Ministry of Agriculture

KEYHOLE GARDEN

Producer Reference Book

THE NATIONAL FOOD AND NUTRITION COMMISSION OF ZAMBIA

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Implemented by
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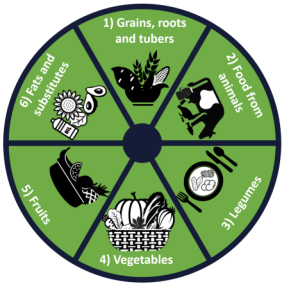
CRS CATHOLIC RELIEF SERVICES



EAT HEALTHY
EAT DIVERSE
EAT DIFFERENT
FOOD GROUPS

Keyhole Garden Producer Reference Book

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Ministry of Agriculture

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On behalf of the
Federal Ministry for Economic Cooperation and Development (BMZ)
Germany

Foreword

The Ministry of Agriculture has the pleasure to provide you this Keyhole garden (KHG) user manual for small scale farmers. This manual provides guidelines on how to construct a KHG using locally available materials, hence it is economical, requires less labour to build and has the benefits of minimising soil moisture loss and is easy to manage for the farmers.

Although, crop production is registering positive gains on specific rain-fed field crops, the crop sector is still dominated by maize production (Second National Agriculture Policy, 2016). Consequently, there is urgent need to diversify into horticultural crops, especially nutritious and high value vegetables. However, the major challenge in vegetable production is the limited number of households with access to water sources for vegetable irrigation. To address some of the challenges highlighted above, the keyhole garden user manual provides an opportunity for households to diversify and engage in vegetable production throughout the year.

A keyhole garden is a circular raised bed with a walkway and a centrally placed basket for watering and composting. It is called a keyhole because the walkway and the basket at the centre of the garden makes it look like a keyhole when seen from above. The garden is normally located near the household with the purpose of growing different nutritious vegetables.

This user manual is intended for extension service providers, community leaders and farmers as a reference on how to construct and manage nutritious vegetable crops in the keyhole garden. By following this manual, a farmer can successfully construct and maintain the keyhole garden, diversify crop production and improve household food and nutrition security.

Songowayo Zyambo
Permanent Secretary,
Ministry of Agriculture.

Acknowledgements

This keyhole garden user manual is the result of the efforts of the stakeholders involved in nutrition sensitive agriculture to improve the Food and nutrition status of women and children during the 1000 most critical days. The Ministry of Agriculture (MoA) would therefore like to thank the Zambia Agriculture Research Institute (ZARI) and the National Food and Nutrition Commission (NFNC) for the Technical support provided to the development of this Keyhole garden user manual. Additionally, we would like to thank the thank the German Federal Ministry for Economic Cooperation (BMZ) for funding the Food and Nutrition Security Enhanced Resilience (FANSER) project implemented by GIZ in collaboration with the Catholic Relief Services which supported the entire process in the development of this user manual.

Special thanks to the Rural Initiative for Children's Hope (RICH), Send a Cow Zambia (SACZ) and community members in Petauke District under the FANSER project that participated in the development of this user manual.

We hope the information in this booklet will help to improve the health and nutrition status of women and children in the 1000 most critical days in Zambia. The booklet can be adapted for use in various parts of Zambia to sustainably improve household food and nutrition security.

Peter K. Lungu

Director of Agriculture

Ministry of Agriculture

List of Abbreviations

BMZ	German Federal Ministry for Economic Cooperation
CRS	Catholic Relief Services
FANSER	Food and Nutrition Security, Enhance Resilience
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
KHG	Keyhole Garden
MoA	Ministry of Agriculture
NFNC	National Food and Nutrition Commission
RICH	Rural Initiative for Children's Hope
SACZ	Send a Cow Zambia
ZARI	Zambia Agriculture Research Institute
SEWOH	Special Initiative ONE WORLD - No Hunger

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Background

The keyhole gardening concept originated in Africa. The method was started by a humanitarian organization who wanted to help find a gardening style that was suitable for extremely hot and dry conditions. Initially, it was developed by Consortium for Southern Africa Food Security Emergency (C-SAFE) programme in Lesotho to enable farmers to grow own vegetables within the homestead. The technique of constructing and maintaining a keyhole garden was developed in the semi-arid and mountain climates of Lesotho and the intervention has been successful. As a result of the positive impact of the keyhole garden in ensuring food and nutrition security, the technology is now adapted throughout many African countries such as Malawi, Zimbabwe, Kenya, Rwanda, Sudan and Nigeria. Keyhole gardens will soon be part of the agricultural strategies as they enable people to grow vegetables without too much reliance on water or artificial fertilizers.

In Zambia, keyhole gardens are particularly important because they are drought-resistant and are beneficial in improving household diets. They also have a unique design that allows for composting and a decent raised height which means that children, the elderly and disabled can maintain and access the vegetables that are grown in it. Therefore, keyhole gardens play a pivotal role in contributing to household food and nutrition security.

The Food and Nutrition Security, Enhanced Resilience (FANSER) programme has been initiated by the German Federal Ministry of Economic Cooperation and Development (BMZ) as part of the German Special Initiative ONE WORLD – No Hunger. The project aims to address the challenge of hunger and malnutrition among deprived people, particularly women of reproductive age (15 – 49) and children under the age of two years. GIZ in collaboration with the MoA, ZARI, NFNC and CRS introduced the concept of the Keyhole gardening to sustainably produce vegetables among the targeted beneficiary households .

