.0
Others (Single, maid, etc.)	9.8	11.7	10.7
Education of respondent			
Years of formal education	4.7	5.2	5.0
Primary and elementary education	41.8	48.5	45.2
Secondary education	37.0	35.0	36.0
College and university	16.5	35.0	36
Income category			
Poor (KSh 0-20,000 or Tz 0-400,000 per month)	76.6	68.4	72.3
Medium (KSh 21,000-100,000 or Tz 401,000-2,000,000)	18.8	29.1	24.2
Well-off (greater than KSh 100,100 or Tz 2,001,000)	4.6	2.5	3.5
Other household details	*mean*	*mean*	*mean*
Age of respondent	35.92	33.63	34.76*
Age of household head	39.05	36.08	37.58*
Total number of people in household*	5.24	4.59	4.91
Number of children ages 2–5 years in the household*	.73	1.23	.99
Number of children age less than 2 years in the household	.26	.27	.27
Sample size	**303**	**326**	**629**

*Indicates significance at 0.05 level.

Income and household size

In terms of income category, the majority of respondents interviewed during the baseline and adoption surveys were in the poor category (≥68%). However, more respondents in the adoption survey were grouped as medium and well-off (31.6%) than in the baseline survey (23.4%). As the same markets were targeted for the two surveys and only consumers visiting TAV and sweetpotato traders were interviewed, the increased number of medium and well-off might mean that there may have been some changes in perception of the target crops as poor man's food.

For household size, the baseline consumers had a higher average number of people living constantly in the house but a lower number of children 2–5 years of age (Table 3). Impact households were larger than baseline households, but they had fewer children 2–5 years of age.

Consumption of any vegetable

Examination of consumption habits of consumers at the beginning and end of the project showed that there were no major differences in consumption frequency of any type of vegetable (exotic or TAV) . The proportion consuming any vegetable regularly (almost daily or every other day) remained at about 81% between the baseline and impact surveys. However, a higher proportion of consumers in the impact survey (57.4%) consumed vegetables about every other day, whereas during the baseline survey, 50.8% consumed vegetables every day. This change in frequency of consumption may be attributed to low availability of vegetables due to a prolonged drought

period before the surveys (Table 4). This finding, therefore, necessitates continuation of awareness campaigns about the need for daily consumption of TAVs.

Table 4. Frequency of any vegetable consumption last season (June-September)

	Baseline	Impact	Total
Frequency	**%**	**%**	**%**
Never	0.3	0.3	0.3
A few times per month (<1 per week)	1.6	2.1	1.9
About once per week	7.2	6.7	7
About every other day (2–4 times per week)*	40.1	57.4	48.8
About every day (5–7 times per week)*	50.8	33.4	42
Sample size	319	324	645

*Indicates significance at 0.05 level.

Consumption of TAV

There were clear changes in consumption of all types of TAVs, and the proportion of consumers consuming any of the five TAVs (amaranth, nightshade, spider plant, cowpea, and sweetpotato leaves) increased between the baseline and adoption surveys. The fact that the proportion consuming TAVs increased while the proportion eating any vegetable (exotic and TAV) remained the same would mean that this increase was caused either by a shift or diversification among those who were already consuming vegetables.

Looking at individual TAV, an increased proportion (from 86.5% to 90.8%) consumed amaranth at least once a month (Table 5). Consumers eating amaranth regularly (every other day to daily) increased from 57.3% to 61.0%.

There was also a significant increase (from 85.9% to 95.7%) in those who consumed nightshade at least once in a month. Similarly, there was significant increase in the proportion of consumers eating nightshade regularly (from 57.4% to 73.7%). The proportion who consumed spider plant at least once a month also increased (from 55.8% to 66.3%), and those who consumed it regularly increased (from 28.5% to 37.1%).

With regard to cowpea leaves, the proportion who consumed it increased significantly (from 68.0% to 81.3%). However, there was a slight decrease in those who consumed cowpea leaves regularly (from 39.8% to 32.9%). There was a significant increase in consumers who ate sweetpotato leaves at least once a month (from 10.9% to 31.9%), and the proportion who ate it regularly increased (from 1.8% to 22.7%).

Table 5. Frequency of TAV consumption in the past six months

	Baseline	Impact	All
Frequency	**%**	**%**	**%**
Amaranth			
Never	13.5	9.2	11.3
Monthly (<1 per week)	13.2	9.5	11.3
About once per week	16	20.2	18.1
About every other day (2–4 times per week)*	38.2	50.9	44.7
About every day (5–7 times per week)*	19.1	10.1	14.6
Nightshade			
Never*	14.1	4.3	9.1
Monthly (<1 per week)*	10.3	5.8	8.1
About once per week	18.2	16.3	17.2
About every other day (2–4 times per week)*	39.5	62	50.9
About every day (5–7 times per week)*	17.9	11.7	14.7
Spider plant			
Never*	44.2	33.7	38.9
Monthly (< 1 per week)	10.3	12.3	11.3
About once per week	16.9	16.9	16.9
About every other day (2–4 times per week)*	19.7	30.7	25.3
About every day (5–7 times per week)	8.8	6.4	7.6
Cowpea leaf			
Never*	32	18.7	25.3
Monthly (< 1 per week)	14.1	13.8	14
About once per week*	14.1	24.5	19.4
About every other day (2–4 times per week)*	26.6	36.8	31.8
About every day (5–7 times per week)*	13.2	6.1	9.6
Sweetpotato leaf			
Never*	89.1	68.1	77.9
Monthly (< 1 per week)	4.9	3.1	3.9
About once per week	4.2	6.1	5.2
About every other day (2–4 times per week)*	1.4	17.8	10.2
About every day (5–7 times per week)*	0.4	4.9	2.8
Sample size	319	326	610

*Indicates significance at 0.05 level.

