Multi-storey gardening

Training Manual  2008

Micro-Agriculture (MSG) promotes good health   (capsicum California wonder)

GTZ DADAAB 2004 - 2005
Introduction

Participants

Each participant (Facilitator/Extension officer) has to introduce him/herself to the other

Guiding Questions

1. **What is agriculture?**
   - Means Cultivation of the field for the purpose of crop production, rearing of livestock. It involves storage, processing and marketing of agricultural products

2. **What are the key principles of agriculture?**
   - Land
   - Rainfall
   - Capital
   - Marketing

3. **What are the roles of agriculture in the economies of ---?**
   - Provides food
   - Provides employment
   - Provides raw materials for industries
   - Provide foreign exchange

4. **What are the problems facing agriculture?**
   - Poor crop and animal husbandry
   - Poor marketing facilities
   - Lack of capital
   - Physiological and sociological factors
   - Poor tools
   - Pests and diseases
   - Fluctuation of commodity prices
   - Aridity
   - Land use
   - Land tenure
   - Poor storage

5. **What are the principles of crop production?**
   - Rainfall – distribution of rainfall, rainfall reliability, erosion and storm damage, evaporation
   - Temperature and Altitude
   - Light – light intensity, light duration, light wave length
   - Evapotranspiration—(factors contributing - air temperature, relative humidity, wind)
   - Wind
   - Soil

6. **Common vegetable production**
   - Kales
   - Spinach
• Okra
• Capsicum
• Pepper-chili
• Tomato
• Onion
• Cabbage
• Cow peas
• sorghum

6 Field operations/MSG see bklet
• Land preparation
• Sowing-Germination, Transplanting, plant population
• Weeding
• Pests and disease control
• Harvesting
• Storage

7. Record keeping

MSG
Multi-storey gardening is a simple farming technology, which is aimed at producing vegetables to supplement the food basket for micronutrient provision.

The project goal is to improve the nutritional status of the community. The purpose (Project expectation from the target group) is to increase production of vegetables through small scale vegetable production (MSG and conventional farming). An expectation of the participants has to be explored through plenary.
MODULE 1

NUTRITION

Definition of Nutrition: (WHO)

“Nutrition is a process where living organisms utilize food nutrients for the maintenance of life, maturation, and normal functioning of organs and tissues and the production of energy.

In other words, nutrients from different foods allow the body to do the following:

- develop, replace and repair cells & tissues
- produce energy to keep warm, move & work
- carry out chemical processes such as the digestion of food
- protect against, resist & fight infections, as well as recover from sickness

FOOD is made up of nutrients – we classify foods into different groups according to their nutrient content

Macronutrients – the body needs these in large amounts – they are:

- Proteins
- Carbohydrates
- Fats & Oils

Micronutrients – the body needs these in small amounts – they are:

- Vitamins
- Minerals

As well as non foods that play essential roles in the body – they are:

- Fibre
- Water

Most foods have mixtures of nutrients – but many of them contain a lot of one nutrient and a little of the other nutrients – hence foods are grouped ideally according to the nutrient they contain in abundance i.e. highest content in terms of functions in the body.

FUNCTIONS & FOOD SOURCES OF NUTRIENTS

<table>
<thead>
<tr>
<th>NUTRIENT</th>
<th>Roles/function/s in the body</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROTEINS</td>
<td>Body building. Build and repair body tissue</td>
<td>Animal proteins: milk, meat, fish, eggs, chicken</td>
</tr>
<tr>
<td></td>
<td>NB. Animal proteins contains all essential Amino acids – plant proteins do not</td>
<td>Plant proteins: beans, soya, ndengu, peas, groundnuts</td>
</tr>
<tr>
<td>CARBOHYDRATES</td>
<td>Energy giving foods – for work and other functions</td>
<td>Wheat flour, maize, rice, millet, sweet-</td>
</tr>
<tr>
<td></td>
<td>NB. These foods contain mostly carbohydrates but</td>
<td>Potatoes, Sorghum, potatoes,</td>
</tr>
<tr>
<td>Nutrient</td>
<td>Description</td>
<td>Sources</td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>FATS &amp; OILS</strong></td>
<td>Energy giving. Support/cushion organs e.g. heart, kidney, intestines. Insulation – keeps body warm. Fats &amp; oils are a concentrated form of calories i.e. more than twice the amount of energy in carbohydrates. Excess kcal get converted into fat &amp; stored in body.</td>
<td>Animal fats: cooking fat, ghee, butter. Plants: corn oil, palm oil, simsim oil, groundnut oil, margarine (blue band).</td>
</tr>
<tr>
<td><strong>VITAMINS</strong></td>
<td>Organic substances found in foods in small amount and are essential for metabolic functions.</td>
<td>Fat soluble: A D E K. Water Soluble: C &amp; B complex (8). *See separate table.</td>
</tr>
<tr>
<td><strong>MINERALS</strong></td>
<td>Organic substances needed in small amounts but essential for regulating &amp; building the cells which make up the body.</td>
<td>* Separate table.</td>
</tr>
<tr>
<td><strong>FIBRE</strong></td>
<td>Binds the contents in the large intestine that are not digested into a soft faecal mass that can be expelled.</td>
<td>Leafy vegetables, fruits.</td>
</tr>
<tr>
<td><strong>WATER</strong></td>
<td>To makes cells &amp; fluids e.g. tears, digestive juices, urine. To make sweat for cooling body. For essential body processes. Keeping linings of mouth, gut, eyelids, lungs etc wet &amp; healthy.</td>
<td></td>
</tr>
<tr>
<td><strong>VITAMIN</strong></td>
<td><strong>Roles/function/s in the body</strong></td>
<td><strong>Sources</strong></td>
</tr>
<tr>
<td>D</td>
<td><em>Sunshine vitamin</em> Proper formation of bones &amp; teeth. (prevents rickets- brittle &amp; soft bones)</td>
<td>Sunshine, (makes Vit D under skin). In small amounts in eggs, butter, fish oil, ghee.</td>
</tr>
<tr>
<td>E</td>
<td><em>Antiageing factor</em> Protects the cell structures i.e. ensures cells function properly. Helps body fight infections &amp; diseases (e.g. heart, asthma, arthritis...) essential for fertility &amp; reproductive health.</td>
<td>Vegetable oils – sunflower seed oil, soya bean oil, wheat germ oil. Nuts &amp; seeds. Dark green leafy vegetables. Eggs.</td>
</tr>
<tr>
<td>K</td>
<td><em>Antihemorrhagic vitamin</em> Helps the blood to clot (thru production of clotting agent prothrombin)</td>
<td>Sukuma wiki, spinach, cabbage, broccoli. Bacteria in intestines produces Vit K.</td>
</tr>
<tr>
<td>C</td>
<td>Ascorbic acid Helps body fight infections. Healing wounds thru formation of collagen. Helps body use other nutrients e.g. calcium for building bones, blood vessel walls, skin &amp; teeth. Helps body absorb iron.</td>
<td>Citrus fruits – lemons, oranges. Cabbages, tomatoes, pilipili hoho (capsicum), potatoes, apples, mangoes, melons, papaya.</td>
</tr>
</tbody>
</table>
B9 Folic Acid/Folate