This keyhole garden user book is a product of many consultative meetings and workshops with various stakeholders from the public and private extension services as well as project beneficiaries among others. It is our hope that this book will equip the smallholder farmers, especially the women with knowledge and skills on how to sustainably produce vegetables; taking into consideration the common water challenges being experienced as a result of erratic rainfall in parts of the country.

1. Introduction

Hello!

My name is Enelesi Zulu. I produce vegetables from my Keyhole Garden (KHG) in Eastern Province, Zambia. A keyhole garden is a circular raised garden bed with a built-in walkway and a centrally placed basket for watering and composting. It is called a keyhole because the walkway and the basket at the centre of the garden look like a keyhole from an aerial view.

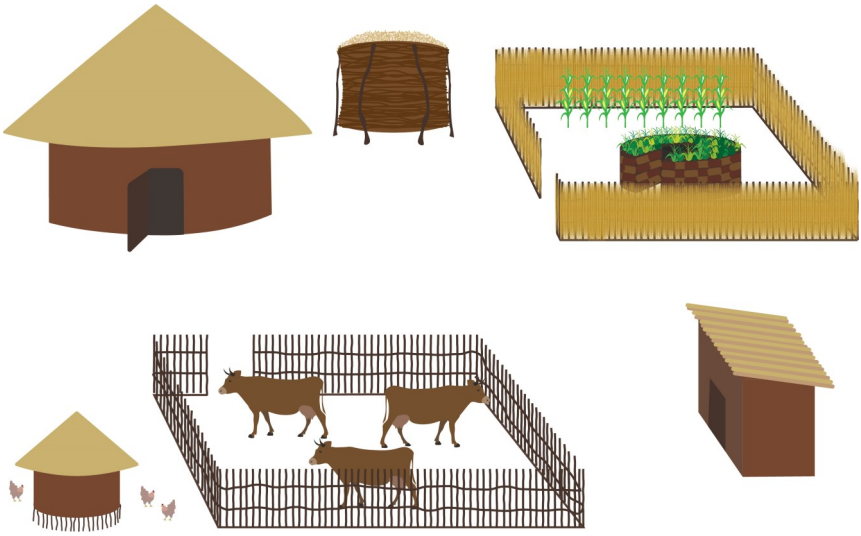
We are a healthy family because we always eat nutritious vegetables from the KHG constructed within our homestead. I no longer walk long distances to fetch vegetables from the traditional garden (Dimba) or buy from the local community market. Our KHG is easier to manage due to its smaller size, uses less water and we have nutritious vegetables for household consumption throughout the year.

In this book, I will share with you how to construct the KHG and grow nutritious vegetables. It is my hope that you will learn more from this reference user book.

Thanks!

2. Site Selection for the KHG

The KHG should be conveniently located right within the homestead. Below is the map or aerial view of our homestead.

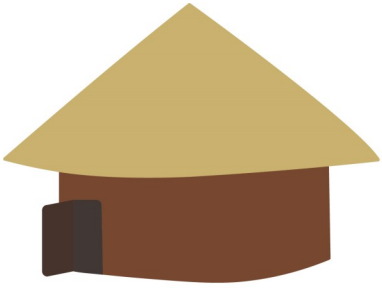


When we were about to start constructing our KHG, we decided to choose a site away from light obstruction and close to our house for easy crop management.

We found a suitable place that was big enough to accommodate the KHG and ensure a sizeable fencing around it for protection against livestock and theft.

3. Site preparation

After identifying a suitable place where to establish our KHG, we started preparing the site in readiness for construction.

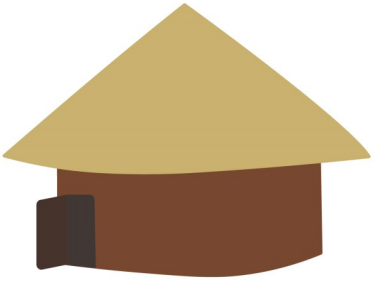


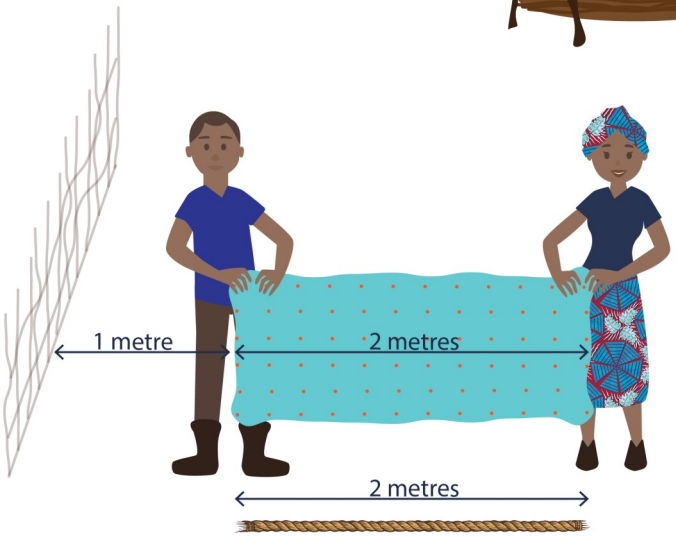
The following are the steps we followed:

- Step 1: We cleared and cleaned the site.
- Step 2: Then levelled the place so that when the KHG is constructed water and nutrients will be distributed evenly within the KHG.

- Step 3: We then measured the site for our 2 metres diameter KHG as follows:

  a) Used a rope to measure a 4 by 4 metres piece of land equivalent to the length of 2 pieces of Chitenge material, and left some space of at least 1 metre (chitenge width) around the KHG wall and the fence.





