

References

- Vegetable growing Norwegian 4H manual
- Establishing a 11 SQ. meter family size survival garden. Dave Goolsby
- Field Guide Bruce L.Parker, N.S. Talekar, and Margareth Skinne
- Vegetable Production Manual Asian Vegetable Dev. Centre, Taiwa

About this manual.

This manual has been made by Weston Sianchongwe & Håkon Spigseth. Many of the chapters have been borrowed from the Norwegian 4H manual “vegetable growing in Gambia”.

Weston Sianchongwe did the main work of re-writing the manual into an “*organic vegetable growing*” manual - concept, fitting for Zambian climatic conditions.

Ken Nshindano from Livingstone. drew the drawings on front page, as well as those of the compost heap and irrigation systems and pests.

Organic vegetable growing is a very challenging issue; you need to be a good farmer to succeed in Organic Vegetable Growing, as you need good knowledge about the soil and biological diversity, so that you can play on the team of nature.

This manual is the fourth edition, it has improved a bit from the first “trial” edition. It will still, however, be worked upon to make it even better. We therefore welcome any suggestions for improvements.

Please bring advice and suggestions forward to Håkon Spigseth at Response Network ,

The manuals can be sourced at no cost from Response Network office on Nkumbi Road, Plot 936, near the ZAWA offices and the Railway museum. Tel (260) 213 32 04 91, Fax: (260) 213 32 36 34, E-mail: mail@responsenetwork.org or fravor@responsenetwork.org

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Community Self –Help Series no. 6

ORGANIC VEGETABLE GROWING



Resources Manual

Shortened quote from The Universal Declaration of Human Right:

Everyone has the right to a standard of living adequate for the health and well being of himself and his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability widowhood, old age or lack of livelihood in circumstances beyond his control. (25.1)

By
Weston Sianchongwe & Håkon Spigseth

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CONTENTS:

Chapter		Page
1	VEGETABLE GROWING	2
2	BUDGETNG	5
3	DIFFERENT TYPES OF VEGETABLES & HOW TO GROW THEM Beans P.8, Okra .9, Bitter Tomato P.10, tomato P.12, Eggplant P.13, Pepper P.13 Cabbages, P.14 Onions P.15, carrots P.16, Lettuce P.17,	8
4	HOW PLANTS GROW Ecology & Rainfall P19, Temperature & light P20	19
5	THE SOIL Composition P.21 ,Nutrients P.22, Plant & vegetable propagation P.23, Preparation of a bed P.24, How to make Compost & Manure P.24, Compost Making P.25, Methods of Heap Construction , Manures, green manure & Compost P.26, Fertilizers & Manure tea P.27,	20
6	CROP ROTATION MONOCROPPING & INTERCROPPING	28 29
7	CONSTRUCTION OF A NURSERY BED	30
8	WORK THROUGH THE GROWING SEASON Planting & sowing, Thinning & staking , Plant protection watering P.32, Table for the season P.33.	31
9	PESTS & DISEASES	34
10	WATER RESOURCES & IRRIGATION SYSTEMS Tables of Irrigation Systems P.38-40, How to fit a drip Irrigation System P.41, Shadoof Irrigation System P.42, Treadle/chova pump P.43, Notes P.44	37
	References	46
	About this Manual	47

The “Community Self Help Education series” published by Response Network have available 16 self help education manuals for use by Church & community leaders

- 1.“Let’s start our own Community School”.
- 2.“Let’s start our own community sports club”.
- 3.“Let’s start our own Community Literacy class”.
- 4.“Let’s start our own Community Skills Training”.
- 5.“Let’s start our own women’s group”
- 6.“Organic Vegetable Growing.”
- 7.“Let’s start our own HIV/AIDS Support Group.”
- 8.“Lets start our own community health and nutrition club.”
- 9.“Let’s start our own know your rights club.”
- 10.“Let’s start our own community Alcohol awareness and support group”
- 11.‘Let’s start our own community Mental Health support Group”
- 12 ‘Let’s start our own community participation (governance) club.”
- 13 ‘All included’ Let’s start our own community support group for special needs children.”
14. Let’s start our own Community Women’s Rights Club – Stop the Violence.”
- 15.“From team to Inclusive Sports Club.”
- 16.‘The Gender Equality in Governance Club.”

The manuals supplement each other so you will benefit from combining the resources from two or more manuals to increase the quality of your education project. For instance literacy Skills and skills training are like brother & sister because skills training make literacy lessons more meaningful & relevant to the adult learner.

Acknowledgements

Without the consistent encouragement & financial assistance for the printing costs from Norwegian Church Aid, this resource manual as well as the other fifteen manuals would not have been written & printed. I However any inaccuracies are entirely my own responsibility.

You are free to make copies and share the information with everybody that needs to know more about education resources.

However we appreciate that you tell where you found the information.

Ref: manualadvent

[illegible]

Why should we grow vegetables?

Vegetables add a lot of minerals and vitamins to the diet. People need vitamins for good health. If you eat a lot of vegetables, you supply your body with vitamins and mineral salts. If you want your body to be in good health, you must eat vegetables.

The Zambian Climate, with its wet and dry seasons, is suitable for vegetable growing. Vegetables do well in Zambia and you can have a lot of vitamins and mineral salts supply into your body at almost all the time. As the vegetable season is in the dry season, there is little or no competition with the field crops. Most Zambian soils are suitable for vegetable crops production.

Vegetable crops require much more skillful management than field crops. It is essential to know the crop and its requirements, weed control, insect and disease control, suitable varieties, planting details like spacing and planting depths, how much manures you may need to apply, irrigation requirements, harvesting methods storage requirements, and marketing aspects. You should know that successful vegetable production during the dry season relies on water supply and mulching.

Where you find difficulties, please contact your nearest Agriculture extension work; camp officer, any officer at Department of field services, mount makulu Research station, Mazabuka Research station.

You can also contact the authors of this manual Response Network at Plot 215, Limulunga Road, Livingstone.

Other expenses in the field who would be glad to give advice is:
MR. Clous Muiller or Mr. Fial Muhali,
Twin Fountain,
Box 272,
Kalomo.

ORGANIC VEGETABLE GROWING

What is organic vegetable growing? And what is the purpose of organic farming?

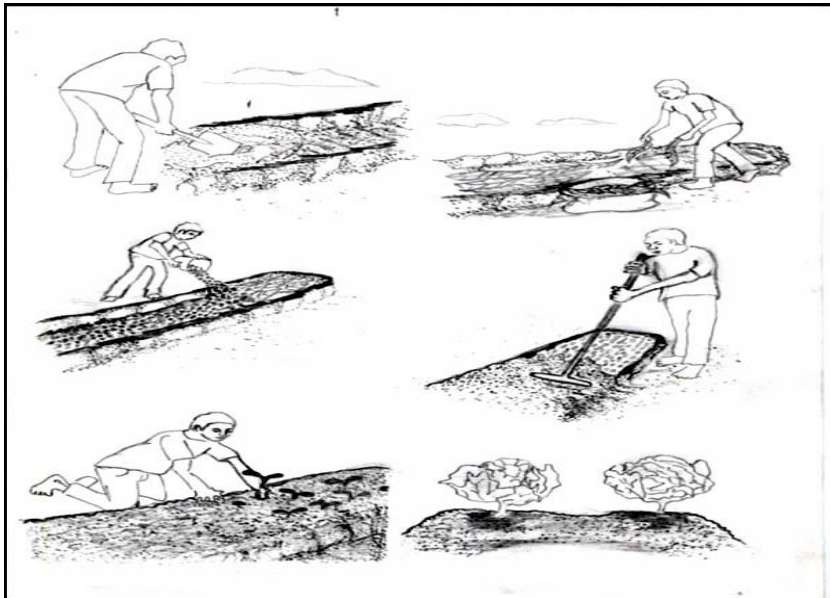
It is producing food which we are sure are free from traces of pesticides. It also enables us to grow food without the use of expensive fertilizer and pesticides. An organic vegetable grower knows how to keep to soil very nutritious, in order to get good harvests without the use of artificial fertilizer.

2

Treadle or Chova Pump

Since the price of fuel has become so high that most Zambian farmers fell to make their crops reach maturity stage, there is need people to look for and use irrigation equipment that can operate without the use of Diesel or petrol. What pump shall we use without the trouble of where to get money for the purchases of fuel? It is the mighty treadle pump.

The treadle pump uses one person who chova or cycle the pump. It requires some pipes as well. The treadle pumps are now available in some shops at a reasonable price of around K500, 000.00. The treadle pump can water about 2 Lima per day without any extra cost.



