Climate Smart and Resilient Urban Farming

A Guide for Smallholder Farmers

Climate Smart and Resilient Urban Farming

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Table of Contents

Disclaimer

The content of this urban farming training manual has been developed by the Elgon Integrated Urban Farmers' Association (EIUFA) and is therefore property of EIUFA.

It can be used for the transformation of smallholder farm projects and promoting sustainable urban and peri-urban agriculture for, household income enhancement, healthy and nutritious diets and to contribute to more resilient urban food systems in Uganda.

The views presented in this manual do not necessarily represent those of the funders and other partners.

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Foreword

Going into the future, the role of smallholder farmers in ensuring urban food provision has been emphasized by scholars and practitioners, alike. In fact, urban farming is set to become a key source of urban food supply in cities of developing countries, who will host a substantial proportion of the global urban population.

This training manual on urban farming offers the much needed practical support to those involved or are aspiring to enter into the urban food production system, more so smallholder farmers.

As RUFS, we commend the effort by the Elgon Integrated Urban Farmers' Association (EIUFA) led by Mr. Juma Wepukhulu. It is our desire that, this rich knowledge will go a long way in supplementing our efforts towards improving the urban food shed.

We appreciate, the AgriFoSe20230 programme for funding our interventions aimed at unlocking the potential of smallholder farmers towards a more climate smart and resilient urban food system in Uganda.

Prof. Frank Mugagga (PhD)

Team Leader - RUFS Project

1.0 Introduction

1.1 Background about Elgon Integrated Urban Farmers' Association

Elgon Integrated Urban Farmers' Association (EIUFA), located in Mugishu Cell, Namakwekwe Ward, Northern Division, Mbale City, was initiated in 2014. It aimed at transforming community livelihoods through introducing new modern urban farming practices to solve the pervasive problem of food shortage, occasioned by competing demands on land in Uganda's urban areas. In 2018, the Northern Division recognized and certified EIUFA as one of the leading local organizations with a practical demonstration site in Mbale Municipality.

Presently, EIUFA undertakes a range of activities including workshops, radio talk shows on various outlets including Islamic University In Uganda (IUIU) FM, community trainings, fieldwork and hands-on skills trainings for farmers and other stakeholders at the demonstration facility in Mugishu Cell, Namakwekwe Ward, Northern Division.

The targeted stakeholders, aside from farmers, include educational institutions, NGOs, households, hotels, restaurants, religious institutions, health facilities, agrobusinesses, industrial sector, and among others.

Contrary to the popular belief that farming is expensive in terms of inputs and land requirements, EIUFA has demonstrated that it is possible to undertake farming even with limited land and inputs. EIUFA innovatively sources and uses locally available low-cost plastics materials like pipes, jerry cans, bottles, basins, polythene, reused cement bags sacks, vehicle tyres, nets, and gumboots. Other waste materials include logs, timer and banana stems. The above mentioned waste materials are added value and used to create

planting medium for either on-ground and/or above the ground to support plant growth.


Fig.1-2: Sukuma wiki (Kale) Grown in a jerrycan and gumboots respectively

Based on field observations, and practical experiences, EIUFA realized that urban farmers have a wide range of market options and generate more profits than rural farmers. The major buyers of our safe, organically grown and hygienic products include surrounding neighbors, who pick the products at farm gate, thereby, avoiding transport costs. We also incur lower storage costs while also reducing the incidence of losses.

2.0 What is urban farming?

Urban farming is an agricultural practice done within cities and towns. It is operated in a confined area such as backyards or

compounds as well as larger plots of land. Urban agriculture aims to optimize the use of scarce land to improve household food security and create alternative sources of household income. In fact, going into the future, urban farming will be the major source of urban food provision in the majority of developing countries, especially, in Sub Saharan Africa and Eastern Asia.

In regard, EIUFA specialize in the following fruits and vegetable varieties; beetroot, sukuma wiki, spinach, radish, carrots, green pepper, sweet pepper (red and yellow), hot pepper, local chillies, onions, egg plants, bitter berries, rosemary, cabbages, lettuce, cucumber, garlic, coriander (dhania), ginger, climbing beans, French beans, beans, spring onion, leek, tomatoes, watermelon, sugarcane, Irish potatoes, nakati, okra, strawberry, pineapples, passion fruits, mangoes, oranges, bananas, cauliflower, broccoli, squash, dodo, maize and groundnuts.

