Home gardening in Ethiopia - its contribution to food system transformation

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SWRE-RAISE-FS-working paper # 026

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This working paper presents the experience of home gardening initiative in Ethiopia's Amhara, Oromia, Tigray, Central, and Southern regions engaged 2,920 farmers across 16 *woredas* and 55 kebeles to address dietary challenges. Focusing on diverse, organic, and climate-smart vegetable cultivation, the program included training and nutrition education to improve household decision-making. Results showed increased vegetable production, better dietary practices, enhanced nutrition knowledge, and women's empowerment. Despite challenges like water scarcity and limited market access, the study highlights the potential of integrating home gardening into agricultural systems to promote dietary diversity and resilience.

Key words: home garden, vegetable, nutrition knowledge, dietary diversity, Ethiopia

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Contents

Preface ii

List of abbreviations and acronyms iii

Summary v

1 Introduction 1

2 Methodology 2
2.1 Geographical coverage 2
2.2 Sampling and institutional engagement 2
2.3 Farmer participation structure 4
2.4 Monitoring, data source and analysis 4

3 Implementation pathway 5
3.1 Layout and design 5
3.2 Input acquisition and crop selection 6
3.3 Capacity building 6
3.4 Consolidation and sustainability effort 8

4 Results 9
4.1 Home garden vegetable and fruit production practices 9
4.1.1 Vegetables grown 9
4.1.2 Garden design and layout 9
4.1.3 Fertilizer use 9
4.1.4 Pest and disease management approaches 9
4.1.5 Vegetable and fruit seed/seedling supply 10
4.2 Overview of production status across *woreda*s 12
4.2.1 Household vegetable and fruit production status 12
4.2.2 Household fruit and vegetable harvesting and consumption frequencies 13
4.3 Knowledge, Attitude and Practices enhanced 15
4.3.1 Enhanced home gardening production 15
4.3.2 Improved knowledge and dietary diversity practices 15
4.3.3 Improved cooking practice and food hygiene 15
4.4 Gender decision-making & social dynamics changed 17
4.5 Improved household income 20

5 Discussion 21
5.1 Vegetable production 21
5.2 Vegetable harvesting and consumption 21
5.3 Crop-specific harvesting and consumption 22
5.4 Knowledge, attitude & practices 22
5.5 Decision making and labour distribution 22
5.6 Income generation 23

6 Challenges and lessons learned 24
6.1 Implementation and sustainability barriers 24
6.2 Key lessons 24

7 Conclusion and recommendation 26

References 1

Annexes 3

Preface

Resilient Agriculture for Inclusive and Sustainable Ethiopian Food Systems (RAISE-FS) is a four-year programme funded by the Embassy of the Kingdom of the Netherlands in Addis Ababa and hosted by Stichting Wageningen Research Ethiopia. The programme was established to support transformation of Ethiopia's food system through demand-driven, interdisciplinary research and practical action that contributes to the country's development priorities.

This working paper presents the experience and learning generated through an integrated home gardening intervention implemented in Amhara, Oromia, Tigray, Central Ethiopia, and Southern Ethiopia. The intervention treated home gardening as more than a means of producing vegetables. It combined diversified fruit and vegetable production with nutrition education, behaviour change communication, gender-responsive approaches, and institutional collaboration. Farmers were supported to use locally adapted garden designs, organic and climate-responsive practices, compost, integrated pest management, staggered planting, field days, cooking demonstrations, and couple-based learning. Together, these activities sought to improve year-round access to nutritious foods while strengthening household knowledge, decision-making, and resilience.

The findings show encouraging improvements in production, harvesting and consumption of vegetables, dietary diversity, cooking and food-hygiene practices, women's participation in household decisions, income generation, and community sharing. At the same time, the paper reflects honestly on the barriers that must be addressed for lasting impact, including water scarcity, limited access to quality seeds and seedlings, pests and diseases, labour constraints, weak extension support, market limitations, and socio-cultural factors. The lessons and recommendations that follow point to the importance of local ownership, sustained institutional support, stronger input and water systems, farmer-to-farmer learning, and policy integration. We hope this evidence will support future efforts to scale practical, nutrition-sensitive home gardening approaches and strengthen Ethiopia's food systems.

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List of abbreviations and acronyms

ARC	Agricultural Research Centre
ARI	Agricultural Research Institute
CASCAPE	Capacity Building for Scaling up of Evidence-based Best Practices in Agricultural Production in Ethiopia
DAs	Development Agents
EFBDG	Ethiopian Food Based Dietary Guidelines
EPHI	Ethiopian Public Health Institute
ETB	Ethiopian Birr
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
HEWs	Health Extension Workers
ICF	International Coaching Federation
IPM	Integrated Pest Management
KAP	Knowledge, Attitude and Practice
NGOs	Non-governmental Organizations
RAISE-FS	Resilient Agriculture for Inclusive and Sustainable Ethiopian Food Systems
SAA	Social Analysis and Action
SBCC	Social and Behaviour Change Communication
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization

Summary

Home garden interventions were implemented across five regions of Ethiopia viz. Amhara, Oromia, Tigray, Central Ethiopia, and Southern Ethiopia to explore how integrated home gardening can contribute to improved nutrition. The intervention was designed to address the prevailing and persistent dietary challenges in Ethiopia, where diets remain mainly dependent on staple crops and micronutrient-rich foods are often under-consumed, contributing to poor dietary diversity and malnutrition.

The interventions adopted a food systems approach that integrated home garden production, nutrition behaviour change communication, gender, and institutional collaboration to improve access to nutrient foods. It was implemented in 16 *woredas* across 55 *kebeles* through partnerships involving research centres, universities, agricultural extension systems, health sectors, and local government actors. A total of 1,239 host households and 1,681 follower farmers participated, reaching 2,920 farmers in total. The intervention promoted diversified and nutrient-dense vegetables using small plots, locally adapted designs, organic production principles, and climate-responsive practices. Households cultivated multiple vegetables and fruits including Ethiopian kale, carrot, beetroot, Swiss chard, lettuce, head cabbage, pak choi, cauliflower, beet root, carrot papaya, and banana, while emphasizing compost use, integrated pest management, and locally available pest-control methods. Capacity-building activities formed a central pillar of implementation and included training, field days, cooking demonstrations, nutrition education based on Ethiopian food based dietary guideline (EFBDG), and couple-based approaches to strengthen household decision-making and women empowerment. More than 2,920 farmers and 473 stakeholders participated..

The overall results demonstrated that the intervention improved household home garden production, dietary practices, and social outcomes. Vegetable production increased substantially across intervention *woredas*, although with some variation. Boloso Bombe, Yilmana Densa, and Gumer recorded the highest production, while lower production was observed in Ziquala and Atsbi, largely reflecting differences in water access, agroecological conditions, and adoption of production packages. Importantly, increased production translated into improved consumption. Households harvesting frequencies ranged from 2-4 times per week and consumed 3-5 times per week, with higher consumption frequencies reported from Haramaya, Silti, Gumer, Kersa, Kofele, Sire, Boloso Bombe, and Yilmana Densa *woredas*. This may be attributed to the year-round availability of vegetables and positive behavioural changes among farmers. These results indicate that home gardening improved household access to and frequent consumption of nutrient-rich vegetables.

Beyond production and consumption outcomes, the intervention generated broader behavioural and socio-economic benefits. Participants reported improved nutrition knowledge, greater dietary diversity, better cooking and food hygiene, increased acceptance of previously underutilized vegetables, stronger women's participation in household decisions, and improved social bond through vegetables sharing. Income generation also emerged as an important co-benefit, with surplus vegetable and fruit sales supporting household food purchases, and other expenses.

Despite these gains, sustainability challenges remain, including limited access to irrigation water, limited access to seeds and seedlings, pest pressure, limited extension support, labour constraints, market limitations, and socio-cultural barriers affecting consumption. The study concludes that integrated home gardening interventions, when combined with nutrition education, gender, stakeholder engagement, and institutional support, can serve as an effective pathway to improve dietary diversity, strengthen local food systems, enhance women's empowerment, and build household resilience. The paper recommends institutionalizing home gardening within agricultural and nutrition systems, strengthening local seed and extension services, expanding behaviour change communication, and scaling successful models through farmer-to-farmer learning and policy integration.

1 Introduction

In Ethiopia, many households, especially in rural and peri-urban areas, rely heavily on staple crops, limiting access to nutrient-dense foods, and contributing to low dietary diversity. Literature indicates that the Ethiopian diet, particularly among rural peoples, is predominantly starch staples with limited consumption of legumes, fruits, vegetables, and animal-source foods (Jateno et al., 2023). Moreover, malnutrition remains a major public health concern, with 37% of children under five affected by stunting and 7–10% affected by wasting, while micronutrient deficiencies such as vitamin A deficiency and anaemia are widespread (EPHI & ICF, 2021; WHO, 2020). Limited dietary diversity, poverty, recurrent droughts, and low maternal education are the key factors among others. Home gardening can improve access to diverse, nutrient-dense foods, enhance dietary diversity, and strengthen household resilience to food insecurity and climate shocks (UNICEF, 2021). Home gardening is one of the nutrition-sensitive agricultural interventions for improving dietary diversity, addressing food insecurity, and mitigating climate vulnerability.

Home gardening refers to the cultivation of fruits, vegetables and other useful plants on a small portion of land, typically located around the household or within walking distance. It often involves a mixed cropping system that may include vegetables, fruits, plantation crops, spices, herbs, ornamental and medicinal plants. Sometimes it provides livestock's supplementary food and income for the households. Home gardens are an integral part of local food systems and family farming worldwide and are widely practiced by subsistence families in low-income countries. Studies have shown that home gardening is essential for improving food security, dietary habit, and livelihoods in both urban and rural setting (Galhena et al., 2013; Altieri et al., 2012).

The government of Ethiopia supports home gardening and, since 2016, has set targets of 40% of rural and 25% of urban households having home gardens (Leta et al., 2017). However, home gardens are promoted through short-term projects implemented by development partners, including NGOs or temporary government programs. Such initiatives often provide funding, inputs, and staff support to households for agronomic practices and nutrition education. However, sustainability remains a challenge. A review of the CASCAPE project found that only 20–30% of women were able to continue home gardens after the end of the project. Similarly, in the CANAG project, 90% of the participants would continue the home gardens in the rainy season. However, participants in Tigray are less likely to continue dry season, mentioning water access as a key limiting factor (Pittore et al., 2025). Identifying leverage points for long-term sustainability is therefore crucial. It is also important to note that increasing the supply of vegetables through home gardening does not automatically translate into improved dietary behaviours; integrated approaches are needed to promote consumption and nutrition outcomes.

Specifically, the primary objective of the intervention was to generate evidence for the efficient and sustainable implementation of home garden innovations as a pathway for food system transformation, aiming to improve household dietary habits through integrated outcome-oriented actions on production, nutrition, and gender. Accordingly, this working paper aims to provide insights into the year-round production and consumption of vegetables from home gardening interventions, which were identified as critical leverage points targeting food-insecure and high-potential food system areas in Amhara, Oromia, Tigray, central Ethiopia, and Southern Ethiopia. The scope of the intervention covers production**,** nutrition**,** gender**,** economic benefits**,** behaviour change**,** and food system integration based on the experiences from Amhara, Oromia, Tigray, Central Ethiopia, and Southern Ethiopia regions.

The remainder of the paper is organized into six sections. Following the methodology, the paper presents the implementation pathways adopted and the main results achieved, supported by key evidence. It then discusses the findings in detail, highlighting the major challenges encountered and lessons learned. The final section presents the conclusions and recommendations for future initiatives aimed at transforming Ethiopia's food system.