WEEK & DATE	VEGETABLE CROPS	WORK TO BE DONE & PERIOD OF TIME FOR WORK COMPLETION	TOOL TO BE USED	TICK WORK DONE	EVALUATION OR COMMENTS

BUDGETTING

What is a budget and what important role does a budget play in your vegetable gardening?

It is unfortunately very common for many of us to start projects that fail to reach completion. This is usually because of lack of proper budgeting and planning. It is very important to think about the cost. People start gardens with very little capital that will not make their crop to maturity or harvesting time. Often crop fail before harvesting time due to lack of planning and budgeting.

When you budget you will definitely know whether you can manage to grow the crop you intend to grow or if you find that your money can not allow you to grow it you can grow a different crop or reduce the hectare (amount of land).

When you have decided what kind of vegetable you want to grow, you must set up a budget. This is to get a certain idea of what the crop growing will be crossing you and what you may expect earn from it. Remember you are interested in great profit.

A complete budget must have the followings:

- A realistic cost of production – how much will I spend into the project?
- How much money on labor or how many people do I need?
- What am I likely to get
- Transportation to the market must also be taken into account.
- Type of irrigation or cost of irrigation if any must also be considered

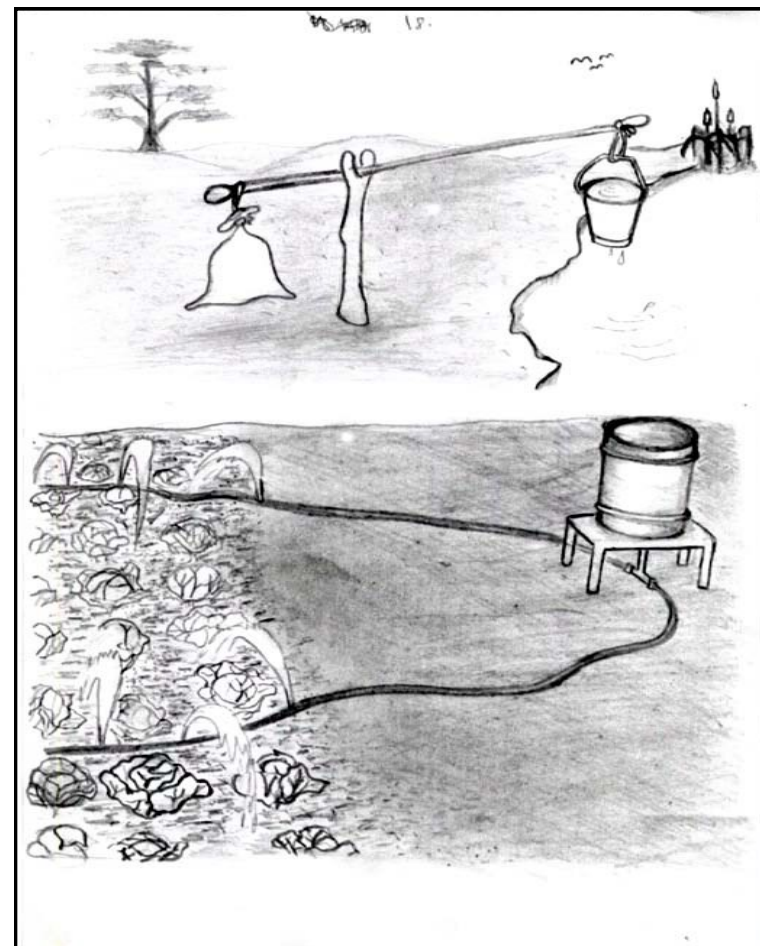
Making a Budget

Over leaf is an example of a budget. It has been made very realistic, i.e. this is the minimum you should expect to profit from your garden. In most cases you should be able to profit a lot more.

Shadoof irrigation system

- ◆ Tie a bag ½ or bag of sand to help you pull down the end of the pole where you Operate from.
- ◆ Tie a bucket on the other end. The bucket will draw water from the source of water.
- ◆ Empty the bucket into the drum (or brick-tank).
- ◆ Make a canal to the field for irrigation

*Drawing below: **Shadoof irrigation.**: From the river you simply empty the bucket into a drum or make a simple tank out of bricks. From this drum/tank water can be led into the garden.*



LABOR: Requirements: water needs to be poured only into the bucket, the distribution to the plants is automatic.
COST: for a drip system it is very cheap.

Potential problems

- Suspended soil particles may clog the dripper
- Plastic buckets breaks when sitting in the sun for long periods

Solutions

- Filter the water when putting in the bucket
- Protect buck from the sun.

How to fit a drip irrigation system

You cut 4 (four) poles. Dig two holes and put the two poles in the holes. Then fix the remaining 2 poles about a meter from the ground across the two poles. Thus where you will plot the bucket and the drippers.

If you do not understand this system well ,contact the following at Namwianga Mission; Box 22 Kalomo

- 1 Mr. Fred Kalatambala,
- 2 Mr. J Moono, Mr. Patson shula.

OR
 LEDDY VARNER
 2501 LINCOLN
 RIVE,
 DRIVE, ABOLENE
 USA
 TEX: 79601, USA

GODDON L DOWELL
 791 LYSTLE SHORES

 ABILENE TEX AS 79602

Shadoof irrigation system

Due to the problematic situations faced by many Zambian farmers, we have found it ideal to recommend this method for irrigation. Reasons are as follows;

- A shadow does not require any large amount of money. It only needs a bucket or ay container that can be hanged on a pole.
- This technology does not need any oil, fuel (petrol) but requires few calories of energy to put the pole up and downward.
- Requires only a few bricks to make 50 cm radius tank which acts as a reservoir.
- Short outlet pipe.
- One person can work efficiently and cover a big area while the other two operate the machine.

COST OF PRODUCTION – CAPITAL:

TRANSACTION/ TEM TO BUY/ COST OF LABOUR	PRICE OR CHARGE PER INDIVIDUAL	PRICE SET	ACCUMULATIVE COST
2x25g egg plants seeds	K32, 500. 00	K65, 000. 00	K65, 000. 00
2x25g rape seeds	K55, 000. 00	K11, 000. 00	K76, 000. 00
9x3g green pepper seeds	K4, 277. 00	K38, 500. 00	K114, 500. 00
2x10g cabbage seeds	K45, 000. 00	K90, 000. 00	K204, 500. 00
Labour x2 workers	K286, 000. 00	K286, 000	K490, 500. 00
Transport to market	K100, 000. 00	K100, 000	K590, 500. 00
TOTAL SUM			<u>K590, 500. 00</u>

VEGETABLES SOLD IN KGS	PRICE/KG	PRICE Pr. SET	ACCUMULATIVE INCOME
500 kg cabbage	K300 kg	K180, 000	K180,000
Garden eggs	K500 kg	K130, 000	K310,000
Rape	K250 kg	K150, 000	K460,000
Green pepper	K500 kg	K270, 000	K730,000
TOTAL SUM			K730, 000

Income from production K730, 000
Cost production K590, 500
Profit + K139, 500

SYSTEM	ADVANTAGES	DISADVANTAGE
Petrol or diesel engine pumps and poly pipes.	<ul style="list-style-type: none"> - Petrol or Diesel engines and poly pipes can water a big area within a short period of time. - Requires very few people to do the work - It is not laborious and not tire-some. 	<ul style="list-style-type: none"> - Petrol or Diesel engines are expensive - The pumps and pipes also cost a lot of money. - Very few people afford the purchase of such pumps. - Petrol or diesel and oils expensive. - Because of high pressures produced by the pumps cause erosion of good soils in the soil.
Flood irrigation	<ul style="list-style-type: none"> - Very fast and coves a very big area. - A lot of water penetrates the soil. - Waters all area gives the plants a lot of water. - Requires few people to do the work. 	<ul style="list-style-type: none"> - Easy to transfer diseases to un affected / infested area. - to much water destroys microbes which helps to decompose matter that later becomes organic manures. - Moves or sweeps away tip soils and deposits where the farmer desires not.
Row Irrigation	<ul style="list-style-type: none"> - Irrigation is cheap and economic - Requires low amount of labor. 	<ul style="list-style-type: none"> - Not all the root gets water for plants. - Parts which are not irrigated become hard pans. - Transfers diseases from one plant to another within the row.

SYSTEM	ADVANTAGE	DISADVANTAGE
Bucket Collection from Stream	<ul style="list-style-type: none"> ◆ Cheap and easy to do ◆ Fast to get water from the stream hence the speed is favorable 	<ul style="list-style-type: none"> ◆ Laborious – many people required to cover a big area. ◆ Can be a vector to disease i.e. if runoff water from fields get into the water sources
Treadle Pump	<ul style="list-style-type: none"> ◆ The treadle pump is now costing K 500,00 hence is not cheap to buy. ◆ The method is fast and can cover a big area with extra costs i.e. for diesel or petrol. ◆ if you use a tank you can irrigate alone. Requires few people to do. 	<ul style="list-style-type: none"> ◆ Compacts the soil hence destroys the soil structure causing hard pans ◆ Very few people can afford to buy T- pump K 500 000 is too much for certain people. ◆ Pipes are also extra costs.

