

FOREST GARDEN FARMING FOR PEOPLE AND THE PLANET ANNUAL PROJECT REPORT 2023



Ten month Forest Garden, Kituri farm



Six months papaya in Fruit plot within a Forest Garden



Vegetable training, Mapambano Group

Contents

List of Acronyms	4
LIST OF TABLES.....	5
Acknowledgement	6
Aim of the report.....	6
1. Background.....	8
2. Project outcomes.....	9
2.1 Increased diversity of nutrient-rich foods throughout the year	9
2.2 Diverse farm products provide more to sell	11
2.3 Improved landscapes	11
2.4 Farmers (including youth) are more knowledgeable, enthusiastic and socially empowered	11
2.5 Local NGOs capacity has been built in FGs approach.....	12
3. Project outputs	13
3.1 Output number 01: Government officers and villagers engaged	13
What demonstrates this?.....	13
3.2 Output number 02: Ten Forest Garden groups functioning	15
3.3 Output 03: Minimum of 10 Group Facilitators and 4 extension officers trained.....	16
3.4 Output 04: Members trained while establishing 10 joint Forest Gardens	16
3.5 Output 05: 360 individual farmers' Forest Gardens established	16
3.6 Output 06: 1080 Neighboring farmers trained/recruited by group members.....	16
3.7 Output 07: Savings and Loans function started, Marketing Associations established...17	
3.8 Output 08: Local NGOs have participated to raise its capacity in FGs	18
4. Baseline data collection	18
5. NURSERY ESTABLISHMENT AND MANAGEMENT	18
5.1 NURSERY SITE SELECTION	18
5.2 TREE NURSERY LAYOUT	19
5.3 TREE NURSERY ACTIVITIES	19
6. Forest Garden design	21
7. List of Important Lessons Learned During SAT Training	22
7.1 Crop Rotation and Integrated Pest Management.....	22
7.2 Intercropping	23
7.3 Improvement of soil fertility	23

Hot compost.....	23
Warm compost.....	24
Cold compost.....	24
7.4 Preparation of liquid fertilizers/Plant boosters (Chai mmea and Chai samadi)	25
Chai samadi	25
Chai mmea.....	25
7.5 Kitchen gardens.....	26
Bag garden (Bustani mfuko).....	26
Procedures for making a bag garden	26
Bricks gardens (Bustani kichuguu).....	26
Car tire gardens (Bustani tairi)	27
Hanging gardens	27
Double dug gardens	28
7.6 Preparation of vegetable nurseries	28
7.7 Organic pesticides	29
<i>Azadirachta indica</i> /Neem plant/(Mwarobaini)	29
How to prepare.	29
Functions of each component	29
Neem plant.....	29
Chill pepper	29
Aloe Vera.....	29
7.8 Watering by using plastic bottles	30
7.9 Plant propagation methods.....	30
Grafting.....	30
Types of grafting	30
Budding	31
Air layering.....	32
Layering by bending tree brunch.....	32
Wounding tree brunch	32
8. Challenges	43
8.1. Original local partner failing to start.....	43
8.2. Challenge of keeping the team unified.....	43
8.3 Insufficient cooperation from project beneficiaries	44

8.4 Delays in establishing tree nursery and delays in transplanting.....	44
8.5 Insufficient motivation of beneficiaries	44
9. Conclusion and recommendations.....	45

List of Acronyms

FGs	Forest Gardens
Group facilitators	Term used in the project proposal of group leaders or lead farmers (not to be confused with Project facilitators who are project staff and extension officers)
KIWAMWAKU	Kikundi Cha Wanawake Mwanga Kupambana na UKIMWI
KIWAKKUKI	Kikundi cha Wanawake Kilimanjaro Kupambana na UKIMWI
ME	Monitoring and Evaluation
MoU	Memorandum of Understanding
SAT	Sustainable Agriculture Tanzania
Spp	Species

LIST OF TABLES

TABLE 1 FIRST VILLAGE MEETING ATTENDANCE	13
TABLE 2 SECOND VILLAGE MEETING ATTENDANCE	14
TABLE 3 NUMBER OF PROJECT BENEFICIARIES ATTENDED STUDY TRIP	14
TABLE 4 NUMBER OF PROJECT STAFF ATTENDED STUDY TRIP	14
TABLE 5 NUMBER OF TREE SEEDLINGS PRODUCED BY FARMERS	15
TABLE 6 SEEDS GERMINATION AND TREATMENT	21

LIST OF FIGURES

FIGURE 1 HOW TO PLANT MAIZE BY USING NINE SEEDS METHOD.....	10
FIGURE 2 NURSERY LAYOUT	19
FIGURE 3 FROM THE RIGHT SIDE; PICTURE ONE ARE GLIRICIDIA TWIGS, PICTURE TWO DRY LEAVES ON TOP OF TWIGS, PICTURE THREE GLIRICIDIA LEAVES ON TOP OF DRY LEAVES, PICTURE FOUR IS ANIMAL MANURE, SOIL AND WOOD ASH ON TOP OF GLIRICIDIA LEAVES.....	24
FIGURE 4 PREPARATION OF CHAI SAMADI: FIRST PICTURE FROM THE RIGHT SIDE IS MS AGNES PARTICIPATING TO PUT FRESH ANIMAL MANURE IN A BAG, SECOND PICTURE ARE TRAINEES TIE 50KG BAG INSIDE A BARREL BY USING STICK, THIRD PICTURE IS A BARREL WITH A TIED BAG IN IT.	25
FIGURE 5 PREPARATION OF CHAI MMEA: FROM THE RIGHT SIDE; FIRST PICTURE IS MS AGNESS, MR KIMARO AND OTHER TRAINEES COLLECTING FRESH LEAVES OF TITHONIA DIVERSIFOLIA, SECOND PICTURE IS GRINDING OF TITHONIA DIVERSIFOLIA LEAVES BY USING LOCAL EQUIPMENT.....	25
FIGURE 6 BRICK GARDEN (BUSTANI KICHUGUU) BUILD BY USING FIRE BRICKS.....	27
FIGURE 7 TIRE GARDEN.....	27
FIGURE 8 A HANGING GARDEN.....	28
FIGURE 9 DOUBLE DUG GARDENS: FROM THE RIGHT SIDE; FIRST PICTURE ARE EGGPLANTS PLANTED IN A DOUBLE DUG GARDEN, SECOND PICTURE ARE ONIONS AND LAST PICTURE ARE MATURED EGGPLANTS.....	28
FIGURE 10 TYPES OF GRAFTING	31
FIGURE 11 T-BUDDING.....	31
FIGURE 12 BARK SHIELD WITH THE BUD ATTACHED	31
FIGURE 13 WRAPPED BUD.....	32
FIGURE 14 BARK SHIELD WITH BUD INSERTED INTO T CUT.....	32
FIGURE 15 (A) INVERTED T-CUT, (B) BARK OPENING, (C) BUD INSERTED, (D) BARK COVERING THE BUD, (E) WOUND COVERED BUT BUD IS EXPOSED TO GROW	32
FIGURE 16 AIR LAYERING: FROM THE RIGHT SIDE; STEP 1. BARK CUT, STEP 2. PUT ROOT HORMONE ON THE WOUND, STEP 3. PUT SAW DUSTS, STEP 4 COVER BY USING PLASTIC BAG.....	33
FIGURE 17 FROM THE RIGHT (FIRST PICTURE) MR KIMARO AND NOEL TRAINING FEW FARMERS AT KITURI C; SECOND PICTURE THREE KALIMANI GROUP MEMBERS ATTENDED TRAINING AT THEIR NURSERY SITE.	44
FIGURE 18 OVERGROWN TREE SEEDLINGS AT JUHUDI NURSERY	44

Acknowledgement

We the implementing partner organizations are grateful to the donor, the Ministry for Foreign Affairs of Finland for providing us with the opportunity to implement this project. The success described in this report wouldn't be possible without contribution from Liana, the main grantee of the project and the main coordination body (by Eija) of the collaborative effort.

We are deeply grateful to the Executive director of KIWAMWAKU, Ezekiel for his unwavering support, and Project officer Agness for her multiple contribution in scheduling activities, communications between the groups and the project staff, and training of farmer groups, and Ms Neema for her financial arrangements for the project activities. A big thank you also to Noel whose energetic efforts in the position of Lead field officer in June-September improved the project especially by bringing in the much-needed agroforestry expertise, and a more holistic and systematic organisation of activities; and Yahaya who joined us in September and brought his enthusiasm, skills and knowledge of growing crops and trees, even those that we had not previously heard of And thank you to Mr Kimaro, one of the extension officers of the project area, who has tirelessly participated in, and contributed his long-term knowledge to the project, taken lead in many activities, and in person connected us with the agricultural extension services; and Lydia and Rachel who stepped in to take charge in group trainings especially during the busy time of November-December when the project expanded to new areas. As a whole, we would like to sincerely express our gratitude to Mwanga district and village governments where the project operates.

Also, we would like to thank Lead farmers and farmer groups of Kalimani, Kituri A, Kituri C, Juhudi, Kitopeni, Mapambano, and the youth groups, for their collaboration and acceptance of the project activities as potential beneficiaries, indeed these are the people who make this report successful.

We are ever grateful for the efforts and support of Trees for the Future, especially Samwel and Mr Mgonzo, whose expertise we relied on at the beginning of the project during the village meeting stage and the nursery establishment that followed.

We also feel grateful for four KIWAKKUKI personnel Mama Matechi, Riziki and Joseph, first, for their contribution to the interim period between Samwel's departure and Noel's recruitment, and the tireless efforts of temporary project staff, Ndanu, who collected most of the baseline information and helped farmers map their current shambas.

This annual report was written by the following persons: Noel Senge, Agness Saria and Yahaya Jumanne.

Aim of the report

This report will document all planned and implemented activities starting from January to 30th December 2023. It will also elaborate project outcome/objectives and specific activities which have been carried out in each objective.