2 Methodology

2.1 Geographical coverage

The home garden intervention was implemented by ten research and academic institutions across five regions of Ethiopia: Oromia, Central Ethiopia, South Ethiopia, Amhara, and Tigray. These institutions coordinated activities across 16 *woredas*, covering 55 *kebeles*, and representing both food-secure and food-insecure food system typologies, enabling a diverse implementation landscape and cross-learning across agro-ecologies (Table 1). The *woredas* were strategically selected based on food system typology, ensuring representation of both food-secure and food-insecure communities.

2.2 Sampling and institutional engagement

A total of 1239 households were targeted in Amhara, Oromia, Central Ethiopia, Tigray and South Ethiopia. The host farmers were purposively selected from selected kebeles based on information provided by woreda experts, development agents (DAs), and the kebele administration. Participants were selected using criteria designed to ensure meaningful representation of women-headed households, lower-income households and model farmers. Besides, the availability of backyard land for home gardening, access to water, and willingness to participate were considered.

In the first year, ten households were selected from each intervention kebele to implement the home garden model as a demonstration. In the second year, an additional 10–15 farmers were included together with the initial participants to advance the intervention as a pilot phase. In the third year, ten or more farmers were again selected, incorporating previous participants, to translate the intervention toward institutionalisation, ensuring sustainability and enabling wider adoption.

Table 1 below presents host farmer data disaggregated by gender and age category. A total of 1,239 host farmers participated, including 610 male-headed and 629 female-headed households. This indicates nearly equal engagement of male- and female-headed households during the targeting phase. Regarding age demographics, 62% were adults, while 38% were youth (<35 years), indicating that adult farmers were primarily involved in the intervention. In the Amhara region, male-headed farmers were more dominant, while in Oromia, Central Ethiopia, and Southern Ethiopia, female-headed households were more engaged. In Tigray, male- and female-headed households showed almost equal engagement.

Table 1 Home Garden host farmers across *woredas*

Region	*Woreda*	Male	Female	Total	Adult (.35) years (%)	Youth ≤35 years (%)
Amhara	Angot	54	40	94	61 (64.9)	33 (35.1)
	Gazo	47	12	59	39 (66.1)	20 (33.9)
	Yilmana Densa	81	60	141	107 (75.9)	34 (24.1)
	Ziquala	6	26	32	26 (81.3)	6 (18.8)
	Total	188	138	326	233 (71.5)	93 (28.5)
Oromia	Babile	35	49	84	47 (56.0)	37 (44)
	Haramaya	35	56	91	51 (56.0)	40 (44)
	Kersa	15	62	77	39 (50.0)	38 (49.4)
	Kofle	46	33	79	32 (40.5)	47 (59.4)
	Sire	62	65	127	82 (64.6)	45 (35.4)
	Wolmera	38	7	45	33 (73.3)	12 (26.7)
	Total	231	272	503	284 (56.5)	219 (43.5)
Central Ethiopia	Gumer	83	78	161	102 (63.4)	59 (36.6)
	Silti	41	59	100	47 (47.0)	53 (53)
	Total	124	137	261	149 (57.1)	112 (42.9)
Southern Ethiopia	Boloso Bombe	27	64	91	64 (70.3)	27 (29.7)
Tigray	Atsibi	17	3	20	16 (80.0)	4 (20)
	Enderta	12	6	18	8 (44.4)	10 (55.6)
	Tsaeda Emba	11	9	20	17 (85.0)	3 (15)
	Total	40	18	58	41 (70.6)	17 (29.3)
	Total	610	629	1239	771 (62.2)	468 (37.8)

The implementing partners consisted of national and regional agricultural research centres and universities, with each institution responsible for guiding intervention activities, training farmers, and providing technical backstopping (Table 2). The pilot implementation was supported by the RAISE-FS (inter)national and regional teams.

Table 2 Implementing partners and coverages

Region	Implementing partners	*Woredas*	Food system typology	# of *kebeles*	# of host farmers
Oromia	Haramaya university	Kersa, Babile and Haramaya	Food insecure	12	252
	Melkassa ARC	Sire	Food insecure	4	127
	Holeta ARC	Welmera	Food secure	8	45
	Kulumsa ARC	Kofale	Food secure	4	79
Central Ethiopia	Worabe ARC	Gumer	Food secure	2	161
	Worabe ARC	Silti	Food insecure	4	98
South Ethiopia	Areka ARC	Boloso Bombe	Food insecure	4	91
Amhara	Adet ARC	Yilmana Densa	Food secure	4	141
	Sirinka ARC	Angot and Gazo	Food insecure	5	153
	Sekota ARC	Ziquala	Food insecure	2	32
Tigray	Tigray ARI	Tesad amba, Atsibi, Enderta	Food insecure	6	60
Total	10	16	2	55	1239

In addition, *woreda* and kebele level stakeholders such as the agriculture, health, women, children, and social affairs office, and community level actors such as kebele administration and influential persons were actively engaged from the pre-intervention phase through to the final implementation. All stakeholders participated according to their organisational roles and responsibilities, contributing to technical, operational, and social support, as well as financial and material inputs. Their engagement ensured ownership, effective implementation, and the sustainability of home gardening activities. These stakeholders have strong potential to drive sustainable transformation, as many are government officials helps to integrate and scale the pilot interventions within ongoing government initiatives.

2.3 Farmer participation structure

A two-tier farmer engagement model was used consisting of: host farmers, who were directly supported with inputs, training, and home garden establishment materials, and follower farmers, who participated through farmer-to-farmer learning facilitated by implementing institutions, *woreda* and *kebele* levels stakeholders and extension agents. In total, the project engaged 1,239 host farmers and 1,681 follower farmers, representing a combined outreach of 2,920 farmers across regions. Host farmers served as local demonstration points within their respective *kebeles*, while follower farmers replicated practices through participatory learning.

2.4 Monitoring, data source and analysis

Data collection and evidence generation were central for assessing the effectiveness, efficiency, and sustainability of the home garden intervention from a food systems perspective. Producing credible evidence was also essential for informing decision-making and guiding future scaling. In collaboration with implementing partners, a harmonised monthly and annual data collection tool was used. Complementary qualitative data and stories of change were also gathered from host farmers. All partners consistently used the standardised formats to collect detailed monthly data on home garden performance and implementation progress. In addition, this paper draws on qualitative data from an end line assessment conducted through focus group discussions (FGDs) with all implementing partners and host farmers to evaluate the implementation process, particularly in the SBCC pilot areas. The data were analysed using descriptive statistics. Frequencies (numbers), mean, and percentages were used to summarize the quantitative data and were presented in tables, bar charts, and pie charts. Qualitative data were analysed thematically and illustrated using representative quotes from participants.

3 Implementation pathway

In collaboration with the implementing partners, the intervention conceptual framework was developed based on findings of the baseline (Abate & Schaap, 2022; 2025) and rapid food system appraisal (Snel et al., 2022). The design process followed a structured sequence of steps, including: identifying key food system challenges, leverage points; defining potential intervention options; establishing targeted food system outcomes (both primary and secondary); strengthening activities and interventions across these outcomes; assessing possible trade-offs and associated risks; formulating key learning questions; and determining appropriate indicators and measuring methods. For details of the home garden pathway (see Annex 1 for detail).

Figure 1 Intervention outcome pathway

3.1 Layout and design

Home gardens were established using different designs, including flat beds, keyhole gardens, and vertical gardens, depending on land availability. Examples of these home garden designs are provided in the home gardens experience paper (Alemayehu et al., 2025). Promote low-cost, locally adapted, and environmentally friendly production practices, including the use of natural pest control methods.

Figure 2 Performance of vegetables in Kofele (left), fruit in Boloso Bombe(centre) and vegetable in Tigary (right) using flatbed home garden design

3.2 Input acquisition and crop selection

Home garden interventions prioritized the production of diverse, nutrient-dense vegetables and fruits to improve household access to micronutrient-rich foods. Crop selection was guided by expert recommendations and adapted to local agro-ecological conditions and included mainly leafy vegetables along with other fruits and vegetables. Farmers were supported with initial planting materials, followed by sustainable seed access through local sources. Continuous technical support was provided by extension agents and research partners to strengthen production and management practices.

3.3 Capacity building

Strengthening the knowledge and capacity of stakeholders and host farmers to understand local food-system interlinkages is essential for transforming Ethiopia's food system. Recognizing that increasing vegetable and fruit supply through home gardening does not automatically translate into improved consumption or healthier dietary behaviour, a capacity-building–first approach was adopted. The project initially trained its implementing partners, who then cascaded the learning to local stakeholders and targeted farmers through structured training sessions.

Host farmers and their spouses, follower farmers, and invited local actors participated in workshops, demonstrations, and field visits designed to build practical skills and deepen understanding. The training covered sustainable home garden production, healthy diets, food hygiene, and gender sensitisation, all nutrition-related messages were guided by the Ethiopian Food-Based Dietary Guidelines (EFBDG).Social Behaviour change communication (SBCC) approaches aligned with the EFBDG were implemented in the SBCC pilot areas through locally translated posters (available at https://raise-fs.org/others/) and community discussion sessions. These approaches aimed to improve farmers' nutrition knowledge and promote healthier dietary practices. In addition, social analysis and action (SAA) approaches were implemented in selected *woreda*s, using home gardens as a leverage point to facilitate dialogue, address social norms, and support positive behaviour change. Cross-cutting themes including gender equality, women and youth empowerment, joint decision-making, sustainability, and evidence documentation were integrated throughout the sessions. The training sessions were designed from a food systems perspective to strengthen the linkage between diversified food production, safe food preparation and consumption (including cooking demonstration), improved household nutrition, and women's empowerment. The integrated nature of the training aimed to promote sustainable home garden production and utilisation while enhancing nutrition knowledge, food safety practices, equitable household participation, and long-term dietary behaviour change. The target audience of the training was farmers with spouses, follower farmers and various-level key responsible stakeholders (Figure 3) such as researchers, *woreda* experts, *kebele* DA and health extension workers.

Beyond theoretical training, host farmers received hands-on training in sustainable production techniques and took part in participatory cooking demonstrations. These sessions aimed to strengthen community knowledge on healthy food preparation, with emphasis on methods that preserve micronutrients and enhance dietary diversity. The demonstrations also promoted better utilisation of home-produced foods by showcasing diverse, nutritious recipes prepared from home-grown vegetables and other food groups.

A total of 3,290 farmers (1,608 men and 1,682 women) including host farmers, their spouses, and follower farmers across all regions participated in the training sessions. In addition, 473 local stakeholders were trained. Overall, participation was nearly gender-balanced across regions, with men and women having almost equal access to the training opportunities. In Oromia and Amhara participation was notably higher with Oromia recording the largest number of trainees. In contrast Boloso Bombe and Tigray showed lower participation levels. The reduced turnout in Tigray is largely attributed to the delayed start of activities, while in Boloso Bombe it reflects the smaller number of host farmers included in the intervention.