DIFFERENT TYPES OF VEGETABLES & HOW TO GROW THEM

Under the articles you should write down:

- The name of the varieties you are growing
- If you are using any kind of manure le animal or composite
- If any pests or diseases show up and what you do to protect the plants.

Beans

Beans are a very important protein source and do not need a very a rich soil. All the members of the Legumes family have a small bacterial fastened to the roots. These bacteria are called nitrogen – fixing bacteria, and help the plants to take nitrogen from the air, and not only from the soil water.

This means that legumes can actually give the very important plant food, nitrogen (N), to the soil and other crops. Therefore the legumes are a very important group of plants to use for intercropping and rotation. Beans are the most grow crop in this group. Beans are often sown together with maize. The beans will cover the soil under the maize and thereby prevent soil erosion and the growth of weeds. This will also prevent the soil from drying out.

The nitrogen-fixing bacteria on the roots of the beans will add nitrogen to soil and maize.

Beans are best grown in the cool season, because pod set is poor under high temperatures. It takes 8-10 weeks from sowing to harvesting.



Varieties

As available in shop

Giant and dwarf are now available – cowpeas sugar beans etc have any varieties

Other varieties:

Beans are sown directly, never in a nursery. Spacing: 30-50cm between rows, 10-15

Manure and fertilizer: (see page 27 for advise)

Care during the season:

Watering is necessary. Weeding is very important, so weed frequently.

Pests and diseases :

Pests are bores, which may damage the pods. See P.34

Pods should be harvested young and before the beans can be felt to have reached more than half size. For dry beans, allow pods to mature on the plant.

Okra

Okra is grown in the rainy season when temperatures and rainfall are high. Can be grown in the dry season with irrigation, but plants are slow growing. It takes two months from germination to the first harvest, and 4 to 6 weeks between the first and the last harvest.

Varieties:

Pine and pineless are available.

Spacing when transplanting: 60 cm between rows, 50 cm between plants

Pests and diseases:

SYSTEM	ADVANTAGES	DISADVANTAGES
Drip irrigation	<ul style="list-style-type: none">- It is water saving does not need a lot of water- Buckets (plastic) are not expensive and are easy to get.- No possibilities of disease transfers since drops are only on the intended crop plant.- It is time saving you can be irrigating while doing another work;- Drop lines are easy to carry back home compared to poly pipe- Labor saving- It is cost effective- Requires	<ul style="list-style-type: none">- Buckets and drip lines may be expensive to some farmers.- If you do not use them properly they can be blocked.
Shadoof irrigation system	<ul style="list-style-type: none">- It is easy to make since you need 2 poles only and a short pipe.- It needs 1 bag cement or clay soil for making reserve tank so it is cheap.- Irrigation a bigger area within short time.- It only costs K45000. So cheap.- Transfer of disease is minimized.- Requires less labor one person can do it.- Requires no fuel and oils- No engine.	<p>One can be tired lifting the buckets and running to open the beds</p>

WATER RESOURCES & IRRIGATION SYSTEMS

Water is essential for plant growth. But water contains all kinds of impurities both visible and invisible ones.

Surface water (from a lake or stream) usually has a lot of germs (bacteria, protozoa's and virus). Suspended clay particles (makes water cloudy and brown) and dissolved minerals. The bacteria may be harmful to humans or animals but usually not harmful to plants. The suspended soil particles and dissolved minerals are "FERTILIZERS" for the plants. The ancient Egyptians knew the goodness of the annual flooding of the Nile River. The Tonga people along the Zambezi River especially those of Maamba area have also recommended the flooding of the Zambezi River. They grow a lot of maize and vegetables, which are not irrigated. They call these practices as "INCELELA"

Ground water from wells may or may not contain germs. The mineral content of that water depends on the rocks in the underground where the water comes from. The water around Lusaka contain a lot of Calcium (Lime)

Whichever source of water you use, it is the most precious natural resource for a farmer, even more important than land itself.

IRRIGATION SYSTEMS

Applying water is a major task for a farmer. Let us look at different methods of applying water to a vegetable garden and their advantages and disadvantages.

Drip irrigation system.

In areas with little rainfall like the southern province of Zambia water needs to be used more efficiently. For a bigger garden a farmer needs a system that requires less labor and less water wastage. Most farmers in Zambia especially southern province require a system that;

- Is efficient, because we are often short on water
- Is cost effective (the production must be good enough to justify the cost the system.
- Must require as little labor as possible so that we have time for other farm activities.

Question: can you think of a place in southern province were farmers are not much worried about using water efficiently?

The Bucket drip irrigation system

EFFICIENCY: water is applied only where this plant is growing.

LABOUR: Requirements: water needs to be poured only into the bucket the distribution to the plants is automatic.

Care during the season:

Watering is necessary in the dry season. Weeding should be done regularly.

Pests and diseases: (see P.34)

Early bright

Harvesting

Pods should be picked while still immature or they become leathery. Frequent harvesting is recommended. Keep for one day only, unless placed in cool storage. Okra pods can be dried and kept for much longer periods in a dry atmosphere.

Bitter Tomato

Bitter tomatoes are usually grown during the rains when smooth, good quality fruits are obtained. They can also be grown in the dry season if watering is possible.

The first fruits appear 3-4 months after sowing. The plants will continue to bear fruit if water is supplied, but plant vigor is reduced after a year.

Varieties: (your own notes)

Bitter tomatoes become large plants, and need plenty of space. When transplanting there should be 80 cm between rows and 65cm between plants.

Manure:

Apply as much manure as your soils may need
Watering is necessary during the dry season. Weeding is important, especially at the seedling stage.

Harvesting

Picking the tomatoes when they are quite ripe, that means red all over. Handle the fruit carefully and do not pile too many on top of each other. It is best to pick tomatoes during the day when they are not wet. Wet tomatoes do not keep well.

If you intend to sell tomatoes at the market you must take them there the same day as they are picked, because they cannot be stored. Do not leave the picked tomatoes in the sun, but try to make a shelter for them. Then they will keep better.

Remember: it is important to survey the market before your tomatoes are ripe. It is advised that if your market place is far from your garden on farm is read to harvest tomatoes when they turn yellow.

Transplanting

Transplant your tomato seedlings about 5 weeks or 6 weeks after sowing. It is very important that the roots are not damaged during the transplanting. Take care that the plants do not dry out in the sun. It is best to transplant in the evening, when the sun is not so hot. Pack the earth down well around each tomato seedling, and water it. Keep some seedlings in the nursery bed to replace any transplanted seedlings that do not grow.

Spacing when transplanting:

1. m between rows, 60 cm between plants.

Care during the season

Irrigate very often. Be careful not to pour on the leaves and fruits, as too much water on the leaves and fruits encourage tomato blight.

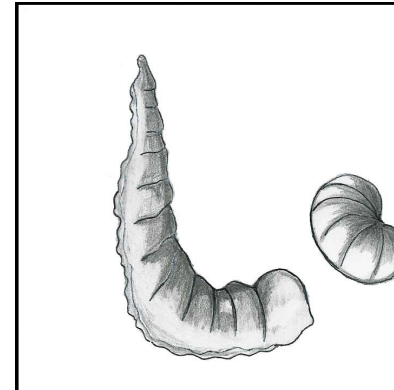
Remove weeds as often as possible. Weeds take the nourishment that the tomatoes could be using. When you are cultivating, remove snails and insects. Take out and burn plants that are diseased or have been spoiled by pests. Replace the diseased plants with seedlings from the nursery beds.