Targeted project outcomes are:

1. Increased diversity of nutrient-rich foods throughout the year.
2. Diverse farm products provide more to sell.
3. Improved landscapes by increased trees, improved water cycle and microclimates.
4. Farmers are more knowledgeable, enthusiastic and socially empowered and they have adequate employment and livelihood.

In addition, the project targets capacity building of the local implementing partner organisations:

- local NGOs' capacity has been built in FGs approach and communications (especially social media and organizational home page development and updating)

This report also covers results outputs which include,

- Output 1. Government officers and villagers engaged
- Output 2. Ten Forest Garden groups functioning
- Output 3. Minimum of 10 Group Facilitators and 4 extension officers trained
- Output 4. Members trained while establishing 10 joint forest gardens
- Output 5. Individual farmers forest gardens established
- Output 6. Savings and loan's function started; marketing associations established
- Output 7. Local NGOs have participated to raise their capacity in FGs.

In this report you will also find explanations of the important lessons learnt while implementing the project (related to practices and sequence of activities), and lessons learned on SAT training courses which included crop rotation and intercropping, improvement of soil fertility, preparation of liquid fertilizers (Plant boosters), kitchen gardens, preparation of vegetable nurseries, control of pests by using organic ways, and watering fruit trees by using plastic bottles.

Challenges and recommendations will also be looked upon in this report.

1. Background

The project “Forest Gardens for People and the Planet” introduces Forest Gardens (FG) Approach in Northern Tanzania. Forest Gardens are multi-layered, integrated agricultural system that combine trees, shrubs, crops and animals in one area to sustainably produce a variety of products and environmental services.

Current farming methods used by small-scale farmers pose many challenges:

- They give low yields from small number of crops
- Families are food insecure with poor nutrition and lack of cash income
- Farming few annual crops leaves soils exposed leading to soil degradation and hampered water cycles, contributing to biodiversity loss, climate change and low resilience against weather variation
- Agriculture does not attract the youth, yet job opportunities are scarce and unemployment high.

Forest gardening is a low-maintenance, sustainable plant-based food production and agroforestry system based on woodland ecosystems, incorporating fruit and nut trees, shrubs, herbs, vines and perennial vegetables which have yields directly useful to humans. Making use of companion planting: Planting of different crops in proximity for several different reasons, including pest control, pollination, providing habitat for beneficial insects, maximizing use of space, and to otherwise increase crop productivity. Companion planting is a form of polyculture. Different plants can be intermixed to grow in a succession of layers to build a woodland habitat. Forest gardening is a prehistoric method of securing food in tropical countries.

Forest gardens, like natural forests, can help us combat global warming, by choosing to mimic natural forests in our gardens, we can help to protect a range of species and promote the healthy biodiversity of plants, help control pests and disease, give us with other yields such as fuel, timber, craft materials, herbal medicines, plant fibers and animal fodder. Forest gardeners make landscapes and food systems more nutrition-sensitive and enhance the nutritional resilience of local communities and the growing global population.

Forest gardens support food security and nutrition in a number of ways, they provide nutritionally important foods (including fruits and vegetables), make invaluable contributions to the income of people living in and around them, often providing the only means of accessing the cash economy, thus enabling access to nutritious foods also through purchasing.

FGs enhance biodiversity. Biodiversity from across the agricultural system landscape is important for the integrity of the ecosystems and the nutritional resilience of local people in the face of social, economic and environmental changes.

Integrated system of crops on farms are particularly important to poor people in developing countries for coping with cyclical and transitory shortages (seasonal variation, drought, illness and other external shocks). Indigenous tree species are particularly adapted to local climates and often more resilient in the face to local climatic extremes. Also FGs improve landscape, make them more attractive, and provide a valuable contribution to employment and livelihoods of rural people.

Forest Garden for People and the Planet project is implemented in Mwanga district lowlands starting from Kituri and Kifaru villages and expanding to other villages during second year. In the donor categorization, the project's main sectors are Agriculture, General environmental protection and Government and civil society. Respectively, the Project areas of sector specialization (for the above sectors) are Agricultural alternative development (agroforestry), Biosphere protection and Women's equality organizations and institutions.

The principle objective of this project is to contribute to the sustainable livelihoods of the small-scale farmers and combat some of the most acute local and global environmental problems such as climate change with extreme weather conditions and global warming, soil degradation (loss of microbial activity, loss of fertility, loss of soil volume by erosion), biodiversity loss, and hampered water cycle. FGs also contribute to enhance the rights and status of women and girls, and the economic status of small-scale farmers and the youth by job generation, livelihood opportunities and well-being. Specifically targeted beneficiaries are marginalized groups which includes women and girls, youth, and persons with disabilities (including PLHAs).

SECTION 1: Linking outcomes, outputs and activities

2. Project outcomes

2.1 Increased diversity of nutrient-rich foods throughout the year

What activities have contributed towards this outcome?

Food crops:

- Farmers received improved maize seeds (1/2kg DKK-777 for their gardens and extra 1/2kg for the demonstration plot) and were trained in improved planting methods (April 2023). Farmers were trained in the method of nine seeds technology (Mbegu 9) for planting maize using Chaka how. (see picture below: Blue dots are holes at a distance of 30cm each.)
- 95kg of Pigeon peas were purchased from Karatu and issued to 89 farmer with each farmer receiving 1kg to their own gardens and 1kg for the demonstration plot. Forest gardens in Tanzania (as taught by Trees for the Future) are typically divided by something called 'marejea'. Marejea are rows of pigeon peas (or *Gliricidia sepium*) that cross the farm or the maize section from east to west (avoiding shading) or along contours in case the farm is on a slope. In the project area no farms were on the slope, so marejea only was used. Delivering pigeon peas coincided the busiest time of maize planting and thus many farmers missed the training and did not learn the different intercropping methods of pigeon peas with maize.

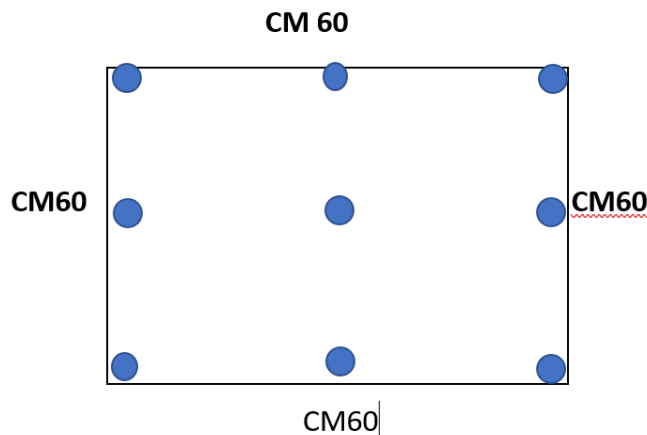


Figure 2-1 How to plant maize by using nine seeds method

Fruit trees:

Farmers received papaya seeds (42 packets, timing in May 2023, mistake to deliver too late). These were hybrid seeds (MALKIA F1) that yield fruits at an early age 8 months. Each farmer got 20 seeds. Seeds were planted in polythene bags in tree nurseries and transplanted in July. Bottle irrigation method was taught to direct water to the roots (instead of the soil surface).

Fruit tree nurseries were introduced to the youth groups, comprising a variety of fruits such as avocados, passions, guava and lemons. This initiative aims to contribute to farmers' nutritional well-being and provide employment opportunity to the youth. The seedlings will be distributed to farmers, serving as a valuable source of nutrient supplements while other seedling will be sold to the free market by the youth group.

Vegetable growing:

The introduction of vegetables to the farming community started with the cultivation of ten varieties strategically chosen to encompass a range of colours and types. The selection includes *green leafy* vegetables such as Blacknight shade, Spinach, Collard green, Chinese, and Cabbage, as well as *fruit* vegetables like Tomato Tanya, Pepper and Eggplant, along with a *root* vegetable Carrot and Onions, 25g for each variety. The initiative commenced with comprehensive training sessions in each group's the training garden, emphasizing the importance of raised bed cultivation to mitigate waterlogging challenge during El Nino rains. This phase started in late October and has continued till the end of the year, every farmer taking some seedlings to their home garden. Vegetables grown were irrigated only by watering cans, and drip irrigation was introduced only at the very end of the year (due to heavy rains).

Our original plan was to introduce sweet potatoes and cassava already during long rains of April-May, however, farmers were too overworked by outplanting live fence seedlings and shamba work that this activity was pushed forward. Sweet potatoes and cassava will be introduced during next rainy season in April 2024, together with transplanting of more live fence trees and fruit trees.

Success of this outcome will be measured by indicators like diversity of food consumed and months of food sufficiency and it will be verified by interviewing of 30 members at the beginning and further 30 when forming new groups in year 2, and comparing this baseline with evaluation data at the end of the project in year 2026.

2.2 Diverse farm products provide more to sell

What activities have contributed towards this outcome?

Not yet.

This outcome is realistic only after farmers diversify their crops and practice growing them first for home consumption and sporadic local selling. Later, Marketing Associations will be established for more systematic growing for markets.

Success of this outcome will be measured by indicators like number of farm products sold and farmers report contribution of farm produce to household income. It will be verified by interviewing of 30 members at the beginning and further 30 when forming new groups in the second year 2024, and comparing this baseline with evaluation data at the end of the project in year 2026.

2.3 Improved landscapes by increased trees, better soils and improved water cycle

What activities have contributed towards this outcome?

Farmer's first activity was to establish tree seedling nurseries. This started in early February and seedlings were transplanted starting in early April. Establishment of the live fence around a Forest Garden is the first step in targeting this outcome. Farmers grew three tree species, *Acacia polycantha*, *Gliricidia sepium* and *Leucaena leucocephala*. All farmers, except the late joiners, have planted parts of the live fence, and very few finished the task during the first rainy season.

Open field area was to be divided by alleys of pigeon pea or *Gliricidia* planted ten meters from one line to another (called marejea), however, only few individual farmers managed to complete this during the first year.