2.1 Importance of practicing urban farming

1. Ensures food security for households' consumption and surplus for sale to institutions like universities, religious institutions, hotels, hospitals, prisons, among others.
2. It's an additional source of income for the family through sales to other stakeholders
3. It's hygienically safe and fresh for human consumption.
4. It minimizes daily expenditure on food by the family.
5. It caters for healthy nutrition to boost and maintain human immune systems.
6. It enables exposure, knowledge sharing and learning for children in homes, schools and tertiary and universities.
7. It is relatively easy to start-up, monitor and maintain.
8. It is more profitable because of the direct transactions between the buyer and seller since the middleman is not needed.

9. It contributes to the regulation of urban surface water run-off since water can be harvested for irrigation.
10. It ensures the optimal use of small plots of land in urban areas.
11. It is a medium that facilitates nutrient recycling (e.g. from chicken to garden and from garden to chicken) hence reducing daily contributing to soil conditioning and ultimately environmental conservation.
12. It reduces the proportion of urban waste by turning it into manure for your plants (crops) hence, promoting circular agriculture.
13. Urban farming promotes organic farming practices which are safer for human consumption.
14. It contributes to the beautification and enhancement of the urban aesthetics.
15. It enhances creativity and innovation among communities.

2.2 Advantages of urban farming

- It can be practiced in a small space.
- It is highly profitable given that the producer deals directly with the final consumers (usually neighbours), thereby avoiding the middleman.
- It is relatively secure given it is practiced on backyard/compounds.
- It is practices throughout the year.
- It is cost effective in terms of labor and other inputs.
- It is a resilience measure to climate change and its effect to food security.

2.3 Fast-growing vegetables under urban farming

There are a number of quick maturing food crops which can be practiced in urban setup as highlighted below;

1. 3-4 weeks: Sukuma wiki, Spinach, Dodo, Chain cabbage, Spring onion, dhania, spring onion.
2. 75-80 days: Beetroot, Watermelon, cauliflower, broccoli.
3. 3-4 months: Bitter berry, eggplant (garden egg), tomatoes, cabbages, onions, green pepper, chili, cucumber, climbing beans, carrots, squash.
4. 8-11 months: Passion fruits.

2.4 Key requirements for urban farming

1. Identify land or space for the establishment of the farm.
2. Locate nursery bed site.
3. Determine nursery bed type and size and construct it.

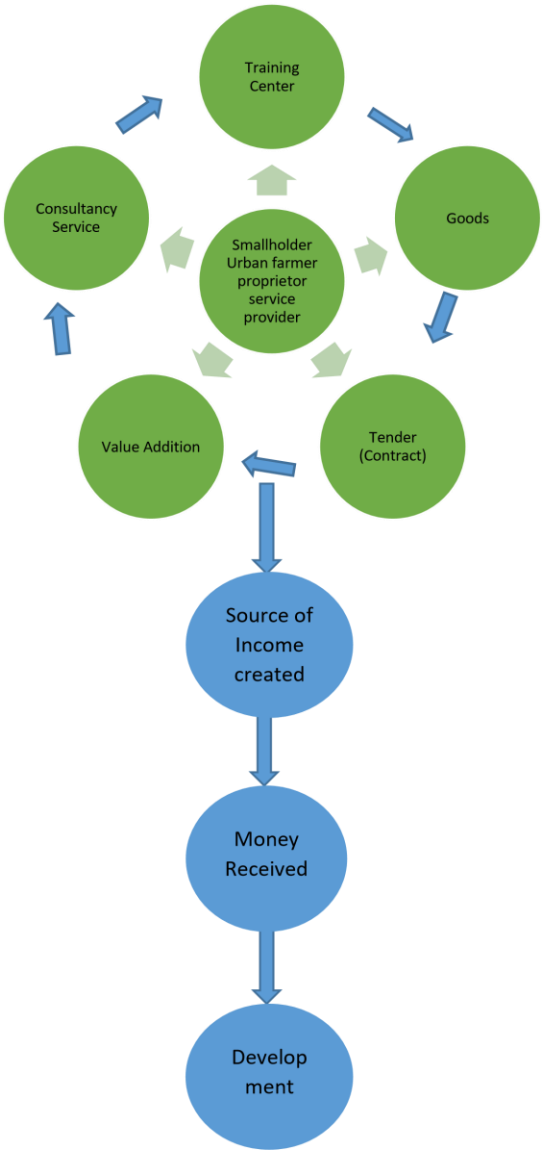
3.0 How to get clean money in urban farming