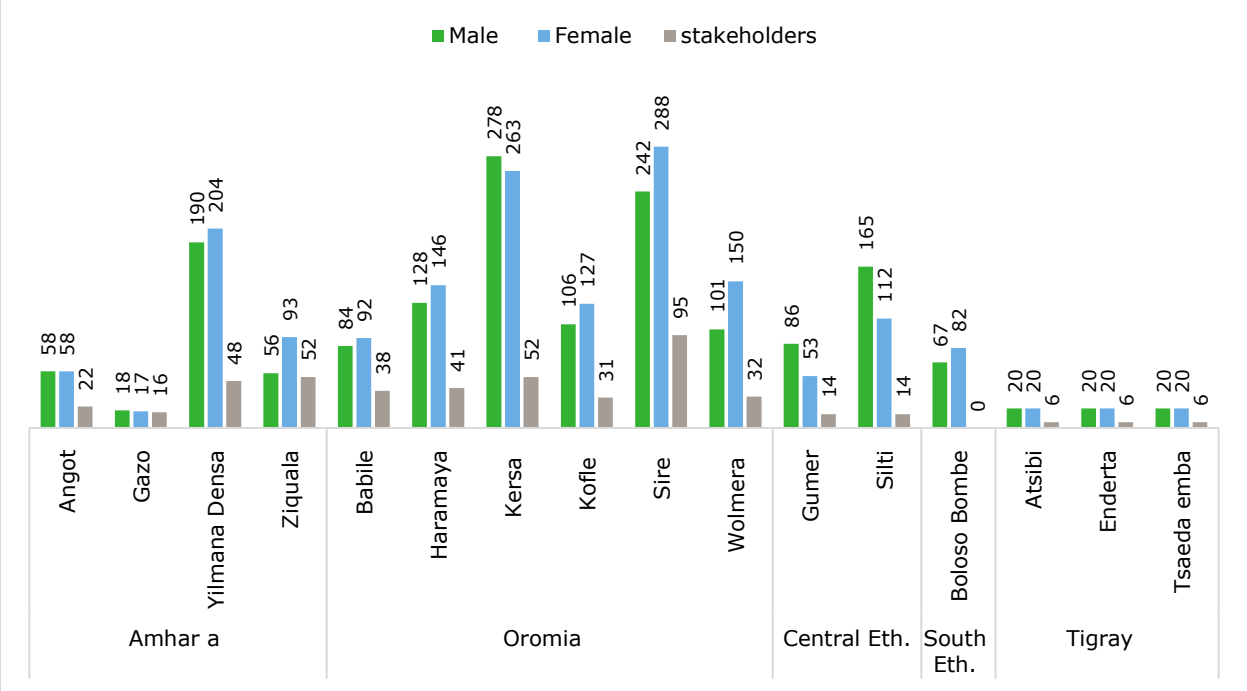

Figure 4 training participants across the woredas (2022 – 2025)

Field days allowed participants to observe the performance of home garden crops such as diversity, productivity, soil health improvements, and management practices, under actual local conditions. Besides it created a platform for host farmers to share experiences, challenges, and solutions with follower farmers and stakeholders like *woreda* experts and development agents that helping them support institutionalization and integration into local plans. Figure 4 indicates the number of participants engaged in the field day activities across implementation *woredas*.

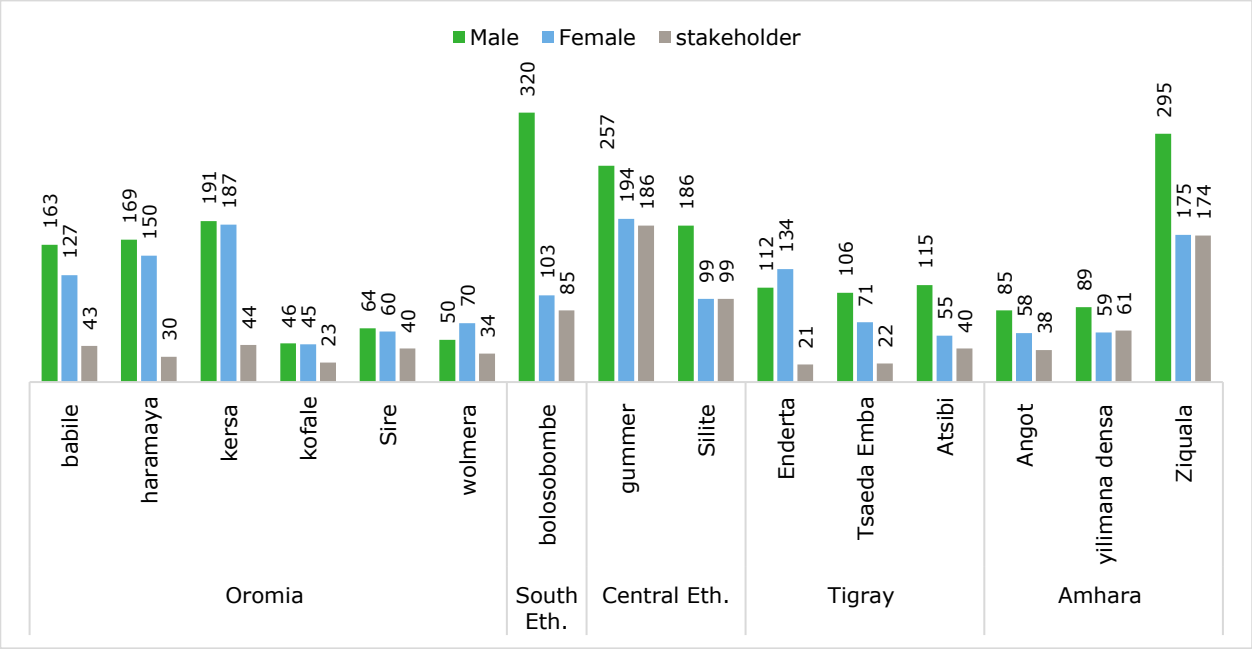

Figure 3 Field days participants across regions

In Tigray, six home gardening field days were held across three woredas between 2024 and 2025 engaging 593 participants. In Amhara, over a period of three years (2023–2025), field day events engaged a total of 761 farmers (469 men & 292 women), and 273 stakeholders. In Oromia, 1,536 participants took part across six woredas, including 683 men, 639 women, and 214 stakeholders. In Central Ethiopia, field days reached 443 male farmers, 293 female farmers, and 285 stakeholders, while in South Ethiopia, 320 men and 103 women participated. Across all regions, women's participation remained consistently lower than that of men.

Figure 5 Field day event participants in Welmera (left) and Yilmana Densa (right)

3.4 Consolidation and sustainability effort

To ensure consolidation and long-term sustainability, the intervention began with extensive engagement of key stakeholders and strengthened collaboration across research, agriculture, and health sectors particularly frontline actors such as development agents and health extension workers, who provided continuous support and follow-up Kebele administrations and influential community members were actively involved in field days, cooking demonstrations, and training. Host-farmer training applied a couple-based approach to reinforce joint decision making on food production, purchasing, and consumption, while promoting equitable access to information. After awareness-raising about the importance of home garden vegetables and diversified food consumption, host farmers were encouraged to continue the practices independently, with the technical support and follow-up as needed. They were also tasked with supporting follower farmers through peer learning and community events. The project also facilitated linkages between seed suppliers and host farmers, and in some woredas piloted seedling businesses were established to improve seed access and support the long-term sustainability. Experience-sharing events further contributed to scaling and institutionalization the home garden initiative across communities.

4 Results

4.1 Home garden vegetable and fruit production practices

Home garden production systems across the assessed *woredas* demonstrate a diverse mix of vegetables, traditional gardening practices, and varying levels of pest and disease management practices. Although each *woreda*'s agroecological context differs, several common patterns were observed (Table 3).

4.1.1 Vegetables grown

Vegetables grown by the host farmers in the study *woredas* varies across most *woredas*, with households growing between three and eight vegetable types. Common vegetables include carrot, beetroot, Swiss chard, kale, and lettuce, while some *woredas* incorporate fruit species such as papaya**,** banana, and moringa, indicating a multipurpose garden system. *Woredas* such as Sire and Boloso Bombe grown more diverse crops due to the incorporation of vegetables and fruit trees.

4.1.2 Garden design and layout

Home gardens are typically established as simple 100 m² plots using raised beds, which improve drainage, soil structure, and root development. *Woredas* such as Kersa, Babile, Haramaya, and Boloso Bombe incorporate keyhole gardens, vertical gardens, and flat beds, demonstrating adaptability to space and moisture constraints. In Sire, farmers use keyhole gardening combined with fruit seedling pits to enhance moisture retention and support perennial crops. This diversity of garden designs reflects local innovations and adaptability to ecological and household resource limitations.

4.1.3 Fertilizer use

Across *woredas*, the most commonly used fertilizers are farmyard manure and compost, highlighting a strong reliance on organic nutrient sources. Some *woredas*, such as Yilmana Densa, integrated both organic and chemical fertilizers. It is evident that, this practices of the use of organic fertilizers in home gardening support soil health improvement, moisture-holding capacity, and long-term fertility, aligning with sustainable home garden management principles.

4.1.4 Pest and disease management approaches

Pest and disease management varied significantly across the *woredas*. These practices include, traditional practices, such as hand-picking infested plants, in Kofele**,** Yilmana Densa, and *woredas* in Tigray region. Organic pest control methods, including ash and plant-based mixtures, are used in Wolmera, contributing to the popularity of organically grown vegetables among local buyers. Integrated Pest Management (IPM) is the dominant method in more *woredas* such as Sire, Gumer, Silte, Boloso Bombe, Angot, and Gazo. IPM practices included: crop rotation, using healthy seed, weed management, deep ploughing, maintaining soil health, monitoring pest populations. This indicates an improved understanding of ecological pest control systems by the households in these *woredas*. Generally, it is observed that, the use of organic fertilizers and IPM suggests progress toward regenerative and sustainable home gardening practices. Farmers in some *woredas* have adapted

innovative garden designs, particularly keyhole gardens, which help address water scarcity. Organic pest-control methods have resulted in market recognition in areas such as Wolmera.

4.1.5 Vegetable and fruit seed/seedling supply

Across all home garden implementation *woredas*, the project supplied vegetable seeds and fruit seedlings to participating farmers. This initial support was based on the assumption that once farmers recognized the nutritional, health, and economic benefits of home garden practices, they would sustain the activity independently. To enhance long-term access, efforts were made to organize farmers into savings groups, enabling them to collectively purchase seeds and seedlings. These groups were further linked with local vegetable seed suppliers to strengthen supply chains and improve continuity of input availability.

