In the course of implementation of home garden technologies by the Biodiversity for Food and Nutrition (BFN) Project in Busia County, Kenya it was observed that the frontline extension staff would benefit from resources to strengthen technical capacity on key home gardening technologies. For this reason, the BFN Project has developed this resource to be disseminated widely and provide access to information about such technologies to increase awareness and strengthen capacity.
According to the Global Nutrition Report (IFPRI, 2014), efforts to reduce undernutrition in Kenya have been regrettably slow, with no significant change in the nutritional status of children below five years of age since 1998.

Food and nutrition insecurity persist in many parts of the country with the most recent demographic and health survey (KDHS, 2014) revealing that 1 in 4 (26%) Kenyan children below five years of age are stunted (below adequate height for age), 11% are underweight and 4% are thin, conditions that could be easily prevented by providing adequate nutrition and healthcare in the early stages of child development.

Malnutrition, the survey showed, was also more likely to occur in low-income low-education households. Busia County in Western Kenya is no exception. Poverty rates range from 63% to 74% and over two-thirds of the county’s population is unable to meet its basic food requirements.

Home gardens have the potential to increase micronutrient intake and improve the health and nutritional status of at risk populations, especially following the reintroduction of food species that are under threat of extinction yet are highly nutritious.

The Kenyan national Food and Nutrition Security Policy (FNSP, 2012) identifies home gardening as one of the key strategies for diversifying diets, and contribute to improved nutrition and household food security. It is for this reason that home gardening technologies (HGTs) are being promoted by the Ministry, and why the Biodiversity for Food and Nutrition (BFN) Project has produced this complimentary resource.

The purpose of the BFN project is to enhance the existing biodiversity and reintroduce food species that are under threat of extinction, yet are nutritionally valuable. The project chose to pilot this intervention in Busia County because of its rich agricultural biodiversity yet high rates of malnutrition, particularly undernutrition and micronutrient deficiencies.

The **BFN Infographic** featured on the following page provides a summary of why agrobiodiversity (the variety and variability of plant and animal species) is vitally important for food and nutrition security.

**HGT1: Composting** is a must-read, as all the gardening technologies included in this resource require soil which is rich in nutrients and minerals for seeds and seedlings to flourish and grow well.

Choose from **HGT2-9** the most suitable gardening technology depending on the space, time, resources, materials and environmental climate you have to work with.
Home Gardening Technology 1: Composting

Traditional vegetables grow well in soils that are rich in organic matter (OM), that is, the nutrients and minerals made available to the soil when microorganisms break down food and plant waste. Composting in the area near your garden plot will not only enrich the soil, it will also mean less need for chemical fertilizers, less soil erosion, better soil structure and moisture for plant roots to grow, and the recycling of organic material which would otherwise be discarded as waste.

What makes good compost?

- Use a carbon to nitrogen ratio of 2 : 3, so about 1/3 more nitrogen-containing matter such as kitchen scraps, food remnants, the stems, leaves and seeds of fresh fruits and vegetables, grass clippings than carbon-containing matter such as dried leaves, shredded newspaper, cardboard, fireplace ashes, nutshells, egg shells, sawdust
- Ensure a good moisture content, around 40-60% by weight of the pile. This will provide humidity and the best conditions for microorganisms to breakdown the organic matter.
- Oxygenate the compost to speed up decomposition. Turn the mixture at least once a day for optimal results, but try not to compact the pile as it requires oxygen for microorganisms to thrive.
- Keep the pile warm to promote decomposition. Direct sunlight will increase the temperature of the pile and enhance biological activity for breaking down materials.

How do I get started?

You will need:

- Bins (plastic, metal or concrete) with lids
- Organic waste (keep the carbon : nitrogen ratio)
- Water
- Air
- Gloves

Procedure:

- Choose a bin that suits your needs
- Mix food waste, animal manure (contains microorganisms) and dry leaves in the ratio of 1:1:1 by volume.
- Add a little water to make the mixture alike to a wrung out sponge.
- Stir the mixture at least once daily.
- Keep the bin covered and in a dry open place.
- After 1 month the mixture will have turned to crumbly, dark brown humus.
- Spread it on a flat surface for 1-2 days to enable it to dry.
- The compost is now ready to be used in kitchen gardens, flowers, potted plants, etc.

The compost mixture smells bad, what do I do?

The pile is lacking air, or the moisture is too high. Turn the pile over to provide oxygen, and add dry materials to soak up some of the water.

The compost mixture is not heating up, what do I do?

