KASENGE RIVERFORD ORGANIC CENTRE

Sustainable Organic Farming Course

Notes taken during two weeks training session August/September 2007

**“Whoever works his land will have plenty of bread,
but he who follows worthless pursuits lacks sense.”
(Proverbs 12:10)**

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Sustainable Organic Farming Course

Introduction

Objectives of Training

- Participatory
- To extend knowledge to different areas
- Poverty eradication/alleviation
- Improve diet and reduce malnutrition
- Improve food production

What is organic farming?

Farming without chemical pesticides
Environmentally friendly, economically viable and having social justice
Natural methods to keep livestock healthy and soil fertile

Organic vegetables are becoming much more prevalent nationally across Uganda, and they sell for higher amounts than non-organic. It is the old way of farming, but with some improvements. Living organisms are preserved for the use of the farmer. When pesticides are sprayed, those organisms are killed. In organic farming, manure is put into the soil which lasts for 3 years, but when chemicals are used, they have to be used every year.

Everything is closely related – the soil, the environment, the farmer.

God told man to look after everything properly, so are you preserving the soil on your farm? God is annoyed if you are not. Uganda has a unique climate, and we don't use it as we should. If we feed the soil, it will feed us. We should replace the lost nutrients in the soil.

At a seminar Timothy had recently attended about GM crops, the comment was made that GM crops should be given the go ahead because they needed them to feed the 3rd world. The African reps there were very annoyed, saying they are quite capable of feeding themselves, they just need the knowledge regarding soil erosion etc. At the seminar, Timothy asked about the health of those people who would eat GM crops, given that insects who ate them died! The reply was that they didn't care about that, all they cared about was their jobs.

Main criticisms of current agriculture

Some farmers of Uganda are organic by default because they don't have the money to buy chemicals. This is a blessing. Most chemicals go to big organisations. You have to be certified as an organic farmer. The criticisms of current farming methods are:

- They damage the soil structure
- They damage the environment
- They create health hazards in foods, eg tomatoes are sprayed. The spray causes cancer, and many tomato growers are sick.
- There is a reduction in good quality food
- It is economically costly to society and to the farmer.

Preserving the soil structure is a FUNDAMENTAL MUST!!

Three steps to organic farming

- **Stop depending on chemicals.** They are not sustainable – have to apply them every season.
- **Feed the soil with organic material** and then a good structure will automatically develop
- **Encourage nature** – insects etc. As big a range of wildlife as possible. Even snakes – they eat the pests at night and won't attack you if you don't disturb them. And frogs – dig a hole, line it with paper and fill it with water and frogs will come. They will eat the pests. Also, encourage ladybirds, which eat aphids.

Components to organic farming

- Crops
- Soil
- Animals
- Farmer

Practices of organic farming

1 Soil Care/management

- nutrient recycling
- mulching
- use of liquid manure
- use of plant teas
- use of green materials
- use of leguminous plants

2 Crop rotation

3 Water harvesting

- in the house
- in fields, by digging etc. Dig contours around your land so that the water doesn't overflow but goes to the field.
- water tanks. If you cannot afford to build water tanks, improvise by using logs to build tanks – they only last about a year before the logs rot. But as farmers are disappointed when they collapse, possibly this is not to be recommended
- water catchment

4 Pest and disease management

- proper seed selection – not diseased ones
- proper land preparation
- timely planting
- planning – ie dig holes before rains
- plant before rain, not after. Take the roots off plants, soak them in cold water overnight – this suffocates the pests. Don't just plant it in the hole with the roots on.
- correct spacing – for pest and plant population
- don't allow weeds to flower. Weed before flowering
- timely harvesting to avoid waste
- sprinkle woodash on vegetables when they start to grow. It is acidic, so when it rains, it kills the pests

Good pesticides – wheatflour mixed with water. Spray on pests. It will cover the pests in a membrane which will suffocate them. As the plants grow, the

membrane will crack. Milk can control plant blight – 0.5 ltr of milk to 1 litre of water. Also, soak garlic in paraffin overnight and spray – this will kill pests.

The best fertiliser on the farm is YOUR FEET. You need to walk around your farm every day and see what needs to be done. "Telephone farmers" don't get results.

5 Proper storage

6 Intercropping
eg. cabbage cropped with onions, and maize with beans. If maize is planted early, it is mature by the time the grasshoppers arrive with the virus they carry – it does not attack mature maize. Garlic is good too – it also scares away monkeys!

7 Use of predators
eg. ladybirds (one lava eats 200 aphids/day), wasps, nasturtium. When the pests come, they will concentrate on the nasturtium and by the time they have eaten them all, the vegetables are grown. Aphids like nettles also, so plant these amongst the cabbages.

Organic Farming Stages

It is a transitional process to becoming an organic farmer.

Stage 0 – the farmer has animals or crops, but has no knowledge of the farming business
Stage 1 – the farmer starts to get knowledge. He gets specialised knowledge in all farming activities, attends seminars and workshops.
Stage 2 – the farmer takes action by deciding to work on fertile soils. Keeps pure local or improved breeds of animals, and uses improved seeds
Stage 3 – diversification. The farmer uses low input to maximise output. The family income is increased and the farmer has several enterprises, eg eggs, mangoes, oranges. You have to start with what you've got, improve your existing products first. Don't try immediately to get new – you must work hard, like the farmer who was willing to pick up cow dung from the road to put on his ground, because he had no cow.
Stage 4 – Farm integration. Everything links together, eg. the pigs eat maize/fish, produce manure to grow more crops. The fish provide nutrients to the pigs. Farmers can also use human manure.

The Ugandan government is saying it will use DDT to combat mosquitoes. However, the EU has said that it won't import Ugandan crops if DDT is used. So, keep farming organically! An acre of land farmed organically will have a higher yield than 3 acres farmed non-organically.

COMPOST MAKING

Margaret Kifuko Kisawuzi, SAC Uganda. 0772 964005 0752 668297

Theory

A farmer who has 10 sons divides his land between his sons when he dies.

Son 1	Son 2	Son 3	Son 4	Son 5	Son 6	Son 7	Son 8	Son 9	Son 10

Each of those sons then has 10 sons and divides their plot of land between their sons when they die.

Son 1a	Son 2	Son 3	Son 4	Son 5	Son 6	Son 7	Son 8	Son 9	Son 10
Son 1b									
Son 1c									
Son 1d									
Son 1e									
Son 1f									
Son 1g									
Son 1h									
Son 1i									
Son 1j									

Each of these sons then has 10 more sons, and divides their plot of land between their sons when they die. And so it goes on…..

Son 1b									
Son 1c									
Son 1d									
Son 1e									
Son 1f									
Son 1g									
Son 1h									
Son 1i									
Son 1j									

You can see that the land is now very overworked because bad methods of agriculture and grazing have made it very tired. If fertilisers are used on the land, this actually makes it worse because all the beetles, earthworms and all living organisms which help to make the soil fertile are all killed. The soil is exhausted.

Compost Manure

This manure is made from organisms which were once alive – weeds, grass, animal droppings, and any other materials which can decay.

Macro organisms are ones which can be seen with the naked eye
Micro organisms are ones which can only be seen with a microscope

We need all these organisms to make paths in the soil so that oxygen can travel through the soil. They also fix nitrogen in the soil.

Advantages of Compost Manure

- The crops grow well
- The yield is great from just a small portion of land
- The plants grow rapidly
- The manure stays a long time in the soil whereas fertilisers have to be replaced all the time
- It contains the full diet of the plant. We have to have a balanced diet for the plant as well as a balanced diet for people
- It is cheap to make – if you have no cow, go and ask your neighbour for cow dung

What is needed for Compost Manure?

- Shade – always build it under a tree. The sun will remove the chlorophyll from the plants, so it needs to be in the shade.
- Animal & bird dung & urine
- Ash and water – to help decay
- Top soil – contains the organisms
- Dry and fresh weeds – must use ones that decay quickly not ones that don't like avocado, mango, coffee
- Hoe and panga

- Small sticks
- Long fresh stick about 6 feet long to act as a thermometer

We need to improvise – even the poorest person can make compost manure. You are your own capital – the head is the chairman, the feet are the mobilisers, the mouth is the mouthpiece.

Stages of compost making

- Collect all your materials you wish to use
- Make proper measurements of the place you are to use. Make temporary shade – under banana leaves. Plot needs to be twice the length one side as the other, eg. 1 metre x 2metres, or as large as you wish. Mark the plot out with large sticks
- Make holes in the soil to allow the worms to come out and the oxygen to go in.
- Place the small sticks to act as ladders for the worms, eg maize sticks.
- Place dry grass, about 2-3" deep. Make it level. Must be dry because it allows the oxygen through, but does not suffocate the worms which are coming out
- Sprinkle water or urine
- Sprinkle ash, not too much
- Put dung all over – if you use goat dung, soak it first as it is very dry
- Cover with top soil
- Put fresh grass, chopped up, eg pumpkin leaves, tomato leaves etc
- Sprinkle water or urine
- Sprinkle a little more ash
- More dung
- More top soil
- Continue layering from No 5, ie placing dry grass.
- After you have used up all your materials, cover with dry grass, eg remains from maize, beans etc.
- Place the long stick to act as a thermometer from the top corner of the pile, to the opposite bottom corner.

- Pour water on every day. If it is raining, there may be no need.
- After 2 weeks, pull the stick out and see if it is hot and white. If the pile is decaying as it should, the stick should be hot and white. If it is not, then place the stick on the top of the pile to see where in the pile you need to water.
- Then chop the heap and turn it over well so that what was on the inside is on the outside, and what was on the outside is in the inside
- Let it stay for another 2 weeks – your compost will now be ready.

To use the compost, use 1 part compost to 2 parts soil. The compost will always be black, no matter what colour your top soil.

Ask your neighbour for dung, but train him first and work together.

Do not put compost straight onto the plant. It needs to be mixed up together with the soil.

If you wish to use human urine, to store it you can pour a little cooking oil on the top to form a layer and prevent smells.

If you only have a small amount of compost, then you can only fertilise a small plot of land.

The compost manure process can be repeated time and time again on the same place – it is your factory.

Some people recommend digging a compost hole, but why go to the trouble of digging out a hole when you can make compost manure straight onto the ground.

KITCHEN GARDEN

This is a type of vegetable garden, called a kitchen garden because it is close to your kitchen so that all edible remains from the garden can be thrown in easily. There are other types of vegetable garden, see page 11.

The garden looks like a flower in the compound, but it is a flower which gives food.

The more vegetable gardens you have, the more vegetables you can grow. You need to plan where to put them in your compound. Normally Ugandans just grow potatoes, and not vegetables, but you need to grow lots for a healthy diet. If you farm organically, you can easily grow vegetables.

One kitchen garden will grow 40 cabbages, each with a head bigger than your own head. If they are smaller than this, you are not making your compost properly. You can sell them for a minimum of 500/-. If you grow 40, you could eat 10 and sell 30. Which will make you 15,000/-.

How to make a kitchen garden

- Decide where to build your garden
- First collect all your materials
- Find the centre point
- Draw circle round it 1.5 ft radius
- Draw a larger circle round it 5 ft radius
- Dig the inner circle 6” deep

- Put small poles around the inner circle 1 metre high. This inner circle then becomes a compost mound

- Build up your compost mound as instructed in previous section
- Fill the outer circle with compost from another compost heap, and top soil. The water you pour each day onto the inner circle will drain good food into the outer circle at the same time.

- Keep feeding the inner circle with vegetable peelings etc, and this will keep feeding the soil
- To protect the outer circle, use bricks/stones/tightly tied sticks

- Mulch
- Leave for a week to settle
- Plant your vegetables in circles, not rows

The outer circle cannot be any larger otherwise you won't be able to lean across to weed it.

When you make the path, situate it so that it traps any water around, eg facing up a hill so the water runs into it.

Don't use soapy water to water the centre circle because soap has chemicals, but water used for washing vegetables is good.

VEGETABLE GROWING

Why grow vegetables?

- For human consumption
- As a source of income
- For herbal medicine
- For manure and mulching – water loss prevention, prevents weeds, and also controls pests
- As flavour
- To give nutrients and vitamins
- As fodder

Cultural vegetable growing

Ugandans used to grow vegetables – by just clearing the weeds and planting them. Or they were just growing everywhere, by themselves. People didn't make beds or worry about manure, nature grew them. There were various methods of vegetables growing:

- Sowing the gardens, ie intercropping
- Growing by themselves in the bush
- Sown by running water
- Sown by the wind
- Dispersal by sunshine
- Dispersal by animals, man, birds

But now the land is tired and all the nutrients are gone from the soil.