Prevents anaemia. Required for making of red blood cells – specifically the formation of haemoglobin. Healthy skin & hair, building of antibodies

Liver, meat, fish, eggs, Cowpeas, lentils, beans, Spinach, wholegrain cereals, Avocados,

B12

Development of new cells and healthy nervous system. Proper utilization of fats, carbohydrates & proteins, promotes growth

*Animal products only liver (esp. sheep & goat). meat, fish, chicken, eggs, milk

NB. B9 – Folic Acid is the single most important nutrient for a pregnant woman and her growing foetus. Prevents anaemia in the mother & protects the foetus against certain birth defects

Other B complex vitamins are B5 pantothenic acid found in extensive quantities foods, & is involved in all vital functions of the body & B8 – Biotin, vital for a healthy immune system, skin & nervous system

<table>
<thead>
<tr>
<th>MINERALS* those of concern</th>
<th>Roles/function/s in the body</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>Proper development of bones &amp; teeth Helps muscles to function Aids with blood clotting &amp; healing process</td>
<td>Milk &amp; milk products (yoghurt, cheese, mala) Dried fish Millet, coconut, beans, nuts, green leaves</td>
</tr>
<tr>
<td>Iodine</td>
<td>Part of thyroxine hormone produced by thyroid gland. Essential for regulating body's metabolism</td>
<td>Primary source is seafood. (esp. salt water fish) Iodized salt</td>
</tr>
<tr>
<td>Iron</td>
<td>Essential for production of haemoglobin. Helps blood carry oxygen through the body. Removes carbondioxide from the tissues (purifies the blood) Aids growth. Prevents fatigue</td>
<td>Animal foods - meat, liver, chicken, fish (heme iron – better absorbed) Plant foods – soya beans, beans, wholegrains, peas, cauliflower greens, nuts (non heme iron – not well absorbed)</td>
</tr>
</tbody>
</table>

NB. Iron from animal sources is better absorbed by the body (heme iron), than iron from plant sources (non heme iron).

Vitamin C helps with absorption of non heme iron. Also, including a bit of animal protein with plant proteins helps the body absorb the non heme iron.

NB. Anaemia = low haemoglobin level. (Normal levels = 12 – 18 (M) 11-18 (F) of hb per 100 ml

Anaemia

Very common in expectant women

Is deficiency of blood caused by inadequate synthesis of hemoglobin in the body?

Symptoms
- dizziness
- fatigue
- shortness of breath
- headache
- loss of appetite
- Numbering and tingling of fingers and toes.
- The mucous membrane becomes pale.
**Intervention of Anaemia**

Diet rich in iron,
- Liver, green leafy vegetables, eggs
- Legumes – beans, peas, cowpeas, green grams.
- Meat

*Note; Absorption of iron is interfered by tea*

**Night Blindness**

- Vitamin A deficiency. It affects the eyes.
  
  **Symptoms**
  - reduced ability to see in dim light
  - reduced immunity especially in children

**Intervention of Night Blindness**

Foods rich in vitamin A – vegetables, pawpaw, tomatoes,

Exercise – collect data on how many do not see well as from 6 00 pm

**Group work:**

Identify persons suffering from Anaemia/night blindness
Visit one of the pharmacies and find out frequency of persons buying vitamin drugs

**MICRONUTRIENT DEFICIENCIES**

Refers to conditions or illnesses that are caused by lack of certain micronutrients in our bodies. Those of concern to us are as follows:

- Vitamin A deficiency – leads to Xerophthalmia i.e. dryness of the eyes, & Night blindness
- Iron deficiency – leads to anaemia
- Iodine deficiency – causes Goiter, Mental impairment (critical to school going children)
- Vitamin C deficiency – can lead to scurvy – a condition characterized by swollen & bleeding gums.