The pile could be lacking moisture or nitrogen, or the particle size of the materials is too big for the microorganisms to break down. Add water if the mixture dry, mix in fresh manure grass clippings or fruit scraps to increase nitrogen, and chip or squeeze larger material during turning to reduce their size.
Home Gardening Technology 2: Multi-storey garden

Advantages:
- Takes less space, ideal for urban households
- Provides healthy vegetables for a long time
- Cheap to make
- Requires water only every other day rather than daily
- Capacity to hold 200 stems depending on choice of plant
- Considerable pest control achieved by intercropping

Materials required:
- Area: 2ft x 2ft
- 4 poles, each 2m long with a 2” diameter
- 1.5 m polythene tube, 90-kgnylon cereal bag or large plastic basin
- 4-L empty hollow tin gallon or paint tin
- 1 wheelbarrow ballast (stones or rocks)
- 7 wheelbarrows soil and manure/compost
- Organic foliar feed 1 L
- Plenty of water
- 250 seedlings (50 exotic, 150 local)
- Sharp knife

Steps:
1. Measure area 2ft by 2ft and dig 1ft deep if garden is to be established on the ground
2. Place the hollow tin (bottom cut out) at the center of the area
3. Secure the 4 poles at each corner of the square
4. Insert the polythene tube 60 inches wide around the 4 poles or to size of gunny bag
5. Fill the hollow tin with ballast
6. Mix manure and topsoil or compost and then put the mixture between the hollow tin and the edges of the bag
7. Gradually fill in the mixture making sure not to interfere with tin
8. Once soil reaches top of tin, lift the tin without moving from the center position and refill with ballast
9. Fill in layer by layer of the soil and manure mixture, keeping the tin in the centre until the bag is full
10. Water the soil moderately between each layer
11. Punch holes spaced 6”x 6” diagonally into the bag (about 9 rows with 16 holes each)
12. Plant the seedlings, making the soil around each firm
13. Water through the central core of stones or rocks until soil is soaked, top dress, and leave overnight to set.
14. Foliar feed (apply organic liquid fertilizer directly to leaves of plants) as necessary, and provide water (20L) every other day

What should I plant?
- Green onion in (season)
- Kale in (season)
- Etc.
- Etc.
Home Gardening Technology 3: Mandala Garden

Advantages:

- High plant population hence higher yields/unit area
- Deeper penetration due to double dug beds
- Can water entire garden from a single point
- Effective sprinkler irrigation due to the garden’s round shape
- Ideal garden in areas without enough water for irrigation
- Has aesthetic value due to beautiful patterns
- Requires minimal maintenance

Materials required:

- Wheelbarrow, forked jembe (garden rake) and mattock
- Well decomposed manure/compost
- Top soil
- Twine, tape measure, and marking pegs
- Labor - 10 man days
- Water source – from roof catchment, ground water run-off or detergent-free waste water from the kitchen

Steps: Provided by David Kuria & Ann Githii

1. Choose your site: Best is near the homestead or a water source located on the upper side of the garden.
2. Lay out the beds: Make at least 3 circular beds of 1.3m to 1.5m width beginning from the central pit (1m wide and 1m deep). Leave a space 0.3m to 0.5m as a path between every 2 beds.
3. Spread a thick cover of well decomposed manure on the bed. 1 debe per m square should be sufficient.
4. Starting from one end of the bed, measure out a narrow strip 60cm wide.
5. Dig the strip, mixing the compost into the top soil.
6. Remove the soil you have just dug and take it to the end of the bed. Put it outside the bed on the far end. Make sure that you have removed all the top soil. You will know this when your jembe hits a harder layer at the bottom or when the soil changes colour from dark brown to reddish brown.
7. Then dig this compact subsoil deeply. When the whole strip is completed, level out the loose subsoil. Apply another layer of manure or chopped green vegetation on the leveled subsoil.
8. Measure out another strip of 60 cm; dig the top soil again mixing it well with the compost you had applied on the surface.
9. Again remove all the top soil but this time put on the top of the subsoil of the previous strip.
10. Continue to dig as Step 8.
11. Measure out another strip; continue to dig as Step 9 and 10.
12. Continue like this until the whole topsoil is dug and removed in order to allow a second digging of the bottom compact subsoil. This is why the technique is called double digging.
13. The finished bed is then raked and mulched in preparation for planting.

Tips for mandala garden management

- Practice crop rotation
- Always weed and harvest produce while standing on the paths to avoid compacting the soil.
- Every 2-3 years, renew the mandala garden by following these steps:
  1. Fertilize the top soil with compost.
  2. Dig out the topsoil to a 30cm depth.
  3. Then loosen the subsoil to a 30cm depth and level.
  4. Add a layer of manure to the subsoil.
  5. Replace the topsoil, level off, mulch, then plant.

