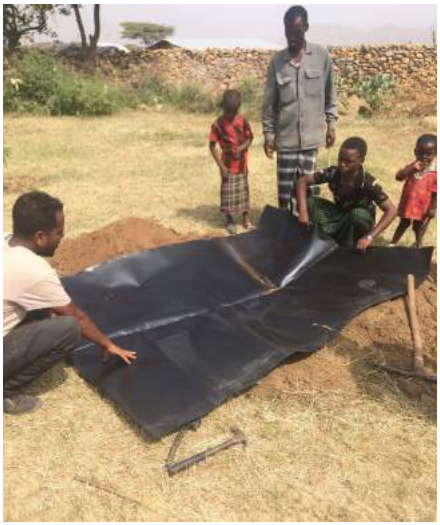
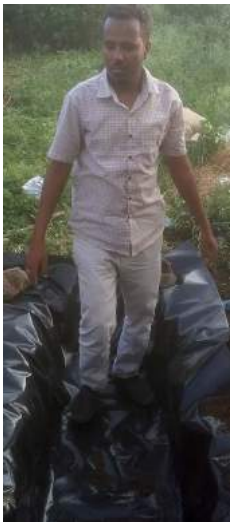
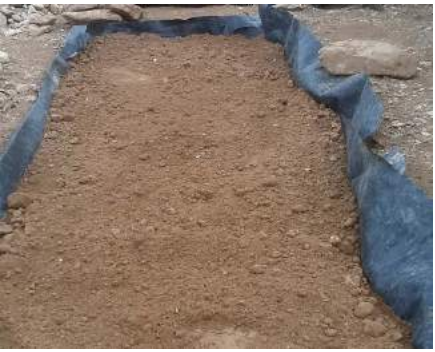
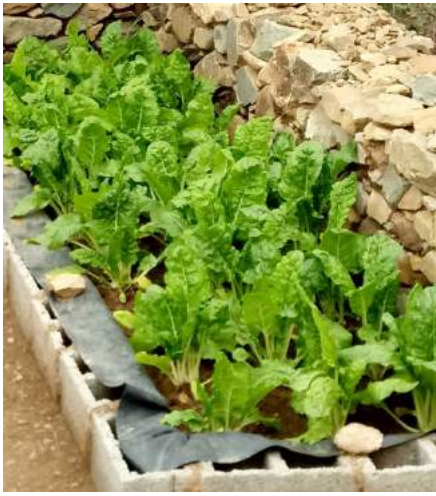
Trench Gardening

for Vegetable Production in Arid and Semi-Arid Areas

PELUM Ethiopia Consortium

Trench Gardening

for Vegetable Production in Arid and Semi-Arid Areas

By

PELUM Ethiopia Consortium

Published by
PELUM Ethiopia Consortium

P.O. Box: 171–1110, Addis Ababa, Ethiopia
Tel: +251-(0)911-246046 / +251-(0)978-815102
Fax: +251 116 686724
e-mail: hailuara@yahoo.com; Director@pelumethiopia.org
Website: www.pelumethiopia.org

PELUM Ethiopia Consortium and its member organizations gratefully acknowledge the financial support of Bread for the World / Protestant Agency for Diakonia and Development to work with smallholder farmers and agro-pastoralists in Ethiopia. We also appreciate their assistance in the identification, write up and publication of manuals, newsletters and good practices.

Copy Editor and Designer: Wibishet Fessha Assefa

Printed by:

Contents

ACKNOWLEDGMENT

PELUM Ethiopia Consortium is grateful and would like to extend its thanks and appreciation to the following organizations and individuals for their unreserved contribution in implementing the project and developing the manual.