Modern vegetable growing

Now need to think about many things:

- Have to find seeds
- Need to make nursery beds
- Field preparations
- Distance from water
- Natural sprays, not chemical ones
- Tools
- Management – have to plan ahead
- Look at the market
- Storage facilities

Rules of vegetable growing

- Use manure, especially compost manure
- Use natural pesticides, not artificial ones
- Use proper spacing
- Use crop rotation
- Mulch the garden
- Plant marketable vegetables, ie. see what sells best in your region
- Plant quality vegetables
- Keep the vegetables clean for market

Types of vegetables

Vegetables fall into 6 categories:

Brassica	comprising cabbage, cauliflower, lettuce, spinach, sukuma week
Solanacy	bitter berries, tomatoes, night shade, egg plants
Greens	doodo, buuga, ejjobyo

Legumes	beans, soya beans, kawo, nkolimbo, peas, ngogodi, groundnuts
Roots	carrots, onions, garlic, cassava, banana
Cacubits	pumpkin, watermelon, cucumber

We have to know what category a vegetable falls into so that we can ensure proper crop rotation. Plants of the same category must not be planted in the same place two years running.

How to grow vegetables

- Clear the bush
- Cultivate
- Till the land
- Divide into plots. Always go across the contours, not down them.
- Put in compost
- Mulch
- Leave for 2/3 days
- Plant your vegetables
- When harvesting, pick when it is cool either early in the morning or in the evening. If you harvest when it is hot, the plants will lose a lot of moisture.

Types of gardens

- Kitchen garden (see page 8)

- Double dug garden – measure the area of the plot you wish to dig. Dig a hole one shovel-length deep (nine or ten inches) and the length of your planting area. Pile the soil in a wheelbarrow. Loosen the soil at the bottom of the hole another nine to ten inches. Add compost, and thoroughly mix into the subsoil. Dig a second hole parallel to the first and repeat. Use the topsoil from the second hole to fill the first one, adding more compost and mixing it in. Repeat the procedure until you've dug and composted the entire plot. Fill the last hole with the topsoil you put in the wheelbarrow when you dug the first hole, enriching it with compost as you did before. Your double dug gardens should be plots 4 feet wide, with a 1 foot wide path inbetween from which you will plant and weed.

- Mandala garden – a circular garden, with the entrance facing up towards where water may run from, so as to collect it easily. The water will collect in the centre and water the plants in the circle.

- Sack mound – use two sacks, one inside the other. Using a small piece of pipe, insert a column of stones throughout the sack, filling the outside with top soil and compost as you gradually fill up the sack. Water through the stones, and the water will penetrate the rest of the sack.

- Mountain garden – create a mound of compost. Put stones around it, all over, and plant in-between the stones. Then mulch it.

- Raised garden

- Sunken garden

How to make a sunken garden
This is the garden to make when your land is rocky.

- Dig a hole 2 or 3 feet deep, 4 feet wide and as long as you want the garden to be.
- Put the dug soil above the hole so that the rain washes it onto the garden
- Put dry grass up to 6 inches on the base of the hole
- Add compost mixed with top soil, up to 6 inches from the top
- Mulch, and add water

This is suitable for eggplants, night shade and bitter berries.

It is very necessary to train your neighbours as well as the brothers and sisters. The neighbours will destroy your garden and steal your crops.

You need to eat what you grow – do not sell it all. Eat organically and be healthier.

Bitter berries cure blood pressure, and reduce fever

For planting and spacing details of each vegetable, please see Appendix 3

BANANA GROWING

Perez Kawumi – 0772 625465 (only from 7am – 9.30pm)

Bananas are the major food crop in Uganda. 18.4 million tons are grown per season, on 13.4 million hectares of land. It accounts for 65% of the total crop production of Uganda. 90% of the population think of it as their major food. Bananas in Jinja come all the way from Mbarara because there aren't enough grown in Jinja.

Importance of bananas

- Food for humans
- An income source
- Leaves are used for soil conservation
- Peelings are food for animals
- Manure
- Art & crafts
- Building houses & other farm structures
- Foreign exchange earner
- Complementary crop to other crops, eg. it acts as a shade for coffee plants

Problems associated with banana production

- Pests & diseases. Examples of pests include banana weevil, nematodes, monkeys, irresponsible humans. Examples of diseases include banana bacterial wilt, streak virus, banana wilt.
- Everyone comes to the market at the same time so the market is flogged
- Poor soils, though the soil in Uganda is the best in the world. But Ugandans have poor practices and do not look after the soil properly.
- Little agricultural skills. Everyone who fails in other sectors, ends up as a farmer. In UK for example, you have to train to be a farmer, but in Uganda it's what you do when you cannot do anything else.
- Bananas are a low value crop because you discard 50% of the crop
- Seeds have a very short viability
- It cannot withstand drought. In northern Uganda, although there is the best soil in Uganda, they cannot grow bananas there unless they irrigate first because there is prolonged drought

Characteristics of bananas

- The plant produces without fertilisation – pathenocapically. There is no cross pollination. If your bunches are small, it is because of poor management.
- The stem is always underground.

- The leaves grow from the inside up – the oldest dry out on the outside and become fibre. At flowering time the leaf elongates from the corm up, and then flowers. The bananas are the female flower, and the remaining bit is the male flower. Nutrients go into the flower. The top of the bunch as it hangs down is always the largest, the last one is always the smallest.
- When you want to weaken the banana, you have to remove the corm – if you weaken the pseudostem, then another will grow out. If the corm is damaged the weevils will get in.
- It produces or multiplies well vegetatively

Requirements for banana production

- It can grow in a wide range of soils, but the best soils are loam, sandy loam with a lot of manure.
- Plenty of rainfall, >1000mm/year evenly distributed
- Relatively high temperature. Won't fruit well, if under 12degC or over 37degC

Planting

1 Site Selection

- Fertile
- Gentle slope
- If possible, should not have had bananas for the past 3-6 years because they will have left pests and diseases

2 Preparation of site

- slashing (no burning – this is the worst thing you can do for the living organisms in the soil. God did not create organisms for us to burn them all).
- Primary ploughing. Hand/hoe/tractor. This is to loosen the soil so water infiltrates easily and roots penetrate easily, also to check weed growth and to check the pest cycle
- Secondary ploughing, after about 3-4 weeks
- Smooth the soil
- Proper mixing of decomposing weeds/plants with the soil

3 Soil and water conservation measures

- construct ridges or contour bands using an A frame (see page 24) This is very important and although the preparation does take time, the actual operation is quick. If you don't prepare, the operation takes much longer.

4 Selection of plant materials

- healthy sucker – should have tiny leaves (called sword suckers)
- variety – think about yield
  maturity period
  tolerance to pests & diseases
  tolerance to drought

5 Marking the plot

The holes should be dug between 10 – 13 feet apart. The spacing may change because of:

- Gradient of slope. The leaves should get tangled together so that they grow together and will then stop soil erosion. If they grow straight upwards it is no good for soil erosion.
- Soil infertility. If the soil is less fertile, put the banana plants further away so it has more soil to get its nutrients from. The corm sucks the nutrients from the soil which are then pulled in from the surrounding soil

6 Farming system/practices

- Do not leave the new suckers alongside the plant. Train it to produce them in one place by putting the compost at one side only. Let each plant produce 2 or 3 suckers. If you put compost all around, it will produce suckers everywhere, and it will be impossible to remove the dead mother plant without destroying some young ones. They will all die and will become fertile ground for the banana weevil. If you put compost on one side, the suckers will grow that side, and eventually the mother plant will die and will be able to be easily removed.

- The suckers will be good quality if the original plant and soil are good. If you have bad suckers, it is an indication that you must renew the manuring etc of the mother plant.
- Do not put compost on top, it must be dug in. Otherwise the roots will come upwards, and the plants will grow on the surface.

7 Digging holes

- Holes should be dug at least 1 -2 months before planting. The hole should be 2-3 feet wide and 2 feet deep. Do not dig to a point, it should be 2 -3 feet wide all over the hole.
- Place the black soil on the upper side of the hole, and the red on the lower side, so that when it rains, the black soil will automatically be washed onto the plant.
- You need to wait 1-2 months for the environment within the hole to stabilise before you plant

8 Prepare planting materials

- Four types of corm:
  - Sword sucker (30-100cm long)
  - Maiden sucker (2+ metres high, but not flowered yet)
  - Bull head (from harvested corms)
  - Tissure culture plantlets (very expensive)

  Normally one of the first two is used
- Prepare the corm. Uproot without serious damage to the corm. Pare the corm – cut off any roots, cut off any tunnel for the weevils. Do this at the place you get the plants from so that you leave the pests and diseases there. Do this 2 days before planting
- Dip in warm water c 50 degC. To measure the temperature, place a candle on the water, with a stick going through the candle. It will go to the bottom of the water. As the water warms, the candle will melt, and the stick will rise to the top. Then it will be the right temperature. Dip the corm in this water for 10-20 minutes. This is to kill the eggs of the weevils.
- Multiplication of planting material - the split corm technique. The corm, now free from pests and diseases will have little buds/eyes which are all capable of becoming plantlets. Split the com so that each piece has a bud in it. Put in a dry but cool place for about 3-4 days. This is to cure the wounds created by the cutting. Can use the leaves of the neem tree to cover the pieces – this acts as a repellent to pests.
- You can now plant these in a nursery to ensure there is no over-watering. Good quantities of manure are required. After 2-3 months in the nursery, they are now ready for planting.

9 Planting

- must be done at the beginning of the main reliable rains
- the corm will come out in about 2 weeks

- if you use suckers from the plant, then remove leaves and cut off roots to remove weevils and nematodes. Also, if you cut them off, they will develop quickly, if you do not, they will take a long time to grow.

10 Intercropping

Use a leguminous cover crop. The roots of these have nodules which can attract nitrogen to act as nitrates. They will supplement the soil fertility.
Use creeping legumes, not eg. soya bean. They will act as cover.
Cover crops are good because

- They have very early maturity
- They are not a greedy feeder
- They need less water to survive
- They have commercial value

Use cover crops to:

- Control soil erosion
- Smother weed growth

11 Other practices in banana management

- Mulching – covering the soil with dry grass/leaves.
- Must use dry not fresh, as there may be pests present in fresh. Also, fungus grows easily on fresh plants
- Must be laid across the slope, not down it (for water infiltration), 1-2 feet from the stool. If it touches the stool, the roots will come straight upwards. It will also provide access for weevils
- The grass should be 10-15cm in depth. Any more and the water won't be able to get through
- Desuckering – removal of extra suckers. Just leave 2-3

- Pruning and detrashing. Pruning is the removal of unwanted leaves, the ones that are yellow and broken. Detrashing is removing the trash, ie the dry leaves and fibres. You have to leave the pseudostem clear to photosynthesise
- Staking. This should be done as the need arises. In properly managed plantations, you will need a stake. If they are not managed well, they will not be strong enough to need a stake.
- Pest and disease management. Weevils, nematodes, irresponsible human beings. The larvae of the weevils are the most dangerous – they eat corms and create tunnels. If you place stones on the top of the corm when they come out at night, they won't go back in because the stones will keep it still

dark. You can come in the early morning, can easily get them and crush them.

- Keep the field hygiene good, and the pests will less easily get a stranglehold
- Fight banana streak virus (makes leaves brittle) by providing good nutrition

GROWING CEREALS

Richard Nakabirye

What are cereals?

- Seeds are planted by sowing
- Seeds have one cotyledon (a monocot)
- They produce a simple seed

Cereals are very nutritious. 99% of what we consume comes from cereals such as wheat, millet, sorghum, maize, rice. They have long thin leaves with parallel veins. The endosperm contains carbohydrates and the embryo contains vitamins.

Because they bear a dry form of fruit, cereals can be kept for months and years without spoiling, if they are stored under the proper conditions. Cereal grains form the basis of the human diet all over the world. Their endosperm consists of carbohydrates and proteins which are very important in the human diet. Their embryos contain vitamins and fibres which help to move food throughout the digestive system.

The land must be fertile. You have to know what type of soil you have, as different cereals respond better in different soils.

Preparation of the soil for planting

- Season. Rainy seasons should be targeted for higher yields, but this should not be a problem where irrigation is to be used.
- Choice of soil and preparation of field. Different cereals thrive in different soils - therefore one must be able to choose which cereal would do well in which type of soil or in the type of soil he/she has. Eg. rice does well in waterlogged soil.
- Ploughing. Fields should be prepared well to provide suitable conditions for sowing, transplanting and germination of the seeds. You can use machinery for ploughing, such as tractors, or manually using a hoe, or ox-ploughing. If you use machinery or the ox-plough, you must remove the tree stumps first so that the tractor or the plough are not damaged.

