Scaling Up Sweetpotato through Agriculture and Nutrition (SUSTAIN)

2013-2019

FINAL REPORT

CIP INTERNATIONAL POTATO CENTER
A CGIAR RESEARCH CENTER

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CGIAR RESEARCH PROGRAM ON Roots, Tubers and Bananas

SUSTAIN Scaling up Sweetpotato through Agriculture and Nutrition

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2013–2019

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Acronyms and abbreviations

A4NH	Agriculture for Nutrition and Health CGIAR Research Program
CIP	International Potato Center
DFID	Department for International Development
FGDs	Focus group discussions
IYCF	Infant and young child-feeding
M&E	Monitoring and evaluation
MEL	Monitoring, evaluation and learning
MSU	Michigan State University
NGO	Non-governmental organization
OFSP	Orange-fleshed sweetpotato
SUSTAIN	Scaling Up Sweetpotato through Agriculture and Nutrition

Executive summary

The Scaling Up Sweetpotato through Agriculture and Nutrition (SUSTAIN) project (2013–2019) aimed to improve the diets of at least 2.3 million households with children under 5 years of age in Africa and South Asia through biofortified (vitamin A-rich) orange-fleshed sweetpotato (OFSP). SUSTAIN applied integrated agriculture and nutrition interventions to scale up the production and consumption of OFSP and assessed the effectiveness of different delivery approaches for reaching its target population. It focused on Kenya, Malawi, Mozambique, and Rwanda, with additional activities in Bangladesh and Tanzania. It was led by the International Potato Center (CIP) working in partnership with national agriculture research institutions, health services, civil society organizations, and private sector partners.

SUSTAIN resulted in more than 2.3 million farming households with children under 5 years of age producing and consuming OFSP. It also reached over two million caregivers through nutrition education and training to improve their capacity for OFSP use for household nutrition, in particular feeding young children. These household numbers include those that were directly engaged in SUSTAIN's activities and those that indirectly accessed OFSP and nutrition knowledge through farmer-to-farmer diffusion and related partner initiatives using OFSP technologies and behavior change modules developed by SUSTAIN.

Through quantitative and qualitative assessments, including a comprehensive four-year randomized control trial, SUSTAIN generated evidence on outcomes and identified additional knowledge gaps. In Rwanda, evidence shows that around 23% of households in target communities adopted OFSP varieties. This is within the range expected given that Rwandan farmers have several preferred non-biofortified local sweetpotato varieties available and their small land holdings usually do not easily allow for expansion. Around 70% of adopters was still growing OFSP at least one year after receiving planting material. A comprehensive OFSP adoption study is underway in Malawi to assess longer-term trends and outcomes of OFSP adoption by varieties and delivery mechanisms.

Rwanda has among the highest rates of sweetpotato consumption worldwide. OFSP consumption among adopting households consistently increased and improved the diet diversity of all household members. In Rwanda during seasons of availability, around 24% of households consume OFSP at least five days a week. After the relatively short time of four years, OFSP varieties now represent 15–20% of all sweetpotato consumed in the target communities.

SUSTAIN demonstrated the technical feasibility and initial commercial viability of commercial processing of OFSP into nutritious puree as an ingredient in local food-processing industries, specifically the local bakery sector. Across the target countries, annual sales of OFSP puree-based products are estimated at more than USD 890,000 as a result of SUSTAIN. In Kenya, Rwanda, and Malawi, this has resulted in independent private sector investments in OFSP processing beyond the scope of the intervention. And in Kenya, regulatory frameworks are being strengthened to support these investments in a biofortified crop. Scaling up commercial OFSP processing will require innovations in the supply chain beyond open markets for smallholders. It will likely include contract farming or other forms of vertical integration and intensification of production of specific processing varieties.

Research in Mozambique and Kenya indicates that fresh OFSP markets can be a major source of income for farmers, at least seasonally. A key knowledge gap is how best to increase sustainably the availability of fresh OFSP roots in different rural and urban markets and increase access for low-income rural and urban consumers. Any future phase of SUSTAIN would need to develop business models for specific market types of importance to the poor.

Among notable improvements were leveraging significant delivery capacity in the civil society sector by including OFSP in food security and nutrition activities, enabling women to participate more fully as OFSP seed multipliers, stimulating private sector investments in diversified OFSP processing, and increasing the number of studies and publications in later years from savings made by shifting to a more facilitative delivery approach.

What is special about orange-fleshed sweetpotato?

Vitamin A deficiency (VAD), one of the most pernicious forms of undernourishment, can limit growth, weaken immunity, lead to blindness, and increase mortality in children. Globally, 165 million children under 5 suffer from VAD, mostly in Africa and Asia. Over the past decade, CIP and partners have developed and disseminated dozens of biofortified OFSP varieties in Africa and Asia. These varieties contain high levels of beta-carotene, which the body converts into vitamin A. Just 125 g of fresh OFSP root (a medium-sized sweetpotato) meets the daily vitamin A needs of a preschool child, and also provides high levels of vitamins B6 and C, manganese and potassium, among other nutrients.

CIP-led work in promoting production and consumption of OFSP has made it a cost-effective and sustainable source of vitamin A for vulnerable populations, especially women and young children. OFSP also provides the raw material to support rapidly growing commercial production of nutritious foods, creating jobs and income opportunities, including for women and young people.