4. Organisation of construction materials/tools

After preparing the site for our KHG, we then organised the following construction materials and tools:

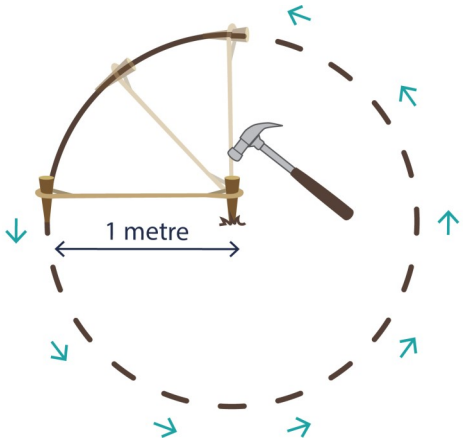
1) Bricks: 550 pan bricks.
2) Anthill soil paste which bonds with bricks better for a stronger KHG wall.
3) Water from the nearby source within the village.
4) Basket – inner core made of rafters/twigs coiled round to form a cylindrical basket.
5) Hoes, Shovel, hammer, wooden stick, pick axe, bucket, rope, measuring tape and spirit level.

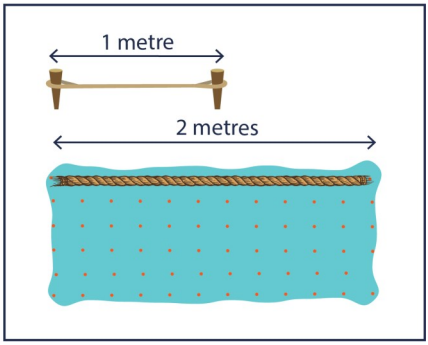
We constructed our KHG using locally available resources such as bricks and anthill soil paste. We therefore did not spend much money on the procurement of construction materials.

5. Construction of the KHG

Step 1: We used the following materials to measure the size of our KHG: Rope, 2 wooden pegs and a chitenge wrapper.

We measured the rope to the size of the length of the chitenge wrapper – which is 2 meters long. Later folded the 2 meters rope in half and tied one of the two pegs on either ends of the rope. And inserted one peg at the centre of the cleared site using a hammer or wooden stick.



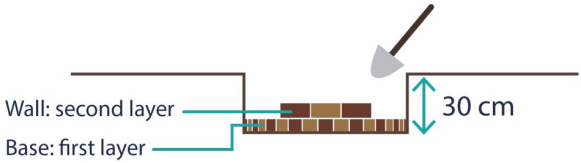


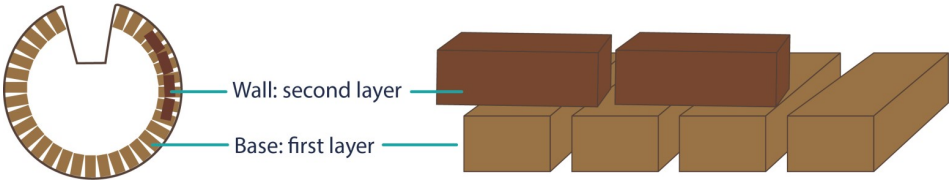
Holding the free hooked peg to the rope, we pulled the rope along the ground surface, pressing the tip sharp end of the peg on the ground firmly and moved round along to form the circular drill. The peg should hold firmly to the ground till a complete circle is formed.

Leveling of KGH

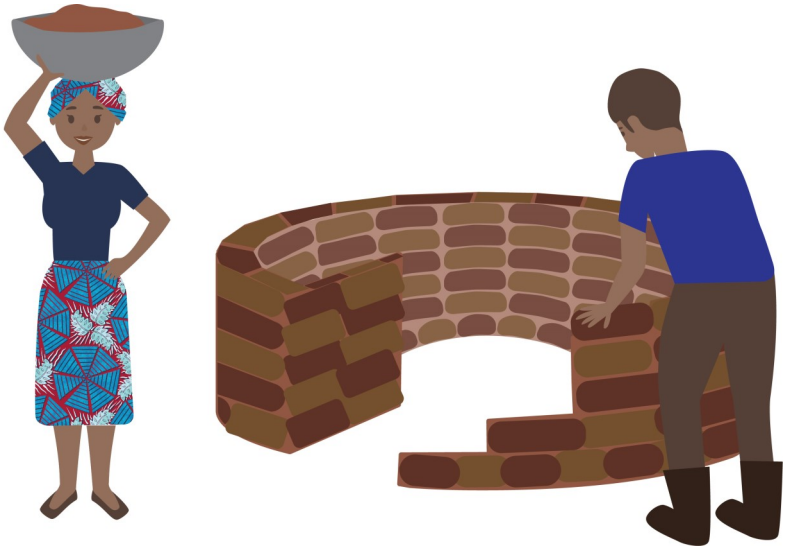
When a KHG is not well levelled, water will easily run off to one side - resulting into poor absorption of nutrients and growth of plants.

Step 2: We dug the 30cm deep foundation and started construction works by laying bricks in width shape for a stronger basement of the KHG wall. We mixed the anthill soil with water to form a paste that was moist enough to hold the bricks together.