Papaya trees were planted soon after the April-May rains contributing to observable land use change (20 trees per plot) and starting a fruit tree area in the otherwise open field.

This will be justified by increased trees, better soils, improved water cycle, improved microclimates to grow crops and trees, increased biodiversity, carbon sequestration and protection from weather extremes. Success of this outcome will be measured by indicators like number of plants added on the farm (at the end), Visible signs of soil erosion, farmers report about change in farm environment and verification of this outcome will be after three to four years.

2.4 Farmers (including youth) are more knowledgeable, enthusiastic and socially empowered

What activities have contributed towards this outcome?

By June 2023, farmers have gained the following knowledge through project activities:

- General knowledge of Forest gardens through village meeting presentations by Trees for the Future trainers in January in Kituri, Kifaru and Kileo and further six meeting in Kwakoa, Ngulu, Kambi ya Simba, Butu, Kwanyange, Kisangara and Kiruru Ibwaijewa in November.
- Peer exchange learning on a study tour to Singida, 8 persons (January 2023); another 65 members from new villages (Kwakoa, Ngulu, Kambi ya Simba, Butu, Kwanyange,

Kisangara and Kiruru Ibwaijewa) to Kituri and Kifaru (November 2023), democratically selected in a village assembly considering gender balance for women and men.

- Study tour participants motivating by giving speeches and making presentations in the second village meetings (and information of the first village meeting recapped)
- Organised collective effort by establishment of groups and compiling constitution (11 groups formed, 6 old groups and 5 new groups with subgroups)
- Nursery establishment (includes cutting seedbags, seed preparation by hot water treatment, sowing seeds in seedbags)(February 2023 onwards)
- Outplanting seedlings, and with specific patterns (April 2023)
- Mapping the current status and monitoring development on their farms (includes empowerment, not just knowledge) (February-April2023)
- Maize planting technique, with Pigeon pea marejea (April 2023)
- Organising collective activities (transporting seedlings and outplanting together) (includes empowerment, not just knowledge) (May 2023)
- Facilitation of youth group and their efforts to grow live fence seedlings and fruit tree seedlings (includes empowerment, not just knowledge) (February-May, Nov-Dec 2023)
- Two youth representatives from Juhudi and Mapambano group were given opportunity to attend SAT training to learn about organic agriculture, after the course they established fruit trees including Passion edulis and Passion passiflora, Citrus lemon, Guava and Avocados.

Success indicators of this outcome will be farmers report increased enthusiasm for farming and farmers report the benefits of working in a group. Verification of this outcome will be done by outcome harvesting.

2.5 Local NGOs capacity has been built in FGs approach and communications

What activities have contributed towards this outcome?

- All Trees for the Future training materials have been given in the use of all staff. Sections have been distributed in WhatsApp group, relevant chapter at a time for self-study before trainings (end of 2022, January 2023).
- Staff participated in a study tour to see Forest gardens in Singida (KIWAKKUKI regular staff did not participate, however, one staff saw the Gardens in October, and Ndanu, a temporary project staff participated in the tour) (January 2023)
- Training of trainers organized by Samuel for nursery establishment (KIWAKKUKI joined in one day late but learned in practice working side-by-side with Samwel). Newly trained staff trained group members and thus effectively learned themselves. (February 2023)
- Training in nursery care, and outplanting (directly to groups with all NGO staff involved) (March-April 2023)
- Training organized by KIWAKKUKI staff for maize and pigeon pea planting. This did not attain the goal of building the capacity of KIWAMWAKU, as no training materials were made available, and delivery of seeds was organized outside the project work plan schedule. (April 2023)Two training courses at SAT Morogoro on organic agriculture (see more later), Participants on Basic course: Noel, Agness, Kimaro (June); and Yahaya (Oct); Intermediate course: Kimaro, Yahaya, Lidya, Rachel and 6 farmers' representatives from Kituri and Kifaru.

- A small step was taken at the very end of the year to introduce WordPress to one staff member (Yahaya) who (together with Eija) opened up a web address in order to start short blog articles aiming at publicizing useful practical information on techniques and practices needed in Forest Garden development by organic agriculture principles. This blog will become active from January 2024 onwards and will follow trainings offered to the second set of farmer groups in new villages.

Baseline data shows that there was no capacity in FGs at the beginning of the project (Only recent theoretical expertise in FGs by one staff visiting Singida in Oct 2023 and studying manuals. At KIWAKKUKI there is eight years of experience in other agriculture projects. It is expected that both local organisations will be capacitated as project continues, and this will be indicated by requesting to train and/or give seminars and/or partner by them. Sources of verification will be ability to share experiences along the project and documentation of activities in annual reports.

3. Project outputs

3.1 Output number 1: Government officers and villagers engaged

What demonstrates this?

This achievement was achieved by signing an agreement with the district (MoU), catalyzed by conducting two village assemblies in each village , a study trip to Singida participated by three extension officers to visit Trees for the Future project and see three year old forest gardens, and forming of first groups Kifaru and Kituri.

Another three meeting were conducted in each new villages and a study trips to Kifaru and Kituri participated by new 5 extension officers, 5 village leaders and 6 farmers representatives from each village to visit eight months Forest Gardens.

People's level of enthusiasm was very high and can be testified by the number of people attended village assemblies and number of farmers active establishing Forest gardens. Number of people attended village meetings are as shown in the table below;

Table 1 First village meeting attendance

VILLAGE NAME	MALE	FEMALE	TOTAL
KIFARU	28	78	106
KITURI	21	37	58
KILEO	18	47	65

VILLAGE NAME	MALE	FEMALE	TOTAL
KAMBI YA SIMBA	24	16	40
NGULU	41	42	83
BUTU	13	19	32
KWAKOA	36	37	73
KWANYANGE	12	17	29

KISANGARA	26	29	55
KIRURU IBWAIJEWA	0	17	17
TOTAL	152	177	329

Table 2 Second village meeting attendance

VILLAGE NAME	MALE	FEMALE	TOTAL
KIFARU	50	85	135
KITURI	50	85	135

VILLAGE NAME	MALE	FEMALE	TOTAL
NGULU	31	28	59
KWAKOA	38	35	73
KWANYANGE	19	20	39
KISANGARA	31	34	65
KIRURU IBWAIJEWA	0	17	17
TOTAL	119	134	253

Number of people attended study trip to Singida, Kituri and Kifaru were shown in the table below;

Table 3 Number of project beneficiaries attended study trip

VILLAGE NAME	MALE	FEMALE	TOTAL
KIFARU	4	4	8
KITURI	4	4	8
KWAKOA	6	4	10
NGULU	6	4	10
KWANYANGE	5	5	10
BUTU	5	5	10
KAMBI YA SIMBA	5	5	10
KWAKOA	6	4	10
KISANGARA	5	5	10
KIRURU IBWAIJEWA	0	10	10

Table 4 Number of project staff attended study trip to Singida

NAME	POSITION
EZEKIEL DEMBERE	Project coordinator
AGNESS SARIA	Project officer
MICHAEL KIMARO	Extension officer
LYDIA MKENI	Extension officer
RACHEL	Extension officer

SAMWELI MKUMBO	Agroforestry expert from Trees for the Future
ATANAS NDANU	Temporary project staff

3.2 Output number 2: Ten Forest Garden groups functioning

(This means 10 after new groups have started at the beginning of 2024. The original aim was to start 4 groups of 35 people that is 140 members, in year one, and 6 groups of 35 members in year 2)

How much has been achieved by now?

Currently there are six active farmer groups (Kituri A, Kituri C, Juhudi, Kalimani, Mapambano, and Kitopeni). However, these groups are smaller than originally intended and have a total number of 63 active members. From this number males are 28 and female are 35.

In addition, initially 15 youths formed a group and established a tree nursery. At the time of selling their live fence seedlings through the project to the farmer groups, there were 10 active members. Later, two youth groups formed (Juhudi and Mapambano) and established a fruit tree nursery (November 2023).

Another 5 new farmer groups were formed (Kwakoa, Ngulu, Kwanyange, Kisangara and Kiruru Ibwaijewa) making about 300 new members, This plan targets to reach 350 active members that would participate till the end of the project.

Special attention was paid to having diversity in the groups. The aim was to have over 50% women in each group and minimum of 10% PLHA. Well written rules for groups were essential to make them function and to safeguard good code of conduct.

So far, we can assess ‘functioning’ of groups by counting number of live trees and by group attendance levels in ‘harambee meetings’ (scheduled weekly time for discussion, organizing, training, working together). Counting of tree seedlings at the end of the nursery season turned out to be challenging, and thus the numbers in the table below are not totally reliable.

Table 5 Number of tree seedlings produced by farmers

Group	Gliricidia	Leucaena	Acacia	Total seedlings/group	No of Members	seedlings/farmer
Juhudi	4 500	4 500	8 000	17 000	16	1 063
Kitopeni	6 500	6 500	10 500	23 500	17	1 382
Vijana	417	1 177	600	2 194	9	244
Kituri A	1 700	700	1 500	3 900	12	325
Mapambano (K B)	1 800	2 000	4 500	8 300	13	638
Kituri C	3 940	2 997	7 057	13 994	9	1 555
Kalimani (K proper)	3 238	3 046	6 958	13 242	11	1 204
	22 095	20 920	39 115	82 130	87	944

Later, in November, another attempt was to find out how many meters of live fence each group member still needs to plant, aiming at helping the project plan the right amount of seeds and seedbags for the next nursery season of 2024; and reversely find out how many meters of live

fence has been planted in total, and thus how many seedlings have been planted, we estimated one step is approximately to one meter and thus for Acacia(first line) need four seedlings, two seedlings(second line) one Glyricidia and one Leucenae and two Glyricidia for (third line) (knowing that the planting interval is 30cm first line, 50cm second line and 60cm third line).

3.3 Output 3: Minimum of 10 Group Facilitators and 4 extension officers trained

How much has been achieved by now?