Table 1. Selected achievements

Output/ outcome	Selected indicators	Achievements
Outcome	Percentage of OFSP adopters still producing OFSP after one year	70%
	No. of women and children <5 consuming OFSP regularly when available	> 1.2 million
Output 1	Households with children <5 receiving OFSP planting material	2,357,280
	Planting material multipliers operational	549 (65% female)
Output 2	Caregivers receiving nutrition and utilization training	2,011,090
	Studies on behavior change completed	9
Output 3	No. of OFSP-based products commercially traded	10
	Annual sales volume of OFSP-based products	USD 893,746
Output 4	No. of publications	16

1. Outputs

1.1 OUTPUT 1: Access to OFSP planting material by smallholder households with children under 5 years of age

The Scaling Up Sweetpotato through Agriculture and Nutrition (SUSTAIN) project has created access to orange-fleshed sweetpotato (OFSP) planting material for at least 2.3 million households with children aged under 5 years (Table 2). Overall, the beneficiary households in Kenya, Malawi, Mozambique, Rwanda, Bangladesh and Tanzania began producing and consuming OFSP as a result of interventions. These beneficiaries include more than 2.8 million children under 5 years of age, 2.9 million women of reproductive age, and 1.1 million adolescent girls. Beneficiary households include those that were directly engaged in the activities led by the International Potato Center (CIP) and those who accessed OFSP planting materials through farmer-to-farmer diffusion and related partners linked to SUSTAIN.

Surveys and operational research indicate at least 70% of farming households continued to produce and consume OFSP more than a year after the intervention. Farmer-to-farmer diffusion rates and scaling up through partners differed by country and delivery mechanism. The delivery approach consisted of distribution of bundles of 100–200 vine cuttings of known OFSP varieties to eligible households with children under 5 years of age, involving local multipliers trained by SUSTAIN, commercial multipliers (Malawi), public extension service, NGO activities, and in some cases participatory varietal evaluation trials. SUSTAIN closely monitored participation by women as multipliers and beneficiaries and adjusted its approaches after year two to increase their participation. On the whole, a direct-to-indirect beneficiary ratio of 1:4.2 was achieved.

Table 2. Achievements towards Output 1

Selected indicators		Kenya	Malawi	Mozambique	Rwanda	Bangladesh	Tanzania	Total
Household with children <5 receiving OFSP vines	Total households directly reached	56,059	125,710	53,737	186,647	7,527	23,643	453,323
	Total new OFSP adopters (direct and indirect households)	291,507	653,692	279,432	970,564	39,140	122,944	2,357,280
Planting material multipliers operational	No. of multipliers reached	66 (50% female)	5 (60% female)	96 (25% female)	39 (54% female)	343 (79% female)	24 (40% female)	549 (65% female)

1.2 OUTPUT 2: Access to improved nutritional knowledge and diversified use of OFSP by both female and male caregivers

SUSTAIN has reached more than two million caregivers, both men and women parents and other family and community members, through a range of nutrition education, counselling, and training activities in the target countries. Delivery of this output was closely linked to Output 1 and targeted the same category of beneficiaries, namely households with children under 5. In all cases, distribution of OFSP planting material was combined with delivery of nutrition messages. This was done to reinforce nutrition and agricultural knowledge together and capitalize on the combined cultivation and consumption of OFSP. The basic nutrition messaging was complemented by nutrition education and, where feasible, nutrition counselling at rural health centers, field day events, food demonstrations, and community mother-to-mother nutrition clubs. Media campaigns were also conducted to increase awareness of OFSP as a source of vitamin A and as part of healthy and diversified diets.

SUSTAIN completed several operational research and qualitative assessments (https://hdl.handle.net/10568/99302) of the effects of these activities on dietary behavior change among beneficiary households. Findings from this research show that nutrition knowledge increased and regular OFSP consumption during seasons of availability has

been established in the diets of both adults and children in most communities reached by SUSTAIN. However, knowledge gaps remain including identifying the most cost-effective approach for delivery of dietary behavior change interventions that utilize existing agriculture and health sector institutional mandates, evolving markets, and innovative media and social and behavioral change communications methods. SUSTAIN's focus on smallholder farming households as its main beneficiary group prioritized agricultural entry points for behavior change interventions, which limited the range and depth of alternative nutrition behavior change strategies.

Table 3. Achievements towards Output 2

Selected Indicators		Kenya	Malawi	Mozambique	Rwanda	Bangladesh	Tanzania	Total
Caregivers (m/f) reached with nutrition and utilization training	Total caregivers directly reached	46,495	90,600	38,691	188,544	10,080	12,338	386,748
	Total caregivers reached (direct and indirect)	41,774	471,120	201,193	980,429	52,416	64,158	2,011,090
Change in level of knowledge and attitude	Level of change recorded	>50%	n/a	n/a	>50%	n/a	>50%	n/a
Case studies and focus group discussions (FGDs) completed	No. of reports completed	3	2	2	2	n/a	n/a	9

1.3 OUTPUT 3: Commercially marketed processed products utilizing OFSP

SUSTAIN demonstrated the technical feasibility and economic viability of commercial processing of OFSP in target countries (Table 4). Building on proof-of-concept research and working closely with private sector partners, SUSTAIN established commercially traded OFSP products in mainstream markets. Annual sales volumes reached more than USD 540,000 in Kenya and USD 260,000 in Rwanda. Commercial uptake in Mozambique was slower, reflecting overall smaller markets and a more limited national food-processing sector.