TAV consumption by gender

There were several changes in consumption of TAVs by gender. Among men there were changes in frequency of consumption for all TAVs, and the proportion of men consuming TAVs at least once in a month increased between the baseline and impact surveys. The proportion of men consuming TAV at least once a month between baseline and impact surveys changed from 76.0% to 85.7% for amaranth, 80.0% to 89.3% for nightshade, 50.0% to 53.6% for spider plant, 60.0% to 69.6% for cowpea, and 8.9% to 25% for sweetpotato leaves (Table 6). The proportion of men consuming amaranth regularly decreased slightly from 56.0% to 51.8%. However, there were increases in regular consumption of other TAVs, with nightshade consumption increasing from 44.0% to 64.3%, spider plant from 24.0% to 28.6%, cowpea leaves from 32.0% to 35.7%, and sweetpotato leaves from 2.2% 12.5%.

The proportion of women consuming TAV also increased over the period. The proportion of women consuming TAVs at least once a month changed from 88.5% to 91.8% for amaranth, 87.0% to 97.0% for nightshade, 56.9% to 68.8% for spider plant, 60.5% to 84.6% for cowpea leaves, and 11.3% to 33.1% for sweetpotato leaves. The proportion of women consuming TAV regularly increased from 57.6% to 62.8% for amaranth, 59.9% to 75.5% for nightshade, 29.4% to 38.7% for spider plant, 42.3% to 44.2% for cowpea, and 1.7% to 24.5% for sweetpotato leaves.

Table 6. Frequency of TAV consumption by gender in the past six months

		Baseline	Impact	Total
Gender	**Frequency**	**%**	**%**	**%**
Males				
Amaranth	Never	24	14.3	18.9
	Monthly (<1 time per week)	4	12.5	8.5
	About once per week	16	21.4	18.9
	About every other day (2–4 times per week)	38	41.1	39.6
	About every day (5–7 times per week)	18	10.7	14.2
Nightshade	Never	20	10.7	15.1
	Monthly (<1 time per week)	10	7.1	8.5
	About once per week	26	17.9	21.7
	About every other day (2–4 times per week)*	30	53.6	42.5
	About every day (5–7 times per week)	14	10.7	12.3
Spider plant	Never	50	46.4	48.1
	Monthly (<1 time per week)	4	12.5	8.5
	About once per week	22	12.5	17
	About every other day (2–4 times per week)	18	25	21.7
	About every day (5–7 times per week)	6	3.6	4.7
Cowpea leaf	Never	40	30.4	34.9
	Monthly (<1 time per week)	14	12.5	13.2
	About once per week	14	21.4	17.9
	About every other day (2–4 times per week)	26	28.6	27.4
	About every day (5–7 times per week)	6	7.1	6.6
Sweetpotato leaf	Never*	91.1	75	82.2
	Monthly (<1 time per week)	2.2	1.8	2
	About once per week	4.4	10.7	7.9
	About every other day (2–4 times per week)	2.2	7.1	5
	About every day (5–7 times per week)	0	5.4	3
Total		50	56	106
Females				
Amaranth	Never	11.5	8.2	9.9
	Monthly (<1 time per week)*	14.9	8.9	11.9
	About once per week	16	20.1	18
	About every other day (2–4 times per week)*	38.3	52.8	45.5
	About every day (5–7 times per week)*	19.3	10	14.7
Nightshade	Never*	13	3	8
	Monthly (<1 time per week)*	10.4	5.6	8
	About once per week	16.7	16	16.4
	About every other day (2–4 times per week)*	41.3	63.6	52.4
	About every day (5–7 times per week)*	18.6	11.9	15.2
Spider plant	Never*	43.1	31.2	37.2

Gender	Frequency	Baseline %	Impact %	Total %
	Monthly (<1 time per week)	11.5	12.3	11.9
	About once per week	16	17.8	16.9
	About every other day (2–4 times per week)*	20.1	31.6	25.8
	About every day (5–7 times per week)	9.3	7.1	8.2
Cowpea leaf	Never*	30.5	16.4	23.4
	Monthly (<1 time per week)	14.1	14.1	14.1
	About once per week*	14.1	25.3	19.7
	About every other day (2–4 times per week)*	26.8	38.3	32.5
	About every day (5–7 times per week)*	14.5	5.9	10.2
Sweetpotato leaf	Never*	88.7	66.9	77.2
	Monthly (<1 time per week)	5.4	3.3	4.3
	About once per week	4.2	5.2	4.7
	About every other day (2–4 times per week)*	1.3	19.7	11
	About every day (5–7 times per week)*	0.4	4.8	2.8
Total		269	269	538

*Indicates significance at 0.05 level.

TAV consumption by region

In urban areas of Kenya, consumption changes in amaranth, nightshade, spider plant, and cowpea leaf were observed, and amaranth consumption increased to every other day (Table 7). Those who consumed nightshade increased from 88.5% to 95.4%. In addition, nightshade consumption increased for consumers who ate it every other day but decreased for those who ate it every day. Consumers who ate spider plant and cowpea every other day increased, but those who ate them every day decrease slightly. This decrease in the proportion of consumers who ate them daily might be due to more types of TAVs eaten, reducing the number of each type eaten per week. There was no significant change in sweetpotato leaf consumption. The proportion of those who consumed TAVs every other day increased, while proportion of those who consumed it daily decreased. A decrease in those consuming it daily might be a result of the survey capturing more new consumers who had started eating TAV as well as the fact that availability of TAV might have affected the rate of consumption.

In rural areas of Kenya, there were minor changes in consumption of TAV over the period. Although the proportion of consumers eating other TAVs (except amaranth and sweetpotato leaves) increased, there was a general decline in those who consumed TAV regularly. Only the regular consumption of cowpea leaves increased. The decline in regular consumption of TAVs might have been occasioned by the availability of drought-prone TAV in the rural areas visited.