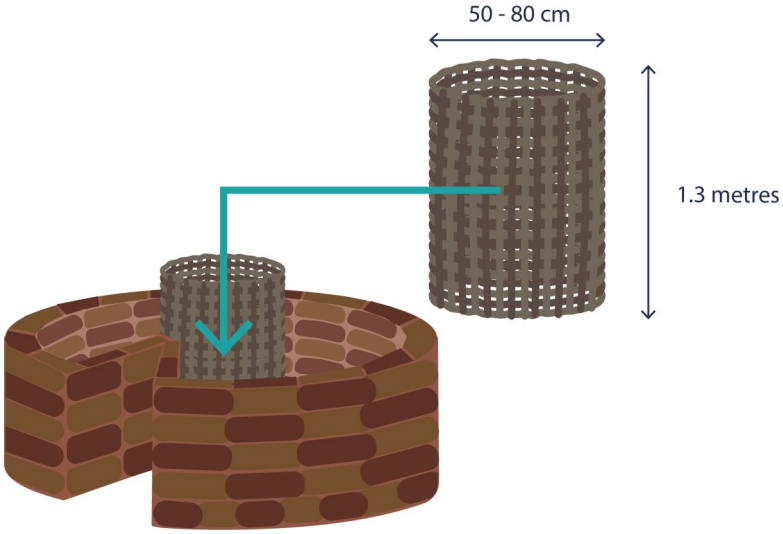


Step 3: We then started constructing the 1 metre wall structure of the KHG from foundation using the mixer of anthill soil and water to form a paste.



Step 4: Afterwards we made the Basket for the KHG from rafters or twigs measuring 50 – 80 cm in diameter and 1.3 meters high, which was placed at the centre of the KHG during filling.

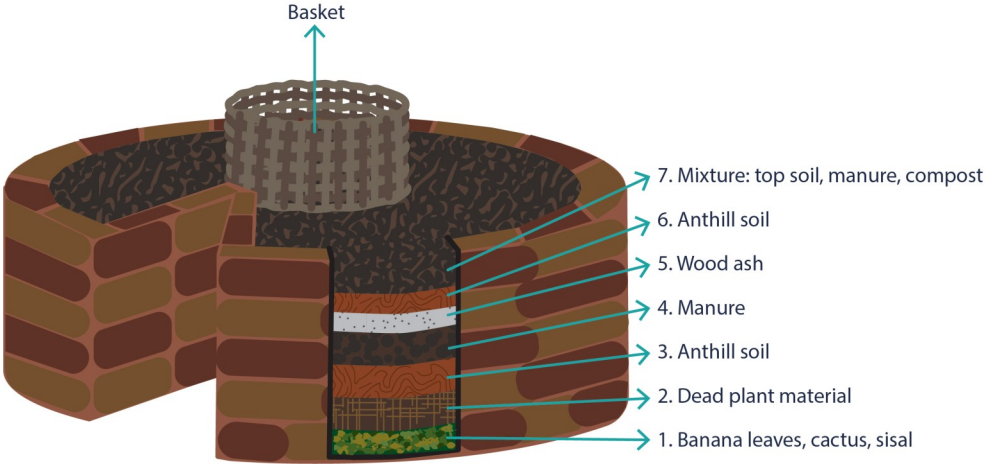
The Basket was made by first securing at least 12 big twigs or rafters inserted in a circle of 50 – 80 cm diameter and enriching the structure by weaving or coiling smaller twigs round the bigger pillar twigs to form a basket that allows water and nutrients flow to all parts of the KHG.



The Basket in the KHG is used for composting organic matter and helps in allowing water and nutrient elements flow to all parts of the KHG.

6. Filling of the KHG

After constructing the KHG and allowing 1 to 2 days to dry, it was now time to fill it with the required materials. We made sure we gathered all the necessary materials and filled it up (not the basket) in the following order:



Step 1: We covered some parts of the base of the KHG with banana leaves, cactus leaves, sisal leaves and pieces of broken clay pots.

Where available, flat iron sheets and other scrap metals like old metals cups and plates can be used. These materials help capture water for moisture retention in the KHG, the uncovered potions also help in controlling water drainage during heavy rains.

Step 2: Compacted a 20 cm layer of dead plant materials (equivalent to the length of the palm of an elderly person), such as dried sunflower, maize, soya beans and groundnuts stalks.

Through the decomposition process, these materials provide nutrients to plants as well as retain moisture.

Step 3: Added a 20 cm layer of anthill soil which provides nutrient elements and moisture retention.

Step 4: Added 20 cm layer of dry animal or plant manure to provide nutrients to the crops.

Step 5: Added 10 cm layer of wood ash (equivalent to half a palm), which provides potassium and assists in the decomposition process of organic matter.

Step 6: Added 10 cm more anthill soil for water and nutrient retention.

Step 7: Added a layer of 20 cm mixture of top soil, dry animal manure and compost.

(Avoid fresh animal manure in the KHG as this burns seeds and young seedlings during the decomposition process).

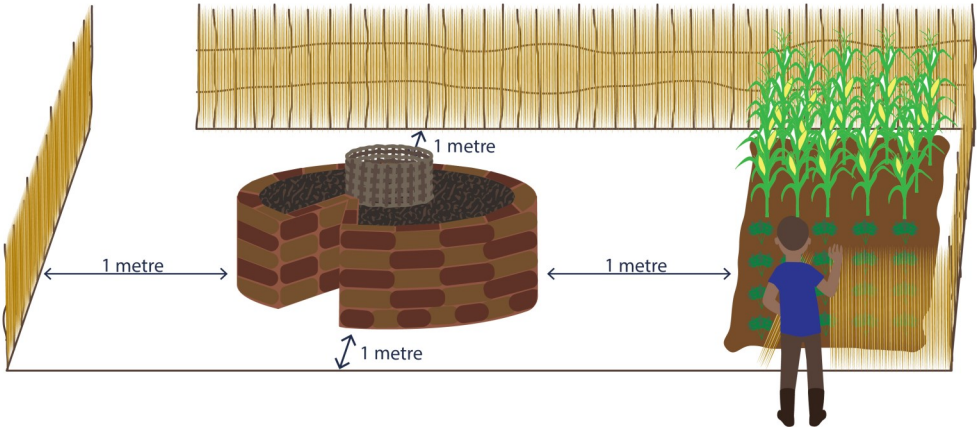
Please Note

When filling the KHG, Aluminium and Lead should never be used. Aluminium affects the absorption of nutrients by plants while Lead is poisonous to humans.