First and foremost, we extend our gratitude to the farmers and agro-pastoralists, their households and partners for implementing this project with the support of their local experts and administrations. Communities are the basis of development work and sustainability because without their ownership and their positive attitude little can be achieved and made sustainable. My special thanks go to the implementing communities in Koneba and Semurobi Gela'elo weredas of Afar Region for practicing the technology to make it fruitful. I would also like to extend my appreciation to the first implementer (Alidera) and the second implementing group (Sheik Ibrahim, W/ro Meryem and Mohammed Idris (Wereda Administrator) of Koneba. My gratitude also goes to the Best Practice Association (BPA) and the Voice of Wilderness Developmental Organization for implementing the project in Koneba and Semurobi Gela'elo weredas respectively.

Next is Bread for the World / Protestant Agency for Diakonia and Development that has provided the funding for PELUM Ethiopia to strengthen the network and enable members to work with the farmers and agro-pastoralists. In Ethiopia, BFTW/ PADD has extended its support since long; PELUM Ethiopia is one of the beneficiaries. Therefore, we would like to extend our thanks to the organization including its staff for their unreserved advice and assistant in the implementation of the project.

PELUM Ethiopia would like to extend its appreciation for its member organizations who are working in agro-ecological practices. The initiation and the implementation of the agro-ecological projects implemented under moisture stress areas of the country are based on the interest of the member organizations. This manual for trench gardening is deliberately designed for communities living in moisture stress areas of the country and elsewhere.

Last but not least PELUM Ethiopia acknowledges Netsanet Genene, Berhanu Hagos, Nurhusen Kemal and Nega Megersa for facilitating the implementation of the technology at the grass-root level and assisting the preparation of this manual.

Hailu Araya Tedla (PhD)
PELUM Ethiopia Consortium
Addis Ababa, Ethiopia

FOREWORD

This trench gardening user manual is prepared by PELUM Ethiopia for farmers, agro-pastoralists and development practitioners working with local communities. Trench gardening is one of the agro-ecologically best fitting technologies to make vegetable production possible in moisture stress areas. This methodology is tested and accepted by grass-root communities living in rural areas. People living in moisture stress areas are not only food insecure because of lack of access to crop production, but they are also nutrition insecure due to unfavorable climatic conditions to grow diverse varieties of crops. This technology has become popular for empowering women, elderly people, children and people with disabilities because of its applicability around homestead areas and because of its need for less water. This manual is meant to assist farmers, agro-pastoralists and development practitioners all over the country and beyond to use trench gardening as a means to achieve food and nutrition security.

This user manual shows the 'how-to' of trench gardening for moisture stress areas to enhance their food and nutrition security. It contains a step by step guide for growing vegetables not only in drier areas but also in small land-holding. The step by step user manual includes aspects ranging from land preparation, planting to harvesting and vegetable storage management. It also includes success stories of vegetable production from two areas.

I hope this manual will be important not only for people living in Ethiopia but also for users from outside Ethiopia. Therefore it shall be shared among partner organizations and it might be translated into different languages in order to become most useful for grass-root communities engaging in agro-ecological food production.

As Bread for the World / PADD, we are pleased to support our partner PELUM Ethiopia network in promoting agro-ecology and in publishing this manual.

Christoph Schneider Yattara
Addis Ababa, Ethiopia
February 2019

1. What is trench gardening?

Trench gardening is a manageable vegetable growing approach that can be built and maintained easily on small homestead areas in a trench (lower bed) dug into the ground. Trench gardens are mostly practiced in areas that face water scarcity/shortage, have a rocky landscape and poor or disease infected soil that cannot support the growing of any kind of vegetables or herbs. Trench gardening requires fertile soil i.e. a mix of two or more of topsoil, fertile soil, compost, manure, etc., to be added into the trench.

N.B.: PELUM Ethiopia modified the preparation of trench gardening as follows.

In moisture stress areas, especially in arid and semi-arid areas, water/moisture is mostly scarce and limits plant growth. As a result of this, priority must be given to using water/moisture efficiently. Therefore, PELUM Ethiopia designed the preparation of lower beds in a trench by laminating the bottom and both sides using plastic cover and then adding fertile soil or soil mixed with compost until the trench is full. The plastic cover inhibits the percolation of water to the ground; it helps to retain and conserve water/moisture and supply nutrients to the plant for a longer time.