In Tanzania, consumption frequencies increased for all TAVs. Consumption of amaranth increased from 81.1% to 95.5%, nightshade from 76.6% to 96.4%, spider plant from 13.3% to 54.5%, cowpea leaf from 42.2% to 75.9%, and sweetpotato leaf from 23.3% to 85.7%. Additionally the frequency of amaranth consumption increased for those eating it every other day, although it decreased for those consuming it every day. Nightshade consumption increased for those eating it every other day. Spider plant consumption increased for those eating it monthly as well as every other day. Cowpea leaf consumption increased for those eating it

monthly and once a week, but it decreased for those consuming it every day. Similarly, sweetpotato leaf consumption increased for those eating it every other day as well as every day (Table 7).

Consumption of TAVs in urban Kenya and Arusha increased, whereas there was decrease in rural areas. The decrease in rural areas might be due to the drought reducing availability of TAVs. Also promotion messages may have been more effective in urban areas than rural areas.

Table 7. Frequency of TAV consumption by region in the past six months

		Baseline	Impact	Total
Region / TAV	**Frequency**	%	%	%
Kenya urban				
Amaranth	Never	12.2	12.3	12.2
	Monthly (<1 time per week)	21.8	13.1	17.8
	About once per week	16	14.6	15.4
	About every other day (2–4 times per week)*	32.7	50	40.6
	About every day (5–7 times per week)	17.3	10	14
Nightshade	Never*	11.5	4.6	8.4
	Monthly (<1 time per week)	16	9.2	12.9
	About once per week	19.9	16.2	18.2
	About every other day (2–4 times per week)*	33.3	62.3	46.5
	About every day (5–7 times per week)*	19.2	7.7	14
Spider plant	Never	36.5	40.8	38.5
	Monthly (<1 time per week)*	12.8	5.4	9.4
	About once per week	20.5	13.8	17.5
	About every other day (2–4 times per week)*	15.4	33.8	23.8
	About every day (5–7 times per week)*	14.7	6.2	10.8
Cowpea leaf	Never	28.2	23.1	25.9
	Monthly (<1 time per week)*	18.6	8.5	14
	About once per week	14.1	22.3	17.8
	About every other day (2–4 times per week)*	23.1	40	30.8
	About every day (5–7 times per week)*	16	6.2	11.5
Sweetpotato leaf	Never	95	95.4	95.2
	Monthly (<1 time per week)	2.1	0.8	1.5
	About once per week	2.1	1.5	1.8
	About every other day (2–4 times per week)	0.7	2.3	1.5
	About every day (5–7 times per week)	0	0	0
Total		156	130	286
Kenya rural				
Amaranth	Never	9.6	10.7	10.2
	Monthly (<1 time per week)	6.8	7.1	7
	About once per week	19.2	31	25.5
	About every other day (2–4 times per week)	53.4	39.3	45.9
	About every day (5–7 times per week)	11	11.9	11.5
Nightshade	Never	8.2	4.8	6.4
	Monthly (<1 time per week)	5.5	7.1	6.4
	About once per week	23.3	23.8	23.6
	About every other day (2–4 times per week)	56.2	52.4	54.1

Region / TAV	Frequency	Baseline %	Impact %	Total %
	About every day (5–7 times per week)	6.8	11.9	9.6
Spider plant	Never	8.2	7.1	7.6
	Monthly (<1 time per week)	11	9.5	10.2
	About once per week	23.3	31	27.4
	About every other day (2–4 times per week)	50.7	41.7	45.9
	About every day (5–7 times per week)	6.8	10.7	8.9
Cowpea leaf	Never	8.2	4.8	6.4
	Monthly (<1 time per week)	6.8	7.1	7
	About once per week	23.3	19	21
	About every other day (2–4 times per week)	46.6	56	51.6
	About every day (5–7 times per week)	15.1	13.1	14
Sweetpotato leaf	Never	94.3	97.6	96.4
	Monthly (<1 time per week)	3.8	2.4	2.9
	About once per week	1.9	0	0.7
	About every other day (2–4 times per week)	0	0	0
	About every day (5–7 times per week)	0	0	0
Total		73	84	157
Tanzania				
Amaranth	Never*	18.9	4.5	10.9
	Monthly (<1 time per week)	3.3	7.1	5.4
	About once per week	13.3	18.8	16.3
	About every other day (2–4 times per week)*	35.6	60.7	49.5
	About every day (5–7 times per week)*	28.9	8.9	17.8
Nightshade	Never*	23.3	3.6	12.4
	Monthly (<1 time per week)	4.4	0.9	2.5
	About once per week	11.1	10.7	10.9
	About every other day (2–4 times per week)*	36.7	68.8	54.5
	About every day (5–7 times per week)	24.4	16.1	19.8
Spider plant	Never*	86.7	45.5	63.9
	Monthly (<1 time per week)*	5.6	22.3	14.9
	About once per week	5.6	9.8	7.9
	About every other day (2–4 times per week)*	2.2	18.8	11.4
	About every day (5–7 times per week)	0	3.6	2
Cowpea leaf	Never*	57.8	24.1	39.1
	Monthly (<1 time per week)*	12.2	25	19.3
	About once per week*	6.7	31.2	20.3
	About every other day (2–4 times per week)	16.7	18.8	17.8
	About every day (5–7 times per week)*	6.7	0.9	3.5
Sweetpotato leaf	Never*	76.7	14.3	42.1
	Monthly (<1 time per week)	10	6.2	7.9
	About once per week	8.9	16.1	12.9
	About every other day (2–4 times per week)*	3.3	49.1	28.7
	About every day (5–7 times per week)*	1.1	14.3	8.4
Total		90	112	202

*Indicates significance at 0.05 level.

