VEGETABLE GARDENING OUTLINE
… Day 2

1. Drip irrigation
   … One drip irrigation kit with two lines on a 15 meter bed and with 20 liters of water both morning and evening will provide enough vegetables to feed a family of 5-7 in the dry season

   A. Reasons to use:
      - Easy to use
      - Operate on very little water
      - Reduces watering labor requirements
      - Maximizes the use of limited water because the water goes straight into the soil where the plant roots are (makes every drop of water count)

   B. Procedure
      - Follow the directions in drilling, cutting, or burning a hole in the bottom of a 20 liter bucket
      - Assemble the tubes, filter, washer, and fittings as directed
      - Place the bucket 1 meter above the planting bed
      - Place the two 15 meter (50 feet) lines on the 1 meter wide planting bed
      - Use clean water or filter the water through a cloth when filling the bucket
      - Fill the bucket morning and evening
      - If cared for carefully the kit will last 5-7 years

2. Seedbeds
   … Some seeds are planted directly into the growing area
   … Other seeds are planted in a small part of the garden with very fertile soil and a shade to protect the seedling
   … Seeds can also be started in a cold frame or hotbed or in flats (containers) in a greenhouse or shade house

3. Seeds and seedlings
   … Starting with good quality seed is very important

… The seed includes a seed coat, embryo, and stored food
… Moisture softens the seed coat and causes the seed to swell starting the germination process
… Keeping the seedling moist until the root can take in moisture is extremely important

4. Direct Seeding vs Transplanting

A. Keys in Direct Seeding
- Plant at the correct spacing and depth with 2-4 seeds in each spot
- Keep the bed moist and protected
- Keep the bed free of weeds
- Thin out plants to have one healthy seedling at each spot

B. Advantages of Direct Seeding
- Saves the time needed to transplant seedlings

C. Disadvantage of Direct Seeding
- Some seeds may not germinate leaving empty spots
- Takes more time and water to keep an entire bed moist , protected, and weeded than it does for a seeding area

D. Determining When Transplants are Ready to Move
- When the stems become less soft and more rigid
- When the third true leaf has developed
- When the seedling stems reach the size of a ball-point pen

E. Transplanting Pointers
- Transplant in the late afternoon, on a cloudy day, or early in the morning
- Remove seedling very carefully by lifting them with a trowel or stick bringing some soil with the roots
- Keep seedling that are dug up covered and out of the sun until they are planted
- Be careful not to damage the stem by pinching it; lift holding the leaf of the plant

- Plant at the same depth that the plant was growing; if the plant is spindly plant the plant deeper than it was
- Water in the planting hole and adding water immediately after transplanting will increase plant survival
- If fertility is low adding compost, dried animal manure, or liquid fertilizer can give the transplant a boost

5. Mulching

A. Advantages
   - Conserves water by reducing water evaporation (important in the dry season)
   - Reduces soil loss through erosion
   - Reduces weed growth
   - Reduces soil temperature
   - Encourages the presence of micro-organisms
   - Lessens the greening of ripe root and bulb crops

B. Disadvantages
   - Can increase insect and disease problems
   - Can decrease germination if applied before seeds come up

6. Crop Rotation

A. Reasons to rotate crops
   - Rotating crops reduces the disease and insect problems
   - Rotating crops can add nutrients to the soil (legumes add much needed nitrogen to the soil which is needed in large amounts by maize)

B. Crop families

   - Fruit crops (tomato, eggplant, pepper, pumpkin)
   - Legumes (beans and peas)
   - Leaf crops (cabbage, spinach, kale, greens)
   - Root crops (onions, carrots, Irish potatoes, sweet potatoes, also called yams)

7. Pests
   A. Chewing Pests (grasshoppers, cutworms, slugs, caterpillars, leaf-cutting ants, beetles, borers, locusts, etc.)
      - May hide in the day and feed at night
      - Controlled by placing poison on the leaves
      - Some of these pests live in the soil and eat the roots of the plant (white grubs, termites, etc.) making them very difficult to control

   B. Sucking Pests (aphids, mites, thrips, white flies, mealy bugs, etc.)
      - Live on the plant ad suck the juices out
      - Found on underside of leaf and are usually not noticed until the plant is severely damaged

   C. Stinging Pests (melon flies, stink bugs, and squash bugs, etc.)
      - Inject poison into the plant
      - Can destroy a crop in only a few days