7. Construction of the KHG Fence

We constructed the KHG fence at least 1 metre around the KHG wall to allow easy movement when tending crops as well as for security purposes.

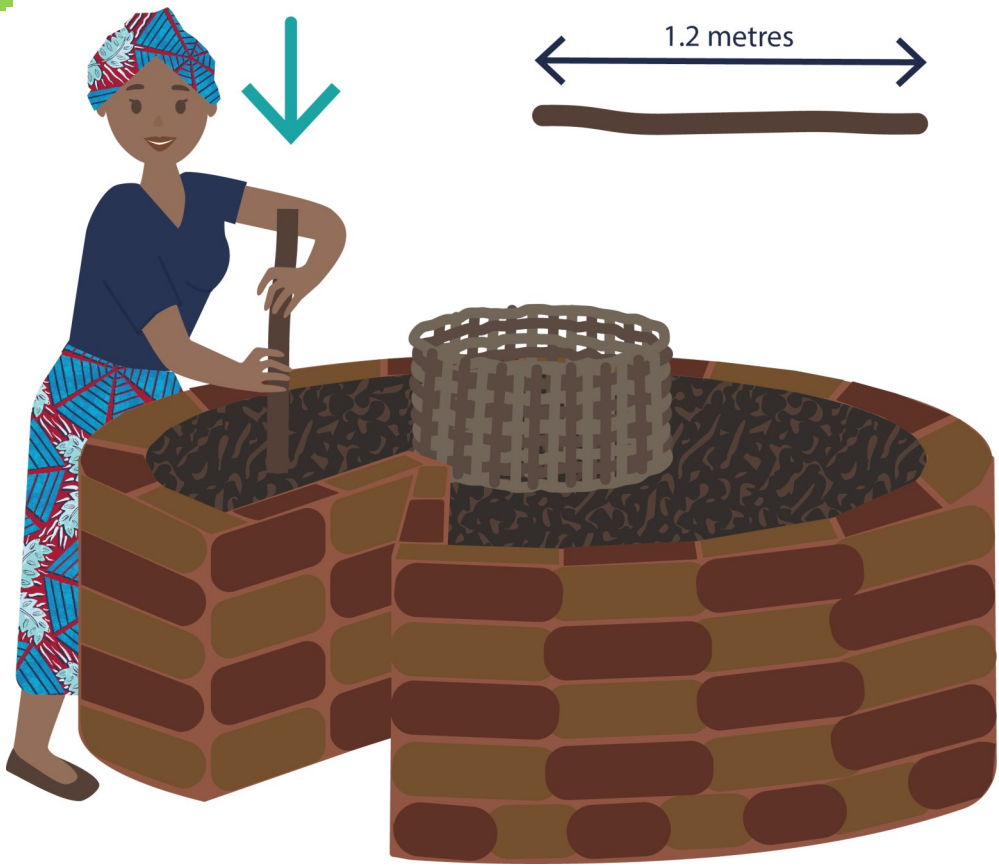
We used poles, sticks, thorny twigs, elephant grass and bark fibre to construct the KHG fence. The height of the fence should be high enough (1.5 – 2 metres long) to prevent livestock accessing the KHG as well as thefts, but not too high to obstruct crops from sunlight.

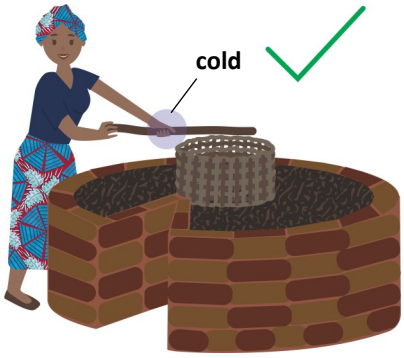


8. Initial Watering of KHG

After filling the KHG with all the necessary materials, we watered the garden with at least 3 by 20 litre containers every day for two weeks to allow the decomposition process of the organic materials take place. We made sure that there was enough moisture in the ground, so that the seeds/seedlings would not die when planted.

After two weeks, we checked the readiness of the KHG soil for planting of seed/seedlings by dipping a 1.2 metre dip-stick into the KHG soil. When we first dipped the stick into the KHG and removed it, it came out warm when touched, meaning that the decomposition process was still going on. We kept checking daily until five days later, when the stick came out cool, meaning decomposition process was now complete. We were now ready to plant the seeds/seedlings in our KHG.