TAV consumption by income category

In analyzing TAV consumption by income, there were changes in all categories (poor, medium, and better-off). Of those who consumed TAVs at least once a month, there were increases in all income categories for all TAVs, except amaranth, which had a small decrease for the medium income category. Of the poor consumers, those who ate amaranth increased from 84.9% to 91%; nightshade, from 87.1% to 96.4%; cowpea leaf, from 70.7% to 82.5%; and sweetpotato leaf from 10.4% to 30.5%. Amaranth consumption increased for who consumed TAVs every other day but decreased for those who ate TAVs every day (Table 8). Similarly, medium and better-off consumers who ate TAVs regularly increased, except for a slight decline in those who ate amaranth. These findings mean that income category did not play a major role in influencing consumption of TAV.

Table 8. TAV consumption by income category in the past six months

		Baseline	Impact	Total
Income / TAV	**Frequency**	**%**	**%**	**%**
Poor				
Amaranth	Never*	15.1	9	12.1
	Monthly (<1 time per week)	10.8	9	9.9
	About once per week	15.5	17.5	16.5
	About every other day (2–4 times per week)*	40.1	53.8	46.8
	About every day (5–7 times per week)*	18.5	10.8	14.7
Nightshade	Never*	12.9	3.6	8.4
	Monthly (<1 time per week)	8.2	5.8	7
	About once per week	19	14.8	16.9
	About every other day (2–4 times per week)*	41.4	62.8	51.9
	About every day (5–7 times per week)	18.5	13	15.8
Spider plant	Never*	39.7	31.4	35.6
	Monthly (<1 time per week)	11.2	12.6	11.9
	About once per week	17.2	16.6	16.9
	About every other day (2–4 times per week)*	23.3	33.2	28.1
	About every day (5–7 times per week)*	8.6	6.3	7.5
Cowpea leaf	Never	29.3	17.5	23.5
	Monthly (<1 time per week)	12.9	13.9	13.4
	About once per week	14.7	21.1	17.8
	About every other day (2–4 times per week)	28	42.2	34.9
	About every day (5–7 times per week)	15.1	5.4	10.3
Sweetpotato leaf	Never*	89.6	69.5	79.1
	Monthly (<1 time per week)	4.5	2.7	3.5
	About once per week	4.5	3.6	4
	About every other day (2–4 times per week)*	1.5	18.8	10.6
	About every day (5–7 times per week)	0	5.4	2.8
Total		232	223	455
Medium				
Amaranth	Never	7	10.5	9.2
	Monthly (<1 time per week)	14	9.5	11.2
	About once per week	19.3	27.4	24.3
	About every other day (2–4 times per week)	36.8	44.2	41.4

Income / TAV	Frequency	Baseline %	Impact %	Total %
	About every day (5–7 times per week)*	22.8	8.4	13.8
Nightshade	Never	12.3	5.3	7.9
	Monthly (<1 time per week)*	15.8	5.3	9.2
	About once per week	21.1	20	20.4
	About every other day (2–4 times per week)*	33.3	60	50
	About every day (5–7 times per week)	17.5	9.5	12.5
Spider plant	Never	49.1	36.8	41.4
	Monthly (<1 time per week)	10.5	10.5	10.5
	About once per week	19.3	17.9	18.4
	About every other day (2–4 times per week)*	10.5	27.4	21.1
	About every day (5–7 times per week)	10.5	7.4	8.6
Cowpea leaf	Never	31.6	23.2	26.3
	Monthly (<1 time per week)	21.1	12.6	15.8
	About once per week	15.8	31.6	25.7
	About every other day (2–4 times per week)	24.6	24.2	24.3
	About every day (5–7 times per week)	7	8.4	7.9
Sweetpotato leaf	Never*	86.5	65.3	72.8
	Monthly (<1 time per week)	5.8	4.2	4.8
	About once per week*	5.8	10.5	8.8
	About every other day (2–4 times per week)*	1.9	16.8	11.6
	About every day (5–7 times per week)	0	3.2	2
Total		57	95	152
Well-off				
Amaranth	Never	14.3	0	9.1
	Monthly (<1 time per week)	42.9	25	36.4
	About once per week	14.3	12.5	13.6
	About every other day (2–4 times per week)	21.4	50	31.8
	About every day (5–7 times per week)	7.1	12.5	9.1
Nightshade	Never	28.6	12.5	22.7
	Monthly (<1 time per week)	21.4	12.5	18.2
	About once per week	14.3	12.5	13.6
	About every other day (2–4 times per week)	28.6	62.5	40.9
	About every day (5–7 times per week)	7.1	0	4.5
Spider plant	Never	78.6	62.5	72.7
	Monthly (<1 time per week)	0	25	9.1
	About once per week	21.4	12.5	18.2
	About every other day (2–4 times per week)	0	0	0
	About every day (5–7 times per week)	0	0	0
Cowpea leaf	Never	50	0	31.8
	Monthly (<1 time per week)	14.3	25	18.2
	About once per week	14.3	37.5	22.7
	About every other day (2–4 times per week)	14.3	37.5	22.7
	About every day (5–7 times per week)	7.1	0	4.5
Sweetpotato leaf	Never	85.7	62.5	77.3
	Monthly (<1 time per week)	14.3	0	9.1
	About once per week	0	25	9.1
	About every other day (2–4 times per week)	0	0	0

Income / TAV	Frequency	Baseline %	Impact %	Total %
	About every day (5–7 times per week)	0	12.5	4.5
Total		14	8	22

*Indicates significance at 0.05 level.