Table 1 Home garden innovation intervention practiced across woredas

Woreda	Vegetables grown	Garden design & layout	Fertilizer used	Pest & disease management
Welmera	Carrot, head cabbage, kale, Swiss chard	Simple A 100 m² plot; raised bed production techniques	Farmyard manure	Use of ash, neem extracts, pepper, garlic, onion, and ginger mixtures.
Kofele	Carrot, beetroot, Ethiopian kale, lettuce, Swiss chard	A 100 m² plot; raised bed production	Farmyard manure and compost	Traditional hand-picking of insects.
Kersa, Babile & Haramaya	Swiss chard, beetroot, carrot, perennial kale, cauliflower	50–100 m² home gardens including flatbeds, keyhole, and vertical garden models	Compost	Traditional pest and disease management practices.
Sire	Kale, amaranths, pak choi, carrot, beetroot, Swiss chard, banana, papaya	Non-replicated plots of various sizes up to 100 m²; keyhole gardens for moisture conservation; pits prepared for fruit seedlings	Compost	use of healthy seed, crop rotation, weed management, pest monitoring, deep ploughing, and consideration of previous crop history.
Gumer	Cauliflower, Swiss chard, lettuce, carrot, beetroot	A 100 m² plot; raised bed production	Farmyard manure	healthy seed selection, crop rotation, weed control, insect and mite management, deep ploughing.
Silte	Swiss chard, lettuce, carrot, beetroot	A 100 m² plot; raised bed production	Farmyard manure	crop rotation, weed management, insect control, deep ploughing, and soil health maintenance.
Boloso Bombe	Papaya, moringa, tomato, Swiss chard, beetroot, carrot	Flat raised beds and keyhole gardens; standard production packages applied; fruit seedling pits prepared	Farmyard manure	healthy seed, rotation, weed management, insect control, deep ploughing, and integrated cultural practices.
Yilmana Densa	Swiss chard, beetroot, carrot	A 100 m² plot; raised bed production	Organic + inorganic fertilizer	Chemical-free approach; regular inspection, hand-picking of infected plants, soil sterilization through sun exposure, and improved soil health.
Angot & Gazo	Head cabbage, beetroot, carrot, Ethiopian kale, Swiss chard	A 100 m² plot; raised bed production	Farmyard manure; full production packages	use of cattle urine, removal of infested leaves, and hand-picking of insects.
Ziquala	Banana, sweet potato, papaya, lettuce, Swiss chard, Ethiopian kale	A 25-30m² plot, raised bed and keyhole production	compost or farmyard manure	Traditional pest and disease management practices.
Tesad Amba, Atsibi & Enderta	Kale, lettuce, beetroot, Swiss chard, carrot	A 100 m² plot; raised bed production	Manure and compost	Integrated Pest Management (IPM) including improved varieties and cultural methods, use of disease free seeds, mechanical and physical control such as hand picking insects, field scouting etc)

4.2 Overview of production status across *woredas*

Home garden vegetable production varied considerably across *woredas* in terms of harvested quantities, harvest frequency, and crop types. Overall, leafy vegetables such as Swiss chard, Ethiopian kale, and pak choi were the most frequently harvested crops, while root vegetables, including carrot and beetroot, showed substantial yield differences across agro-ecological zones. Fruit crops such as papaya and moringa also contributed significantly in Boloso Bombe *woreda*.

4.2.1 Household vegetable and fruit production status

The aim of the project was to use home garden intervention as one mechanism to address household nutrition challenges, though some households produce vegetables beyond home consumption and use for income generation. The results show that, there is a considerable variation among households across *woredas* in terms of production (Table 4). This variation is attributed to the differences among households in their engagement in home gardening, agroecological conditions, access to water source, gardening practices and the full adoption level of the home garden bundles.

Although the target plot size was 100 m², the actual land size may vary among households and *woreda*s due to differences in available space and local conditions. therefore, productivity comparisons should consider land size variation among the implementation *woredas* Boloso Bombe *woreda* recorded the highest average vegetable production per household per month, with households producing about 494.2 kg per month, followed by Yilmana Densa *woreda* with the value of 369.8 kg per month and Gumer *woreda* with a monthly production value of 101.0 kg. These production levels are considerably higher than those produced by households in other implementation *woredas* and this may suggest better access to water sources, stronger implementation support, higher household participation, or favourable environmental conditions for home garden production of these *woredas*. Similarly, Kofale, Angot, Enderta and Wolmera *woredas* also recorded relatively high production, with average value of about 96.4, 92.5, 85.5 and 82.0kg per month.

Besides, moderate vegetable production levels were observed in the *woredas* such as in Babile (57.7 kg/month), Kersa (56.0 kg/month), Haramaya (50.5 kg/month), and Silti *woreda* (48.1kg/month). These results suggest that households in these *woredas* were able to produce the amount of vegetables that could meaningfully contribute to the household level food consumption and dietary diversification. Thus, the production obtained in these *woredas* indicates the potential of home garden interventions to improve the availability of nutrient-rich foods at the household level. Conversely, lower average production levels per week were observed in *woredas* such as Gazo (42.6 kg), Sire (42.1 kg), and Tsedamba (34.1 kg). The lowest production level was recorded in Ziquala and Atsbi *woredas*, where households produced on average only 28.3 and 21.1 kg of vegetables per month respectively. This low production levels in these particular *woredas* may indicate home garden production challenges faced in the *woreda* such as water scarcity, limited land availability, inadequate agricultural inputs supply, less extension support, or lower adoption of home garden production bundles.

Vegetable production per month by households across different intervention *woredas* disaggregated by vegetable types, is presented in Annex 2.

Table 2 Household fruit and vegetable production per month

S.N	*Woreda*	kg/month*
1	Kofale	96.4
2	Wolmera	82.0
3	Kersa	56.0
4	Babile	57.7
5	Haramaya	50.5
6	Sire	42.1
7	Gumer	101.0
8	Silte	48.1
9	Boloso Bombe	494.2
10	Yilmana Densa	369.8
11	Angot	92.5
12	Gazo	42.6
13	Ziquala	28.3
14	Tesad Amba,	34.1
15	Atsibi	21.1
16	Enderta	85.5

**Estimated standardized vegetable quantities were converted into kilograms (kg) using predefined local conversion factors: 4 bundles (chibit) equivalent to 1 kg, 10 carrot roots equivalent to 1 kg, 6 beetroot roots equivalent to 1 kg, and 2 cabbage heads equivalent to 1 kg.*

4.2.2 Household fruit and vegetable harvesting and consumption frequencies

Household vegetable harvesting and consumption frequencies varied across intervention *woredas* and regions, although overall patterns indicate relatively frequent production and utilization of leafy vegetables (Table 5). Across the intervention areas, the average vegetable harvesting frequency ranged from two to four times per week, while household consumption frequency ranged from three to five times per week. In most *woredas*, harvesting occurred approximately three times per week, suggesting a relatively stable supply of vegetables at household level. The results indicate variations in the frequency with which households harvested and consumed fruits and vegetables, reflecting differences in home garden productivity, crop diversity, seasonal availability, and household dietary practices across the intervention areas.

With regard to fruits (banana and papaya), only selected *woredas* reported measurable harvesting and consumption frequencies. In Amhara region, Ziquala *woreda* recorded an average fruit harvesting frequency of 2 times per month and a consumption frequency of 4 times per month. Similarly, in the Oromia region, Haramaya *woreda* reported an average fruit harvesting frequency of 2 times per month and a relatively high consumption frequency of 5 times per month. In South Ethiopia region, the Boloso Bombe *woreda* recorded fruit harvesting and consumption frequencies of 2 and 3 times per month, respectively. The higher consumption frequencies compared to harvesting frequencies in some *woredas* may indicate that households supplemented home-produced fruits with purchases or sharing from nearby sources.

In the Amhara region, households in Angot, Gazo, and Yilmana Densa harvested vegetables three times per week, while Ziquala reported a lower harvesting frequency of two times per week. Despite similar harvesting patterns, consumption frequency differed across *woredas*, with Gazo and Yilmana Densa reporting higher consumption (four times per week) than Angot and Ziquala (three times per week), indicating possible variation in household utilization practices or alternative vegetable sources.

In Central Ethiopia, households demonstrated comparatively stronger production and consumption performance. Silti recorded the highest harvesting frequency among all intervention *woredas* (four times per

week) and maintained a high consumption frequency (four times per week). Similarly, Gumer households harvested vegetables three times per week and consumed them four times weekly. This pattern suggests relatively close alignment between production and household dietary use.

Among the intervention *woredas* in Oromia, harvesting frequency remained largely consistent at three times per week, except in Welmera where harvesting occurred twice weekly. However, consumption frequency showed greater variation. Haramaya exhibited the highest vegetable consumption frequency across all study *woredas* (five times per week) despite harvesting vegetables three times weekly, which may suggest more efficient household utilization, market access, or additional sources of vegetables. Kersa, Kofale, and Sire each reported consumption frequencies of four times per week, while Babile showed comparatively lower consumption (three times per week).

In Southern Ethiopia, Boloso Bombe showed balanced harvesting and consumption practices, with vegetables harvested three times and consumed four times per week, indicating regular integration of vegetables into household diets.

Compared with other regions, Tigray exhibited relatively lower harvesting and consumption frequencies. Atsbi and Tsaeda Emba reported harvesting twice weekly and consuming vegetables three times weekly, while Enderta demonstrated slightly better performance with harvesting and consumption frequencies of three and four times per week, respectively.

The findings indicate that although vegetable harvesting frequencies were relatively similar across most intervention *woredas*, household consumption frequencies varied more substantially. *Woredas* such as Haramaya and Silti demonstrated comparatively stronger vegetable consumption patterns, whereas Ziquala, Atsbi, and Tsaeda Emba showed lower harvesting and consumption frequencies. Overall, the results suggest that the home garden intervention contributed to improving the availability and utilization of fruits and vegetables among participating households. Vegetable harvesting and consumption frequencies were generally higher than those of fruits, likely due to the shorter production cycles and easier cultivation of vegetables in home garden settings. However, the variations observed across regions and *woredas* highlight the importance of strengthening context-specific support, including access to water, quality inputs, nutrition education, and technical assistance, to enhance year-round production and regular consumption of nutrient-rich foods.

Table 3 Household fruit and vegetable harvesting and consumption frequencies

Region	*Woreda*	Fruits		Vegetables	
		Average harvesting frequency per month	Average consumption frequency per month	Average harvesting frequency per week (leafy vegetables)	Average consumption frequency per week
Amhara	Angot			3	3
	Gazo			3	4
	Yilmana Densa			3	4
	Ziquala	2.3	3.6	2	3
Central Ethiopia	Gumer			3	4
	Silti			4	4
Oromia	Babile			3	3
	Haramaya	2	5	3	5
	Kersa			3	4
	Kofele			3	4
	Sire			3	4
	Wolmera			2	4
Southern Ethiopia	Boloso Bombe	1.8	2.6	3	4
Tigray	Atsbi			2	3
	Enderta			3	4
	Tsaeda emba			2	3

4.3 Knowledge, Attitude and Practices enhanced

4.3.1 Enhanced home gardening production

The host farmers' gardens were previously not used for the production of vegetables and fruits; instead, they were largely overgrown with various weed species or left for animal grazing. Although a few farmers had cultivated one or two types of vegetables, production was generally minimal and seasonal. This limited practice exposed households to food gaps and shortages during certain periods of the year and also increased their reliance on starchy staple foods.

However, following the pilot interventions, including training on sustainable home gardening practices the situation changed significantly. Table 3 shows that farmers across each region produced 3–5 different types of vegetables. In addition to the host farmers who directly benefited from the intervention, other farmers referred to as followers, also gained substantial knowledge and improved their practices and attitudes toward home garden production and utilization. Many of these farmers reported that they voluntarily adopted the pilot practices in their own backyards and experienced similar benefits.

4.3.2 Improved knowledge and dietary diversity practices

Across all regions, the behavioural change communication-related interventions, especially posters and monthly session interventions, positively contributed to dietary behaviour changes at the household level. Participants mentioned improved ability to identify different food groups and a noticeable increase in the consumption of vegetables and other locally available, diverse foods. Farmers also indicated that households increasingly incorporated multiple food groups into their daily meals using produce from their own farms, while also purchasing some nutrient-dense foods from the market to improve dietary diversity.