Among the six groups, each group has nominated their leaders. These may not be the same as the administrative leaders of the groups (chair, secretary and treasurer). Each group also needed to select the most potential person to be trained on the SAT intermediate organic agriculture course. These trainees participated as assistant trainers for the first time during vegetable trainings. Organizing tasks have been given to group leaders for them to learn leadership and being in charge. So far we have had one extension officer, Kimaro, who started participating, and even taking lead in every activity since April; and two extension officers Lydia and Rachel who participated especially in VICOBA and vegetable trainings.

Significant progress has been made in the training initiative with another five extension officers organized to support the newly formed groups. Their recent visits Kituri and Kifaru Forest Gardens demonstrate their commitment to engage and ensure effective support and guidance in the targeted new groups. Facilitators all need to use knowledge and skills gained to raise levels of self-motivation to other farmers to fully participate in project activities as planned.

3.4 Output 4: Members trained while establishing 10 joint Forest Gardens

How much has been achieved by now?

Initially it was planned that each group was supposed to have a joint garden, and these gardens were meant for training and learning. However, this did not go as planned. This output was dropped as a requirement, as members were reluctant to start joint Forest gardens. This was understandable because farmers struggled having enough time to start outplanting even in their own land during cultivation time. Only Kituri A group started a joint garden. Thus, for all other groups, groups were asked to choose one farm to be used as a place for training and learning, or have a rotational system for a training place. Also, all tree seedlings (also those bought from the youth group) were planted on members' own farms.

3.5 Output 5: 360 individual farmers' Forest Gardens established

How much has been achieved by now?

Numbers of individual farms that have done the first phases of FGs (taught between January and December) were 63; currently we have six groups Kalimani 11 members, Kituri A 8 members, Kituri C 7 members, Juhudi 15 members, Kitopeni 13 members, and Mapambano 9 members.

3.6 Output 6: 1080 Neighboring farmers trained/recruited by group members

How much has been achieved by now?

Group members have not yet started to teach their neighbors. It is expected that after a period of two years farmers will have started to benefit from their forest gardens, and this is what will convince other farmers to join and to be willing to establish forest gardens. Group members will also grow extra seedlings to sell to their neighbors. However, as VICOBA trainings attracted more farmers than the farmer group members, it provided an opportunity to open up the farmer groups and the project to more farmers in the initial two villages of Kituri and Kifaru.

3.7 Output 7: Savings and Loans function started, Marketing Associations established

The VICOBA (Village Community Banking) training for forest garden farmer groups began in September 2023, involving participants from six groups, with a focus on self-managed savings and loans function. The introductory sessions covered the concept, benefits, formation, and operation of VICOBA groups. Five groups were formed, including Mapambano, Kituri A, Kituri C, Kitopeni and Juhudi, totaling 97 members, of which others are invited outside the Forest Gardens groups. Kalimani group joined neighboring groups due to insufficient members. Each group received essential equipment support, such as cash boxes, passbooks, ledger books, locks, stamps and ink pads for initial investment. Participants, mostly women, already possessed knowledge in this area. This training equipped farmers with financial management skills and provided a platform for community collaboration for suitable development.

The table below shows number of farmers who join the Forest Garden VICOBA group:

SN	GROUP NAME	FEMALE	MALE	TOTAL
1.	MAPAMBANO	16	10	26
2.	KITURI A	06	19	25
3.	KITURI C	16	04	20
4.	KITOPENI	10	10	20
5.	JUHUDI	03	03	06
	TOTAL	51	46	97

The table below shows a detailed description of equipment:

SN	DESCRIPTION	ITEMS
1.	Cash box	5 (One for each group)
2.	Pass book	194 (Two copy for each member)
3.	Locks	15 (Three for each group)
4.	Stamp	5 (One for each group)
5.	Ledger	10 (Two for each group)
6.	Ink pad	5 (One for each group)

Verification of the VICOBA function will be done once they have had the opportunity to save at least one round/season which is one year. This will be done by interviewing on what investments have loans made possible.

Marketing Associations will be started later, when farmers have produce to sell and need pooling of products in order to sell larger amounts jointly. The need for these will be assessed as we progress.

3.8 Output 8: Local NGOs have participated to raise its capacity in FGs

- 4. Please see activity lists under what farmers have been reported to do, especially under 2.4 and 2.5, as this gives the full list of all activities offered to farmers and facilitators. All activities have been planned, discussed and analyzed in project meetings, which has enhanced the learning experience of all project staff and the quality of trainings offered to farmers. Baseline data collection**

Data for baseline was collected mainly in March and mainly by KIWAKKUKI temporary staff Ndanu who moved around by his motorbike interviewing selected 30 farmers. Eija, assisted by another Liana member, designed the baseline survey using known internationally used template for the questionnaire. Eija translated it into Swahili and it was checked by Adela of KIWAKKUKI. The baseline included also a mapping exercise that was taught to farmers, group by group while training of the Forest Garden establishment and the different components of a Forest Garden. The aim was to be able to draw a map of the existing farm as it is now, and then plan what to add to it to make it a Forest Garden during the four years of the project.

SECTION 2: Detailed record of activities and their main content

5. NURSERY ESTABLISHMENT AND MANAGEMENT

(From nursery trainings of early February by Samwel) A tree nursery is place where young tree seedlings are produced and taken care off before out planting/Transplanting. Farmers were trained to establish a temporary nursery in one place where every member was to take care of their seedlings.

5.1 NURSERY SITE SELECTION

Farmer were trained to select nursery site basing on the following criteria:-

- It should have enough space to easy nursery management
- The area for nursery establishment should have partial shade. (To avoid direct sun light as it will cause evapotranspiration and drying of seedlings which have not yet establish root system to withstand shortages of water)
- It should be close to clean water source
- Nursery cites should be fenced against thieves and destructive animals
- It should avoid water logged and steep slopes areas
- The site should be accessible
- Previous land use should be chemical free
- It should be in the proximity to Labour source (Commercial nursery)

5.2 TREE NURSERY LAYOUT

Farmers were trained the nursery Layout. It is how nursery activities are arranged to fit to the nursery site. These activities include soil mixing area, sieving area, potting area, walking roads, nursery beds and seed bed areas.

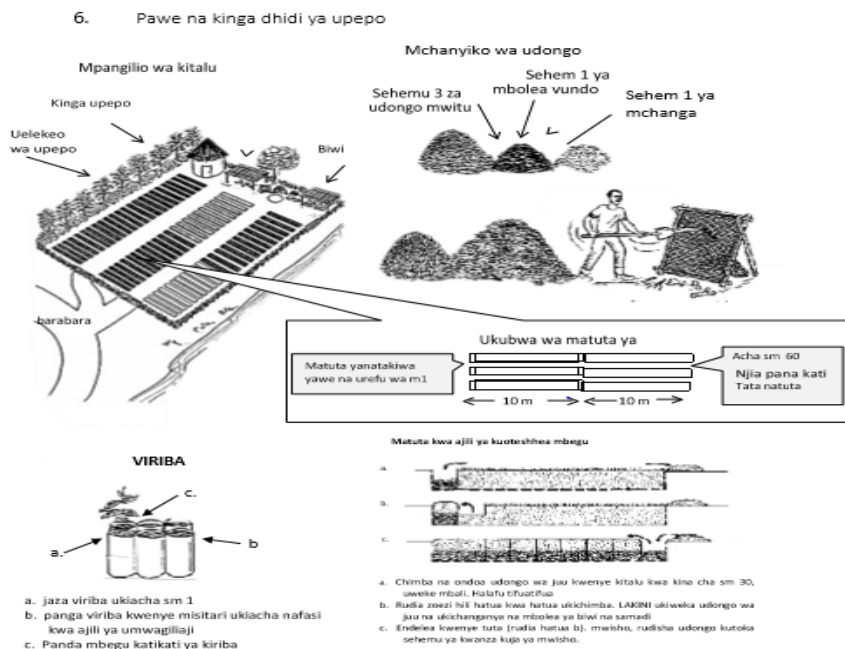


Figure 5-1 nursery layout

5.3 TREE NURSERY ACTIVITIES

Farmers were trained the following basic nursery operations;

i. Preparation of potting mixture

• Soil

Farmers were taught that, a correct soil that can be used as one of the potting mixture is top forest soil which contains lots of mycorrhiza and organic matter. This type of soil is available in the environment where farmers live. Also, they were taught three types of soil which were loam, clay and sand and their characteristics. They were also trained how to identify their soil type by making moist ball of soil by hand and the results were as follows; if you release the ball and particles are small, then the soil is sand; if particle are medium, it is loam; and if the particles are large, it is clay soil.

• Soil ratio

Farmers were trained to prepare potting mixture basing on 3.1.1 ratio, three parts of top forest soil (for supplying organic matters), one part sand (To allow water penetration and soil aeration) and one part animal manure (To supply organic matters) respectively.

ii. Pot sizing and filling

Farmers were taught to size pots of 15cm by using a piece of hard box sized in 15cm. The polytube was rolled around the box and was cut by using sharp knife. Pot filling were done by using hands (The first portion 7cm of the soil in the polytube were compacted to contain the soil in the tube as well as to easy relocation of poly bags in the nursery area).

- **Estimation of kilograms of polythene tubes**

1kg of polytube gives 400 seedbags, it was budgeted that each farmer gets 2000 bags.

127 farmers x 2000 bags=254,000 seedbags.