TAV consumption by meal and by children 2–5 years of age

There were changes in when TAVs was consumed: more consumers ate TAV for dinner. There was a decline among those who consumed TAVs as snacks (Table 9).

The majority of consumers fed less TAVs to children aged 2–5 years than to other household members; this proportion increased significantly between the baseline and adoption surveys (Table 9).

Table 9. TAV meals and consumption by children 2–5 years of age

	Baseline %	Impact %	Total %
Meal where TAV was consumed			
Breakfast	8.8	13.2	11
Lunch	90	92.6	91.3
Dinner*	93.4	98.5	96
Snacks*	12.9	7.1	10
Special occasions	38.4	36.9	37.6
Sample size	318	325	643
TAV consumption by children aged 2–5 years			
Less than rest of household*	50	64.2	57.4
More than rest of household	20	15.9	17.9
Same as rest of household*	30	19.9	24.7
Total	160	176	336

*Indicates significance at 0.05 level.

Production and purchasing of TAVs

Examination of sources of TAVs for consumers showed that there were no major changes between the baseline and impact surveys for most TAVs. However, there were significant changes in the proportion of consumers purchasing spider plant and sweetpotato leaves (Table 10). The proportion producing each type of TAV did not change significantly over the period.

Table 10. Sources of consumed TAV

	Baseline	Impact	Total
Buying			
Amaranth	77.3	73.8	75.5
Night shade	79.7	84.2	82.1
Spider plant*	66.3	54.5	59.9
Cowpea leaf	68.1	61.5	64.4
Sweetpotato leaf*	9.8	28.2	20.8
Producing			
Amaranth	26	26.7	26.3
Nights shade	23.3	18.6	20.9
Spider plant	20.9	15.1	17.8
Cowpea leaf	24.5	23.3	23.8
Sweetpotato leaf	4.7	4.7	4.7
Sample size	215	323	538

*Indicates significance at 0.05 level.

Knowledge about TAV

When consumers were asked whether they knew of health or nutritional benefits of eating TAVs, it appeared there was no major change in consumer awareness. Probing further into the accuracy of consumer knowledge, it emerged that there was a significant increase in consumer knowledge that TAVs contained iron and contributed to a balanced diet by having many vitamins and minerals (Table 11). Although consumer awareness of general nutritional benefits of TAVs might not have changed much, there was increased knowledge about details (e.g., that TAVs contribute to a balanced diet because it contains many vitamins and minerals).

The increase in knowledge about nutritional details might have been caused by the increase in proportion of consumers (39.5% to 46.6%) who had watched or heard TAV advertisements (Table 11).

However, there was slight increase in consumers who were aware of taboos that stopped them from eating TAVs (Table 11). This finding might mean that the project raised awareness of existing taboos, and future intervention might have to address these taboos.

Table 11. Consumer knowledge about TAV

	Baseline	Impact	Total
	%	%	%
Health and nutritional benefits			
Aware of health or nutritional benefits of TAV	91.8	90.4	91.1
Sample size	319	324	643
Protect the body or strengthen immunity	**38.9**	**36.7**	**37.8**
Contained vitamin A	23.9	18.0	20.9
Contained iron*	15.0	33.9	24.5
Contributed to balanced diet/has many vitamins and minerals*	35.8	46.8	41.3
Had medicinal properties	26.6	26.4	26.5
Had few pesticide residues	1.0	2.4	1.7
Sample size	293	295	588
Leafy vegetable advertisements in the past year			
Heard or seen advertisements for TAV in the past year	39.5	46.6	43.1
Sample size	319	326	645
Types of advertisement			
Radio	68.0	75.8	72.3
Pamphlets/flyers at markets*	13.4	7.0	9.9
Posters at markets	10.2	3.2	6.3
Food packaging	11.0	17.2	14.4
Saw or heard the advertisement on other	36.2	33.8	34.9
Sample size	127	157	284
Taboos for not eating TAV			
Is aware of any taboos/cultural reasons for not eating TAV*	7.9	13.0	10.5
Sample size	318	322	640

*Indicates significance at 0.05 level.

Consumption of sweetpotato

There was a significant increase in the proportion of consumers eating sweetpotato (from 78.4% to 88.3%) after project interventions (Table 12). Eating all types of sweetpotato regularly increased from 24.7% to 31.1%. However, there was high increase in consumption of WFSP compared to other types.

Table 12. Consumption of sweetpotato by frequency and type

	Baseline	Impact	Total
	%	%	%
Frequency of sweetpotato consumption			
Never*	21.6	11.7	16.6
A few times per month (<1 per week)	30.1	28.7	29.4
About once per week	23.5	28.4	26.0
About every other day (2–4 times per week)	21.6	26.2	24.0
About every day (5–7 times per week)	3.1	4.9	4.0
Sample size	319	324	643
Types of sweetpotato consumed last season			
Orange-fleshed sweetpotato	15.4	17.5	16.5
Yellow-fleshed sweetpotato	62.6	66.3	64.4
White-fleshed sweetpotato*	57.5	73.5	65.3
All types	3.1	0.8	2.2
Sample Size	318	302	620

*Indicates significance at 0.05 level.

Consumption frequency of varieties of sweetpotato

Consumption frequencies of the three types of sweetpotato had increased. Consumption of OFSP increased from 17.0% to 18.4%, YFSP consumption increased from 50.2% to 62.4%, and WFSP consumption increased from 43.3% to 69.0%. The proportion of consumers who regularly ate each type of sweetpotato increased marginally, with OFSP consumers increasing from 3.8% to 4.6%; YFSP, from 15.3% to 24.6%; and WFSP, from 10.4% to 22.4% (Table 13).