SUSTAIN facilitated the development of OFSP supply chains from smallholder farmers to commercial food processors, linking more than 2,200 farmers to this new source of income and documenting the benefits from their market engagement. Farmer numbers stayed below targets in most countries, however, indicating that, at least at this initial stage, supply chains prioritize fewer, regular producers.

Manufacturing and utilization of OFSP puree by local small and medium enterprises have been a major innovation by SUSTAIN which triggered uptake of OFSP as an ingredient in the commercial bakery sector in the target countries. Research support from CIP's Food and Nutritional Evaluation Laboratory in Nairobi facilitated the development of nutritious, safe, and storable OFSP puree produced from OFSP roots grown by smallholders. Partnerships with the bakery sector and local food technology firms enabled the initial uptake of OFSP puree in commercial food processing.

Nutrition analysis has shown that OFSP puree-based bakery products are nutritionally superior to regular, wheat-based versions because of their higher vitamin A content, reduced amounts of sugars and fat, and lower glycemic index. They also provide cost savings in target countries through the substitution of imported wheat flour and the reduction of other ingredients.

Since 2017, additional commercial partners have taken up this food technology to supply national markets with OFSP puree-based bread and other food products. The regulatory landscape has started to respond to this increasing commercial visibility of OFSP; the Kenya Bureau of Standards has developed its first set of standards for biofortified sweetpotato roots, bread, and flour.

Table 4. Achievements towards Output 3

Selected Indicators		Kenya	Malawi	Mozambique	Rwanda	Bangladesh	Tanzania	Total
No. of OFSP-based products commercially traded	Achieved	4	3	0	3	n/a	n/a	10
No. of smallholders selling to processing market	Achieved	1,036	500	130	663	n/a	n/a	2,329
Annual sales volume of OFSP products in USD	Achieved	545,396	76,385	11,809	260,156	n/a	n/a	893,746

1.4 **OUTPUT 4:** Evidence of achieving outcomes and disseminating findings

Assessment methodologies, research findings, evidence generated, and lessons learned from implementation have been widely disseminated through publications in peer-reviewed journals, and presentations at international conferences on nutrition and agriculture and have been uploaded to the CGSpace repository (https://hdl.handle.net/10568/99302).

Monitoring and assessment tools and methodologies have been reviewed and updated during the implementation as part of CIP's monitoring, evaluation, and learning (MEL) framework. In year five, CIP intensified its collaboration with HarvestPlus and the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH) to develop a harmonized MEL system for scaling up biofortification across the CGIAR. The system will be completed in the next 2–3 years.

SUSTAIN engaged an internationally recognized research team from Michigan State University (MSU) as independent external evaluators to carry out quantitative and qualitative assessments of CIP's interventions. The MSU team implemented a comprehensive 4-year randomized control trial in Rwanda that generated new insights into the effectiveness and cost-effectiveness of different OFSP delivery mechanisms that combined agricultural, nutrition, and to a lesser extent marketing interventions. In addition, MSU carried out qualitative evaluations of CIP's implementation approach in Kenya and Malawi.

Table 5. Achievements towards Output 4

Selected Indicators		Achievements
Monitoring indicators and assessment tools developed, tested, and published	MEL tools developed and applied	• CIP MEL framework and tools updated • CIP MEL manual broadly disseminated and applied through community of practice • Harmonization of MEL framework and tools with A4NH and HarvestPlus advancing
Studies to capture cost-effectiveness and sustainability of delivery models	Evaluations completed	• Randomized control trial completed in Rwanda; evaluation report submitted • Qualitative assessment in Kenya and Malawi completed; evaluation reports submitted
Publications and conference participation	Publications and conference participations achieved	• Eight peer-reviewed publications and eight technical reports produced and published https://hdl.handle.net/10568/99302 • Presentation of findings and lessons on more than 20 international conferences

KEY ACHIEVEMENTS

MORE THAN **2.3 million** FARMING HOUSEHOLDS

with children under 5 received OFSP planting material.

MORE THAN **1.2 million** WOMEN AND CHILDREN

under 5 regularly consumed OFSP when seasonally available.

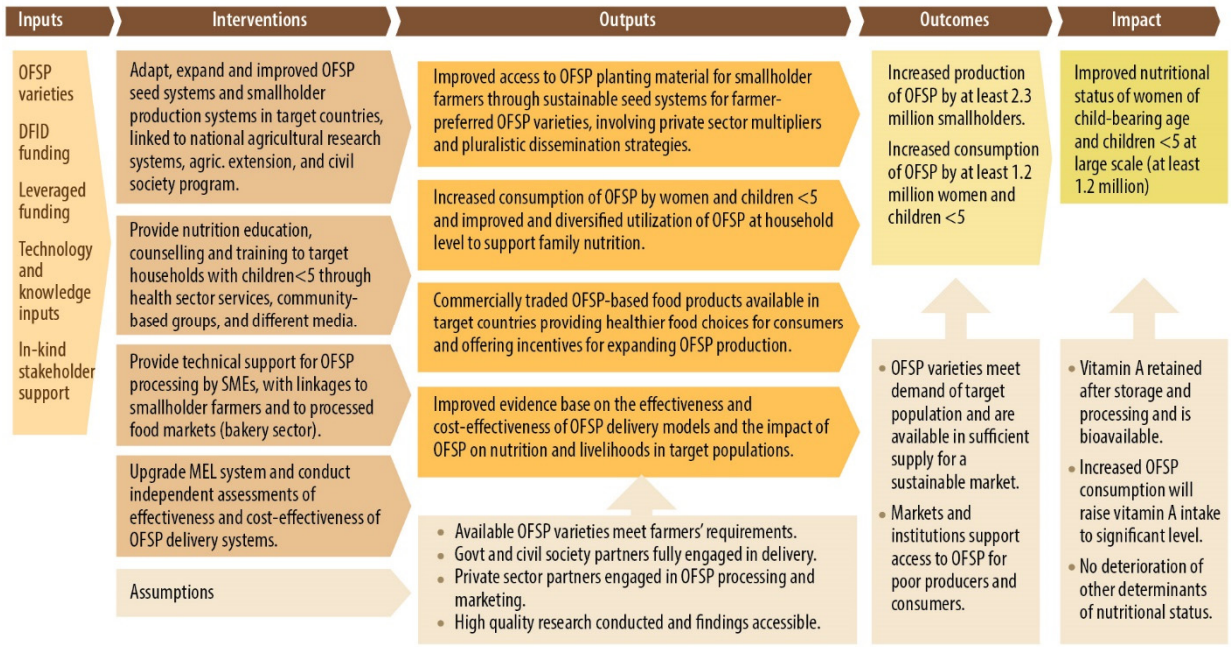
OVER **2 million** CAREGIVERS WERE REACHED