What should I plant?

- Crotalaria in (season)
- black nightshade in (season)
- amaranth in (season)
- jute mallow in (season)
Home Gardening Technology 4: Stick Sack Garden

Advantages:

- Takes up minimal space (1m x 3 m)
- Not labor intensive and provides healthy and succulent vegetables for a long time
- Very cheap to make because the materials used are local and cheap
- Requires less water than open ground
- High plant population hence high yield/unit area
- Ideal for contaminated, congested, and rocky areas
- Requires minimal maintenance

Materials required:

- Small sticks
- Jembe (garden rake)
- Stones
- Tithonia leaves
- Dry matter (such as maize or sorghum stalk)
- Well decomposed manure/compost
- Top soil
- Ash
- Dry grass
- Logs or banana stems

Steps:

1. Measure area 1m x 3m
2. Set out the boundary of the garden by placing sticks all around measured area
3. Cover measured area with a layer of stone
4. Place a layer of dry matter on top of the stone
5. Place a layer of dry grass on top of the dry matter
6. Next, layer with tithonia leaves
7. Mix topsoil with compost, and spread over tithonia leaves
8. Sprinkle ash over topsoil/compost mixture
9. If garden is dug during a dry spell, water bed
10. Plant seedlings
11. Mulch with dry grass
12. Place logs/banana stems around border of garden to prevent erosion

What should I plant?

- Crotalaria in (season)
- jute mallow in (season)
- Ethiopian kale in (season)
Home Gardening Technology 5: Key-hole (Mountain) Garden

Advantages:

- Cheap to prepare
- Resources used are available on the farm
- Feeds the household throughout the year
- High plant population hence high yield/unit area
- Requires minimal area (2 meters in diameter)
- Income generation from surplus produce
- Management is cheap

Materials required:

- Small stones
- 4 poles 1m long each
- Rope
- Dry matter (dry grass/banana leaves)
- Top soil
- 8 wheelbarrows well decomposed manure/compost
- Seedlings or seeds
- Logs or banana stems
- Jembe (garden rake)

Steps:

1. Remove topsoil of 60cm diameter and make hole in the middle
2. Put stones in the middle of 15cm height, then put sticks around the stones to keep them in place
3. Tie rope around sticks/stones
4. Press dry matter in the middle of the sticks
5. Mix topsoil with fully decomposed manure/compost
6. Start building anthill with topsoil/compost mixture until it reaches just 1in below the top of the sticks
7. Make small opening at side of hill for stepping when watering hill in middle
8. Place logs/banana stems around to prevent erosion

What should I plant?

- black nightshade in (season)
- green onions in (season)
- spider plant in (season)
Home Gardening Technology 6: Hanging Garden

Advantages:
- Suitable for household where land, labour and time is constrained.
- Growing of different vegetables and fruits is possible at the same time
- Possible to grow crops on clean root media even in polluted areas
- Income generation from sale of surplus produce
- Efficient water utilization
- More production in a small area,
- Height makes it secure from theft and flooding
- Time saving and can be made to be moveable
- Continuous harvesting and replanting is easy
- Design is flexible and applicable at ground level, balconies, rooftops
- Have aesthetic outlook and can be incorporated in landscaping
- Children particularly enjoy this type of gardening technology

Materials required:
- Planting media options:
  - media mixture of topsoil with manure in ratio 2:1 (this is the ideal media)
  - combination of loamy garden soil, sand and peat moss in ratio of 2:1:1
  - or commercial potting mixtures from sawdust, peat moss, vermiculite, and wood chops can be purchased
- 36 planting materials (buckets or similar-sized containers)
- 2.5m central wooden post
- 3 pairs of 3” by 4” timber of 1m, 2m, and 3m length respectively
- 2kg of 4” nails
- Labor for construction
- Seeds or seedlings

Steps:
1. Select site: must receive at least 6 hours of sunlight throughout the day.
2. A 3m x 3m space is required. Design may also vary depending on the space available
3. A vertical 3m high strong post is firmly fixed at the center
4. Cross bars or stair cases are fixed on the post at 1m intervals above the ground
5. The containers filled with planting media are hung on the bars or placed on the stair cases and balanced to ensure stability of the stand
6. Plant the seedlings/seeds in the containers
7. White containers are recommended because they reflect the sun rays and reduce evaporation