* In Dadaab – children <5 years are supplemented with Vitamin A every 6 months. Moderately malnourished children <5 years are supplemented with Vitamin C on admission to the SFP

**Example s of Food value**

<table>
<thead>
<tr>
<th></th>
<th>100gm amaranth us</th>
<th>Cowpeas leaves</th>
<th>Cabbage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>8.9</td>
<td>5.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Vit c – (mg)</td>
<td>64</td>
<td>-</td>
<td>54</td>
</tr>
<tr>
<td>Calcium</td>
<td>410 mg</td>
<td>25 6</td>
<td>47 mg</td>
</tr>
<tr>
<td>B- carbonate (vit A)</td>
<td>5,716</td>
<td>7,970</td>
<td>100 (micro gram)</td>
</tr>
</tbody>
</table>

See the table attached

**Group work assignments**

- What is the common food in the community
- Analyze the class it belongs
- Nutrients it provides to the body
- Are there GAPS?
- What are the solutions?
MODULE 2
MSG CONSTRUCTION/ESTABLISHMENT

MSG
Multi-storey gardening is a simple farming technology, which is aimed at producing vegetables to supplement the food basket for micronutrient provision

Components of MSG

Tools and Equipments
1. Jembe – used to dig the soil that will be mixed with other components for constructing the garden.
2. Forkjembe – used to dig the soil in hard ground areas.
3. Spade – used in collection and mixing the soil components.
4. Tinsnip/Knive – used to cut the top part of the tin completely.
5. Tin punch - used to punch holes on the tins surfaces and the bottom.
6. Wheelbarrow – used to measure and transport the various soil parts to the recommended ratio.
Equipments for MSG
1. Perforated tins.
2. Sacks.
3. Gravel clay soil.
4. Sand soil (main Part).
5. Manure.
7. Water.

Purpose of various equipments
1. Perforated tins – To pass water through to the soil component
   - To hold the gravel in the sack
   - Filters dirty water
   - Bottom tins have few holes and no holes on the bottom.
   - 2nd bottom tin have more holes.
   - 3rd tin has more holes than the rest.
2. Sacks - Hold the soil.
   - To act as a planting base.
3. Gravel - To water garden through it.
   - To filter dirty water.
   - To divert the flow of waterside ways
4. Clay soil - Collect the topsoil for better crop development
   - Main soil part of the garden.
5. Sand soil - To create air spaces
6. Manure - Provides nutrient to the soil for good plants growth.
   - Should be well rotten manure.

Ratio: This depends with the area soil type.
**MSG construction**
- Tools
- Mix the three soil parts
- 2 Spades of soil are put in the sack and leveled. The bottom tin perforated at the sides filled with gravel, but not perforated at the bottom is placed on the soil.
- Soil is filled at the sides to the level of the tin and the other tin placed on.
- Soil is again filled at the sides to the level of the second tin; same process is repeated till the last tin.

**Sitting /basic requirement of each crop to be observed.**
- A place without direct sunlight.
- A place without direct wind blowing.
- A place where no interference.
- Places where there is enough protection and if necessary protect the area first if not.

**Pretreatment**
After the garden is constructed watering is supposed to be done till all parts receive enough moisture content for sowing and planting.
Vegetables suitable for Multi storey gardening.

Vegetables needs constant husbandry from germination to harvesting.
### Suitable vegetables for MSG

<table>
<thead>
<tr>
<th>Common name</th>
<th>Somali name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dania</td>
<td>Dania</td>
</tr>
<tr>
<td>Sukuma wiki</td>
<td>Sukuma</td>
</tr>
<tr>
<td>Capsicum</td>
<td>Pilipilihoho</td>
</tr>
<tr>
<td>Egg plant</td>
<td>Birganya</td>
</tr>
<tr>
<td>Spinach</td>
<td>Spinach</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>Nyanya</td>
</tr>
<tr>
<td>Okra</td>
<td>Bamia</td>
</tr>
<tr>
<td>Amaranthus</td>
<td>Terere</td>
</tr>
</tbody>
</table>

### Seeds and seedlings production

#### Seeds

Treated seeds from certified seed company are the most preferred for sowing due to their resistant to soil borne diseases. In the present world research is still on progress to get seeds which will produce maximum yield.

#### Seedlings Production

This sowing of seeds either **direct** or **indirect** to produce young vegetables.
**Direct sowing**
- Sowing on the garden top part as seedbed and transplant some at the recommended period to the sides of garden as per the recommended layers, plant population per garden per vegetable.

(Demonstrate the right quantity of seeds to be sown, layers recommended, plant population per vegetable).

**Indirect sowing**
- This is the sowing of seeds in the seedbed for special care and transplanting them, later to the field (portable seedbed suitable also).

**Transplanting seedlings**

This transfer of the seedling from seedbed to the required place for growth or full development till harvesting.

- Watering the seedling before transplanting is recommended.
- Uprooting the recommended hardened seedling always to ensure survival at the field.

