Practice Note 1:
Vertical Gardens

Education and Training for Sustainable Agriculture and Nutrition in East Africa
EaTSANE
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Research on vertical gardens

Vertical gardens are space saving as they extend the planting area from the horizontal into the vertical dimension. Researchers in the EaTSANE project designed vertical garden systems that can be constructed by recycling locally available materials. These garden systems emulate known structures in the research areas (e.g. granaries or house wall) and thus can be built with local construction techniques. The three prototypes were the second wall, the planting tower and the bucket system. While the planting tower and bucket system stand freely, the second wall is required to lean against another structure such as a house wall.

Together with students from secondary schools in Kapchorwa, researchers of the EaTSANE project established, tested and evaluated the three garden systems with four different vegetable species: field peas (*Pisum sativum L.*), African spinach (*Beta vulgaris ssp. vulgaris*), black nightshade (*Solanum nigrum L.*) and collard greens (*Brassica oleracea L.*). The student-researcher teams measured productivity and water holding capacity of each system and made the following observations:

- **The planting tower** and the **second wall** had higher yields than the **bucket system**. The stability of the **bucket system** increases with bucket size and should stand freely to increase accessible planting surface area.
- The stability of the **bucket system** increases with bucket size and both it and the **planting tower** should stand freely to increase accessible planting surface area.
- Yields depended on the position of the plant in the system, with the highest yields from plants in the middle of the **planting tower** or the **second wall**.

The three systems tested in Kapchorwa, Uganda: Second wall, emulting a house wall (left); Planting tower, emulating a granary (center); and bucket system, emulating stacked buckets. Photos by Saskia Grünwasser.

Practical implications

Vertical gardens are suitable for households that wish to produce vegetables in a controlled environment, close to their house. Being off the ground, the crops are protected from small ruminants and fowls. Our research has shown that particularly the **second wall** and the **planting tower** have the potential to increase production of leafy green vegetables, other types of vegetables, or even spices. While the planting tower provides are larger surface for planting in a free stand, the second wall has the advantage of needing less space and being more protected.

The systems are especially suitable for households with land constraints to produce vegetables. To address the needs of women, who are mainly involved in producing vegetables, the systems are designed to save time and labour. The vertical gardens can be established close to the house and kitchen, where the vegetables are used for cooking. Once the systems are constructed, the water distribution system (cotton cloth) and included biological materials, such as manure or compost, reduce time for watering, fertilisation and harvest.

Required materials and skills

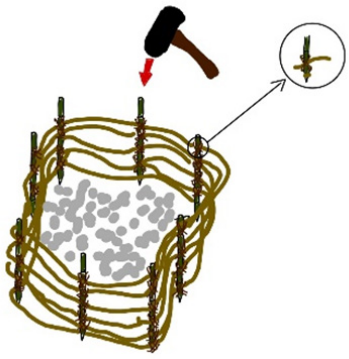
The garden systems were conceptualised to re-use materials that are already present in the household (old clothing, plastic bottles). Constructing a **second wall** or **planting tower** requires the following materials:

Material	Examples of locally available materials
3 pipes á 80 cm, prepared with holes in a diameter of 1-2 cm at a distance of 5 cm	PVC pipe or any material that can be put into a pipe shape
15 long and flexible sticks, sharpened on one end	Cypress Branches or other bendy branches
8 sturdy sticks, approximately one meter	Eucalyptus branches – their length defines the height of the system
Nails	Any type of nails
Larger piece of fabric	Gunny bags or any other material that can hold soil, waterproof fabric (such as wax cloth) increases the durability
Rope to fixate sticks	Rope made of sisal or other plant materials
Cotton materials for water distribution in the system	Old T-Shirts, jeans, other clothing, but the materials should be cotton and not a synthetic material
Gravel	Any hard gravel that prevents waterlogging
Substrate	Home-made compost from manure (cow or goat), household waste, and plant residues. Mixed with a ratio of 80 parts soil and 20 parts fertiliser
15-20 plastic bottles	Bottles any size and shape, for example, water or soft drinks