through nutrition education and training to improve their capacity to use OFSP.

2. Theory of change and progress towards outcomes

SUSTAIN's theory of change (Fig. 1) assumed that a broad-based partnership involving government, private sector, and civil society could be engaged in the development and delivery of OFSP.

Figure 1. SUSTAIN program theory of change



The goal of SUSTAIN was to improve the nutrition status of women of child-bearing age and children under 5 in a subset of 2.3 million households through the regular consumption of vitamin A-rich OFSP. This goal was achieved among an estimated 1.2 million individuals. Validation of this impact is provided by scientific studies proving the efficacy of OFSP roots for reducing vitamin A deficiency in the target group. SUSTAIN promoted known OFSP varieties with recognized high levels of beta-carotene, a precursor to vitamin A. Previous evidence has shown that about 125 grams of boiled roots of these varieties can meet the daily vitamin A requirements of a 5-year-old.

At impact level, SUSTAIN had to consider the frequency of OFSP consumption, given the initial scale of household-level production following adoption and the seasonality of the crop in many target countries. Surveys in Rwanda show that during seasons of availability, women and children in at least 24% of households consumed OFSP on five out of seven days. Nevertheless, it needs to be recognized that OFSP is not yet available throughout the year in smallholder communities and, as such, provides a complementary source of vitamin A at this stage. Second, SUSTAIN's support to processed OFSP products raised the question of whether vitamin A remained bioavailable in these products and also possible health risks from the consumption of processed foods. Research by CIP and partners demonstrated that the transformation of OFSP roots into puree (rather than flour) provides an excellent strategy for retaining beta-carotene in a stable and safe product as well as increased flexibility to sustain a wider range of food innovations. Even after baking, the final puree-based products retain more than 90% of the original beta-carotene in the OFSP root: in principle just two slices of OFSP bread can provide about one-third of the vitamin A requirement of a 5-year-old. The use of OFSP puree as a wheat substitute in bakery products lowers the glycemic index and significantly reduces the amount of added sugar and fat, thus providing additional health advantages. SUSTAIN used OFSP to develop healthier mainstream food products while promoting the use of OFSP roots at household level as the main form of OFSP consumption among target beneficiaries.

At outcome level, SUSTAIN achieved its target of 2.3 million new households gaining access to OFSP planting material. Adoption rates among these households appear within the expected range of early adoption of new technologies; about 23% of smallholder households in target communities established OFSP production as part of their farming activities. Of these adopters, about 70% still cultivated OFSP more than one year following initial adoption.

SUSTAIN further aimed to change nutrition behavior and increase OFSP consumption among beneficiary groups. Extrapolating from research results in Rwanda, at least 1.2 million women of child-bearing age and children under 5 regularly consumed OFSP roots during seasons of availability. They did so more frequently than initially assumed (five times a week, rather than once a week).

Through a randomized control trial, researchers determined that higher frequency of planting material distribution (two rounds versus one) increased adoption and continued production as well as consumption frequency more significantly than accompanying nutrition education and counselling or marketing interventions. However, implementing either nutrition or marketing activities still increased the likelihood of adoption, continued production, and consumption when compared with single stand-alone distributions. SUSTAIN prioritized high-potential sweetpotato-growing areas for OFSP introduction. As the agro-ecological suitability is high in these locations, OFSP faces strong competition from well-established, non-biofortified local sweetpotato varieties. Despite this competitive environment, OFSP adoption, continued production, and consumption proved to be within the target range.

Progress has been more limited for improving availability of OFSP in rural and urban markets. This is partly due to the comparatively low volume of production among new households receiving bundles of 100–200 vine cuttings as starter material. Harvests at this level are mainly consumed within the household, and SUSTAIN targeted beneficiary households with children under 5 for this reason. On the other hand, to reach larger consumer groups, including urban poor and vulnerable rural populations without access to adequate farming resources, OFSP needs to enter markets more substantially—and indeed to create demand. Any future phases would need to develop strategies, demand-creation efforts, and business models for achieving this market penetration by working with smallholders or larger farmers as needed.