**Seedling selection/plant population per MSG**
- A mature seedling, healthy seedling meeting the below age,

Show the recommended transplanting age/population of various seedlings/vegetables in MSG,

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Transplanting age</th>
<th>Plant population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dania - coriander</td>
<td>4-6 true leaves</td>
<td>16-25 plants.</td>
</tr>
<tr>
<td>Sukuma wiki - collards</td>
<td>4-6 true leaves</td>
<td>16-25 plants.</td>
</tr>
<tr>
<td>Capsicum - california wonder</td>
<td>4-6 true leaves</td>
<td>12 plants</td>
</tr>
<tr>
<td>Egg plant - black beauty</td>
<td>4-6 true leaves</td>
<td>12 plants</td>
</tr>
<tr>
<td>Spinach - fordhok giant</td>
<td>4-6 true leaves</td>
<td>16-25 plants.</td>
</tr>
<tr>
<td>Tomatoes - caj,M82</td>
<td>4-6 true leaves</td>
<td>12 plants.</td>
</tr>
<tr>
<td>Okra - pusasawani</td>
<td>4-6 true leaves</td>
<td>16-25 plants.</td>
</tr>
<tr>
<td>Amaranthus - Terer</td>
<td>4-6 true leaves</td>
<td>16-25 plants.</td>
</tr>
<tr>
<td>Onion</td>
<td>Pencil thickness</td>
<td>16-25 plants</td>
</tr>
</tbody>
</table>

This will ensure that the plant stem will have acquired the recommended strength to avoid breaking during transplanting period. Transplanting is always done in the evening. After transplanting watering in the morning and evening 5 litres simultaneously.
**Water is essential for life.**

After transplanting, watering is done in the morning and evening 5 litters simultaneously. Waste water from kitchen, water stands/taps/kiosks spillage water is used to water the garden. Various areas need to have water troughs and more roof catchment be constructed. The target group should be informed that waste water is suitable for the farming technology in practice or introduced.

**Example**

Irregular watering in tomatoes causes’ disease called Blossom End Rote due to insufficient translocation of the nutrients required for its fruit development. Lack of calcium ions which act as electrolyte for water transportation in plants-helps water move from one cell to the other.
Questions fro group work.
1. Why is water/waste essential in MSG?
2. How do you detect if your garden has insufficient water?
3. How do you detect if your garden is over watered?
4. How do you come up with additional water source?

Group work

Practical on MSG construction, sitting, pre-treatment and transplanting.
MODULE 3

MALNUTRITION

Dfn: It is a condition that occurs due to lack of the required amounts or right kind of food that the body needs to grow, develop and function normally.
There are two forms of growth failure (Malnutrition)
1. Wasting
2. Stunting

1. Wasting (acute malnutrition)
Condition of persons suffering from above
- Extremely weak
- Readily reversible
- Measured by weight for height index
- Is evidence of P.E.M( Protein Energy Malnutrition) means lack of protein body building foods

3. Stunting (chronic Malnutrition)
Condition of persons suffering from above
- Develops over along period of time as a result of inadequate nutrition or repeated infection or both.
- Are short for age
- Look younger than their usual age
- By 2years height deficits may not be reversible
- Measured using the height for age index.

Types of Malnutrition

1. Marasmus
   - means starvation

Signs and symptoms
- Protruding stomach and prominent ribs.
- Hair colour changes
- Looks like old person
- Low weight for height
- Very hungry, have good appetite
- Skin is thin, wrinkled and looks too big for the body.

2. Kwashiorkor
   - Due to lack of protein

Signs and symptoms
- Oedema (swelling of the body especially the face-moon face, hands, forearms, hands, legs and feet.
- Child looks miserable and disinterested in surroundings
- Lack of appetite
- Skin looks light in colour
- Retarded growth.
• Thin sparse hair that looks reddish, grayish.

3. Marusmic kwashiorkor
• A condition where both protein and energy intake is low

**Intervention of Kwashiorkor**
- High protein foods - eggs, milk, fish, beans, cowpeas, spinach
- Energy giving foods – millets, sorghum, enriched maize porridge, rice, wheat products.
- Appropriate weaning of the practices in terms of age of child.

**Causes of Malnutrition**
- Environment factors - famine
- Wars and displacements
- Disease illness
- Poor diet - under nutrition, over nutrition
- Ignorance
- Cultural factors (traditional beliefs and taboos)

Group work;
Identify persons suffering from Anaemia/night blindness
Visit one of the pharmacies and find out frequency of persons buying vitamin drugs
Selected households/areas targeted will be reported as below:

<table>
<thead>
<tr>
<th>Sites/households selection criteria’s</th>
<th>No. of households and on site of the group</th>
<th>No. of MSG</th>
<th>Acreage</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households with children under 5years</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Households living with HIV AIDS (home based care patients</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female headed families,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Households with agricultural background</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Households with old persons</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schools (Environment club members),</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each farmer to have data collection forms for record keeping
PEST AND DISEASE CONTROL

**Pest** – is any living organism or animal that causes plants disorder affecting the total yield either by feeding/sucking the plant saps on the leaves or stem thus impairing with photosynthesis.

**Disease** – is any infection caused by fungi, nematode and virus. It’s a physiological disorder caused by fungi, virus, nematode, bacteria, insects and nutrient deficiency.

Vegetables are prone to pests and disease attacks but if field hygiene is observed it can be minimal.