Advantages of ploughing

- It ensures that the weeds are killed by burying them
- Burying the weeds and residues from the previous season helps to add organic matter to the soil
- It loosens the soil for easy percolation of water so that the water penetrates deeper into the levels of the soil
- It increase the aeration of the soil

There must be no burning or use of herbicides – they have more disadvantages than advantages

Seed selection

This is of great importance because poor seeds will always produce poor crops and hence poor yields. Many plant diseases are carried in seeds and therefore if these are selected the plants that will grow from them will suffer from the disease. Therefore when selecting, farmers should ensure that mature, dry seeds, which were properly stored, are used. NB. Seeds from hybrid crops should not be selected – they can only be used once. Good quality seeds which have been tested and proven are available in agricultural shops. A good seed has the following characteristics:

- Must be clean, and not contaminated with other seeds
- Should be able to produce good and healthy plants
- Never plant seeds from hybrids because they produce weaker versions of the parent plant
- Should be free from disease
- Should be fully developed, ie. mature, and from a mature plant. (should leave in the field to dry there, and then bring in and remove seeds)
- Should be viable, ie. able to germinate. This can be tested before planting. Soak a known number of seeds in water for 1-2 days, and allow to germinate. If more than 70% of them have germinated, the seed is ok. (Soaking seeds is a good way of preventing squirrels eating them – soaking seeds makes them germinate quicker, so by the time the squirrels come, it is too late)

Methods of planting

- Broadcasting - for small seeds like sorghum, millet, rice
- Row planting – more accurate and better than broadcasting, most especially where machinery is available. It ensures a good and proper spacing of the seeds and hence easy weeding.
- Transplanting - needs a nursery bed. After germination (2-3 weeks), the seedlings are fully germinated and can be transplanted to the field from the nursery bed. This is done manually with a hand trowel. Before transplanting, the seedlings must be allowed to get used to the outside conditions, called hardening off. Remove the covering from the nursery bed and leave the seedlings exposed to the outside conditions for 2-3 days before transplanting. You must water the seedlings before transplanting sufficiently enough to loosen the soil. You must do this on a cloudy day or in the evening to avoid too much sunshine. The advantage of transplanting is that the seedlings are spaced according to the spacing required by crops in the field.

Information regarding different cereals

Crop	Seed rate	Spacing	Maturity period	Yield
Maize 2/3 seeds per hole	20-25kg per hectare	75 x 50cm	120-160 days	4-5 tons per hectare
Sorghum 2/3 seeds per hole	8-10kg per hectare	40 x 15cm	90-100 days	3-5 tons per hectare
Finger millet broadcast	4-10kg per hectare	Rows 30cm apart	100-120 days	3 tons per hectare
Rice broadcast	70-90kg per hectare	Upland 20 x 30cm	100-120 days	3 tons per hectare

Weed control

A weed is a plant growing where it is not wanted – blackjack, lumbugu, couch grass, star grass, spear grass, wandering Jew, oxalis etc. Weeds take the nutrients and the light and contain pests. Some weeds are poisonous.

1 Importance of weeding

- It reduces competition between crops and weeds, for soil nutrients and light
- It improves the quality of the produce
- Some weeds are poisonous
- They harbour pests
- It results in increased yields

2 Methods of weed control

- Cultural – including crop rotation, mulching, close spacing
- Mechanical – here machines are used by tractors
- Garden tools – such as hoes, forks, pangas, slashers etc. This is the most common method
- Chemical – use of herbicides. This is very dangerous for they kill useful bacteria and soil macro-organisms, eg works
- Biological – weeds can be controlled by introducing insects that can feed on them, and it is assumed that they will die incidentally when their food is over. But what if they don't die?! Not a very safe method

Fertiliser application

After weeding the farmer is expected to assess the progress of his crops. This can be easily done by looking carefully at the leaves of the crop. Healthy crops have dark green leaves and look strong and healthy. But if this is not observed, there is a need to apply fertiliser – compost.

Pest and diseases

Pests that do the most damage to our crops include insects, birds, mammals and nematodes, mites. These attack by eating parts of the plant, or sucking juice from the crops. Others are vectors for viruses.

Control methods

- Spray organically – eg neem tree
- Plant some weeds – eg mix together pepper, chilli, neem tree, ash & muuk and spray. This will not enter the leaves to taste.
- Plant some pest repellents like onions

Specific pests & their controls

- Mammals, such as rats, mice, squirrels which do most damage by eating the seeds during germination or when the crops are mature and contaminating it with their waste after harvesting. Others include pigs, monkeys, baboons. In Kenya you are not allowed to kill monkeys, but you are in Uganda.
- Mites – if you spray the plant you will kill the insects which eat the mites so you will end up with more mites. Mites don't cause much damage and are found where their predators have been killed by burning or herbicides
- Birds – these are the principal pests for cereals and they cause enormous losses to farmers. Can use scarecrows, and the use of noise can scare the birds away
- Fungi, bacteria, & viruses – these also cause serious plant diseases and multiply best in warm, wet conditions. They can be controlled by early planting. Can spray with natural fungicide such as the neem tree. Maize streak is an example of diseases caused by bacteria.

Harvesting

You have to prepare, whether you are going to sell your crop dry, or fresh. You have to build granaries, or buy tarpaulins. Ensure that your stores and granaries are properly roofed to avoid any leakages. Grains which are to be used for seeds should be allowed to dry in the field before harvest. When harvesting, care should be taken to avoid shattering of the grain in the field.

Post Harvest Loss

Any product or part of it lost between the field and the home and the consumer is known as post harvest loss. Causes of these losses are:

- Not harvesting in time, causing shattering of the seeds
- Transportation between farm and home
- During the processing and packaging
- Transportation between home and market
- Poor storage

Therefore, it is good for any farmer to ensure these losses are minimalised.

After harvesting and drying, the grains need to be stored in good conditions, cool and dry, where no water or rainfall can reach.

Seed dressing

This involves coating the seeds which will be used in the next planting by chemicals that protect the seeds from insects and animal pests. It can be done by special equipment known as seed dressers. How do we dress them organically? Can use dry red chilli, or hot pepper, mix the powder with wood ash and powder taken from moringa leaves and the neem tree. Put the seeds in a tight container together with this mixture and tightly cover the container. Note – dressed seeds should not be consumed by either humans or livestock.

Keeping records

We have to be able to evaluate what we have done, so keeping records is a must.

Planting record

Type of seed	Date planted	Amount & Cost	Area planted	Cost of labour

Harvest record

Date of harvest	Crop	Amount	State & condition	Cost of labour

Growing maize in little plots – 9 seed maize

Remember – compost manure is the backbone of organic farming.

Dig each hole 6” deep, 3’ x 3’. Place 2 basins of compost in the hole, bring back the topsoil you have removed, and mix. After mixing, level it and start planting. 9 seeds to a hole, three across the top, three across the middle, three across the bottom. Plant beans between the squares. After harvesting, do crop rotation, and swap them round. The second year you plant in the squares you did not plant in the first year, and then swap again the next year. After 2/3 years, the whole area will be very fertile.

	Plant 1st year	Plant 2nd year						

SOIL CONSERVATION AND WATER MANAGEMENT

Soil conservation is about maintaining the soil fertility, and also using the soil. Eg the story of the talents in the Bible – we have to use what we are given. We have to use the soil in a sparing way, but at the same time maintain its fertility. It is a living organism, it feeds, it breathes, it reproduces and grows. So there has to be aeration etc. These are the methods of soil conservation and water management:

Crop Rotation

We grow different types of crops on the same piece of land, but during different growing seasons. Crops are in different families which have different requirements. Different crops consume different nutrients, so that there is a balanced removal of nutrients from the soil, such as nitrogen, phosphorus, potassium, calcium, zinc, carbon magnesium, manganese, boron and iron. Nitrogen, phosphorus, potassium, calcium, carbon, magnesium are magno nutrients. These are needed in very great quantities and it is very obvious if they are not there. The others are micro nutrients which are only required in small amounts. If the plant takes in a lot of one nutrient, it is automatically forced to consume the others. All the time, if you practise crop rotation, the different nutrients will be available. If one is missing, the others won't be taken in by the plant, so its diet is not balanced.

Need to include legumes in the rotation like this:
Heavy feeders – 4th year
Light feeders – 2nd year
Medium feeders – 1st year
Nitrogen fixers – 3rd year

Timely planting and use of proper spacing

Plant before the first rains so that they infiltrate the soil, saturated into the soil. Plants will have developed roots and a canopy which will compact the soil – this will stop the water escaping. The canopy will also stop too much water falling on the crops and washing the crops away. The crops have to be established before the first rain.

If plants are spaced well, they will establish themselves better, so that they will grow better above ground. There will be sufficient nutrients available to it so it will be more able to withstand pests. The water will try to flow, but will hit a strong plant so will not be able to. If plants are spaced properly they are more able to control pests and diseases. A good canopy will be formed so too much rain won't land on the soil and wash it away, and the canopy will keep the soil moist.

Mulching

This is the covering of the soil surface with dry grass. Some people use synthetic farming, but we would prefer to use dry grass. Mulch should be 10-15cm deep. Lay across the slope, not down it, to prevent water loss.

Contour Farming – The A frame

This relates to both ploughing and planting. You must plough across the slope, not down it.

For ridging and construction of bands/trenches, you need to make an A frame. You need two sticks, 10' long and one stick 5' long. Plus string, plus a heavy object or plumb bob (you can use the male flower of the banana). Plus you need 3 nails. Join the long poles at the topmost point.


Measure the middle point on each stick and nail the cross bar across the two. Make it relative to one's size. Make a middle point on the cross bar, tie the string from the top onto the heavy object. The string must pass through the middle point – if it doesn't you have not made it properly. Make your contours using the A frame.

Keeping one leg of the A frame on the floor, move the other leg round along your plot. When the string passes through the middle point, mark where the 2nd leg is. Then keep that leg on the floor, and move the first leg of the A frame around. When the string passes through the middle point, mark again. And so on….. You will soon end up with a row of markers


Do 2 rows. Build your trench diagonally from the first marker of the first row to the second marker of the second row.

From the first trench, walk backwards with a book held on top of your nose – when you can see the trench, that is the place to build the next contour and trench. If the ground is steep, the trenches will be close together, but if the ground is not steep, the trenches will be further apart.

Build tie ridges when building trenches, if the contour goes flat. This will provide an obstacle to the water, so that it gathers there.

Trenches should be 2' wide and 2" deep. Plant grasses to keep the trench in position. Look for grasses that have multiple functions, eg grass that can be cut and fed to animals.

Cover Cropping

It is important to use crops that can reinstate soil fertility – to rejuvenate it. They must be

- Early maturing
- Tolerant to drought
- Not greedy feeders
- Can easily recover from pruning or grazing
- Can withstand pests and diseases

Tree planting or afforestation

This is where we use land, combining the use of livestock, crops and trees. Trees must be evenly distributed, they must have multiple uses and should not form a very dense canopy. Crops need light, warmth, and oxygen. If they have no light, the plants will try to reach light and grow taller, and therefore will not be good plants and won't be able to support the fruit.

Don't plant eucalyptus – it is a greedy feeder and will suck all the moisture from the soil. Its leaves take a long time to rot and form manure. The leaves form a mat under which is an accumulation of acids which will affect the micro-organisms in the soil.

Water harvesting

When water gains momentum, it has the ability to create gullies. These gullies need to be diverted so that you can harvest the water.

You can create a pit to harvest water. Dig a pit and smear it with clay. Make sure the clay dries properly – it will act like a pot. It is semi-permeable. It won't completely prevent the water from escaping, but will keep it for some time. You can

drop moringa seeds into the water. You can also buy a polythene sheet to line your pit with.

Discourage water running off your land – it will take the top soil with it, which is the most fertile.

Correct pasture carrying capacity and proper grazing systems
If animals overgraze where there are not plants, etc, soil is easily eroded, the sun dries it easily and the wind blows it away. Practice

- Rotation of grazing
- Deferred grazing
- Strip grazing
- Zero grazing

Rotational grazing – divide the land by fencing into paddocks, each area should rest for at least 21 days to enable the grasses to rejuvenate. The soil surface must not be bared. The more fertile the soil, the greater its capacity to resist being eroded.

Strip – a strip should be fenced off, then move to another strip. You only need one fence because as you move the fence, the animals will relocate automatically where there is food.

Deferred grazing – keep one piece of land aside for some period of time

Zero grazing – only applicable where you have a few animals. It is the best way to ensure no over grazing.

Intercropping

This is growing different crops on the same piece of land during the same growing season. It helps because:

Different crops require different nutrients

Different crops have different root systems to utilise air in the soil properly, eg tall crops have long root systems. The roots utilise the nutrients where they are in the soil. The more fertile the soil, the more it has the ability to support proper plant growth. This will mean there will be no bare soil, which will mean there will be no soil erosion. There is no evaporation of water if there is no bare soil. Different roots will have the ability to keep the soil particles together, so that they won't be washed away by the water.

Fallowing

This is letting the land rest for some time. If you have over used the land, you must let it rest. Plant leguminous plants in it which are nitrogen fixers – this will rejuvenate the soil.

Minimum tillage

As much as possible, avoid opening up the land. You loosen the soil particles – so that they are then easily able to be carried away by the water. When you carry out secondary ploughing for eg, growing bananas, you have to incorporate soil conservation methods so that the soil doesn't disappear. Minimise the opening up of land by mulching, slashing or cover cropping.

Some people use chemicals, but we have to do it the correct way.

Green manuring

Like a woman matures prior to marriage, so plants come to flush growth before harvesting. Have to give it green manuring so that it is at its best. When the flower comes, it expects the male to come and fertilise it. It has to be full of nutrients so that it is able to fertilise. Applying green manure just before flowing will provide it with the nutrients, and will provide the organic matter.

Organic matter is decayed and decomposed plants, and animal remains. Organic matter improves the soil structure (the compactness/looseness of the soil) and improves the soil texture (the roughness/smoothness of the soil). There are 3 types of soil all over the world – sand, clay and silt. The combination of these will determine the texture class. There are over 100 classes from these 3 types.

If the soil is sandy, it will have very big particles, if it is clay it will have soft medium particles. Sandy soil will have rough texture and be loose. Clay will be compact and smooth. Clay sticks together with lots of water so nutrients and living organisms cannot grow there very well. Sandy soil has lots of air space between so water easily passes through.

On clay soil organic matter will unite the particles and will improve aeration between them. Plants need moisture, not water. On sandy soil, organic matter will settle in the air spaces between particles and will reduce the ability of water to pass through. Organic matter supports water penetration/infiltration. Once lots of plants are there, the soil loses its ability to be eroded.

Strip cropping and terracing

With strip cropping, the grass stops the water taking the soil away and persuades it to go on to the crops.

With terracing, the ditches will absorb the water to provide moisture to the plants.

Ways through which soil may be destroyed by man

- Irresponsible application of chemicals. Not all chemicals are very dangerous – those that are biodegradable are better.
- Over grazing
- Deforestation
- Using burning in bush clearing – this destroys the environment, and also houses and crops!
- Poor farming methods like mono culture – only growing one crop. This is very dangerous
- Irresponsible exposure of the soil surface eg brick making, sand mining, stone quarrying
- Construction. Most people strive for structural development (lots of buildings), but we need sustainable development. We should understand the environment and maintain it, eg when we cut down a tree to build, we should plant another one. We need to develop the agricultural sector, and develop the environment
- Irresponsible disposal of non-biodegradable materials. We should construct a pit to throw them all in – don't just throw them into a pile outside the compound.

Good trees to plant

Leuceana
Calliandra
Sesbania
Glincidia
Grivellia
Ficus

These are all leguminous trees.

PLANT TEAS AND MANURE TEAS

Plant teas and manure teas are liquid manures.

Plant teas

This is using leaves from different categories. One of the ways a farmer can fertilise the soil is by using liquid manures. This is found in the leaves which are grouped according to the nutrients found in them. They are decomposed within 7 days:

Grouped in 3 categories:

A leaves from leguminous crops or trees. Beans, peas, lablab, mucuna, calliandra, sesbania, glincidia, leuceana, desmodium (silver or green), jackbean, albizia etc

B hairy leaves, eg Russian comfrey, tithomia etc

C soft bodied leaves, eg yams, cassava, wandering jew, potato leaves etc

Procedure

Take leaves from each group, chop into smaller pieces and place in a container, or dig a pit and put a bavera into it and place the leaves in this. Fill the container ¾ full with the leaves. Add handful of woodash, without charcoal. Put the container in the shade, fill it with water and cover it. After 2 days, stir it and within 7 days the fertiliser is ready.

Dilution and application

Ratio 1:2 on soft bodied plants eg doodo, nakati, lettuce. (one part plant tea, 2 parts water)

Ratio 1:1 on heavy feeders, eg maize, banana, spinach etc

Apply on the root zone for at least 3 consecutive days. On root crops, eg cassava, apply once in their growing period, or when they are almost to flower. Mulch after applying to prevent loss of nitrogen. When you see the young ones coming up, remove them and sell them.

If you use urine instead of water, the ratio should be 1:3 on light feeders and 1:2 on heavy feeders.

You should also use plant teas when use compost manure, as the tea adds nutrients to the plant rather than fertilising the soil. This will mean you get higher yields.

Manure teas

This is made from animal waste, fermented for 21 days, eg cow, goat, pig and poultry droppings. You can make this fertilise in any container provided you follow this formula:

Drum (200 litres) – use 30kg animal waste
Jerry can (20 litres) – use 3 kg animal waste

Poultry droppings are the best to use because they contain potassium.

Procedure

Get a porous bag and put the animal waste inside, put a stone on the top of the waste and tie the sack. The stone is so that the sack will sink.

Tie the sack onto a stick placed across the top of the container so that the sack hangs from it into the container. Fill the container with water and cover it to reduce the smell and the flies.

Keep shaking the sack after every 2 days. After 21 days most of the nutrients will have gone into the water and you will now have a strong liquid called a manure tea.

Dilution and application

Ratio 1:4 on every crop. You should apply this on the root zones.

Apply once a week on doodo, etc.
On fruit crops, eg tomato, egg plants, solanacys, apply once every 2 weeks.
On root crops apply only once during their growing period.

Chicken manure has sufficient amount of nitrogen, phosphorus, potassium as well as zinc. Vegetables grown using manure teas are rarely deficient in all nutrients. Therefore manure tea is the best, simplest and cheapest fertiliser available. We only use liquid manure on existing plants, not when planting.

Green manuring

Chop up leguminous plants, mix straight into the soil and leave it for 7 days to decompose. You can then plant your crops.

ORGANIC PESTICIDES

Pests can be either insects or animals that destroy our crops. There are three categories:

- Those that chew, eg grasshoppers, termites, caterpillars, beetles etc. These do most of their damage by chewing parts of the plant, especially the leaves which are important for photosynthesis. They are very difficult to deal with since some of them attack at night and others hide in the soil and damage the roots of the crop.
- Those that suck, eg birds. Sucking pests hide themselves under the leaves of the crops and suck water from them. Some hide under the ground and suck the water from the roots, eg birds, aphids, nematodes. Birds attack rice. Their effect can be detected when you see the leaves rolling themselves or changing colour. (Sometimes the change of colour means that they need compost, eg when maize goes yellow, it needs potassium).
- Those that sting, such as flies or spiders. Most of these are vectors, ie disease carriers. These may not be the cause of the disease but they carry the bacteria which cause the disease. Eg, spiders' webs harbour insects which can be dangerous to the flower. Webs are maternity wards for the bacteria.

Methods of prevention

You should apply enormous quantities of compost etc so that you know that when you do see the colour of the plants change, it is due to pests. There is no overdose possible for compost – the crop just takes what it needs. So if you put enough compost on the garden, then you know that it is pests who are causing the problems. (Cassava and potatoes don't like too much compost).

Before any action is taken, you need to know the type of pest or disease which has attacked your crop. Proper identification of the pest or disease will save you from controlling the wrong problem, and hence time.

General principles to be followed:

- Apply adequate amount of compost, liquid manure and plant teas
- Avoid weak plants by carefully selecting seeds of resistant varieties
- Appropriate spacing of crops in the field
- Plant and weed early
- Remove sick or disposed plants from the garden in time, and do not throw them on the compost. You should burn them, so that they don't spread disease throughout the garden
- Crop rotation helps to break the pest cycle and prevents the carrying of pests to the next season
- Use intercropping – marigold and onions planted between crops

Advantages of organic pesticides

- They are cheap & easy to make - all the materials are around us
- They are environmentally friendly
- They increase yields
- They save us from being attacked by chronic diseases, eg cancer
- They are economical
- They don't spoil the soil
- They control harmful diseases
- They don't change the taste of the food

We can control some pests by trapping, eg after harvesting banana remove the banana stem and trap the weevils underneath, killing them physically.

How to make pesticides

Pest to be controlled	Plant to use	Method
Nematodes, cut worms, aphids	Neem Tree	Get a handful of leaves, grind them in 3 litres of water. Bring to the boil and leave overnight. Filter. Then spray onto the leaves
All pests which attack vegetables	Tephrozia	Grind handful of leaves. Add water in ratio of 1:5, then add one 5ml spoon of red chilli or hot pepper. (Squeeze it to get the juice out). Split a matchbox size of brown soap into very small pieces, add, and boil the mixture. Filter and then spray. NB. Keep for only 2 days
All tomato aphids, cut works, caterpillars, locusts	Phytoraca	Pound leaves and squeeze. Use 2kg of pounded leaves in a basin full of water. Add 3 tablespoon paraffin, 3 teaspoons bicarbonate of soda. Add brown soap (or white soap, but NEVER blue). Mix well, leave for 10-20 minutes. Filter and spray on crops for 3 consecutive days.
Butterflies on cabbage and caterpillars	Tomato leaves	Squeeze 2 handfuls of leaves, add 2 litres water. Allow to stand for 5 hours, then add some soap, filter and spray. Can also spread tomato leaves on the cabbage garden – this will have the same results.

POULTRY MANAGEMENT

Nakawombe Lydia 0752 897122

Poultry farming is the keeping of domestic birds.

Why do we go in for poultry farming?

- It is a source of food
- It is a source of income
- The droppings are useful for manure
- They are useful for study purposes
- It is a hobby
- Source of employment
- Tourist attraction
- Can be well integrated with other industries
- Compared with other industries, it takes little space
- Cultural purposes
- Compared with other industries, has higher production rate per unit area

Factors determining the success of the industry

- Availability of land (perhaps near a trading centre)
- Capital (eg loan or credit scheme)
- Determination, interest and capability of the farmer
- Labour
- Availability of high quality day old chicks and hatcheries
- Availability of high quality feeds
- Efficient marketing system
- Efficient transport system
- Efficient disease control
- Efficient extension services
- Education of farmers on production and marketing
- Price policy of inputs and outputs should be considered
- Sensitisation of the inhabitants of the area – you have to educate your neighbours so that they are not jealous
- Fence the land – though that doesn't stop someone paying a farm labourer to poison your birds

Methods of production

1 Local/village

- Kept free-range
- Local breeds
- Unimproved genetically – low production levels
- Disease tolerant
- Mainly for home consumption
- On a small scale
- Self incubation
- Very low income input
- Less attention required to manage
- Less food required
- Housing standard – not well catered for

You should apply management processes whether local or exotic. Some people prefer local birds, not the day old exotic chicks. You can house even local ones.

2 Commercial production

Breeds – layers, broilers, dual purpose

White leghorn – very suitable for commercial productions. Egg producers. Are nervous and flighty. Light in weight

Rhode Island Red – dual purpose, easily managed, good for egg production as well as meat. Yellow skinned – this can be a disadvantage as people don't want yellow meat

Light Sussex – dual purpose, easily managed

Hybrid Broiler – for meat production. Under good management, can weigh 3kg at 2 months.

Management systems

- Free range – birds are left to roam. By chance can find a shelter somewhere, but are left to go around as they wish
- Fold units – wooden structures, raised off the ground, movable and portable
- Restricted range – fenced off area
- Permanent yard – fenced off area
- Battery cages – put in metal cages, with the floor made of slats so that droppings can drop down. Food and water supplied by electricity
- Deep litter – the best way

Deep litter System

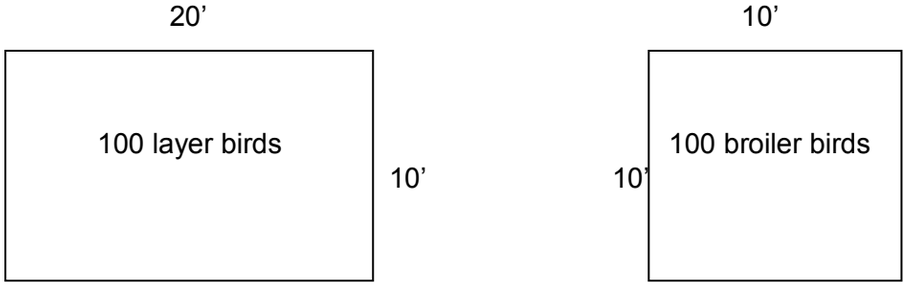
- High capital investment
- Birds are confined full time
- Housing structures should be well catered for to provide best conditions for the health of the birds
- Litter should be of good material and kept clean at all times, changed frequently as need arises. Litter is the material you put down for the birds to rest in – dry grass, coffee husks, sawdust, though beware with sawdust as some trees have certain chemicals which are dangerous to chickens.

Housing

The shelter should be strong enough to provide protection and security for the birds, it should be rain proof and should be raised enough to allow sufficient ventilation and aeration. Droppings and urine give off ammonia – the birds will suffocate and it is not pleasant for humans – if there is not sufficient ventilation.

Also, the shelter should be rat and pest proof. Walls should be constructed in such a way – half brick/mud material, and half chicken mesh to allow ventilation. These should also be rat and cockroach proof.

Spacing



Broilers are squashed in so that they don't move around and use energy, otherwise they will not put enough weight on.

Rearing of young

House
Heaters (lamp, charcoal or stove)
Feed and water (water should be warmed a little)
Litter – should be in a separate place and well covered to avoid chickens mistaking it for food

Keep the chicks in the house for the first 4 weeks of life. While they're growing, extend the house and introduce more feeding troughs.