Table 13. Number of times per week types of sweetpotato was consumed

	Baseline	Impact	Total
	%	%	%
OFSP			
Never	83.0	81.6	82.3
Monthly (<1 time per week)	8.5	9.2	8.9
About once per week	4.7	4.6	4.7
About every other day (2–4 times per week)	3.8	3.4	3.6
About every day (5–7 times per week)	0.0	1.2	0.6
YFSP			
Never	40.8	37.4	39.1
Monthly (<1 time per week)	22.9	17.8	20.3
About once per week	21.0	20.2	20.6
About every other day (2–4 times per week)*	11.9	20.9	16.4
About every day (5–7 times per week)	3.4	3.7	3.6
WFSP			
Never*	56.7	31.0	43.7
Monthly (<1 time per week)	22.3	24.8	23.6
About once per week*	10.7	21.8	16.3
About every other day (2–4 times per week)*	8.5	19.3	14.0
About every day (5–7 times per week)	1.9	3.1	2.5
Sample size	319	326	645

*Indicates significance at 0.05 level.

Sweetpotato consumption by gender

Examination of sweetpotato consumption by gender showed there were no major changes in the proportion of men consuming OFSP but there were major increases in proportion of men consuming YFSP and WFSP. There were slight increases in the proportion of women consuming OFSP and YFSP and major increases in the proportion consuming WFSP (Table 14). There was an increase in regular consumption of YFSP (from 12.0% to 21.5%) and WFSP (from 8.0% to 14.3%) among male consumers, while among female consumers there was a slight increase in consumption of OFSP (from 3.7% to 4.8%) and higher increases in consumption of YFSP (from 16.0% to 25.2%) and WFSP (from 10.8% to 23.8%).

Table 14. Frequency and type of sweetpotato consumption by gender in the past six months

		Baseline	Impact	Total
Gender / Type	**Frequency**	**%**	**%**	**%**
Males				
OFSP	Never	82	82.1	82.1
	Monthly (<1 time per week)	6	8.9	7.5
	About once per week	8	5.4	6.6
	About every other day (2–4 times per week)	4	3.6	3.8
	About every day (5–7 times per week)	0	0	0
YFSP	Never	58	42.9	50
	Monthly (<1 time per week)	16	14.3	15.1
	About once per week	14	21.4	17.9
	About every other day (2–4 times per week)	6	16.1	11.3
	About every day (5–7 times per week)	6	5.4	5.7
WFSP	Never	60	48.2	53.8
	Monthly (<1 time per week)	22	17.9	19.8
	About once per week	10	19.6	15.1
	About every other day (2–4 times per week)	4	10.7	7.5
	About every day (5–7 times per week)	4	3.6	3.8
Females				
OFSP	Never	83.2	81.4	82.3
	Monthly (<1 time per week)	9	9.3	9.1
	About once per week	4.1	4.5	4.3
	About every other day (2–4 times per week)	3.7	3.3	3.5
	About every day (5–7 times per week)	0	1.5	0.7
YFSP	Never	37.5	36.4	37
	Monthly (<1 time per week)	24.2	18.6	21.4
	About once per week	22.3	19.7	21
	About every other day (2–4 times per week)*	13	21.9	17.5
	About every day (5–7 times per week)	3	3.3	3.2
WFSP	Never*	56.1	27.5	41.8
	Monthly (<1 time per week)	22.3	26.4	24.3
	About once per week*	10.8	22.3	16.5
	About every other day (2–4 times per week)*	9.3	20.8	15.1
	About every day (5–7 times per week)	1.5	3	2.2

*Indicates significance at 0.05 level.

Sweetpotato consumption by region

There were marginal increases in consumption of OFSP (from 10.9% to 16.9%) in urban areas of Kenya, although this was also observed with YFSP and WFSP (Table 15). Other increases were witnessed in the proportions of consumers who regularly ate OFSP (0.7% to 3.8%) and YFSP (11.9% to 31.5%), although there was a slight decrease in those who regularly ate WFSP (11.8% to 10.7%).

In rural areas of Kenya, there was a surprising decline in those who consumed OFSP (from 43.1% to 27.4%). Those who had consumed OFSP regularly also decreased (from 11.1% to 4.6%). For YFSP there was a decrease in those consuming monthly (i.e., less than once per week) but an increase in those consuming every other day. Those who consumed WFSP increased from 74% to 89.3%.

In Tanzania, the only change noticed in consumption of sweetpotato was in OFSP, where those who consumed it increased marginally from 10.0% to 13.4%.

The fact that there was increase in the proportion of consumers who ate OFSP in urban Kenya and Tanzania, while the proportion who consumed it regularly had declined might mean that more consumers had been made aware of OFSP, but possibly due to a high number of consumers who had started eating it, the proportion who ate it regularly declined.

Table 15. Sweetpotato consumption by region in the past six months

		Baseline	Impact	Total
Region / Type	**Frequency**	**%**	**%**	**%**
Kenya urban				
OFSP	Never	89.1	83.1	86.4
	Monthly (<1 time per week)	7.7	10	8.7
	About once per week	2.6	3.1	2.8
	About every other day (2–4 times per week)	0.6	3.8	2.1
	About every day (5–7 times per week)	0	0	0
YFSP	Never	12.8	13.1	12.9
	Monthly (<1 time per week)*	38.5	27.7	33.6
	About once per week	26.9	27.7	27.3
	About every other day (2–4 times per week)*	16	27.7	21.3
	About every day (5–7 times per week)	5.8	3.8	4.9
WFSP	Never	46.2	54.6	50
	Monthly (<1 time per week)*	32.7	20	26.9
	About once per week	9.6	14.6	11.9
	About every other day (2–4 times per week)	8.3	9.2	8.7
	About every day (5–7 times per week)	3.2	1.5	2.4
Kenya rural				
OFSP	Never*	61.1	72.6	67.3
	Monthly (<1 time per week)	16.7	8.3	12.2
	About once per week	11.1	9.5	10.3
	About every other day (2–4 times per week)	11.1	6	8.3
	About every day (5–7 times per week)	0	3.6	1.9