Pests and diseases:

As for eggplants and tomatoes red spider mites may be a problem , (see P34)

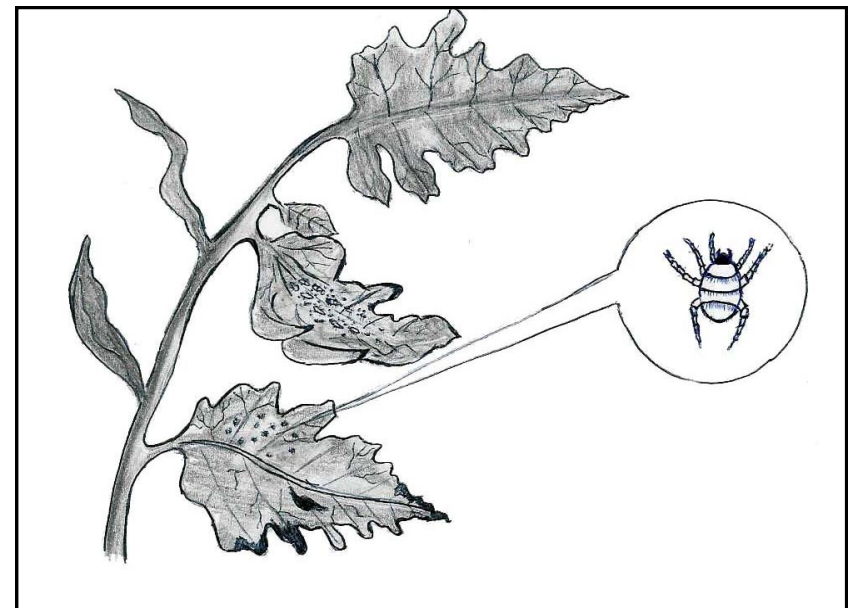
The fruits are picked when they first start to turn red. They can be stored for a few days.

Cutworms (magnified)



Bacteria spot (tomatoes)

Red Spidermite on Tomato Leaf



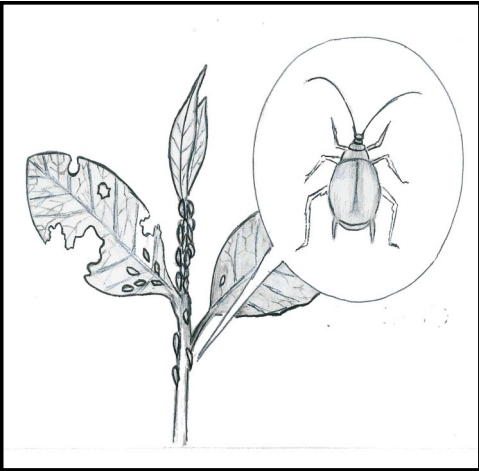
Put all these into 10 liters of water – close the container tightly for 24 hours then spray.

- (b) You can control red spider mites with the following
This can also kill diamond back moth (plutella)
Pound Cisuzi kalamba leaves – 1 tajili Cup (20g)
Pound Muyongolo fruits 2 tajili Cups (40g)
Add into 10 litres of water leave for 24 hours then spray.
- (c) Pound fruits of Muyongolo 2 tajili 40g powder
Pound Mululwe 2 tajili Cups (40g)
Add all these into 10 litres of water for 24 hours the spray.

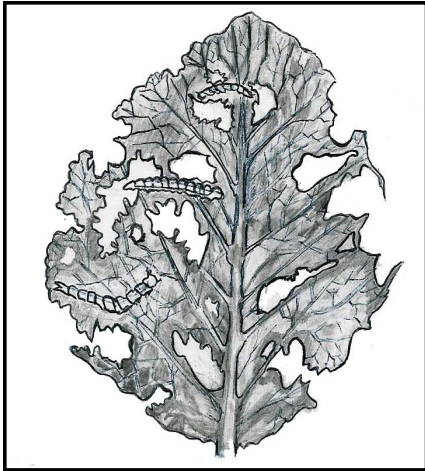
Drawings of pests

Below are drawings of some of the most common pests on vegetables. The drawings will make it easier for you to identify the pests and find out what measures to take according to the above recommendations. For those which are not mentioned under Pest control, still use pest control measures which works on others, as they very often are effective on several pests.

Afid (greenfly)



A cabbage leaf severely attacked by caterpillars



Pruning

Tomato plants grow very quickly. They put up many small branches, which must be pruned. If not, the plant will be late in bearing fruit, and they will be small in size. Remove the buds, which show between the leaf and the stem. Keep only one or two main stems with their leaves and flowers. Prune twice a month.



Tomato

Tomatoes grow well in a hot and dry climate. Damp air and rain encourage disease. In region where the air is very damp, it is best to grow them in the dry season. Crop rotation is very important when growing tomatoes. Make sure that you do not plant tomatoes, or plants from the same family, such as potato, tobacco, eggplant, pepper, in the same site year after year. You should wait at least 3 years before you grow some of them again.

Varieties (Your own notes)

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.....

.....

Prepare the soil well

Tomato roots go deep down into the soil. Tomatoes therefore need a deep soil. You must till the soil fairly deeply. When tilling, mix manure into the soil. The manure must be well decomposed.

Organic manure and manure tea (see chapters 4 & 5)

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Sowing

Tomatoes must be sown in nursery beds. Sow the seeds in rows, leaving 10 cm between rows. Irrigate twice a day. If you make a shelter for them, they will be protected from the sun. When the seedlings have come up and begun to grow, remove surplus or weak seedlings, so that the plants grow well. Weed at the same time which may attack are bacterial and viral disease which are normally controlled by controlled water supply. Please leaf on pest and disease control.

Eggplant

Eggplant belongs to the same family as the tomato. Therefore growing of eggplant is very much the same as tomatoes. Eggplant is well adapted to both dry and wet season production. Watering is necessary at all stages.

Many are there- big yellow and pink varieties are available.

Spacing: 80 cm between rows, 80 cm between plants.

Manure

As your soil type may need different amounts needed in different areas sands need more.

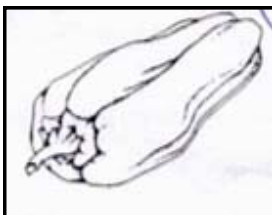
Pests and diseases:

Pests – Red-spider mites. Just as in tomatoes nematodes may be a problem but good crop notation controls.

Not many diseases attack the crop. Avoid logging and dumping, (see P34).

Pepper

Peppers are very tolerant to temperature and rainfall and can therefore be produced all year round. They belong to the same family as the tomato. Their growth period is 8;12 weeks.



Varieties (sweet and hot):

Whatever available in your locality. Many are there (sweet & hot peppers)

Recommend amount of manure and manure tea Depends on your soil type.

Spacing when transplanting:

1. cm between rows, 60 cm between plants.

Care during the growing season

Peppers have a very shallow root system, so high soil moisture must be maintained throughout the growing season.

Hoe regularly to keep crop free of weeds.

Pests and diseases:

Very few pests that may attack your pepper but rare chances of nematodes. Diseases which may attack are bacterial and viral disease which are normally controlled by controlled water supply, (see P34)..

PESTS & DISEASES

For our vegetables to grow well they must be protected from pests and disease. The control of these disease and pests should not depend on the use of chemicals or pesticides. There are other ways of controlling pests and disease.

1. Cultural – this depends on how we can plant our crops. e.g. when you are controlling aphid plants between bed or rows plants that can not be attacked by aphids e.g. Onion, garlic. Crop rotation disturbs eelworms and cutworms in soil by planting crops that cannot be attacked by that pest in control.
2. Biological Control – Here you can go to Mt. Makulu if you have enough money and buy lady-birds but this will cost you a lot of money. Hygiene is very important. Remove some of the bushes but leave other trees for birds to help control some pests.

Invite some wasps (manko) by planting trees or flowers where wasps stay on.

Diseases are controlled culturally by embarking on a logically ordered crop rotation program. Also by avoiding dumping and logging. Make sure that there are no dams of water in your garden beds. Water supply should be controlled.

You can contact the plant protection section department of field services offices or your camp officer ministry of Agriculture.

Pests & Pest control

1. Aphids and Semiloopers

To control aphids and Semiloopers you need to: -
Pound paw-paw stalk and paw-paw leaves (1 cup tajili 20g)
Pound Onion leaves 1 tajili Cup or 20 g of powder.
Pound Tomato stalks and leaves 1 tajili Cup (20g)

Soak the powders into 10 litre of water, close the container tightly and sieve then spray. Let the mixture for 24 hours and spray. You ask you friend to help or give you the said above.

2. Red Spidermites and Control.

- (a) The red spidermites can be controlled if you:-
Pound backs of Mubula tree. 1 tajili Cup (20g)
Pound leaves of Mulvi trees 1 tajili Cup (20g)
Get 120 drops of Muzwezi milk

Weeding date																	
Thinning date																	
Transplanting date																	
Sowing date																	
Manure application date																	
Variety																	
Name of																	

Harvesting

When the fruits are fully-grown, they may be harvested while still green, before their color changes to red. Otherwise fruits are picked as they ripen.

Green fruits: The fruits should be fully developed, be firm and have a dark, glossy green color.

Colored fruits: When red pigment starts to show on the point of the fruit. May be dried and stored for a long period.

Cabbages



Cabbage is very rich in vitamins and minerals and has a good amount of proteins.

Cabbages grow well under moist. Cool to warm conditions, but do not grow well in very high temperatures. They need good rainfall or watering.

Soil

Cabbages need a well-drained, fertile soil with a lot of humus, and do not like acidic soils.

Varieties:

Early maturing and late maturing varieties many are on shops but common ones are Riani F1 hybrid, Rotana hybrid. Copperhagen market (early) Brunswick other as availability may allow in your area.

Sowing

Sow seeds as shallow and thinly as possible, 15-20 cm between rows. Later thin to 2-3 cm between plants. Cabbages are ready to transplant when they have 4 true leaves. Transplant only plants with strong healthy roots. Spacing in the garden: 60 cm between rows and 60 cm between plants.

Manure and manure tea.

Apply whatever manure you have as long as it has fully decomposed. When signs of weakening please apply manure tea.

Care during growth season

Keep the ground free of weeds until the leaves cover the ground. The shade from the cabbage leaves will prevent weeds from growing.

Look for pests and diseases. Remove caterpillars from the plants. Contact your Extension Agent for advice on pest control.

Pests and diseases (see P.34)

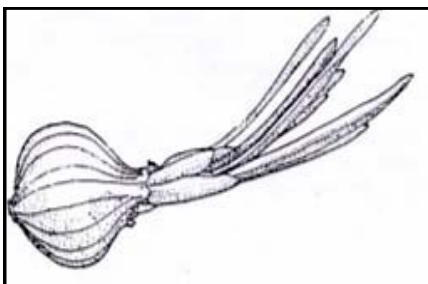
Harvesting

Harvest when the heads are large and firm. The leaves that are cut off can be fed to your animals.

Remove the stems of the plants when harvesting, to prevent the spreading of pest and diseases. Make sure that you do not grow cabbage on the same plot the following years. You should wait at least three years before you grow cabbages again. Remove the stumps of the plants from the field to prevent the spreading of diseases.

Take the cabbage heads to the market as soon as possible. They can be stored for a few days in a cool, dark place, protected from rats and pests. For home use, harvest when necessary.

Onions



Onions prefer cool conditions but varieties such as Red Creole can grow in hot areas under irrigation. During growth they need rain or watering for about 2-3 months, followed by a long dry period for ripening. The soil needs to be firm but well drained. If the soil is too loose, the newly planted onions will tip over.

Varieties

You can have varieties available in your shops but early premium, Texas Grans are the

commonest varieties.

Transplanting

Transplanting when the plants have the thickness of half a pencil. The site must be carefully prepared so that it is firm and contains no big lumps of soil.

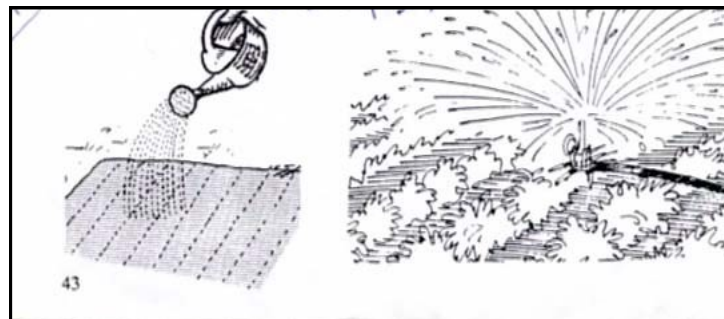
Spacing when transplanting:

30 cm between rows, 8-15 cm between seedlings.

Depth: The seedlings should not be planted too deep. The base of the (where the roots start) should only be about 1 cm below the soil surface.

Watering

Vegetables need plenty of water in order to develop their roots and leaves. They do not grow well in dry soil, therefore the soil of the bed must always be kept moist. Water is a part of the life process in the plant, and transports nutrients from the soil to the plant roots. Plants need more water as they grow bigger and must therefore be watered often. Most of the vegetables are grown during the dry season. To grow vegetables is necessary to have water close to the garden, and enough water for



watering twice a day, morning

and afternoon.

Watering is done with a watering can or by pipe irrigation.

i) Sprinkle (ii) Drip (iii) Flood / splash

In planning a rotation the following points may serve as guidelines:

1. Crops with high nutrient requirements should come first in newly cultivated land.
2. Deep rooters should alternate with shallow rooters.
3. A grass break should be dovetailed in the rotation in order to rebuild soil structure.
4. Crops that are easy to weed should alternate with crops that are not so easy to weed. By doing this, grass weeds, which tend to build up under the latter type of crops, will be removed.
5. Crops that have similar pests or disease should not succeed one another during the rotation.

The main advantages of rotation include the following:

- a) Maximum use is made of soil resources by growing plants with different growth habits.
- b) Efficient control of pests. Certain pests, which tend to build up under continuous mono cropping, may be controlled, provided they do not have an alternative host around.
- c) Disease control. Life cycles of disease organisms are broken.
- d) Parasitic weeds specific to cereal, can be controlled by planting non-cereal crops for a period of time.
- e) Nitrogen content of the soil may be enhanced by including a legume in the rotation.

- 3.. Choose only the best seedlings. Trim off part of the roots and leaves
4. Transplant the seedlings into holes made with the dibber, and bury the roots up to the crown.
5. Press the earth down firmly around the plant.
6. Water the transplanted seedlings thoroughly

Some vegetables, for example carrots, cannot be transplanted. The seeds have to be sown directly into the garden. This very often means that the small plants will be growing too close to each other, and will therefore not be getting enough nourishment from the soil. In order to give the strongest plants more space in which to develop, it is important to remove any weaker, diseased or misshapen plants. This process is called thinning. Be very careful when thinning not to damage the remaining seedlings.

WORK THROUGH THE GROWING SEASON

Planting and sowing

Planting must be done correctly and in time. During the planting of various crops, it is important that the seed is planted at the correct depth. This ensures quick and uniform germination of seed, which leads to uniform plant stand. The appropriate depth for planting various types of seeds will depend on seed size, and the condition of the soil.

Thinning

Some vegetables, for example carrots, cannot be transplanted. The seeds have to be sown directly into the garden. This very often means that the small plants will be growing too close to each other, and will therefore not be getting enough nourishment from the soil. In order to give the strongest plants more space in which to develop, it is important to remove any weaker, diseased or misshapen plants. This process is called thinning. Be very careful when thinning not to damage the remaining seedlings.

Staking

Vegetables with long and weak stems, for example beans and tomatoes, need stakes. This way the stems can grow around the stake and have more air. Insects that live in the soil will also less damage the plants. A stake is just a stick firmly embedded in the earth. It is best to use hard wood, which does not rot.

Plant protection

Your plant must be protected against weeds, disease and pest. The most important factor is to keep the site free of weeds, the soil in good condition, and to choose suitable vegetables. Healthy, thriving plants have a greater power of resistance than weak plants.

For further advice on how to protect your plans, see Pest and Disease control.

Manure and manure tea

Whatever manure use you should apply it in your bed before transplanting since the spacing is small. Spacing determine the size of bulb.

Direct sowing

Onions can be sown directly in the vegetable patch. Make rows 30 cm apart and sow thinly and shallowly. Thin shortly after germination to 2-3 cm between the plants. When the plants have the thickness of a pencil, thin again to 8-15 between plants. The thinned onions can be eaten raw or cooked.

Pest and disease:

The crop does not get attacked by pests here in Zambia but bacteria wilt and wire root cause problems to our onions. Cover seedlings with plastics when it rains- grow onion off rain season.

Harvesting

Harvesting can start about 5 months after sowing. When the onions are fully developed, and the leaves start to turn yellow and dry out, bend the stems down. After a few days the stems will be totally dry and the onions can be pulled up. Leave them on the ground, or take them somewhere else to dry. Cover them with some dry grass, or give them some shade if it is very hot. Turn the onions every day so that they can dry evenly.

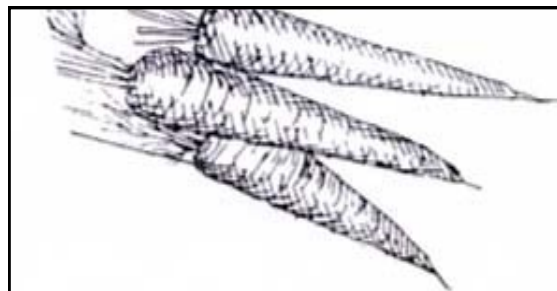
Storage

Eat or sell the very large or thick-necked onions first as these will not store well. Put the onions in flat boxes, only one or two layers in each box, or tie them together by the leaves and hang them up in a dry cool place. Check them regularly and remove any rotten ones.

Carrots

Carrots are rich in carbohydrates, minerals and vitamins. They like a cool warm climate, but do not like very high temperatures, as this will make the roots pale and short.

They prefer a well-drained sandy loam. Carrots are sown directly in the field. They need a very fine seedbed –like the one you make when preparing a nursery



Varieties

As available on your shop

Sowing

Make the rows 30 cm apart. Sow the seeds as thinly as possible. Shortly after germination thin to 2-4 cm between plants.

Manure and manure tea

Use of too much manure for carrots, may cause the roots to branch. Grow carrots after crops such as tomatoes or cabbage, where you have used manure. Not too much manure should be applied. Ash may also help you

Care during the growing season

Weeding is very important until the carrot leaves grow big. Hoeing should be shallow to avoid damage to the roots. Look for symptoms of pests and diseases.

Watering after sowing is important, as germination will be greatly reduced if the soil dries out. After the plants emerge, watering frequency can be gradually reduced to an interval of 5 days.

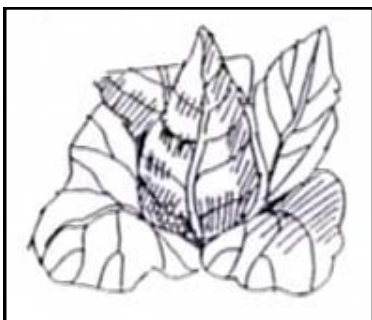
Pests and diseases (see P.34)

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Harvests and storage

Carrots are ready for fresh market. Harvest when the roots are 2-3 cm thick at the top. Leaves should be removed immediately and roots should be washed before sale. Undamaged carrots can be stored for some time in a dry, cool, dark place protected from rats and other pests.

Lettuce



Lettuce production is best during the cool, dry season. Heavy rainfall and high temperature make rainy season production difficult. Lettuce needs 6-12 weeks from sowing to harvesting, depending on the variety. They must be transplanted 2-3 weeks after sowing.

Varieties

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CONSTRUCTION OF A NURSERY BED

A nursery bed is a bed for growing seed. When the seeds have grown into young seedling, they are transplanted into another bed.

Big seeds are placed deeper into the soil than smaller ones. For example, push the seeds of okra and beans 3 cm deep into the soil and the seeds of lettuce and onions 0.5 cm. Then press the soil firmly over the seeds. Sow in rows. The distance the rows depends on the size of the plants

Site of Nursery bed:

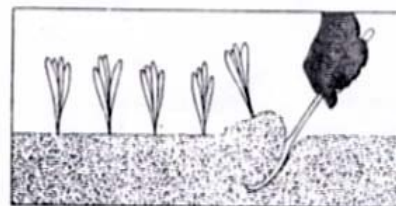
The site of a nursery bed must be to the best standard. Any plant life starts in the nursery, so be careful that your baby plant is not born with diseases or does not get the disease at the earliest part of part of its life. Whatever happens in the nursery bed reflects the life of the plant in the main field or garden.

1. The site must be free from disease infections and be free from pests.
2. Must be virgin land with a lot of manure in it.
3. Must be near water source.
4. Must be near to your homestead thus for easy monitoring – Remember this proverb:
“It is the foot of a farmer that grows a crop and his eye that fatten the oxen”
5. Must be free from run off water. The run off water may be carrying some disease agents or pests.
6. May be free from trees where birds rest- reason as above.

Transplanting

The first sign of seed germination is the appearance of the seed leaf. When the permanent leaves appear it is time for transplanting.

Transplanting means taking a seedling out of the nursery bed and planting it into the vegetable garden. The purpose of transplanting is to give each plant more space and to give the roots and leaves a better chance to develop.



Some types of vegetables, such as carrots, cannot be transplanted. They are sown directly into the vegetable garden. The best way of transplanting seedlings is to:

1. Thoroughly water the nursery bed, so that the seedlings can be more easily lifted.
2. When lifting, be careful not to break the roots.



Mono cropping

Advantages:

- Easy to weed
- Easy to spray against pests and diseases
- As the crop is planted in rows, it is easier to establish the correct plant Population/unit area.
- Easy to harvest and estimate yield.

Disadvantages:

- Under certain circumstances, for example where the crop does not cover the ground adequately, land eases is likely to spread faster in a pure stand than in a mixture of crops. not fully utilized.
- Outbreak of pest or diseases

Intercropping

Advantages:

- Total yields per unit area are higher
- Ample crop cover protect the soil from erosion by rain
- Maximum utilization of the environmental resources; nutrients, moisture.
- Interrupts spread of pests and diseases
- Legumes in the mixture will benefit the soil by nitrogen fixation
- For a farmer with a small field, mixed cropping acts as an insurance

Disadvantages

- Not so easy to carry out operations such as spraying, weeding and harvesting.
- Spacing rather haphazard
- Mechanization almost impossible
- Sometimes wasteful of fertilizer, which may have to be given too less profitable crops in the mixture.



Intercropping

Manure & manure tea

Apply as your soils may need. Sand need more clay need less.

Spacing when transplanting:

35 cm between rows, 30 cm between plants

Lettuce reacts quickly to dry conditions, so regular watering is necessary. Remove all weeds as soon as possible.

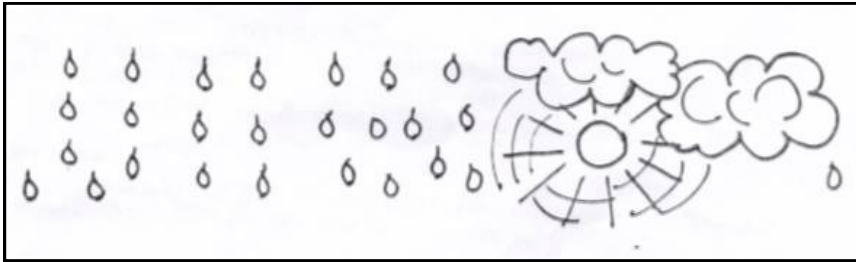
Pests and diseases (see P.34)

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Harvesting

Harvest as soon as the head is firm and the leaves mature. Over-mature pants tend to be bitter and unpalatable. Cutting must be done either late in the afternoon of the previous day, or early in the morning of the day of the marketing.

HOW PLANTS GROW



This chapter tells you about how plants grow and what they require. You can read about the soil and the nutrients that the plants need, about propagation and nursery and work that has to be done through the growing season.

Ecology

is the study of how plants and animals live and interrelate with each other and the environment. For plants to grow they require among other factors water, air nutrients, light and warmth. Water and nutrients come from the soil while light and air come from the atmosphere. For the plants to grow well these environmental factors must be available in the right quantities and at the right time.

Rainfall

Rainfall provides water for plant growth. Water is essential for all life process to take place. Wilting occurs when the water availability in the soil is lower than the plants' requirements. Lack of water is also known to hasten the maturity of plants.

For a farmer to be able to decide which crops to grow and when to plant them, it is important to know what the distribution of rainfall throughout the year is like. The rainfall in Zambia is concentrated on the rainy season. This means that growing crops during the dry season depends on irrigation water. The dry season temperature is very suitable for vegetable growing. If there is irrigation water available, the vegetable crop yield can be very good.

Heavy rainfall results in runoff, because the soils can only "accept" a certain amount of water at a time. The runoff carries with it topsoil. The amount of soil lost this way depends on whether the soil is bare or not. By ensuring a good soil cover, runoff is reduced. Another disadvantage of high rainfall intensities is that the soil tends to become compacted. This reduces the capacity of the soil to absorb water, and in turn aggravates the runoff problem.

Crop Rotation Example—create 5 beds as below, Then rotate

Rape Cauliflower Cabbage	Beans Green Beans	Onions Garlic Carrots	Tomato Bitter toms Okra Potatoes	Chinese Cabbage lettuce
Brassicas	Legumes	Beat Crops	Fruit crops	Chinese Cabbage Lettuce

Crop rotation means growing different crops in an ordered sequence on the same field. In practice the field is demarcated into a number of units. The main objectives of rotation are to make maximum use of the soil by growing a variety of crops which have significantly different growth habits and nutrient requirements.

In planning a rotation the following points may serve as guidelines.

1. Crops with high nutrient requirements should come first in newly cultivated land.
2. Deep rooters should alternate with shallow rooters.
3. A grass break should be dovetailed in the rotation in order to rebuild soil structure.
4. Crops that are easy to weed should alternate with crops that are not so easy to weed. By doing this, grass weeds, which tend to build up under the latter type of crops, will be removed.
5. Crops that have similar pests or disease should not succeed one another during the rotation.

The main advantages of rotation include the following:

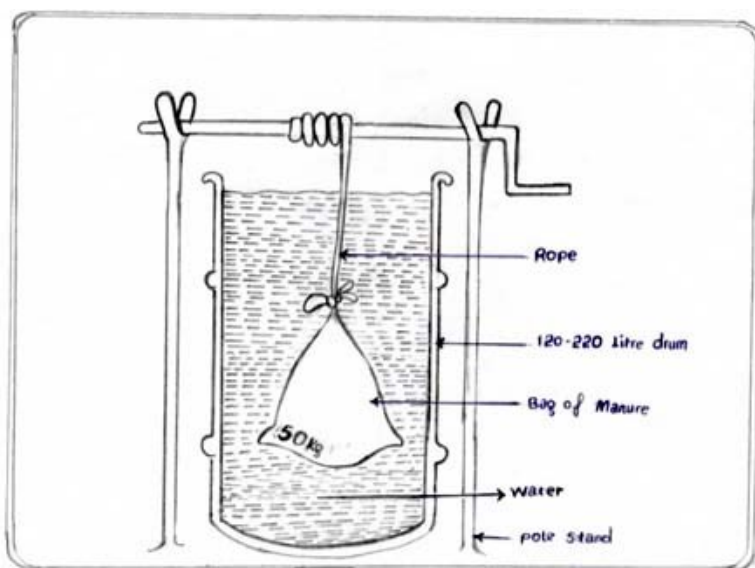
- a) Maximum use is made of soil resources by growing plants with different growth habits.
- b) Efficient control of pests. Certain pests, which tend to build up under continuous mono cropping, may be controlled, provided they do not have an alternative host around.
- c) Disease control. Life cycles of disease organisms are broken
- d) Parasitic weeds specific to cereal, can be controlled by planting non- cereal crops for a period of time.
- e) Nitrogen content of the soil may be enhanced by including a legume in the rotation.

Fertilizers

Fertilizers are artificially- made nutrients. Fertilizers add mineral salts to the soil, but they are costly and very few people in our location are able to purchase or buy these fertilizers; there is not too much to be gained by applying fertilizers if your farming work is not well done. Fertilizers have also a danger cause to our soils. They cause our soil to be acidic hence our crop production goes down unless we add agricultural lime to it. But all this is costly. Can't we grow vegetables without the application of artificially made fertilizers? God made this soil fit for human habitation and Crop production or growth. Here is the best alternative! Apply the following, which have the nutrients you require for plant growth: Compost manure, green manure, manure tea, animal manures and intercropping with leguminous plants e.g. beans is also advantageous to your soils.

How to make manure tea

Manure Tea has proved to be the top dressing for our crops especially in gardens. Make compost, animal manure decomposes properly. When this is done put your manure into a 50 kg bag. Tie the bag firmly or tightly.



Put two toothed poles or poles with two branches into the ground, put a 30 –55 gallon or 120 – 220 litres drum or any other suitable container, put water into the drum. Put a pole across the drum but pole should run from pole to pole. Tree your 50 kg bag into the drum of water. Soak it until you are sure that all the nutrients into the manure has gotten into the water. The liquid that comes out of the bag will be rich in nutrients hence be poured by your plants –not on part of plant. You will burn your plant.

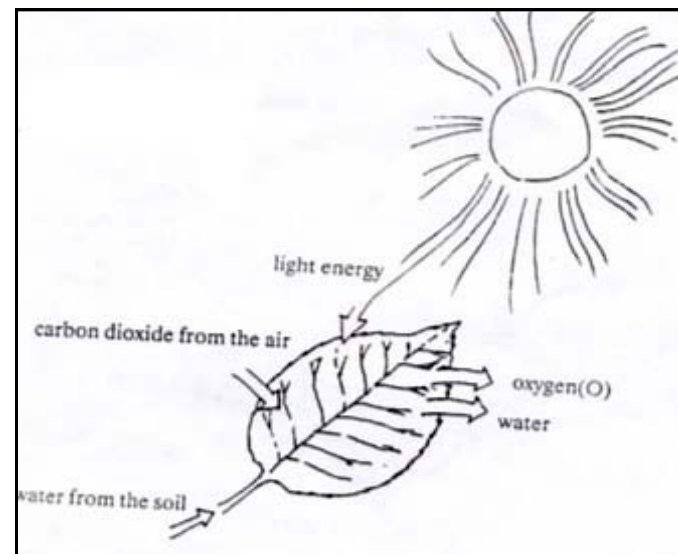
Temperature influence on plant growth

If the temperature is too low or too high, the growth stops. The optimum temperature for growth varies with variety and stage of development of the plant. Optimum temperature means the temperature at which the plant growth is best.

Soil temperatures are normally higher than atmospheric. While the soil is heated by direct radiation from the sun, the air is heated by the heat reflected from the surface. Soil temperature is important for germination and later the root activities. Temperature can be modified in various ways, such as mulching, shading or irrigation.

Light

Light is the source of radiant energy required for photosynthesis. This is the process whereby green plants manufacture carbohydrates. Raw materials for the process are carbon dioxide from the air, and water from the soil. The green pigment, chlorophyll, is able to absorb the light energy necessary to convert these materials into energy-rich carbohydrates. Photosynthesis is thus the basis of all food production, and the growth of plants is entirely dependent upon it.



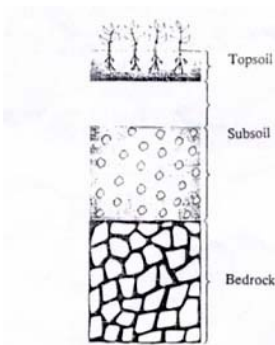
Light
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tion are both important to growth and development of plants. The rate of photosynthesis increases with increase in light intensity, but only up to a point where other factors become limiting, such as the availability of carbon dioxide.

THE SOIL

The soil is the material in which plants grow. It gives the plant a firm basis in which to grow, and contains essential water and nourishment.



We can divide soil into three layers:

1). Topsoil

The topsoil is the layer in which we grow the plants and is therefore the part of the soil we work with. This layer is approximately 30-50 cm. In depth.

2). Subsoil

The subsoil is the layer under the topsoil. The thickness of this layer can vary from 10cm to several meters.

3). Bedrock

The bedrock is the layer underneath the subsoil. It is made up of different kinds of rock, and gives the upper layers their material.

Topsoil

Topsoil is a mixture of the materials from the bedrock and the subsoil, and organic materials from plants, trees and animals. The quality of the topsoil depends of the content of organic matter. Soil, which has been covered by forest or grass for a long time, is rich in organic matter.

Humus

The organic matter is called humus. Humus is made through the rotting process of branches

What is soil made of?

Soil is a mixture of sand, silt, clay and humus. The proportion of sand, silt, clay and humus differs from place to place.

Sand

Sandy soil does not stick together when you press it in your hand. It is coarse. It contains a lot of air, is well-drained and has a low content of humus. It has low salt content. Sandy soil is easy to work with, but soil erosion occurs easily.

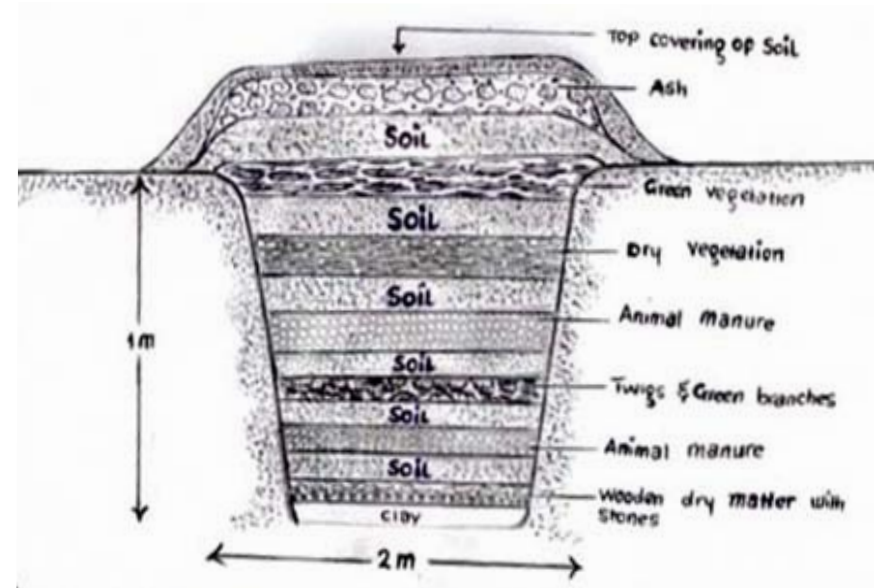
Silt

Silt is made up of grains much smaller than sand grains, and therefore does not allow water to pass through as easily as sand does. This means that silt soil does not dry out as easily as sandy soil.

Clay

When it rains on clay soil the water does not go through the soil easily. Wet clay sticks to the tools. Because of this, clay soils are difficult to work after rainfalls. During the dry season clay soils become very hard and compressed.