Feeding (layers)

1-8 weeks – chick mash
8-20 weeks – growers' mash
20 weeks on – layers' mash

Introduce changes gradually

Feeding (broilers)

1-4 weeks – broiler starter
4-8 weeks – broiler finisher
May not be ready for sale at 8 weeks

Management of laying flock

- Provide proper laying nest boxes to avoid egg eating or breaking. Feed should contain calcium to prevent shell weakness. Should not be any light inside the laying box
- Provide grit to layers (can use sand) – this helps with digestion
- At times try to provide green herbs for provision of vitamins. Carotene from Vitamin A gives the yellow to the yolk
- Ensure the feed is given in such a way that food or water doesn't spill. Water can cause diseases if left
- Hygiene and sanitation should always be given top priority

Vices in birds

- Cannibalism
- Pecking
- Egg eating

This happens when they don't get a balanced diet, especially lack of calcium. Also, when they're bored or overcrowded. This shows poor management.

Control – give a balanced diet, provide food and water at regular intervals, provide greens, provide perches in laying areas, provide grit and ensure the laying houses are dark.

Cull less productive or totally unproductive birds.

Disease control

- Maintain proper hygiene
- Isolate sick birds

- Early detection of disease – if one has a drooping head, then it is sick. You must detect early to control spread of the disease
- Extension services – consultation of a vet for quick action
- Timely vaccinations – they must be done at the correct time
- Can use herbs as first aid – grind and mix in water and add to the water trough

Some common poultry diseases in Uganda

- Fowl pox (vaccine administered through wing)
- Newcastle (vaccine administered through eye)
- Coccidiosis/salmonellosis – no vaccine, can give antibiotics
- Gumbro disease – vaccine available
- Fowl typhoid – vaccine administered in breast muscle

Marketing

You have to ensure that there is a market for your product.

Record keeping

This is a vital step in every enterprise. You must keep financial records, feed records, production records, breeding records.

Your major aim is to maximise profits.

PIGGERY MANAGEMENT

Why is piggery management not yet well developed?

- Religious beliefs
- Sociological and cultural factors
- Lack of knowledge
- Government not put much emphasis on it
- Karamoja only have cattle because they move a lot, and pigs can't cope with moving
- Pigs compete with humans for the same food

Breeds of pigs

1 Local breeds

2 Exotic breeds

- Large white – erect ears, curved face, good mothering ability, good carcass quality, fast growth rate (mature in 6 months)

- Land Race – white, ears cover eyes, longer body than large white, good at milk production

- Wessex Saddle Black – black, white ring around it, very prolific, highly productive, good converter of herbage to meat.

Systems of production

- Intensive – all the time indoors
- Extensive – in paddocks, free range, though must put in provision for shelter when cold and wet. Need lots of fencing.

Management of breeding herd

Boar

How to choose a boar

- Fast growth rate
- Should have high libido
- Testes should be big – giving high quality semen
- Strong enough to stand the stress of mating (you can tell this from records)
- Should have good mammary development
- Should not have more than 2.5cm back fat

Always look at the records, so that you get one with no genetic defects or diseases. Some have lameness or blind teats. Need to get one from a line which normally gives around 12 piglets.

A boar at 5 months old is ready for mating, but leave it till it is 8 months old, or 114kg weight before you make it serve.

Housing the boar – indoors or outdoors, depending on the environment. Use a separate shelter, or the same shelter as others, but separated off.

Feeding the boar – don't overfeed. Feed the correct amount, and the correct quality. If you overfeed it will get fat, if you underfeed it will lack energy, and then in both cases it will not serve.

Allow it to serve 8 times per week (twice a day). When it is 15 months old, allow it 3 times a day, or 12 times a week.

Mating systems

Hand mating – always take the sow to the boar, not the other way round. You have to make sure that the boar has done the work. Accurate breeding rate can be recorded so you know when the piglets will be delivered. Record the fertility of the sow. This way takes a lot of time.

Pen mating – always bring the new boar to the pen, with 12 sows in it. A boar can be taken out after 24 hours, and another brought in. Can ensure synchronisation of heat so all female pigs come on heat on the same day – you have to give a hormone injection which you can buy.

Culling

- When the boar has reduced libido
- When sick
- When there is weakness in the legs
- Reduction in size of testes due to age or exertion
- When penis is injured

Artificial insemination in pigs

Advantages

- Disease control can be achieved
- Economical
- Even when the boar is dead, semen can be collected and used, it can be stored for about 5 years
- Helps in maintenance of good genetic traits
- One ejaculation can be used to serve 15 sows
- Genetically high grade boars can be used to improve the herd

Disadvantages

- Have to have advanced know how in heat detection and insemination
- Faster semen processing may be a problem with certain firms

Sow

How to choose a sow (an unmated sow is called a gilt)

- In good health
- Strongly built to withstand the stress of mating
- Highly prolific (able to produce large litter)
- Good appetite and growth rate
- Good mothering ability
- Well developed teats (not blind or shrunk), and a good number (over 12)
- Good temperament

Flushing

This is the tender care given to young sows (gilts) to prepare them for mating, in the form of feeding concentrates etc, medical care. You have to ensure that they are favourable.

Signs of heat in pigs

- Becomes restless
- Vulva swells
- Frequently passes milk
- Stands still on being touched, knows is to be mounted

Sows are 8 months old when they are ready, but leave them till they are 10 months old so that they are developed enough.

Management of pregnant sow

- Good balanced diet should be provided. Should have carbohydrates, proteins, fats, vitamins, fibre
- Good management practice should be put in place at all times
- Water should always be available, clean and in a clean container
- Gestation period – 3 months, 3 weeks and 3 days (ie 115 days). You must keep accurate records so that you know when she is about to deliver
- During the last month, must get everything ready for the birth. Ensure very good hygiene. Provide extra nutrients in food. By so doing , you are catering for the piglets so that they will come out as vigorous as possible
- During the last week prior to delivery, reduce the amount of feed and increase the amount of water in order to avoid problems at farrowing, eg distortion, constipation, foetus becomes too big. Using concentrates can stimulate more drinking – you need them to drink a lot so that they will produce more milk. Nature makes them take in more water.

Preparation for farrowing

- Clean the premises where the farrowing will be
- Clean the feeders and waterers
- See to it that building structures are in good condition, because pigs can be aggressive during labour pains
- Deworm the sow 2 weeks prior to farrowing
- Wash pig, especially the teats so that no diseases are transmitted to the piglets
- Just before the 115 days, take the sow to the place where she will farrow so she gets used to it
- Continue observing signs – discharge from vulva, she will become restless
- As the piglets come out, remove them quickly and put them on a clean blanket or on dry grass to prevent the sow being aggressive and eating them. (If you have given her enough magnesium and calcium (from herbage) before the birth, she won't eat the young). Don't use fresh grass because it can harbour insects which can infect the umbilical cord and eyes etc.
- Wipe the mucus off with a clean cloth
- Put your mouth up to the mouth of those who aren't breathing, and blow to encourage them to breathe

Problems experienced at farrowing

Dystocia – difficulties at giving birth – may be due to

- Abnormal presentation (you can assist the delivery)
- Foetus is too big (surgery is the only way, or you must slaughter the pig)
- Death in utero (inject a hormone which will expel the dead foetuses
- Aggressive sows – can even trample on the piglets. (You have to ensure you choose a sow with a good temperament. Otherwise you can put a rope on it, and it will calm down enough to deliver).

Caring for the young

- Starts at farrowing time – you must assist at birth and be present throughout the farrowing
- Wipe mucus from piglets' bodies
- Help weak ones to breathe
- Clean the cords with salt solution

- Cut umbilical cords, if it bleeds tie them
- Assist the weak ones onto the teats as soon as delivery time is over
- Clip the needle teeth (or pull them out) so that they don't injure the mother's teats or attack other piglets Do it carefully so you don't make the gums bleed
- Identify the piglets, so you know which is which, so as they grow you can monitor them and tell which is doing well. You need to cull those which don't do well.
- Record birth weights, litter size, so that when they are weaned you can tell how many have survived and whether the mother has good mothering skills. Some sows sometimes have 12 piglets but only 1 or 2 grow to full adulthood – this is not a good mother.
- Record any problems identified in the litter, eg if she eats the piglets.

Orphaned piglets

These are piglets who

- Have lost their mother
- Have a mother which has no milk
- Have a mother with a larger litter than number of teats

You cannot leave them to die because they are your future herd.

Foster mothering

- Bottle feeding – using cow's milk and porridge. Has to be at body temperature, so cow must be nearby.
- Bucketing feeding – using cow's milk and porridge, or water from steaming vegetables
- Foster mothering by another sow which might have farrowed during the same period. Get some iodine, smear on the nostril of the sow, and on the nostrils of the piglets – she will then recognise them and will accept them as her own.

Disease control

- Practise hygiene and sanitation properly. This is a fundamental basis of disease control.
- Check the flock regularly for any sign of disease outbreak
- Check on the consistency of the droppings. If they are loose or too hard, the pigs are falling sick.
- Check for parasites – the ears and the whole body. Make friends with the animal. They also cough when they have worms.

Some common diseases

- African swine fever – comes on suddenly. Shivering, high temperature. No cure, it is fatal. Control – isolation of sick animals, limit visitors to your farm (they can bring the disease with them) and ensure clean source of food

- Parasites – worms, lice, mites. Can give tablets or injection. Ivermectin for lice, mites, worms. Can also use engine oil, but only externally.

- Pneumonia – sneezing, coughing, bad breathing. You must go and find medication.

- Hypoglycaemia – lacking glucose. This can give general malaise, loss of energy. You can add glucose to the feed or give a glucose injection

- Swine dysentery

Always keep records of any diseases, and any culling.

Marketing

- Factors to consider:
- Transport means – piglets are susceptible to rough handling
- Distance to travel – piglets cannot stand stress
- Time of day and weather conditions – if it is wet or too hot, this can cause stress

Causes of high mortality in piglets

- Poor selection of parents
- Poor management during pregnancy
- Problems at farrowing including hygiene and sanitation, over sized piglets, dystocia, aggressive sows
- Chilling and pneumonia
- Diseases like milk fever, mastitis leading to loss of milk
- Malnutrition
- Improper plucking out of milk teeth which can lead to anaemia
- Poisoning – through feed, malice by neighbours, chemicals used on farm

CATTLE MANAGEMENT

Why do we keep cattle in Uganda?

- To eat
- For income
- Prestige
- Cultural purposes
- Foreign exchange
- Climate very favourable for the enterprise
- Provision of other by-products (manure, urine, blood, bones, hides & skins etc)
- Labour (eg ploughing and transport)
- Some land is unsuitable for crop growing, so can be put to cattle rearing

Breeds of cattle

Local – indigenous breeds (Bos Indicus)

- Tolerant of pests and diseases
- Tolerant of harsh climate and grazing
- Hardy and easily managed
- Has a hump
- Reach maturity late
- Low production levels regarding milk and meat

Exotic (Bos Taurus)

- Bigger in size than locals (females are 500-1000kg, and live 5/6 years)
- Not pest and disease tolerant
- Faster growth rate (calf at birth is 35-40kg)
- Humpless, even the crosses

Examples of local breeds

- East African Zebu. Is brown/fawn, has high mortality rate
- Boran. Is white, doesn't have horns, good for meat production
- Nkendi. Excellent beef production, poor milkers. Some black, or red/fawn
- Karamojong. Long legs and horns. Dual purpose, milk & meat. Blood meal
- Ankole. Long horned. Not so long legs. Not such a prominent hump, and has less developed dew lap.
- Uganda. Cross between ankole/small EA zebu. Medium size, dual purpose.

Examples of exotic breeds

- Guernsey. Distinctive patch on forehead. Medium size, moderate milker
- Friesian. White switch on tail. Black/white or brown/white. Good milkers. Low fat content
- Jersey. Hardy, sustain rough grazing. Medium milker, medium beef. Good fat content
- Ayrshire. Brown/black, round face, protruding eyes. Dual purpose.
- Aberdeen Angus. Beef
- Simmental. Beef
- Red poll. Dual purpose

Local cattle management

- Tethering on ropes. This is no good for lots of animals. You can keep control over the animal, but is tiresome as you have to keep changing its position

- Communal grazing. Overgrazing causes soil erosion. It is difficult to control disease. Is hard for the farmer with small land
- Free range. This is nomad practice.
- Farms, ie fenced. Ensure the young graze first. Adults don't pass on diseases
- Ranches – large fenced areas
- Zero grazing. Can control disease, collect the urine & manure for compost, stay in harmony with the neighbours, keep feed to optimum levels. It is very labour intensive. It is not cost effective – you have to build structures. The cattle get bored easily and need constant attention. You must ensure there are no ticks, whereas when grazing the fields, they become immune. If you zero graze, you must spray twice a week to ensure they have no ticks – takes a lot of extra care

Calf rearing (local)

In natural rearing, many calves are denied milk so they are stunted. Farmers sell the milk instead, and only use calves to stimulate the milk. This is wrong – you should let the calf have the biggest share. Some farmers say that you should not let the calves drink too much because it causes a disease – but this disease is caused by a brown ear tick. At birth, calves weigh 10-20 kg. They must take in at least 1/10 of their body weight twice a day. Eg a 20kg calf must take in 2 litres of feed twice a day. You should leave a calf to suckle for about 2 months before you milk its mother.