3.1 Strategies for generating income

1. Source of income: Urban farming is a daily income generating source through selling fresh food including fruits and vegetables. It can also be a source of revenue from agricultural tours.
2. Trainings. Urban farming can act as a demonstration farm or training center where individuals, communities and institutions can acquire skills and knowledge at a cost (incentivized peer-to-peer knowledge exchange and learning).
3. Processed organic manure from the farm can also be a source of income for urban farmers and their households.

4. Urban garbage can also be reclaimed and value generated from it through recycling into organic manure which can be processed and sold.
5. Through consultancy services, experienced urban farmers can gain extra income by providing consultancy services to individuals and institutions that aspire to set up farms.

3.2 Urban farming chain service and income flow chart



This table chain system shows how smallholder urban farmers transect business through urban farming practices e.g. service delivery and income flow having the end result as development.

3.3 Nursery beds and their establishment

A nursery bed is a selected site/element with conducive conditions to support seed germination for example, raised bed, basin, and boxes among others. It is recommended that nursery beds should be located based on the following considerations:

a) Nearness to the garden where the seedlings will be planted.
b) Availability and accessibility of water.
c) Gently sloping land.
d) Labour supply – responsible person to look after the seedlings.
e) Well-drained fertile soil to control effects of flooding.
f) Previous cropping to mitigate spread of pests and diseases to the seedlings.
g) Direction of wind which might blow off the shelter.

Types of nursery beds

There are four types of nursery beds; surface nursery bed, tray nursery bed, polythene potted nursery bed, and direct nursery bed planting.

a) Surface nursery bed

This is the commonest one that is used by almost 98% of the farmers.

Advantages

i. It is easy and quick to apply i.e. one person is enough to do the work.
ii. It is very easy to apply even on a large scale.
iii. It is easy to transplant the seedling even if the garden is far.

iv. Any place can be identified for a seed bed.
v. Rainfall can easily act as natural irrigation.

Disadvantages

i. Seed germination is not 100% guaranteed.
ii. It needs some level of monitoring when done on a large scale.
iii. Seeds can easily get broken, stressed resulting in a longer germination period.
iv. It is selective when it comes to the type of soil to use to apply the seed bed.
v. Bad weather, especially heavy rain and hailstorms can easily spoil the seed.

Requirements for setting up a surface nursery bed

a) Location/site.
b) Farm yard manure/compost.
c) Water/watering can.
d) String/banana fiber.
e) Dry matter such as grass/banana leaves.
f) Labor.
g) Wood ash.

Procedures for setting up a surface nursery/ seedbed

The area for the establishment of the nursery bed should be fertile.

1. Dig, prepare and soften soil to be fine, and soft.
2. Measure and demarcate the size of the bed.
3. Raise and level the bed, consider the direction of the sun. It should be oriented in the East-West direction.
4. Establish or make rills in which the seed will be sown.
5. Drop the seeds in the created rills.
6. Cover the seeds with thin layer of soil.

7. Sprinkle water to the seed bed using a watering can. 8. Sprinkle wood ash or apply pesticides to the bed 9. Cover with dry matter; grass, banana leaves.
10. Apply water to the bed every evening but water should be regulated.
11. Make a fence around the seed bed to prevent damage from animals, humans and hens/birds.
12. On the third day, check if the seeds have germinated. If so, remove the covers to enable the seedlings to grow well but if not, keep checking.
    - Never, allow seedlings to germinate though the covers.
    - However, there are seeds which take more than five days, so one should wait until the time of germination before you uncover e.g. onions, passion fruits among others.
13. Immediately after removing the covers, construct a shade to allow minimum sunshine and prevent heavy raindrops.
    - The higher height of the shade should face the rising sun and the shorter height face the setting sun for ease of access of light and vitamin D.
    - Hardening off should be practiced to prepare the seedlings to the normal environment. This is done through gradually reducing the shade and watering within the first three weeks and remove all covers in the last week to transplanting.
14. Transplanting should be done when the seedlings are ready for planting.
    - Water the seeding the evening before, and the morning of transplanting day.