3. Monitoring, evidence and learning

SUSTAIN had a robust MEL system that helped to track systematically evidence of progress against its goals for learning and decision making. Its M&E philosophy was built around 'utilization-focused evaluation' in which stakeholders' learning and the use of M&E outcomes for decision-making are crucial. SUSTAIN adopted, with some adjustments, the SMILER (Simple Measurement of Indicators for Learning and Evidence-based Reporting) approach for systematic measurement of performance indicator data and recording of evidence. In addition, specific operational research and regular indicator surveys were used to learn how to overcome implementation challenges. The outcomes of monitoring and research fed into country- and SUSTAIN-wide stakeholder engagement and learning events as monthly stakeholder feedback meetings, field days, and home and farmer visits by health and agriculture professionals. Further, the MEL activities were anchored on CIP's broader MEL system from which indicator data collection tools and techniques were adopted and adapted. These tools and techniques were jointly developed by CIP, HarvestPlus, and partners, and have recently fed into the design of a CGIAR-wide MEL platform.

CIP conducted several indicator monitoring surveys and operational studies to support evidence-based decision-making during implementation. These surveys and studies informed the selection of OFSP varieties, identified determinants and tools for behavior change for better household nutrition and child-feeding, and helped CIP refocus OFSP processing towards use of puree and emphasis on more nutritious bakery products.

SUSTAIN carried out a comprehensive randomized control trial in 2014–2018, independently through a renowned external party, MSU. The trial assessed the scalability and relative effectiveness of different versions of CIP's integrated agriculture-nutrition-marketing approach for achieving nutrition and economic outcomes. Analysis of randomized control trial data shows that OFSP has entered into the farming systems and diets of farmers in Rwanda, though the spread of OFSP from farmer to farmer and the volume of production are not yet at the level anticipated during planning.

From a sample of over 28,000 households in 252 communities, about 23% of households have adopted OFSP into their production system. About 70% of OFSP adopters retained OFSP on their farms and in their diets one year later. Similarly, 24% of households consumed OFSP during seasons of availability—a good level of achievement in sweetpotato-growing communities where OFSP was recently introduced.

When comparing the effectiveness of different intervention modalities, the randomized control trial found (among other observations) that to improve nutritional outcomes for target households, repeated distribution of planting material at similar prices is critical. Providing planting material alone for multiple seasons is no more effective than providing planting material for one season along with nutrition and marketing components. That is, the full intervention base model seems to be the most effective intervention. There is some mixed evidence that either the nutrition or marketing component would be sufficient, and that the nutrition component may be more effective in encouraging OFSP consumption among women and children.

Qualitative assessments through SUSTAIN revealed further underlying drivers of technology adoption and diffusion. Several studies using behavioral economics methodologies suggest that emotional and aspirational factors, rather

than revenue calculations or factual knowledge, can be decisive for OFSP adoption by farmers and consumption of OFSP foods. Any future phases would have to take advantage of insights from consumer research more systematically to reach larger and more diverse groups of consumers in rural and urban areas.

Lessons learned

Among the lessons learned over the course of implementation, the following stand out:

- The basic assumption that agriculture and nutrition interventions can reinforce each other to effect behavior change towards healthier diets in smallholder households has been validated at a large scale. Important aspects for success include gender relations that need to connect decision making in the production sphere (which is often male dominated) and the nutrition and child-care sphere (which is often female dominated). Implementers need to be mindful of this structural aspect when designing and implementing interventions and need to seek to promote consistent 'nutrition-sensitive' choices. Design and implementation processes need to facilitate monitoring of cost-effectiveness of approaches and be able to adjust based on emerging evidence. SUSTAIN found it challenging to assess cost-effectiveness ex-post or through independent evaluators. A clearer focus on this important determinant of scalability from the design phase will generate greater insights in any future phases.
- SUSTAIN chose a primarily agricultural entry point for improving nutrition outcomes. This determined the focus on smallholder households in high-potential sweetpotato-growing areas where OFSP can gain a foothold relatively quickly. To understand the scalability of OFSP, however, a broader and more diversified strategy will certainly be required in future. Significantly scaling OFSP production levels beyond current levels amongst smallholders seems unrealistic. Yet the marketing of OFSP will remain limited until and unless larger production volumes are achieved. This will require separate starting points through larger producers who can target their production at markets, either fresh or for processing. Given that vitamin A deficiency remains, regretfully, severe not only among smallholder farmers but also among other rural and urban poor, this will be an important lesson for future design.
- Incentives for investing in OFSP can take longer to evolve than the project cycle can capture, yet will likely be decisive for sustained uptake and scaling of OFSP. SUSTAIN successfully stimulated commercial investments in processing over the course of four years, yet investments in supply chains to serve these new markets still need to be made. To accelerate commercial scaling, projects will need to co-develop with their commercial partners more comprehensive business plans, both at enterprise and overall market-chain levels. Otherwise, there is a risk that projects will provide unsustainable gap-filling for several years, which may eventually jeopardize efficient and inclusive commercialization.
- Behavior change for healthier diets requires a detailed understanding of drivers of food choice within households and in society at large. The role of caregivers, but also of individuals deciding on food purchases and food production, need to be taken into account by behavior change strategies. Likewise, wider social and cultural norms and aspirations of different consumer groups can influence food choices, irrespective of OFSP being available on farm or in markets. Any future phases would need to work through these drivers of food choice to support the scaling of OFSP.