2. Why trench gardening is necessary?

Trench gardening:

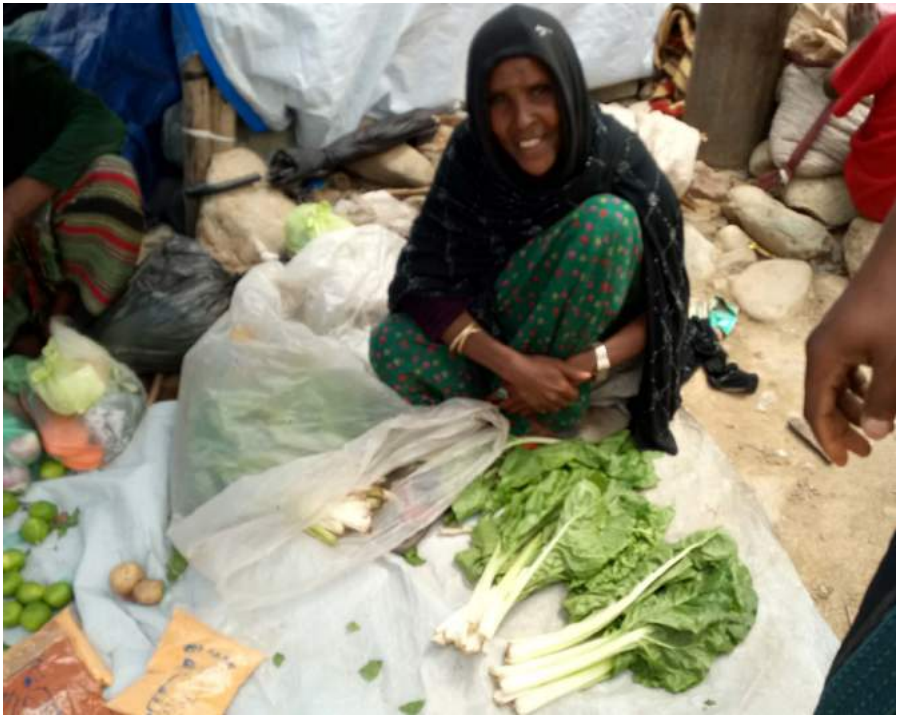
- It helps to improve the livelihood and nutritional status of individuals, family and community by growing vegetables. This also improves balanced nutrition to mitigate malnutrition of children.
- It is a better alternative gardening method since it utilizes conserved scarce water and moisture in dry areas which may not be able to sustain crop production.
- It helps families with limited/ very small plots of land, nearer to their homesteads, to produce vegetables.
- It presents opportunities for collecting fertile soil from nearby areas to an area that has poor soil to support any kind of vegetable or herb cultivation.
- It helps to empower women, differently-abled and elderly persons to use trench gardening as a source of income and food since it can be managed by family labor.

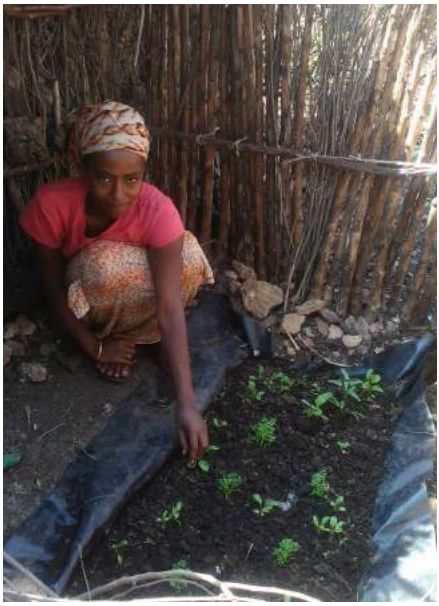
Practical training on the preparation and filling of trench beds in Semu Robi Gela'elo wereda of the Afar National Regional State