In Central Ethiopia, one host household reported remarkable behavioural and social improvements attributed to the home garden intervention. She described gaining a stronger understanding of diversified vegetable production systems and beginning to incorporate a wider variety of vegetables and food groups into daily meals, prioritising household consumption before selling surplus produce. She also noted increased income from selling vegetables, strengthened social bonds through sharing produce with neighbours, and enhanced women's participation in household decision making. Positive changes were also observed in childcare practices and intra household food distribution, including the shift toward eating meals together as a family. Additional evidence supporting these changes has been documented and is available on the project website look https://www.youtube.com/watch?v=QJS82B_7jeM&t=2s,for

Similarly, in Angot *woreda* of the Amhara region, participants reported earning meaningful income from surplus home garden production, which enabled them to purchase additional nutrient-dense foods. They also noted that daily vegetable consumption has now become a norm, and sharing produce with neighbours has strengthened social ties. Before the intervention, they neither intentionally produced nor regularly consumed vegetables; however, one participant explained that she now grows and eats a variety of vegetables and actively encourages her neighbours to do the same

4.3.3 Improved cooking practice and food hygiene

Cooking demonstrations and food hygiene training played a critical role in improving farmers' knowledge, attitudes, and practices. These practical sessions enabled households to better utilize the vegetables produced in their home gardens, promoting safer food handling and more diverse, nutrient-rich diets. The

cooking demonstration sessions included all six food groups indicated in EFBDG, with a strong emphasis on vegetable-based recipes. A total of 41 cooking demonstration sessions were organised across the region (Oromia 22, Amhara 5, Tigray 6, Central Ethiopia 7 and South Ethiopia 1) with the engagement of host farmers, follower farmers and the various level stakeholders from the research, university, project staff, *woreda* and *kebele* level responsible persons.

As a result, measurable improvements in household dietary practices were observed across all intervention *woredas* of the regions. These patterns reflect increased familiarity with vegetable-based meals and improved confidence in preparing them. This indicates not only improved access but also enhanced utilization of vegetables in daily meals, supported by better knowledge of preparation and preservation utilisation.

The qualitative findings from targeted *woredas* show clear shifts in food preparation practices and dietary behaviour among host farmers. Participants reported improved vegetable cooking techniques, particularly shorter cooking times that help preserve nutrients. There were also changes in dietary habits, eating diversified food in their home, start focusing consumption of nutrient-dense food instead of selling, including reduced salt use during cooking. Importantly, farmers described increased acceptance and consumption of previously underutilised or non-consumed vegetables.

In Sire *woreda*, amaranth leaves have become more commonly integrated into household meals. In Tigray and central Ethiopia, farmers reported increased use of beetroot and orange-fleshed sweet potato leaves. In Southern Ethiopia, moringa leaves are increasingly consumed as part of regular diets. These changes reflect not only improved knowledge but also practical adoption of nutrition-sensitive behaviour promoted through the intervention.

Figure 6 Cooking demonstration training Welmera (left), food preparation from vegetables at kofele (centre), and Tigray (right)

4.4 Gender decision-making & social dynamics changed

The household-level decision-making on production, marketing of surplus home garden products, income control of the income generated from the surplus sale, and household consumption is presented in Table 6. The majority of the decisions for those factors was dominated by men and women while the contribution of youth (boys and girls) in the household decision making is minimal. The household home garden production decision making was dominated by men (51%) with considerable contribution of women (42%) in most of the *woredas* where the intervention was conducted. However, there are cases like in Sire (Oromia region) and *woredas* in Tigray (Atsibi, Tsada Emba & Enderta) production was decided majorly by women with considerable involvement of men. The other decision factors were dominated by women with average magnitude difference between women and men, respectively, for marketing (59 vs 35%), income control (58 vs 39%), and consumption (69 Vs 25%). The contribution of youth (both girls and boys) was low with magnitude of 5.6%, 4.6%, and 8.5% for marketing, income control, and consumption, respectively.

The result presented above was also reflected by the partners during the end line discussion (from Tsada Emba, Yilmana Densa, and Gumer *woreda* discussions). Stakeholders in home garden intervention *woredas* reported shifts toward more equitable household roles, shared decision-making, and inclusive participation in home gardening and nutrition-sensitive practices. According to partners focused group discussion (FGD), men and women increasingly made joint decisions on what to plant, consume, sell and use of income at the household level. The social relationships within households strengthened, with couples reporting improved interaction and mutual respect, that led greater confidence to work together and make equal decisions on household priorities, particularly those related to healthy diets production and consumption.

The home garden production is labour intensive undertaking that involves multiple sequential tasks including land preparation, obtaining seed, planting, weeding, soil cultivation, harvesting, transporting, and whenever there is surplus-marketing. Cultivation, in home garden context, means the physical act of loosening soil for aeration, water percolation and weed control. The result of the data captured during 2023 across all the project intervention regions and home garden innovation *woredas* indicated that tasks including land preparation, seed obtaining, and planting takes, on average, less than an hour, because they are one-time operations across the growing seasons. The remaining tasks (weeding, cultivation, harvesting, transporting and marketing) used more average hours since they are repeatedly practiced (Figure 7).

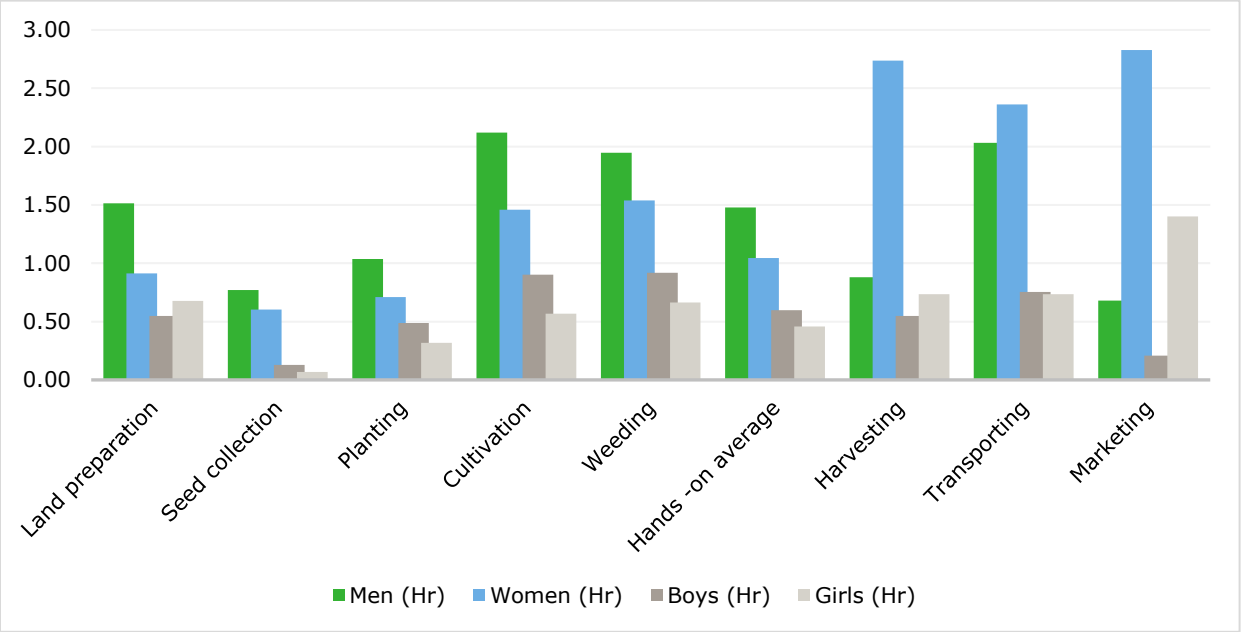

Figure 7 Labour distribution of the home garden tasks across household members in hours

The labour distribution across family members (men, women, boys, and girls) was further disaggregated to see what home garden activity tasks are concentrated on whom, and its implications for productivity, equity, and household members wellbeing. When considering overall home garden activity tasks, on average, women contributes 39%, followed by women (33%), girls (15%), and boys (13%). A closer look at the implementing institutions shows that there is difference in scenario from *woreda* to *woreda* (Figure 10). Majority of the tasks are handled by men in Adet, Sirinka, Sekota, Melkasa, Haramaya, and Areka, while at Holeta and Worabe women were the major actors. However, the hand-on works including land preparation, obtaining seed, planting, cultivation, and weeding were priorly by men (41%) followed by women (29%), boys (17%) and girls (15%) (Figure 9). The easy-to-perform tasks (harvesting, transporting and marketing) were handled by women, men, girls, and boys with proportion of 50%, 23%, 18%, and 9%, respectively. No marketing task was recorded at Sekota and Melkasa may indicate either the host totally consumed what they produced or the amount produced was not sufficient for market beyond consumption (Annex 3). Marketing was dominantly handled by women in Adet, Sirinka, Holeta, Haremaya and Worabe.

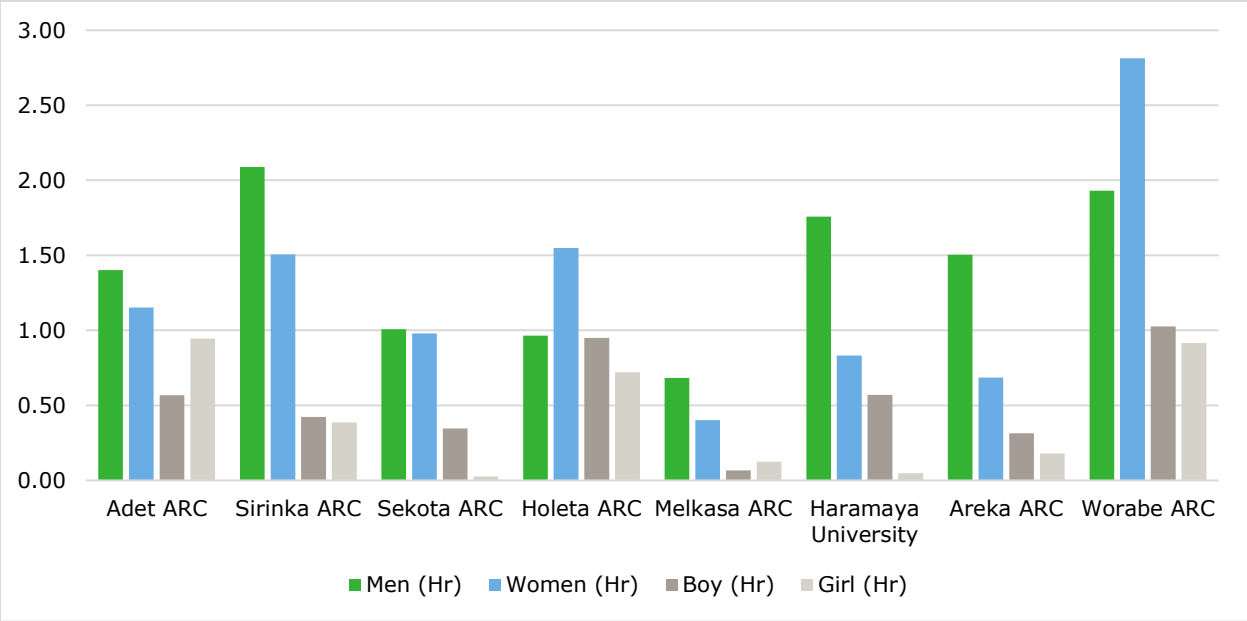

Figure 8 Labour distribution of different implementing institutions (woredas) across household members

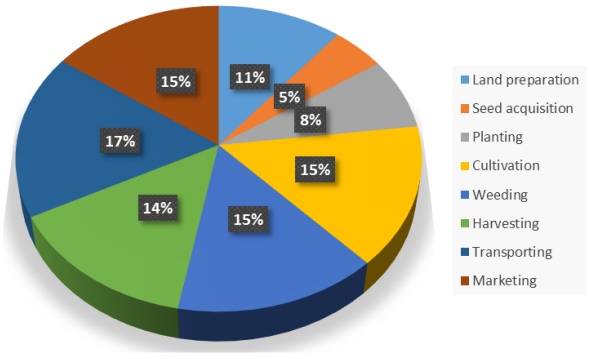

Figure 9 The proportion of average time (hour) used to perform home garden activities across regions in Ethiopia