Heap construction



Manure

Manure is the droppings from cattle, sheep, goats, pigs and poultry. Make it is rotten (decomposed) before you use it. Manure has beneficial effects on soil structure. If you have plenty of manure, you can spread it on the whole field. Then mix it carefully with the soil. All this must be done before planting or sowing.

Green manure.

This is made by incorporating plant material into the soil while still green. Ideally the green manure crop should have the following properties:

1. Rapid growth
2. High nitrogen content
3. Highly vegetative or leafy
4. Capable of rapid rotting

Upon decay, green manure enriches the soil with organic matter, and, to lesser extent, plant nutrients, notably nitrogen and phosphorus. Some period of time must elapse between the incorporation of the green manure crop in the soil and the planting. This gives time for the decomposition of the green manure crop. Sunflower and various legumes have occasionally been used as green manure. Decomposition period may be 6-8 weeks.

Compost

Compost is a mixture of plants, (could be stems of millet and maize), refuse from the house, food remains, such as vegetables and fruits, which all rot together.

Compost Making

How to make a compost pit

A good place for making the heap in is the shade of a tree. The tree will prevent the heap from drying out. Dig a hole, and start by placing a lot of big pebbles and stones in the bottom of the hole. This is to avoid allowing too much water to be left standing in the hole.

Put branches at the bottom (to improve aeration) and then alternate coarser and finer materials animal manure making a heap. The top of the heap should be “closed” with some clayey soil to prevent drying out. Make sure that all material is moist (water after rise to about 2 meters in height. The height applies pressure to help speed decomposition while the top of the heap is still convenient to read from the ground.

There are many ways of making a compost heap.

Or:

Put branches at the bottom (to improve aeration)

Then throw in all household refuse, weeds and plants you have cut down, and refuse from the harvesting. Water the heap to make it rot. Like manure, the compost must not dry out. Having the compost in a hole will help to keep the moisture in the heap. You can cover it with grass, old sacks or plastic prevents it from drying out.

It is recommended that you turn the heap after 4-6 weeks. This is to make sure that the waste materials in the heap are properly mixed. It also helps to give the heap air. After turning the heap 2-3 times it should be ready for use

Different materials heaped together kept moist will decompose and make humus which has a high water holding capacity and a high mineral releasing capacity. Air and moisture are very important!!

Methods of heap construction

1. Pit or hole compost heap
Dig a 1 meter wide x any desired length and 2 meter depth. Remove all the soils – the top rich soil must be put on one side since you will need it in your covering of alternating layers.
 2. Put wooden pieces, twigs and braches underneath these must be dry materials.
 3. Then put green materials i.e. grass, leaves then cover with a little soil. Apply some moisture.
 4. Then put dry vegetation and some manure to help introduce bacterial in your heap or rotting kitchen wastes.
 5. Put some soil and apply some water (moisture)
 6. Put ash and soil then water.
- N.B Keep on alternating the layers until you close your heap with clayey soil then keep it moist.

Remember /Caution, Every layer must be followed by some soil and water application to speed up decomposition.. Any other method can be used, brick built, Plank built.

Nutrients

Plants need food to build up their roots, stems, leaves, flowers and seeds. Such foods are known as nutrients. Every time you harvest and remove the crop from the field,

Macro-nutrients that the plants need	Micro-nutrients:
Nitrogen (N) Phosphorus (P) Potassium (K) Magnesium (Mg) Calcium (Ca) Sulphur (S)	Iron (Fe) Manganese (Mn) Copper (Cu) Zink (Zn) Boron (B) Molybdenum (Mo)

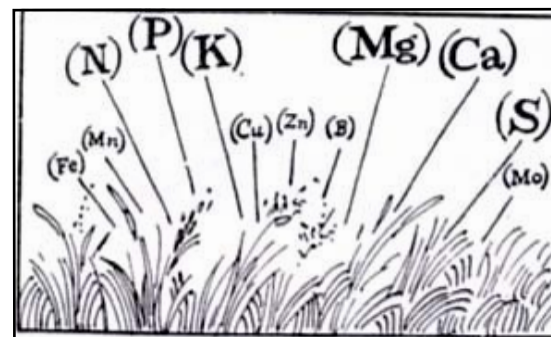
Plants also need Hydrogen (H), oxygen (O) and carbon (C). they get these nutrients through the photosynthesis.

Nitrogen – phosphorus – potassium

Nitrogen, phosphorus and potassium are very important nutrients. These nutrients affect the yield and quality of the produce very much. All these nutrients are found in a well- prepared compost or animal manure.

Remember to add animal manure to your compost heap.

Nitrogen (N) makes leaves grow, and gives them a good green color, causing the protein content in the plant to be increased. If the plants do not get enough nitrogen, they will turn pale and their growth will be reduced.



Potassium (K) helps the plants to withstand drought and diseases. It also helps the plant to build up food reserves, so that the roots become fatter and seeds more plentiful and of inner quality.

The plants can be supplied by nutrients and thereby give a better yield. If they get too much nutrients it will act as poison to the plants.

Plants can be supplied by nutrients to give a better yield, but it is important to note that too many nutrients can act as a poison on the plants, and thereby destroy them.

Nutrients can be given as:

- 1) Organic manure that is farmyard manure or compost
- 2) Inorganic manure, that is different fertilizers, but this is not needed in organic farming. Fertilizers add a lot of acid hence lowers the soil PH very much.

Plant propagation

Plant propagation is the formation and development of new plants. There are two main ways or methods of plant propagation.

- Propagation by seed
- Vegetable propagation

Propagation by seed

Propagation by seed is also called sexual propagation because all the union of the female (ovule) precedes the formation of the seed and male (pollen grain) gametes during the process called fertilization.

Many cereals and legume crops, such as maize, wheat, sorghum, millet and beans are propagated by means of seed. Other important crops, which are propagated by seed, include tobacco, sunflower, cotton, coconut, groundnut etc. Propagation by seed is the cheapest method of propagation for many agricultural crop plants. All the vegetable crops mentioned in this book are propagated by seed.

Vegetable propagation

Vegetable propagation includes all methods of propagation not dependent on the formation of seeds. The method relies on the vegetative parts of the plant, such as the stem, leaves or roots, to perpetuate the parent plant. The vegetative parts contain or develop buds, which give rise to new individuals. Also potatoes and certain vegetables are propagated vegetative. Such plants are identical copies of the parent plant. This is one of the main, and the most important advantages of vegetative propagation. Thus, from one or only a few plants can be produced.

Vegetative propagation is used when the plants either do not produce seeds, or when although the seeds are produced, they are not viable, or they do not breed true to type, as is the case in out-crossing crop varieties.

The main methods of vegetative propagation used in practice are as follows:

1. Cuttings
2. Layering
3. Grafting
4. Budding.

Preparation of a bed (see back page)

Prepare your land in the garden a head of time so that when you bring your new seedlings they find well rotted manure or well-decomposed branches and grass in beds. Whether you used furrows planting, flat beds, raised beds or sunken beds try to follow this procedure:

- a) A bed or furrow is prepared but must not be more than a/m in width but can be of any length you want. The standard bed is 1 meter in width and 30 meters in length. The addition of organic materials is used to provide nutrients and to improve the soil structure. A trench for furrow or sunken bed is made about 30 – 60 cm deep. For a flat or raised 15 cm depth is made and tree leaves or other green materials are placed in trenches to the depth 15 cm.
- b) A 5 cm layer of fresh manure is placed on top of the green materials. (Whichever manure you may have e.g. chicken, cattle, goat or kitchen wastes.

NB. Make sure that compost should be made head of time.

Remember to put twigs or branches underneath the bed to allow aeration so that the microbes that decompose the materials do not die.

How to make compost & manure

Tea

Before we very much talk about how to make our compost manure or how much manure we should apply, let us consider the soil type, structure and texture. If your soils are good enough to supply nutrients why worry about the manure application amounts. (See “some characteristics of our soils in Zambia” in this manual)

All this depends on what soils you have on your farm garden. A better soil must contain the mixture of four soil types namely sand, loam, clay and humus. In order to improve the fertility of the soil for our gardens, we want to improve the organic component (Humus)

Organic Matter

Which Organic materials can be used in our composed bed or compost heap making?

- (a) Any plant materials but NOT grass that makes rhizomes!!! Plant material is the best for a vegetable bed when it is more or less decomposed. As those plant materials rot, they release minerals into the soil.
- (b) Animal manures (cattle, sheep, goat, chickens, donkeys, pigs) are very good for the soil because it decomposes easy and contain a lot of minerals. Be cause animal manure can be “very strong” they may “burn” plants and are best used when composted (rotted).
- (c) In addition to organic matter ash is a very useful source of minerals!.