Initial plans was to have 127 farmers.

$$\text{Seed bags bought} = \left[\begin{array}{lcl} 1\text{kg of polytube} & = & 400 \text{ seedbags} \\ ?\text{kg of polytubes} & = & 254,000 \text{ seedbags} \end{array} \right]$$

Seed bags bought = $1 \times 254,000 \div 400 = 635\text{kg}$

iii. Seeds

Farmers were taught the meaning of seeds which is a living part of a plant that can germinate and grow, it can be a grain/kernels (maize, sunflowers, vegetables, Leucaena etc.) or stem (roots). They were also taught the characteristics of viable seeds which were;

- a) Not affected by insects
- b) Well preserved
- c) Ability to germinate from 80% onward
- d) Not have mixture of different type
- e) It should be matured seed

- **Estimation of Kilograms of seeds**

Gliricidia seeds bought 10kg (1kg = 7,000 seeds) = 70,000 seeds

Leucaena seeds bought 10kg (1kg = 7,000 seeds) = 70,000 seeds

Acacia seeds bought 2 x 13 kg (1kg = 10,000 seeds) = 260,000 seeds

- **Seeds germination and treatment**

Methods for tree seed preparation/treatment taught were three (boiling, rub and soak in cold water for several hours or day). Treatment of the three seeds species that are used for fencing forest garden farms (*Acacia Polycantha*, *Gliricidia Sepium* and *Leucaena leucocephala*) were as shown in the table below:-

Table 6 Seeds germination and treatment

Tree species	Treatment	Time in nursery	Days to germinate	Number of seed in tube
<i>Acacia polycantha</i> (Mgunga)	Soak in hot water for 12 hours	10-14 weeks	10-21 days	2
<i>Gliricidia sepium</i>	Soak in cold water for 3 to 12 hours	8-12 weeks	9-5 days	2
<i>Leucaena leucocephala</i> (Mlusina)	Soak in hot water then let it cool for 12 hours	12-16 weeks	7-21 days	2

iv. Watering

Farmers were taught to water tree seedlings two times a day morning and evening by using fine perforated water cans.

v. Weeding

Farmers were guided on how to remove competing weeds from nursery bed by hand picking in order to remove competition of nutrients and water.

vi. Root pruning /Wrenching

Farmers were taught to cut actively growing roots of the seedlings so as to avoid the roots of the seeds inter- twining , to enable the seedlings to develop a well-established root system fit for easy establishment in the field and for seedlings not to penetrate in to the soil and get establish within the nursery sites.

vii. Requirements for thatching

Germinating seed and recently transplanted seedlings need protection from hot sun, heavy rain and hard frost. Therefore, some method of shading beds in nurseries is essential. Shading reduces the temperature of the soil and the amount of water lost by seedlings. Farmers were trained to shade their nursery by making of small roof of dry grasses supported by poles around nursery area.

6. Forest Garden design

(Trainings in March) The project uses the Trees for the Future Forest Garden model. Over 10,000 of these Forest Gardens have been previously established in Tanzania.

- The live fence is planted around the farm of 0.5 to 2 acres at the beginning of the rainy season in early April:
 - On the outer line *Acacia polycantha* seedlings are planted at 30cm interval; on the middle line combination of *Gliricidia sepium* and *Leucaena leucocephala* are planted alternately at 30cm interval; and on the inner line *Gliricidia* is planted at 30 or 50 cm interval.
 - In total, this is about 2500 seedlings per farm.
 - The hedge pruned and weaved to keep it less than 2 meters high.

- Both *Leucaena* and *Gliricidia* are used for fodder (*Leucaena* alone, *Gliricidia* as mixed with other fodder types), and *Gliricidia* branches and leaves are cut for mulch. Larger branches can be used for firewood.
- The farm area inside the live fence is divided for different agroforestry activities by east-to-west alley lines or contour lines of Pigeon peas and/or *Gliricidia* and fodder grass combinations, planted in early April.
- Space is allocated for a variety of fruit and timber trees; maize intercropped with pigeon pea or other legumes; growing vegetables (by irrigation), sweet potatoes, cassava etc. Space may be allocated also vertically for multiple uses (multi-layered, with taller plants over shorter plants).
- Composting and crop rotation, together with organic pesticides and boosters are used to combat pests and ensure healthy soils.

This model was taught to the farmer groups in March by using mapping (baseline and how the Forest Garden will be at the end of the project) and a handout that guided farmers to think where to place all the different components of a Forest Garden. Forest Garden design concept will be returned to at every step when new crops and trees are introduced to farmers.

7. List of Important Lessons Learned During SAT Trainings

Three project facilitators took part in the basic organic agriculture course in June (Noel, Agness and Kimaro). In September Yahaya took the basic course alone. Further, in October Yahaya, Kimaro, Rachel and Lydia, with 6 farmer representatives took part in the intermediate organic agriculture course). The following section explain in detail both basic and intermediate organic contents covered:

7.1 Crop Rotation and Integrated Pest Management

Crop rotation is a pest control technique. When a single crop is planted repeatedly in the same soil, insects and diseases that attack that crop are allowed to build up to unmanageable levels, greatly reducing the farmer's harvest. The most basic form of crop rotation learned while at SAT is never plant the same crop in the same place twice. This results in naturally breaking the cycles of weeds, insects, and diseases that attack food crops. Rotations are used to prevent or at least partially control several pests and at the same time to reduce the farmer's reliance on chemical pesticides. Crop rotation is often the only economically feasible method for reducing insect and disease damage. Crop rotation involves replacement of a crop that is susceptible to a serious pest with another crop that is not susceptible. Each food crop comes with its own set of pests that attack that particular crop. By planting a different crop each time, farmers are able to starve out those pests. Often a set of three or four crops are planted on a rotating basis, ensuring that by the time the first crop is replanted, the pests that attack it are substantially reduced. Another side benefit of crop rotation is that it improves the soil. Constantly growing the same crop in the same location will strip the soil nutrients that a particular crop requires. Rotating to a different crop also reduces the demand on soil fertility. We learned that our farmers can rotate between maize, millets and cassava as a source for Ugali flour.

7.2 Intercropping

Is the agriculture system which involves cultivation of two or more crops simultaneously on the same field? The most common goal of intercropping is to produce a greater yield on a given piece of land by making use of resources or ecological processes that would otherwise not be utilized by a single crop. Successful intercropping depends on a good balance between competition and facilitation. Examples of strong facilitation is where legumes improve soil quality due to their nitrogen fixing character or where a second crop acts as a cover crop which shades the soils and increases water retention or serves as a windbreaker that shelters a crop or reduces wind erosion. The other side of the coin is where the secondary crop competes with the primary crop for moisture, space and nutrients. To cut off this, this cover crops are not planted near to the primary crops. We learned many spatial combinations possible for intercropping, including mixed intercropping, in which different crops are planted in the same row or without regard to row, and row intercropping, which involves planting different crops in alternating rows. We learned that, our farmers can use crops like legumes (Pigeon pea, beans and peas) and cover crops like potatoes.

7.3 Improvement of soil fertility

Soil fertility refers to the ability of soil to provide essential nutrients to plants for growth. This concept is a measure of a soil's capacity to support plant life not only by providing all necessary nutrients in adequate amounts but also by maintaining an appropriate pH level, offering a good soil structure, and keeping a satisfactory water-holding capacity. Soil that is unable to support plant growth and development signals depletion of essential nutrients required for plants growth and this type of soil need to be improved. We learned how to improve soil fertility by using compost manure. There are three types of compost manures which are warm, hot and cold composts. All these manures are named by considering amount of materials required to make it.

Hot compost

It uses 60% of dry leaves/brown materials and 40% of other raw materials like cow dung, soil and fresh/green leaves. The following were steps for making hot compost manure;

Step 1. Arrange sticks in the area where the compost will sit on top, sticks prevent compost to attach directly to the ground, compression and to allow air circulation.

Step 2. Arrange dry leaves on top of the sticks, dry leaves are source of carbon which support life of decomposing organisms (Beneficial insects) and plants growth.

Step 3. Put green leaves from legumes plants like *Tithonia diversifolia* (Mexican sunflower), *Gliricidia sepium*, pigeon pea, and *moringa oleifera* (Mlonge) to cover dry leaves.

Step 4. Sprinkle fresh cow manure to cover green leaves. Fresh animal manure contains a lot of nitrogen and it has decomposing organisms and it is a good environment for decomposers to grow.

Step 5. Partially cover cow manure by spreading soil. Soil has microorganisms which act as decomposers.

Step 6. Sprinkle wood ash to caver soil. Wood ash has calcium which supports plants growth. Also it helps to balance between basicity and acidity of the mixture.

Step 7. Sprinkle 20litres of water to add moisture of the materials to easy decomposition.

Step 8. Insert vertically dry stick straight from the upper layer to the bottom layer. This stick act like a thermometer.

For any organic matters to effectively decompose heat must be generated from the materials which decompose. To test rate of decomposition is by measuring temperature of the materials by just removing and touching of the thermometer by hand. High temperature signals high rate of decomposition and lower temperature signal low rate of decomposition. Hot compost is ploughed one to two times a week and it takes 18 to 30 days to be ready for uses.

Warm compost

It use 80% of dry leaves and 20% of other materials like green leaves. It is ploughed two times a month and it takes two to three months to be ready to use. Procedures for making this kind of compost are similar to hot compost.



Figure 7-1 From the right side; Picture one are Gliricidia twigs, picture two dry leaves on top of twigs, picture three Gliricidia leaves on top of dry leaves, picture four is animal manure, soil and wood ash on top of Gliricidia leaves.

Cold compost

There are no specific ratios of the materials for making this type of manure. A good example is a dump site where every rubbish thrown into it. It takes six months to one year for the rubbish to decompose (Except plastics and Glass). Procedures for making cold compost are similar to hot compost.

7.4 Preparation of liquid fertilizers/Plant boosters (Chai mmea and Chai samadi)

Chai samadi

This is a liquid obtained from the mixture of water and animal excrement. Fresh animal manure can be collected from cow, pig, chicken and bat. How to prepare: Put 50kg of this fresh manure in bag which allows water to get in and out, tie it and hang it inside a barrel by using stick. Pour 200litres of water in a barrel and Shake it after three days. Left it to ferment for 21 days and it will be read to use. While using make sure it doesn't give out animal manure odor and if it does, left it for few days for complete fermentation. How to use? Remove a bag from the barrel and what remains inside is a black liquid which is called chai samadi. Recommended ratios are 1:1 and 1:2 that is, 1litre of chai and 1litre of water and 1litre of chai and 2litres of water respectively. Plant boosters are not sprayed on leaves as it will attract fungus. Do spot application (On Plant stem). Use $\frac{1}{4}$ litres direct to the stem of young crops and $\frac{1}{2}$ litres in matured crops.