   D. Insect Damaging Stages
      - Larva stage of moths and butterflies are usually chewing pests
      - Adult insects may damage through chewing, sucking, or stinging

8. Diseases
   A. Kinds of Diseases
      - Fungal, Bacterial, Viral
   B. Preventing Diseases
      - Plant disease resistant varieties
      - Rotate crops
      - Dispose of infected plants by burning
      - Controlling insects will reduce the spread of disease
      - Minimize plant stress (wilting from lack of water, avoid fungus caused by over watering, mulch to lower soil temperature and conserve moisture)

- Use proper cultural practices (plant at recommended times, space plants correctly, etc,)

C. Controlling Diseases
   - Natural controls (see section #9)
   - Homemade sprays (see section # 10)
   - Chemical sprays

9. Natural Controls of Pests and Diseases
   A. Cultural
      - If possible hand pick off insects and kill
      - Rotate crops with from one family of plants to another
      - Select resistant varieties
      - Plant at recommended times (insects typically are most active in hot weather)
      - Control weeds removing a possible insect and disease host

   B. Biological
      - Beneficial insects and animals such as lady birds, praying mantis, dragon flies, lizards, and chameleons can aid in insect control
      - Some plants such as onions, garlic, mint, and marigolds give off an odor that can repel insect pests

10. Homemade Poisons and Traps
    - Fish bean can be used to kill caterpillar larva. Add a double handful of crushed leaves or a handful of crushed seeds to a 16 liter bucket of water, stir, and strain
    - Grind a double handful of Neem leaves, add to water, and boil them or let them soak overnight in 4 liters of water. After straining use the solution as a spray
    - Mixture vegetable oil with biodegradable dishwashing liquid (ratio of 16 to 1) and add 1 tablespoon per 2 cups of water, shake the mixture, and spray onto the plants
    - Ground garlic, mineral oil, and dishwashing liquid can be added to water to make an effective spray

- Paraffin (kerosene) and soap can be used for serious pests; mix ¼ of a cup of soapy water with ¼ tablespoon of paraffin and 1 liter of water; rags soaked in paraffin and then touched to insects can kill them
- Cooled fresh wood ash spread around the base of a plant can control ants, root maggots, snails, slugs, and cutworms.
- Wrapping a transplant stem with newspaper or tying onion leaves around the stem can prevent cutworms
- Pans of beer or vinegar in the garden can be used to attract slugs
- Scarecrows may help keep birds away
- Playing music in the garden can keep raccoons and other animals out of the garden

11. Chemical Controls and Spraying
    - Chemicals are effective but may be harmful to the environment
    - If chemicals are used rotate different chemicals to reduce the chance of insects developing resistance to the pesticide
    - Buy chemicals that are easy to mix and apply and that are available locally
    - Follow instructions for mixed, applying, and after use clean up procedures
    - Avoid skin contact with the chemical spray
    - Spray the entire plant including under the leaves
    - Chemicals commonly available in developing countries would be malathion and sevin for insects and dithane (Manocozab) for diseases

12. Planning and Record Keeping
    A. Crop Record
        - Where the crop was planted
        - Vegetable and variety name
        - Planting date
        - Comments on fertilizer, weeding, etc.
        - Harvest yield results
        - Problems encountered

    B. Crop Rotation Record

- Where the crop was planted
- Vegetable and variety
- Planting date and harvest date
- Next crop planned

DRIP IRRIGATION

1. Lay out drip lines

2. Completed bucket stands

3. Add water to buckets

4. Plant seeds & transplants

5. Mulch planting bed

6. Beds 3 weeks later

7. Growing tomatoes

8. Tomato produce

9. Feeding your family

MAKING A COMPOST PILE

1. Foundation layer

2. Veneer layer

3. Vegetation layer

4. Watering the vegetation

5. Layer of animal manure

6. Layer of soil

7. Watering each layer

8. Add kitchen scraps

9. Repeat 3-7 & mulch the top

RAISED PLANTING BEDS

1. Laying out the bed

2. Dig compost trench

3. Lining the trench

4-5. Add green vegetation. If not available, use brown.