Table 4 The decision-making score (average %) for production, marketing, income control and consumption at HH level across *woredas*

Region	*Woreda*	Production				Marketing				Income control				Consumption			
		Men	Women	Boys	Girls	Men	Women	Boys	Girls	Men	Women	Boys	Girls	Men	Women	Boys	Girls
Amhara	Angot	50.71	39.86	7.08	2.36	33.5	59.7	3.9	2.9	36.9	60.0	2.6	1.6	21.5	74.3	2.2	3.4
	Gazo	45.16	48.39	2.82	3.63	32.9	63.9	1.4	1.9	36.6	61.6	0.0	2.6	20.0	74.6	2.2	4.9
	Yilmana Densa	45.09	52.68	1.64	0.60	38.2	58.2	2.4	1.2	37.9	58.0	1.6	2.4	27.2	68.7	2.6	1.5
	Ziquala	50.00	50.00	0.00	0.00	51.5	48.5	0.0	0.0	51.5	48.5	0.0	0.0	55.9	44.1	0.0	0.0
Central Ethiopia	Gumer	49.05	41.93	7.12	1.90	37.2	57.8	3.0	2.1	36.1	58.7	3.1	2.3	16.2	74.8	1.7	7.7
	Silti	71.22	19.77	8.43	0.58	63.1	30.2	5.5	1.2	65.1	28.2	5.9	0.9	45.9	45.1	3.5	5.6
Oromia	Babile	63.46	36.54	0.00	0.00	39.0	61.0	0.0	0.0	42.7	55.2	2.1	0.0	19.0	80.0	0.0	1.0
	Haramaya	64.84	32.03	3.13	0.00	46.8	50.0	3.2	0.0	44.4	52.4	3.2	0.0	21.0	75.0	3.2	0.8
	Kersa	68.75	31.25	0.00	0.00	42.5	57.5	0.0	0.0	47.5	52.5	0.0	0.0	26.4	73.6	0.0	0.0
	Kofele	45.00	43.44	6.56	5.00	33.8	55.3	5.0	5.9	42.7	51.9	9.4	8.0	32.3	63.3	14.2	15.6
	Sire	45.38	48.74	4.41	1.47	43.7	51.3	3.6	1.5	47.4	51.9	0.7	0.0	32.8	63.6	1.4	3.5
	Welmera	29.55	52.27	9.09	9.09	27.4	60.7	3.6	8.3	31.0	69.0	0.0	0.0	16.7	69.0	0.0	14.3
South Ethiopia	Boloso Bombe	80.29	16.35	3.37	0.00	32.2	62.5	1.9	3.4	50.0	51.0	1.3	1.6	24.5	70.6	0.0	16.7
Tigray	Atsibi	26.19	50.00	19.1	4.76	1.3	88.8	5.0	5.0	10.7	82.1	1.2	6.0	3.6	81.0	9.5	6.0
	Enderta	32.89	64.47	1.32	1.32	14.1	85.9	0.0	0.0	19.1	79.4	0.0	1.5	18.4	77.6	2.6	1.3
	Tsaeda emba	40.00	42.50	7.50	10.00	26.4	55.6	0.0	18.1	23.8	60.0	6.3	10.0	23.8	66.3	3.8	6.3
Grand average		50.97	41.91	5.11	2.01	35.2	59.2	2.4	3.2	39.0	57.5	2.3	2.3	25.3	68.9	2.9	5.5

4.5 Improved household income

The home gardening initiative showed significant improvements in household income generation, alongside its main purpose of enhancing dietary diversity and nutrition within the targeted areas (Table 7). Income from vegetable sales differed by location, due to varying factors such as market accessibility, production levels, land size, and crop choices. The Amhara region achieved the highest earnings from fruit and vegetable sales, totalling approximately 23,982 Ethiopian Birr (ETB), while Oromia followed with around 12,571 ETB; in contrast, the Southern and Tigray regions generated the least income compared to the other regions.

In terms of specific crops, farmers who cultivated fruits like papaya and banana earned higher incomes than those who only produced vegetables, with head cabbage, beetroot, and carrot being the vegetables that generated the most income.

Regarding the income obtained, across all regions the data indicated that the households utilized the income obtained from the home garden mainly for purchasing various food groups they lacked in their home such as crops, such as teff, wheat, beans, maize, chicken, oil and coffee. Similarly, some of the farmers utilized the income for non-food expenses such as purchasing clothes, education material and few of them, especially those that produced fruit, utilized the money for repayment of credit, purchased goat or savings. There were no observed differences between regions for utilization of the income obtained.

Table 5 Income generated surplus of vegetables and fruits across woredas

Regions	***Woreda***	**Incomes per month (ETB)**		**Total income (ETB)**
		Vegetables	**Fruit**	
Amhara	Angot	6059		6059
	Gazo	3131		3131
	Yilmana densa	2232		2232
	Ziquala	3958	8602	12560
	Total			23982
Oromia	Kersa	2105		2105
	Babile	820		820
	Haramaya	1362	300	1662
	Kofele	3781		3781
	Sire	0	0	0
	Wolmera	4203		4203
	Total			12571
Tigray	Atsibi	1269		1269
	Enderta	975		975
	Tsaeda emba	1154		1154
	Total			3395
Southern Ethiopia	Boloso Bombe	700	483	1183
Central Ethiopia	Gummer	2898		2898
	Silit	2479		2479

5 Discussion

5.1 Vegetable production

The finding highlights diversity in crops and garden designs, strong reliance on organic fertilizers**,** adoption of IPM and organic pest control**,** and efforts to strengthen seed supply systems all pointing toward sustainable and regenerative home garden practices**.** The notable increase in vegetable production and harvesting levels observed in certain intervention *woredas* suggest that households in these *woredas* were successfully enhanced the supply of fresh vegetables for their own consumption. This result aligns with research conducted in Ethiopia, which indicated that home garden production systems increase access to varied foods and enhance household nutrition results. The monthly vegetable production data across *woredas* reveals significant disparities in household output, reflecting differences in water access, agro-ecological conditions, household engagement, and adoption of home garden packages. A study carried out in Boru Meda *Kebele*, Ethiopia, revealed that home garden interventions substantially enhanced women's dietary diversity and boosted the production and intake of vegetables and other nutrient-dense foods (Mohammed & Mulat, 2024)

The observed increased in vegetable production in the intervention *woredas* likely contributed to enhanced vegetable consumption within households. It is evident that, vegetables serve as vital sources of key micronutrients, such as vitamin A, iron, folate, zinc, and vitamin C, that are vital for promoting health, boosting immunity, and alleviating micronutrient deficiencies in women and children. The increased frequencies of vegetable consumption noted in these intervention *woredas* indicate that the intervention had a positive impact on household food practices and the use of nutritious foods. Similar findings were also reported by the World Health Organization, which highlights that consistent intake of fruits and vegetables plays a crucial role in preventing micronutrient deficiencies and diseases linked to diet. Study carried out in Ethiopia by Mohammed and Mulat (2024) reported that home garden cultivation greatly enhanced women's dietary variety and boosted household availability of nutrient-rich foods through varied vegetable production systems. Similarly, Mathewos et al. (2018) reported that home gardens focused on fruits and vegetables significantly contribute to enhancing household nutrition, food security, and livelihoods in rural Ethiopia. These findings suggested that a varied diet and higher intake of vegetables and fruits are key indicators of enhanced nutritional quality in Ethiopian households

5.2 Vegetable harvesting and consumption

There are noticeable variations in fruit and vegetable harvesting and consumption frequencies across intervention *woredas* that could be attributed to differences in agroecological conditions, farmers' production capability, access to water and suitable land. Vegetable harvesting and consumption are more frequent and consistent than fruits, reflecting their shorter production cycles and easier cultivation in home garden settings. The contrast between fruits and vegetables underscores that while home gardens effectively improve vegetable availability and dietary diversity, fruit production remains more sporadic. Across most *woredas*, consumption frequencies exceeded harvesting frequencies, likely because households used a single harvest for multiple consumption events. Moreover, the higher consumption frequency, compared to harvesting frequency, may indicate that households relied not only on their own production but also on market purchases, which is in line with the findings of Ogutu et al. (2020) who reported an essential role of market access in fruit and vegetable consumption and dietary diversity. The grand mean frequency of fruit and vegetable consumption in the present intervention (8.8 days per month) was considerably higher than that reported by Mahama et al. (2024), who found that home garden producing households consumed fruit and vegetables only 3 days per month.

The high harvesting frequencies observed in most intervention *woredas* may indicate that households used supplementary irrigation during periods of water scarcity to support year-round production and utilization of crops. Moreover, the high consumption frequency indicates a positive dietary trend or increased dietary diversity, likely reflecting improved awareness or behavioural changes due to the SBCC intervention delivered alongside the home gardening. Several previous studies have proven that small-scale irrigation and

home gardening substantially enhance the availability and consumption of diversified and micronutrient-rich foods (Hirvonen et al., 2017; Blakstad et al., 2021).

5.3 Crop-specific harvesting and consumption

The harvesting and consumption frequencies of vegetables such as Swiss chard, Ethiopian Kale, carrot and beetroot possibly reflect either their potential for repeated harvests or short growth cycles. In Ethiopia, these vegetables were widely promoted by different home gardening programs because of their nutritional content and resilience (FAO, 2020). Considering its nutritional importance, particularly addressing vitamin A deficiency, the presence of orange fleshed sweet potato in several *woredas*, is notable. However, its relatively low harvesting and consumption frequencies suggest that scaling efforts still remain crucial. Swiss chard notably showed consistently high harvesting and consumption frequencies among leaf vegetables because it is a cut-and-come-again crop: its large leaves regrow quickly after harvesting, it tolerates repeated cutting, and it thrives across a wide range of conditions, making it both resilient and productive.

The low production and consumption of fruits observed in the present intervention could reflect the presence of various challenges such as long maturation period and high input requirements, inadequate supply of improved seedlings which aligns with the findings of Ruel et al. (2018) who reported limited fruit consumption, in Sub-Saharan Africa, caused by production constraints. Several other studies have also reported that fruit production and consumption in Sub-Saharan Africa, including Ethiopia remained low because fruit cultivation is constrained by long time required to reach fruiting stage as well as the high skill and input demands related with fruit seedlings production, which discourage smallholder farmers from investing in fruit production (Ayele et al., 2024; Akinnifesi et al., 2007).

5.4 Knowledge, attitude & practices

Across all regions, the host farmers with spouses, follower farmers and various level stakeholder engaged in training sessions, cooking demonstration and field days. The qualitative data informed that nutrition education, field days and cooking demonstrations enhanced nutrition knowledge, cooking and production practices, dietary diversity and women decision making. The integrated intervention bundles were also instrumental in fostering positive consumer behaviour regarding healthy eating (Kachwaha et al., 2024). In addition, these study results are consistent with the findings of several previous studies. A study conducted among women in Ghana showed that BCC approaches improved dietary diversity and increased the consumption of animal source foods (Ludwig-Borycz et al., 2022). Similarly, in Tanzania, women in the intervention group consumed 0.50 more food groups per day compared with the control group (Blakstad et al., 2021). A study conducted in Pakistan also reported that kitchen garden participants had higher knowledge, attitudes, and practices (KAP) compared with non-participants (Shah et al., 2023). Moreover, consistent with the findings of this study, Kachwaha et al. (2024) confirmed that a package of interventions has a greater impact than single interventions. Overall, BCC interventions have been shown to improve knowledge, attitudes, and practices, promote healthy dietary habits, and reduce unhealthy food-related practices. The effect behavioural change communication on nutrition knowledge and dietary diversity among pregnant women resulted in dietary improvement and consumption of nutrient dense food increase of 20.3 % as well as a substantial increase in knowledge, attitude and practices of the targeted group (Tesfaye et al., 2025).