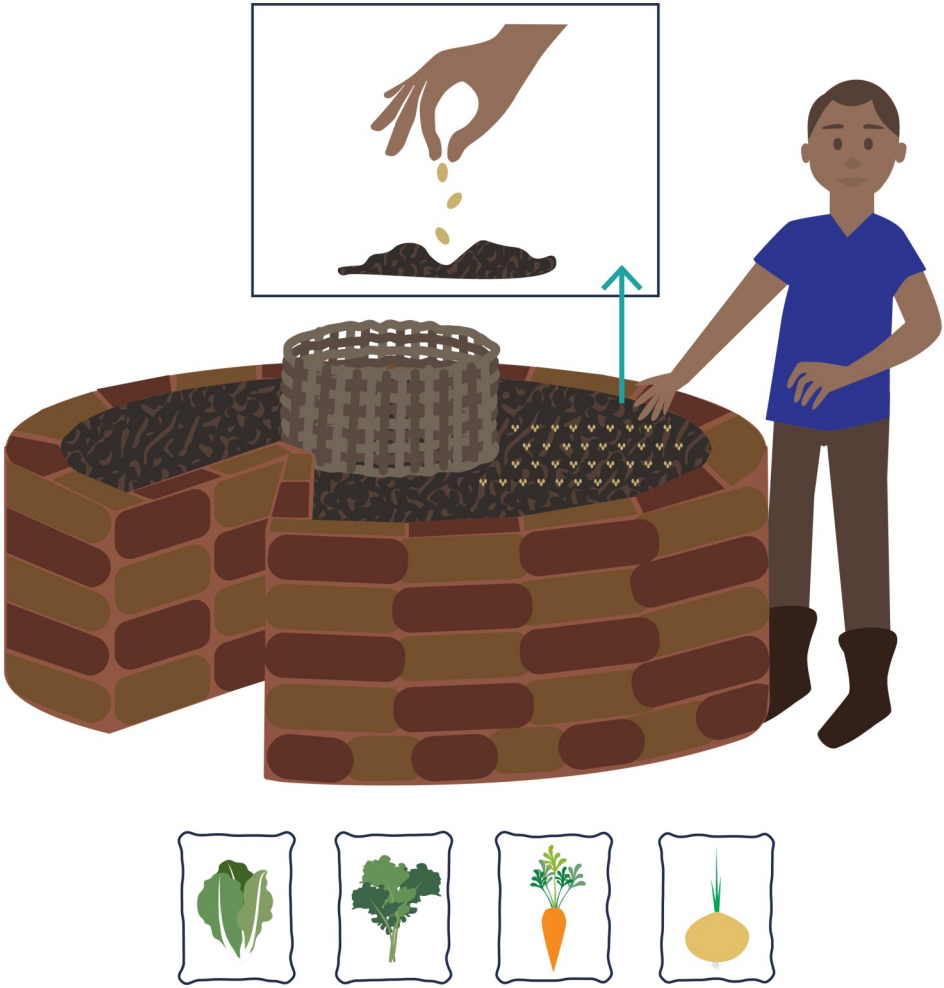

1.2 metres


cold


warm

9. Planning and planting of Vegetables in the KHG

Before finalising the construction of the KHG, we already planned what type of seeds and seedlings to be planted. We took into consideration the following factors such as space available and companion planting of crops. After checking that the KHG was ready for planting, we directly planted nutritious vegetable seeds such as: Spinach, Mustard, Mpilu, Carrot and Onion.



Because of the size of our KHG and time constraints, we could not prepare a nursery and opted to plant the seeds directly.

We planted a maximum of four types of vegetables in order to have access to different nutrients, maintain soil fertility and allow for pest and disease management.

We made sure that the soil in the KHG was watered and moist enough before planting.

After germination, we thinned the plants and ensured that the spacing between plants was good enough to avoid competition for water, nutrients and sunlight.

Companion Planting

The planting of different crops together on the same field/plot to best satisfy space, soil nutrients and pest management needs

We continued watering the crops directly and inside the inner core (baskets) to facilitate decomposition of the organic matter in the KHG, thereby allowing for an even distribution of nutrients.

10. Types of Vegetables recommended in the KHG

We plant mixed vegetables in the KHG because it is important to have a variety of food groups per day as they provide different nutrients. Our family also likes to eat different vegetables from time to time. We ensure that we have about two or three types of green leafy vegetables as well as root crops rich in nutrients in our KHG. The vegetable crops we prefer to plant include:

No	Dark Leafy vegetables	Root crops	Others
1	Spinach	Carrot	Green Beans
2	Swisschard	Beetroot	Herbs and spices
3	Rape	Ginger	
4	Chinese Cabbage	Onion	
5	Lettuce	Garlic	
6	Amaranthus/Bondwe		

The above crops are good to plant in the KHG because they don't require a lot of space to grow. However, some crops are not recommended in the KHG. They obstruct other crops from sunlight and demand a lot of space. Examples of such crops include:

- Sweet potatoes tubers
- Eggplant
- Maize
- Cabbage
- Chibwabwa
- Tomatoes

We instead grow such crops in the traditional home gardens and they also supplement the nutritional needs of our family.

11. Watering of crops in the KHG

It is important to ensure that crops in the KHG have sufficient water for them to grow healthy. To avoid leaching of nutrients we don't water too much every day, as this may result in poor crop growth and weaken the KHG structure.

During watering, we also pour water in the inner core (basket) to allow the decomposition of dead plant matter and circulation of nutrients to crops within the KHG. Sometimes we also use grey water (kitchen waste water) which we pour directly into the KHG Basket to facilitate decomposition of organic matter.

The KHG is a very good approach because it does not require a lot of time to water and it's easier to manage crops due to its smaller size.

During the dry season, we only need about 30 minutes per day (15 minutes in the morning and 15 minutes in the afternoon) to water our 2 metres diameter garden with 2 - 3 (20 litre) containers. This is very little water compared to (4 - 6) 20 litre containers of water used in the traditional or backyard garden of a similar size. We normally use less water in the KHG because there is less evaporation of moisture from the soil due to the presence of high organic matter within the structure.