3. The benefits of trench gardening

The benefits of trench gardening are many; for example:

- Trench gardening plays a great role in introducing the techniques of vegetable production in all agro-ecological zones. Especially, it makes arid and semi-arid areas suitable to produce vegetable all year round.
- The design of trench gardens by itself helps to stop the percolation or loss of water into the ground.
- Trench gardening helps to produce different vegetables/companion crops on small plots of land; therefore it can become a good source of income and can provide a balanced diet for a family.
- Trench gardening helps to improve household income, food and nutrition security for poor households and disadvantaged families by supplying fresh vegetables for their daily diet and to the local market to supplement their cash demands.





- The activities in trench gardening can be easily implemented by women, children, elderly and differently-abled people since labor requirement is low.

- Trench gardening as a production system is more ecologically friendly; therefore, it reduces the use of synthetic inputs (inorganic fertilizers and hazardous chemicals) to grow vegetables.
- Trench gardening controls / reduces the occurrences of soil-borne diseases and pests.
- In trench gardens, added layers of organic materials decompose slowly and release nutrients to the soil over time, promoting a way to grow healthy and nutritious vegetables and robust flowers.
- The organic materials found in trench garden increase the ability of the soil to retain moisture and release it gradually to the growing vegetables; this reduces the volume of water needed for raising the vegetables.
- Trench garden is inexpensive as it can be constructed with materials that can be found within the farm's premise; little or no external input is needed.

4. How is trench garden prepared?

Select an appropriate location for your trench garden. The location should be where humans and animals do not frequently trample on the garden. However, it is better to make it where any family member wash or throw their recyclable food leftover.

Measure the size of the trench. It can be as long as you wish but it should be workable without stepping on the trench. This helps to make management easy. A standard trench bed is 60cm-80cm wide and 30-40cm deep while the length can be as much as you can manage. Generally, you can select any small or large plot of land based on your landholding.

There is no restriction for working tools but digging hoe, shovel, geo-membrane (strong plastic) and manure are a must for preparing trench garden. The following materials are also good to have while preparing a trench garden:

Meter: to measure the size of the trench you prepare; but you can also measure simply by traditional methods;

Pegs: to mark the measured area on each corner of the trench;

Rope: to keep the edge of the trench straight;

Geo-membrane/plastic cover: to protect water/ moisture loss downwards by covering all insides of the trench;

Shovel: to take out the soil from the trench; mix the fertile soil/com post together and then put it back in the trench;

Hoe: to dig out the trench;

Garden fork/rake: to level the soil which in return helps to put the geo-membrane properly, but the soil can also be leveled simply by hand;

Watering can: any container or watering material can be used; and

Manure/compost: to increase the fertility of the soil;

Topsoil: is a growing media for the plant;

Seed/seedling: as planting material.

Procedures

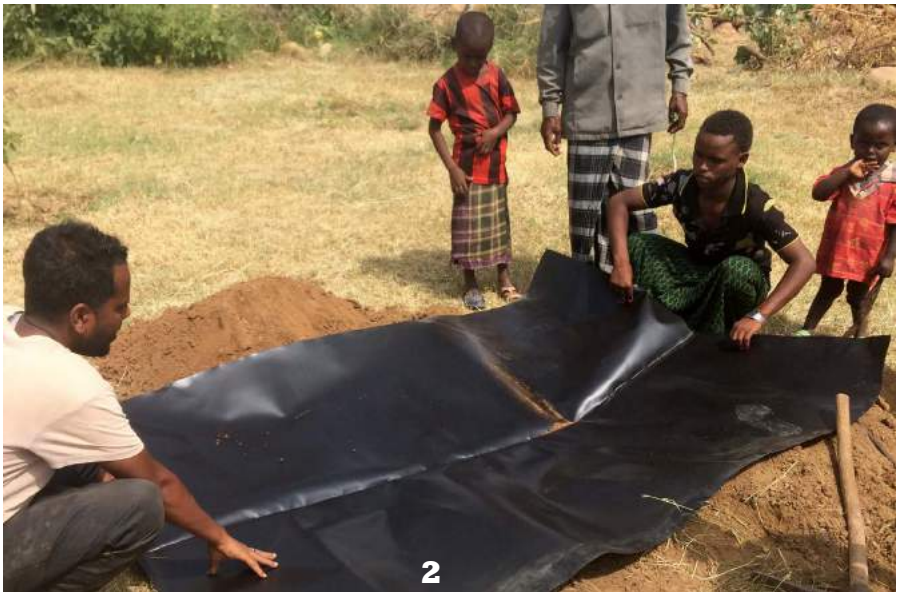
1. Ready an old manure or compost or fertile soil near the trench bed.