Annex 1. Log-frame

Scaling Up Sweetpotato through Agriculture and Nutrition (SUSTAIN)					Assumptions
Impact	Indicator	Baseline 2013/2014	Milestone 1 (Aug. 2015)	Milestone 2 (Aug. 2016)	• OFSP varieties in use yield at least as well as local sweetpotato varieties in expansion area • Infrastructure and staff available at country level to support increase in output of foundation planting material • Policies for integrating agriculture with nutritional concerns remain favorable at the country and regional level

Improved nutritional security and vitamin A intakes by women and young children in at least five countries in sub-Saharan Africa and Asia	• Semi-quantitative index of frequency of consumption of all vitamin A-rich foods during past seven days among women and children aged <2 years and children 3–5 years in rural and urban households, disaggregated by gender of household head
	• Minimum level of infant and young child- feeding practices (IYCF)* attained among children aged 6–23 months, disaggregated by gender of household head
	• Estimate of production (tons) of OFSP, disaggregated by gender of household head
	• The first two of these indicators are from national-level demographic and health surveys that are often repeated every five years; only Mozambique includes OFSP (as distinct from other sweetpotato) in its national agriculture survey
		• % of children aged 6–23 months meeting the minimum standard with respect to IYCF:
		  • Kenya: 38%
		  • Rwanda: 17%
		  • Malawi: 19%
		  • Mozambique: 13%
		• % of children aged 6–23 months consuming vitamin A-rich foods in last 24 hours:
		  • Kenya: 67%
		  • Rwanda: 73%
		  • Malawi: 73%
		  • Mozambique: 58%
		• National production of OFSP: Mozambique (2012): 133,162t
		• Other countries unknown; would have to be established during project baseline
			• 30% improvement of index of frequency of consumption of vitamin A-rich foods among implementation household
			• 25% of implementation household practices minimum level of IYCF practices
			• 25% increase in production of sweetpotato by the intervention households as OFSP since 2014
			• Baseline information to be established in additional countries
				• 40% improvement of index of frequency of consumption of vitamin A-rich foods among implementation households
				• 30% of implementation household practice minimum level of IYCF practices
				• 50% increase in production of sweetpotato by the intervention households as OFSP since 2014	

		Source: Independent evaluation team will collect indicators at project level twice: at baseline (data collection from Dec 2014–Feb 2015) and at end-line (Dec 2017–Feb 2018) with a focus on Rwanda. Demographic and health surveys: Rwanda (2010), Malawi (2010), Mozambique (2011), Kenya (2008–2009), and annual reports.			

<table>
<tr><th>Outcome</th><td>Indicator</td><td>Baseline 2013/2014</td><td>Milestone (Aug. 2015)</td><td>Milestone (Aug. 2016)</td><td>Assumptions</td></tr>
<tr><td rowspan="6">• 2.3 million small-farming households with at least one child under 5 growing and consuming OFSP by 2018
• 400,000 rural and urban consumers purchasing an OFSP-based processed product</td><td rowspan="2">% of those receiving vines who are producing OFSP one year later, disaggregated by gender of households</td><td>• During baseline, will assess % of households already growing OFSP
• Four countries with adapted OFSP varieties available</td><td>• At least 70% of 296,000 households with children under 5 receiving OFSP vines in 2014 are still producing
• Additional countries with adapted OFSP varieties available</td><td>At least 70% of 576,000 households receiving OFSP vines in 2014 and 2015 are still producing</td><td rowspan="6">• Adequate quantities of OFSP vines will be available for distribution in a timely fashion, not lost to floods or droughts
• Women and young children in particular will like the taste and performance of the new OFSP varieties and the OFSP processed products
• Macro-economic and political stability supports private sector investment
• Value-added taxes do not drive the cost of the product beyond it reach of desired target group</td></tr>
<tr><td colspan="3">Source: Independent evaluation team will collect indicators at the project level twice for baseline (Dec 2014–Feb 2015) and end-line (Dec 2017–Feb 2018) project reports. In countries with regular national sample surveys of agriculture, survey results can serve as a source</td></tr>
<tr><td>Indicator</td><td>Baseline 2013/2014</td><td>Milestone (Aug. 2015)</td><td>Milestone (Aug. 2016)</td></tr>
<tr><td rowspan="2">No. of consumers purchasing an OFSP product in urban and rural areas, disaggregated by gender</td><td>• No. of OFSP products available in rural and urban markets
• Sales data from existing products and average frequency of purchase</td><td>At least 40,000 consumers purchasing OFSP products (sales data and average frequency of purchase)</td><td>At least 150,000 consumers purchasing OFSP products (sales data and average frequency of purchase)</td></tr>
<tr><td colspan="3">Source: Monitoring data collected in collaboration with private sector partners from sales records and rapid surveys of product purchasers</td></tr>
<tr><td>Indicator</td><td>Baseline 2012</td><td>Milestone (Aug. 2015)</td><td>Milestone (Aug. 2016)</td></tr>
<tr><td rowspan="2">No. of households with young children and pregnant women consuming OFSP, either as boiled roots or in other processed form; data by men, women, children < 5 years of age, and pregnant women, and by frequency of consumption, disaggregated by gender of household head</td><td>Will assess frequency and amount of consumption of all types of sweetpotato during baseline (seven-day recall)</td><td>No. of women and young children are consuming OFSP on average at least once per week (at least 200,000) and more than twice week; men at least once per month</td><td>No. of women and young children are consuming OFSP on average at least once per week (at least 600,000) and more than twice per week; men at least once per month</td></tr>
<tr><td colspan="3">Source: Project reports (first two indicators from monitoring data); last indicator will be collected by independent evaluation team</td></tr>
</table>