What should I plant?
- spinach/vine spinach in (season)
- amaranth
- strawberries and goose berries
- capsicum
- jute mallow
- crotalaria
- onions
- tomatoes
- pumpkin
- chili
- cowpea
- spider plant
- black nightshade
- ethiopian kale
- herbs: mint, coriander, celery, parsley, thyme, rosemary
Home Gardening Technology 6: Sunken Garden

Advantages:
- More production from a small unit area
- Conserves moisture
- Retains water
- Controls soil erosion
- Suitable for urban areas
- Productive even during dry spell

Materials required:
- Stones
- Jembe (garden rake)
- 3 wheelbarrows of well decomposed manure/compost
- Tithonia leaves
- Dry leaves or grass
- Ash

Steps:
1. Measure area of 1m by at least 2m and loosen soil, to a depth of 60cm
2. Separate topsoil (first 30cm deep) and subsoil (second 30cm deep) and put aside
3. Arrange stones to cover the exposed area, or use a polythene sheet if available
4. Cover stones with dry matter
5. Place layer of tithonia leaves on top
6. Sprinkle ash on leaves
7. Mix topsoil with compost and layer and spread over area
8. Border garden with subsoil
9. Plant seeds or seedlings
10. Water to ensure it’s wet enough

What should I plant?
- Lettuce and spinach in the cool season
- Capsicum and tomato in the warm season
Home Gardening Technology 7: Tumbukiza Garden

Advantages:
- Cheap to prepare
- More production from a small unit area
- Conserves moisture
- Retains water
- Controls soil erosion
- Suitable for urban areas
- Productive even during dry spell

Materials required:
- Working site
- Jembe (garden rake)
- Spade
- Sticks
- Fresh, young tithonia leaves
- Well decomposed manure/compost
- Planting materials

Steps:
1. Measure plot 2ft x 2ft (60cm x 60cm), and set out the boundary corners with sticks
2. Dig 60 cm deep, separating topsoil (first 30cm deep) from subsoil (second 30cm deep), and put aside
3. Place tithonia leaves in hole
4. Mix compost with topsoil and return to hole (it should not fill the hole completely)
5. Plant seeds
6. Mulch with dry grass

What should I plant?
- black nightshade in (season)
- green onion
Home Gardening Technology 8: Banana Stalk Garden

Advantages:

- Conserves moisture
- Retains water
- Suitable for urban areas
- Cheap to produce
- Productive even during dry spell
- Requires minimal maintenance

Materials required:

- Banana stalks
- Well decomposed manure (Compost)
- Machete
- Seeds/seedlings
- Jembe

Steps:

1. Dig shallow trench and arrange banana stalks
2. Using a sharp knife or machete, cut holes into the stalk
3. Fill holes with mixture of topsoil and compost
4. Plant seedlings or seeds

What should I plant?

- Kale
- Spinach
- spring onions
- spider plant
- coriander
- suga
- chimboka
Home Gardening Technology 9: Tire Garden

Advantages:
- Good for the environment (recycling of unused tires)
- Can stack to grow long rooted vegetables
- Can re-arrange to suit needs of the season (spread out or stack tires)

Materials required:
- Strong knife to cut the tire
- Various sized tires
- Container garden soil

Instructions
1. Find a suitable tire. Use any size tire with the metal rim removed. You may also use a knife with a long blade to cut into the tire.
2. Clean the tire with soap and water. Use a sponge to help clean inside the tire. Rinse the tire off with a good spray from the hose.
3. Place landscaping cloth or mulch on the spot where you plan to put the tire garden. Placing the landscape cloth or mulch down first deters weeds from growing up through the tire.
4. Fill the tire with your prepared soil and compost.
5. 1 part soil, 1 part organic compost, and 1 part composted kraal/animal manure for an extra nitrogen boost.
6. Add the soil, compost and manure, and mix well with your hands. Break up any big clods of dirt with your hands or a trowel and then push the soil into the grooves of the tire. Let the soil settle for a few days and add more if necessary.
7. To prevent ants and other crawlies from getting to your veggies, apply grease to the lip of the tire with your fingers.
8. Plant vegetables and ensure to plant chives, garlic and onions around the perimeter to prevent insect damage.
9. Water regularly and mulch if need be.

- Check for local laws against standing tires in yards. Some communities don’t allow tires to be used for anything. Call your local community government for more information regarding this issue.

What should I plant?

In a single tire:
- Squash, cucumber or melon. Make a mound of soil in the centre of the tire and plant 3 seeds.
- Herbs and flowers.
- Tomatoes and peppers

Using two or three tires stacked on each other:
- Plant potatoes
For the intro page:

