Agricultural Extension Development Officers’ Handbook on Good Agricultural Practices

Sustainable Agriculture Production Programme
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FOREWORD

Good Agricultural Practices (GAPS) have been known to contribute towards sustainable agricultural development in Malawi. These GAPS range from crop husbandry practices to post harvest handling and management. The positive impacts that GAPS have on improving the livelihoods of the rural farming communities cannot be overemphasized. Currently, there is a broad range of options for GAPS suitable for rain fed crop production in the various agro-ecological zones and farming systems of Malawi. Many of these have been tested and found to produce significant increases in yields thereby contributing to food, income and nutrition security among the small holder farmers.

However, few of these GAPS have so far “taken off” into widespread spontaneous adoption. In view of this the Malawi government through the Ministry of Agriculture, Irrigation and Water Development (MOAIWD) with support from IFAD is implementing the sustainable Agriculture Production Programme (SAPP). The main thrust of the Programme is enhancement of agricultural productivity based on simple/affordable Good Agricultural Practices (GAPS) which are suitable for smallholder adoption, and will help to bridge the large gap between actual and potential crop yields.

Therefore to ensure increased “take off” and widespread adoption of these GAPS, the AEDO hand book has been developed. The Good Agricultural Practices AEDO handbook will serve as an up to date reference material for the AEDO. In addition, the Ministry recognizes the heavy work load that the AEDO has as such the hand book has been developed in an attempt to provide the AEDO with up dated, handy and user friendly technical information. This handbook contains updated information on maize production, legume production, legume crop associations, conservation agriculture, extension methodologies that are being promoted in the project. In addition the handbook provides the AEDO with information on communication skills, food and Nutrition and; gender and HIV mainstreaming in agriculture.

Apart from assisting the frontline staff who are implementing SAPP the Handbook can also be used by staff who are implementing similar agricultural projects across the country. I therefore appeal to all concerned departments, Managers at all levels, Subject Matter Specialists and stakeholders to actively participate in the effective use of this handbook in order to promote adoption of Good Agricultural Practices in Malawi.

Erica Maganga (Mrs.)

SECRETARY FOR AGRICULTURE, IRRIGATION AND WATER DEVELOPMENT
ACKNOWLEDGEMENTS

The Ministry of Agriculture, Irrigation and Water Development would like to thank the team that actively participated in the development of this handbook. Particularly, the Ministry would like to thank the following people who worked tirelessly to develop this manual: Dr. C. Chowa, Mr. K. Chaula, Mrs E. Lungu-Mwatuwa, Mrs. F. Masambuka-Kanchewa, Mr. O. Chirwa, Mr. E. Kumwenda, Mr. D. Siyeni, Dr. J. Chintu, Dr. A. Ngwira, Mr. H. Chimala, Mr. E. Kanyimbo, Mr. R. Mkisi, Mr. B. Mandula, Mr. W. Nzima, Mr. C. Amoni, Mr. P. Fatchi, Mr. H. Hunga, Mr. J. Kanyangalazi and Mr. N. Limbani.

The Ministry also thanks all frontline staff and Subject Matter Specialists from the SAPP implementing districts for their participation in the pretesting of this handbook and for their constructive comments towards the perfecting of this handbook. The Ministry further appreciates the tremendous work towards the reviews of this handbook for technical soundness and readability which was done by the following officers Mr. A. Chikomola, Mr. Malota, Mrs. Mwale and Mrs Y. Tegha

Appreciation should also go to the International Fund for Agriculture Development (IFAD) for funding the production of this handbook through the Sustainable Agriculture Production Programme.

Finally, but not least, the Ministry would also like to thank Mrs. F. Masambuka-Kanchewa and Mr. H. Chimala for editing the handbook and Mr. McLean G. Mafubza, Mrs. Tawonga Msiska, Mr. M. B. Mkambeni and Ms E. Kazembe for designing the handbook.
1. INTRODUCTION TO SUSTAINABLE AGRICULTURE PRODUCTION PROGRAMME

The Sustainable Agriculture Production Programme (SAPP) is being implemented in Malawi under the Ministry of Agriculture Irrigation and Water Development. The Programme will be implemented over a nine year period as an “earmarked” project within the ASWAp. The goal of the programme is to contribute to reduction of poverty and improved food security among the rural population. The objective is to achieve a viable agriculture sector employing good Agricultural Practices (GAPs) based on simple and affordable technology. The programme has three components namely Adaptive Research and Knowledge Management, Farmer Adoption of Good Agricultural Practices and Programme Coordination and Management. Figure 1 provides an overview of the Programme illustrating how the various components and sub-components will contribute to the achievement of the objectives.

The main thrust of the Programme is enhancement of agricultural productivity based on simple and affordable GAPs which will help to bridge the large gap between actual and potential crop yields. The programme is designed to greatly improve the effectiveness and impact of the FISP, which provides access to improved seeds and fertilizers, but does little to promote their efficient and effective use. An adaptive research programme will be supported to fine-tune GAP packages to Malawian socio-economic and agro-ecological conditions; in conjunction with knowledge management and communication initiatives. A range of extension tools will be deployed to train farmers to adopt GAPs that will sustainably increase staple crop yields (e.g. maize, pigeon peas, groundnuts and cassava), improve soil health, and enable greater crop diversification and commercialization. The Programme will also facilitate farmers in obtaining access to the inputs needed to utilize GAPs including tools, equipment, seeds of alternative (mainly legume) crops, fertilizers, financial services, post-harvest facilities, and improved market infrastructure.

The programme is expected to increase adoption of Good Agricultural practices among farmers who will participate in the project. This will be based on a low-cost farmer-to-farmer extension network modelled on several successful partnerships between the MOAF Department of Agricultural Extension Services (DAES) and NGOs. The network will engage around 200,000 farm households (of which at least 50% will be female or child-headed) and will be structured as follows:
Table 1: Proposed and Simple and Affordable Network

<table>
<thead>
<tr>
<th>No of Districts</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of District Stakeholder Panels</td>
<td>6</td>
</tr>
<tr>
<td>No of District Agricultural Extension Coordinating Committees (DAECCs)</td>
<td>6</td>
</tr>
<tr>
<td>No of Extension Planning Areas (EPAs)</td>
<td>45</td>
</tr>
<tr>
<td>No of Area Stakeholder Panels</td>
<td>45</td>
</tr>
<tr>
<td>No of Agricultural Extension Development Coordinators (AEDCs): 1 per EPA</td>
<td>45</td>
</tr>
<tr>
<td>No of Field Officers: 1 per EPA</td>
<td>45</td>
</tr>
<tr>
<td>No of Agricultural Extension Development Officers (AEDOs): 14 per EPA</td>
<td>650</td>
</tr>
<tr>
<td>No of Lead Farmers: 5 per AEDO</td>
<td>3,250</td>
</tr>
<tr>
<td>No of Farmer Groups: 3 per Lead Farmer</td>
<td>9,750</td>
</tr>
<tr>
<td>No of Farmers: 20 per Farmer Group</td>
<td>200,000</td>
</tr>
</tbody>
</table>

Figure 1: Summary of components, outcomes and outputs for the SAPP
2. AGRONOMIC PRACTICES FOR MAIZE AND LEGUME PRODUCTION

2.1 Maize Production

Maize is one of the cereal crops which is the main food crop in Malawi. Despite being this, the crop can also be a source of income for farmers as it is also being used as a raw material in a number of products such as poultry feed and beer. It is grown under rain-fed or irrigated conditions in Malawi. Nationally, it is aimed at attaining and maintaining its self-sufficiency within Malawi. The objective of the Ministry of Agriculture through various interventions is to increase yield. Generally the crop is beneficial to the farmer in a number of ways the major of which is the main food crop.

Varieties for maize crop

Categories of the varieties of the crop

The varieties for this crop can be categorized three groups as follows:

- Hybrid varieties
- Open pollinated Varieties
- Local Varieties

However, considering that there is need to increase the yields for the crop to maintain self-sufficiency, use of seed of hybrid varieties is encouraged.

Refer to annex 1 for varieties of maize, their agro-ecological suitability and other characteristics

Agronomic practices

Land preparation

Early land preparation is necessary to ensure early planting. Clear, plough and harrow the land where the crop is to be planted.

In most cases, ridges are made after harrowing since the crop is mostly planted on ridges. In some cases, the crop is planted in rows, especially under irrigated conditions.

Ridges and rows are spaced at 75cm apart.
Planting

Under rain fed conditions, planting is done after first rains, when the soils are sufficiently wetted to a depth of 15cm. This is mainly between October and December.

Under irrigation, planting is done when the soil is wet enough to such a depth of 15cm continuously for a longer duration. In most such cases, soils are continuously wet and are in wetted residual conditions

Plant one seed in rows/ridges per stations spaced at 25cm apart.

The rows /ridges should be spaced at 75 cm apart.

Inorganic fertilizer application

Under both scenarios of irrigated and rain fed, basal dressing fertilizer is applied soon after planting or 5 to 7 days after seed emergency.

Apply one Coca-Cola bottle top full of NPK fertilizer under dollop methodology where a hole which is about 3-5cm deep is made between planting stations.

2 bags of NPK (23:21:0+4S) are sufficient for one hectare.

Top dress with UREA fertilizer after 3 to 4 weeks from basal dressing fertilizer application. Use a similar dollop methodology as it was done during basal dressing.

Weeding and weed control

Keep the maize field as free from weeds as possible. This keeps the crop in the field free from competing with weeds for sunlight and other soil nutrients. It also assists in prevention of some pests.

Weeding can be done manually or using herbicides.

Herbicide weed control

Post emergence or pre-emergence herbicides are applied for controlling weeds.

Post emergence herbicides are applied after weeds and the crop have emerged and the target specific weed type.

Pre-emergency herbicides are applied before emergency of the crop and weeds in the field.
Example of pre-emergency herbicide for maize is Harness and dual magnum. Application rates and modalities are indicated on the label for the mentioned type of herbicide.

Crop rotation can also be used to control some weeds such as witch weeds

**Pest and disease management**

**Pests**

<table>
<thead>
<tr>
<th>Pest</th>
<th>Description</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize stalk borer</td>
<td>This is one of the serious pests on maize causing considerable damage in high altitude areas and to the late planted crop.</td>
<td>Use of trichlorfon (dipterex) 2.5 g by applying a pinch (a few granules) into each funnel controls the pest in rain fed crops. At this rate about 8kg per hectare is required. The insect pest can also be controlled by spraying with Endosulfan35 EC and pyrethroids.</td>
</tr>
<tr>
<td>Leaf roller</td>
<td>The larvae infest the leaves, rolling them longitudinally together and live inside the rolled leaf. Leaves are sometimes not actually rolled, but the tips are fastened to the basal part giving the rolled appearance. With heavy infestations plants appear scorched and weakened. High infestation levels may cause severe yield losses. Late planted crops are mostly attacked.</td>
<td>The leaf roller caterpillars can easily be controlled by such pesticides as fenitrothion (sumithion) or carbary (sevin). The rate for leafroller control are for army worm. In small areas with low infestation, clipping of infested leaves and destroying them may help to control the pest.</td>
</tr>
<tr>
<td>Earthworm</td>
<td>The insect is also called African boll worm or tobacco bud worm depending on the crop attacked. In maize the insect pest causes damage by feeding on the silk and soft grains of the cob.</td>
<td>Hand picking is most practical and should be encouraged.</td>
</tr>
</tbody>
</table>
### Diseases of Maize

<table>
<thead>
<tr>
<th>Disease</th>
<th>Description and signs</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tarcicum Leaf Blight</td>
<td>Most widely spread disease in Malawi; known by white blights on leaves. Most improved varieties are vulnerable to the disease.</td>
<td>Use resistant varieties</td>
</tr>
<tr>
<td>Maize streak virus</td>
<td>This disease is widespread in low altitude areas with warm humid environment. It also occurs in high altitude when maize is planted late. The vectors transmitting the virus are leaffoppers (<em>cicadulina</em> spp). The maize planted during off season in dimbas using residual moisture acts as a reservoir of both leaffoppers and the virus</td>
<td>The disease can be controlled by planting early so that the crop passes the vulnerable stage before the population of the vectors grows. Use of tolerant varieties such as DKC 8033, PHB 30G19 and seed dressing by Gaucho is recommended. Apply Gaucho 70 WS 500g in 2 litres of water for 100kgs maize seed</td>
</tr>
<tr>
<td>Cob rot (fusarium spp and diplodia maydis)</td>
<td>The disease can cause 5 to 13 % losses in some seasons depending on time of planting and amount of rainfall.</td>
<td>Cob rots can be controlled by planting tolerant varieties which have good tip cover such as PAN 63, timely harvesting and proper drying of grains before storage</td>
</tr>
<tr>
<td>Grey leaf spot (GSL)</td>
<td>This disease is caused by pathogen called <em>cercospora zae maydis</em> which is a fungi and is carried from season to season in diseased maize residuals. Dissemination is mostly by wind borne spores (wind dispersed), with infected fields acting as initial source of inoculum. Symptoms first appear on the lower leaves moving upwards. Under warm foggy, or humid conditions, the disease quickly affects the whole plant giving it scorched appearance hence the name chiwau. The disease manifests itself mostly at tasseling. Temperatures above 20 °C favour maximum disease spread</td>
<td>Observing good crop husbandry practices such as early land preparation, early planting, burying all diseased plants and others Ensuring that all crop residuals are fully decomposed before planting Rotating maize with non-cereal crops which are immune to GLS such as soy beans where possible Burning severely attacked plants Planting maize varieties that are tolerant to GLS such as PAN 63</td>
</tr>
</tbody>
</table>
Harvesting and storage in maize

Stoking is recommended for cobs to complete drying.

Maize grain for storage should be well treated with storage pesticides such as Actellic upon recommendations on safe use and correct application rates.

2.2 Legume Production

Legumes are very important crops that contribute to improving household food security, nutrition, and soil health and soil fertility. The major leguminous crops grown in Malawi include Ground nuts, Soybeans, pigeon peas and cowpeas.

Importance of Legumes

Legumes are important in Malawi for a number of reasons which include:

Food security and nutrition

Legumes are vital supplement to the largely maize-based diets and are readily available sources of vegetable protein, vitamins and vegetable oil. These major legumes are usually grown under rain-fed conditions in many areas including those that are prone to drought.

Soil fertility improvement and fodder

Inclusion of legumes in cropping systems would help to improve soil fertility as they have the ability to fix atmospheric nitrogen in soils.

Source of Income and foreign exchange

Legumes provide cash farmers thereby contributing to their livelihoods. These crops are exported to generate forex.

2.2.1 Groundnuts Production

Malawi currently promotes two botanical or market types of groundnut, namely: Virginia types in the mid altitude agro-ecology and Spanish types in the lowland agro-ecology.

Currently, six varieties are being promoted, and these are: CG 7, Chalimbana 2005, Nsinjiro, Chitala, Kakoma and Baka.
Recommended Cultural Practices in Ground nut production

Site selection

Groundnut does best on well drained loamy-sand, sandy-loam, or sandy-clay-loam soil with ample calcium and moderate organic matter. Fallow and virgin lands are not suitable for groundnut production as these may have the appropriate natural rhizobium for effective nodulation.

Ideally, a 4-5 month growing season with a steady, rather high to moderate temperature and uniformly distributed rainfall and soil moisture is ideal.

Seed sourcing

Farmers should always use certified seed for higher yields.

Land Preparation

- Plough to a depth of 25-30 cm to achieve loose soil into which the peg can easily penetrate
- Make at 45 cm or 60 cm apart.
- Make flat topped ridges (beds) spaced at 75 cm apart, sowing at two rows spaced at 20-30 cm apart on each bed.

Time of Sowing

- Plant with the first effective rains (approximately 25-30 mm).
- Make a groove 5-6 cm deep on the middle of the ridge, drop a single seed every 10 cm for Spanish varieties and 15 cm for Virginia varieties.
- Cover the groove firmly to ensure rapid and uniform emergence. It is also important that supplying be done within the first week after seedling emergence.

There is need to treat groundnuts kernels with appropriate fungicides such as Thiram or Fernasan D. These fungicides prevent initial losses from seedling diseases and ensure a full stand.

Spacing and seed rate

To ensure optimum plant population and high yields planting at correct ridge or row and plant spacing is crucial.
Table: Recommended Ridge and plant spacing

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Row, station spacing and number of seed per station (cm) under medium management</th>
<th>Seed rate (Kg/ha)</th>
<th>Row, station spacing and number of seed per station (cm) under high management</th>
<th>Seed rate (Kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CG7</td>
<td>75 x 15 x 1 seed</td>
<td>90</td>
<td>75x15x1 seed</td>
<td>110</td>
</tr>
<tr>
<td>Kakoma (JL 24)</td>
<td>90 x 10 x 1 seed</td>
<td>50</td>
<td>75x10x1 seed</td>
<td>60</td>
</tr>
<tr>
<td>Chilimbana 2005</td>
<td>90x15x1 seed</td>
<td>100</td>
<td>75x15x1 seed</td>
<td>110</td>
</tr>
<tr>
<td>Nsinjiro</td>
<td>90x15x1 seed</td>
<td>80</td>
<td>75x15x1 seed</td>
<td>100</td>
</tr>
<tr>
<td>Baka</td>
<td>90x10x1 seed</td>
<td>50</td>
<td>75x10x1 seed</td>
<td>60</td>
</tr>
<tr>
<td>Chitala</td>
<td>90x15x1 seed</td>
<td>90</td>
<td>75x10x1 seed</td>
<td>110</td>
</tr>
</tbody>
</table>

However note that higher yields can be obtained on ridges spaced at 60 cm for Spanish and 75 for Virginia varieties.

Weed control

- Weed at least twice during this critical period is imperative, thus within 20 and 45 days after sowing.
- Hand weeding is encouraged during pegging to avoid damage to developing pods. Chemical weed control can also be done using herbicides such as Dual Magnum, Roundup and Harness and farmers are advised to follow recommendation on the bottle.

Fertilizer application

Groundnuts do not usually respond to direct application of mineral fertilizers. Generally, groundnuts perform well following a well fertilized maize crop, so long as phosphorus, calcium and sulphur-containing fertilizers such as 23:21:0+4S were applied.

- Dress with 100 kg ha$^{-1}$ of single superphosphate (SSP) fertilizer to provide 7% phosphorus, 19.5% calcium, and 12.5% sulphur. The fertilizer should be applied in a band on the ridge, or broadcasted onto the soil and ploughed under before sowing or soon after emergence.
- Top dress with Gypsum at the rate of 200-400 kg/ha directly at the base of the plant when 30% of the plants have flowered will help to correct Calcium deficiency and reduce groundnut pops.
Pest and Disease control

- Groundnuts are attacked by a number of pests and diseases; however the most important and widespread are: Rosette, Early and Late leaf spots and rusts. The diseases can be controlled by early planting at correct spacing, practicing crop rotation, burying previous season infected crop residues and use of chemical control if deemed economical.

- The most important insect pest for groundnuts is aphids transmit the Rosette virus. Aphids can be controlled by early planting and planting at correct spacing.

Harvesting and harvest management

It is common to find pods of different ages on the same plant at any one time the groundnut crop is scouted. Losses of greater than 300-400kg/ha may occur as a result of delayed harvesting while quality gains of 2-3% may be realized within 10 days of optimum maturity date. Ground nuts should be timely harvested to avoid bleaching and discolouration of nuts, sprouting and pods remaining in the ground, and aflatoxin contamination.

Indicators of harvest maturity in groundnut

- Inside of the shell is spotted pale brown.

- 75% of sampled plants show dark colour markings inside the shell, with plump kernels that have reverted to the characteristic colour of the variety, then the groundnuts are mature and ready for harvesting.

- The falling of leaves is not necessarily a sign of maturity. Timely harvesting of groundnuts is essential to avoid bleaching and discolouration of nuts, sprouting and pods remaining in the ground, and aflatoxin contamination.

Harvesting techniques and post-harvest handling of groundnut

Lifting/digging and windrowing

- Dig groundnuts and dry using Mandela cock system

Drying and curing

- After lifting, the groundnut should be quickly and thoroughly dried before storage. Ventilated stacking or Mandela Cock is a modern way of curing the nuts. Small stacks are encouraged since the nuts take a few days to cure depending on environmental conditions in an area.

- Dry pods produce rattling sound when shaken.
Steps to follow in construction of Mandela Cock;

- Construct a circular platform of 1m in diameter,

- Form a base with a few plants are held together at the centre of the platform with the leaves facing down and pods face up, the plants are compressed together up until the whole platform if filled,

- Add more bunches on the periphery of the circle leaving a chimney at the center. In each successive layer, the diameter of the chimney is reduced and the pods are arranged towards the center of the stack. The chimney narrows as more nuts are added and one or two plants are used to close the chimney at a height of about 1.5m. This will take about 2-4 weeks for the nuts to reach about 7-9% moisture content depending of humidity, temperature and wind movement.

**Pic. 1 Base of Mandela cork**  **Pic. 2: Completed Mandela cork**

**Stripping**

- Remove groundnuts from the straws. Majority of farmers’ use hands.

- Use groundnut strippers that can speed the stripping process.

**Storing**

- Store their groundnuts in pods and in well ventilated containers and structures to avoid mould development and aflatoxin contamination.

- Store under dry conditions.
• Wet conditions in storage will enhance the growth of moulds and infection by *Aspergillus flavus* which leads to aflatoxin contamination.

• If stored in bags, stack them on wooden planks or poles to avoid damage from dampness from the wall and the floor.

• Ensure that the bags allow good circulation of air so as to maintain seed vigour and viability.

• Apply recommended storage pesticides

**Shelling**

• Groundnuts are usually shelled prior to sowing or selling, with the majority of farmers shelling by hand.

• Care should be taken when using machines to avoid mixing up of varieties and mechanical damage to the kernels.

• Do not wet pods to prior to shelling as this may lead to development of moulds and aflatoxin

• If using a mechanical shellers sort your pods according sieve sizes. If kernels are too dry before shelling, they end up being split, but if groundnut is dried to recommended moisture content i.e. 7-9%, less than 10% of splits are likely to occur.

**Grading**

• Grade properly, taking out shriveled, rotten, mouldy and split nuts.

• All mouldy nuts should be discarded and not fed to livestock.

• Grade according to other criteria such as variety, seed size and color. The process of grading improves quality of the kernels and is an important determinant of prices.

• Varieties of soya bean
2.2.2 Phaseolus Beans Production

Common Bean Production

Common beans also known as Phaseolus beans is another important leguminous crop. It is grown throughout the country mostly in cool plateau areas.

The bean yields are around 300 to 800kg per hectare. However potential yields are 2000kg/ha for large seeded varieties and 2500kg for small seeded varieties. These yields can be achieved if recommended practices are followed.

Recommended Cultural Practices in Bean Production

Land should be prepared by the end of November for the southern region and by the end of December for the central and Northern regions.

Planting

- Beans should be planted from mid-December to mid-January in southern region and in the month of January in central and Northern regions.
- In relay cropping planting should be done during the months of February and March. In irrigation schemes planting should be done as soon as the summer crop is harvested.

Pure stand and Relay (rain fed) crop

- Dwarf beans should be planted in 2 rows spaced at 30cm on the ridge. Plant 1 seed per station 10 cm apart along each ridge.
- The ridge should be 75cm or 90cm apart.
- This requires a seed rate of 80 and 70 kgs per hectare respectively.
- Climbing beans should be planted on 1 row, 1 seed per station at 15cm apart.
- This requires a seed rate of 75 to 90kgs per hectare.
- Stake climbing beans to maximize podding and to assist the plant to escape disease infestation.
Dimba crop (residual moisture)

- Plant beans on flat as this assists in moisture conservation.
- Plant dwarf varieties in rows 45 cm apart. Plant 1 seed per station spaced at 20 cm
- The seed rate is 35 to 45 kgs per hectare

Irrigated crop

- When planting beans under irrigation follow recommendations under pure stand and interplanted crop.

Fertilizer Application

Fertilizer is needed for root development.

- Use 23:21:0+4s fertilizer at 100 kg per hectare.
- Apply 18 g per 2 metres of ridge length using two and half cupful of cup number 8

Weeding

The crop should be kept weed free during the first 6 to 8 weeks after planting. Avoid weeding during flowering to avoid flower shedding. Hand weeding is applicable when weeds are observed during flowering

Disease Control

Generally all major diseases of beans can be controlled by the use of tolerant varieties such as Napilira, Maluwa, Sapatsika, Nagaga, Kambidzi and Mkhalira.

Anthracnose

This is a fungal disease which produces brown spots on the leaves, stem and pods. To control this disease do the following:

- Spray the crop with Mancozeb (Dithane M45) at the rate of 10 to 15 g per litre of water or Chlorothalonil (Daconil 278w-75) 35g in 10 litres of water.
- Practice a 3 year rotation with cereals
- Bury crop residues
Angular leaf spot

Its symptoms include grey spots which later become dark brown

- Spray Daconil at same rate as with Anthracnose
- Practice rotation

Bean common mosaic virus

Symptoms include dark green sector on leaves and curling of leaves. It is transmitted by aphids

- Spray Dimethoate 20WP or 40EC, 34g or 17ml in 14 litres of water respectively to control aphids fortnightly

Halo blight and common bacterial blight

- These can be controlled by using tolerant varieties, disease free seed and crop rotation

Pest Control

Pests in beans include Bean Stem Maggot, bean beetle and bean aphids

- Maggots can be controlled by adjusting time of planting
- Beetles can be controlled by spraying carbaryl at the rate of 85g in 14 litre of water or 1 litre of water in ULV Sprayer.
- Aphids can be controlled by spraying Dimethoate(WP or EC)

Harvesting

- Harvest when most of the pods on the plant have started drying
- Harvest in the morning to avoid shattering but make sure that dew has evaporated

Threshing

- Do hand threshing to avoid damage
- Threshing can also be done by beating using a stick when the pods have thoroughly dried
2.2.3 Soya Production

Soya bean is one of the leguminous crops that is also grown in various agro-ecological zones of the country.

Site selection

Plant in any soil that is suitable for growing maize but performs

- Avoid poor sandy soils with low content of organic matter.
- Soils that easily compact and form a crust must be avoided for growing soybean because the hypocotyl of soybean seedling breaks easily under pressure.
- A fertile soil ensures that nutrients are available for the soybean crop and therefore minimizes the need for inorganic fertilizer inputs.

Ridge/row spacing:

- Plant soybean either on ridges or flat seedbed
- Make ridges, the ridges should be spaced at 75cm apart
- Make two grooves (20-30 cm apart) on a single ridge where the seed will be placed.
- Plant on row spaced at 45 cm. In either case, plant spacing is 5 cm and 1 seed per plant station
- Seeds should be planted no deeper than 2.5cm.

Time of Planting

- Sufficient soil moisture is necessary at planting. In Malawi, soybeans can be planted in summer (December–April) and/or during winter (off-season) i.e. May/June and harvest around October) with irrigation or in dimbas under residual moisture.
- For the summer crop planting should be done with first planting rains or soon as the rains are well established i.e. 30 mm of cumulative effective rains. Soybean should be planted when it is clear that the rains have properly started.
- In winter season, planting to be done during May/June period but not later than July end.
Use of inoculants:

- Soybean production requires good supply of N for high grain yield. However, like many other legumes, the crop has the ability to meet most of its own N requirement through biological nitrogen fixation after successful nodulation. Inoculants / rhizobia form a relationship with the soybean plant to form nodules/swellings that act as small factories for producing nitrogen.

- Please note that the decision to use inoculants on soybean before planting depends on the variety of soybean you have chosen to plant and land cropping history

Seed rate:

- 80-100 kg/ha for large seeded soybean varieties and 60-80 kg/ha for small seeded soybean varieties such as Tikolore

Fertilizer application

- Apply phosphorus using 2×50 kg bags of 23:21:0 +4S compound fertilizer available in Malawi.

- At planting or one week after planting, incorporate 9-18g fertilizer per meter length of the ridge/row into the made groove in the middle or between the two soybean rows in the ridge.

- If fertilizer application is delayed, it makes the crop grow vegetative without making pods.

Weed management

Proper weed management program can minimize the effects of weeds on growth, development and yield of soybean.

Weed control in soybean could be manual or chemical or both.

Manual weeding

- Carry out the first weeding at 2 weeks after planting and subsequent weeding operations can be done when deemed necessary upon looking at the nature and their infestation in the field.
• **Chemical weed control**: Herbicides for pre-emergence such as dual magnum post-emergence are available for weed control in soybean. If herbicide is applied at planting, one weeding may be required at 5–6 weeks after planting.

• Knowledge of the weed problems in a field and proper weed identification are essential when making herbicide decisions.

**Soybean insect pests and their control**

• During vegetative stage, the crop can be attacked by caterpillars commonly soybean lopper, leaf miners and leaf rollers. Insects that feed on the foliage make up the majority of the insects that attack soybeans and if not controlled may affect final yield because they reduce the plant photosynthetic area.

• Termites can also attack soybean plants at any stage of development from the seed to the mature soybean plant particularly when there is prolonged dry spells.

• From flowering onwards, soybean becomes attractive to pod-sucking bugs that can seriously reduce seed quality. Insect pests can be controlled with a single spray of Cypermethrin or and Dimethoate 10 EC; read the chemical label for application rates and conditions.

**Soybean Diseases and their control**

The most common diseases include Frogeye, bacterial patule and red leaf blotch.

Except for soybean rust and soybean cyst nematode, soybean diseases normally do not result in major yield losses under Malawian growing conditions. From time to time however, weather and growing conditions can combine to produce significant losses from diseases such as Phytophthora root rot, seedling blights, and Phomopsis pod and stem blight. These diseases can be caused by fungi, bacteria and viruses.

In general, soybean diseases can be controlled by:

• Use of certified seed to avoid seed-borne infection or use seed that are produced away from the infection source.
• Use of resistant varieties to prevailing diseases in the area
• Early planting
• Avoiding planting seeds obtained from mosaic-affected plants

Post-harvest operations for soybean grain yield

Primary processing includes threshing, winnowing, cleaning, separation, grading, sorting, packaging, transportation, marketing, storage and so on whilst secondary crop processing involves processing of food for direct consumption.

Threshing soybean

This involves

• Piling soybean plants on tarpaulin or putting dry soybean pods in sacks and beating them with a stick.

• Beating the plants should be gentle to avoid destroying the embryo which eventually may affect germination and overall seed quality.

• The soybean plants can then be winnowed to remove the grain from the soybean debris.

Grading

The purpose of grading is to ensure that discoloured grain, diseased grain, cracked, insect-damaged, shrivelled, any debris and foreign matters are removed.

2.2.4 Pigeon Peas production

Pigeon peas is one of the major grain legume crops in Malawi. The crop has unique characteristics that make it to be an important crop among smallholder farming communities in the country.

Recommended Cultural Practices in Pigeon Peas production

Land Preparation

• Prepare ridges at 75 cm or 90 cm apart. Fields should be properly tilled to conserve soil and water.
Planting

- All farmers are encouraged to use treated seed that should be done with a recommended fungicide before planting to prevent seed-borne and soil borne seedling diseases.

- Planting should be done with the first planting rains or soon after the main crop has emerged where inter-planting is practiced.

Short duration pigeon peas

- Short duration pigeon peas are best produced as sole crop.

- Plant on the ridges which are spaced at between 75 or 90 cm apart on double or single row. Planting on single row requires 2 plants per station, 20 cm apart. Planting on double rows which are spaced at 30 cm apart require one plant per station, 10 cm apart.

- In either case, 75 cm ridge spacing gives a plant population of 111,110 plants per hectare and a seed rate of 16 to 25 kg per ha. Seed yields of the short duration pigeon pea varieties are reduced when intercropped with maize on the same ridge due to shading by the maize plants. The only way to plant short duration pigeon peas with maize is where the maize and the short duration pigeon pea are planted on alternate ridges or in strips of 2 or more ridges.

- Medium and long duration pigeon peas

- Plant 2 seeds per station spaced at 60 cm on ridges of either 75 or 90 cm apart. This requires a seed rate of 8 kg per hectare and the expected plant population is 37,000 and 44,444 plants per hectare at 90 cm and 75 cm ridge spacing respectively.

Management Options

- All early maturing pigeon pea varieties have to be sprayed twice between 50% and full flowering and twice between 50% and full pod to control insect pests.

- Cut worms, white grub, elegant grasshopper and aphids feed on young seedlings.
Pests Management

- The field should be weed free especially in the initial stages of establishment. This is crucial for pigeon pea because initial growth is slow, consequently the crop may not withstand any competition for water nutrients or light.

Insects

- Leaf eaters, pod borers, jassids, thrips can cause up to 70% losses in yields. Flower beetles or blister beetles cause serious damage to flowers. Without exception, all early maturing pigeon pea varieties have to be sprayed twice between 50% and full flowering and twice between 50% and full pod to control insect pests.

Table 4: Chemical control in pigeon peas

<table>
<thead>
<tr>
<th>Insect pest</th>
<th>Chemical</th>
<th>Formulation</th>
<th>Rates</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aphids</td>
<td>Dimethoate</td>
<td>20 WA</td>
<td>34g/litre</td>
<td>Spraying</td>
</tr>
<tr>
<td></td>
<td>Dimethoate</td>
<td>40 EC</td>
<td>17ml/14 litre</td>
<td>Spraying</td>
</tr>
<tr>
<td>Cutworms/Whitegrubs</td>
<td>Carbaryl</td>
<td>85g/14 litre</td>
<td>85g/14 litre</td>
<td>Drenching</td>
</tr>
<tr>
<td>Flower/leaf eaters</td>
<td>Carbaryl</td>
<td>85 WP</td>
<td>85g/litre of water</td>
<td>Spraying</td>
</tr>
<tr>
<td>Pod suckers</td>
<td>Dimethoate</td>
<td>40 EC</td>
<td>17ml/14 litre</td>
<td>Spraying</td>
</tr>
<tr>
<td>Pod borers</td>
<td>Carbaryl</td>
<td>85 WP</td>
<td>85g/litre of water</td>
<td>Spraying</td>
</tr>
<tr>
<td>Storage pests</td>
<td>Decistab</td>
<td>2.5 EC</td>
<td>5 g/ha</td>
<td>Spraying</td>
</tr>
<tr>
<td></td>
<td>Karate</td>
<td>5 EC</td>
<td>12ml/14 litres</td>
<td>Spraying</td>
</tr>
<tr>
<td></td>
<td>Actellic Super</td>
<td>Dust</td>
<td>25g/50kg</td>
<td>Dusting</td>
</tr>
<tr>
<td></td>
<td>Super Guard</td>
<td>Dust</td>
<td>25g/50kg</td>
<td>Dusting</td>
</tr>
</tbody>
</table>

2.2.5 Cow Peas production

Cowpea are a major source of plant proteins and vitamins for man, feed for animals, and also a source of cash income. The young leaves and immature pods are eaten as vegetables. Cowpeas provide soil nitrogen to cereal crops (such as maize, millet, and sorghum) when grown in rotation, especially in areas where poor soil fertility is a problem. It does not require a high rate of nitrogen fertilization; its roots have nodules in which soil bacteria called Rhizobia help to fix nitrogen from the air.
**Climatic and soil requirements**

Cowpea can be grown under rainfed conditions as well as by using irrigation or residual moisture along river or lake flood plains during the dry season, provided that the range of minimum and maximum temperatures is between 28 and 30°C (night and day) during the growing season. Cowpea performs well in agro-ecological zones where the rainfall range is between 500 and 1200 mm/year. However, with the development of extra-early and early maturing cowpea varieties, the crop can thrive in the Sahel where the rainfall is less than 500 mm/year. It is tolerant of drought and well adapted to sandy and poor soils. However, best yields are obtained in well-drained sandy loam to clay loam soils with the pH between 6 and 7.

**Important steps in growing cowpea**

**Site selection**

Proper site selection is very important. Select a well-drained sandy loam soil for rainfed cowpea, or inland depressions and along the shores of a lake for dry season cowpea using residual moisture. Cowpea does not tolerate excessively wet conditions or waterlogging and should not be grown on poorly drained soil.

**Choice of varieties**

Select a variety suited to your agro-ecological zone, based on suitability for the prevalent climatic conditions and cropping systems. The choice of variety is based on maturity period, yield potential, drought tolerance, responsiveness to day length, and pest and disease resistance.

**Table 1. Criteria in selecting a cowpea variety for a particular environment**

<table>
<thead>
<tr>
<th>Production limitation</th>
<th>Variety to use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought</td>
<td>Drought tolerant and early maturing</td>
</tr>
<tr>
<td>heat</td>
<td>Heat tolerant</td>
</tr>
<tr>
<td>Striga infestation</td>
<td>Striga resistant</td>
</tr>
<tr>
<td>Short rainfall</td>
<td>Extra-early and early maturing</td>
</tr>
<tr>
<td>(300–500 mm/year)</td>
<td>(Look out for the varieties that have a maturity period that falls within 60–80 days.)</td>
</tr>
<tr>
<td>Pests and diseases</td>
<td>Resistant to some major pests and diseases</td>
</tr>
</tbody>
</table>
Variety | Drought | Striga / Alectra infestation | Maturity period | Pest & diseases | Recommended areas
---|---|---|---|---|---
Sudan1 | Survives intermittent drought | Not resistant | medium | susceptible | Low to high altitude
Mkanakufiti | Tolerant | Resistant to both | Early-Medium (70-80 days in mid- & 60-70 days in low altitude) | susceptible | Low-Mid-altitude
IT82E-16 | Tolerant | Not resistant | Early-Medium (72-80 days) | susceptible | Low to high altitude

**Pre-planting**

**Land preparation**

Clear the site of shrubs and stubble. Alternatively, spray the field with Glyphosate (Round-up) at the rate of 4 L/ha (about 2 1/3 milk tins of chemical in a 15-L sprayer or 3 milk tins of chemical in a 20-L knapsack sprayer) to kill emerged weeds. Land can also be prepared manually with the African hand-hoe. Plow and harrow the field to provide sufficient tilth for good root growth. Make ridges thereafter if desired. Where the soils are more fragile and prone to erosion, adopt minimum or zero tillage.

**Seed requirement**

Use about 12–25 kg/ha of cowpea seeds, depending on the variety, seed size, cropping system, and viability of the seeds. More seeds are required when erect varieties are used than when prostrate varieties are adopted, because of the closer spacing of the erect variety. Also, fewer seeds are required when the cowpea is to be grown in mixture with other crops. The larger the seeds, the more seeds/ha are required.

Table 5: Shows the seed rate/ha for the different cowpea types

<table>
<thead>
<tr>
<th>Cowpea type</th>
<th>Maturity</th>
<th>Spacing (cm)</th>
<th>Qty of seeds/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erect</td>
<td>Early</td>
<td>50 × 20</td>
<td>25 kg</td>
</tr>
<tr>
<td>Semi-erect</td>
<td>Early/medium</td>
<td>75 × 20</td>
<td>20 kg</td>
</tr>
<tr>
<td>Prostrate (creeping)</td>
<td>Medium/late</td>
<td>75 × 30</td>
<td>16 kg</td>
</tr>
<tr>
<td>Prostrate</td>
<td>Late</td>
<td>75 × 50</td>
<td>12 kg</td>
</tr>
</tbody>
</table>
Seed preparation for planting

Select good seeds (Fig. 1a) without damage holes or wrinkles (Fig. 1b) for planting.

![Good seed](image1) ![Bad seed](image2)

Planting

When to plant

When establishing a cowpea farm, do not plant too early so that the crop does not mature during the rains, and also do not plant too late to avoid the danger of an early end to the rains. The important criterion is to determine the onset and duration of the rains and, more importantly, the maturity period of the cowpea variety. This will guide you on when to establish your cowpea farm. Most of the semi-erect and prostrate varieties are photosensitive. When planted early, they will not flower but grow very leafy and yield may be reduced.

Sowing and spacing for sole cowpea

Erect cowpea varieties should be planted at a spacing of 50 cm between rows and 20 cm within rows, especially for extra-early maturing varieties (60–70 days). For semi-erect varieties, spacing should be 75 cm between rows and 25–30 cm within rows. For prostrate varieties, plant at a spacing of 75 cm between rows and 50 cm within rows. For all recommended plant spacings, sow 3 seeds/hill and thin to 2 plants/stand at 2 weeks after planting. Cowpea should be planted either on ridges or on flat beds, depending upon the field preparation. Planting is usually manual, since mechanical planters are not readily available.
Sowing and spacing for cowpea + cereal mixture

Where cowpea is to be intercropped or relayed with other crops, such as maize, the spacing should be 75 cm × 50 cm. Also the cowpea should be planted at about 4–6 weeks after planting the first crop, maize, sorghum, or millet. For strip intercropping, adopt 2 rows of cereal to 4 rows of cowpea to improve the productivity of erect and shade-sensitive cowpea varieties. The cereal and cowpea should be planted at the recommended spacing.

Sowing depth

Sow seeds at a depth of 2.5 to 5 cm for most varieties; planting seeds more than 5 cm deep will delay emergence. The seeds may rot and plant stand will be uneven.

Fertilizer rate and application

Cowpea does not require too much nitrogen fertilizer because it fixes its own nitrogen from the air using the nodules in its roots. However, in areas where soils are poor in nitrogen, there is a need to apply a small quantity of about 15 kg of nitrogen as a starter dose for a good crop. If too much nitrogen fertilizer is used, the plant will grow luxuriantly with poor grain yield. Cowpea requires more phosphorus than nitrogen in the form of single super phosphate or SUPA. About 30 kg of P/ha in the form of Supa is recommended for cowpea production to help the crop to nodulate well and fix its own nitrogen from the air.

Weed control

Weeds are a serious problem in cowpea production and, if not well managed, can harbor pests and reduce both the yield and the quality of the grain. Fodder yield can also be reduced. Cowpea is not a strong competitor with weed, especially at the early stage of growth. The type of weed control measures adopted should be based on the nature of the problem and the resources available to the farmer. Weed control in cowpea could be during pre-planting and either manual or chemical.

Pre-planting weed control/zero tillage

Spray with Glyphosate where there are troublesome weeds such as sedges and spear grass or when minimum/zero tillage practices are desired. Glyphosate kills the weeds right from the roots and thus allows the farmer to prepare the field or plant the crop without the fear of the troublesome weeds emerging within the same season. Glyphosate is marketed in different brand names, such as Glycel, Force Up, Round Up, Delsate, Uproot, Sarosate, Touchdown, and Clearweed, Kill off, Bushfire, etc.
Manual weed control:

Manual weed control is the most common method used by farmers in cowpea production. Weed cowpea twice with the hoe, first at 2 weeks after planting, and secondly at 4–5 weeks after planting to ensure a clean field. Poor weed control or delay in weeding causes a drastic reduction in yield.

Chemical weed control:

Herbicides, if used properly, are safe and effective in controlling weeds in cowpea. The choice of herbicide, however, depends on the predominant weed species and the availability of the herbicide. If herbicide is used at planting, one hoe weeding may be required at 4–5 weeks after planting. Application of a tank mixture of Parquet and Pendimethalin within 2 days of planting is recommended. Paraquat controls emerged grass and broadleaf weeds while Pendimethalin prevents weed seeds from germinating.

Parasitic weeds:

The two types of parasitic weeds that attack cowpea are *Striga* (Fig. 3) and *Alectra* (Fig. 4) but *Striga* has a more devastating effect than *Alectra*. *Striga gesnerioides* is widespread in areas with low rainfall and poor soil fertility, conditions that are common throughout the northern Guinea and Sudan savanna zones. It causes yellowing between the veins of cowpea leaves, resulting in the death of infested plants. The problem becomes when soil moisture is limiting.

The seeds of these parasites can survive in soil for many years (more than 20 years) until a susceptible variety is planted. Cultural control measures that are affordable to farmers include cowpea–cereal rotation and the use of resistant cowpea varieties.
Cowpea diseases and their control

Fungal, bacterial and viral diseases affect cowpea. Different diseases affect different parts of the crop at different stages of growth. The major and common diseases are anthracnose, *Sclerotium* stem, root and crown rot, damping off, *Cercospora* leaf spot, *Septoria* leaf spot, *Fusarium* wilt, and scab.

Control measures include:

- Adopt crop rotation.
- Use clean seeds.
- Dress seeds before planting (Apron Star).
- Use a resistant variety.
- Uproot and bury infected plants.
- Plow contaminated topsoil to reduce the incidence of pathogens. Apply fungicide (Benomyl or Mancozeb) to leaves at the rate of one small matchbox-full in a 15-L sprayer.

Insect pests and their control

Insect pests are major constraints to cowpea production in West Africa. The crop is severely attacked at every stage of its growth by a myriad insects that make the use of tolerant varieties and insecticide sprays imperative. The level of insect attack increases from the southern Guinea savanna towards the Sahel savanna zone of the region. Damage by insect pests on cowpea can be as high as 80–100% if not effectively controlled. Cowpea pests can be classified into three major groups: pre-flowering, flowering/post-flowering, and storage. Some of the major and important pests of cowpea are discussed below.

**Pre-flowering pests**

**Cowpea aphid (**Aphis craccivora**):**

The adult aphid is a medium-sized, shiny black insect. It not only causes direct damage to the cowpea plant but also acts as a vector in transmitting of Cowpea aphid-borne mosaic virus. The aphid damages young cowpea seedlings by sucking sap from the undersurface of young leaves and stem tissues, and on the pods of mature plants. The honeydew produced on the plant (**Fig. 5**) is evidence of aphids feeding on the crop.
Flowering/ postflowering pests

Flower thrips (Megalurothrips sjostedti [Taeniothrips sjostedti]):

They are frequently responsible for total crop loss. The adult thrips are very tiny black insects, and are found feeding on flower buds and flowers. Severely infested plants do not produce any flowers. When the population of thrips is very high, open flowers are distorted and discolored. Flower buds and flowers fall prematurely without forming any pod (Figs 6a and 6b).

Blistter beetle (Mylabris spp.):

They feed on cowpea flowers leading to considerable crop damage. Large numbers of beetles in a field may result in total crop loss. The adult beetles are attracted to maize pollen. Cowpea fields near to or intercropped with maize often suffer serious damage. It is difficult to control this pest with insecticide sprays as the beetles feed on flowers that persist only for a day (Fig. 7).

Maruca pod borer (Maruca testulalis):

Maruca is widely distributed throughout the tropics and subtropics where it may cause extreme damage. The adult is a nocturnal moth, light brown with whitish markings on its forewings. The larvae feed on tender parts of the stem, peduncles, flower buds, flowers, and pods (Figs 8a and 8b).

Pod-sucking bugs (Anoplocnemis curvipes):

This is a major pest of cowpea in tropical Africa. Yield losses caused by curvipes vary from 30 to 70%. They suck the sap from green pods, causing them to shrivel and dry prematurely, resulting in seed loss. Clean up haulms from previous crops, as these insects may survive over season in such rubbish. Plant resistant cowpea cultivars and spray with recommended insecticides (Figs 9a and 9b).

Insect pest control in the field

Generally, 2–3 sprays with insecticides are required for a good crop of cowpea, depending on the severity of insect attack and also on the cowpea variety. Late-maturing varieties require more sprays than early maturing varieties because of the staggered flowering period.
First spraying:
Conduct the first spraying between 30 and 35 days (4–5 weeks) after planting when flower bud initiation has started. This will control thrips and an early attack of *Maruca* pod borer and ensure good flowering (7–9 weeks). For varieties susceptible to aphids, one spraying may be needed at seedling stage, 14–21 days after planting.

Second spraying:
Conduct the second spraying 10 days after the first spraying when the crop is in full flowering and podding.

Third spraying:
Conduct the third spraying when necessary, 10 days after the second spraying for medium/late-maturing varieties and when there is a heavy attack of *Maruca* and pod bugs.

Harvesting
Harvest cowpea when the pods are fully mature and dry (Fig. 10). In early-maturing and erect varieties, one picking may be sufficient. For indeterminate and prostrate varieties, the dried pods can be picked two or three times. The pods do not mature at the same time because of the staggered flowering period. After harvest, thresh the cowpea pods, clean the seeds, and separate them from the chaff or haulms through winnowing.

Postharvest
Storage
Clean out the store thoroughly before a new crop is loaded. Old residues should be burned. Only well-dried and properly cleaned seeds should be stored (Figs 11a and 11b).

A well-dried cowpea seed should have less than 10% moisture content. Such seeds make a cracking sound when crushed between the teeth.

Storage pests and their control
The most important storage pest of cowpea is the weevil (bruchid) called *Callosobruchus maculatus*. Severe infestation can lead to total grain loss in storage. It is a field-to-store pest; adult beetles lay eggs on pods (in the field) or on seeds (in storage). After hatching, the larvae develop within seeds and eat up the cotyledon, thereby causing extensive damage. Adult emerge from the seeds through characteristic holes made by the larvae. The holes make it easy to recognize infested seeds (Fig. 12). Adopt store hygiene and fumigation, and use airtight containers to control bruchids.
Short-time storage for grains

- Store the grains in airtight containers, such as sealed oil drums, locally constructed tanks, high-density plastic sacks or butyl rubber bags, or mix 5 mL of groundnut oil with 1 small mudu (1 kg) of grains.

- Store seeds by packing them into jute or polypropylene bags with polythene inner liners or by triple bagging.

- Keep rodents away.

Long-time storage for seeds and grains

- Fumigate with Dichlovos (DDVP) combined with Primophos methyl or Phosphine gas at the rate of 1–2 tablets/100 kg of seeds.

- Wrap the Phostoxin tablet in a piece of cloth or tissue paper or perforated envelope before placing it inside the container.

- Do not use Phostoxin directly without wrapping it or in a container that is not airtight.

- Aluminum phosphide is marketed as Phostoxin, Cyclotoxin, Forcetoxin, Protex, Gastoxin, etc.

- Do not store cowpea treated with Phostoxin in a living room or animal house.

- Remove and dispose of the Phostoxin residue and expose grains in the open air for 1–2 hours before use.

- Store seeds by packing them into jute or polypropylene bags with polythene inner liner or triple bagging, or mix 100–200 mL of Actellic 25 EC in 5 L of water and spray 100 m² of the store or 10 bags of grains, and/or mix 16–40 mL of Actellic 25 EC with 1–2 L of water and mix with 10 bags of grains.

- Do not use or sell cowpea grains that have been mixed with storage chemical until after 6 months of storage.

- Ensure good hygiene in the store and check every 2 weeks for any change in storage conditions.

- Keep rodents away.
2.3 Maize-Legumes Crop Association

2.3.1 Intercropping

Intercropping is the growing of two or more different crops at the same time on the same field. In many parts of Malawi intercropping is an old traditional practice. Frequently, maize is grown in association with crops such as beans, cowpea, pigeon pea and pumpkins. In brief this method allow one crop to grow together with the other in either symbiosis or antagonism. Therefore, one needs to follow principles of intercropping for better results.

Principles of intercropping

- Choice of compatible component crops with diverse morphology, geometry and density. For example, maize and beans are compatible in that maize acts as stakes for beans while beans fixes nitrogen for maize crop. However, soybean and groundnut may not be compatible with maize owing to the shading effect of the maize crop on either soybean or groundnut.

- Relative time of sowing for component crops. This is mostly common with maize and cowpea intercrop in which the cowpea crop can be planted later after maize crop establishment. Cowpea is aggressive when planted at the same time with maize.

- Competitive relations including nitrogen fertilizer application and nitrogen economy. For example, the fertilizer applied to maize will not be taken up by the pigeon pea crop in the farming system because it responds little to fertilizers. In addition, pigeon pea has different root systems to maize and pigeon pea has an initial slow growth and therefore does not give much competition to the maize crop during maize crop establishment when planted at the same time or thereafter.

Advantages/benefits

- The system breaks the disease or pest cycle and suppresses weeds and therefore it reduces the occurrence of insect pests, diseases and weeds. For example, the ground cover provided by the pumpkin will suppress weeds and conserve moisture for the maize crop. Intercropping hinders some of the pest to locate the host crop in the system but also restrict the movement of pests and diseases from one crop to the other.
• The maize will benefit from nitrogen fixed by the grain legumes. For example, reports indicate biological N\textsubscript{2} fixation of 20 to 118 kg/ha for pigeon pea and 55 to 150 kg/ha for common bean and therefore improves soil fertility.

• The shade from maize plants will protect the crops below it from the strong rays of the sun and the impact of heavy rains e.g. Beans and pumpkin.

• Crop diversification for food security, income generation per unit land and reduction of risk from complete crop failure

• Erosion control. Intercropping control soil erosion by preventing rain drops from hitting the bare soil where the component crops tend to cover the soil surface and allow better water infiltration.

• Intercropping maize with deep rooting pigeon pea helps to break the hard pan

**Different types of intercropping practices**

*Mixed intercropping*

This is the growing of two or more crops simultaneously with no distinct row management. Pumpkins, okra, cowpeas and cucumbers are some of the crops that may be grown in this system. This would make it difficult for pests to locate their target crop. In addition, this ensures that the ground is covered and therefore it will reduce the water loss through evaporation and will suppress weeds.

*Intra-row and Inter-row cropping*

This is the growing of two or more crops simultaneously either in the same row (intra-row cropping) or in different rows (inter-row cropping). For example, maize intercropped with beans in the same row or between rows.

*Strip intercropping*

This is the growing of two or more crops simultaneously in different strips wide enough to permit independent cultivation but narrow enough for agronomical interaction of the crops. For example, two rows of soybean alternated with four rows of maize crop.

*Relay intercropping*

This is the growing two or more crops during part of the lifecycle of each species. A second crop is planted after the first crop has reached its physiological maturity but before it is ready for harvest.
Multi-storey intercropping

This is the association of tall perennials with shorter biannual and annual crops. Maize can be interplanted with trees like Sesbania and Gliricidia.

Sequential intercropping

This is also an aspect of multiple cropping involving the growing of two more crops in sequence on the same field in the same year. The succeeding crop is planted after the preceding crop has been harvested. There is no intercrop competition and farmers have to manage only one crop at a time.

Arrangements for specific crops in intercropping system

1. Maize with pigeon pea

For long duration pigeon pea varieties e.g. Kachangu and Sauma, maize is planted at 75cm within row plant spacing, 3 seeds per station and 75cm between rows (intra-cropping). The pigeon pea is planted between maize stations, 2 seeds per station and 37.5 cm from each maize station. Planting should be done at the same time.

Another option is to plant maize in alternate rows with pigeon pea (strip cropping). Two rows of maize planted at 75cm row spacing and one seed per station at 25cm apart and alternated with one row of pigeon pea planted at 90cm between plant stations in a row and 3 seeds per station. Planting should be done at the same time.

For medium duration pigeon pea varieties (e.g. Mwaiwathu alimi, Chitedze Pigeon pea 1, Chitedze Pigeon pea 2), the maize crop is planted at 75cm within row plant spacing in 75cm row spacing. Then pigeon pea is planted between maize plant stations, 2 seeds per station. The other option is to plant two rows of maize alternating with one row of pigeon pea. In this case, maize planted at 75cm between rows and 25cm between plant stations. For pigeon pea, plant 2 seeds per plant station spaced at 75cm.

Short duration pigeon pea varieties should not be intercropped with maize because these varieties mature earlier and may not survive the shading effect from maize. The varieties are very short in height to survive the shading.

2. Maize with common beans

The maize crop is planted at 25cm between plant stations and 75cm between rows. The common bean is planted on the same plant station with maize. This is commonly done using climbing beans.
3. **Maize with cowpea**

The maize crop is planted at 25cm between plant stations and 75cm between rows. The cowpea is planted between maize plant stations. Another option is to plant cowpea in alternate rows with maize where cowpea is spaced at 20cm apart between plant stations within a row. Plant cowpea later after maize establishment i.e. 2-4 weeks after maize emergence.

4. **Doubled up approach for legumes**

This intercropping arrangement can be done for pigeon pea and groundnut, or pigeon pea and soybean. Planting pigeon pea and groundnut involves both planting groundnut (75cm x 15cm - 88889 plants per hectare) and pigeon pea (75cm x 75cm - two seeds per plant station) at their full plant population. The other option is to plant groundnut at full population (75cm x 15cm - 88889 plants per hectare) and plant pigeon pea every third row at 75cm x 75cm; two seeds per plant station.

*The research is under way to validate pigeon pea and soybean intercropping.*

2.3.2 **Crop Rotations**

Crop rotation is the alternation of subsistence, cash and green manure cover crops with different characteristics, cultivated on the same field during successive years and following a previously established sequence. The principal objective of crop rotation is to contribute to the achievement of a production that is profitable and sustainable, maintaining soil fertility and health. This is to counter the negative aspects of monoculture like increased pests and diseases, proliferation of certain weeds, reduced yields etc.

**Basic principles of crop rotation**

There are three fundamental and basic principles of crop rotation:

- Rotation is better than monoculture, even when plants of the same family are cultivated
- The most efficient rotations are those that include legumes
- Crop rotation as an isolated practice is generally not sufficient in tropical areas to maintain stable productivity for many years; the addition of some external nutrients is necessary
Advantages/benefits

- Crop rotation gives various benefits to the soil. A well-known effect of crop rotation is the replenishment of nitrogen through the use of grain legumes in sequence with cereals and other crops. It also helps to maintain or increase soil organic matter content
- It mitigates the build-up of diseases and pests that often occurs when one species is continuously cropped
- It improves soil structure for better crop establishment and helps achieve a more abundant and lasting soil cover, stable extraction of nutrients by alternating root systems with different characteristics and depth
- Better weed control e.g. suppression of witch weed (Striga) when maize is rotated with legumes
- Increase soil fertility by alternating deep-rooted and shallow-rooted plants and altering crops with different nutrient requirement - for example, maize followed by groundnuts
- Better labour distribution the farm as different commodities have different peak labour periods
- Overall rotations lead to higher yields compared with monoculture even if external nutrients are supplied

Note: crop rotations are site specific and largely depend on:

- Environment i.e. climate soils and altitude
- Socio-economic preferences
- Markets and trade-offs
- Risk involved
- Tradition

Aspects to take into account in order to establish crop rotations

- The same species should never be sown on the same field in the following season.
- Always include green manure/cover crops, prioritizing the production of biomass to improve soil cover and organic matter content.
• Seeding and harvest times to diversify labour and input requirements
• Crop prices and productivity in the medium term
• Risk involved in each crop
• In order to plan crop rotations, the effects of one crop on the following should be taken into account, considering:
  o Compatibility with the following crop.
  o Degree of resistance to attack by pests and diseases.
  o Biomass production for the subsequent crop.
  o Root type and distribution
  o Nutritional requirements.
  o Allelopathic toxins

Proposed production systems with crop rotations

Design and implement crop rotations according to the various objectives: food and fodder production (grain, leaf, and stalks), residue production, pest and weed control, nutrient uptake and biological subsurface mixing/cultivation.

Since most of the smallholder farmers’ fields in Malawi are dominated by the maize crop, crop rotations require that the maize crop is rotated with legumes like groundnut, soybean, cowpea, common beans, cotton and pigeon pea in both conventional farming practices and conservation agriculture. Apart from legumes, maize can also be rotated with roots and tuber crops like cassava and sweet potatoes.

Some maize-based crop rotations on small-holder farms in Malawi include:

* Maize-cotton
* Maize-soybean
* Maize-groundnut
* Maize-tobacco
Apart from grain legumes, farmers can also plant green manure/cover crops as inter- or relay crops for the sake of accumulating nitrogen in the soil, controlling weeds, producing residues and ground cover. GMCCs are not primarily planted to generate additional incomes (seed or grains). For farmers with more land that is put into fallow, it is advisable that these be planted to GMCCs to reclaim the degraded land.

Typical green manure cover crops in Malawi include:

- **Velvet beans** (*Mucuna pruriens*)
- **Sunhemp** (*Crotalaria juncea*)
- **Tephrosia vogelli**
- **Lablab purpureus**
3. CONSERVATION AGRICULTURE

Conservation agriculture (CA) is a cropping system that aims at conserving agriculture resources, strives to achieve acceptable profits together with high and sustained yield levels while concurrently serving the environment. Conservation agriculture is being promoted in Malawi as an ecologically sound cropping system capable of boosting crop yields and increasing resilience to climate variability and change. Conservation Agriculture can be applied under almost all soil-climate-crop combinations, but is perhaps most effective in increasing and stabilizing yields where low or uneven rainfall limits crop production. It is also suitable for areas with highly degraded unproductive soils as a mechanism for recovering the soils. The farming system can be used in almost all crops including maize, grain legumes, cotton, sunflower, root and tubers crops. However, research is under way to quantify the pro and cons of CA with legumes grown under CA and conventional as well as other crops apart from maize.

Principles of Conservation agriculture

Conservation agriculture is a set of three principles:

- minimal soil disturbance
- year round ground cover
- crop rotations (e.g. maize-legume rotations) and associations (intercropping and relay cropping)

Advantages/benefits

Conservation agriculture (CA) benefits can be immediate or medium to long term: Immediate benefits include:

- Improves soil water infiltration due to surface crop residue retention and an improved continuous soil pore system in the absence of soil tillage.
- Reduces water run-off and soil erosion due to reduced raindrop impact on mulch-covered soil surfaces
- Reduces soil moisture evaporation as mulch-covered soil protects the soil surface from direct solar radiation.
- Reduces moisture stress in times of mid-season droughts or dry-spells
- Reduces weed infestation
Medium to longer-term benefits include:

- Increases soil organic matter (SOM) resulting in better soil structure, higher Cation Exchange Capacity (CEC) and nutrient availability and improved water-holding capacity.
- Increases and stabilizes crop yields
- Significant reduction in costs of production (mainly manual labour for land preparation and weeding)
- Increases soil biological activities thus influencing improved soil aeration, water infiltration and rate of decomposition
- Significant reduction in (witch weed) *Striga asiatica* L. in maize-cowpea cropping systems
- Increases net benefit per unit kwacha invested

**Good crop management practices besides the three key principles are needed to fully realize the benefits of CA**

- Use of improved crop varieties
- Timely planting
- Recommended plant spacing
- Recommended fertilizer use
- Optimum weed, pest and disease control

**CAUTION:** In CA cropping systems, never leave the weeds plants to shed the seeds while in the field. Uproot the weed plants just before they flower to reduce the burden of weed in the following cropping season.

**Requirements to start conservation agriculture**

**Information**

A change in crop management system and therefore adequate information is necessary. It is very important to get information about the system (principles of CA) from experienced farmers and agricultural field staff. The farmer should start with a small area of land (about 10% of the property) and first learn how to manage the system.
Land Preparation
Prepare the field soon after harvest before the onset of the rains (get rid of compaction, perennial weeds and acidity problems).

Produce sufficient ground cover. In the initial year apply 2.5 to 3 tons of crop residues per hectare, as soil cover in the field. Note: CA is not a biomass transfer technology. Therefore, it is not advised to transfer crop residues from the neighbouring garden. Always, particularly in the second season and onwards, retain the residues from the harvested crop as soil cover. Residues cover from maize stalks, legume harvest and green manure cover crops are recommended for use in CA.

Implementing conservation agriculture:

• Use a dibble stick/hoe to seed your crops. When using a hoe, you aim one stroke that does not create a basin.

• It is important to achieve good weed control (where necessary, pre- and post- emergence herbicides can be used e.g. apply harness herbicide before planting or after planting but before crop emergence to kill weed seeds; apply glyphosate herbicide to any living weeds). Consult the herbicides bottle labels for prescribed rates and safety cautions.

• If landholding size is small, start with a maize-legume association to achieve food security while reaping the additional benefits from the legume (e.g. additional residues, nitrogen, and pest and weed control).

• Talk to the farmers who are practising conservation agriculture and learn from their experiences and mistakes. The experiences of farmers who have been implementing conservation agriculture for a longer time might give indications to new ones which key practices generate success and what mistakes to avoid. Information sharing and exchange of experiences is necessary for farmers who are starting with conservation agriculture.

• Before starting with conservation agriculture one very important aspect is to plan a good crop rotation

• Basal fertilizer application in maize or some legumes need to be done at planting or day after planting
• **Planting specifications**: maize crop should be planted in maize rows spaced at 75cm apart and 25cm between plant stations when no basins or pits are used. Groundnuts and soybean are planted in rows spaced at 37.5 cm and 10-15cm and 5cm apart between plant stations. Pure stand of cowpea should be spaced at 37.5 cm between rows and 10cm between plant stations; one seed per plant station. Intercropping cowpea in CA requires planting the cowpea in between the maize rows at 10-15cm apart between cowpea plant stations, one seed per plant station. Intercropping pigeon pea in CA requires planting the pigeon pea in between the maize rows at 75cm apart between pigeon pea plant stations, two seeds per plant station.

**As extension officers**

• You will be the change agent in your community, you should assume a facilitating role that will encourage the confidence of starting farmers that the technology is working.

• This includes demonstrating the technology in other farmers’ fields, demonstrating the economic benefits with facts and numbers and training lead farmers in your designated area to help others.

• As tillage is considered traditional, some cultural barriers that might aggravate the change process can exist in the community of your mandate. It will always be important to recognize these barriers. They include:
  
  o Not understanding the technology
  o Being afraid of the economic risk not being able to buy seed and herbicides
  o Soils or crops are not adequate and need to be adjusted
  o Change usually does not appear “overnight” and will take time. Extension personnel therefore need to be patient and accept that agricultural technologies are adopted step-by-step, because farmers:
    ✓ need to feel at ease with the new technology
    ✓ do not have the capital to invest
    ✓ cannot run a big risk, especially not when the technology is not known
    ✓ need a learning-by-doing environment
Steps to follow when establishing a CA demo plot

The following are steps which will help you in the establishment of the CA demo plot:

- As a facilitator, survey the piece of land allocated by the lead farmer/farmer group with an aim of confirming its actual measurement and the general condition of the land and assess its viability. Remember to be accompanied by the farmers when doing this.

- Design the layout and make the lead farmer/farmer group to understand reasons for everything that is being done in every plot.

- Once you have the layout, proceed to the plot with a rope, pegs, tape measure and a hammer and demarcate the entire demo plot with the assistance of the lead farmer/farmer group.

- After the demarcation, start preparing the plots as per the agreed design layout.
4. **SOIL AND WATER CONSERVATION**

Soil Conservation is the protection, maintenance, rehabilitation, restoration and enhancement of soil resources and includes the management and use of soil resources to ensure the sustainability of such use. Water conservation is ensuring there is increased infiltration of water in the soil so as to reduce erosion caused by runoff.

Soil and water conservation entails a number of technologies. Some of these technologies include marker ridges and ridge alignment, vetiver planting/establishment, gully reclamation and rain water harvesting techniques such as box ridges, raised footpaths, swales, infiltration pits.

**Benefits of Soil and Water Conservation**

The following are the benefits of Soil and Water conservation:

- Reduces water runoff and soil erosion;
- Conserves soil moisture for plant growth and development;
- Improves crop and pasture fields;
- Increases ground water supplies; and
- Reduces siltation and flooding.

**Soil and Water Conservation**

The following practices are done in order to conserve soil and water:

1. **Contour Ridging**

In order to control runoff and soil loss, ridges should be cultivated along the contour.

Source: Rainwater harvesting technical field manual, DLRC. 2013
Peg and construct contour marker ridges as guides to re-align planting ridges. It is better to make marker ridges in the dry season so that planting ridges could be realigned before the next season.

**Instruments for Marking Contour Lines**

There are different instruments used in making contour lines. The low cost instruments are A-frame, Line level and Phiri Lino frame:

The following materials are required to make the above instruments:-

i) The A-frame

- 2m of string.
- 1 stone.
- 3 nails or string to tie the frame together
- 1 panga knife.
- Pegs to mark contour
- 1 hammer or rock or anything for driving pegs into the ground.
- Three 1.6 - 2m poles.
ii) The Line Level

- 1 line level.
- 5m of string.
- 2 wooden poles, 1.6—2m long with flat ends.
- 1 knife.
- Pegs to mark contour lines
- 1 hammer or rock or anything for driving pegs into the ground.

iii) The Phiri Lino Frame

- One Line Level
- 2.5m of string
- 4 wooden poles with flat ends (two 3m long, one 2.5m long and the other one 2m long).
Procedure for making the pegging instruments

i) A-frame
1. Trim ends of the tow 3m poles to make them flat and tie or nail their tops together. Then tie or nail the crossbar to the upright sticks 1m from the bottom to form an A shape. Ensure that the bottom ends of the upright sticks are as far apart as possible to increase inter-peg distance.
2. Hang a string from the top of the two upright sticks with a stone tied to the end so that it hangs 5 – 10cm below the crossbar.
3. Place the A-frame on level surface. Let the string settle, then mark exact spot where it crosses the horizontal stick. Mark the exact positions of the 2 upright sticks on the floor. Then switch the positions of the frame legs. If the calibration is correct, the string will hang precisely over the central point. The A-frame is perfectly level when the string hangs precisely over this central point.
4. If the string is not perfectly cantered both times, check that:
   a. The floor is level; and
   b. The frame is tied securely. Adjust the set up as needed.

ii) Phiri-Lino frame
1. Trim ends of the tow 3m poles to make them flat and tie or nail their tops together. Tie 2.5m poles across the other two poles about 1m from the bottom to form an A shape. Above it, tie the 2m cross stick parallel to the other one to make the frame strong. Ensure that the bottom ends of the upright poles are as far apart as possible to increase inter-peg distance.
2. Cut a groove around each of the 3m sticks at exactly the same height above the ground halfway between the 2 cross sticks.
3. Tie the ends of the string in each groove.
4. Hang the level between 2 knots in the center of the string to stop it from sliding.
5. Test the operation of the equipment by following steps for the line level.

iii) Line level
1. Trim the ends of the sticks to make them flat. Then place them upright on the level ground. Cut groove around each stick at exactly the same height (chest level).
2. Hang the line level centrally on the string and tie a knot on each end of the level to stop it from sliding.
3. Tie the string ends in the groove of each stick.

4. Set the two sticks on a level surface with the string tight. Mark their exact positions on the ground and read the line level. Then switch the positions of the sticks and read the level again.

5. If the bubble on the level is not perfectly centered both times, check that:
   a. The ground is level
   b. The groove heights of both sticks are identical, and
   c. The level is hanging properly.

**Pegging Contour Lines**

1) **Use of A-frame and use of Phiri Lino frame.**

A-frame and Phiri Lino frame are used in the same way. The only difference is that readings from a Phiri Lino are made on the spirit level on the string fixed on the frame. Two people are required to do pegging using these instruments. The following are the steps followed:

**Step 1**
Insert a peg at the starting point of the line, and positioning of one leg of A-frame next to it. Depressions or stones, ridges and humps should be avoided.

**Step 2**
Hold this leg in place, move the other one up or down slope until the string hangs precisely over the mark on the cross pole (A-frame) or bubble is precisely centered (Phiri Lino). Insert a peg at this point of the leg.

**Step 3**
While holding the second leg in place; pivot the first one round and move it up or downslope until the string hangs exactly over the mark again bubble is precisely centered. Drive another peg at this point.

**Step 4**
Continue pivoting across the slope until you reach the end of the field, pegging the position of the legs as you go.

**Step 5**
Moving down the slope to the next contour line. The interval depends on the slope of the field i.e. 20m apart for on a gentle slope, 15m for medium slopes and 10cm for steep slopes.
ii) **Use of Line Level**

Three people are needed for this exercise and will be referred to as A, B, C. The following steps are followed:

**Step 1** Pegging will start at the top of the field about 20m below the upper corner.

**Step 2** C instructs A to insert a peg by his stick to locate the starting point.

**Step 3** C then instructs B to move 5m along estimated contour line with the string tight.

**Step 4** C reads position of the bulb. He/she instructs B to move up or down the slope until the bubble is precisely centered. B inserts another peg at the precisely location of his or her stick.

**Step 5** Leaving B in place, A moves past B to locate the next peg. C instructs A to move up or down the slope while reading line level.

**Step 6** Follow step 4. When the bubble is perfectly centered, insert another peg on A’s stick.

**Step 7** Repeat steps 2-6 above till the end of the field is reached.
Smoothing Contour Lines
Pegged contour lines need to be smoothed in order to reduce sharp angles between them. This simplifies building marker ridges and planting ridges realignment.

Move pegs only on uniform terrain as follows:

- 3 people each stand by the first 3 pegs in the line. Move the middle peg (No 2) so that all 3 pegs are in straight line.
- All 3 people then move two pegs forward, i.e. pegs 3, 4 and 5. Move the middle peg (No 4) so that pegs 3, 4 and 5 are in a straight line.
- Repeat this till the line is finished. The line now will follow the gradual curve.

Contour lines on irregular terrain should not be smoothed as it would cause runoff problems.

Building Marker Ridges
Once pegging of contour lines is over, they should be built into a ridge. The marked ridges serve as guides to realign planting ridges.

II. Re-Aligning Crop Ridges
After marker ridges are built, align crop ridges parallel to them. Align the top half of the area to the top marker ridge, and bottom half to the lower marker ridge.

III. Box ridges
In areas with low rainfall and where erratic rains are experienced, box ridges should be put in place to catch and conserve rainwater so as to ensure adequate soil moisture for crops. Box ridges should be constructed across planting ridges to create ‘micro catchments’ to increase water infiltration and to reduce soil erosion.

Source: Rainwater harvesting technical field manual, DLRC. 2013
Box ridges should be constructed across the entire furrow perpendicular to planting ridges, but slightly lower to allow spill over. Space them 1 – 3m apart depending on the terrain and rate of water flow within the field.

**IV. Gully Reclamation**

A gully is a large ditch formed as a result of the erosion process. It indicates an advanced or severe stage of erosion. A gully can only be reclaimed since it cannot be cleared within a season. Before undertaking any gully reclamation, it is important to first conserve the whole catchment where the problem originates. This could be either by planting trees or use of contour ridging. The most common and cheap method of gully reclamation is by using check dams.

Check dams are simple structures that can check gully erosion by slowing down water flow or runoff in the drainage system as well as trapping sediments. Three types of check dams which are widely used include: stone check dams, brushwood check dams and live check dams.

**V. Stream bank protection**

River banks should be protected to stabilize stream flow and to reduce risk of flooding, siltation, landslides and loss of arable land. Demarcate a strip along the stream channel to cover the banks about 5m wide either side for small streams and 10 – 20m for big rivers. Plant vetiver (0.45mx0.2m) and bamboo (1mx1m) in strips along the river banks. Several tree species like *Acacia galpini*, *A. polycantha*, *A. siberana*, *Faidherbia albida*, *Zizphus abyssinica*, *Z. mauritiana* and *Z. mucronata* can also be planted in strips at 2mx2m.

**Further reading**

5. FOOD AND NUTRITION

Food is the main source of nutrients. Foods contain different nutrients in varying amounts and proportions. No one food can provide all the nutrients. Proper food choices and combinations are vital for adequate nutrition. It is therefore important to ensure that a variety of foods are sustainably available and accessible in adequate amounts and quality; and properly utilised.

Nutrition is the science that deals with how the body obtains and utilises nutrients for normal body processes and functions. It involves food ingestion, digestion, absorption and utilisation by the body. The body requires different nutrients for its normal functions, survival, growth and development. Each nutrient has specific functions. There are two types of nutrients: micronutrients and macronutrients. Micronutrients are nutrients that are required in relatively small quantities to perform their functions in the body but they are vital for normal body processes e.g. vitamins and minerals while macronutrients are required in relatively larger amounts for them to perform their functions in the body e.g. proteins, carbohydrates, fats and water.

Food and Nutrition ensures that farm households to achieve food and dietary diversification for improved nutritional status for members. Food and nutrition helps in the prevention of malnutrition and contribute to the achievement of sustainable food and nutrition security by promoting the production and consumption of diversified high nutritive value foods and proper processing and utilization of the foods to the farming population.

Dietary Diversification

A diet is the total foods and drink eaten by an individual or a group of people at a given time. It is therefore recommended that individuals should have diets that provides nutrients in the right amount and proportions to meet the nutritional requirements of an individual. Dietary diversification is a practice of eating different types of foods from the same food groups. Dietary diversification is promoted by consumption of the six food groups.

Benefits of dietary diversification

1. Dietary diversification ensures that all foods are given equal importance and are consumed.

2. This ensures that households do not only rely on one type of food such as maize.

3. It ensures households have enough food all year round.

4. It helps to close food gaps that exist.
The Malawi six food groups

Malawi uses the Six Food Groups to help people get more variety in their diets. (Insert six food group chart) These six are:

1. **Staples**

These are foods that are high in carbohydrates. They also contain proteins, minerals & Vitamins Examples of foods are cereal grains - such as maize, sorghum, millet, mchewere, wheat, rice etc., Starchy roots and tubers - such as cassava, yams, coco, potato, sweat potato and Starchy fruits - such as plantains.

2. **Legumes**

These foods are rich in protein & carbohydrate. They also contain minerals, vitamins, fiber and fats. Examples of foods are: beans, soybean, cowpea, pigeon peas, ground nuts, kalongonda, kabaifa, nkhungudzu, mbula.

3. **Animal foods**

These foods contain protein and fat. They also contain minerals and vitamins. It includes animal foods and all animal products. Example of these foods are meat, fish, milk, chambiko, mbewa, eggs and insects.

4. **Vegetables**

These foods are primarily made up of vitamins, minerals and water. They also contain protein, carbohydrates and fiber. Examples of such foods are: Leaf crops e.g. kholowa, mpiru, bonongwe, chigwada, mnkhwani, chitambe, chisoso, luni, Limanda, onion, Fungi e.g. mushroom, Root crops e.g. carrot, Fruit crops e.g. egg plant, pumpkin, tomatoes.

5. **Fruits**

These foods contain mostly vitamins, carbohydrates. They also contain fiber and water. Examples of such foods are mango, pawpaw, guavas, oranges, bwemba, mbula, masawu, peaches etc.

6. **Fats and oils**

These foods mainly contain fat. They also contain minerals, vitamins and proteins. Examples of these foods are: cooking oil, margarine, avocado pear.
Meal planning using the Malawi six food groups (Dietary diversification)

When meals are being planned the MULTI MIX PRINCIPLE should be followed at all times. The multi mix principle is a way to plan meals by combining foods from different groups. This principle tells us that the food we eat should come from the different food groups. It usually starts with a staple which is served with foods from other groups. It should contain at least 3 foods from different groups making it 4 groups per day.

<table>
<thead>
<tr>
<th>Breakfast</th>
<th>Lunch</th>
<th>Supper</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Mgabe porridge with groundnut flour</td>
<td>• Nsima from mgaiwa flour</td>
<td>• Cassava with beans</td>
</tr>
<tr>
<td>• Fruit such as pawpaw or guava</td>
<td>• Fried small fish <em>(Usipa)</em></td>
<td>• Fried vegetables</td>
</tr>
<tr>
<td></td>
<td>• Vegetables with groundnut flour</td>
<td>• Fruit</td>
</tr>
<tr>
<td></td>
<td>• Fruit such as Banana</td>
<td></td>
</tr>
</tbody>
</table>

A nourishing meal can be expensive to prepare for most Malawians therefore it is encouraged that:

a) Families can prepare meals with at least 4 groups per meal and make sure that at they have eaten foods from all groups by the end of the day.

b) Families should use the most locally available resources in their meal preparation.

c) Families should be encouraged to grow their own produce or keep their own livestock for animal source protein.

Activities of dietary diversification

There are several activities that households and communities can employ to ensure that they have adequate amounts and have greater variety of nutritious foods. Some of the activities are:

a) promotion of mixed cropping and integrated farming systems;

b) introduction of new crops (such as soybean)

c) promotion of underexploited traditional foods and home gardens

d) small livestock raising

e) promotion of fishery and forestry products for household consumption

f) promotion of improved preservation and storage of fruits and vegetables to reduce waste, post-harvest losses and effects of seasonality
g) strengthening of small-scale agro-processing and food industries

h) income generation

i) Nutrition education to encourage the consumption of a healthy and nutritious diet year round.

**Food Processing**

Food processing is the set of methods and techniques used to transform raw ingredients into other food products or to transform food into other forms for human consumption. The set of methods can either be physical or chemical. Physical methods can include drying, canning and refrigeration. This can be done either in the home or by the food processing industries. Food processing takes clean, harvested crops or butchered animal products and uses these to produce nutritious, attractive, marketable and often long shelf-life food products.

**Benefits of food processing**

1. **To increase the shelf life of food.**
   Processing makes food safe to eat by de-activating spoilage and pathogenic micro-organisms

2. **To remove toxins.**
   Legumes and cereals contain some poisonous substances called toxins such as aflatoxin which when consumed cause adverse health effects of human beings.

3. **To improve digestibility, palatability and acceptability of the food materials**

4. **To increases seasonal availability of many foods.**
   For example most foods are seasonal so processing them into other products makes them available all year round.

5. **Enables easy transportation of food materials.**
   Processed products are easy to transport and lessen the cost of transportation.

6. **To improve the quality of life.**
   Other processed foods are good for people with food allergies, non-communicable diseases such as diabetes.
7. **To enhance the nutritional quality of foods.**

Extra nutrients such as vitamins and minerals can be added e.g. vitamin A can be added to sugar, margarine, cooking oil and other food products.

**Methods of food processing**

There are three major food processing methods:

A. **Physical methods**

These methods destroy the activities of water and enzymes, pH and microbes present in the food. Examples of physical methods are cutting, grinding, pounding, blanching, boiling, roasting, freezing or refrigeration.

B. **Chemical methods**

These methods use chemicals which react on water activity (water present in the food), enzymes, pH and microbes present in the food. Examples of chemicals that are used include additives such as sugar and salt, preservatives such as spices, smoke and acids.

C. **Biological methods**

These methods use microorganisms to react with the other microorganisms in the foods, water, pH to produce other products. Examples include fermentation.

**Legume Processing**

Legumes are very important in the diet as they supplement cereals, roots and tubers by providing plant protein. Legumes contain limiting factors and toxic substances such as anti-nutritional factors and aflatoxins which affects protein digestibility. Legumes have to be processed to for humans to benefit from them nutritionally. Legumes can be processed into various flours, can be part of the main meal, confectioneries and can be used as seasoning. For detailed recipes on legumes refer to the Malawi recipe booklet.

**Soya bean flour**

**Method**

1. Clean soya beans by removing stones, dirty and moldy beans.

2. Boil adequate water depending on the amount of soya beans (1 part soybeans to 3 parts water).
3. Drop the beans into boiling water without causing the water to stop boiling.

4. The soybeans should boil for at least 30 minutes, when the seed coats are easily removed.

5. Remove soybeans from the fire, drain off the water and rinse in cold water.

6. Remove the skins of the cooked beans (dehulling) by rubbing between hands while rinsing with cold water.

7. Dry the dehulled beans in the shade until they are fully dry and do not stick to each other.

8. The dried cotyledon can be milled into flour at a local mill or pounded into flour. This flour should be kept in a dry place at least for 1 month in air tight containers. The flour does not keep for long before it starts having maggots. The flour can be used in porridge, nsima, vegetable seasoning or baby feed.

**Note:**

- The dried cotyledons can be stored for 3 to 4 months in air tight containers.

- When Soya beans are used take 4 parts of maize grains and 1 part soya flour to make porridge, baby foods or nsima.

- When other legumes are uses take 8 parts of maize grains, 1 part groundnuts and 1 part of any other legume to make porridge, baby foods or nsima.

**Pre-treated legume flour**

**Method**

1. Clean and sort the pulses (cowpeas or pigeon peas or beans or ground beans)

2. Boil adequate water depending on the amount of the peas or beans.

3. Drop the beans into boiling water without causing the water to stop boiling.

4. Boil for 15 to 20 minutes

5. Remove the pulses from the water and roast/bake in an oven for 45 minutes

6. Remove the pulses from the heat and sun dry.
Groundnut flour
Method
1. Sort nuts removing all discoloured and moldy nuts
2. Grind the nuts in mortar and sieve
3. Keep the flour in a container in a dry place

Common bean flour
Method
1. Soak beans over night
2. Remove skins
3. Dry adequately
4. Mill with maize or mill the beans alone if the quantity is reasonable enough to go through the grinding mill to make flour

Note:
Combination should be 1 measure for beans or bean flour to 4 measures of maize or maize flour porridge made from this mixture has high quality protein therefore very good for children.

Likuni phala flour (maize, pulses and groundnuts)
Method
1. Clean and sort 8 parts of maize grains, 1 part of ground nuts and 1 part of pulses (cowpeas or pigeon peas or beans or ground beans)
2. Boil adequate water depending on the amount of the peas or beans.
3. Drop the beans into boiling water without causing the water to stop boiling.
4. Boil for 15 to 20 minutes
5. Remove the pulses from the water and roast/bake in an oven for 45 minutes
6. Remove the pulses from the heat and sun dry.
7. Mix the maize, groundnuts and the pulses and mill into flour. The flour can be used in porridge, baby food or nsima.
6. AFLATOXIN MANAGEMENT

Aflatoxin management in Legumes and maize (add with production aspects of legumes)

Aflatoxins are a major challenge in legumes and maize. Due to its adverse effects on human health, they need to be removed before they are consumed. The following are some of the interventions that reduce aflatoxin in legumes and maize;

a) Use clay or lime, these compounds absorb aflatoxins and bind aflatoxins hence making it unavailable to the body

b) Where possible consume less of legumes and maize in favor of other food crops that have lower aflatoxin contamination such as rice, sorghum and millet.

c) Practice fermentation which reduces aflatoxins levels in food because lactic acid bacteria binds aflatoxin.
7. **EXTENSION SYSTEMS, APPROACHES, METHODS AND COMMUNICATION**

There are a number of extension approaches that are used in the provision of agriculture extension services that promote participation of all stakeholders more especially smallholder farmers in planning and implementation of agricultural interventions. Extension methods are tools used for teaching farmers in order to impart knowledge, skills and create awareness about new or existing agricultural technology.

Some of the extension methods are strategic extension campaigns, demonstrations, field days, visits, tours, agricultural shows and examples of approaches include model village, Farmer Field School, Farmer Business School, and agricultural clusters and ulimi wa m’ndandanda. For the purpose of this handbook we have focused only on farmer field school, farmer business school, demonstrations, and field days.

7.1 **Systems and Approaches**

**District Agriculture Extension Services System (DAESS)**

- In the year 2000, New Agricultural Extension Policy was launched “Towards Pluralistic and Demand Driven Services.”

- The Policy focuses on participation of many players: NGOs, Private Sector (Radio stations, seed companies, university), Farmer Based Organizations, and the Public Sector

- The implementation of this policy is through DAESS using the developed guidelines.

**Key Features of DAESS**

- There are two main features of DAESS
- The four Pillars upon which it is built
- The Implementation Structure

**The Four Pillars of DAESS**

- Agricultural extension policy
- Demand-driven extension service
- Pluralistic extension
- Integration of agricultural extension service into the decentralization process
Main Areas of Focus
1. Organization of farmer demand
2. Facilitation of service provider response
3. Co-ordination and strategy development
4. Funding acquisition

Organization of Farmer Demand
- Farmers are organized into the following categories:
  1. Smallholder food security farmers (SHFS)
  2. Small-scale commercial farmers (SSC)
  3. Commercial farmers (CF)
- Frontline staff need to be trained in Participatory Extension Approaches (PEA) for them to properly facilitate articulation (identification and analysis) of farmer needs.
- The needs of farmers are aggregated by Area and District Stakeholder Panels.

Facilitation of Service Provider Response
- There are several stakeholders in the new agricultural extension system.
- To appropriately address farmers demands for services, the following need to be done:
  - Identification of farmers’ service needs
  - Identification of best services for specific needs.
  - Coordination of service provision to farmers’ needs.

Coordination and Strategy Development
- Involvement of many agricultural service providers require proper coordination in planning, implementation, monitoring and evaluation so that no conflict arises in the provision of services.
- Many service providers with different approaches and practices need effective coordination.
- Service providers to be accountable to the farming community.
Financing of Agriculture Extension Services

- Use diverse sources of financing agricultural extension services at the district these may include:
  - Co-financing arrangements between stakeholders
  - Farmers who benefit should pay for certain services
  - District Assembly locally generated funds
  - Donors

The Implementation Structure of DAESS

The implementation of DAESS is through the District Assembly structure:

- District Agricultural Extension Coordinating Committee
- District and Area Stakeholder Panels
- The village is an entry point

Structures of the DAESS
District Agriculture Sub-Committee (DAC)

Composition

• Elected members of the Council
• District Agriculture Development Officer providing secretarial services

Functions

• Recommending to the District Assembly on policy making decisions regarding the governance and agricultural extension delivery services in the District.
• Assist the District Assembly in consolidating and promoting local agricultural institutions and public participation.
• Assist the District Assembly in mobilization of resources for governance and agricultural development.
• Ensure that there is equity in District Agricultural Extension Services provision.
• Supervise, monitor and evaluate the implementation of agricultural activities in the District.
• Initiate locally funded agricultural self-help activities.
• Encourage community to participate in agricultural self-help activities.

District Agricultural Extension Coordination Committee (DAECC)

Responsibilities

• Coordinating agricultural extension services
• Harmonising approaches in service provision and delivery
• Getting and providing feedback on effectiveness of service delivery
• Monitoring and evaluation
• Advocacy within and outside the District Assembly on services delivery
• Linking service providers and farmers to the Assembly
• Compile Inventory and Profiles for all agricultural Extension Service Providers in terms of:
  o Services provided
  o Systems of service delivery
  o Location of service providers
  o Who are the target farmers and how many
  o Capabilities of service providers (human, physical resources
  o What, if any, are the immediate future plans
  o Impact evaluations of services they provide

Role of Stakeholder Panels
• To provide a forum for dialogue where farmer demands and feedback can be directly expressed to extension service providers
• Ensure that farmers’ demands are articulated
• Ensure that service providers respond to farmers demands in a timely way.

District Stakeholder Panel
Composition
• Smallholder Food Security farmers, who should form 50% of the total membership.
• The panels is composed of:
  o Small holder food security farmers (who should form 50% of the total membership,
  o Semi-commercial and commercial farmers,
  o NGOs,
  o farmers organisations,
  o Agribusiness groups,
  o Community based organizations and
  o Relevant committees.
  o DADO will play facilitating role at this level.
Area Stakeholder Panel

Composition

• Smallholder Food Security farmers, who should form 50% of the total membership.
• Semi-Commercial and Commercial Farmers
• NGOs
• Farmers Organisation
• Agribusiness groups
• Community based organization
• Relevant committee
• AEDC plays a facilitator role at this level.

Functions

• Provide a forum for farmers through villages to express their demands.
• Ensure right representation of all stakeholders and that each group is heard.
• Ensure that villages’ demands are articulated and aggregated.
• Ensure that quality response to the demands is provided and maintained by the respective service provided.

Farmer Field School

Farmer Field School is a group training approach that focusses on adult non formal education through hands on field discovery learning. The approach focusses on learning of experienced farmers usually in the same locality or village who learn with hands on especially when the subject matter is related to their experiences. The approach is a school without walls for improving decision making capacity of farmers and stimulating innovativeness for agricultural sustainability and can be done on both crops and livestock

Importance of Farmer Field School

• Improves farmers’ agro-ecological knowledge and their capacity to make decisions
• Improve adoption of knowledge intensive technologies and practices
• Capacity building and farmer empowerment
• Promotes lead farmer concept which enhances farmer to farmer extension
• Enhance Farmer Led Research
• Promote collective problem identification, analysis and solving

Composition of Farmer Field School

FFS is a group that comprises 15-30 participants and a facilitator who have drawn up a learning contract that includes commitments of both; regarding attendance, material, management of resources, and utilization of the harvest and any other key issues with farmers contributing the majority of labour and inputs while the facilitator contributes time and transport.

Principles of Farmer Field Schools

• Based on adult non-formal education which is different from pupils learning in a class

• Based on agro-enterprise cycle and time specific because you have to start with a crop at planting up to harvesting

• Group study where participants work in groups

• Farmer Field School site and study fields are agreed upon by farmers and have to be convenient to farmers and not necessarily the extension worker.

• Building group so that team work and experience sharing is enhanced

• Basic science trainings are conducted and participants are able to understand scientific reasons behind performances of certain crops or agricultural interventions.

• Test and validate the farmers’ practices against what the GAP states. This is not competition but to come up with best practice for the area

• A process not a goal as farmers are interested on how things are done as opposed to just looking at results such as yield

• Follow ups on implementation and adoption

• Evaluation and certification to look at knowledge gained as a result of introduction of a school. Certification is important for confidence building amongst farmers
Steps in establishment of Farmer Field School

- Conduct sensitization of local leaders and farmers
- Form an interested group
- Come up with a name for the school
- Develop norms for running the school with fines in it.
- Conduct a baseline survey to identify gaps on livestock or crop production
- Analyze the data collected during the survey by segregating what farmers do against Good Agricultural Practices
- Share the finding of the survey with the community for endorsement or corrections
- Develop studies after prioritizing with the community
- Design plots/layout for studies which show farmers practice against recommended practices. These could be on various studies developed after baseline survey which could be on nutrient management, variety studies, pest management (IPM) and time of planting.
- Agree with the community on meeting dates and duration for a day’s meeting, be mindful of routine village engagements such as market days, development work
- Select site and source of materials for the school
- Agree on funding of meetings on food or drinks
- Design and implement visibility mechanisms
- Conduct field days
- Conduct Inter schools tours
- Conduct review meeting
- Certification and graduation of school participants after a season long school
- Capacity building for both staff and farmers
Format for conducting gap analysis

<table>
<thead>
<tr>
<th>Subject</th>
<th>Farmers Practice</th>
<th>Recommended practice (Good Agricultural Practice)</th>
<th>Reasons for difference</th>
<th>Reasons from better practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.g. Maize plant spacing</td>
<td>3 plants per station at 90 cm between ridges and 90 cm between planting stations</td>
<td>1 plant per station at 75 cm between ridges and 25 cm between planting stations</td>
<td>Have not observed performance of crops planted at 1 by 25 by 75</td>
<td>Increased plant population</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Increased crop yields</td>
</tr>
</tbody>
</table>

Implementation of Farmer Field Schools

- Conduct pre ballot box test to ascertain farmers’ knowledge
- Divide farmers into smaller groups of four to five to manage specific studies
- Develop a schedule of activities for the next meeting day
- Conduct agro-ecosystem analysis on weekly basis
- Conduct trainings on regular basis based on the outcome of pre-ballot box test
- Conduct post ballot box test to establish knowledge gain as a result of Farmer Field School

Conducting Agro-Eco System Analysis (AESA)

- Improves decision making skills, through a field situation analysis by observing, drawing and discussions
- Improve decision making skills by presenting small group decisions for critique in the larger group
Table 1 below shows how data is processed using AESA:

<table>
<thead>
<tr>
<th>Name of Farmer Field School:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>AESA No.:</td>
<td></td>
</tr>
<tr>
<td>Group No.:</td>
<td>Week:</td>
</tr>
<tr>
<td>Plot No.:</td>
<td></td>
</tr>
<tr>
<td>Problem Addressed:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>General Information</th>
<th>Measurement</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variety:</td>
<td>Length of leaves:</td>
<td>Treatment Schedule:</td>
</tr>
<tr>
<td>Date Planted:</td>
<td>Width of leaves:</td>
<td>Management Practices:</td>
</tr>
<tr>
<td>Age of Crop:</td>
<td>No. of leaves:</td>
<td></td>
</tr>
<tr>
<td>Spacing:</td>
<td>No. of diseased leaves:</td>
<td></td>
</tr>
<tr>
<td>Fertilizer:</td>
<td>No. of dead leaves:</td>
<td></td>
</tr>
<tr>
<td>Weather:</td>
<td>Length of plant:</td>
<td></td>
</tr>
<tr>
<td>Time of observation:</td>
<td>No. of pods:</td>
<td></td>
</tr>
<tr>
<td>Plant Population:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germination %:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insect Pests (draw pests seen)</th>
<th>Plant drawing</th>
<th>Natural enemies (Draw those seen)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Observations</th>
<th>Recommendations (Indicate the management practice to be applied)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil moisture:</td>
<td></td>
</tr>
<tr>
<td>Diseases:</td>
<td></td>
</tr>
<tr>
<td>Insect pests:</td>
<td></td>
</tr>
<tr>
<td>Plant health:</td>
<td></td>
</tr>
<tr>
<td>Deficiency:</td>
<td></td>
</tr>
<tr>
<td>Weeds:</td>
<td></td>
</tr>
<tr>
<td>Predator:</td>
<td></td>
</tr>
</tbody>
</table>

**Conducting Ballot Box Test**

- Through specimen familiar or local to the farmers and relevant to the subject matter.
- Insect pests, natural enemies, nutrients, soils, weeds, diseases, crops, & cultural practices are some of the specimens that could be used.
- Insect pests, natural enemies, nutrients, soils, weeds, diseases, crops, & cultural practices
- Simple and objective questions-relevant to the training
- Ten questions for a single crop are enough
- Allow 30-60 seconds per question depending on literacy level
- Carefully start with the literate.
**Farmer Business School**

Farmer Business School (FBS) is a school that trains farmers to take farming as a business. The school brings like-minded farmers together to work as a group and develop their skills and knowledge about producing for the market. It trains farmers how to manage their farms, how to produce, how to acquire and use farm finance and how to market their farm produce. Farmers learn and do or practice on their farms for the whole year or enterprise season.

**Importance of Farmer Business School**

- The farmer business school helps farmers to:
  - Identify and select most promising farm enterprises to increase profitability and farm income.
  - Acquire necessary tools, equipment, technology and farm inputs for the farm enterprises to increase production.
  - Plan and cost the production process
  - Get the money to start or expand the farm enterprises
  - Set up a way of keeping track of money and how it is spent and made.
  - Acquire the fundamentals of how to grow crops and raise livestock in a business manner
  - Set and achieve farm and family objectives.
  - Find out what the market wants and produce what the market wants.
  - Make a plan for marketing of their farm produce

**Establishment of a Farmer Business School**

Farmer Business School is established by going through the following steps:

*Step 1: Sensitization of Local Leaders and Farmer Organizations*

It involves awareness creation among local or community leaders, farmers and farmer organizations on farmer business school through a meeting. The objectives of farmer business school are presented. Interested and supporting farmers are mobilized.
Step 2: Identifying Interested Farmers

The step involves identifying interested male and female farmers. Consider age, education, land holding size and gender of farmers. Interested members of the farmer business school are selected from existing farmer based organizations (cooperatives, associations, schemes, clusters and other farmers groups) in the area. They should be active and practicing farmers, willing to participate regularly, farmers with a common interest, farmers from the same locality and are willing to share experiences.

Step 3: Organizing farmers into the Farmer Business School

The group needs to develop well defined objectives. The size of the group ranges from 20 to 25 members. This size provides greater opportunity for interaction among members.

Step 4: Setting up the school

The school is located conveniently for members. The site needs to be as comfortable as possible and be one in which all farmers feel at ease. The exact meeting place is agreed upon by participants. There is one main meeting place, but participants are at liberty to move particular sessions to more convenient locations e.g. in the field or at a market. Participants also agree on when and how long to meet. When step 4 is completed, participants start learning in the farmer business school.

Integrated Homestead Farming

Integrated homestead farming (IHF) is the growing of diversified crops and rearing of small stock and or aquaculture around the home for improving food security and nutrition. IHF provides simple food-based approaches to resolving nutrient deficiencies through successful establishment and management of integrated farming at household, institutional and community settings. IHF can be practiced at structures such as model villages, schools, nutrition rehabilitation units (NRUs) and work places.

Benefits to Integrated Homestead Farming

- It increases knowledge and understanding of micronutrient nutrition among farming households.
- It increases production of nutrient rich plant and animal foods.
- It increases consumption of nutrient rich plant and animal foods.
- It increases utilization of vegetables, fruits and animal sources at household level.
- It promotes sustainable utilization of resources at household level.
- It increases household income.
Components of Integrated Homestead Farming

1. Food and Nutrition

The nutrients play various important roles in the body. They provide energy, body building and maintenance. They are also required for control of body processes and for protection against diseases and infections hence food helps us to keep healthy, warm, well-nourished and alive. However no one food supplies all the nutrients the body needs. Food also provides fiber which is important for bowel movement and prevention of non-communicable diseases such as hypertension and cancer. Refer to the food and nutrition section for more details.

2. Vegetables and fruits

Nutritionally, food plants & trees can provide almost all the nutrients needed by humans: vitamins, minerals, proteins, fats and oils, and carbohydrates (including dietary fiber). The homestead can include a wide variety of plants and fruit trees that provide five of the six food groups: vegetables, fruits, legumes and nuts, fats and oils which can significantly improve the family’s diet. Some vegetables such as garlic, ginger, lemon grass etc., are known to be of medicinal importance.

Vegetables

• The choice of vegetables to be planted in the homestead should be those that are nutrient dense.

• Strong coloring normally indicates that the vegetable is high in micronutrients. Such vegetables are dark green, red, yellow or orange.

• Vegetables have high nutritional value in terms of micronutrients and fibre and they also make meals more appealing in flavour, texture and colour.

• Most indigenous vegetables are more nutrient dense than exotic ones. Overcooking of vegetables however cause loss in nutrients, texture, flavour, and colour.

• Vegetable production in the homestead helps households to have year-round access to fresh vegetables.

• Vegetables are categorized as Leafy vegetables such as amaranthus, pumpkin leaves, chisoso, kholowa, cassava leaves, Fruit/Pod vegetables such as tomatoes, okra, green beans, nkhungudzu, Root/Stem vegetables such as carrots, garlic, ginger, onions. Flower/Bud vegetables such as cauliflower, broccoli, pumpkin leaves and Fungi vegetables such as mushrooms.
Fruits

Fruits are a source of many essential nutrients that are under consumed e.g. potassium, dietary fibre, vitamin C and folic acid. A homestead should have fruit trees. The choice of fruits to be planted in the homestead depends on the space available. Producing different types of fruits around the homestead will ensure access to fresh throughout the year. Fruits can be consumed as a snack or it can be part of a meal. Fruits do not require major preparation for somebody to eat. Deliberate effort should be made to plant trees that mature faster and produce in different seasons.

Fruits are categorized differently according to different areas which they are looked into. In these guidelines fruits are categorized as follows;

i. Tropical and Sub-tropical Fruits – These include citrus (e. g. Oranges, Lemons, Tangerines), bananas and plantains, pineapples, mangoes, avocado pears, guavas and pawpaws.

ii. Deciduous fruits –. Examples are Apples, Peaches, and plums.

iii. Indigenous and wild fruits – They include Baobab (*bwemba*), Tamarind (*bwemba*), Jujube (*masau*), Mulberry (*mabulosi*), Plum (*nthudza*) etc.

3. Small stock production

Some of the small stock animals that can be reared around the homestead include poultry, rabbits/guinea pigs and goats. Where possible fish can be reared around the homestead where there are water sources. These species are prolific, easy to keep, widely adaptable, easy to manage and need less space and labour. Other small stock such as pigs are also possible to manage for households that have adequate labour and feed.

Poultry

Poultry include chickens, ducks, guinea fowls, and pigeons as they are commonly found and easy to rear. Poultry production should be incorporated into small farming systems such as homestead farming. Poultry provides manure for the soil, control pests and diseases and feed on weeds. Poultry is relatively cheaper and has minimum cultural and religious obstacles and dietary nutritional qualities. There are various ways on which poultry can be reared. Refer to GAP for more detailed information.

Other small stock

Other small stock include rabbits/ Guinea pigs, goats rearing by smallholder farmers. These should be kept as a source of protein and income. Improved housing, breeding methods, feeding and effective disease control should be observed at all times. Refer to GAP.
Lead Farmer Approach

What Is Lead Farmer Approach
This is a farmer to farmer extension approach whereby selected and trained volunteer farmers provide some extension services to fellow farmers with the aim of increasing adoption of recommended agricultural technologies and good agricultural practices.

Why Lead Farmer Approach
The recommended staff: farmer ratio is 1:750 but currently it is at 1:2,500 due to increasing number of farmers against the reducing numbers of front line extension workers. Therefore, the lead farmer approach is used to increase extension coverage and enhance the adoption of technologies mainly through demonstrations.

Who Is A Lead Farmer
A lead farmer is an individual farmer who has been selected by the village to voluntarily assist in the delivery of a maximum of three good agricultural practices/technologies that are enterprise specific and is trained in those technologies

Roles Of A Lead Farmer
The main role of a lead farmer is to implement and promote some of the technologies especially those he/she can manage best through mainly trainings, demonstrations, field days.

Technologies Covered By Lead Farmers
A lead farmer handles technologies that he/she has already adopted and is practicing. He/she is also trained in the technologies so that he/she is able to technically handle technical and practical aspects of the concerned technologies.

Advantages Of A Lead Farmer
The advantages are that since the lead farmer is part of the community, he/she understands most of the village’s problems and local solutions and that the farmers can learn better from their fellow farmer than from an extension worker who is an outsider.

Ownership Of A Lead Farmer
A lead farmer is owned and belongs to the community which has selected him/her. He/she does not belong to government or any Project or NGO. The extension providers in the area may facilitate his identification, selection and training but he can be used by any extension provider who is working with the enterprise.
Role Of Stakeholders
The role of stakeholders in the approach is to train the lead farmer, motivate him/her in his/her work, provide him/her with supporting materials like stationery, training materials like leaflets and supervising his/her work.

Sustainability Of Lead Farmer Approach
This is done through orientation of local leaders and communities for the approach, conducting joint trainings, supervisory visits, planning and review meetings with stakeholders.

For the success of the approach, extension workers should be mindful that they are custodians of all technologies while a lead farmer is the implementer and promoter of only some technologies and especially those best managed by the lead farmer.

7.2 Methods

Field Days
A field day is an event organized for a group of participants to see improved technologies being practiced on one or more farms, demonstration plots, or research stations. It combines group discussions and demonstrations of results and methods as teaching methods.

Importance
1. It brings about attitude change towards new agricultural technologies
2. It stimulates the need in smallholder farmers to seek for information about the new technology
3. It creates awareness among stakeholders on new and available technologies

Steps in conducting a field day
1. Planning
   a. Themes for the field days should be decided
   b. The objective should be spelled out
   c. Identify sites and farmers/committee to host the field day. These should be sites where demonstrations were conducted
   d. Identify farmers to do the speaking on the day
   e. Conduct rehearsals
2. Conducting the field day

a. Welcome the participants and brief them on the objective(s) of the field day

b. Divide the participants into manageable groups

c. Take them through the prepared sites where host farmers should do the talking

d. Provide time for questions and answers or comments

e. Process the field day to get commitment and potential problems from the farmers. During processing the following questions should be asked.

1. Field day experience: what have you seen? What did you like most and why? What improvements can you suggest for future field days like this one?

2. Generalizing questions: What have you learnt on this field day? Have you seen any difference with what you normally practice? Have you observed similar technology in your area? What proportion of farmers practice this technology in your area?

3. Application questions: From what you have observed, what would you do differently? How many of you are going to put in practice what you have observed today? What kind of technical assistance would you require to do what you plan to do? How do you plan to implement what you have observed?

f. Document the number of participants by gender

g. Document the farmers interested to practice the technology being publicized
Demonstrations

A demonstration is a step-by-step method of teaching smallholder farmers how a particular agricultural technology is implemented and the learner is actively involved in the implementation of the technology demonstrated.

Importance

1. Provides farmers with knowledge and skills necessary to implement a particular agricultural technology
2. Full participation of the Participants in the learning process
3. Instant feedback from the learners about the technology
4. It builds up confidence in the farmers implementing the demonstration

Types of demonstrations

1. Result demonstrations
2. Method demonstrations (main focus for this handbook)

Steps for conducting a method demonstration

The steps are as follows:

Preparation

• the trainer should prepare the objective(s) of the demonstration
• the target audience should be identified
• materials required for the demonstration should be assembled and be locally available
• the trainer should try the demonstration before meeting the audience

Introduce the demonstration

• Arrange participants in a semi-circle for everybody to see and hear clearly.
• Set the climate. If the interactive demonstration is tied to a lecturette, the climate setting for lecturette can serve both.
• Indicate the topic of the demonstration.
• Explain & clarify the objectives of the demonstration.
• Find out if the objectives are clear and worthwhile
• Find out participants experience with the subject matter
• Let those who have ever done it before demonstrate how they do it.
• Let others comment, but do not criticize.
• Acknowledge all contributions

Arrange demonstration materials
• Display and describe all materials that have been arranged for the demonstration
• Let participants touch the materials if necessary.
• For effective participation prepare adequate demonstration materials that would allow as many participants to participate.

Conduct the demonstration
• Ask the participant what the first step should be.
• Explain the first step and demonstrate
• Ask for clarifying questions
• Let two or three participants repeat the first step that has been performed.
• Let the others supervise

Let each participant participate
• Divide participants in pairs or small groups.
• While one performs the step, others should observe
• Then advise them to reverse the roles

Continue with the next step of the demonstration
• Ask participants what the next step should be
• Conduct the next step and allow questions
• Let two or three people take part while the rest observe
• Allow all participants to perform the step.
Repeat the process until halfway through the demonstration

• Let one male and one female summarize the whole demonstration.

Proceed with the last steps of the demonstration following same procedure

Summarize the demonstration

• Let one male and one female summarize the demonstration.

Process the demonstration

• Move away from the place of the demonstration to where people can sit comfortably usually under a tree or in a building.

• Ask participants to reflect on the demonstration

• Discuss the steps of the demonstration, participants’ feelings in performing the steps or some alternative ways to do some steps.

Generalizing Questions

• Ask participants for general comments on the demonstration.

• What does or does not work in real life situation

• Conclusions and lessons learnt from the demonstration

• Recommendations and decision taken

Application Questions

• Ask participants their commitment towards application of the new knowledge and skill(s)

• Ask if there are any anticipated constraints to the implementing the knowledge or skill

• Ask if there is any assistance that might be required to effect change.

Conclude the Demonstration

• Summarize key points

• Find out if objectives of the demonstration were met

• Thank all participants for taking part.
**Tips for successful effective interactive demonstration**

*Practice first:*

Gather together small group of people who are willing to let you test the effective interactive demonstration on them before you take it to the field. Practicing before actually conducting the demonstration will help

*Check equipment*

List all the equipment that you will need for ID and ensure that all of it is in working order and in sufficient supply.

*Contact farmers*

Farmer identified having or not having a particular technical problem and is willing to mount a demonstration at his or her farm using his or her inputs to solve that problem.

Extension worker role is to ensure that the demonstration is conducted following the recommended practices.

*Identification of impact points and contact farmers*

Impact points should be identified in a participatory manner at the community level. Farmers groups should be used to make an in depth assessment of problems under each enterprise and subject. Identification can also be done through normal field visits and interviews to the individual farmers. When assessment is completed, a list of impact points and contact farmers should be consolidated and submitted to EPA.

*If farmers say that is not practical*

Challenge them why and be convinced that the demonstration is not practical.
7.3 Communication

Communication skills

Communication is a process that involves the transfer of messages from a source to one or more receivers in order to influence perceptions or behaviors of the receiver. In extension, communication is aimed influencing farmers’ perceptions so that they follow the Good Agricultural Practices to ensure increased production in their farms. To ensure perception change among farmers there is need for extension workers to communicate effectively. This is because there are a lot of barriers to effective communication which affects the receivers’ interpretation and understanding of the transmitted messages. Therefore, to ensure that all messages that are transmitted have positive impacts there is need to ensure that all messages are properly packaged and presented to the farmers.

Tips for Effective Communication

It is important to note that everyone can communicate and be heard. However, it takes effective communication for one to be listened to be listened to. In agriculture, extension workers work in an environment where there is so much noise. In communication noise is anything that distracts a receiver from receiving the message that is being communicated. This noise is either real or external and imagined or internal.

Real or external noise is the noise that comes up as a result of certain actions in the environment. For example the sound of music during an extension meeting while the extension worker is addressing the farmers may distract the farmers’ attention. On the other hand imagined or internal noise may be as a result of the receivers’ perceptions towards the communicator or as a result of other personal issues on the part of the receiver. Therefore, it requires skills on the part of the extension worker to ensure that s/he grabs the attention of the farmers so that they listen attentively to the extension worker. The following are some of the tips that an extension worker can follow in order to minimize the noise.

1. Personal knowledge

It is important for every extension worker to know who they are in terms of their weaknesses and strengths as well as behaviors. This is because there are some attributes that an individual may possess that may contribute to external noise as such distract the audience. For example, behaviors such as finger eating and head scratching in the middle of a meeting may distract some people in the audience. Therefore, it is important for the extension workers to be aware of these things so that they can work on minimizing them. The following are some of the things that an extension worker can do to address some negative behavior patterns that may distract the audience.
• Find a trustworthy fellow extension worker to help you go through a personal assessment exercise: It is important to ask some other people to help you assess your weaknesses and strength so that you are able to work on them.

• Ask trustworthy extension workers for feedback: Make deliberate efforts to ask a fellow extension worker to accompany you to a meeting and ask them to give you feedback on your communication skills.

• Find a trusted colleague to alert you whenever you start portraying or exhibiting some of the behaviors that may distract the audience.

2. Knowledge of the audience

It is important that the extension workers know their audience in terms of their cultural backgrounds, beliefs and spiritual aspirations. This knowledge is important because it helps the extension worker in the choice of words, examples to use as well as mode of dressing. The extension worker should make deliberate efforts to know the audience through observations and informal discussions. Therefore, it is important that the extension worker should be open minded and be willing to interact with the community through participation in various functions organized by the communities.

3. Knowledge of the subject matter

It is important for the extension worker to have thorough knowledge of the subject matter before organizing a meeting to avoid providing inaccurate information. It should be pointed out that farmers are not ignorant and that they have various sources of information apart from the extension workers. Therefore, there is need for an extension worker to:

• Conduct thorough consultations to get more information on the subject matter. The extension worker is supposed to consult subject matter specialist to get more information on the subject at hand to ensure that s/he is thoroughly equipped with knowledge. The consultations can also be done through conducting literature review and reading other relevant documents.

• Ensure that participatory and adult learning techniques are employed during the meetings. This is important because it enables the extension worker to learn more from the farmers. This also ensures that the farmers are not passive learners and also makes the meeting exciting through knowledge and experience sharing.
4. **Use a variety of teaching methods**

It is important for an extension worker to know and bear in mind that various people learn different. Some people learn better when they see, others prefer hearing while some learn better when they do. Therefore, it is important for the extension worker to employ the various teaching methods when organizing meetings so that all the needs of the learners are met. This is because other learners will be distracted and not pay attention if the learning style that is being used does not address their learning needs.

**Facilitation skills**

- Facilitation is a Learner Centered Approach to adult training encourages creativity and reflection by participants. The situation provides conducive environment for joint learning as both learner and trainer learn from each other.

- Facilitation is a process whereby there is joint learning between learner and trainer. It is learner centered which encourages creativity and reflection by participants leading to change in knowledge, attitude and practices.

**Qualities of a Good Facilitator**

- A good facilitator is not a dictator or controller, nor a leader or group president rather is a person who ensures successful group decision – making by overcoming or minimizing conflicts.

- A good facilitator should have:
  1. Adequate knowledge
  2. Good personality
  3. Adequate skills

**Some of the terms used to describe a good facilitator**

a) **Terms related to adequate knowledge**

  - Competent
  - Intelligent
  - Experienced
  - Mentally alert
  - Encourager
  - Good communicator
b) Terms related to personality
   - Approachable
   - Willingness to learn from others
   - Disciplined
   - Reliable
   - Trustworthy
   - Mature
   - Democratic
   - Constructive
   - Tolerant
   - Open Assertive
   - Empathetic
   - Considerate
   - Respectful

c) Terms related to skills.
   - Orderly
   - Logical
   - Systematic
   - Tactful
   - Organized

Factors that need consideration during planning

When planning for facilitation, considers characteristics of the following
   - The participants
   - The subject matter
   - Resources and constraints
   - Venue
Use of Supporting Materials
Supporting materials should be:
- Visible
- Simple
- Appropriate
- Attractive
- Practical

Participants and their behaviour
Participants exhibit the following characteristics:
- Non-participants
- Super-participants
- Disrupters
- Negatives
- Arguers
- Ramblers

Tips for Making a Presentation
- Sitting arrangement:
  - Free eye contact
  - Audibility
  - Two way communication (participatory)
- Handouts
  - Provide handouts at the end of the presentation
- Duration:
  - Make the presentation short and to the point
- Pace
  - Speak slowly to give participants chance to think – repeat points
- Questions:
  - Constantly ask questions to keep participants active and alert
- Training notes:
  - Refer to them but do not read from them
• Visual aids:
  o Adults learn more when the see something

• Eye contact:
  o Establish and maintain eye contact to stimulate interest and check understanding

• Concrete examples:
  o Illustrate points with clear and specific examples that participants can relate to

• Joint ownership
  o Search for answers together with participants and generate joint ownership of learning

Qualities of Good Presentation

• Objectives:
  o Should be Specific, Measurable, Accurate, Realistic and Timely (SMART)

• A summary:
  o Point form

• Method:
  o Outline the method to be used during the presentation e.g. lecturette or demonstration

• Materials:
  o List training materials/aids that will be required

• Time:
  o Indicate time allotted to each component

• Evaluation:
  o Check whether participants have understood by asking for commitment to change
  o Refer to objectives to see if they have been covered

• Summary:
  o Pick up main points of learning from the presentation
Farmer Mobilization and Sensitization

Extension workers use groups to increase farmer coverage with extension services and to facilitate their linkage to different stakeholders. Majority of group disband without realizing long term objectives for which they were established for. Poor sensitization and mobilization of the farmers is blamed to contribute to unsustainability of groups. These two steps are generally overlooked as public and private extension officers rush to organize farmers in groups without giving them ample time to understand the purpose or objectives of forming a group. Thus interest and long term vision is no created at the outset.

Viability of farmer groups or sustainability of interventions undertaken may have implications on steps and time taken for the members of the group or participants in the intervention were sensitized and mobilized to take part. Thus sensitization and mobilization for farmers are critical step to viable groups and sustainable intervention.

Definitions of Terms: Farmer Sensitization and Mobilization

Farmer Sensitization

It is the process of raising/creating awareness among the farmers on a development issue such as existence and importance of an activity, business undertaking or enterprise.

Benefits

Sensitization process is important in extension and advisory services because it:

- Provides time for farmers think over and synthesize the message from the extension workers
- Enables informed decision making process so that when they are participating in an activity, it is out of understanding not just following.
- Facilitates participation of farmer all gender categories to have their voice heard.
- Creates foundation for meaningful empowerment, emancipation, self-reliance and ownership of the development activity. Thus dependence syndrome can be easily managed.

Sensitization is thus a preliminary step before farmers are mobilized to undertake the activity.
Farmer Mobilization

Is a process of activating interested farmers to meet, discuss and make positive decisions on a development idea or initiative they have shown interest to undertake. This may include forming a group or volunteering to undertake an enterprise. Interested members should register their names.

Benefits

Mobilization strengthens farmers’ thinking to adopt ideas raised during the sensitization process. During mobilization farmers undertake the following actions:

- Rethink, plan and reorganize themselves and form pre-farmer groups.
- Identify potential problems relating to the development idea, articulate their situation and discuss potential solutions.
- Identifies diversity of needs amongst members in relation to the activity
- Clarify roles and identify champions/ persons to lead the activities (they form interim committee)
- Provides basis for viable groups and sustainable intervention because of active participation, empowerment, problem posing, self-diagnosis and ownership spirit are nurtured.

Difference between sensitization and mobilization

Sensitization and mobilization are often confused to mean the same, and that is the reason extension workers go into a community and by the time they leave a group has been formed or farmers have shown interest to participate in activities. This leads to dysfunctional groups or unsustainable interventions due to lack of ownership. The following are the difference between the above terms:

<table>
<thead>
<tr>
<th>Sensitization</th>
<th>Mobilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creates awareness to people</td>
<td>Brings together interested people</td>
</tr>
<tr>
<td>Has no committee</td>
<td>Has interim committee</td>
</tr>
<tr>
<td>Interested farmers are unknown because it is large group</td>
<td>Members interested are known and register</td>
</tr>
<tr>
<td>Determining interest of farmers not easy</td>
<td>Farmers commitment can be assessed</td>
</tr>
<tr>
<td>Farmers have no goal or are not aware of their goal</td>
<td>Interested farmers work together to develop goals and vision and are ready to operate as a pre-group with interim committee</td>
</tr>
</tbody>
</table>
Steps in farmer sensitization

The following are the steps in farmer sensitization:

1. The Extension worker should prepare thoroughly by outlining:
   - objectives of interventions/ initiative,
   - how will it benefit the people
   - contributions expected from people
   - Have vital information concerning the development issue ready

2. Contact the village headman to brief him/her on the subject matter and issues at hand and request him/her to call for a village meeting according to the subject matter.

3. Ask the village headman to invite mostly concerned farmers to the meeting and agree on a meeting place, date and time.

4. During the meeting introduce the subject matter and discuss with farmers in a participatory manner. Ensure to give equal chances to men and women to contribute to the discussion.

5. Let the farmers discuss the subject matter in details on their own. Suggest forming groups to discuss. If agreeable ensure equal opportunities for all gender to discuss their concerns.

6. Encourage all farmers to be part of the discussions and they can be assured of having their voices heard.

7. Let the farmers who are expressing interest in the subject area do so by declaring their interests and those who are completely not interested should be freed. The interested farmers should meet to discuss further and the village headman/his subordinate should chair the meeting. The Extension worker should only facilitate.

8. Let them (farmers) propose dates for the next meeting(s) and agenda.

Sensitization can use multimedia and can be categorized as:

   a) *Small Scale Sensitization*
      - This requires simple strategies such as face to face notification, village meetings, farm household visits, and letter of invitation.

   b) *Large Scale Sensitization*
      - This requires strategies like meetings, posters, mobile, van and radio announcements.

After farmer sensitization interested individuals need to be mobilized.
**Steps in farmer mobilization**

The following are steps undertaken in farmer mobilization:-

1. After farmer sensitization, interested farmers should register their names pending election of leaders, formulation of norms/constitution and structures (committees).

2. Let the pre-farmer group agree on meeting schedule.

3. Members should formulate common objectives and shared vision of the group.

4. Train all members on qualities of office bearers.

5. Facilitate election of an interim committee.

6. Train office bearers on their roles and responsibilities.

7. Facilitate the group to formulate norms.

8. Introduce development workers from other organizations who deal with the enterprise or activity to the pre-farmer group.

9. Further encourage the pre-group to seek information from the stakeholders more often.

10. Facilitate the pre-farmer group members to formulate an action plan through participatory planning approach.

The action plan should have the following:

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>TARGET</th>
<th>TIME FRAME</th>
<th>MONITORING INDICATOR</th>
<th>REQUIRED RESOURCES</th>
<th>RESPONSIBLE OFFICER</th>
</tr>
</thead>
</table>

11. Promote collective action amongst group members.

12. Encourage them to adhere to the action plan whilst implementing activities.

Pre-farmer group should understand that an Extension worker is only a facilitator and that decisions and implementation of activities is their responsibility together with their leaders. Facilitate information sharing among members in the pre-farmer group to avoid misconception which can negatively affect formation and growth of the group.
Potential threats to farmers’ sensitization and mobilization

Farmer mobilization and sensitization process can be threatened by factors such as:

• Deep-rooted over-dependency syndrome of farmers on government and other organizations for development.
• Fear of the unknown
• Suspicion of others (i.e. some farmers suspecting that others may gain more)
• Poor local leadership that discourages other people from assuming leadership roles. Some local leaders (e.g. Village headmen) want to take leadership roles in farmers groups as well without being nominated.
• Some farmers have problems with unequal input to activities.

These factors can prevent farmers from participating in the sensitization and mobilization processes. Strategies are available to address such situations.

Strategies to overcome threats to farmer sensitization and mobilization

1. Facilitating farmers’ need to take action on activities they participated in making decisions.
2. Civic educate farmers to become aware that personal, household, and village development is their responsibility
3. Encourage transparency in leadership and decision making so that suspicions are reduced.
4. Enable members to be accountable or answerable for their actions
5. Support emerging leaders who have the desire to mobilize people for action.
6. Facilitate information sharing on new ideas among farmers. Identify role models from the village and beyond to share experiences.
7. Reinforce trust-building among farmers.

The underlying objectives in properly planned and implemented farmer sensitization and mobilization are to:

• Enhance farmers awareness to developmental issues
• promote participatory and informed decision making at grassroots
• Encourage farmers’ interaction with extension workers
• Encourage contact and dialogue
• Promote joint planning and learning
• Empower farmers to take action
8. AGRIBUSINESS MANAGEMENT

Gross Margin Budgeting/Analysis

Gross margin refers to the remaining income from an enterprise after the variable costs are deducted (Gross income less Variable costs). It is usually calculated before production and after production on unit basis such as per hectare or per herd. Gross margin budget is a fairly detailed estimate of the output, cost, and profitability of individual crop and livestock enterprises. The gross margin budget includes all costs involved in producing the enterprise. It is not profit because it does not include fixed costs which the enterprise shares with other enterprises.

Importance of Gross Margin Budgeting/Analysis

• It helps farmers to compare the performance of a single enterprise using different farming practices and technologies.

• It is used to calculate potential profitability of growing an entirely new crop if a farmer wishes to diversify the products.

Steps for Gross Margin Calculation

1. Determine an average yield per hectare for the enterprise.
2. Determine the average farm gate price for the enterprise.
3. Calculate the gross income per hectare (i.e. the average yield per hectare multiplied by the price at the farm gate.)
4. Calculate the non-labour variable cash costs of inputs and materials per hectare for the enterprise. These should include the costs of seeds, fertilizer, pesticides, machinery services etc.
5. Estimate the labour costs per hectare per activity for each enterprise (e.g. land preparation, sowing, weeding, harvesting, etc.).
6. Calculate the total variable costs by summing the cost of inputs and materials and labour.
7. Calculate the gross margin per hectare by subtracting variable costs from the gross income.
8. Repeat steps 1 to 7 for each enterprise on the farm.
9. Compare the gross margins among enterprises and determine which is or are more profitable.
Gross Margin for One Hectare of Maize Enterprise

<table>
<thead>
<tr>
<th>Income</th>
<th>Price (MK/Kg)</th>
<th>Value (MK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity (Kg)</td>
<td>100</td>
<td>5000 x 100</td>
</tr>
<tr>
<td>Total Income</td>
<td></td>
<td>500,000</td>
</tr>
</tbody>
</table>

Variable costs

<table>
<thead>
<tr>
<th>Item</th>
<th>Total Cost (MK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeds</td>
<td>20,000</td>
</tr>
<tr>
<td>23:21:0+4S</td>
<td>30,000</td>
</tr>
<tr>
<td>UREA</td>
<td>30,000</td>
</tr>
<tr>
<td>Land preparation</td>
<td>5,000</td>
</tr>
<tr>
<td>Ploughing</td>
<td>10,000</td>
</tr>
<tr>
<td>Ridging</td>
<td>15,000</td>
</tr>
<tr>
<td>Planting</td>
<td>5,000</td>
</tr>
<tr>
<td>Fertilizer Application</td>
<td>5,000</td>
</tr>
<tr>
<td>Weeding</td>
<td>15,000</td>
</tr>
<tr>
<td>Harvesting</td>
<td>20,000</td>
</tr>
<tr>
<td>Bagging</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>Total Variable Costs</strong></td>
<td><strong>160,000</strong></td>
</tr>
</tbody>
</table>

Enterprise Gross Margin per Ha

\[(500,000 - 160,000) = 340,000\]

Actual Ha

| Actual Ha | 2 |

Gross Margin per actual Ha

\[(340,000 \times 2) = 680,000\]
Gross Margin for Beef Enterprise

Gross income for a livestock enterprise is calculated as follows:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Kwacha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closing value of animals at end of the year</td>
<td>300,000</td>
</tr>
<tr>
<td>LESS: Opening value of animals at beginning of the year</td>
<td>200,000</td>
</tr>
<tr>
<td>EQUALS: Increase in value of stock</td>
<td>100,000</td>
</tr>
<tr>
<td>Income from sales of animals</td>
<td>100,000</td>
</tr>
<tr>
<td>Income from sales of by-products such as manure</td>
<td>50,000</td>
</tr>
<tr>
<td>Value of products used for home consumption</td>
<td>50,000</td>
</tr>
<tr>
<td>EQUALS: Value of sales and consumption</td>
<td>200,000</td>
</tr>
<tr>
<td>LESS: Purchases of animals during the year</td>
<td>100,000</td>
</tr>
<tr>
<td>EQUALS: Net Sales</td>
<td>100,000</td>
</tr>
<tr>
<td>A + B GROSS INCOME</td>
<td>200,000</td>
</tr>
</tbody>
</table>

Variable Costs

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Kwacha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drugs</td>
<td>15,000</td>
</tr>
<tr>
<td>Feeds</td>
<td>50,000</td>
</tr>
<tr>
<td>Veterinary Services</td>
<td>5,000</td>
</tr>
<tr>
<td>Labour</td>
<td>30,000</td>
</tr>
<tr>
<td>Total Variable Cost</td>
<td>100,000</td>
</tr>
<tr>
<td>Gross margin</td>
<td>(200,000-100,000)= 100,000</td>
</tr>
</tbody>
</table>

Break-Even Budgeting/Analysis

Break-even budgeting is a technique for studying the relationship between costs and income at different levels of production and different prices. A break-even budget estimates the point at which farm’s gross income is equal to its total variable costs. It looks at the level of the activity where no profit (gross margin) is made. The break even can be determined for yield and market price.
Importance of Break-Even Budgeting/Analysis

• It gives an indication of maximum acceptable level of cost—the point at which, if costs increase, the farm will not be profitable

• It also gives the minimum acceptable level of a benefit given an estimated level of cost—the point at which if income decrease, the farm will not be profitable.

• It helps the farmer make a plan when considering making a change in production (yield), inputs or mechanization costs or market price. For example when the farmer wants to substitute one variety of maize for another.

Break-Even Calculation

• Determining the Break-Even Yield

Break-even yield (BY) is the yield required to recover all the costs incurred in production at given prices of the product and given input costs.

\[
\text{Break-even yield/ha (BY)} = \frac{\text{Total variable cost/ha}}{\text{Product Price/unit}}
\]

\[
\text{Break-even yield of Maize/ha (BY)} = \frac{\text{MK 160,000}}{\text{MK 100/kg}} = \text{MK 1600 kg}
\]
Determining the Break-Even Price

Break-even price of the product is the product price needed to recover all variable costs incurred in production at a given output level and cost of input.

\[
\text{Break-even Price/ha (BP)} = \frac{\text{Total variable cost/ha}}{\text{Expected yield/ha}}
\]

\[
\text{Break-even Price of Maize/ha (BP)} = \frac{\text{MK 160,000}}{\text{MK5000kg}} = \frac{\text{MK 32 kg}}{}
\]

Cash Flow Budgeting

Cash flow is the flow of money into the farm from sales, loans and donation or gifts and the flow of money out of the farm through purchases and other payments. The difference between the cash inflows and cash outflows gives net cash flow. Net cash flow is calculated by subtracting the money (cash) spent over the year from the money received.

Importance of a Cash Flow Budget

- The farmer uses it to develop the farm plan
- It helps farmers choose between alternative farm enterprises
- It helps farmers to arrange for loans
- It helps the farmer to assess the overall effect of the enterprise on the household finances.
- It helps to assess whether the family will have enough money to carry out their plan or if they will be short of money in any month.
- It enables the farmer to find the time of the year where additional financial resources may be required.
Steps for Constructing a Cash Flow Budget

The steps involved in preparing the Cash Flow are as follows:

Step 1:
Identify Inflow and Outflow by listing income and expenditure items and when they occur in the year. For example sale of maize in July, buying of fertilizer in October.

Step 2:
Prepare a Cash Flow Table by entering all of the information in a Cash Flow chart which is shown at the end of steps.

Step 3:
Calculate the monthly net Cash Flow by subtracting the expenses from the income for each month. It will be positive if income is greater than expenses; and negative if income is less than expenses.

Step 4:
Calculate the cumulative net Cash Flow by adding the monthly net Cash Flow with the cumulative net Cash Flow of the previous month in order to assess whether the family have enough cash over the year to finance activities.

Step 5:
Analyze the net Cash Flow to determine period (months) when the family has a shortfall or surplus of cash.

Refer next page for an example of a Cash flow Budget
## CASH FLOW BUDGET

<table>
<thead>
<tr>
<th>MONEY COMING IN</th>
<th>Jan (K,000)</th>
<th>Feb (K,000)</th>
<th>Mar (K,000)</th>
<th>Apr (K,000)</th>
<th>May (K,000)</th>
<th>Jun (K,000)</th>
<th>Jul (K,000)</th>
<th>Aug (K,000)</th>
<th>Sep (K,000)</th>
<th>Oct (K,000)</th>
<th>Nov (K,000)</th>
<th>Dec (K,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sales of farm products:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>250</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cassava</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>300</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chicken</td>
<td>130</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>400</td>
</tr>
<tr>
<td><strong>Total Cash Inflow</strong></td>
<td><strong>380</strong></td>
<td><strong>0</strong></td>
<td><strong>360</strong></td>
<td><strong>400</strong></td>
<td><strong>60</strong></td>
<td><strong>60</strong></td>
<td><strong>510</strong></td>
<td><strong>180</strong></td>
<td><strong>420</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>400</strong></td>
</tr>
<tr>
<td>MONEY GOING OUT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Payments &amp; Purchase of inputs:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize inputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>300</strong></td>
</tr>
<tr>
<td>Cassava inputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>37</strong></td>
</tr>
<tr>
<td>Farm inputs livestock</td>
<td>30</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td><strong>30</strong></td>
</tr>
<tr>
<td>Chicken feeding expenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>60</strong></td>
</tr>
<tr>
<td>Beans inputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>200</strong></td>
</tr>
<tr>
<td><strong>Total Cash Outflow</strong></td>
<td><strong>50</strong></td>
<td><strong>270</strong></td>
<td><strong>370</strong></td>
<td><strong>307</strong></td>
<td><strong>260</strong></td>
<td><strong>70</strong></td>
<td><strong>110</strong></td>
<td><strong>70</strong></td>
<td><strong>530</strong></td>
<td><strong>230</strong></td>
<td><strong>50</strong></td>
<td><strong>90</strong></td>
</tr>
<tr>
<td><strong>Monthly Net Cash Flow</strong></td>
<td><strong>350</strong></td>
<td><strong>270</strong></td>
<td><strong>10</strong></td>
<td><strong>83</strong></td>
<td><strong>200</strong></td>
<td><strong>10</strong></td>
<td><strong>400</strong></td>
<td><strong>110</strong></td>
<td><strong>-110</strong></td>
<td><strong>-130</strong></td>
<td><strong>50</strong></td>
<td><strong>310</strong></td>
</tr>
<tr>
<td><strong>Cumulative balance</strong></td>
<td><strong>350</strong></td>
<td><strong>80</strong></td>
<td><strong>70</strong></td>
<td><strong>153</strong></td>
<td><strong>-47</strong></td>
<td><strong>-57</strong></td>
<td><strong>343</strong></td>
<td><strong>453</strong></td>
<td><strong>343</strong></td>
<td><strong>213</strong></td>
<td><strong>263</strong></td>
<td><strong>573</strong></td>
</tr>
</tbody>
</table>
Farm Business Records

Farm Records are financial and physical details involved in the course of operating a farming business. There are two types of farm records namely: Physical records and financial records. Physical records are records of actual quantities in form of kg, meters, litres, hectares, tonnes and other units of measures other than money. Examples include farm map, crop and livestock enterprise record. Financial records are all the data information that is kept for keeping track of the money coming in and going out of the farming business. Examples include farm inventory, cash book, sales book, purchase book.

Importance of keeping farm business records

• Provide the farmer with a history of what has happened on the farm between seasons and years
• Helps to assess the physical and financial performance of an enterprise or the whole farm business
• Establish a basis for budgeting and planning changes in the farm business
• Tell a farmer how much she is earning
• Facilitate advisory services to farmers wishing to borrow money for investment, sales and marketing of agricultural products
• Records aid the producer in obtaining greater net returns and/or making savings in operating the farming business than would have been possible without such records.

Sample crop enterprise record

<table>
<thead>
<tr>
<th>Crop</th>
<th>Ha</th>
<th>Seed used</th>
<th>Fertilizer Used</th>
<th>Manure</th>
<th>Sprays</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sample record of home consumed farm produce

<table>
<thead>
<tr>
<th>Date</th>
<th>Details</th>
<th>Eggs</th>
<th>Meats</th>
<th>G/nuts</th>
<th>Beans</th>
<th>Vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AEDO Handbook on Good Agriculture Practices
Sample sales and receipts (Incomes-In Section) record

<table>
<thead>
<tr>
<th>Date</th>
<th>Details</th>
<th>Receipt No.</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cash</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bank</td>
</tr>
</tbody>
</table>

Sample Purchases and expenses (Expenditures-Out Section) record

<table>
<thead>
<tr>
<th>Date</th>
<th>Details</th>
<th>Receipt No.</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cash</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bank</td>
</tr>
</tbody>
</table>

Sample sales book record

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
<th>Cash</th>
<th>Credit</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/2/2014</td>
<td>Vegetables</td>
<td>50</td>
<td>70</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>Eggs</td>
<td>120</td>
<td>60</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>Green maize</td>
<td>200</td>
<td>0</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>Milk</td>
<td>250</td>
<td>400</td>
<td>650</td>
</tr>
<tr>
<td></td>
<td><strong>Total sales (daily)</strong></td>
<td><strong>620</strong></td>
<td><strong>530</strong></td>
<td><strong>1150</strong></td>
</tr>
</tbody>
</table>

Market Research

Market research is the activity of collecting information about customers’ needs and preferences concerning a specific product/service as well as information concerning the competition. It is the starting point for any production activity to determine what, where, how, why the product is in demand in order to prepare a production, processing, operations and marketing plan to respond to the perceived demand. Market research helps farmers to produce what they can sell rather than produce then hunt for a buyer.

Importance of Conducting Market Research

- It helps farmers to respond adequately to market demand or market requirements.
• Minimises marketing difficulties by producing what you can sell rather than sell what you have already produced.

• Helps to find out what products people want and reasons for their preferences.

• It assists accurate collection of information so that a reliable level of sales and production can be forecasted.

• Helps farmers prepare for possible changes – embark on mass production or change into a new product.

• It assists in establishment of good relations with potential customers or buyers.

• It assists in gathering relevant information or data for business plan write-up.

Steps for Conducting Market Research

**Step 1:**
Farmers should develop a questionnaire or checklist of data they want to collect during market research.

**Step 2:**
Farmers should discuss the questionnaire/checklist with fellow farmers and draw a visitation plan to the possible buyers of their products.

**Step 3:**
Buyers should be written for booking in the visit / interview in advance.

**Step 4:**
Conduct the survey to all possible buyers based on visitation and booking plan to collect data.

**Step 5:**
After conducting the market survey, farmers should analyze the survey results to choose markets or buyers which farmers can make contract with or get linked.

**Step 6:**
Farmers should then decide whether to go on with their farm plan of producing for the possible identified buyers.
**Example of Questionnaire for Conducting Market Survey**

Kafukufuku wa misika

Dzina la bungwe____________________________________________________________

Komwe bungwe lili (location)________________________________________________

Munthu wolumikizana naye pogulitsa katundu

Dzina la ogula____________________________________________________________

Udindo wake mu Bungwe___________________________________________________

Lamya ya gula____________________________________________________________

Email ya ogula ___________________________________________________________

Address ya ogula __________________________________________________________

1. Kodi katundu amene mumagula ndi ochuluka bwanji, nanga mumagula pa mtengo wanji ndipo mumagula mitundu yanji?

<table>
<thead>
<tr>
<th>MBEU</th>
<th>MTUNDU (varieties)</th>
<th>KUCHULUKA (kg)</th>
<th>MITENGO (MK)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2012</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Kodi katundu ameneyu mumagwiritsa ntchito yanji?

<table>
<thead>
<tr>
<th>KATUNDU</th>
<th>NTCHITO YAKE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Amene amakubweretselani katundu pakali pano ndi ndani?

<table>
<thead>
<tr>
<th>Katundu</th>
<th>Dzina la Obweretsa katundu</th>
<th>Kuchuluka kwa katundu (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. Kodi ndi miyezi iti imene katundu amabwera wambiri nanga ndi miyezi iti yomwe amabwera ochepa?

<table>
<thead>
<tr>
<th>MBEU</th>
<th>Miyezi Yomwe katundu amachuluka</th>
<th>Miyezi yomwe katundu amachepa</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Kodi okubweretserani katundu ndi odalilika bwanji pa kachulukidwe ka katundu wawo, kaonekedwe kake (quality) ndi kalandiridwe ka ndalama

<table>
<thead>
<tr>
<th>Dzina la Ogulitsa</th>
<th>Kudalilika pa Kachulukidwe</th>
<th>Kudalilika pa Kawonekedwe</th>
<th>Kudalilika pa kalandiridwe ka ndalama</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

6. Kodi malipiro kwa obweretsa katundu mumapereka patapita nthawi yaitali bwanji, nanga munjira yanji (cheque/cash)?

<table>
<thead>
<tr>
<th>katundu</th>
<th>Nthawi yo perekera ndalama</th>
<th>Njira yoperekera ndalama</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Kodi pali mbeu zina zimene mungazikonde zimene sizipezeka pakadali pano

<table>
<thead>
<tr>
<th>MBEU</th>
<th>MTUNDU (varieties)</th>
<th>KUCHULUKA (kg)</th>
<th>MITENGO (Mk)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Kodi mungatigule mbeu zochuluka bwanji titati talima za quality yomwe mumafuna ndi kuzigulitsa pa mtengo omwe mumagulila enawa?

<table>
<thead>
<tr>
<th>Mbeu Zomwe zingagulidwe</th>
<th>Kuchuluka (kg)</th>
<th>Mtundu (varieties)</th>
<th>Mtengo (mk)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Analyzed Market Research Data

<table>
<thead>
<tr>
<th>ID</th>
<th>ORGANISATION</th>
<th>CROP</th>
<th>VARIETY</th>
<th>QUANTITY</th>
<th>PRICE</th>
<th>TRAMOUNT</th>
<th>DELIVERY</th>
<th>P R O D U C T AVAILABLE</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Madisi Secondary School</td>
<td>Maize</td>
<td>All</td>
<td>540 bags</td>
<td>2700</td>
<td>17/kg</td>
<td>1 Month</td>
<td>cash/Check</td>
<td>Feb-Mar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Lilongwe Hotel</td>
<td>Tomato</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cabbage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Mzuzu Central Hospital</td>
<td>Maize</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IrishPotato</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Blessings Hospital</td>
<td>Chinese</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Farm Business Plan

A farm business plan is a plan that records the most important decisions and actions affecting the operation of the farm business. It is a way to make sure that all the things that need to be done are done in a way that makes the farm more profitable. A farm business plan can be very simple or very complex.

Components of Farm Business Plan

1. Background—Describe farm business, objectives of farm business, vision and goal of farm business.

2. Farm Production Plan—State the number and types of farm enterprises (crops, livestock), and the size of each farm enterprise.

3. Technical Feasibility—State or check if it is possible to produce the proposed farm enterprises based on rainfall, temperature, soil, water availability, grazing land etc.

4. Physical Resources and Inputs—Describe the resources and inputs needed such as capital, inputs and materials, quantity need and available and sources of supply.