6. Adding animal manure

7. Watering each layer

8. Covering the compost

9. Leveling the raised bed

Making Your Own Pesticide

Insect Killing Sprays

... Sierra Club
...non-toxic solutions without chemical pollution

Basic Oil Spray

- 1 cup of vegetable oil 1 tablespoon biodegradable dishwashing liquid
- Add tablespoon of the oil mixture to 2 cups of water
- Place in a spray bottle. Because oil and water don't mix well, shake the spray bottle often while applying
- Repeat treatment in 7-10 days

Garlic Oil Spray

- 3 ounces of minced garlic
- 2 teaspoons of mineral oil
- Soak the garlic in the mineral oil for at least 24 hours
- Mix in a glass jar 1 ounce of dishwashing liquid, 1 pint of water, and the garlic and mineral oil mix
- Use 1-2 tablespoons of the concentrated garlic mix in 1 pint of water
- Apply with a spray bottle with frequent shaking of the spray bottle

Basic Soap Spray

- 2 tablespoons of biodegradable dishwashing liquid in 1 gallon of warm water
- Mix and use as a spray
- Repeat as necessary
- Most effective on soft-bodied insects, mites, aphids, whiteflies, thrips

Lovely Lemon Spray

- Peels of 2 large or 4 small lemons
- Boil for 10 minutes, cold, and take the lemon peels out of the solution
- Put the solution in a spray bottle and use

Sticky Flour Spray

- 4 tablespoons of wheat or potato flour and 1 teaspoon of biodegradable dishwashing liquid added to 1 quart of warm water to dissolve the flour so it will flow through the sprayer
- Spray sticks to the insect or they eat it and it affects their digestive tract

Insect Repellents

All- purpose Garlic Spray

- 6 cloves of garlic, 1 small onion, 1 tablespoon of cayenne pepper, and 1 tablespoon of biodegradable dishwashing liquid added to part of the 1 quart of waterto mix in a blender, then add the rest of the water
- Ideally let the solution set for 24 hours, 2 hour minimum
- Strain the solution and place it in a spray bottle

Hot Pepper Spray

- 3-4 Hot peppers chopped or 2-4 tsp. of tabasco sauce or hot pepper powder in 1 quart of boiling water, let it set for 24 hours and then strain and add another quart of water and 2 drops of biodegradable dishwashing soap
- Do a spray test on a small area before spraying all the plants

Tomato Leaf Spray

- 2 cups of chopped tomato leaves in 1 quart of water
- Heat in a saucepan to a simmer, allow the solution to cool, and then strain
- Add 1 teaspoon of biodegradable dishwashing liquid and spray as needed

Odor of some plants can repel insects

- Onions, garlic, horseradish, ginger, rhubarb, cayenne pepper, marigold flowers

Insect Traps

Pans of beer or vinegar

- Can attract insects and they drown in the liquid

Unifying a Community and Growing the Church through a Cluster Garden

Community Garden Chairman Taona Sithole said the cluster garden involving 40 families had built a sense of community through working together. Tsverukai Muyambo says her four children help with weeding and carrying water. They have raised cova, onions, mustard spinach, and butternut squash. Next year they want to add okra, tomatoes, and carrots.

Elizabeth Sithole raised mustard spinach, onions, and tomatoes. She had been gardening but the raised beds and drip irrigation were new to her. She says the new techniques have increased her production and she has sold the surplus to buy clothes for her children as well as things like salt and sugar. Urayai Masitkati has eight children and five grandchildren. The garden is a family activity that has provided tomatoes, onions, and pumpkins to eat and some to sell.

Both Sarah Chipindaumwe and Susan Marwa have six children. As they picked okra, they said, "The garden has helped us develop new friends as we work together in the garden". Tinashe Gwabuya grows okra, butternut squash, and cova. He said, "We are thankful for the garden training and garden fence. We used to go to the mountain to pick wild vegetables. Now we are raising our own vegetables!" He also said, "The garden has unified the community and through working together new friendships have been created."

The first aspect of Healing Hands International's involvement was trainer John Dube conducting a survival gardening workshop. The hard working gardeners were faced with two main challenges, shortage of water and free grazing cows and goats.

Because of a shortage of water the group was forced to concentrate on a few garden beds. They took turns day and night doing watering and keeping animals out of the garden. Healing Hands assisted the group with garden fencing, tools, and seeds along with a second training workshop. At HHI we say that we "aid, equip, and empower people in the name of Jesus". The goal is to help people help themselves. The addition of drilled water well to the workshop training and the provision of fencing has been life changing for the people and the community.