- Transplant the seedlings during afternoon hours, place them in a container with little water and place them in a shade.
- Planting should be done in the evening starting from 5:00 pm.
- Irrigate the seedlings with little water that evening and continue gradually until you see they have established.

Fig. 3: Surface nursery bed

b) Polythene potting nursery bed

This is technology which is not frequently used.

Advantages

i. Germination is 99% guaranteed and seedlings pick up very fast after transportation due to less stress. ii. It is easy to know the exact number of seedlings one has depending on the number of polythene potting bags.

ii. Soil is well selected and treated before it's put to use.

Disadvantages

i. It is time consuming and expensive to employ people to get the work done.
ii. It is expensive to purchase the right kind of potting paper if you have a large size of land.
iii. It is expensive to transport the seedlings to the garden in case of long distances.
iv. Identification of the location to place the polythene may be difficult due to the nature of the seed bed.

Requirements for a polythene nursery bed

a) Loan soil.
b) Farm yard manure/ compost.
c) Potting bags.
d) Watering can/water.
e) Hoe/spade.
f) Poles/stakes.
g) String.
h) Labor.

Procedures

1. Locate and construct a shade and/or fence in order to regulate or prohibit sunshine, heavy rain, hailstorms, animals, humans and birds from damaging the bed.
2. Mix soil and manure.
3. Place mixture into the potting bag.
4. Sow seeds, and add thin layer of mixed soil.
5. Apply water onto the potting bags and cover with dry matter where possible. Watering or irrigation should be done every morning and late evening until the time of transplanting.

6. After three day, open the cover to establish whether the seeds have emerged.

Other procedures are the same as for **Surface nursery bed.**

Fig. 4: Polythene nursery bed

c) Tray nursery bed

This is also a new technology which uses a special soil called peat moss.

Advantages

i. Germination is relatively guaranteed and once transplanting is done, seeds pick up easily because of less stress and the seeds are transported with their roots intact.
ii. It is easy to know the number of seedlings planted because this is done according to the number of trays used.
iii. It requires less care and attention in terms of weeding and watering because it's done three times a week.
iv. It is free from pests since its soil or substrate peat moss is well treated.

Disadvantages

i. It is tiresome and expensive to employ people to do that kind of work especially during the transplantation.
ii. It is costly to purchase these kinds of trays if you have a big piece of land. iii. It is expensive and tiresome to transport the seedlings if the garden is very far.

Requirements for a tray nursery bed

a) Substrate soil and peat moss.
b) Trays.
c) Watering can/water.
d) Hoe/spade.
e) Poles/stakes.
f) Labor.

Procedures

1. Make a raised stand in the form of a table to enable the tray to be arranged on a levelled ground.
2. Construct a shade in order to regulate the direct sunshine and prohibit heavy rains or storms.

3. Construct a fence in order to prevent animals, birds or humans from destruction.
4. The substrate soil, peat moss is brought and filled in trays.
5. A single seed is planted in each hole of box of the tray.
6. The seed is covered with substrate peat soil.
   - Watering or irrigation is done by using a spraying pump not a watering can.

Other procedures are the same as for **Surface nursery bed.**

Fig. 5: Tray nursery bed

d) Direct seed planting nursery bed

This is mainly done by smallholder farmers practicing on a small scale and mostly in urban areas.

i. It is time saving because it takes a short period of time to mature.
ii. Germination is relatively guaranteed.
iii. It is good for urban farming.

Disadvantages

i. It is difficult to handle since it's easily exposed to risks like sunshine, hailstorms, birds and humans.
ii. It needs close monitoring to get good results.
iii. It is difficult to monitor from time of planting to maturity and requires a lot of attention.

Requirements

a) Location/site.
b) Farm yard manure/ compost.
c) Loam/black soil.
d) Polythene/sacks/cement bags/plastic, etc.
e) Water/watering can.
f) String/banana fiber.
g) Dry matter such as grass/banana leaves.
h) Labor.
i) Wood ash.
j) Among others.

Procedures

1. Assemble all the materials at the site.
2. Mix loam soil with farm yard manure/compost (ratio of 2:1).

3. Add the mixture into a container or polythene bag or any other assembled bed.
4. Sow the seeds in the ‘bed’ and cover with a thin layer of the mixture.
5. Sprinkle water and ash to the bed.
6. Where possible, cover the bed with dry matter.
7. On the third day, check if the seeds have germinated. If so, remove the covers to enable the seedlings to grow well but if not, keep checking.
    a. Never, allow seedlings to germinate though the covers.
    b. However, there are seeds which take more than five days, so one should wait until the time of germination before you uncover e.g. onions, passion fruits among others.
8. Apply water to the bed every evening but water should be regulated.
9. Make a fence around the seed bed to prevent damage from animals, humans and hens/birds.
10. Other procedures are similar, except transplanting.
11. For this technology, it is the ‘bed’ which are shifted to clear a space in which they can grow best for better yields.

Fig. 6-7: Direct seed planting

4.0 Cropping technologies under urban farming

4.1 Entrance growing

Urban agriculture can be practiced as an art for example, the picture below depicts a Malaga plant (locally known as “endelema”) planted at the entrance of a farm as an ornamental or landscaping activity. At the same time, it provides food and herbal medicine.

Fig. 8-9: Malaga planted at the entrance

4.2 Hanging gardening

Similarly, urban agriculture is practiced in form of hanging gardens on tree stems as depicted in the pictures on the next page:


Fig. 10-11: Sukuma Wiki planted in a hanging bottle

4.3 Passion fruit growing

Passion fruit are grown on the top of the roof, and it provides shade during the hot season as demonstrated below;

Fig. 12: Passion fruit on roof top

4.4 Briefcase gardening

This is called 'briefcase' because it is portable and movable. It can be moved from one place to another. Simple fast-growing vegetables are grown as indicated below:

Fig. 13-14: Sukuma wiki grown in a jerry cans and box gardens

4.5 Polythene paper

Sugarcanes are becoming scarce day by day, which have increased their cost to the consumers. Therefore, households have to look for appropriate means to grow them in their compounds using polythene papers. Similarly, vegetables can also be grown using the same technology.

Requirements

- Polythene papers.
- Loan soil.

- Farm yard manure/Compost manure and/or biodegradable materials.
- Sugarcane seeds.
- Water.

Procedures

- Gather the soil and compost manure.
- Mix loam soil with manure.
- Locate the polythene papers in a desired location, for better growth space at least 2-3ft apart.
- Add the mixture to a desired height in the polythene paper. It is recommended to add biodegradable materials in the polythene paper.
- Insert/plant sugarcane cuttings of your choice.
- Apply moderate water to moist the soil but avoid too much water.

Fig. 15-16: Sugarcanes and eggplants grown in polythene bags

4.6 Planting crops in pipes

Amazingly, crops can be grown with any method/technology using 'manured' soil as a planting medium. Waste pipes are collected and

perforated with a hot knife to create holes through which seedlings are planted.

Materials

- Waste pipes.
- Loam/black soil.
- Knife.
- Fire.
- Water.

Procedures

- Assemble all the materials required.
- Mix soil with manure.
- Lit the ‘jiko/sigiri’ to help heat the knife.
- Cut holes into the pipe into a shape of your choice using hot knife.
- Did small-sized hole into the ground and place the pipe.
- Add soil mixture into the pipe.
- Apply water into the pipe to moist the garden.
- Plant the seedlings.

Fig. 17-19: Sukuma wiki grown using waste pipes

4.7 Banana stems

Under this technology, live banana stems are used to for vegetable growing for example sukuma wiki. This is referred to as, "*parasite gardening*". In this technology, the stem provides moist environment and support for the growth of vegetables. However, vegetables should be grown using stems of mature banana trees (ready for harvesting) to avoid disturbing the growing banana plants.

Requirements/materials

- Loam/black soil.
- Farm yard manure/compost.
- Fibers.
- Stakes.
- Knife.
- Seedlings.

Procedures

- Identify mature banana trees.
- Mix soil with manure.
- Create planting holes at 45° (slanting angles), the holes are extended using a sharp stake for about 6 inches long.
- Add and push mixture into the holes.
- Plant and support the seedling with stakes or tie firmly with banana fibers.