With artificial feeding – introduce a bottle or a bucket, and it will soon learn. By about 3 months old, the calf will be able to eat herbage.

You must castrate bull calves so you can sell them as beef. Also you must dehorn them so that they don't damage the rest of the herd.

Operative techniques in calf rearing

- Castration, at 2-3 weeks old
- Dehorning, as soon as the horns start appearing
- Identification of calves, via ear tagging or ear notching
- Continue to keep good records
- Always be on the watch for any sign of disease

Artificial colostrum (for all species)

0.6 litres of whole milk
0.3 litres of water
1 whipped egg
½ tsp of castor oil, or vegetable oil

Mix all the ingredients together. This is the first feed for orphaned animals.

Foster mothering

Very similar to foster mothering in pigs. See page 42. Calves at birth should receive the maximum attention – they are your future herd.

After first week of life, give the calf water and some tender herbage so will get used to grass. The amount of water you give it will depend on its capacity. When they're born, calves have only one stomach, the other develops as they get older.

Caring for a bull
Similar to caring for a male pig – see page 39. Select bulls according to best quality, as with pigs. Shouldn't be too fat or too lean.

Caring for a dam (female cow in calf)
They require similar attention as pregnant pigs (see page 41) Feeding should be properly balanced. If you house them, ensure the diet is balanced – elephant grass mixed with legumes, or if you have money you can use concentrates. Water should always be available. If they are housed, ensure there is a mineral brick for the animal to get sufficient minerals.

Hay and silage
Hay = dry grass. Prepared from fresh grass during times of excess herbage, dried well and stored properly for times of feed scarcity or shortage

Silage = fresh grass prepared and kept fresh by certain processes to assist during period of scarcity of food.

Breeding
Heifers – DO NOT mate before they are 18 months old
Bulls – DO NOT mate before they are 15-20 months old
Gestation period = 9 months (275 (plus/minus 5 days)
Calving interval – 1 year (only one calf per year). Cow must be served 2-3 months after calving, hence the importance of farmers recognising the signs of heat
Life expectancy – 10-15 years

Care at calving and problems associated with calving
Same as for pigs (see page 41).

Housing
Calf pens
Corrals
Sheds
Milking parlours

Diseases, conditions and disorders
Please note, while the cow is being treated for any disease, you must never use any of the cow's milk.

- East Coast Fever – very many die from this. Caused by brown ear ticks which invade the lymph nodes. Best control is tick control.
- Anaplosmosis – this is also tick borne.
- Babesiosis – this is also tick borne. Makes the cow pass red urine
- Endo/ecto parasites. Worms, liver mites. Are tablets and injections
- Bloat – gas builds and pressurises the lungs and heart. Needs roughage. Give the animal legumes in a little amount. Herbage is the best roughage.
- Milk fever – this is due to poor milking conditions, or not being milked enough. You should inject calcium or antibiotics
- Mastitis – needs antibiotics, penicillin.
- Poisoning – caused by jealous neighbour, or from some herbage
- Trypanasomiasosis – caused by tsetse fly.

Record keeping
Same as for pigs and chickens – you must keep records on reproduction, finances and production

Culling
Any non-productive animal must be killed and replaced.

Marketing
As with pigs. (See page 43)

Clean milk production
The milker
- Must be in good health
- Must not have cough or fever
- Must be clean, as any slight smell (eg onions) goes into the milk
- Must have short fingernails, and must have hair covered
- Never wear perfumes, because the scent will be imparted to the milk. Milk is very ascorbic
- Female milkers should always wear trousers so that they can run quickly if the animal kicks

The animal
- Must also be free from any disease otherwise some of the disease will go into the milk
- Animal's udder must be thoroughly cleaned with warm water to avoid germs in both the animal and the milk
- Animals must be trained to keep calm while being milked – can play music, or have a colleague brush them with leaves, or talk to them. Once the animal has got used to one method, don't change it, or it won't give any milk
- Don't tie the animal
- Try as much as possible to milk the udder dry so as to guard against mastitis

The utensils
- Must be made of good quality materials, especially stainless steel. This does not rust, and is easy to clean. DO NOT use plastic
- Should be seamless and circular, for easy cleaning
- Should be portable and stored well. You can use ordinary soap to wash, as long as there is a stand to dry them on

Always sieve the milk before you take it to market. Hair from the animal etc may have dropped into milk as it is being milked.

ENERGY SAVING STOVE

Three wheelbarrows of sand, and three wheelbarrows of soil from a dead termite hill.

Mix the sand and soil together. Cover and leave for couple of days.


Take off leaves from potato vines and mash in water. Sieve the mixture of sand and soil. Mix this water into the soil/sand mixture – trample it in with your feet, so that it is all thoroughly mixed well together.




Cover well, and leave for 3 days.


Form into large balls.

Throw down onto floor over banana stem which forms what will be the hole into the stove, where you will put the sticks.


Shape into a stove, and form holes for pans.


Continue to form the stove, scooping out the mud from inside the stove,


Wrap some of the potato vines with the mixture to form the chimney. Shape as required.


Your new stove will be very much more efficient than a normal open fire because it will use far less fuel. If you look after it, it should last you about 10 years.

AGRO FORESTRY AND THE ENVIRONMENT

Banerya musa Kasoone. 0756 604929

Bakureka majja – an organisation working with Send a Cow to promote organic farming.

The environment's components are:

- Air
- Sun
- Water
- Man
- Animals
- Plants.

The environment is all to do with man's surroundings. Each component has its part to play in the environment and it all fits together. Man controls it to a certain extent.

Understanding the environment

Environment means
Man and his surroundings
Earth and its surroundings

Environmental degradation from:

- Deforestation
- Bush burning
- Wet land farming
- Brick making
- Polluted air from factories
- Unnecessary waste of polythene bags (bavera)
- Civil wars
- Digging minerals underground
- Road construction

Consequences of environmental degradation

- Reduced land productivity output
- Reduced trees and forests
- Deserts and changes in seasons
- Water table lower, hence wetland dries

Why do we need to care for our environment now more than before?

- From the time the earth was created, it has never been increased in size, and never will be.
- The population continues to increase and therefore the demand for resources grows. There is not enough land or water to go round.

We have to harness nature to put minerals back into soil.

Agro Forestry

Agro forestry is a system of growing trees on a farm in a way that benefits the crops and animals as well as protecting the soil.

Importance of agro forestry

- To control soil erosion
- Profitable utilisation of land

- Maintains soil structure
- Maintains soil fertility (continually, trees maintain the land even when you don't make compost)
- Improves transpiration in the atmosphere – air that plants put back into the atmosphere
- Maximise profits
- Acts as tourist attraction if your farm is good
- Attracts rainfall
- Acts as herbs and windbreakers
- Generates employment, particularly self employment
- Easy interdependence between crops and animals
- Provision of wood products and non-wood products
- Acts as habitats for living organisms
- Continuous existence of food chain

Benefits of agro forestry in integrated organic farming

- High income earner
- Food security
- Safe from chemicals
- Improvement and maintenance of soil fertility
- High yields
- Cheap, and easily managed
- Helps in mulching
- We get nitrogen
- Protects soil erosion

Types of trees in agro forestry

- Wood and non-wood trees, eg musizi (wood), fruit (non-wood)
- Fodder trees, eg calliandra
- Medicinal trees, eg moringa, neem
- Trees which add fertilisers to the soil (leguminous), eg tephrosia

Characteristics of agro forestry trees

- Multipurpose
- Fast growing
- Should be deep rooted so that crops can get nutrients
- Should regrow when they are cut
- Palatable
- Should allow air circulation easily
- Should not be competitive to plants, ie should not be greedy feeders
- Should be easy to manage

Management of agro forestry trees

- Pruning (from the branches and roots)
- Pollarding (interim cutting of trees at the level of 2-3 metres from the ground to stimulate new growth)
- Coppicing – cutting back of the tree 10-50cm from the ground to stimulate the production of new shoots. NB before coppicing, trees should be 3-4 metres high.

Agro forestry systems

Alley cropping. Trees are planted in rows and in between you grow crops. The system adds nutrients to the soil but the trees have to be pruned all the time – the cuttings will feed the animals or make compost

Boundary planting – trees are planted around land borders
Contour hedges – trees are planted on terrace lines
Live fence – planted close for paddock purposes on the farm
Home gardens – planted in gardens for shade or fruit
Crop combinations – crops like coffee, bananas, coconuts, vanilla are planted together but crop spacing is encouraged

THE SPIRITUAL APPLICATION OF ORGANIC FARMING

During our 2 weeks at Kasenge Riverford, we read our Bibles every evening, and learned many things from one another. Our teachers kept telling us how important it was to put what we were learning into practice on our farms, and we would not pass if we didn't, and we realised that the same emphasis should be put on putting what we read in the Bible into practice. It's not just head knowledge – in fact head knowledge is worse than useless.

Since returning from Uganda, I have compiled the notes below which I hope will prove useful.

Compost

The first thing we learned about was how to make compost. Compost is the basis of good organic farming, in fact the motto of Kasenge Riverford is "Feed the soil and it will feed you". It doesn't take too much stretching of a point to put that into a spiritual context and think that if we think of the soil as our spiritual lives in Jesus, if we feed our spiritual life, we will grow spiritually and produce fruit (fruit of the Spirit), but if we starve it, we will become dry and arid and not produce any fruit at all. And remember, we were told that an acre of land farmed organically will produce 3 times as much as an acre of land farmed non-organically. So if you try to think of that from a spiritual point of view - not only do we have to make sure that we feed ourselves, we have to make sure that we feed ourselves the correct things.

So, compost. Compost is made up of some pretty dirty stuff – dung, water, ash, top soil, worms, vegetable scrapings. All added in a particular order. Basically, it's anything that is/was living. But it matures down into food for the soil, and food for the plants that are grown in it. We learned all about the micro organisms and macro organisms that live in the soil, and how important it is that we don't kill them off. All these living organisms need to be fed so that they can do their work. Think of the spiritual lesson we can learn from this – if we do not feed our spiritual life, it will die. But if we feed our minds with the word of God, then it will do its work in our lives, and help to change the way we live our lives.

Compost too is free – it can be made with everything that a farmer will find on his land. And I am reminded of what Isaiah says in 55:1-2 "Come, all who are thirsty, come to the waters; and you who have no money, come, buy and eat. Come, buy wine and milk without money and without cost."

Remember the parable of the sower. Luke 8:4-15. You know the story very well. But the point is made that it is the soil which determines the fate of the seed. On the path there was no soil so the seed had no hope, on the rock the soil was very thin and there was no goodness to be had in the soil. Among the thorns there was too much competition for the seed to grow properly, and it was only in the "good soil" that it grew and yielded a superb crop. And we can see the parallels in our own lives all too easily. Maybe sometimes we do fall into the category of the path, but maybe more often we fall into the 2nd category where our soil is just too thin and there is no depth or goodness in it. Not only is there hardly any soil, but what there is has nothing in it. The 3rd category is one we all fall into, most of the time I'm sure. There is too much competition going on in our soil – there are too many things in our lives that crowd out the potential of the fruit. The soil may be good and have lots of depth to it, but if there are too many thorns crowding out the fruit, it will not be good.

Remember that we learned about correct spacing. Correct spacing not only helps the plants to grow because they have the space they need, it also helps to prevent the spread of pests – again another spiritual parallel? So we need to make sure that our soil is good, that it exists in the first place, that there is enough of it, and that we don't try to grow too many things in it which compete with each other for the nutrients in the soil.

So how do we feed our soil – how do we get to the state of having good, healthy nutritious soil? What is the spiritual parallel of the goodness found in compost, which if made properly, contains all the food that soil needs to provide all the nutrients the plants need?

Food for our compost

So, God has supplied our needs, but do we use the supply we have? The ingredients for the compost are there for the making, but it is up to us to actually use them and make something of them. The obvious food for our soil is the Bible – without constant reading and meditating on God's words to us in the Bible, our soil will gradually lose its quality and goodness. We will lose the nutrients and it will become thin. When soil is thin, it is more prone to be washed away by heavy rain and winds, and so becomes worse, and eventually nothing at all will grow in it.

Prayer too is a necessary food for our soil – talking to and listening to God as he talks back to us. The fellowship of our brothers and sisters can also be of immense help to us – the friendship and support that they offer as well as the spiritual guidance they might give. And of course the Breaking of Bread which is also food for our soil. Remember that compost is made up of living things, not dead things – and the Bible, prayer, fellowship and the Breaking of Bread are all real, living things. Jesus himself tells us he is the Bread of life – John 6:35. "I am the bread of life. He who comes to me will never go hungry and he who believes in me will never be thirsty". And we can probably think of more things which can feed our soil.

Water harvesting

Obviously in a warm climate like Uganda's water is essential – we were told that we have to water compost daily for a start, as well as the plants! And we must always water in the evening and in the morning, never in the heat of the day. Maybe that's a clue to when is best for us to have our quiet times meditating with God.