**Four Main Methods of Pest and Disease control.**

- Cultural methods
- Traditional methods
- Chemical methods
- Biological methods

**Cultural methods**

This is control of pests and disease through good farming practices such as use of clean planting materials, early planting, field hygiene, crop rotation, growing resistant varieties, manuring, correct spacing/pruning, weed control and quarantine incase of disease outbreak.

**Traditional methods**

These are those methods which people have been using since they started farming.

**Chemical methods**

If the above two could not work this method is tried. This method is expensive and chemicals are harmful and instruction manuals should be followed strictly.

The following are important points to note;

- The pest/disease to be controlled must be clearly identified so that the right agrochemicals is purchased
- Buy /acquire agrochemicals that you will use and exhaust within that spraying time
- Confirm the expiry dates before you move out from the source
- Do not transport chemicals with the same basket with food, as they are poisonous.
- Dilute agrochemicals according instructions given at the label
- Advice farmers to harvest mature vegetables before spraying.
- Spraying should be done in the evening in hot areas.
- Advice the farmer to water the vegetables before spraying.
- Spray agrochemical with longer-harvest interval when plants are young/when you have long time to harvest.
- Spray agrochemicals with short pre-harvest internal when you have to harvest in a short time.
- Wash the knapsack sprayer at the end of spraying.
- Do not store diluted chemicals.
- Dilute chemicals that will be exhausted at the spraying period.
Group work on Pesticide (chemical) analysis
Assignments
- Classify the chemicals and follow the above guidelines for use and give information required.
- Name of chemicals
- Manufactured date
- Mixing ration
- Type of chemicals (pesticide)
- Crop applied.

Pests/Disease identified
Specimens to be collected from the field if any vegetables available.

<table>
<thead>
<tr>
<th>Vegetable Group assignments</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinach leaf, okra fruit, leaf</td>
<td>1</td>
</tr>
<tr>
<td>Tomatoes, eggplant</td>
<td>2</td>
</tr>
<tr>
<td>Pepper, kales</td>
<td>3</td>
</tr>
</tbody>
</table>

Common pests and diseases and their control.

<table>
<thead>
<tr>
<th>Pest/disease</th>
<th>Crops infected</th>
<th>Symptoms</th>
<th>Recommended control methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Blight</td>
<td>Tomatoes</td>
<td>Leaves have lessons and dry up after few days</td>
<td>Crop rotation. Use of resistant/tolerant varieties. Use preventive antracoal, dithane-M45. Use curatives Milraz, Ridomil, topsin, fosphite.</td>
</tr>
<tr>
<td>3 Bacterial wilt</td>
<td>Tomatoes Okra, Eggplant</td>
<td>All plants wilt suddenly the plant crosssectional areas shows xylem and phloem black. When squeezed, the sap smells rotten</td>
<td>Uprooting the plants</td>
</tr>
<tr>
<td>4 Diamond back month</td>
<td>Kales, cabbage</td>
<td>Large holes on the leaves</td>
<td>Practice crop rotation. Transplant seedlings at the beginng of rain season. spray Thuricide treat the seeds with red copper and all transplants in solution of topsin.</td>
</tr>
<tr>
<td></td>
<td>Cutworm</td>
<td>Tomatoes, eggplant, okra, kales</td>
<td>Cut the plant at the base and falls down, burrows in the stem of the plant and produces</td>
</tr>
<tr>
<td>---</td>
<td>---------</td>
<td>--------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>

For others see the crop protection handbook

- **Biological Method**

  This by use of other insects/animal feed on the pest
  **Example:** the lady bird feeds on beetles aphids, American boll worm and chafferworm
  Identify the pests/disease well and differentiate from the natural enemies.
  Learn the life cycles of the different pests and disease transmitters for detection of the best stage to control

Refer to integrated pest Management booklets, tomatoes, brassica and okra by Anna Milena Varela and Abdurabi Seif.

**Traditional pest/Disease Management**
- Tobacco-powder
- Pepper-powder

Group presentation
Facilitators Options.
MODULE 6

HARVESTING/FOODPRESERVATION

Each vegetable has harvesting technique,

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Harvesting technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinach</td>
<td>Prick the 2 lower leaves</td>
</tr>
<tr>
<td>Kales</td>
<td>Prick the 2 lower leaves</td>
</tr>
<tr>
<td>Okra</td>
<td>Prick the pods as more will be produced</td>
</tr>
<tr>
<td>Tomato</td>
<td>Pick the ripe fruit</td>
</tr>
<tr>
<td>Eggplant</td>
<td>Pick the biggest fruit</td>
</tr>
<tr>
<td>Pepper/Capsicum</td>
<td>Pick the bigger peppers always</td>
</tr>
<tr>
<td>Spinach amaranthus</td>
<td>Prick the bigger leaves always and fresh ones</td>
</tr>
<tr>
<td>Leek onion</td>
<td>Prick the leaves</td>
</tr>
</tbody>
</table>

When optimum vegetables are husbandry is adhered, benefits, goal/purpose are achieved.

Do all of you know how to cook the vegetables? Do you personally eat the vegetables planted in multi storey gardens?