Fig. 20-22: Sukuma wiki growing using live banana stems

4.8 Surface (ground) garden farming

This is the traditional practice of growing vegetables by households in every community in Uganda. The practice is adapted to because of its effectiveness and reliability in case of any weather changes. Further, it requires less skills and can be practices by any person with or without any acquired skills in climate smart/regenerative agriculture. Using this practice, gardens can be established near kitchen, areas where compost has been removed, demolitions, or where wastes are always burnt and allowed to cool after a time.

Requirements

- Location/space.
- Farm yard manure/compost.
- Planting material in which to plant the vegetables but it can be the ground itself.
- Hoes.
- Pangas.
- Wood/brick/banana stem/stakes, etc.

Procedures

- Identify location/site.

- Prepare site (till/dig).
- Measure the size.
- Did holes in proper lines/rows.
- Add manure in the holes.
- Plant seedlings in the evening.
- Apply water to seedlings.
- In the morning of the next day, water and cover the seedlings. with offcuts (obugogo) of banana stems.

Note:
It is important to mulch your gardens to mitigate moisture content loss from the soil. It also helps to prevent disease attack to the plants.

Fig. 23-25: Vegetables grown under surface gardening

4.9 Hanging technology

This refers to growing crops in hanging gardens for, example onions, radish, beetroot, carrots, and cabbages, sweet and Irish potatoes among others. This helps to create more space for expansion especially on the land surface.

Requirements

- Location/space.
- Loam/black soil.
- Farm yard manure/compost.
- Planting material in which to plant the vegetables.
- Strings.
- Nails/hummer.

Procedures

- Identify tree or hanging pole.
- Mix soil with manure.
- Select planting material (garden).
- Hang garden on the pole/tree using strings.
- Add soil mixture in the garden.
- Plant seedlings in the garden, preferably in the evening.
- Apply water to seedlings.

Fig. 26-27: Hanging vegetable gardens

4.10 Sack gardening

Under this technology, vegetables are grown on the side of the sack. This calls for a farmer to prepare the sack and plant the selected vegetables as indicated below:

Requirements to start up an organic backyard farm

1. Location/site.
2. Farm yard Manure/compost.
3. Wood shavings/charcoal dust.
4. ¼ inch stone aggregates.
5. Wheelbarrow/basin.
6. Sack or any other planting garden.
7. Spade/hoe/panga.
8. Bottomless container/tin (Nomi/Omo/Paint).
9. Jerry can/Watering can/water.

Procedures

i. Locate site/space.
ii. Assemble all the materials.
iii. Mix soil with farm yard manure/compost in ratio of 2:1
iv. Add a layer of one foot (1ft) of the mixture into the sack.
v. Lift and place hardly on the flow to firmly on it the ground.
vi. Place a bottomless tin onto the one-foot layer of the mixture into the sack.
vii. Add ¼ inch aggregates into bottomless tin, and surround it with soil mixture.

viii. Repeatedly uplift the tin as you surround it with soil mixture up to the top of the sack, and thereafter, remove the tin.

ix. Cut planting holes in the sides of the garden using a knife.

x. Insert hardly three stakes into the ground and tie firmly a string around the sack and water it via the top and sides.

xi. Plant the seedlings into the holes and stake the seedlings to control bending downwards.

Fig. 28-30: Site location & assembling of materials

Fig. 31-33: Soil-manure mixing & perforated sack gardening

5.0 Organic pesticide production

5.1. Introduction

In urban farming, households intensively use locally available inputs such as compost and farmyard manure (from poultry, livestock) to replenish soil nutrients and control pests. Organic farming is ideally devoid of chemical fertilizers and pesticides hence, use of inorganic chemicals for crop growth. Thus, Organic pesticide relates to a liquid locally processed using natural plants (vegetation) and animal waste products e.g. human and animal urine majorly for plant protection against pests.

Table 1: Advantages of organic pesticides over inorganic pesticides

Advantages of Organic Spray and Manure	**Disadvantages of Inorganic Pesticides and Fertilizers**
Environmentally friendly to human beings, birds and animals.	Not friendly to the environment, very harmful to human beings, animals and birds.
Very cheap (affordable)	Very expensive
Crops can be harvested and eaten immediately after spraying.	From the time you have sprayed, you are advised to take 4-5 days before harvesting crops.
It restores and boosts soil fertility through spraying.	It destroys the organisms in the soil through spraying.
Crops grown organically have a wide market and	It has a limited market and farmers earn little in terms of pricing.

earn farmers a good price.	