Output 1	Indicator	Baseline 2013/2014	Milestone 1 (Aug. 2015)	Milestone 2 (Aug. 2016)	Milestone 3 (Aug. 2017)	Assumptions
Access to improved OFSP varieties by smallholders scaled up in at least 5 countries (Mozambique, Malawi, Rwanda, Kenya, Bangladesh) reaching at least 2.3 million household with children <5 years	No. of households receiving vines or multiplying improved OFSP varieties, including % of vine recipients who were women, disaggregated by gender of household head	• Through other projects have reached since 2009: Kenya: 11,000; Rwanda: 650; Malawi: 110,000; Mozambique: 182,000 • Baseline information for additional countries available in 2015	Will have reached an additional 50,000 direct beneficiaries and 120,000 indirect	Will have reached 120,00 direct beneficiaries and 264,000 indirect	*Will have reached 180,000 direct beneficiaries: Kenya 30,000; Malawi: 60,000; Mozambique: 35,000; Rwanda: 50,000; Bangladesh: 5,000*	• Commitment by government ministries of agriculture, health, and education to support integrated food- based approaches and contribute at least staff time in-kind • OFSP varieties in use in other locations in the target countries are acceptable in the new expansion areas • No major political upheaval or climatic shock causing major interruption in timing of disseminations • Partners interested in implementing an integrated ag-nutrition approach can be identified and agree to adopt common M&E system
	Indicator	Baseline 2013/2014	Milestone 1 (Aug 2015)	Milestone 2 (Aug 2016)	Milestone 3 (Aug. 2017)	
	No. of multiplication sites established with trained farmer multipliers or commercial operators supported, disaggregated by gender	No. of existing multipliers in selected intervention areas at baseline	At least four farmer multipliers per district or equivalent capacity in commercial or government sector	At least six farmer multipliers per district or equivalent capacity in commercial or government sector	At least seven farmer multipliers per district or Equivalent capacity in commercial or government sector	
	Indicator	Baseline 2013/2014	Milestone 1 (Aug. 2015)	Milestone 2 (Aug. 2016)	Milestone 3 (Aug. 2017)	
	Multipliers can be individuals or groups depending on context		**Source:** Monitoring system data summarized in annual donor report Midterm independent evaluation (Aug 2016) and final independent evaluation (Y5) verify reported data			
Impact Weighting	Indicator	Baseline	Milestone 1 (Aug. 2015)	Milestone 2 (Aug.2016)	Milestone 3 (Aug. 2017)	
50%	Yields of different varieties will be captured in sub-samples to enable better production estimates	Yields from on- farm trial data	Yield assessment updated	Yield assessment updated	Yield assessment updated	
		Source: Monitoring team in collaboration with partners				

Output 2	Indicator	Baseline 2013/2014	Milestone 1 (Aug. 2015)	Milestone 2 (Aug. 2016)	Milestone 3 (Aug. 2017)	Assumptions
Access to improved nutritional knowledge & diversified use of OFSP by both female and male caregivers (household members providing child- feeding care)	No. of caregivers (female and male) reached through nutrition and diversified use training administered through pathways designed to achieve behavioral change	Through other projects have reached since 2009: Kenya: 6,000; Rwanda: 490; Malawi: 55,000; Mozambique: 10,000	50,000 caregivers reached	120,000 caregivers reached	180,000 direct beneficiary caregivers reached: Kenya: 30,000; Malawi: 60,000; Mozambique: 35,000; Rwanda: 50,000; Bangladesh: 5,000	• Available partner organizations in target areas will be willing to test and adapt innovative approaches and document their successes and failures during implementation. • All partners will be willing to follow appropriate coding schemes for expenditures and share cost date with cost analysis experts
			Source: Monitoring data; previous OFSP integrated agriculture-nutrition impact pathways adapted based on lessons learnt and encountered cultural context in new areas			
	Indicator	Baseline 2013/2014	Milestone 1 (Aug. 2015)	Milestone 2 (Aug. 2016)	Milestone 3 (Aug. 2017)	
	No. of events (media, field day, classes, etc.) held that promote the appropriate use of OFSP to improve nutrition and diversify its use	Will conduct rapid assessments of events held by other OFSP promotion efforts to date.	At least two events sponsored by SUSTAIN in each country, with participation noted by gender whenever possible	At least four events sponsored by project in each country, with participation noted by gender whenever possible	At least six events sponsored by project in each country, with participation noted by gender whenever possible	
			Source: Monitoring system data summarized in annual donor report; mid-term independent evaluation (Aug 2016) and final independent evaluation (Y5) will assess degree of exposure to various events			
	Indicator	Baseline 2013/2014	Milestone 1 (Aug 2015)	Milestone 2 (Aug 2016)	Milestone 3 (Aug. 2017)	
	Change in level of indices capturing nutritional knowledge and attitudes and practices concerning sweetpotato among female and male caregivers	Baseline levels will be measured in both intervention and control areas	Focus groups discussions to assure messaging is on track	At least 20% improvement in indices among female caregivers; 10% among men	At least 30% improvement in indices among female caregivers; 20% among men	
			Source: Independent evaluation team for quantitative data at baseline and final target. Monitoring team will conduct qualitative work at Milestone #3			