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Part cooked</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinach</td>
<td>Leaves</td>
<td>Big leaves</td>
</tr>
<tr>
<td>Kales</td>
<td>Leaves</td>
<td>As above</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>Fruit</td>
<td>When ripe</td>
</tr>
<tr>
<td>Eggplant</td>
<td>Fruit</td>
<td>Big fruits</td>
</tr>
<tr>
<td>Dania</td>
<td>Whole plant</td>
<td>Mature</td>
</tr>
<tr>
<td>Okra</td>
<td>Fruit</td>
<td>Small fruits</td>
</tr>
<tr>
<td>Leek onion</td>
<td>Leaves/bulbs</td>
<td>Average big</td>
</tr>
<tr>
<td>Capsicum</td>
<td>Fruit</td>
<td>Mature (ripe)fruit</td>
</tr>
</tbody>
</table>

Group assignments

Salad group

Ingredients for salad preparations

**Tomatoes, onions, spinach, carrots, leek onion.**
- Wash each of the vegetables well in clean sufuria
- Remove the stems of the vegetables slowly
- Cut and slice the vegetables in order of their suitability
- Add some pinches of salts and a spoon of vegetable oil.
- Cover your prepared salad ready to serve
- Its ideal to use separate plates when preparing salads

Mixed preparations group.
- Wash any vegetable before cooking
- Cut the kales into small pieces
- Slice the onion into small pieces
- Cut the eggplant into small pieces
• Put oil into the sufuria  
• Add leek onions  
• Place into fire and stir using spoon.  
• Add tomatoes, eggplant, okra and cover with a lid.  
• Let the mix cook for 5 minutes.  
• Remove the mix from the fire and pour on plate and cover.

Separate preparations group  
**Spinach, onion, tomatoes, eggplant.**

**Onion and tomatoes**
• Wash the vegetables  
• Cut the vegetables into small pieces  
• Take a clean sufuria put the small oil and place on fire.  
• Add cut onion and let it fry for sometimes  
• Add cut tomatoes  
• Add spinach an let it fry for a while  
• Waite for 5 minutes and remove

**Spinach and onion**
• Wash the vegetables  
• Cut the vegetables into small pieces  
• Take a clean sufuria put the small oil and place on fire.  
• Add cut onion and let it fry for sometimes  
• Add cut spinach  
• Add spinach an let it fry for a while  
• Waite for 5 minutes and remove

**Onion and Eggplant**
• Wash the vegetables  
• Cut the vegetables into small pieces  
• Take a clean sufuria put the small oil and place on fire.  
• Add cut onion and let it fry for sometimes  
• Add cut eggplant  
• Add spinach an let it fry for a while  
• Waite for 5 minutes and remove

**Food Preservation**

Its process of keeping food safe and wholesome for later use by preventing spoilage.

**Reasons for food preservation**
• Use when fresh food is out of season  
• Left over food to be utilized again at later date.  
• Easier for transportation  
• Minimizing later expenses on buying the same food.

**Causes of food spoilage**
- Micro organisms
- Yeast
- Moulds
- Bacteria

To preserve food enzymes must be rendered inactive.

During preservation process ensure that the flavour, colour and plants and nutrient value of the food is retained.
We must ensure that microorganisms do not invade.

a) Micro organisms
   - Require air, warmth, moisture, and food to grow.
   - To control
     - Reduce moisture content
     - Taking air away
     - Making food unsuitable for the microorganisms to establish.

b) Moulds
   - Develop rapidly in warm, damp and dark places.
   - Boiling food for a few minutes.

c) Bacteria
   - High concentration of salt and salt do not favour the growth of bacteria.

d) Yeast
   - It thrives best in warm moisture, air, sugar, flour, for growth.
   - Boiling food for a few minutes.

Control of Yeast
   - It destroyed by high temperatures.

e) Enzymes
   - Are organic compounds produced by living cells.
   - They do grow
   - Causes considerable and undesirable change in the food.
   - Responsible for ripening
   - During storage they change the flavour of vegetables

N/B very active at room temperature became in active by boiling.

Methods of Food Preservation
a) Drying
   i) Sun / solar drying
   ii) Hot air Drying
   iii) Smoking
   iv) Deep Freezing
   v) Vinegar
To get good results observe the following rules

a) Use clean utensils, clean mades and water.
b) Use only fresh food which is in good condition.
c) Cover the drying food to prevent dust, dirty, flies, and other insects. From contaminating food.
d) Place the food in a safe place where it cannot get dirty, or be destroyed by animals.
e) Never dry food directly on the ground or sand.
f) Store food in air tight containers.
   - When drying vegetables one must blanch them before drying to kill the enzyme, so that they do not spoil the food.
   - Blanching should be done by dipping vegetables into boiling salted water for 0-1 min
   - Be cooled.

Preparing dried vegetables
   - First soak in water to restore the moisture.
   - It can take 30 minutes to 2 hrs depending on the vegetable.
   - Soaking water should be used for cooking.
   - Now you can prepare like just fresh vegetable.
MODULE 7
COMMUNICATION

Under participatory approach, matter of subject being known by the extension officer, facilitators will assess what is known by the beneficiary to what is unknown. The beneficiaries are adults and have a wealth experience on many other issues in their lives.

The trainer should use simple clear and audible language while talking to the beneficiaries. For adults practical lessons will be of great importance and regularly used than any other in aid of visual aids.