Figure 7-2 Preparation of chai Samadi: first picture from the right side is Ms Agnes participating to put fresh animal manure in a bag, second picture are trainees tie 50kg bag inside a barrel by using stick, third picture is a barrel with a tied bag in it.

Chai mmea

This is a plant booster from legumes plants like *Gliricidia sepium*, *Moringa oleifera* (Mlonge), *Leucenae leucocephala*, *Tithonia diversifolia* (Mexican sunflower/Alizeti Pori) and Pigeon pea. How to prepare; Grind leaves of these plants to make 50kg of grinded leaves and put it in a barrel then mix it with 200litres of water. Left it to ferment for 21 days, filter leaves and what remains is chai mmea. Ratios and uses are similar to chai samadi.



Figure 7-3 Preparation of chai mmea: From the right side; first picture is Ms Agness, Mr kimaro and other trainees collecting fresh leaves of *Tithonia diversifolia*, second picture is grinding of *Tithonia diversifolia* leaves by using local equipment.

7.5 Kitchen gardens

It is a garden where you grow your own food herbs, vegetables, fruits. What's more, it gives city dwellers and rural farmers chance to produce their own fresh and healthier food. It is used for growing edible plants and often some medicinal plants. Plants are grown for domestic use. We learned the following types of kitchen gardens; Bag gardens (Bustani mfuko), Bricks gardens (Bustani kichuguu), car tire gardens (Bustani tairi), Hanging garden and Double dug gardens.

Bag garden (Bustani mfuko)

This garden requires a bag having capacity of carrying 100kg, soil, compost manure, rice husks or sand. All of these are mixed in a ratio of 3:2:1 (Soil: Manure: Sand) you can use compost if you have it which is an alternative to that mixture, a wide pipe with a diameter of 30cm or a 10litres bucket with holes around it or any device that can easily pass things at least 20cm diameter and 4 buckets of pebbles. Procedures for making a bag garden:

Mix soil with manure and husks in a ratio of 3:2:1, prepare a bag, fold it short to make it easier to put the soil, put a pipe in the middle of the bag, put pebbles inside of the pipe. Put compost around the pipe, unfold the bag few steps and repeat the same steps until the bag is full. When the bag is full, pour water into the pipe and remove it, then perforate the bag and plant vegetable seedlings around and on top of it.

Bricks gardens (Bustani kichuguu)

A garden made by using fire bricks, There are many gardens of this type depending on the equipment you have. It is build by using bricks in different shapes, fill soil and then plant crops (vegetables).



Figure 7-4 Brick garden (Bustani kichuguu) build by using fire bricks

Car tire gardens (Bustani tairi)

Made by using used car tires, filled with soil in the inner part. Prepare tires, cut the top to remove the circle, build a small seat where the tire will sit, place the tire and nail it to the bottom to add strength, fill the tire with soil, and plant vegetable crops.



Figure 7-5 Tire garden

Hanging gardens

The following were steps to make a hanging garden. Build a structure which resembles football goals. Prepare buckets, large drinking plastic water bottles and cut in the middle, make holes in the sides and bottom to allow water to pass. then hang on the top and side posts and plant vegetable crops.



Figure 7-6 A hanging garden

Double dug gardens

Dig a hole 2-3 foot deep, 3 foot wide and 12-15 foot long. Then fill the hole with top soil 2 foot, put grass or any rotting garbages in the hole at least 1 foot, water it and then put compost or mixed soil 2 foot. The garden is ready and you can plant any seasonal crops.



Figure 7-7 Double dug gardens: From the right side; first picture are eggplants planted in a double dug garden, second picture are onions and last picture are matured eggplants.

7.6 Preparation of vegetable nurseries

Vegetable nursery is a place for raising or handling young vegetable crops plant seedlings until they are ready for more permanent planting. Is a place where vegetable seedlings are grown before transplanting them in the main plots. We were trained to prepare these nurseries by tillage of an area intended for nursery, remove grasses, slightly raise edges of the area, level it followed by making shallow furrows for sowing seeds. Seeds were partially covered by soil and dry grasses to create conditions necessary for seeds to germinate.



Figure 10. First picture from the right side is Noel levelling vegetable nursery area, second picture is Mr. Kimaro on levelling of the nursery area, third picture is Agnes and other trainees making shallow furrows for sowing seeds and last picture is a nursery bed cover by dry grasses.

7.7 Organic pesticides

Azadirachta indica/Neem plant/ (Mwarobaini)

Neem plant can be used as an organic pesticide which is used to control all insects with soft and hard bodies. Requirements for making Neem medicine were; Green leaves of Neem plant, one kilogram of chill pepper and 1litre of Aloe Vera extracts.

How to prepare:

Grind neem leaves to soften it well and weigh one kilogram of it, Grind one kilogram of chill pepper, Grind Aloe Vera leaves and collect 1litre of its extracts, prepare 20litres of water, mix all materials in 20litres of water by using a bucket, sieve it and put it in a clean knapsack and spray it on crops during evening time only. It is not recommended to spray during noon times due to strong heat effect which will break medicine bonds. Farmers can use this solution at 7days interval and this solution remains active only within 24hrs and no more.

Functions of each component

Neem plant

Its bitterness repel insects and destroy growth stages of insects (Ecdysis stages) (shedding of exoskeleton) and interfere with respiratory system of insects.

Chill pepper

Its itch kills soft bodied insects.

Aloe Vera

The sticking nature of aloe extracts helps components of the medicine to attach on crops leaves (Harvest only the lower leave in order to leave the plant growing).

7.8 Watering by using plastic bottles

While at SAT, we learned to water kitchen gardens by using 12litres of plastic water bottles. These bottles were perforated to make tiny holes around it by using a very thin needle. Bottles were placed in pits which were dug in three corners of the garden and then covered by soil except on the lid, these bottles were then filled with water. Water comes out from the bottle through tiny holes around it to moisten the whole garden.

7.9 Plant propagation methods

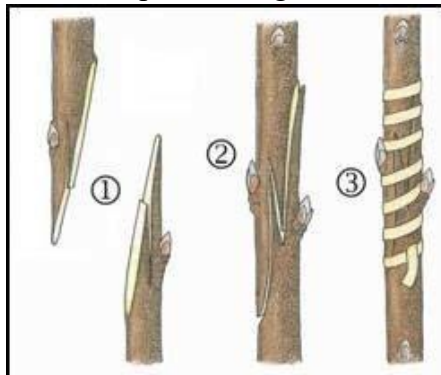
We learned three types of plants propagation methods which were grafting, budding, and air layering.

Grafting

Grafting or Graftage is a horticultural technique whereby tissues of plants are joined so as to continue their growth together. The upper part of the combined plant is called the scion while the lower part is called the rootstock. The success of this joining requires that the vascular tissues grow together, plants should be of the same Spp, scion should be matured and free from diseases and joined part must be tightly covered by budding tapes and covered by using budding cap to prevent water to get to the wound. Fruit tree that can be propagated in this ways are *Persea americana* (Avocado), *Psidium guajava* (Guava), *Citrus limonia* (Lemon), *Mangifera indica* (Mangoes) etc.

Types of grafting

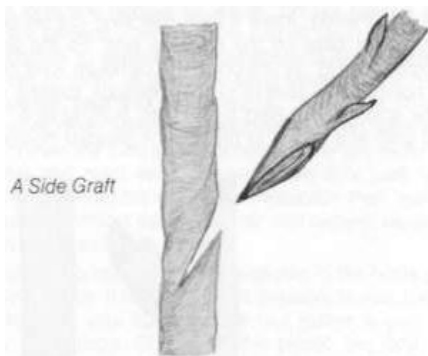
I. Wipe and tongue



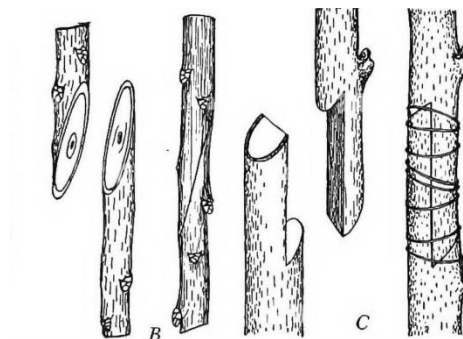
II. Cleft grafting (Mangoes and avocado)



III. Side veneer



IV. Contact grafting



Wipe and tongue

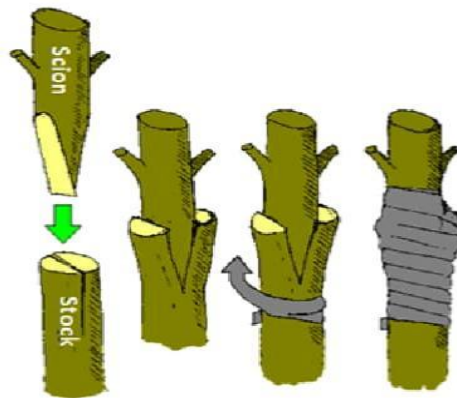


Figure 7-8 Types of grafting

Budding

A type of plant propagation method which is mostly applicable in citrus fruits, is a form of

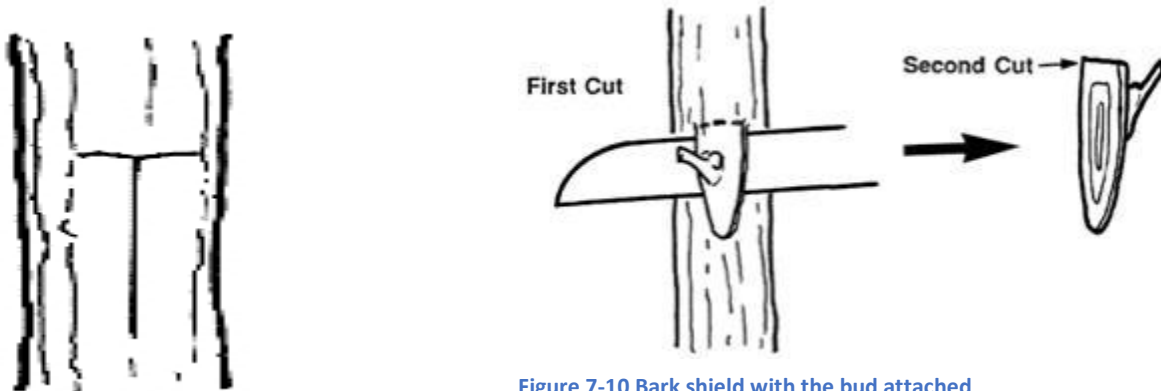


Figure 7-10 Bark shield with the bud attached

Figure 7-9 T-Budding

vegetative or clonal plant propagation by which an exact replica of the parent plant is produced. We learned two different methods of budding which were inverted T-bud and T budding. The difference between the two were procedures to make a T-cut.