2. Decide and measure the size (length, width and depth) as you want and then dig (See photo 1).

   Dig out the topsoil (0-15 cm) and put it to one side of the trench.

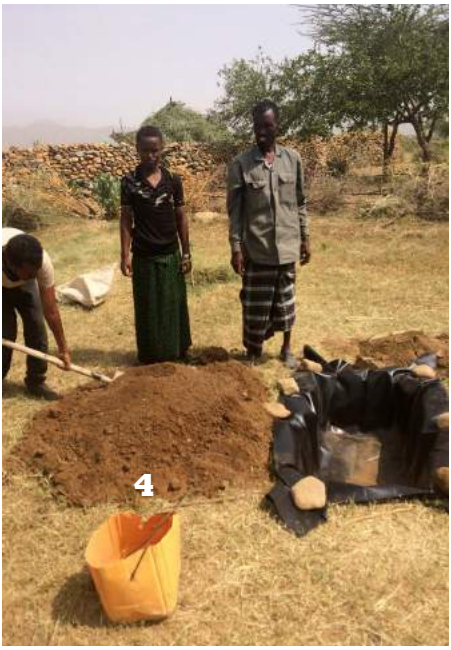
   Dig out the next 15-40 cm and put it to the other side.

3. After you are finished digging the trench please check the bottom and the sides for any rough or sharp materials such as stones that can cut and create holes in the geo-membrane. If so, please remove it.



4. Measure and cut the plastic cover depending on the trench size (See photo 2).

New type of trench laminated with plastic sheet in order to protect moisture from being lost downwards



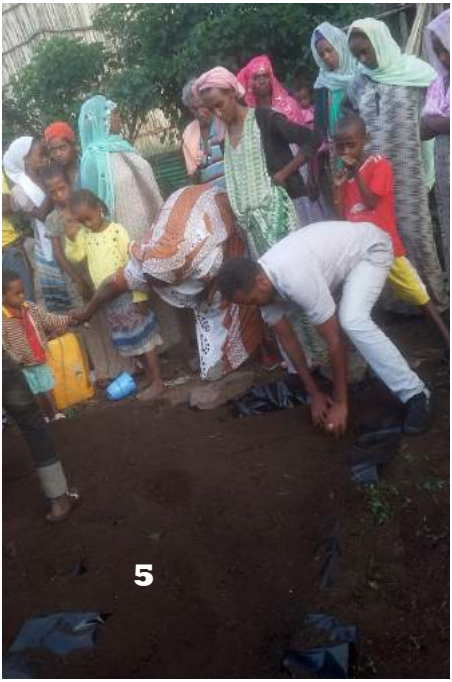
5. Then cover all sides (bottom and side) of the trench properly by the plastic cover (geo-membrane). Make sure that you have an extra edge of the plastic above the sides of the trench (See photo 3).