5.2 Requirements and procedures for organic pesticide production

1. First of all, one needs to buy a drum (pipa) or big jerrycan depending on the volume he/she wants to start with e.g., a drum with a capacity between 100 to 200 liters or a big jerry can which ranges from 20-50 litres.
2. Fill half of the jerrican with the urine and the remaining half with plant material (which should be cut/smashed into small pieces). The most common herbal plants (vegetation) used include neem tree, mwetango (chenopodium opulifolium), aloe vera, mululuza (Bitter leaf), kamulali (chili), garlic, vvu (ash), kapanga (lantana kamara), tobacco, mulugu (fish trapping herb plant), spring garlic leaves, residues of sugar (sukali glue), etc. though more herbal plants around you can be added to strengthen or increase the value of bitterness of your organic pesticide.
3. Stir the mixture well and cover it; after which you connect a pipe in the drum or jerry can to regulate the gas substances that are created due to the ongoing fermentation processes in the jerry can/tank.
4. Wait until 21 days then open, stir, sieve and close it well.

5.2 Storage and application of organic pesticides

1. Keep your pesticide at an average room temperature.
2. Shake it well before use.
3. Get 60mls, mix it in 20ltrs of water and then spray.

4. Spray early morning before sunrise or spray late evening starting when temperatures are not so high.
5. Spray thoroughly from top to bottom (covering the leaves and stem).
6. Meanwhile, keep opening your pesticides for a minute to allow gas or pressure created inside the jerry can to escape. Otherwise, the container may burst.

Note:

- The longer the pesticide stays, the more effective it becomes.
- The organic pesticides/fertilizer can work as a fertilizer and pesticide.
- It can also be sprayed on nursery beds to prevent attack of pests and boost the growth of the seedling.

Fig. 34-36: Production of organic pesticides

6.0 Tower gardening

6.1 Introduction

This is called a tower garden because of its rising height and it occupies a small confined space, is very easy to manage and maintain. It can accommodate a number of crops. The operation of tower

gardens has the following stages; construction stage, planting, and maturity (harvesting stage) are illustrated below;

Fig. 37-39: Procedural construction of tower garden

6.2 Costing and requirements for tower gardening

One needs to budget for input materials.

Table 2: Annual estimated budget of ten (10) tower gardens

No.	Materials (items)	Qty	Measurement unit	Unit Cost (UGX)	Subtotal (UGX)
1	Tyres	50	Pieces	3000	150,000
2	Wheelbarrow	1	Piece	150,000	150,000
3	Reliable water source				
4	Knapsack sprayer	1	20 liters	100,000	100,000
5	Labor	1	Person	200,000	200,000

6	Organic pesticide	2	1 liter	30,000	60,000
7	Assorted seedlings	600	Pieces	300	180,000
8	Transport		Lump sum	120,000	120,000
9	Spade	1	Piece	25,000	25,000
10	Hand hoe/handle	1	Piece	20,000	20,000
11	Aggregates	1	Wheelbarrow	20,000	20,000
12	Watering can	1	Piece	10,000	10,000
13	Organic manure	10	Wheelbarrows	3000	30,000
14	Loam soil	40	Wheelbarrows	2000	80,000
	Total				1,145,000

One needs to know the projected revenue from the garden.

Table 3: Annual harvests, income and profit for Yr.1

No.	**Crop**	**Twice harvest (weekly) Kg**	**Monthly Harvest Kg**	**Annual Harvest Kg**	**Price Kg**	**Total revenue (UGX)**
1	Sukuma wiki 600 plants	20	80	960	3000	2,880,000
	Total input					**1,145,000**
	Total output					**2,880,000**
	Profits					**1,735,000**

Table 4: Expenditure for 10 (6-stacked tyres) tower gardens in Yr.2

No.	Materials (items)	Quantity	Measurement unit	Unit cost (UGX)	Subtotal (UGX)
1	Organic pesticide	2	Liter	30,000	60,000
2	Transport	1	Lump sum	60,000	60,000
3	Labor	1	Person	50,000	50,000
4	Organic manure	5	Wheelbarrow	3,000	15,000
	Total expenditure input				**185,000**

Table 5: Yields and revenue from 10 (6-stacked tyres) tower gardens in Yr.2

No.	Crop	Twice harvest (weekly) Kg	Harvest (monthly) Kg	Harvest (annually) Kg	Price per Kg	Total revenue (UGX)
1	Sukuma wiki	20	80	960	3,000	2,880,000
	Total input					**185,000**
	Total output					**2,880,000**
	Profits					**2,695,000**

Note:
Total costs for materials in Yr.1 is higher due to the many startup inputs. However, in Yr.2, a good profit will be realized because of lower inputs.