When the well was successfully drilled and the pump put in place, project chair Taona Sithole said, "I can't believe it. People have been taking turns by day and by night to water their vegetables. I have happy that my wife and I will not have to wake up at night to take turns watering the garden." Local agricultural extension officer, Mangaiso Brighton, said, "The well will have the double impact of providing sufficient water for the garden and providing clean safe water to the community." Local councilor Lydia Sekisana commented, "I am so happy to have such a development in my area. I am thankful for a concerned church and a partner organization like Healing Hands

The nearby Mwanyisa Church of Christ meets under a tree near the garden. During the workshop, trainees were provided with World Bible School lesson one. During the March, 2018 visit by HHI Director of Agriculture, Carl observed that most of the church members were sitting on the ground during church services and few people had a Bible. Donors stepped forward to provide 10 eight seat church benches, 20 Bibles, and 25 song books. The church has had tremendous growth numerically and spiritually. In four years the church has grown from 6 to 80 members. As we say at Healing Hands International… first the bread then the bread of life

Helping a Community Reduce Hunger and Malnutrition

…Zvishamiso Cluster Garden Workshop in Zimbabwe

Zvishamiso Cluster garden has a total of 59 individual households. The May 23 & 24 workshop included 63 trainees. The cluster garden is over 10,000 meters square with fertile soils. The garden is well fenced with diamond mesh wire donated by Care International. Following open air classroom instruction work in the field included construction of five raised planting beds, compost pile making, bucket system drip irrigation setting and installation, making of home-made basal and top dressing fertilizers, manure tea making, planting, transplanting and mulching.

The workers sang and danced as they worked. Simbarashe Tavagwira, the garden Chairperson, said, **"I was worried that with the hard ground we would not complete the making of raised beds but to my surprise, all the groups worked hard to finish first. I liked this kind of spirit and I am sure people have learned a great lesson on the advantages of working as a group"**.

After the completion of the beds, planting methods and the different watering methods were demonstrated. The group saw the advantages of the use raised planting beds.

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Virginia Mubazangi, who was the Agriculture Extension Officer Supervisor present concluded by asking participants to mention the challenges that they have been experiencing as a result of their poor methods of preparing the soil.

Trainer John Dube reported it was thrilling and interesting to hear from Philip Chisvinga comparing his past experience to what he learned. "**One can only imagine how the crops could grow on ground that is so hard to even dig with a sharp grubbing hoe. The raised bed is like the good soil that we read about in the Parable of the Sower."**

Daniel Mamuto said, **"This training is both enlightening and challenging. This is the kind of knowledge we have been lacking for so long. I feel grateful to be a part of this Healing Hands workshop."**

Training Provides Hope for the Future

Riaisoe Primary School in the western Kenya county of Kisii was the workshop host of 75 students, teachers, and parents. Trainees were thankful to learn the sustainable agriculture skills taught by Ebenezer Udofia.

Seventy-two year old Alice Matunda is the mother of 7 children and the grandmother of many grandchildren. Alice shared, **"The workshop was God sent. Life has been difficult for me because so many depend on me to provide for their daily needs."**

Jane Nyabuto is a buyer and seller of vegetables. Jane and her husband have 5 children including Peter who is a Riaisoe Primary School 6th grader. Jane said**, "I have been traveling to other towns to buy vegetables for sale, but now with this training, I will be planting and raising my own vegetables for sale."** Once the planting beds were developed at the workshop, the care and harvesting of the vegetables became the responsibility of the students. Peter said, **"I am glad to learn these skills that I can use for the rest of my life."**

Using What You Learn and Teaching Others

The Zikoti, Malawi workshop conducted August, 20-21 was near the Zambia border. The 75 trainees included village chiefs, community basic facilitators (CBF), and area farmers. Trainer Mbwenu Chirwa learned that community basic facilitators usually conduct farmer field schools around the area. Trainer Mbwenu also reported, **“Each trainee promised to make his/her own garden and then teach their follower farmers at field schools they conduct. I was really impressed with their keen interest to learn from the start until the end.”**

Benson Mhoni said, **"I have attended several workshops and I am a lead farmer, but this school has touched my heart. I see poverty leaving us even before we have practiced what we have learned today. God loves us."** At the end of the workshop Benson invited Mbwenu to his home to see his farm and fruit tree grafting nursery.

Trainee Joyce Nyirenda said, **“This survival gardening training will help me so I will not have to walk long distances finding wild food as I have been doing. This is my opportunity to grow my own food at my home".**

Village chief Wilson Saka said, **"Thank you Chirwa and HHI for giving us these life changing lessons. This will save families from the need to exchange maize for vegetables."** He urged everyone attending the workshop to have his/her own backyard garden and teach his/her neighbor.