6. Mix the fertile soil (old manure and compost) with the topsoil and prepare to add it on the trench (See photo 4).

7. Sprinkle some water at the bottom of the trench on the plastic cover.

8. Start filling the trench with the mixed fertile soil properly.

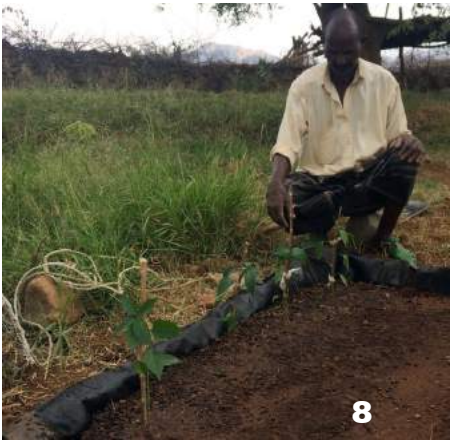
9. Level the soil in the trench by hand or any other tool such as garden fork and then compact it gently (See photo 5).



10. Put stones or any protective barriers at the edge of the trench or on the plastic cover (See photo 6).

11. Put dry biomass/mulch as cover on the top of the trench to conserve moisture especially when it is used as a nursery for vegetables.

12. Water the trench well until the soil is wet to make it ready for planting (See photo 7).



13. Before planting you have to do the following:
    a. Check whether the soil is moist enough and fertile
    b. Determine the type of vegetable to be planted
    c. Determine the companion plants for intercropping
    d. Maintain space between plants to reduce competition for nutrient and water (See photo 8).
    e. Prepare the diverting trench for any sudden flooding.

5. The companion crops for trench gardening

Companion crops are crops/vegetables that can grow together without harming one another; they exist for mutual benefits. Companion planting in gardening is planting of different crops for mutual benefits in proximity for different reasons including pest control, pollination, providing habitat for beneficial organisms, maximizing use of space, reducing competition for nutrients, water and sunlight and increasing crop productivity. They are used by farmers and gardeners.

In companion planting we can grow the following plants together:

Main Crop	A mix of 2 or more companion crops	Main Crop	A mix of 2 or more companion crops
Tomato	Asparagus, Carrots, Garlic, Lettuce, Spinach, Onion, Basil, Parsley, Green peppers,	Cabbage	Beet roots, Beans, Onion, Potato, Chamomile, Mint, Oregano, Rosemary, Spearmint
Asparagus	Carrot, Tomato, Basil, Coriander, Parsley	Beans	Broccoli, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Cucumber, chard, Corn, Eggplant, Kale, Peas, Potatoes, Strawberries
Green pepper	Garlic, tomatoes, beetroot, lettuce, onions, carrot	Carrot	Beans, Garlic, Leek, Lettuce, Onion, Tomato, Parsley, Rosemary
Onion	Beetroots, cabbage, carrots, lettuce, tomato, Chamomile, Marjoram, Rosemary, Savory, Strawberry	Lettuce	Beans, Beet roots, Broccoli, Carrots, Corn, Onions, Peas, Mint, Strawberries
Potato	Beans, Corn, Garlic, Lettuce, Onions, Peas, Spinach, Radishes, Basil	Zucchini	Beans, Corn, Garlic, Peas, Spinach, Oregano
Spinach	Beans, Broccoli, Brussels Sprouts, Cabbage, Cauliflower, Eggplant, Lettuce, Melons, Peas, Potatoes, Tomatoes, Strawberries	Pumpkin	Beans, Corn, Squash
Cauliflower	Beans, Peas, Spinach, Tomato, Chamomile, Oregano, Rosemary, Sunflower	Beetroot	Garlic, Leeks, Onions, Broccoli, Brussel Sprouts, Cabbage, Cauliflower, Lettuce, Spinach
Broccoli	Beet, Beans, Carrot, Cucumber, Garlic, Lettuce, Onion, Spinach, Swiss Chard, Basil, Chamomile, Mint, Rosemary	Brussels sprouts	Beets, Carrots, Garlic, Onion, Basil, Mint

6. Planting techniques in trench gardening

To ensure that your garden stays fertile, productive and pest-and-disease free, knowing planting techniques especially planting with space is useful. The planting space varies among different crops. For example, the distance between plants for tomato is 35-40cm; pepper 15-20cm; onion 5cm; lettuce and cabbage 25-30cm. You can plant or transplant the seedlings, in any way you choose. To reduce the competition for nutrients and moisture plus to create enough room for plants to grow it is better to leave approximately 30 cm between rows.