7.0 Vertical-horizontal gardens

7.1 Introduction

This involves raising a stand to act as a garden and a fence accommodating many plants. The first, second and third rows have 120 plants each, making a total of 360 plants. This type of garden can be applied in a small space compared to if it was applied on the surface (land) and it is very easy and simple to manage. The pictures below illustrate the various stages of operating this type of garden; first stage is construction (far left, top and middle, top); the second stage is the planting process (far right, top) and the last stage is harvesting (bottom).

Fig. 40-42: Procedure for making horizontal gardens

Fig. 43-44: Onions and spinach grown in horizontal gardens

Table 6: Costing for vertical-horizontal garden in Yr.1

No.	Materials (items)	Quantity	Unit cost (UGX)	Subtotal (UGX)
1.	Poles	6	10,000	60,000
2.	Wheelbarrow	1	150,000	150,000
3.	Hand hoe	1	20,000	20,000
4.	Spade	1	25,000	25,000
5.	20 litre spray pumps	1	100,000	100,000
6.	Loam soil wheelbarrows	40	2,000	80,000
7.	Organic manure	10	3,000	30,000
8.	Watering can	1	10,000	10,000
9.	Organic pesticides	1	100,000	100,000
10.	Transport	1	150,000	150,000
11.	Nets in metres	30	7,000	210,000
12.	Robes (roles)	4	11,000	44,000
13.	Nails (kgs)	2	7,000	14,000
14.	Cement (1 bag)	1	35,000	35,000
15.	Labor	1	200,000	200,000
16.	Rubber tyres	30	3,000	90,000
17.	Grass (sacks)	3	2,000	6,000
18.	Pipers	6	4,000	24,000

19.	Chain link	1	180,000	180,000
20.	Tank	1	1,500,000	1,500,000
Total expenditure inputs				**3,028,000**

Table 7: Total yields and revenue from vertical-horizontal garden in Yr.1

No.	**Crops (plants)**	**Harvest (weekly) Kg**	**Harvest (monthly) Kg**	**Harvest (annually) Kg**	**Price per Kg**	**Total revenue (UGX)**
1	Spinach (120)	8	32	384	6,000	2,304,000
2	Spring onion (120)	6	24	288	3,000	864,000
3	Beet root (120)	3	12	144	3,000	864,000
						4,032,000
	Total input					**3,028,000**
	Total output					**4,032,000**
	Profits					**1,004,000**

Table 8: Total cost for vertical-horizontal garden in Yr.2

No.	**Material (item)**	**Quantity**	**Unit cost (UGX)**	**Subtotal (UGX)**
1	Organic manure	5	3,000	15,000
2	Organic pesticide	1	100,000	100,000

3	Transport	1	100,000	100,000
4	Labor	1	150,000	150,000
5	Grass	3	2,000	6,000
	Total expenditure input			**371,000**

Table 9: Total yields and revenue from vertical-horizontal garden in Yr.2

No.	**Crop (plant)**	**Harvest (weekly) Kg**	**Harvest (monthly) Kg**	**Harvest (annually) Kg**	**Price per Kg**	**Total revenue (UGX)**
1	Spinach (120)	8	32	384	6,000	2,304,000
2	Spring Onion (120)	6	24	288	3,000	864,000
3	Beet root (120)	3	12	144	6,000	864,000
	Total revenue					**4,032,000**
	Total input					**371,000**
	Total output					**4,032,000**
	Profits					**3,661,000**

Therefore, basing on the total materials (assets and tools) cost input for the vertical horizontal garden, in the first year is more than output.

Note:

This was taken from one (1) sample of a vertical-horizontal garden giving cost input more than output. If samples of 2,3,4,5 of vertical vise horizontal gardens were taken, output would be more than input because of the increase in the number of gardens.