Impact weighting	Indicator	Baseline 2013	Milestone 1 (Aug 2015)	Milestone 2 (Aug 2016)	Milestone 3 (Aug. 2017)	
20%	Reports of FGDs and other qualitative data to assess current practice and ability to change behaviors	Review of existing tools for behavioral change in the country; rapid formative research will be conducted to assure that socio-cultural context captured	FGDs to assure messaging is on track and gender and age considerations are being fully taken into account	FGDs to pinpoint behaviors that are and are not changing	At least one case study in each country on behavior change, based on evidence from FGDs and/or other methodologies	
			Source: Project nutritionist will lead this data collection in collaboration with implementing partners			

Output 3	Indicator	Baseline 2013	Milestone 1 (Aug 2015)	Milestone 2 (Aug 2016)	Milestone 3 (Aug. 2017)	Assumptions
At least one commercially marketed processed product that uses OFSP as a major ingredient in each target country	No. of OFSP value-added products on market	Rwanda: Golden Power Biscuits (45% wheat flour replaced by OFSP puree) and OFSP doughnuts (*mandazi*) on market made by local farmer groups	Research on a range of potential products and their potential socio-economic target groups conducted and report of findings produced	At least one new OFSP product under commercial development in Kenya, Malawi, Rwanda, and Mozambique	At least one new OFSP product under commercial development in Kenya, Malawi, Rwanda, and Mozambique	• Economically viable OFSP- based processed products can be developed that are liked by different consumer target groups (young, women, young children, etc.) • Potential health risks from increased consumption or process products high in fat, sugar, and/or salt are measured, understood, and communicated through labelling and consumer education • Private sector companies agree to and continue to be willing to share sales volume and value information • Representative sub-samples of urban consumers from different socio-economic strata can be compiled and interviewed cost-effectively
	Indicator	Baseline 2013	Milestone 1 (Aug 2015)	Milestone 2 (Aug 2016)	Milestone 3 (Aug. 2017)	
	No. of smallholder farmers linked to these value chains, disaggregated by gender	None	Agreements between agro-processor and smallholders completed	At least 300 smallholders supplying OFSP for processing in Kenya, Malawi, Rwanda, and Mozambique	At least 400 smallholders supplying OFSP for processing in Kenya and Rwanda and at least 200 smallholders in Malawi and Mozambique	
Impact weighting	Indicator	Baseline 2013/March 2014	Milestone 1 (Aug 2015)	Milestone 2 (Aug 2016)	Milestone 3 (Aug. 2017)	
30%	Sales levels of OFSP products and urban and rural stores and through ambulant traders	Outlets belonging to agro-processor will be mapped as part of baseline exercise	Sales levels for each company exceed USD 20,000/ year for each product in Kenya, Malawi, Rwanda and Mozambique	Sales levels for each company exceed USD 80,000/ year for each product in Kenya and Rwanda USD 20,000/year in Malawi and Mozambique	Sales levels of OFSP-based products exceed USD 80,000 in Kenya and Rwanda USD 20,000/year in Malawi and Mozambique	
			Source: Monitoring data; Project progress reports			

Output 4	Indicator	Baseline 2013/2014	Milestone 1 (Aug 2015)	Milestone 2 (Aug 2016)	Milestone 3 (Aug. 2017)	Assumptions
Evidence of achieving outcomes and disseminating findings	No. of monitoring indicators and assessment tools, including qualitative tools, developed, tested, and published	Indicators from previous efforts and literature reviewed, modified if needed, and selected	First set of assessment tools and methods developed and field-tested (vine multiplication, value chains, nutrition/health)	Assessment tools and methods implemented, reviewed and published; qualitative gender tool implemented for mid-term assessment	Exit strategies for sustained access to quality planting material and nutrition advise developed	• Independent evaluation team will be hired by November 15, 2013 • Trained staff of implementing partners collect quality monitoring data
	Indicator	Baseline 2013	Milestone 1 (Aug 2015)	Milestone 2 (Aug 2016)	Milestone 3 (Aug. 2017)	
	No. of studies that capture cost-effectiveness and assess the degree of sustainability of the different delivery models (vine multiplication, value chains, nutrition/health)	• One completed study for Uganda and Mozambique indicated cost-effective nutrition intervention • Baseline study will be conducted in early 2014	Qualitative assessment of project impact on gender roles and gender equity	Independent qualitative evaluation of effectiveness of approaches in Kenya and Malawi	Independent qualitative evaluation of the effectiveness of approaches in Kenya and Malawi and the project—internal cost- effectiveness assessments in two countries	
			Source: Independent evaluation team Reaching End Users and Mama SASHA studies for methodology 2012 Priority setting exercise on sweetpotato for the CGIAR Research Program on Roots, Tubers and Bananas			
	Indicator	Baseline 2013/2014	Milestone 1 (Aug 2015)	Milestone 2 (Aug 2016)	Milestone 3 (Aug. 2017)	
	No. of regional technical conferences to share and improve tools and disseminate findings	Annual attendance at Sweetpotato for Profit and Health Initiative meeting and at least one other regional technical meeting	Participated in regional and global conferences, presenting project findings; technical publications widely available online	Participated in regional and global conferences, presenting project findings; technical publications widely available online	Participated in at least two regional and two global conferences, presenting project findings; at least four technical publications widely available online	
			Source: Monitoring data, PowerPoint presentations; programs from conferences			

Annex 2. SUSTAIN Publications

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