What is communication?
- Passing information from one person the other or place to other place

In communication we must have the following
- Message
- Sender
- Receiver

In our case what is the message?
- Small scale vegetable production on conventional farming and Multistorey gardening

In our case who is the sender?
- Trained farmers /MOA/UNICEF/GTZ.

In our case who is the receiver?
- Beneficiaries at household level/institutions.

In our case what do we expect from the beneficiaries/institutions?
- Response

What kind of response are we expecting?
- Selected /invited farmers/households/institutions to attend training
- To come and receive materials for small scale vegetable production through conventional farming and Multi-storey gardening
- To construct MSG/establish small farms.
- Sow seeds
- Water the plants
- Transplant
- Harvest the vegetables
- Consume the products
- Malnutrition controlled
- Hidden hunger eradicated
In communication forums are used, name some,
- Public baraza
- Home visits
- Demonstrations
- Group meetings
- On spot trainings
- Neighbour to neighbour approach

In our case why are we communicating?
- To empower the community with knowledge.
- Create common understanding
- Motivate the community
- Build trust
- Trigger fro action

Group assignments

Group 1 Why is it important to conduct public baraza?

Group 2 why is group meeting /home visits vital strategy in promoting small scale vegetable production?

Group 3 what are the barriers of communication?

Group presentations 1, 2, 3.
Part 2
Poultry Production

How is it practiced in the region?

Facilitator roles; Look for the systems applied and improve on that

High feed costs and comparatively low cost of other competing meats
However through the sale of eggs/meat can boost family’s income.

Breeds of chickens
Light breeds
- **White leghorn**-has white plumage with yellow legs and beak The cock weighs 3kg with a firm comb while the hen comb is large and may flop over one eye and the hen 2kg
- **Other light** breeds are Ancona, Minorca and the Sykes

Heavy breeds
- **Rhode Island Red**-Has broad, deep body and lowly set tail. The flesh and legs are yellow
  - The cock has medium sized comb which stands upright.
  - Plumage is reddish brown, cock weighs 4kg, hen 3kg when all heavy breeds finish laying will provide valuable carcass.
- **Other heavy breeds**-Light Sussex and New Hampshire

Hybrids
- Crossed two inherent different breeds of chicken
- Present day hybrid birds are capable of reaching an average live weight of 2kg in 56 days and laying over 200 eggs per hen during the laying season,
- Examples Thorner 404 and 707, Hiline stock, shavers, sterling and Ross birds

Rearing systems
- Can be done intensive and extensive system of MGT
- Commonly used ones are
  1. **Free range system**
  2. **Fold system**
  3. **Deep litter system**
  4. **Battery cages**

1. **Free range system**
   - Chickens growing and laying eggs are left to roam in a perimeter fence
   - Adopted where there is enough land 200-300 per hectare
- Eats randomly insects, grasshoppers, green grass etc
- Vices such as cannibalism, feather pecking, egg eating and broodiness are reduced to minimum
- Area becomes progressively contaminated with diseases and parasites

2. Fold System
- Limited number of birds can be kept in this system.
- Birds are confined in small movable houses known as folds or arks-3.5mx1.5mx1.5m for 10-15 birds
- 1/3 of the fold is roofed to provide shelter and laying place, other part is open covered with suitable wire
- The folds are movable in one area to the other for fresh air
- **Advantages of this system**
  1. Manure is spread evenly
  2. Feed cost is reduced
  3. Worm and parasite build up is reduced.

However the folds are not durable, if a lot of chicken are to be kept many folds are to be made.

3. Deep Litter system
- Birds are confined throughout their life in the house
- House is well ventilated and insulated to keep the birds healthy
- House should be sited in a well-drained and easy to clean place.
- House is filled with appropriate litter (saw dust, woodshavings, crushed maize cobs or chopped straws) 10-15cm high
- Old litter should be mixed with fresh litter to inject bacteria which break down down the droppings and thus keep the litter dry and warm.
- The litter may become dump if the house is leaking, high humidity. This can be controlled by constant raking
- Remove old litter when new stock of birds is to be kept.
- 2-3 birds per meter square
- Laying nests, resting perches, feed and water troughs should be provided

**Advantages**
1. Low initial capital investment in housing
2. Low labour needs and high stocking rates

**Disadvantages**
1. High cannibalisms
2. High egg eating
3. Predisposition of chicken if litter is dump
4. Inaccurate egg record per hen.
5. If litter is not available risk to diseases
6. Welded /slated floor is also used for droppings to slate below the floor.

4 Battery systems
- Most intensive system and birds are confined in cages
- Per cage 1-4 birds
- Cages are made of wire and are placed in tiers one above the other in the whole house.
- Each cage has a sloping floor to allow eggs flow to one side
• Since the droppings fall onto the floor, the lowest tier of cages should be 0.6m to 0.9m above the floor to facilitate cleaning
• Watering and feeding are continuous throughout the length of the cages
• The battery house should be well lighted and ventilated
• Floor should be concrete or cemented

Advantages
1. High stocking rates is achieved
2. Individual hen stock rates can be easily kept.
3. No egg eating, cannibalism, contamination of food and water

Disadvantages’
1. High capital required.