We know that Jesus is the water of life, and we can think of all the verses that talk of this. For example, John 4:13-14. John 7:37. The idea of harvesting water is obviously to collect it, for example by means of guttering, and store it for use when there is shortage of water or even drought. Another means of harvesting water was by means of contours. We learned how to make contours on the land, and build up the land so that the water didn't just run off down the hill, but was kept on the land to drain in and water the plants that were there because the water wouldn't just run off the land and be wasted, it would always take the top soil with it. And obviously, the next time it rained, yet more top soil would be washed away, and eventually the plants would be sitting in very shallow soil, as we saw before.

Thinking about this, and trying to draw a spiritual parallel. We can go to things like Youth Camp, Sisters' camp, and Sunday meetings when we are with our brothers and sisters, and definitely feel that we are drinking the water of life from Jesus. But it drains into our souls, as it were, and is gone. But I think we should be trying to keep the water we pick up at these times to use when our spiritual lives become dry and parched. An oasis in the desert is there all the time for thirsty travellers to drink from,

and maybe we can try to do the same in our lives with the water of life that we take into ourselves. I think the way to do this is to feed the soil of our lives properly, and make sure it is good soil. Remember how we were taught that the better the soil on our farms is, the more able the water is to drain into it. Just think how water runs straight off hard sun-baked soil. It is the same with us - if our minds are more attuned to the things of Jesus and God, we are more likely to retain and remember what we hear and read at meetings. If we are reading our Bibles regularly, things fall into place more easily, and when we hear things at the meeting, sometimes it can have immediate relevance to something we have just read or pondered or meditated about, and can therefore have more significance for us than was perhaps intended by the speaker. Or if we are praying about something specific, something said or sung at a meeting can have a direct influence on us. So I think that the more we feed the soil of our lives, the more we will retain the water that falls on it, and so therefore the better the soil will be anyway.

Growing vegetables and cereals

We also learned the principles of growing vegetables, and cereals. Preparation of the plot of land is vital, and so is the composting and mulching of the soil. Seeds must be chosen with care, always choosing the best ones, and must be planted only when the compost has had time to mix with the soil. Plants must be spaced correctly, and pruning as necessary has to take place, for the good of the plant. Constant watering is vital, and good field hygiene is important to withstand the onslaught of pests. Often the farmer can fight against pests simply by providing good nutrients to his plant – the plant will be strong enough to withstand the attack. It was also pointed out to us that one pest is man – often jealous neighbours can steal another's crops if they're better than their own. The antidote to this was to go and teach the neighbours and work together with them.

But there are all sorts of pests, appropriate to the different sorts of plants. And we were encouraged to practise intercropping – the mixing of plants so that one protected the other. Planting onions amongst the cabbages confuses the grasshoppers which eat the cabbages, and planting garlic amongst other crops chases away monkeys!

And spiritually speaking, we are all growing fruit, of one sort or another. We all have different pests which would try to destroy our fruit – but our temptations may be different from those of our brothers and sisters, and we can easily see the spiritual parallel of intercropping – fellowshipping with our brothers and sisters so that they can help us ward off our own particular temptations. One pest of course can sometimes be man himself, and we have to be careful that we don't put temptation in someone else's way by our own thoughtless actions or words. And as we were encouraged to teach our neighbours and work together with them, so we have to work together with our bros/sis, and help and teach each other.

Producing fruit

And so, with the right food, the right water and the correct methods of growth, eventually, a high yield can be obtained! And that's what we are aiming for. The fruit we should be producing is clearly set out for us in Gal 5:22-23. But each of us produces different amounts of fruit – remember the parable of the sower where some produced 30 fold, some 60 fold and some 100 fold.

In John 15:1-8 & v16. Jesus tells us we are the branches attached to his vine, he tells us that as long we remain in the vine, we <u>will</u> produce fruit. There we are also told that God is the gardener, so it is he who is judging the quality and the quantity of the

fruit on each of the branches – it is not for us to do that. God cuts us off if we don't bear fruit at all (it's a waste of time having dead branches on a tree because they take the nutrients out of the soil), and he prunes if we do bear fruit so that we will be even more fruitful. And we can't bear fruit on our own – the only way to do it is to remain in Jesus – and if we do that, we will automatically produce fruit. "If a man remains in me and I in him, he will bear much fruit", not maybe, will.

Remember that we were told that the best fertiliser on a Uganda farm is "your feet"! Some farms in Uganda are run by large companies, and the managers just ring up in the morning to check everything is ok. What do they know? They can't see what is happening on the ground! The farmer who achieves the most is the farmer who is constantly walking round his farm to check that everything is ok, and to put right anything he sees that isn't. He goes round his farm at least once a day to check and see what's what. And that's like us too – we have to do spiritual check ups on ourselves to see where perhaps the soil is a bit thin, where things need spacing out a bit, where more water is needed. We are told to examine ourselves each time we partake of the Breaking of Bread service, but it will do us no harm to do this exercise far more frequently. Remember – the best fertiliser is your spiritual feet.

"But blessed is the man who trust in the LORD, whose confidence is in him. He will be like a tree planted by the water that sends out its roots by the stream. It does not fear when heat comes; its leaves are always green. It has no worries in a year of drought and never fails to bear fruit." (Jeremiah 17:7,8)

PRACTICAL EXPERIENCE IN

ORGANIC FARMING

A

PRESENTATION

BY

TIMOTHY NJAKASI

TO

Farmers from Mayuge, Iganga, Palisa and Jinja

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INTRODUCION:

What is Organic farming?
Is a system of farming which is environmentally friendly, Economically viable and Socially justice OR Organic farming is the system of farming which uses natural methods to keep soil fertile and livestock healthy.

Why Organic farming?

Soil has been intensively used to produce food which has resulted in the reduction of organic matter levels and this has been accompanied by the deterioration in soil structure leaving the soil more prone to compaction and erosion. As of now some soils are suffering dangerously low organic matter levels and can't be expected to sustain the farming systems which have been imposed on them. This is a serious problem the world is facing which need to be addressed. Other global food issues include :
GENETICALLY MODIFIED CROPS,ENDLESS WARS, FOOD SECURITY and TRANSRPORT.

The main criticisms of current agricultural practices include;

- It damages soil structures
- It damages the environment
- It creates potential health hazards in food
- It has brought about a reduction in food quality
- It is economically costly to society and increasingly to a farmer

So the preservation of soil structure, earth worms, micro-organisms and large insects is essential to the working of an organic system. Therefore the protection of soil and the environment is a fundamental **'MUST'** for the organic farmer. The potential health hazards of pesticide residues and nitrates resulting from conventional agriculture are now receiving some attention. However there is growing scientific evidence about the positive quality aspects of organically produced food. For example higher dry matter and vitamin content and improved storage as a part of food security

THERE ARE THREE STEPS IN ORGANIC FARMING

1. **Stop depending on chemicals**
   Forget the idea that chemicals are essential. Natural fertilizers have a more lasting though less dramatic effect. Chemical fertilizer certainly give a rapid increase in yields in a short time but the effect is not sustainable.

2. **Look at the soil**

   Feed the soil, that is give the soil a good supply of organic material and good soil structure will gradually develop

3. **Encourage nature**

   An organic farm should encourage as wide as range appropriate natural life as possible from the obvious favorite such as birds, butterflies to the million of insects and other tiny creatures.

Components of organic farming:

- Animals
- Crops
- Land
- Man

PRACTICES OF ORGANIC FARMING

Soil care

The aim of taking care of the soil is to achieve good soil structure, which means the proper balance between mineral, organic material and pore air when there is good soil structure the soil will be fertile too.

Weed management

Weeds are part of a good mixed environment and the aim of weed management should be to keep weeds under control rather than to eliminate them completely. Weeding immediately before planting is a useful techinics.

Animal manure application

- Improves soil structure and fertility
- Best composted before use, adding bulky materials such as straw if not already present
- Fresh manure should not be used directly on the soil as the free nitrogen it contain can be as harmful as artificial fertilizer, un-decomposed, fresh manure is bound to attract pests.
- Avoid manure from town sewage.

Other practices include:

-Vegetation mulch

-Green manure

-soil cultivation practices

-compost making
-contour cultivation
-crop rotation
-Agro forest

MY PERSONAL VIEW ON ORGANIC FARMING

Man , farming and the environment are regarded as one and in a few communities globally, this is still the situation . an example are the Karamajongo in Uganda who are still living in the natural environment which has not been disturbed by man. In such communities there is a delicate balance between what man needs and what the environment can give. The soils are still fertile which can sustain farming activities. In other communities this has changed due to increasing population, leading to more cash demand there fore people must market crops to get money for school fees and to get modern techniques enabling large methods of farming and artificial water supply. In several areas globally, the balance of nature has been lost to over grazing in cattle areas which leads to general soil erosion and loss of fertility.

Another issue is that of severe climate condition. For example the different circumstances of tropical developing countries and temperate developed countries whereby in the former the drought and heavy rainfall cause damage to the environment. Which leads to soil erosion which is the main problem faced by the farmers in those areas. However in some parts , crops can be grown throughout the year. The increasing population has resulted in encroaching on the natural forests and marshland for food production in return this affects the environment.

In conclusion, there is nothing in the whole of nature which is more important or deserves more attention as the soil. Soil makes the world a friendly environment for the man kind. It is the soil which nourishes and provides for the whole nature, the whole creation depends on soil, so the fertility of the soil is crucial to the long term sustainability of life on this planet or the soil has been generous to us.

Thank you very much.

Timothy Njakasi

Tel; 075648493

Box, 68 mukono

Email: kasengeriv@utlonline.co.ug

Pest and disease management

- It is important to apply the integrated pest management (IPM) approach.
- This include ;
  - Proper seed selection
  - Proper land preparation
  - Timely planting
  - Best plant population

Pest and disease management

- Timely weeding, don't allow the weeds to flower
- Timely harvesting, to avoid waste
- Proper storage (during and after transportation)
- Intercropping
- Use of predators

DEVELOPMENT STAGES OF ORGANIC FARMING

- O stage:
- Here a farmer has animals , grow crops but he/she doesn't have knowledge on farming business.

DEVELOPMENT STAGES OF ORGANIC FARMING

- 1st stage:
- Here a farmer gets specialized knowledge in all farming activities by;
  - doing something continuously
  - exposure visits
  - attend seminars and workshops

DEVELOPMENT STAGES OF ORGANIC FARMING

- 2nd stage:
- Here a farmer takes action by deciding on what to do by;
  - working on fertile soils
  - keep pure breeds of animals
  - use improved seeds

DEVELOPMENT STAGES OF ORGANIC FARMING

- 3rd stage:
- This is the diversification stage- increase family income
- Here you start with what you have at hand by improving on the existing projects and later expand with new projects

DEVELOPMENT STAGES OF ORGANIC FARMING

4th stage:

- Farm integration

DEVELOPMENT STAGES OF ORGANIC FARMING

ANIMALS	CROPS
pigs	banana
Poultry	beans
Goats	vegetables

COMPOSTING

CONTACT ADRESS

- THANK YOU VERY MUCH

- TMOTHY NJAKASI
- BOX 68 MUKONO
- EMAIl: kasengeriv@utlonline.co.ug

Dorothy - Nakalambe.

PLANTING CHARTS FOR VEGETABLES

Group	Crop	Between lines	Between plants	Time to germinate	Ready for use after germination
Solanaceae	Tomato				
	(Staked)	90cm	45cm	1 week	3.5 - 4 months
	(un staked)	60cm	60 cm	1 week	3.5 - 4 months
	Sweet pepper	90 cm	30cm	2 - 3 weeks	3.5 - 4.5 months
	Hot pepper	90cm	45cm	2 - 3 weeks	3.5 - 4.5 months
	Egg plant	90 cm	60 cm	10 - 14 days	4 - 4.5 months
	Nakatti	30 - 45cm	5 - 15cm after thining	5 - 7 days	1 - 2 months
	Entula	90cm	90cm	10 days	4 months
Leguminoceae	French beans	60cm	15cm	5 - 7 days	2 months
	Mange tout Peas	45cm	10cm	7 - 10 days	2.5 - 3 months
	Sweet peas	45cm	10cm	7 - 10 days	2.5 - 3 months
Root Group	Onions	20cm	10cm	10 - 14 days	4.5 - 5.5 months
	Leeks	20 cm	20 cm	1 - 2 weeks	4 - 6 months
	Garlic	30 cm	15cm	1 - 2 weeks	6 - 8 months
	Carrot	40cm	5cm after thinning	1 - 2 weeks	2.5 - 3 months
Brassicas	Cabbage	90cm	60cm	10 days	3 - 5 months
	Broccoli	60cm	30cm	1 week	3 - 3.5 months
	Cauliflower	75cm	60cm	1 week	3 - 4 months
	Kabe	60cm	45cm	1 week	2.5 - 3 months
Leafy Crops	Spinach	30 cm	10 cm	1 - 2 weeks	1.5 - months
	Lettuce	30 cm	30 cm	3 - 4 days	2 - 3 months
	Swiss chard	60 cm	30 cm	1 - 2 weeks	3 - 25 days
	Amaranthus	30 cm	Thinning	1 week	30 - 45 days
	Bugga, Jobyo)				
Cucurbits	Sweet melon	180 cm	90 cm	5 - 7 days	3 - 3.5 months
	Watermelon	180 cm	120 cm	5 7 days	3 - 3.5 months
	Squash	90 cm	75 cm		
	Cucumber	90 cm	45 cm	5 - 7 days	2 - 2.5 months
	Pumpkin	180 cm	180 cm	5 -7 days	3.5 - 4.5 months
	Turia (Ridge Gourd)	90 cm	45 cm	5 - 7 days	1.5 - 2 months
	Karela (Bitter gourd)	90 cm	30 cm	5 - 7 days	55 - 60 days

APPENDIX 3

BANANA PRODUCTION IN UGANDA

Bananas rank as the highest among the important food crops in Uganda.