5.5 Decision making and labour distribution

The majority of decision on production was by men due the long-established tradition that most agricultural practices are run by men. However, the increase in the contribution of the women has improved following the intervention indicating possibility of shift towards the balanced joint decision. In those *woredas* where production decision dominated by women was either cultural considering home garden as small productive operation left for women (Tigray) or irrigation practice run mostly by women (Sire *woreda*). Increasing men and women joint decision on what to market, how to utilize the income and what vegetables to consume at household level reflecting a shift toward more inclusive household resource management. The social analysis and action (SAA) approach adopted opened space for household dialogue, mutual support, and women's

empowerment through spouse training further strengthened equal understanding and encouraged families leading to more balanced decision-making, shared workloads, and joint control over production and income. However, the limited involvement of youth (girls & boys) was due to the fact that, they are often viewed as dependents rather than decision makers, as cultural norms reserve important household and agricultural decisions for adults especially parent.

Regarding labour distribution, home gardening tasks are labour intensive that mainly depend on family labour. The tasks including land preparation, maintaining seed and planting took less hours compared to other tasks because they are one-time operations. Harvesting and marketing were dominantly handled by women since the decision making on the sale and income control is mainly by women (also indicated under production decision). One of the repetitive tasks, weeding, was done by hand since the production system is mainly pesticide free.

According to a study conducted in Bangladesh, the homestead vegetable production fits well within women's existing livelihood strategies because it requires minimal land and allows them to flexibly allocate time around household chores without traveling outside the homestead (Patalagsa et al., 2015). Another study in Nepal indicated the involvement of both genders in vegetable production, women generally contribute more labour to home garden management (Adhikari, 2023). This study further noted that income control from the sale of surplus vegetable production is controlled by women in poorer households because, the output was vital for immediate family survival. However, in better-off or medium-wealth category, men held greater access to and control over of the income from the garden production. The time allocation for home garden tasks were also reported elsewhere that physically intense tasks like land preparation (plot clearing, digging, seed bed preparation) are adult men dominated while, older boys are systematically involved (Abebe & Mulu, 2017). Regarding marketing, when the surplus is small, women and girls carry the vegetables to local, village markets and retain control over these small cash amounts, using them directly for immediate household needs like salt, soap, or school supplies (Dinku, 2026).

5.6 Income generation

Even if the main goals of our project home garden intervention focused on household consumption, it was recommended that if there is excess production, households should sell it on the market. The outcome confirmed that the home garden intervention contributed to farmers' income. Selling excess vegetable and fruit production can enhance the financial situation and well-being of local farmers by generating extra income through sales in the local market. This finding highlighted various literature conducted in developing nations, including Ethiopia (Atiso et al., 2020, Prasai et al., 2021). Moreover, the finding shows that the income derived from home gardens was utilized for various food and non-food items. This aligns with other studies, which indicated that this income translated into enhanced purchasing power for food items, education, and other social activities. Hirvonen and Headey (2018) show that homestead gardening economic, or financial benefits are often cited as the reason for continued participation in the activities promoted during the intervention.

6 Challenges and lessons learned

6.1 Implementation and sustainability barriers

According to farmers' responses, the home garden intervention faced several barriers across production, consumption, and market dimensions that affected its sustainability and sustainable impacts.

Production-related challenges:

- Limited access to sufficient water: Inadequate and unreliable irrigation systems constrained year-round vegetable production.
- Limited access to quality seeds: High seed prices, lack of local suppliers, and hybrid varieties hindered seed saving and sustainable production.
- Pest and disease outbreaks: Incidences of tomato and lettuce diseases, papaya seedling damage, and cutworms reduced crop yields.
- Labour shortages: Labour constraints, particularly for watering and harvesting, were common due to the manual nature of irrigation and competing household demands.
- Land constraints and lack of cold storage: Limited land size and the absence of storage facilities restricted production and postharvest handling.
- Weak extension services: Limited technical support and low adoption of full agronomic packages reduced productivity, alongside poor access to improved, stress-tolerant varieties.
- Climate variability: Drought, frost, and weed infestations further undermined crop growth and resilience.
- Financial constraints restricted access to inputs, irrigation equipment, and other tools (e.g., generators, hoes, and watering cans), reducing efficiency and productivity.

Market and consumption related barriers

- Low household income: because of limited income and farmers preferred to sell rather than consume to cover the household expenses, resulted reduced dietary benefits.
- Seasonal price fluctuations and perishability: the limited shelf life of vegetables, combined with market price fluctuations, discouraged the production and frequent consumption of surplus produce, particularly carrots and beetroot.
- Poor market access: The farmers mentioned that in rural areas faced inadequate market access due to limited infrastructure and the absence of cold storage facilities. This challenge reduced market opportunities for both selling and purchasing vegetables.
- Socio-cultural factors: Fasting periods, traditional food preferences, and low awareness of dietary benefits constrained household consumption of vegetables.

Insights from FGDs (qualitative data on SBCC): Participants emphasised the unaffordability and poor quality of vegetable seeds, limited water access, resource constraints, and environmental challenges such as pests, diseases, frost, and drought. They also noted the lack of cooperatives supplying small seed quantities and inadequate technical support, workload at ground level expert support were mentioned, which collectively limit the sustainability of home garden practices.

6.2 Key lessons

From the three-year intervention, the following key issues were identified to inform future sustainability and scaling of the intervention from a food systems perspective.

I. Capacity building and community engagement

- ***Couple-based training***: this approach was improved shared household decision-making and increased family engagement in food production and consumption.
- ***Engagement and collaboration of multiple stakeholders***: Including consultations with influential community members and key actors, enhanced community ownership and intervention effectiveness.
- ***Ground-level expert collaboration***: Crucial for enhancing coordination among frontline experts especially health extension workers and development agents in nutrition-related activities. This collaboration helps address root causes and ensures effective implementation and support for host farmers.
- ***Continuous support and follow-up***: From local experts, alongside integration of research, agriculture, and health sectors, continues follow-up and support was key to achieving expected outcomes.

II. Behaviour changes and knowledge transfer

- ***Behavioural change communication (BCC)****: Vital for improving consumption of nutrient-dense foods and promoting healthy dietary practices with EFBDG key messages.*
- ***Experience sharing events****: Field days and cooking demonstrations significantly influenced community behaviour and facilitated scaling of successful practices.*
- ***Guiding manuals and outcome pathways****: Helped identify key gaps, leverage points, learning questions, risks, and trade-offs, and linked interrelated activities for better data-driven adaptation.*
- ***Develop targeted, farmer friendly communication materials****, such as posters, that are easy to understand and effectively convey key messages*

III. Mainstreaming food system activities

- ***Integration of food system activities****: mainstreaming production, nutrition, gender, market linkages, and preservation technologies with home garden intervention helped address food system outcomes.*
- ***Access to small quantities of quality seeds and seedlings****: it is critical to sustain the home garden intervention after the project support*
- ***Introduction of drought-tolerant crops and improved varieties****: Enhanced resilience and productivity in moisture-limited areas.*
- ***Staggered planting practices****: Enabled farmers to achieve two to three harvests per year, ensuring continuous vegetable availability.*

IV. Outcomes and benefits

- *Home gardening has contributed to multiple benefits, including improved household consumption, income generation, and social cohesion through produce sharing, supporting long-term sustainability.*

7 Conclusion and recommendation

The integrated home garden intervention, framed within a food system perspective, has delivered notable successes in promoting sustainable agricultural production, enhancing the availability and accessibility of vegetables and fruits, increasing dietary diversity, generating income, empowering women, and alleviating food shortages. Over the four years of implementation, the intervention's successes have been supported by an effectively designed implementation pathway, continuous technical and capacity-building support, inclusive targeting, and the combination of theoretical and practical training. Active engagement of diverse stakeholders and inclusive participation of both lead and follower farmers facilitated the adoption of improved home gardening practices. These efforts resulted in tangible improvements vegetable and fruit access, household dietary diversity, knowledge, attitude, and practices on sustainable production and nutrition, and strengthened women's decision-making roles in food consumption and household management. The integration of home gardening alongside capacity-building initiatives has emerged as a transformative approach to shift consumption behaviour and improve nutrition outcomes sustainably. When farmers fully recognise and appreciate the broad benefits that home gardening brings to their families, from nutrition to income generation, they are more motivated and capable of adopting and sustaining these practices independently, guaranteeing lasting positive impacts for communities. To ensure long-term success and scalability as well as year-round production and consumption, sustained institutional collaborations (government, farmers, NGO and the private sector), ongoing support and follow-up mechanisms at ground level, and addressing input supply challenges remain critical.

To ensure long-term sustainability and effective scaling of home garden interventions across different areas, the following key recommendations are suggested:

- ***Strengthen local ownership and institutional support****:* Promote community ownership and embed home garden initiatives within existing agricultural and nutrition systems. Strengthen collaboration among local stakeholders, extension offices, research institutions, government bodies, NGOs, and private sector actors through training, follow-up support, and leadership engagement to ensure long-term sustainability and scaling of home garden practices
- ***Strengthen local input supply system****:* improving farmers' access to diversified, quality, and affordable seeds and seedlings through sustainable business models and stronger linkages among farmers, seed producers, nurseries, input suppliers, and extension services. In addition, improve access to reliable, locally available water sources, such as community groundwater and irrigation supply to support year-round vegetable production,
- ***Opportunities for scaling****:* Scale up successful home garden models to new areas through farmer-to-farmer knowledge exchange**,** demonstration plots, and experience-sharing events are also important component for scaling this intervention. Besides, linking home garden practices with nutrition education, climate-smart agriculture, and efficient water management to enhance resilience and productivity is also important for scaling the home garden intervention. Again, strengthening youth and women-led seedling and vegetable seed production to ensure a sustainable local supply system will also support replication and wider adoption.
- ***Institutionalization and policy integration****:* Mainstreaming home garden interventions into regional and national agricultural, nutrition, and climate resilience strategies is required to sustain the home garden practices. This includes developing supportive policy frameworks and allocating local budget lines to strengthen program continuity.

Generally, the sustainability and future direction of home garden interventions relies on local empowerment, integrated partnerships, institutional alignment, and policy commitment. These elements together will ensure that home garden practices continue to improve household nutrition, income generation, and resilience across diverse agro-ecological and socio-economic contexts. In general, the implementation framework demonstrates a wide geographic reach, strong institutional collaboration, and successful mobilisation of farming communities that established a solid foundation for scaling home garden practices, strengthening local food systems, and enhancing dietary diversity across both food-secure and food-insecure areas. Moreover, the intervention not only improved production practices but also reshaped attitudes and behaviours around diet, cooking, and social engagement. Households moved from minimal, seasonal vegetable use to diverse, nutrition-sensitive, and socially inclusive home garden systems**,** with measurable impacts on dietary diversity, women's empowerment, and community sharing.