Use companion planting and sow crops of different types next to each other. Put leafy crops next to root vegetables to obtain mutual benefits, as this method works well in trench gardens. It is better to use bio-intensive planting companion plants.

Bio-intensive agriculture is an organic agricultural system that focuses on achieving maximum yield from a small area of land. Practicing it will help:-

a. to retain/conserve moisture
b. to minimize weed and diseases infestation (by planting companion plants that can repel insects).
c. to diversify the planting
d. to get more production on a small plot of land
e. to sustain the fertility of the soil by leaving most of the bio mass of the companion plants for mulch, compost, fertile soil, liquid fertilizer, etc.
f. to ensure long term sustainability of the vegetable production and nutrition supply for a family

Root crops, eggplants, spinach, lettuce, beans, tomatoes and peppers can grow better and give good yield in trench bed environment than on compacted or soils with high clay content.

After planting, prepare a fence (it can be easily prepared by using sticks) that helps protect the seedlings from external damage (caused by domestic and wild animals, chicken, etc.).

N.B.: Keep the desired depth while directly sowing the seeds or transplanting the seedlings.

Sow or transplant early in the morning and/or afternoon when the weather is cool. Avoid intense sunshine hours.

7. Follow up on trench gardening

After planting the companion crops on the trench garden you have to perform the following activities as a matter of priority. This includes watering, weeding, fertilizing, scouting, soil loosening and disease control measures. But we have to identify the time and interval of practicing the activities. For instance,

a. Scouting must be done all the time,

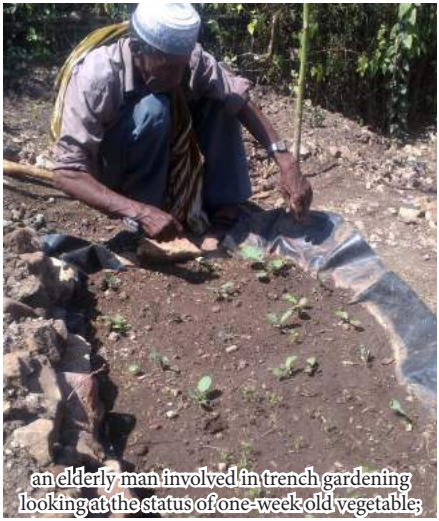
b. Frequent watering at an early stage early in the morning and late afternoon; and whenever water is available (3-4 days interval) after it grows well;

c. If the companion crops are well selected the chance of growing weed is minimum but weeding must be done whenever any weed is observed in the bed;

d. If there is enough fertile soil the chance of soil compaction is very low but soil loosening will be good after the plant is well established.

e. Please give much attention to pest and disease all the time. And if observed please apply naturally prepared liquid fertilizer.

f. Be careful for unexpected rainfall or flooding. Even though your area is arid, semi-arid or moisture stress, due to the effect of climate change rainfall or flood may happen. Therefore, be sure to have a plastic cover during sudden rainfall to divert flood or excess water.



an elderly man involved in trench gardening looking at the status of one-week old vegetable;