Management of Poultry
• Incubation; dfn-the embryonic development of fertile egg to chick hen takes 21 days; Ducks 28 days, Turkeys 28 days and Geese 30 days
• Incubation can be natural or artificial
• Natural incubation;
  • Hen sits on the 10-15 eggs and provides the heat for 21 days.
  • Laying box should be provided
  • Survival to hatching is high.
• Artificial incubation
  • Done in an incubator and special training is required, conditions are maintained at an optimum level for hatching for instance temperature, moisture and aeration are controlled

• Brooding
  • During 8 weeks after hatching chick needs to be kept in an enclosure supplied with heat.
  • Brooding house should be well ventilated and provide with water/food.
  • 1st few weeks temp-25-30 degrees and reduce it gradually there after.
  • Chicks at this stage should be fed on finely ground grains and skimmed milk, starters mash may be used contains 20-22 %protein
  • Debeaking to be done in 8-10 days

Rearing of growers
• 9 -22nd week chicks
• Need 18-20cm cubic space for 100 birds
• Diet (Growers mash) should contain a proportion of insoluble grit, 16-17% protein

Rearing of layers
• 22-24 weeks start laying eggs
• Well fed, grit in diet to produce strong egg shells, enough space of 0.3msquare per bird.

Rearing of table birds
• Chickens kept for meat production only
There are various classes of table birds.

**Broilers**
- 60-70 days ready for slaughtering, 2kg body weight

**Roasters**
- Slaughtered at 3-5 months; less tender than broilers.

**Capon**
- Castrated cockerels sold at 16-22 weeks, 3-3.5kg weight

Meat birds should have their feeds with high energy to produce rapid growth. After the 10\textsuperscript{th} week the protein content should be low.

**Egg quality**
- Characteristics; strong, regular and clean shell, the albumen should be thick, clear and firm; yolk should be light-colored well centered and free from blood and meat spots
- ;

1. Ensure the following is done to get good quality eggs

**Ask plenary**
- Feed the laying hens with proper rations containing minerals and grit
- Provide clean nesting materials
- Gather eggs frequently
- Clean dirty eggs and keep them in a cool place.
- Candle eggs to look for blood spots/meat
- Separate eggs in small/medium/large. Pack carefully and sell them immediately.

**Production records**

**Rearing records**
- Daily food consumption.
- Number and cost of purchased chicks
- Cost of heating the brooder
- Labour and medicine cost
- Dead chicks

**Layers records**
- Number/value of hens as they start
- Number of eggs collected per day
- Daily food consumption
- Labour and medicine cost
- Number of dead hens
- Number of culled hens

Qts why are chickens considered as the most successful poultry for rearing
Name the main hazards in encountered in poultry farming
# Table of contents

<table>
<thead>
<tr>
<th>Part 1</th>
<th>Pg 1/27</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSG Training</td>
<td></td>
</tr>
<tr>
<td>Covering page</td>
<td>Pg 1</td>
</tr>
<tr>
<td>Introduction</td>
<td>Pg 2</td>
</tr>
<tr>
<td>Module 1</td>
<td></td>
</tr>
<tr>
<td>Nutrition</td>
<td>Pg 4-7</td>
</tr>
<tr>
<td>Classes of food</td>
<td>Pg 4</td>
</tr>
<tr>
<td>Functions and Food sources of Nutrients</td>
<td>Pg 4/6</td>
</tr>
<tr>
<td>Micro-Nutrient Deficiency</td>
<td>Pg 6/7</td>
</tr>
<tr>
<td>Module 2</td>
<td></td>
</tr>
<tr>
<td>MSG Construction/Establishment</td>
<td>Pg 8-14</td>
</tr>
<tr>
<td>Components of MSG</td>
<td>Pg 8</td>
</tr>
<tr>
<td>Tools/Equipments for MSG</td>
<td>Pg 9</td>
</tr>
<tr>
<td>MSG Construction</td>
<td>Pg 10</td>
</tr>
<tr>
<td>Purpose of various Equipments</td>
<td>Pg 10</td>
</tr>
<tr>
<td>Suitable vegetable for MSG</td>
<td>Pg 11/12</td>
</tr>
<tr>
<td>Seeds and seedlings production</td>
<td>Pg 12</td>
</tr>
<tr>
<td>Transplanting seedlings</td>
<td>Pg 13</td>
</tr>
<tr>
<td>Water in MSG</td>
<td>Pg 14</td>
</tr>
<tr>
<td>Module 3</td>
<td></td>
</tr>
<tr>
<td>Malnutrition</td>
<td>Pg 16/17</td>
</tr>
<tr>
<td>Module 4</td>
<td></td>
</tr>
<tr>
<td>Target and Targeting</td>
<td>Pg 18</td>
</tr>
<tr>
<td>Module 5</td>
<td></td>
</tr>
<tr>
<td>Pest/Disease control</td>
<td>Pg 19/21</td>
</tr>
<tr>
<td>Module 6</td>
<td></td>
</tr>
<tr>
<td>Harvesting /Food Preservation</td>
<td>Pg 22</td>
</tr>
<tr>
<td>Cooking methodologies</td>
<td>Pg 23</td>
</tr>
<tr>
<td>Food Preservation Methods</td>
<td>Pg 23/24</td>
</tr>
<tr>
<td>Cooking Methods of Preserved veggies</td>
<td>Pg 25</td>
</tr>
<tr>
<td>Communication</td>
<td>Pg 26/27</td>
</tr>
<tr>
<td>Part 2</td>
<td></td>
</tr>
<tr>
<td>Poultry production</td>
<td>Pg 28-31</td>
</tr>
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