Annual production is estimated at 8.45M tons and this accounts for 15 % of the total of total world banana out put.

In Uganda, over 7 million people, including 65% of the urban population depend on bananas as their staple food.

Its estimated that 75% of the farmers in Uganda grow bananas on 1.3M hectares.

Importance of Bananas

- Locally, it's a staple food crop to many people in Uganda
- Its an income earner to the farmer, and its currently being exported, mainly to the niche' markets in Europe and Asia.
- It provides a soil cover and hence reduces the rate of soil erosion on steep slopes.
- It's a principle source of mulching materials and this helps to improve water infiltration into the soil.
- Banana peelings and pseudo-stems are used as feeds for livestock
- Can also be used as dessert.

Problems Associated with bananas

- The fruit once harvested, its highly perishable
- If you compare the weight of the peelings and the stalk, they are almost equal to what the consumer is actually going to eat.
- Its seeds have got a very short viability. So in most cases its not easy to improve like most of the crops known.
- ~~Its also facing competitions from other highly valued crops known.~~
- Its also facing competition from other highly valued crops on addition to the current escalating pests and disease like the banana bacteria wilt.
- It cannot withstand very long dry spells

Plant Characteristics

- The plant produces pathenocapically.
- The true stem is always under ground (Corm)
- The pseudostem elongates and its made up of leaf sheaths.
- ~~At maturity, the true stem elongates.~~
- ~~At maturity the~~ true stem elongates to bear the fruit.
- The seeds have a very short viability and its always propagated ~~negatively~~. vegetatively.

Ecological Requirements

Bananas can grow in many types of soil and climate. However, for the best result, the following are required.

Rainfall
They require a lot of water, so they thrive better in areas which receive a lot of rainfall, between, 1500mm-2500mm per year, and with preferably short dry intervals.

The rainfall must be well distributed.

Temperature
Optimal mean monthly temperature of 27%. The lowest mean annual temperature for growth is 12^0C and temperature beyond 37^OC can cause leaf scorching.

Soil
Bananas require a deep, well drained loam soil with a high humus content.

A PH range of 5.6 – 7.5 is optimum. They require considerable amounts of nitrogen and potassium so as to maintain high yields.

Uses/Types of bananas
(i) Cooking type e.g mainly named according to location e.g Mpologoma, Nakabululu, Muvubo, Nakitembe,Nfuuka etc.
(ii) The beer type e.g Kayinja, Kisubi, Mbidde etc.
(iii) Roasting type e.g Gonja
(iv) Desert type e.g Bogoya, Sukari –Ndiizi FHIA 17, etc.....

Recent Introductions Include
FHIA 01, FHIA 03, FHIA 17, PHIA 23, FHIA 25 and KM5
Some of these can be used either for cooking, beer, roasting or dessert, but their taste, softness and juice sugar content may not equate to the local varieties, but in some cases may be comparable.

THE FOLLOWING STEPS ARE TAKEN IN THE PRODUCTION OF BANANA AND ITS PROPER MANAGEMENT ON AN ORGANIC FARM.

Site selection:
Banana require plenty of moisture and fertility , so the site should have the following characteristics
- Fertile soils with plenty of organic matter
- Gently sloping and well drained land
- Free from pests and diseases of banana
- Easily accessible
- Preferably when the site has not had bananas for the last 3-5 years.
- If possible, the PH range of 5.6 –7.5 is optimum

Land preparation is done in four major steps as follows:-

- Land should be cleared by slashing and removing all big obstacles
- Primary ploughing is done using primary tillage implements

The importance of primary tillage is to

- Loosen the soil for proper aeration, water infiltration and root penetration
- Check weed growth and burry trash in the soil so as to improve organic matter content.
- Also to destroy the pest and disease cycles.

Secondary
~~Secondly~~ ploughing should then be done after 3 weeks. Its anticipated that by that time the buried trash would have properly decomposed.

-It will mix properly the decomposed trash with soil

- It will further make the soil fine for proper root penetration and water infiltration
- It will also destroy or enable the removal of dangerous weeds like couch grass

At this stage, you construct the soil and water conservation measures

You can use the A- frame, which helps to establish the contour lines
The top most contour line should be dug, creating a trench while putting the dug soil at the lower side of the trench. Then the subsequences trenches are dug while putting the soil at the upper sides of the trenches.

Plot marking and holes digging is the next step.

The spacing may be 10ft x 10ft .But at times, the spacing may be slightly changed depending on the land scape (if the plot is very steep), fertility status (if the soil is less fertile), and the farming system.

Dig the holes, which should be either 2ft x 2ft or 3ft x 2ft. As you dig, the top soil should be on the upper side of the hole and the sub-soil put on the lower side of the hole.This should be done atleast 2 months before planting. You can add compost manure, one month before planting or at planting time.

This is followed by selection of the planting materials.

Its recommended that you select your sucker with the following characteristics:

- Free from pest and diseases, and from a healthy stool.
- Early maturing
- High yielding
- Tolerant to drought, pests and disease attack.

The planting materials may either be:

- Sword suckers (30-100 cm high with narrow sword like leaves)
- Maiden suckers (About 2m high and not yet flowered) or its corm.
- Bull head (corm from a plant which has been harvested) with or without a sword suckers.
- Bull head sections (corm pieces with a bud, eye)
- Some people use tissues culture plantlets.

The split corm technique for producing banana planting materials

Every bud of a banana corm can develop into a full plant. Therefore, many planting materials of selected plantains can be produced by cutting small pieces of the corm, following the procedure below:

- Select the best variety of bananas.
- Choose corm that are free of pests and diseases.
- Using a clear sharp knife, cut the corm into 3-10 small pieces, each with one eye or bud, let the wounds dry thoroughly (curing) in a shady place for one or more days.
- During curing , they can be covered with neem leaves.
- Plant the pieces of corm in a clean nursery, enriched with compost.
- cover the pieces with mulch, (preferably dry neem leaves) to keep the soil moist.
- Water them twice a day, and after root development, reduce the watering rate.
- After 2-3 months, when each corm has developed into a small plantlet, you can transplant them to the main field.

For an organic farm, sword suckers and maiden suckers are the most recommended ones.

The next important step is sucker preparation.

The sucker which is selected should be uprooted using a very sharp shovel or hoe to reduce damage to the mother plant

If it's a maiden sucker, cut it back just below the crown or cut it at about 15 cm above the corm (pseudo-stem joint) so as to reduce bulk.

Mounds
1.2m x 1.2m cassava
Sizeable 4-5 vines/mound

The sword suckers should not be cut back. To avoid taking weevils and nematodes to the new field, remove all the roots and peel off the outer layer of the corm and old leaf sheaths.

Try to remove all tunnels formed by weevil larvae and the reddish-brown or black tissue due to nematodes, if the tunnels go deeper, then such a sucker is discarded.

The suckers should be cleaned from where it has been obtained.

The pared suckers can be dipped in hot water of approximately 52°c -55°c for 20 minutes.

For better germination, its advisable to plant the treated suckers within one week after uprooting.

If there is need to store them temporarily, they should be kept in a shade and away from an established plantation.

Planting

Should be done at the beginning of main rains because they need atleast 4-6 months of growth without water stress.

The sucker is placed in the hole and its corm covered first with top soil mixed with compost manure . If the land is sloping steeply, the sucker should be oriented that the ratoon emerges against the slope. This will delay development of a high mat.

You can plant a cover crop like beans or ground nuts to ~~smother~~ smoother weed growth, add more nitrogen and control soil erosion.

After the removal of the cover crop, weeds may be controlled by mulching. The dry mulches are laid across the slope and atleast 1.7 ft or 50cm from the stool.

The few weeds that may establish can be removed by hand pulling or using a small hoe.

Other practices can then be carried out as need arises and these include:

- **Prunning**: which is the removal of the broken and serious diseased leaves.
- **Desuckering**: Removal of excess suckers, leaving atleast 2-3 suckers of varrying stages.
- **Detrashing**: is the removal of dried banana leaves and fibres to expose the pseudostem as its important also in photosynthesis.
- Removal of the male inflorescence: which should be removed when the banana fingers begin turning upwards, atleast 1 month after flowering.
- **Staking** : Can also be done as need arises, depending on the weight of the bunch and strength of the pseudostem.

Fertility ~~managing~~ management can be done by an annual application of compost manure, atleast 1 tin per year or depending on crop requirements and soil fertility status. You can also use a living mulch or plant tea.

Pests and disease control measures should be employed

Banana weevils and parasitic nematodes are the most destructive pests of bananas in Uganda, on additional to birds, monkeys and careless people

Banana weevils and nematodes can be controlled by good sanitation, using a clean planting material and trapping them. You also split the pseudostem and use of tolerant varieties

At planting time the suckers can be kept in water for a night after paring them. You can use concoctions ash, urine , hot pepper tephrozia and soapy water .

You also plant marigold around the stool or use lemon grass as mulch.

Most of the diseases are controlled by field sanitation like regular pruning, cleaning planting material and use of tolerant varieties.

For dangerous diseases like banana bacterial wilt and banana streak virus disease you control by early removal of the male inflorescence, destroy affected stools and practice quarantine measures.

Harvesting is between 3-4 months after flowering depending on variety.

Facilitated by

Perez Kawumi
Tel. 0772- 625465
E-mail : p_kawumi@yahoo.com

KASENGERI VVERFORD ORGANIC CENTER

PLANT TEA

This is one of the ways a farmer can fertilise the soil by using liquid manures.
We get plants I different types of leaves, grouped according to the nutrients found in them and are decomposed within seven days

Types of leaves:
These are grouped in 3 categories A,B,C

Group A
We get leaves from leguminous trees and crops eg. Beans, G.nuts, lablab, mucuna, calliandra, sesbania, griricidia, luceana, desmodium, (green and silver leaves), jack bean, stylo etc

Group B
Hairy leaves ie. Russian comfrey, tithonia etc

Group C
Soft bodied leaves eg black jack, amaranths, sweet potato leaves etc.

PROCEDURE
Chop them into smaller pieces 1-2 inches ,
- get a container e.g a Jeri can,
- then fill it ¾ of chopped leaves
- fill it with water ,
- add a handful of wood ash,
- cover the container to avoid loss of nitrogen.
- Put the container under a shed or tree,
- after 3 days stir, and within 7 days plant tea will be ready and you sieve.

APPLICATION
1:2 ratio of plant tea to water apply on amaranths,
1:1 ratio on heavy feeders eg, lettuce, cabbage, maize, banana, spinach, pawpaw etc.

Application is the root zone at least three consecutive days. On root crops you apply only once in their lifetime.
Apply when plants are almost flowering, or when you see the yellow colour on the leaves, and mulch after pouring plant tea on the root to prevent loss of nitrogen.

END

MANURE TEA

This is a fertilizer made through fermentation animal wastes for a period of 21 days eg. Cows, goats, poultry manures.
You can make this fertilizer in any container provided you follow the following steps:

- in 200 litres drum of water use 30kgs of animal waste
- in 20 litres Jeri can use 33kgs of animal waste - poultry droppings has a lot of nitrogen and potassium.

INGRIDIENTS- poultry droppings

- put 30kgs or 3kgs in a porous bag ie a maize sack
- place a stone on the top of the manure and tie the sack tightly (the purpose of the stone is to enable the sack to sink when placed into water.
- Get a reasonable stick and put it across the container, and tie the sack on the stick.

- fill the container with water and cover it properly to reduce the smell and the flies.
- Keep shaking the sack after every two days
- After 21 days the manure will be ready and most of all the nutrients by the then will have reached into water and the final result is a strong liquid called liquid manure or manure tea.

MIXING RATIO

- 1:4 (one part of manure into 4 parts of water

APPLICATION

- On leafy crops apply weekly ie amaranths and other soft vegetables
- On fruit crops apply once every two weeks ie egg plant tomatoes etc
- On root crops only one application during their growing season.
- The manure lasts for only two weeks
    - Manure tea has sufficient amount of nitrogen, phosphorus, zinc and potassium
    - Vegetables grown using manure tea are rarely deficient in all nutrients .

Therefore, manure tea is the best simplest and cheapest fertilizer available
NB. Manure tea only adds nutrients to the soil, but doesn't improve soil frtility as compost does.