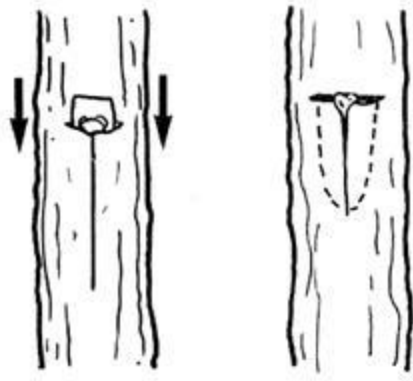


Figure 7-13 Bark shield with bud inserted into T cut.



Figure 7-12 Wrapped bud

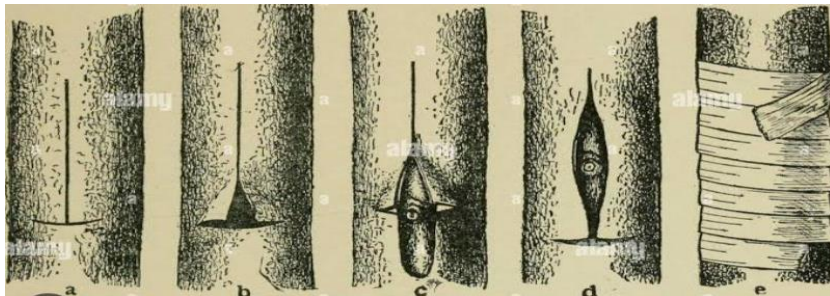


Figure 7-11 (A) Inverted T-cut, (B) Bark opening, (C) Bud inserted, (D) Bark covering the bud, (E) wound covered but bud is exposed to grow

Air layering

Air layering is a method of propagating trees and shrubs from stems still attached to the parent plant. A good example of fruit tree that can be propagated in this way is *Psidium guajava* (Guava). We learned two types of air layering which were layering by bending a tree branch and attach it to the ground and by wounding of tree branch.

Layering by bending tree brunch

Bend tree twig, scratch/wound it (remove bark to make 2.5cm/Inch deep) near bud apply root hormone (aloe plants extracts can be used) on the wounded part and then attach it to the ground. Aloe extracts acts as rooting hormone.

Wounding tree brunch

Wound the tree branch making a 2.5cm (1inch) cut through a leaf bud to remove bark. Put root hormone on the wounded part (Aloe extracts); tie it with a bag filled with a mixture of saw dusts and soil.

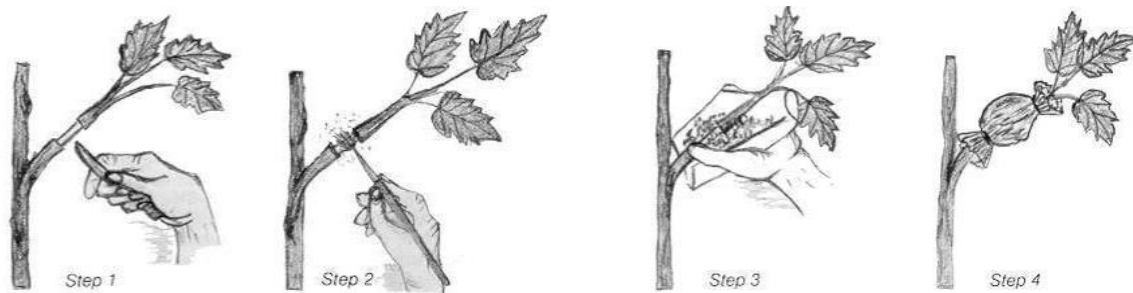


Figure 7-14 Air layering: From the right side; Step 1. Bark cut, Step 2. Put root hormone on the wound, Step 3. Put saw dusts, Step 4 cover by using plastic bag.

7.10 Banana Propagation Using Banana Stem

Banana Propagation through stem cuttings is an effective and rapid method to produce multiple seedlings. Here's a short elaboration on how you can achieve this:

Materials Needed:

1. Mature banana plant with a healthy pseudostem
2. Sharp knife or machete
3. Hot water
4. Well-draining potting mix (timber dust)
5. Pots or polybags for planting

Procedure:

1. Selecting the Parent Plant: Choose a mature and healthy banana plant with a well-developed pseudostem. The plant should be free from diseases and pests.
2. Preparing the Stem Cutting: Use a sharp knife or machete to cut the pseudostem into sections. Each cutting should have at least one healthy bud or eye cutting sharp to make cross shape to promote growth.
3. Treating the Cuttings: Dip the cut end of each stem cutting into hot water, this helps prevent diseases.
4. Planting the Stem Cuttings: Plant the treated stem cuttings in box, pots or polybags filled with well-draining and treated potting mix. Ensure that the bud or eye is positioned facing upwards.
5. Providing Ideal Conditions: Place the potted cuttings in a warm and humid environment with indirect sunlight. Maintain temperature by covering with shed net if available.
6. Regular Watering: Keep the soil consistently moist but not waterlogged. Bananas grow in well-draining soil, so avoid waterlogging to prevent root rot.

7. Transplanting Seedlings: After 8-12 weeks, the cuttings should develop roots and grow into small plants. Transplant them into larger containers or directly into the field if the climate is suitable.

8. Fertilization: Begin fertilizing the banana seedlings with a balanced fertilizer to support healthy growth.

9. Monitoring and Maintenance: Regularly monitor the seedlings for pests and diseases. Provide additional support, such as staking, if needed.

10. Transplanting to the Field: After about three months, when the seedlings are robust and around 12-18 inches tall, they can be transplanted into the field or larger containers for further growth.

By following these steps, you can efficiently propagate banana plants from stem cuttings and produce more than 30 healthy seedlings within three months, provided that the conditions are favourable for growth.



Figure 7-15 Planting the banana stem cut (one can produce about thirty seedlings)



Figure 7-16 Banana stem preparation

Implementation of SAT Course by Farmers:

Implementing a Sustainable Agriculture Training (SAT) course among farmers can have significant positive impacts on agricultural practices. Below is a short elaboration on how farmers applied the knowledge gained from the training, focusing on compost making, organic vegetable cultivation, and raised double-dug beds with cover crops:

1. Compost Making:

Knowledge Application: some farmers managed to apply the compost-making techniques learned during the SAT course to recycle organic waste into nutrient-rich compost. They collect kitchen waste, crop residues, and other organic materials. Layer them in a compost bin, turning regularly to promote decomposition. Use the mature compost as a natural fertilizer for crops.



Figure 7-17 Juhudi farmer explain how to turn compost to their fellow who didn't attended the SAT course

Benefits: Improved soil fertility, enhanced water retention, and reduced dependence on chemical fertilizers.

2. Organic Vegetable Cultivation:

Knowledge Application: Farmers utilize organic vegetable cultivation methods acquired from the SAT course to reduce reliance on synthetic pesticides and fertilizers. They prepare raised beds, and apply compost as a natural fertilizer. Employ pest control methods learned in the training, such as companion planting and beneficial insect attraction like marigold.

Benefits: Healthier vegetables for some farmers but mostly they failed to managed due to El Nino rain cause water logging.

3. Raised Double-Dug Beds:

Knowledge Application: Farmers implement raised double-dug bed techniques to enhance fertility and soil moisture. Double-digging involves loosening and aerating the soil deeply, this builds a nutrient-rich soil structure for long time. More than 18 beds were raised to 6 farmers in the joint leaning and others implemented to their farm.



Figure 7-18 Germination beds for vegetables



Figure 7-19 Raised double dug for carrots

Benefits: Improved water drainage, reduced soil erosion, increased microbial activity, and enhanced nutrient availability for long time.

4. Community Impact: Knowledge Sharing: Farmers trained in SAT courses become ambassadors of sustainable practices in their communities, sharing knowledge and encouraging others to adopt eco-friendly farming methods. They planned to visit themselves every end of the month to ensure learning from everyone.

In summary, after completing the SAT course, farmers can actively apply their knowledge by incorporating compost making, organic vegetable cultivation, and raised double-dug beds into their farming practices. This not only benefits individual farmers by reducing input costs but also contributes to the broader goals of sustainable and environmentally friendly agriculture,

Drip Irrigation Kits Installation

In response to the challenges posed by drought conditions, a project was initiated to provide farmers with drip irrigation kits as a sustainable water management solution. The aim was to enhance water efficiency and vegetable yield while addressing the critical need for resource conservation in agriculture.

Distribution of Drip Irrigation Kits:

Farmers were supplied with two sets of drip irrigation kits, each comprising essential components such as tubing, emitters, connectors, pressure regulators, and end caps.