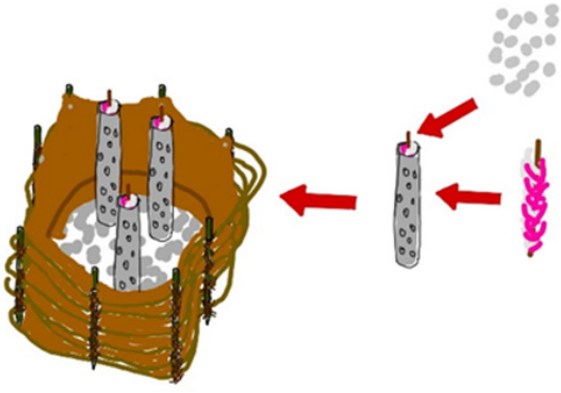
The construction needs similar skills as building a granary or wall of a house. The best time for establishing and planting of the vertical garden is the beginning of the planting season. After two to three seasons, the cotton cloth on the surface of the garden systems needs to be replaced. To maintain the fertility of the soil, crop residues can be placed on the top so that the nutrients leach into the soil when watering.

Guide for Constructing a Planting Tower

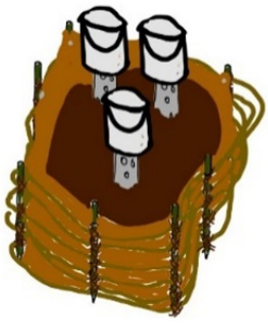
1. Built a circle with the 8 branches, all branches should be at a distance of 40 cm to the centre.
2. Knock them in the ground.
3. Interwove 15 bendable branches intro the sticks, similar to a granary.
4. Tie the bendable branches to the sticks
5. Fill gravel (5-8cm layer) into the frame.



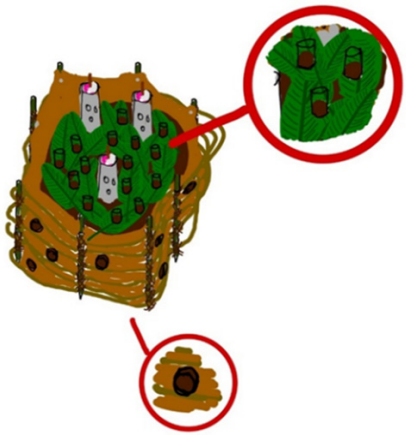
6. Place the large piece of fabric into the framework and fix with nails. Fold the open lower side like a package.
7. Wight gunny bags with gravel.
8. Place the PVC tubes in the same distance to the walls and between each other.
9. Wrap three straight branches with old cotton clothes and place them in the PVC tubes.
10. Fill gravel into each PVC tube around each cotton wrapped branches as a drainage.



11. Cover the three PVC tubes with a bucket in order to avoid dumping the soil in the PVC tubes.
12. Fill in the soil fertiliser mixture into the planting tower.



13. Place dried banana leaves on the system to protect it from direct sunlight and associated evaporation.
14. Cut a total of 16 holes at the size of a plastic bottle with a knife in the banana leaves to accommodate plants.
15. Place pieces of plastic bottles (half cylinders) in the holes to avoid washing out of seeds and support later plants.



About the EaTSANE project

The EaTSANE project is an interdisciplinary research project on diversified agriculture, nutrition, and value chains, implemented by research and development institutions from Kenya, Uganda, Germany and the Netherlands in the period from 2018 until 2021. The main objectives are to develop more sustainable farming practices and improve diets of households in Teso South, Kenya and Kapchorwa, Uganda by diversifying the food system with a participatory action research approach. The research teams identified practical implications across the project activities, which led to a set of practice notes.

Further reading and training materials

Further reading and training materials can be found: https://www.eatsane.info/publications

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With support from Federal Ministry of Food and Agriculture by decision of the German Bundestag