Region / Type	Frequency	Baseline %	Impact %	Total %
YFSP	Never	27.4	19	22.9
	Monthly (<1 time per week)*	17.8	7.1	12.1
	About once per week	34.2	29.8	31.8
	About every other day (2–4 times per week)*	17.8	35.7	27.4
	About every day (5–7 times per week)	2.7	8.3	5.7
WFSP	Never*	26	10.7	17.8
	Monthly (<1 time per week)*	27.4	9.5	17.8
	About once per week	26	34.5	30.6
	About every other day (2–4 times per week)*	19.2	36.9	28.7
	About every day (5–7 times per week)*	1.4	8.3	5.1
Total		73	84	157
Tanzania				
OFSP	Never	90	86.6	88.1
	Monthly (<1 time per week)	3.3	8.9	6.4
	About once per week	3.3	2.7	3
	About every other day (2–4 times per week)	3.3	0.9	2
	About every day (5–7 times per week)	0	0.9	0.5
YFSP	Never	100	79.5	88.6
	Monthly (<1 time per week)	0	14.3	7.9
	About once per week	0	4.5	2.5
	About every other day (2–4 times per week)	0	1.8	1
	About every day (5–7 times per week)	0	0	0
WFSP	Never	100	18.8	55
	Monthly (<1 time per week)	0	42	23.3
	About once per week	0	20.5	11.4
	About every other day (2–4 times per week)	0	17.9	9.9
	About every day (5–7 times per week)	0	0.9	0.5
Total		-	111	111

*Indicates significance at 0.05 level.

Sweetpotato consumption by income category

Examination of consumption patterns by wealth showed that there was a significant change in consumption frequency in the poor and well-off categories. There was an increase in the poor category of the proportion of consumers who ate all types of sweetpotato. In the same category, there were also increases in regular consumption of all types of sweetpotato. All income categories increased consumption of OFSP marginally (Table 16).

Table 16. Sweetpotato consumption by income category

		Baseline	Impact	Total
Income / Type	**Frequency**	**%**	**%**	**%**
Poor				
OFSP	Never	81	78.7	80.1
	Monthly (<1 time per week)	9.1	10	9.4
	About once per week	5.2	5.3	5.2
	About every other day (2–4 times per week)	4.8	4	4.5
	About every day (5–7 times per week)	0	2	0.8
YFSP	Never	41.8	15.3	31.4
	Monthly (<1 time per week)	21.1	16.7	19.4
	About once per week	22	27.3	24.1
	About every other day (2–4 times per week)*	12.1	34	20.7
	About every day (5–7 times per week)	3	6.7	4.5
WFSP	Never*	56.5	30.7	46.3
	Monthly (<1 time per week)	21.1	16	19.1
	About once per week*	11.6	23.3	16.2
	About every other day (2–4 times per week)*	9.1	24.7	15.2
	About every day (5–7 times per week)	1.7	5.3	3.1
Total		230	222	452
Medium				
OFSP	Never	87.7	84.1	85.2
	Monthly (<1 time per week)	7	9.1	8.5
	About once per week	5.3	4.5	4.8
	About every other day (2–4 times per week)	0	2.3	1.6
	About every day (5–7 times per week)	0	0	0
YFSP	Never	36.8	52.3	47.6
	Monthly (<1 time per week)	21.1	18.9	19.6
	About once per week	26.3	16.7	19.6
	About every other day (2–4 times per week)	10.5	10.6	10.6
	About every day (5–7 times per week)	5.3	1.5	2.6
WFSP	Never	54.4	32.6	39.2
	Monthly (<1 time per week)	26.3	26.5	26.5
	About once per week	10.5	23.5	19.6
	About every other day (2–4 times per week)	5.3	15.9	12.7
	About every day (5–7 times per week)	3.5	1.5	2.1
Total		–	95	151
Well-off				
OFSP	Never*	92.9	84.1	86.2
	Monthly (<1 time per week)	7.1	6.8	6.9
	About once per week	0	2.3	1.7
	About every other day (2–4 times per week)	0	4.5	3.4
	About every day (5–7 times per week)	0	2.3	1.7
YFSP	Never	28.6	68.2	58.6
	Monthly (<1 time per week)	50	18.2	25.9
	About once per week	7.1	6.8	6.9
	About every other day (2–4 times per week)	7.1	6.8	6.9

Income / Type	Frequency	Baseline %	Impact %	Total %
	About every day (5–7 times per week)	7.1	0	1.7
WFSP	Never	57.1	27.3	34.5
	Monthly (<1 time per week)	28.6	50	44.8
	About once per week	7.1	11.4	10.3
	About every other day (2–4 times per week)	7.1	11.4	10.3
	About every day (5–7 times per week)	0	0	0
Total		–	8	8

*Indicates significance at 0.05 level.

Sweetpotato consumption by meal and source

There was a significant increase in proportion of consumers eating sweetpotato for breakfast, but a significant reduction in those consuming sweetpotato during special occasions. Additionally there was a significant increase in consumers offering sweetpotato to visitors (Table 17), which meant more consumers had changed their attitude about sweetpotato. There was a notable change in the proportion of consumers purchasing OFSP, which increased significantly from 17.8% to 38.1%.