Installation Process:

A training was conducted to educate farmers on the proper installation of drip irrigation systems using Liana instruction. The step-by-step guide covered planning, layout design, connection to water sources, and customization according to crop types. Farmers were actively involved in the installation process to ensure hands-on learning.



Benefits for Farmers in Drought Conditions:

1. **Water Conservation:** Drip irrigation minimizes water wastage by delivering water directly to the root zone, reducing evaporation and runoff.
2. **Optimized Water Use:** The system's precise water delivery allows farmers to optimize water use, ensuring that every drop contributes to plant growth.
3. **Crop Health and Yield:** Maintaining consistent soil moisture promotes healthier crops, mitigating the impact of drought stress and increasing overall yield.
4. **Resource Efficiency:** Some farmers reported reduced dependency on scarce water resources, contributing to long-term sustainability and resilience in the face of drought.

By empowering farmers with sustainable water management practices, the project aims to build resilience in agriculture, ensuring food security and economic stability prone to water scarcity. Ongoing support and monitoring will contribute to the success and scalability of this initiative.

8. VICOBA trainings

The VICOBA training for forest garden farmers groups commenced in September, 2023 with initial sessions where participants from six 06 groups (**02 from Kifaru and 04 from Kituri**) were introduced to the concept and benefits of Village Savings and Loans Associations (VSLA's)/VICOBA. In a nut shell “**VICOBA group is a self-managed group of 15-25 individual members from within a community who meet regularly (weekly, biweekly, or monthly) to save their money in a safe space, access small loans and obtain emergency insurance**”. Other things covered during the introductory part were how to form and operate VICOBA, understanding what share is, share out and how it work, loan disbursement (size of the loans) and repayment.

How material for the training got together?

Materials for the training were obtained from different online sources (websites and report) that were summarised to deliver the intended project objectives and requirements.

How the training delivered

The Village Community Bank training where delivery through various methods such as engaging individual farmers specifically women to share experience since most of them had prior knowledge on the matter, distributing the summarized materials/notes to individual farmers that they can refer to for information during and after the training.

How the training were planned

During planning for the Village Community Bank (VICOBA) training, the following steps were considered:-

1. **Define Objectives:** Clearly outline the goals of the training, such as understand the concept of Village Savings and Loans Associations (VSLAs)/VICOBA, understand the benefits of participating in Village Savings and Loans Associations (VSLAs)/VICOBA, understand how to form and operate Village savings and loans associations, understanding leadership selection and their roles as well as forming their own constitutions, understanding loan disbursement and repayment and understanding what is share out and how it works
2. **Preparation of relevant materials,** including handouts, and cash box, pass books, locks, stamp and ledgers just to mention few
3. **The training involved engaging the knowledgeable trainers** with expertise in VICOBA and community banking that is Agness and Kimaro were the leading officers during the training for they had experience on the matter and provide a chance for other extension officers to learn from their facilitations.
4. **Interactive Sessions:** Plan engaging series of questions and discussions to enhance understanding and participation of the farmers.
5. Facilitate the formation of VICOBA groups after the training, encouraging farmers to select others that will be close to them and with the same characteristics for sustainability of the VICOBA group
6. Provide ongoing support and mentorship to VICOBA groups as they establish and manage their financial activities



Photos taken during VICOPA introduction sessions from Kituri C and Kalimani groups

Soon after the introductory sessions the farmers group were guided to understand the leadership selection and their roles as well as forming their own constitutions which serves as a foundational document, shaping the structure and operation of the VICOPA groups within the context of the forest garden initiative.

Forming of VICOPA groups

Savings and Loans are very beneficial bonus activities that go side-by-side with FG establishment. They enable farmers to make small investments and improvements in their livelihood outside the FG concept. In order to form VICOPA group must bring together a group of 15-25 people. It is important that members select:

- People who they already know are trustworthy and dependable
- People who can attend weekly meetings and participate in weekly savings
- People who live in the same community or village

The training was successful attended by the farmers groups but also opened door for more people than group members to join. Due to the small number of forest garden farmers not reaching 25 people per group, the project provide an opportunity for farmers to invite others not part of the forest garden to join the VICOPA groups under forest garden project. This ensures that the amount generated will provide sufficient support for the respective farmers.

The table below shows number of farmers who join the forest garden VICOPA group:-

S/N	GROUP NAME	FEMALE	MALE	TOTAL
1.	MAPAMBANO GROUP	16	10	26
2.	KITURI A	06	19	25
3.	KITURI C	16	04	20
4.	KITOPENI	10	10	20

5.	JUHUDI	03	03	06
	TOTAL	51	46	97



VICOPA session at Kitopeni and Kituri A groups on constitutional making

Kalimani group failed to establish a VICOPA group due to having a small number of members, not even reaching 10 this is because of minimum response from villagers outside the forest garden, and some group members were already part of other community VICOPA. Therefore, those willing were invited to join neighbouring groups like Kituri A and Kituri C.

Furthermore these VICOPA groups were provided with supporting equipment that they can use as initial investment.

The table below shows a detail description of equipment provided:-

S/N	Description	Items number
1.	Cash-box	5 (groups)
2.	Pass books	97 (members)*2 passbook
3.	Locks	5(groups)*3 locks
4.	Stamp	5 groups
5.	Ledgers	2*5 groups
6.	Ink for stamp	1*5 groups



Photos of cash-box that were provided to the farmers groups

8. Challenges

While implementation of the project activities effective from January to December 2023, the following were challenges encountered.

9.1. Original local partner failing to start

KIWAKKUKI did not make itself ready in late 2022 to start with village assemblies immediately after New year. Thus, KIWAMWAKU was invited to organize all January activities. After meetings and correspondence between the donor and Liana, KIWAMWAKU was at the end of January accepted as the other official partner organisation. KIWAKKUKI joined from the beginning of February. However, by mid-May, as the basic project administration (specifically submitting bookkeeping and worksheets to Liana) had been neglected, new funding installments were made conditional on submitting the required pending documents. By the end of June, the situation was still unresolved.

9.2. Challenge of keeping the team unified

Ever since the two local organisations have been involved, it has been challenging to keep the team unified. Hiring the Lead field officer from outside from the beginning of June (whose main interest is only the success of the project) did not solve the issue. By the time of writing this report joint efforts have failed to find a niche for KIWAKKUKI that would be both acceptable to KIWAKKUKI and contributing to what is needed in the project (more field staff).

9.3 Insufficient cooperation from project beneficiaries

This project, like so many development projects, faces the typical problem of wavering farmer motivation at the start. Many farmers do not arrive on time in trainings, and when they attend, they are very few. Also, many farmers do not fulfill their obligations after being given instructions, for example, regarding planting of trees in joint gardens, and transplanting.



Figure 0-1 From the right (first picture) Mr kimaro and Noel training few farmers at Kituri C; second picture three Kalimani group members attended training at their nursery site.

8.4 Delays in establishing tree nursery and delays in transplanting

Even though nursery establishment was started in early February, filling seed bags took so long that sowing seeds was badly delayed. There were also problems in sourcing seeds (Acacia). This meant that most seedlings were very small at the beginning of April when the outplanting time came and rains started.

Another issue with seedlings came when the outplanting time started. Farmers hurried to their shambas and refused to start outplanting. This left many overgrown tree seedlings in farmers nurseries. And perhaps this might be among of the reason as to why level of self-motivation of the farmers is down, as they are now concerned about how they will be able to water border trees during this dry season.



Figure 0-2 Overgrown tree seedlings at Juhudi nursery

8.5 Insufficient motivation of beneficiaries

There have been a big number of those who have dropped out from the groups. We started with 140 farmers enrolled in farmer groups in February. During the nursery stage the number dropped to 89. Later, it further dropped to 70, and now it is 63. There are also few farmers who have left their seedlings in the nurseries for example at Kitopeni and Juhudi. Some farmers expected to be given additional work equipment like rain boots and watering equipment. This has discouraged some farmers to fully participate in the project activities.

8.6 Insufficient fund

While introducing this project many villagers were motivated to come to implement the project but some ended up been out of the project because the missed seeds, trainings and seminars due to limited fund to accommodate all.

9. Conclusion and recommendations

- **More fruit trees earlier in the project.** Because of the nutritional importance of fruit and the fact that most of the fruit in the world come from trees, fruit trees-based cropping systems need to be given greater attention to ensure the nutrition-sensitivity of the farmer's food system. (Fruit tree nurseries are scheduled to be started at the beginning of the second year, as first year's nurseries are only for border trees)
- **Timely provision of all necessary agro inputs.** Some farmers said they were not given enough seeds to plant as a result lots filled polybags end unused in the nursery area. Another explanation for empty seedbags can be that newly germinated seeds died after planting. (either way it is impossible to prove afterwards)
- **Documentation of the farmer's activities.** It is clear that many of our farmers have not been taught to keep records of the work they do, for example number of seedlings they produce in their nurseries, transplanted seedlings in the fields, dead seedlings, and the number of seedlings that have grown well. This information will be essential for monitoring and evaluating the progress of the project. Group leaders need to be tasked to take the lead in data collection from their members, and pass it on to the project records.
- **Essential plants for making organic pesticides.** Raw materials for organic pesticides are locally available. This includes plants like chill pepper, Aloe Vera, and neem tree (*Azadirachta indica*/Mwarobaini). Therefore, farmers must get these important plants for organic agriculture in their farms. These are easy to propagate from seeds. When the project provides tree seeds for the next planting season it is also important to provide these seeds.
- **More organized work for group members at critical times.** When forming new groups for the second year, it is recommended that each group (or several farmers forming a small group) works together not only in the nursery but also in transplanting tree seedlings in their FGs. This system is widely used in many places in Iringa and is called unity (Umoja). Thus, the whole group (or several members together) would plant seedlings of one member on one day, and then move on to another member, until seedlings are transplanted to all members' farms. This is highly recommended and may ensure that tree seedlings are planted on time.
- **Look for more partnerships**
Since farmers are highly demanding the project, there is a need to look for more partners to mobilize resources and help them more