Please Note

Avoid using contaminated water such as salty water, salty food waste and non-bio degradable substances/objects in the KHG, because they are harmful to the crops and environment.

12. Weeding and Aeration of the KHG

We like to see our vegetables grow healthy and don't want to see weeds in the KHG. Weeds are not good because they deprive vegetables of important nutrients, space and sunlight, making them grow slow and unhealthy. We therefore remove all the weeds every time we see them in the KHG by simply uprooting them using hands, garden folk, small hoe or any other suitable piece of equipment. The uprooted weeds can be composited in the KHG Basket to form organic manure.

Avoid tempering with the root system of vegetables during weeding and aeration in the KHG.

The weeds in the KHG can also be suppressed by mulching which prevents them from accessing sunlight energy.

Dangers of Weeds

Weeds are among the most serious threats to crop production and reduce farm productivity. They threaten the survival of many plants as they compete with crops for space, nutrients and sunlight.

Weeds typically produce large numbers of seeds and rapidly multiply. They contribute to poor soil health and affect plant growth due to their huge uptake of nutrient elements.

During aeration, we use garden folks or a small stick to loosen the soil and allow air, water and nutrients to be easily accessed by the crop. This helps the roots to grow deep and produce strong and healthy crops.

13. Compositing with the KHG

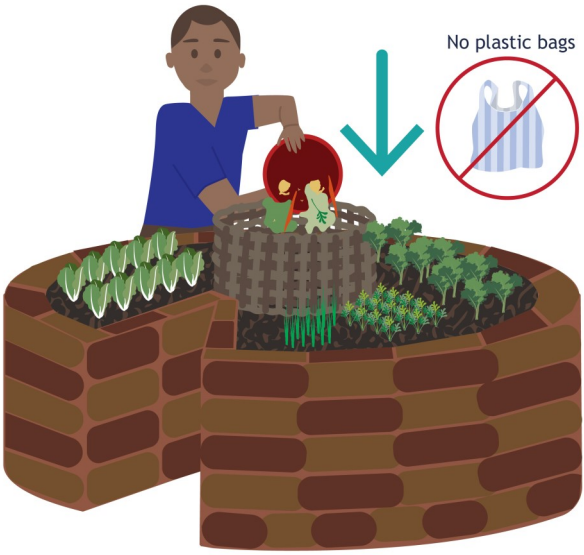
The vegetables in our KHG are grown organically. We don't use any chemical fertilisers but only apply manure and compost in the garden during construction. We also apply some manure when managing crops and during crop rotation.

Compost

- Compost is organic matter that has been decomposed. This process involves the breaking down of various dead plant materials and other organic waste into compost.
- These materials decay because they are decomposed by microorganisms (bacteria and fungi) when the conditions are conducive (**moist**, **warm** and **aerobic**).
- Compost provide essential nutrients for the growth of crops.

In addition, we put organic waste (decomposable matter) into the basket and this helps to improve the soil fertility in the KHG.

To maintain soil fertility and levels of compost/soil at 80 cm high from the base within the KHG, we add some more dry manure and topsoil when the levels drop down. This is very important because over time the KHG loses some nutrients and the vegetables stop growing well.



14. Pests and Disease Management in the KHG

Crops can be affected by pests and diseases. In the KHG we only use organic methods to manage pests and diseases. These include crop rotation, companion planting, mixed cropping, use of hands, and organic substances such as:

- Chilli powder
- Pawpaw leaves
- Tobacco snuff
- Red Onion
- Garlic powder
- Neem/Eucalyptus tea
- Cow dung tea
- Gliricidia
- Tephrosia
- Moringa tea/Powder

You can mix two or three of the above substances, soak them in water for 24 hours and make a solution strong enough to manage pests and diseases.

We don't recommend the use of agro–chemicals in the KHG because they are harmful to the environment and poisonous to humans especially pregnant women, lactating mothers and children if ingested.

15. Harvesting of Vegetables

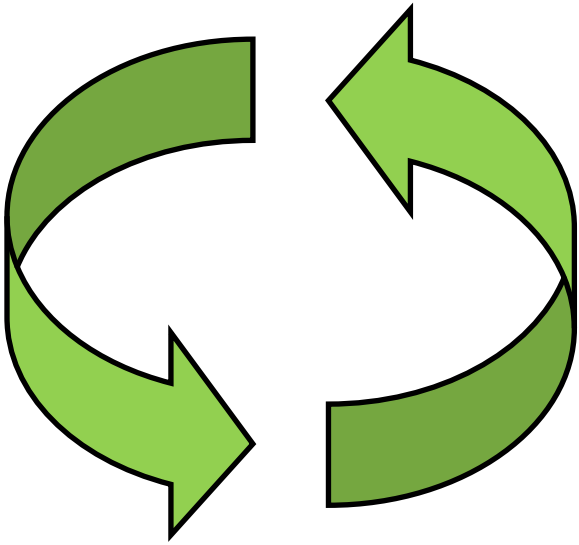
We harvest different nutritious vegetables systematically by using a sharp knife to pick uniform number of fully mature leaves per plant. By consuming a variety of nutritious vegetables every day, our household gets diverse food nutrients needed for better health.

Harvesting vegetables is easy because the size and shape of the KHG allows someone to reach the vegetables at the centre.

16. Crop Rotation in the KHG

Crop rotation means growing crops of different families within the same portion in cycles. The process improves soil structure and fertility by increasing biomass from varied dead plant materials. This also helps to disturb pests and disease cycles.