Table 17. Consumption of sweetpotato by meal and source

	Baseline %	Impact %	Total %
Meals in which sweetpotato is consumed			
Consumes sweetpotato during breakfast*	77.4	87.4	82.5
Consumes sweetpotato during lunch	46.4	43.6	45
Consumes sweetpotato during dinner	39.2	38.3	38.8
Do you consume sweetpotato as a snack	47.6	47.9	47.8
Do you consume sweetpotato during special occasions*	23.5	13.2	18.3
Do you consume sweetpotato in other meals	1.3	1	1.1
Offers sweetpotato to visitors	57.4	63.5	60.5
Sample size	319	326	645
Offers sweetpotato to visitors*	57.7	68.8	63.1
Buying			
Do you buy OFSP*	17.9	38.1	24.8
Do you buy YFSP	74.2	67.2	70.6
Do you buy WFSP	54.1	55.1	54.7
Sample size	218	305	523
Sample size		317	317
Producing			
Do you produce the OFSP	7.8	6.3	7.1
Do you produce the YFSP	20.3	21.2	20.8
Do you produce the WFSP	16.1	17.4	16.8
Sample size	217	226	443
Sample size	–	100	100

*Indicates significance at 0.05 level.

Knowledge about OFSP

The proportion of consumers who knew about OFSP increased significantly from 58.6% to 81.4% (Table 18). There was also a significant increase in consumers who were aware of the health and nutritional benefits of eating OFSP (from 18.2% to 42.2%). Although the proportion of consumers who knew nutrient content of OFSP did not increase, the results showed that more consumers had heard about OFSP varieties and its nutritional benefits.

Table 18. Consumer knowledge about OFSP

	Baseline	Impact	Total
	%	%	%
Health and nutritional benefits			
Is aware of any health or nutrition benefits of eating OFSP*	18.2	42.2	29.8
Does not know OFSP*	41.4	18.6	30.3
Sample	319	301	620
Benefits of eating OFSP mentioned by consumer			
Vitamins in general*	22	6.7	11.4
Contain vitamin A	13.6	14.9	14.5
Good for eyes	8.5	4.5	5.7
Strengthens immunity	8.5	2.3	4.2
Answer mentions any other correct fact	45.8	46.6	46.4
Sample	59	135	194
Advertisements and sources of information			
Heard or saw advertisement for sweetpotato in the past year	25.5	24.2	24.9
Radio	65.9	62.9	64.3
Pamphlets/flyers at markets	8.5	9.4	9
Posters at markets	11	4.7	7.7
Food packaging	11	12.9	12
Other	41.5	32.6	36.9
Sample	82	85	167
Aware of taboos/cultural reasons for not eating sweetpotato	**0.9**	**1**	**1**
Sample	316	302	618

*Indicates significance at 0.05 level.

Conclusion

Although the two-year project implementation was short for any audit to produce tangible evidence on project impact, the findings of this study showed positive outcomes that, if combined with other evidence, such as increased production of OFSP and TAVs and increased nutritional awareness from the producer and trader studies, it would be possible to attribute these outcomes to project interventions. Further econometric analysis may also help in strongly attributing resulting outcomes to project interventions.

Despite the fact that the baseline and impact sampling were random, the characteristics of sampled consumers were generally similar. There were more women than men in both the baseline (84.3% were women) and impact (82.8% were women) surveys. There were no major differences in the education level of respondents in the two surveys. The majority of respondents

had primary and elementary education (41.8% for baseline and 48.5% for impact), whereas about one-third of the respondents in both surveys had secondary education.

The average age of respondents in the impact survey was significantly lower (by two years) than of those in baseline. Also the average age of household heads in the impact survey was significantly lower than of those in baseline. This phenomenon may only be explained by possible change in attitude of younger households, and the results may indicate that younger households had increased consumption of TAVs and sweetpotato.

The fact that the same markets were targeted for the two surveys and consumers targeted were those visiting TAV and sweetpotato traders, the increase in number of medium and well-off consumers in the sample might be interpreted as changes in attitude toward the target crops as a poor man's food.

The proportion of persons consuming vegetables regularly (every other day or almost daily) remained at about 81% between the baseline and impact surveys. However, the proportion consuming each type of TAV generally increased over the period. The fact that proportion consuming TAVs increased while the proportion eating any vegetables (exotic and TAVs) remained the same would mean that the increase was caused by either a shift or diversification among those who were already consuming vegetables.

There were increases in the proportion of consumers who ate any of the five TAVs (amaranth, nightshade, spider plant, cowpea, and sweetpotato leaves) during the project period.

There was an increase in consumption of TAVs in urban Kenya and Arusha, while a decrease in rural areas may have been caused by the drought, which TAV affected growth. However, promotional messages may have been more effective in urban areas than rural areas.

Increase in consumption of TAVs among different wealth categories did not vary significantly, indicating that wealth category did not play a major role in influencing change in consumption of TAVs.

The proportion who consumed sweetpotato increased significantly from 78.4% to 88.3%, and those who consumed it regularly increased from 24.7% to 31.1%. The increase, though small, in OFSP from 3.7% to 4.8% by female respondents was favorable, especially if maintained, because orange-fleshed varieties provide important nutrients to pregnant women and children.

The fact that there were increases in the proportion of consumers who ate OFSP in urban Kenya and Tanzania might mean more consumers had been made aware of the benefits of OFSP and possibly that a high proportion had started eating it, which may explain the lower proportion of consumers who ate them regularly during the adoption survey. Again, the increase might be an indication of promotion campaigns being more effective in urban areas.

Consumption changes among gender showed more changes among women than men, with an increase in women consuming nightshade, spider plant, cowpea leaf, sweetpotato leaf, and WFSP.

There was increase in the proportion of consumers who had gotten information on the nutritional benefits of TAVs and sweetpotato within the project period. More consumers knew that TAV contributes to a balanced diet by having many vitamins and minerals, and similarly, more consumers knew that OFSP has high nutritional benefits, although they did not necessarily know the nutritional details. The significant increase in consumers offering sweetpotato to visitors was an indication of change of attitude toward sweetpotato.