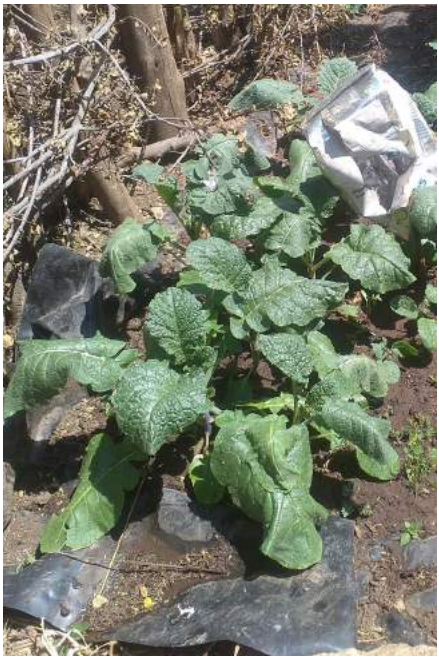
A young woman scouting her trench garden

8. Some successful examples of trench gardening

At the moment the trench garden designed by PELUM Ethiopia Consortium is implemented in dry land/water stress areas, mainly in two weredas of the Afar National Regional State; these are Koneba and Simurobi Gele'alo where the project is implemented through member organizations of the Consortium: Best Practice Association and Voice of Wilderness Developmental Organization respectively.

Now it is evident that the projects are successful because some agro-pastoralists, as beneficiaries of the project, in these weredas started consuming and selling vegetables within 3 to 4 months after implementation.

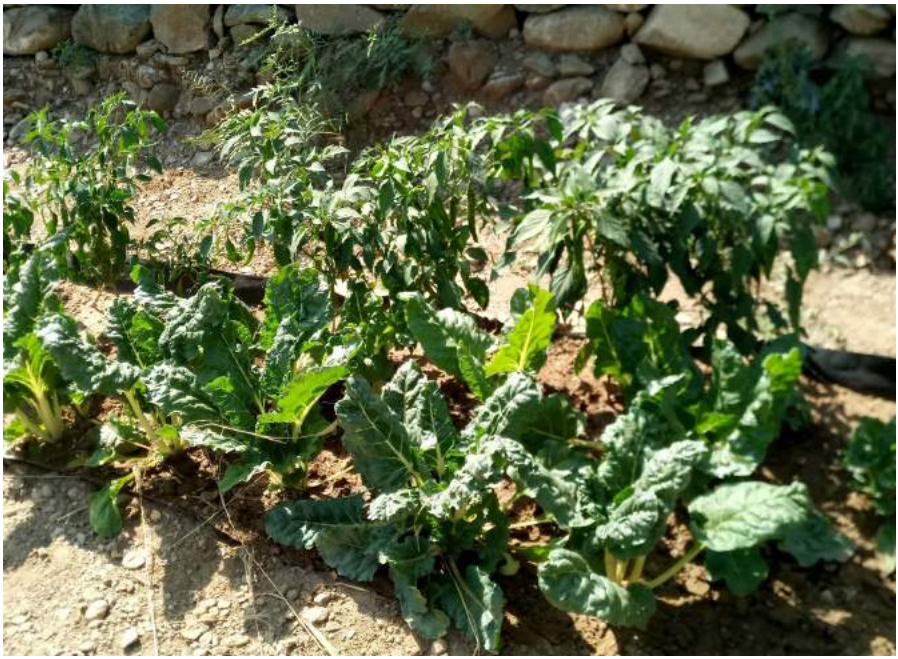
Well-grown spinach in Koneba wereda of Afar National Regional State

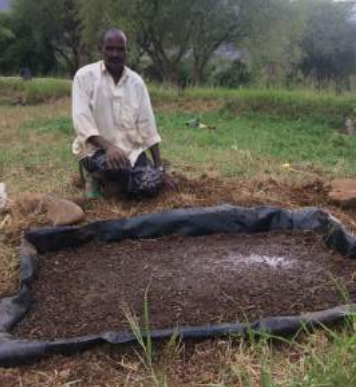


Well grown local cabbage (kale) in Sumi Robi Gela'elo wereda

Trench gardening by W/ro Meriyem Ali at Koneba town

Trench gardening by Ali Dera of Koneba town





Brot für die Welt

PELUM ETHIOPIA
Networking for a greener Africa.

Best Practice Association

VWDO
Voice of Wilderness Developmental Organization