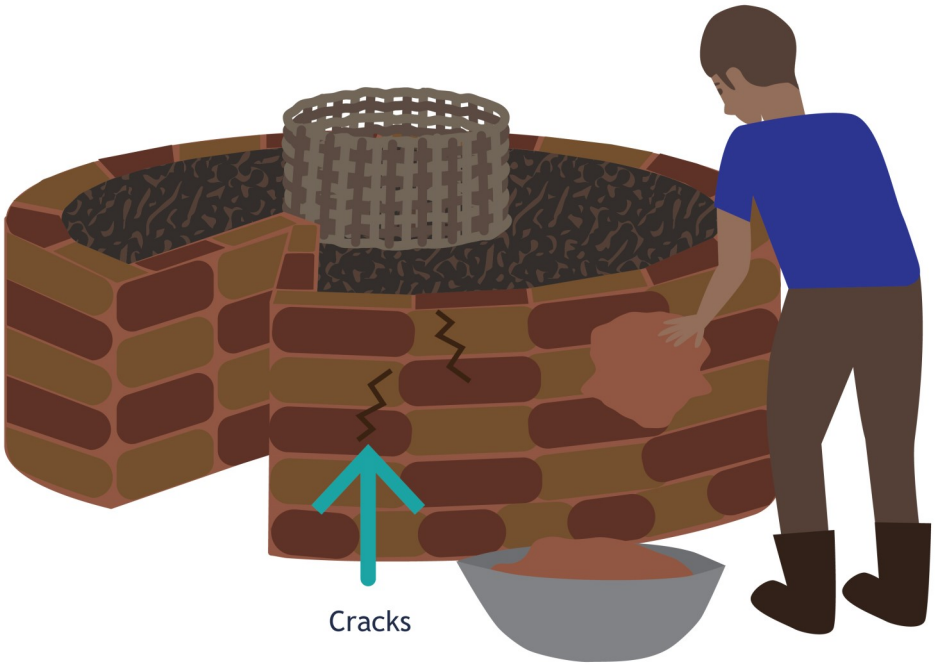
To avoid the KHG being empty between crop cycles, successor crops should be planted in a nursery at least a month earlier before the principle crops reach their life span.



17. Maintenance of the KHG

Our KHG is made of bricks and anthill soil paste. It is not very strong compared to the one made of bricks and cement because the walls wear out after some time, especially during the rainy season. We therefore need to take care of our structure so that it can last longer.

To ensure that our KHG lasts longer, we should avoid leaning on the wall during watering, vegetable picking and growing deep rooted crops within the structure. This weakens the entire wall of the KHG. Whenever we see cracks on the wall, we quickly mend them using bricks and anthill soil paste.

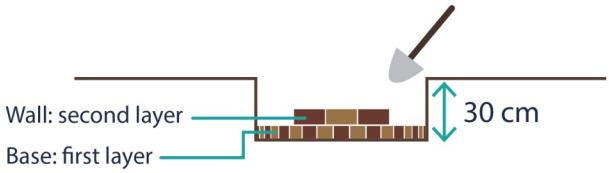


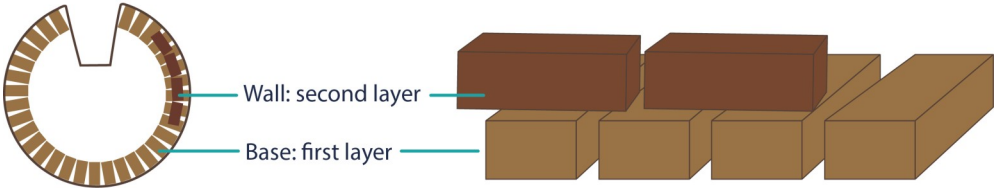
When the basket was worn out, we made a new one using twigs and replaced it. We also kept the surroundings of the KHG clean and maintained the boundary fencing to keep away livestock and prevent thefts.

18. Improvement of the KHG

In future, we intend to construct the KHG using bricks and cement because it lasts longer compared to other KHGs types made of bricks and anthill soil paste or compacted earth.

Our neighbour, Amake Willie has a strong KHG made of bricks and cement with a strong basement of bricks aligned in width shapes. It can withstand waterlogging during the rainy season because of its porosity.





When I asked her about the number of bricks and cement bags used, she told me that they used about 550 bricks and 3 bags of cement. We like her Keyhole Garden because it looks attractive and very strong. The bricks do not easily wear out. Ever since her KHG was built almost two years ago, it has shown minimal wear and tear and does not require any repairs at all.

Please Note

KHGs made with a strong basement using bricks and cement are much stronger because they don't easily get washed away during the rainy season and do not require a lot of repairs.

Amake Willie further explained that she organised and used the following materials to construct her improved KHG:

- 550 pan bricks
- 3 bags of cement
- 8 wheelbarrows of river sand
- 8 wheelbarrows of top soil
- 10 wheelbarrows of anthill soil
- 10 wheelbarrows of compost
- 10 wheelbarrows of animal or plant manure
- Enough plant residue for 2 layers of 20cm thick each
- 5 wheelbarrows of wood ash, if possible
- Enough twigs to weave a compost basket.

Most of the materials Amake Willie used to construct her pan-brick KHG are locally available. She also advised us to avoid plastering the inside of the KHG wall as this affects porosity resulting into waterlogging and poor plant growth.

As a family, we will mould and burn enough pan bricks and sale some chickens to raise money for buying cement and construct a strong KHG which can last longer.

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