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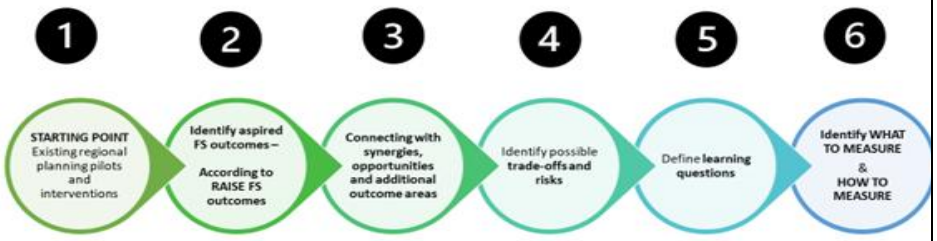
Annexes

Annex 1. Home garden outcome pathway

<table>
<tr><td colspan="2">Harmonized Data Collection: –
towards learning questions for RAISE-FS innovation

Year -round production and consumption of nutrient-dense fruit, vegetables and root crops (Home Gardens)</td><td colspan="2">
</td></tr>
<tr><td>IDENTIFIED FOOD SYSTEM CHALLENGE & LEVERAGE POINTS</td><td>DESCRIPTION OF PROPOSED AND ONGOING INTERVENTION</td><td>ASPIRED FOOD SYSTEM OUTCOMES (Primary and intermediary)</td><td>IDENTIFY POSSIBLE TRADE-OFFS AND RISKS</td></tr>
<tr><td rowspan="2">1. Limited production and consumption of nutrient dense foods
• Limited availability / affordability / accessibility of nutrient dense vegetable and fruits
• Low dietary diversity
• Limited options for livelihood diversification
• Shortage of nutrient dense food throughout the season
• High workload for women</td><td>1. Demonstration of banana, papaya and orange flesh sweet potato (OFSP) for home consumption
2. Year- round production and promotion of consumption for home garden vegetables and fruits

STRENGTHENING ACTIVITIES AND INTERVENTIONS ACROSS OUTCOMES
Production:
1. Supporting local seedling multiplication and distribution (specify seed types)
2. Supporting distributers with technical support to pilot small seed packs
3. Linkages with vegetables seed suppliers
4. Capacity building for year-round and diversified production system through training
Market
Improve market channel for surplus products</td><td>• Improved access, and availability of nutrient dense vegetable, fruit and root crops for household consumption year round
• Improved knowledge on production of diversified ND crops in home gardens
• Improved knowledge of nutrient dense vegetable, fruit and root crops (HH / Kebele level)
• Improved household dietary diversity
• Livelihood diversification
• enhance ability to cope stress (food gap month) /resilience to food shortage
• Improved women and youths' decision making on</td><td>• Health risk due to use of chemicals in home gardens
• From income generated, low quality food products are purchased by farmers
• Losses due to no access to quality seed and chemicals at household
• Increased labour for women and youth
• Income generated is used by other household members (i.e. men)
• Surplus product loss due to limited local market access and storage technologies
•Gender norms are strongly linked to culture and may be hard to change during the project
•Vegetable seed packaging is subject to regulations which may be challenging for small scale seed packing groups to meet.</td></tr>
</table>

• Limited decision-making power for women • Lack of awareness on value of NDF and healthy diets	**Consumption:** 1. Capacity building of the household through training and cooking demonstration 2. SBCC activities to improve dietary knowledge and awareness of NDF at household level 3. Support stakeholder collaboration and engagement at ground level. **Women empowerment** 1. Inclusive targeting of home garden hosts (men and women from different age, sex and social categories I.e. married women, female headed households, young farmers... 2. Promoting engagement of all household members in home garden work (shared roles and benefits in the household) 3. Integrate gender sensitization trainings and gender transformative approaches	income, production, utilization etc	

DEFINE LEARNING QUESTIONS / Does the intervention contribute to:

1. Year -round production NDF at the household?
2. Year- round consumption of nutrient-dense food for households?
3. Reduction of food gap months at household level?
4. Reduced labour burden for women and youth?
5. Change in decision making patterns in household level?
6. Change power relationship in the household
7. Improve knowledge, attitude and practices of healthy diets at the household?
8. Increased income? And to what extent does the intervention influence the amount of control women and you have around decisions on income use.
9. Improve access to knowledge, information, inputs for intervention participants?
10. Resilience in relation to short term food scarcity

Newly identified challenges/ leverage points to ensure sustainability

Annex 2. Household fruit and vegetables productions per month disaggregated by crops

Woreda	Vegetables	Amount of harvest per month in Kg*
Kofele	Carrot	36.7 Kg
	Beetroot	34.2 Kg
	Ethiopian kale	10.2 kg
	Lettuce	6.4 kg
	Swiss chard	9.0 kg
Wolmera	Beetroot	12 kg
	Head cabbage	18.1 kg
	Swiss chard	10.6 kg
	Kale	10 kg
	Ethiopian kale	31.3kg
Kersa	Carrot	7.6kg
	Beetroot	23.2kg
	Swiss chard	10.2kg
	Kale	9.4kg
	Cauliflower	5.6kg
Babile	Carrot	7.8kg
	Beetroot	22.5kg
	Swiss chard	8.3kg
	Kale	10.3kg
	Cauliflower	8.9kg
Maya City	Carrot	6.9kg
	Beetroot	18kg
	Swiss chard	8.9kg
	Kale	7.8kg
	Cauliflower	8.9kg
Sire	Swiss chard	3.5kg
	Kale	3.6kg
	Pak choi	22.5kg
	Amaranths	3.1kg
	Carrot	4kg
	Beet root	4kg
	Ethiopian kale	1.5kg
Gumer	Cauliflower	27kg
	Swiss chard	26.5kg
	Lettuce	15.7kg
	Carrot	20.2kg
	Beetroot	11.7 kg
Silte	Swiss chard	14.7kg
	Lettuce	8.9kg
	Carrot	24.5kg
Boloso Bombe	Papaya	18kg
	Moringa	16.2kg
	Tomato	11.5kg
	Swiss chard	4.27kg
	Lettuce	2.9kg
	Beet root	206.8kg
	Carrot	234.6kg
Yilmana Densa	Swiss chard	324.8kg
	Beetroot	20.9kg
	Carrot	24.2kg
Angot	Head cabbage	48.2kg
	Beetroot	16.6kg
	Carrot	14.7kg
	Ethiopian kale	5.7kg
	Swiss chard	6.6kg
Gazo	Head cabbage	16.8kg
	Beetroot	8.5kg
	Carrot	7.9kg
	Ethiopian kale	4.8kg
	Swiss chard	4.kg
Zequala	Swiss chard	9.1kg
	Lettuce	10kg
	Kale	9.2kg
Tesad Amba	Kale	3.8kg
	Lettuce	7.5kg
	Beetroot	5.6 kg
	Swiss chard	6.0kg
	Sweet potato	2.3kg
	Carrot	6.0kg
Atsibi	Kale	3.kg
	Lettuce	10.1kg
	Beetroot	2.1kg

	Swiss chard	2.9kg
	Sweet potato	1kg
	Carrot	3.9kg
Enderta	Kale	22.2kg
	Lettuce	2.2kg
	Beetroot	10.9kg
	Swiss chard	2.8kg
	Sweet potato	1.4kg
	Carrot	46.2kg

Annex 3: Average Labor distribution (hours) recorded for implementing institutions for tasks across household members

Implementer	Home garden task	Men (Hr)	Women (Hr)	Boys (Hr)	Girls (Hr)
Adet ARC	Cultivation	1.0	1.1	0.4	0.6
	Harvesting	0.9	1.1	0.4	0.5
	Land preparation	0.9	1.0	0.5	0.4
	Marketing	0.9	1.1	0.3	2.9
	Planting	0.8	0.9	0.5	0.5
	Transporting	4.5	1.9	1.5	1.1
	Weeding	0.7	1.1	0.5	0.6
Adet ARC Total Average		1.4	1.2	0.6	0.9
Sirinka ARC	Cultivation	3.7	2.3	0.7	0.6
	Harvesting	0.8	0.7	0.1	0.2
	Land preparation	2.7	1.1	0.4	0.2
	Marketing	1.0	2.5	0.1	0.7
	Planting	1.7	0.6	0.3	0.2
	Transporting	0.4	0.3	0.1	0.1
	Weeding	4.9	4.6	1.9	1.0
Sirinka ARC Total Average		2.1	1.5	0.4	0.4
Sekota ARC	Cultivation	2.5	1.9	0.6	0.1
	Land preparation	0.7	0.6	0.2	0.0
	Planting	0.6	1.0	0.4	0.0
	Seed collection	0.6	0.7	0.3	0.1
	Weeding	0.7	0.9	0.3	0.0
Sekota ARC Total Average		1.0	1.0	0.3	0.0
Holeta ARC	Cultivation	1.0	1.6	1.5	1.1
	Harvesting	0.9	1.9	0.8	0.6
	Land preparation	1.3	1.7	1.5	1.0
	Marketing	0.3	2.0	0.3	0.3
	Planting	1.2	1.7	1.4	0.9
	Seed collection	1.2	0.7	0.2	0.1
	Transporting	0.8	0.5	0.5	0.2
	Weeding	0.9	2.2	1.1	1.4
Holeta ARC Total		1.0	1.5	0.9	0.7
Melkasa ARC	Cultivation	0.3	0.2	0.0	0.1
	Harvesting	0.2	0.2	0.0	0.1

	Land preparation	1.3	1.1	0.2	0.1
	Planting	0.2	0.2	0.1	0.3
	Seed collection	0.3	0.2	0.0	0.1
	Weeding	1.3	0.2	0.0	0.1
Melkasa ARC Total Average		0.7	0.4	0.1	0.1
Haramaya University	Cultivation	1.9	1.1	0.9	0.0
	Harvesting	2.0	6.0	1.0	2.0
	Land preparation	2.1	0.4	0.4	0.0
	Marketing	0.0	6.0	0.0	5.0
	Planting	2.0	0.3	0.5	0.0
	Seed collection	1.0	1.0	0.0	0.1
	Transporting	0.0	5.0	0.0	2.0
	Weeding	1.9	1.2	0.9	0.0
Har University Total Average		1.8	0.8	0.6	0.0
Areka ARC	Cultivation	2.7	1.8	0.6	0.4
	Harvesting	0.4	0.9	0.1	0.5
	Land preparation	2.3	0.7	0.3	0.2
	Planting	0.9	0.2	0.2	0.1
	Seed collection	2.0	1.0	0.0	0.0
	Transporting	0.1	0.1	0.0	0.0
	Weeding	0.8	0.5	0.4	0.2
Areka ARC Total Average		1.5	0.7	0.3	0.2
Worabe ARC	Cultivation	4.5	2.3	2.2	1.5
	Harvesting	1.0	7.1	1.0	1.6
	Land preparation	1.3	0.7	0.7	0.3
	Marketing	0.5	7.2	0.0	1.0
	Planting	1.0	0.8	0.5	0.4
	Transporting	0.7	6.6	0.2	1.2
	Weeding	4.8	3.0	2.4	1.8
Worabe ARC Total Average		1.9	2.8	1.0	0.9

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Resilient Agriculture for Inclusive and Sustainable Ethiopian Food Systems (RAISE-FS) is a four-year program funded by the Dutch Embassy in Addis Ababa and hosted by Stichting Wageningen Research Ethiopia based in Addis Ababa, to bring about transformation in the Ethiopian food system. RAISE-FS will develop and implement a demand-driven and interdisciplinary approach to Research for Food System Transformation (R4FST) and as such contribute to the Government of Ethiopia's transformational agenda.

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