5. Labour Requirements—Describe the quantity of labour required and available to carry out farming activities. State also when and where the needed labour will be sourced.
6. Market plan—State where (buyers and place) you will sell the products, selling price, packaging and transport arrangement.

7. Profitability—State enterprise gross income (quantity x price), enterprise variable costs, gross margin and fixed costs to determine farm profit.

8. Cash availability—Describe how much cash is needed and available to finance farm activities. Describe also the flow of cash over the months and the sources of cash.

9. Risks—State possible farm business risks and how farmers will handle them.

10. Notes—Write any other information farmers may require to record such as where to get some technical assistance.

**Simple Farm Business Plan Template**

**Background**

<table>
<thead>
<tr>
<th>Name</th>
<th>Village/District</th>
<th>Period of Farm Business Plan e.g. 2014/2015 Farming Season</th>
</tr>
</thead>
</table>

**Vision**

- 
- 
- 

**Goal**

- 
- 
- 

**Farm Production Plan**

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Area(ha)</th>
<th>Output (Kg/ha)</th>
<th>Total output (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Milk Production

<table>
<thead>
<tr>
<th>Type of animal</th>
<th>Number of animals</th>
<th>Litres per animal</th>
<th>Total litres</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Technical Feasibility

<table>
<thead>
<tr>
<th>Technical Production Factors</th>
<th>Okay/Not okay</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Physical Resources and Inputs

<table>
<thead>
<tr>
<th>Resources/Inputs</th>
<th>Quantity</th>
<th>Source of supply</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Labour Requirements and Availability

<table>
<thead>
<tr>
<th>Enterprise Activity</th>
<th>Month</th>
<th>Total labour required to do the activity</th>
<th>Amount of labour to hire</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.g. Land preparation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Market Plan

<table>
<thead>
<tr>
<th>Target market</th>
<th>Expected quantity to sell</th>
<th>Marketing Costs (MK)</th>
<th>Expected Price (MK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.g. Mzuzu Central Hospital or ADMARC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Profitability

Enterprise: _________________________________________________________

### Income

<table>
<thead>
<tr>
<th>Product</th>
<th>Quantity</th>
<th>Price per unit (MK)</th>
<th>Total Value (MK)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Expected Income</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Variable Costs

<table>
<thead>
<tr>
<th>Resource/Inputs/labour</th>
<th>Quantity needed</th>
<th>Cost per unit (MK)</th>
<th>Total Costs(MK)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Expected Enterprise Profit</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Enterprise: _________________________________________________________

### Income

<table>
<thead>
<tr>
<th>Product</th>
<th>Quantity</th>
<th>Price per unit (MK)</th>
<th>Total Value (MK)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Expected Income</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Variable Costs

<table>
<thead>
<tr>
<th>Resource/Inputs/labour</th>
<th>Quantity needed</th>
<th>Cost per unit ($)</th>
<th>Total Costs($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Expected Enterprise Profit</strong></td>
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</table>
### Whole Farm Profit

<table>
<thead>
<tr>
<th></th>
<th>Enterprise 1</th>
<th>Enterprise 2</th>
<th>Total Expected Enterprise Profit</th>
</tr>
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<tbody>
<tr>
<td>Expected Enterprise Profit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less Fixed Costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Fixed Costs</td>
<td></td>
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### Cash Availability

<table>
<thead>
<tr>
<th>Cash needed</th>
<th>Cash Available</th>
<th>Source</th>
</tr>
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<tbody>
<tr>
<td></td>
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</table>

### Cash Inflow and Outflows

<table>
<thead>
<tr>
<th></th>
<th>Month1</th>
<th>Month2</th>
<th>Month3</th>
<th>Month4</th>
<th>Month6</th>
<th>Month7</th>
<th>Total</th>
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<tr>
<td>Cash Inflow</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Total Cash Available</td>
<td></td>
<td></td>
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<tr>
<td>Cash going out/expenses</td>
<td></td>
<td></td>
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<tr>
<td>Total cash going out</td>
<td></td>
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</tr>
<tr>
<td>Net Cash Flow</td>
<td></td>
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<tr>
<td>Cumulative Cash flow</td>
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### Risks

<table>
<thead>
<tr>
<th>Risks</th>
<th>How to handle the risk</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

### Notes

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7. GENDER AND HIV MAINSTREAMING IN AGRICULTURE

Gender disparities and HIV issues are among the major constraints that affect agriculture development in Malawi. A situation analysis of men and women in the agriculture sector reveals that women are more disadvantaged than men in terms of access to and control of agriculture resources and benefits, and are also more affected by HIV and AIDS impacts.

**Impacts of gender disparities in agriculture**

The following are some of the gender issues in the agriculture sector in Malawi:

- Limited access to, ownership, and control over productive resources such as land, labour, financial services, income, technology by vulnerable gender categories particularly women
- Limited access to markets by vulnerable gender categories especially when the markets are located far away from the village
- Low participation of women in decision making on issues related to agriculture production including community meetings.
- Unequal division of labour at the household where women tend to carry out most of the farm work on top of doing other reproductive work such as fetching water, taking care of the children and cooking

**Impacts of HIV and AIDS on agriculture**

HIV and AIDS on the other hand, has devastating impacts on farming communities in Malawi especially in the rural areas where agriculture is synonymous to livelihood security. Some of the impacts of HIV and AIDS on the agriculture sector in Malawi include:

- Diversion of income meant for agriculture production to provision of from to care, treatment and support for sick family members.
- Reduction in available farm labour as a result of sickness of family members, which may delay farm operations
- Grabbing of agricultural equipment and inputs by relatives of the deceased
- Increase in workload especially for women who take the responsibility of caring for the sick and orphans
- Increased morbidity and mortality of agriculture technical staff, which results in difficulties for farmers to access extension services
Why we need to address gender, HIV and AIDS issues in Agriculture

Addressing gender, HIV and AIDS issues in the agriculture sector will improve the lives of women, men, girls and boys, thus making the development process more efficient and sustainable.

How do we mainstream Gender, HIV and AIDS in Agriculture?

Gender HIV and AIDS mainstreaming refers to a process of identifying, internalizing, integrating and institutionalizing gender, HIV and AIDS issues, concerns, needs and priorities so that they are part and parcel of all agricultural development activities.

![Diagram of 4Is process]

**Figure:** Gender, HIV and AIDS Mainstreaming Process

What are the benefits of Gender and HIV mainstreaming?

Gender, HIV and AIDS mainstreaming is done to:

- Reduce gender disparities that exist among men, women, boys and girls in access to and control over agricultural resources and benefits
- Promote participation of all gender categories including the marginalized in agricultural development processes
• Empower the marginalized gender groups such as women, PLHIV, Child headed households through income generating and special projects.

• Reduce the impacts of gender disparities and AIDS on the project/programme mandate and vice versa.

• Ensure that programmes or projects do not to perpetuate or introduce gender disparities or worsen vulnerability to HIV and AIDS.

Steps for Mainstreaming Gender and HIV in Programmes and Projects

The 4 Is

Identification of Issues and Concerns

• Identification of Gender, HIV and AIDS issues and concerns is done with gender categories at community's and in collaboration with relevant stakeholders.

• Identification is done by using gender and HIV responsive participatory appraisal tools.

• It is essential that all gender categories in a community should express the issues and concerns.

• The gender and HIV issues and concerns should be quantified based on their importance and urgency for redress.

• Each project and programme should indicate the gender and HIV issues or concerns it is addressing.

Internalization

• Means to be convinced and committed to deal with the identified Gender, HIV and AIDS issues and concerns.

• For farmers of all gender categories to own the issues and concerns, practical and real life experiences should be used in terms of drama, role-plays, case studies, focus group discussions and other participatory tools.

Integration

• This means addressing gender, HIV and AIDS issues and concerns in the development of the core business (subject area), objectives and interventions with active participation of all gender categories.
• The interventions should be accompanied with use of relevant Information, Education Communication (IEC) materials.

• The issues that are outside the core business should be referred to other stakeholder and partners for assistance.

**Institutionalization**

• Institutionalization means enhancing and scaling up implementation of Gender, HIV and AIDS responsive agricultural interventions, projects and programs.

• This can be done by organizing and strengthening support structures like Gender, HIV and AIDS committees, focal points and desk officers.

**Issues that should be mainstreamed**

**Gender Issues**

This usually involves identification of practical and strategic gender needs through the use of participatory tools. These needs usually revolve around four variables linked to gender equality and women empowerment. These variables include:

• **Division of labor between male and female**

  This looks at who between female and male farmers does what type of work, who is already overburdened with work, who is paid for what type of work to ensure that the concerns of all gender categories are addressed.

• **Access to resources and benefits and opportunities**

  This looks involves conducting a gender analysis to look at who has access to what resources and where there are imbalances, developing actions where there are imbalances to achieve equality

• **Control of resources and benefits and**

  This involves developing strategies that empower vulnerable groups so that they have control over resources such as land for growing crops; choice of crops to grow; what farming systems to follow and how to use the income that accrues from the farming. In most households such decisions (related to strategic gender needs) are vested with men who are called heads of households.
• Participation in decision-making

This involves gender analysis to develop actions to promote equal participation of women and men in decision-making in agriculture activities at the household level as well as selection of women in decision-making positions in all institutions.

HIV and AIDS Issues

HIV and AIDS mainstreaming is a process that enables development actors to address the causes & effects of HIV and AIDS in an effective manner both through their usual work and through their workplace.

This entails placing HIV and AIDS at the center of the development agenda or as a process whereby HIV and AIDS actions becomes part of the normal & routine functions of an organization.

Mainstreaming HIV and AIDS entails addressing the following issues:

• Prevention and behavior change

This involves implementing activities that do not promote HIV infection and transmission amongst farmers, or agriculture staff.

This can also include actions aimed at addressing unequal power relations between men and women that cause women and girls to have limited access to agricultural resources thereby putting them at the risk of HIV infection.

• Access to treatment care and support

Under this component the goal is to provide and expand treatment for People Living with HIV and mitigate the health and nutritional impacts of HIV and AIDS.

• Impact mitigation

This involves designing activities aimed at assisting those that are suffering from AIDS and also those that have been affected by the epidemic so that HIV and AIDS does not have negative effects on their lives. People targeted under this component include People Living with HIV, Orphans and Vulnerable Children, widows, widowers, caregivers, and the elderly.
The table below shows some of the interventions that can be implemented as part of mainstreaming gender, HIV and AIDS activities at community level.

<table>
<thead>
<tr>
<th>Gender Mainstreaming Actions</th>
<th>HIV and AIDS mainstreaming Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Conducting awareness meetings</td>
<td>• Establishment of herbal gardens</td>
</tr>
<tr>
<td>• Conducting advocacy campaigns</td>
<td>• Promotion of early maturing crops and promotion of livestock production</td>
</tr>
<tr>
<td>• Training of farmers</td>
<td>• Training of staff and famers on HIV and AIDS</td>
</tr>
<tr>
<td>• Increasing literacy levels of both male and female farmers</td>
<td>• Conducting HIV and AIDS activities at the workplace</td>
</tr>
<tr>
<td>• Improving access to agricultural input and market information amongst farmers</td>
<td>• Promotion of highly nutritious foods such as QPM, indigenous vegetables, small stock</td>
</tr>
<tr>
<td>• Promotion of production of high value crops/livestock amongst women</td>
<td></td>
</tr>
<tr>
<td>• Promoting Income Generating Projects for vulnerable gender groups</td>
<td></td>
</tr>
</tbody>
</table>

Some do’s to be considered when mainstreaming gender, HIV and AIDS

• Always ensure that vulnerable people are targeted with intervention

• Always ensure equal participation of women and other vulnerable farmers in all activities

• Always ensure that men and women are equitably represented in decision making positions in farmer based organizations committees

• Always ensure that extension meetings are organized during times when women and other vulnerable categories can be able to participate

• Always ensure collection and presentation of gender disaggregated data to capture how interventions are impacting on various gender categories
# Appendix 1: Priority commodities varieties and where they grow

## Maize Varieties

<table>
<thead>
<tr>
<th>Variety</th>
<th>Maturity period</th>
<th>Attributes</th>
<th>Recommended agro-ecological zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>DKC 8033 (Mtezezi)</td>
<td>Early to medium maturing hybrid variety</td>
<td>Released in 2003; prolific white hard dent-grained</td>
<td>Medium altitude areas</td>
</tr>
<tr>
<td>DKC 8053</td>
<td>140 days</td>
<td>Released in 2008; flint grain texture; tolerant to gray leaf spot (GLS), Cob rots, leaf blight and common rust but susceptible to to maize streak virus (MSV)</td>
<td>Medium altitude areas</td>
</tr>
<tr>
<td>DKC 8073</td>
<td>120-140 days</td>
<td>Released in 2005; has large grains, good husk cover; good tolerance to the most common leaf diseases such as GLS, MSV, Cob rots and TLB</td>
<td>Adapted to a wide range of environments (700-1,350m above sea level) that receive between 550 and 950 mm of rain per year</td>
</tr>
<tr>
<td>SC 403 (Kanyani)</td>
<td>131 days</td>
<td>It has good tolerance to heat stress and is highly tolerant to MSV and maize chlorotic mottle virus (MCBV)</td>
<td>Low altitude areas characterized by marginal rainfall conditions, such as the Lakeshore plain and Shire Valley. This variety is also suited for dimba cultivation.</td>
</tr>
<tr>
<td>SC 627 (Mkango)</td>
<td>Medium maturing maize variety (144 days)</td>
<td>White, semi dent-grained hybrid</td>
<td>Medium altitude areas</td>
</tr>
<tr>
<td>SC 719 (Njobvu)</td>
<td>Late maturing variety</td>
<td>Released in 2009; white semi-dent; good resistance to MSV, GLS and common rust</td>
<td>High rainfall areas - medium altitude</td>
</tr>
<tr>
<td>Pan 53</td>
<td>145 - 150 days</td>
<td>Released in 2008; tolerant to MSV, GLS and Rust</td>
<td>Warm lakeshore, Shire Valley and mid altitude areas</td>
</tr>
<tr>
<td>PHB 30G19</td>
<td></td>
<td>Released in 2006; tolerant to GLS, MSV and northern leaf blight</td>
<td>Medium altitude areas to high altitude areas</td>
</tr>
<tr>
<td>ZM 721</td>
<td>Intermediate to late</td>
<td>ZM 721 is tolerant to biotic stresses such as gray leaf spot, rust and leaf blight.</td>
<td>Medium altitude areas</td>
</tr>
<tr>
<td>ZM309</td>
<td>Extra early (110-120 days)</td>
<td>Released in 2009; resistant to maize streak virus, gray leaf spot and the common rust</td>
<td>Low altitude areas characterized by marginal rainfall conditions, such as the Lakeshore plain and Shire Valley. This variety is also suited for dimba cultivation.</td>
</tr>
</tbody>
</table>
Maize Varieties *cont’d*

<table>
<thead>
<tr>
<th>Variety</th>
<th>Maturity</th>
<th>Description</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZM523</td>
<td>Early</td>
<td>Released in 2009; resistant to maize streak virus, northern leaf blight, gray leaf spot and the common rust. It is tolerant to drought and performs well under low soil fertility</td>
<td>Low altitude areas characterized by marginal rainfall conditions, such as the Lakeshore plain and Shire Valley. This variety is also suited for <em>dimba</em> cultivation.</td>
</tr>
<tr>
<td>ZM623</td>
<td>Medium maturing maize variety</td>
<td>Tolerance to diseases, high yield, flint grain - poundable, palatable when roasted or boiled, tolerance to dry spell</td>
<td>Medium altitude areas</td>
</tr>
<tr>
<td>Chitedze 2 QPM</td>
<td>Medium maturing maize variety</td>
<td>Released in 2009; high lysine levels of up to 3.91/10g of protein; semi-flint texture which is good for pounding</td>
<td>Mid altitude and low altitude areas of Malawi</td>
</tr>
<tr>
<td>MH26</td>
<td>Medium maturing maize variety</td>
<td>High yield (good for business), good husk cover on cobs, tolerance to diseases</td>
<td>Mid altitude and low altitude areas of Malawi</td>
</tr>
<tr>
<td>MH30</td>
<td>140 days</td>
<td>Tolerant to moisture stress at flowering, GLS, Cercospora zeae-maydis, MSV, rust Puccinia and leaf blight Exserohilum turcicum</td>
<td>Mid altitude and low altitude areas of Malawi</td>
</tr>
<tr>
<td>MH31</td>
<td>140 days</td>
<td>Tolerant to moisture stress at flowering, GLS, Cercospora zeae-maydis, MSV, rust Puccinia and leaf blight Exserohilum turcicum</td>
<td>Mid altitude and low altitude areas of Malawi</td>
</tr>
<tr>
<td>MH33</td>
<td>140 days</td>
<td>Twin cobbing; it is poundable and has a semi flint kernel texture, tolerant to Grey leaf spot Cercospora zeae-maydis, Maize Steak Virus, rust Puccinia spp and leaf blight Exserohilum turcicum</td>
<td>Mid altitude and low altitude areas of Malawi</td>
</tr>
<tr>
<td>MH34</td>
<td>140 days</td>
<td>It is poundable and has a semi flint kernel texture; is tolerant to Grey leaf spot Cercospora zeae-maydis, Maize Steak Virus, rust Puccinia spp and leaf blight Exserohilum turcicum</td>
<td>Mid altitude and low altitude areas of Malawi</td>
</tr>
<tr>
<td>MH35</td>
<td>140 days</td>
<td>It is poundable and most flint hybrid with a grain texture; tolerant to Grey leaf spot Cercospora zeae-maydis, rust Puccinia spp and leaf blight Exserohilum turcicum</td>
<td>Mid altitude and low altitude areas of Malawi</td>
</tr>
</tbody>
</table>
## Legume Varieties

<table>
<thead>
<tr>
<th>Crop</th>
<th>Variety</th>
<th>Maturity period</th>
<th>Attributes</th>
<th>Recommended agro-ecologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean</td>
<td>Ocepara-4-</td>
<td>Medium to late maturing</td>
<td>Resistant to root knot nematode, large seeded, white flowers, cream seed coat, greyish black hilum, yield potential 2500 kg/ha, suitable for rotation with tobacco</td>
<td>Medium altitude areas</td>
</tr>
<tr>
<td>Soybean</td>
<td>Nasoko</td>
<td>Medium to late maturing</td>
<td>Susceptible to rust, large seeded</td>
<td>Medium to high altitude areas</td>
</tr>
<tr>
<td>Soybean</td>
<td>Makwacha</td>
<td>Medium to late maturing</td>
<td>Susceptible to rust, large seeded, pink flowers, cream seed coat colour, yield potential 3500 kg/ha</td>
<td>Medium to high altitude areas resistance.</td>
</tr>
<tr>
<td>Soybean</td>
<td>Tikolore</td>
<td>Early maturing variety than magoye</td>
<td>Susceptible to rust but can escape, small seeded, self nodulating, on average 37 pods per plant, 2500 to 3000 kg/ha</td>
<td>Low, Medium to high altitude areas</td>
</tr>
<tr>
<td>Soybean</td>
<td>Serenade</td>
<td>Medium to late maturing</td>
<td>Large seeded</td>
<td>Medium to high altitude areas</td>
</tr>
<tr>
<td>Soybean</td>
<td>Solitaire</td>
<td>Matures earlier than soprano</td>
<td>Susceptible to rust, large seeded</td>
<td>Widely adapted to most agro-ecologies</td>
</tr>
<tr>
<td>Soybean</td>
<td>Soprano</td>
<td>a bit late</td>
<td>Susceptible to rust, large seeded</td>
<td>Medium to high altitude areas</td>
</tr>
<tr>
<td>Soybean</td>
<td>Magoye</td>
<td>Small seeded</td>
<td></td>
<td>Low, Medium to high altitude areas</td>
</tr>
<tr>
<td>Beans</td>
<td>NUA 45</td>
<td></td>
<td></td>
<td>Medium to high altitude areas</td>
</tr>
<tr>
<td>Beans</td>
<td>NUA 59</td>
<td></td>
<td></td>
<td>Medium to high altitude areas</td>
</tr>
<tr>
<td>Beans</td>
<td>VTT-924/4-4</td>
<td></td>
<td></td>
<td>Medium to high altitude areas</td>
</tr>
<tr>
<td>Beans</td>
<td>Nyambitiira</td>
<td></td>
<td></td>
<td>Medium to high altitude areas</td>
</tr>
<tr>
<td>Beans</td>
<td>Nantupa</td>
<td></td>
<td></td>
<td>Medium to high altitude areas</td>
</tr>
<tr>
<td>Beans</td>
<td>Napilita</td>
<td></td>
<td>Medium seeds, red speckled, determinate in growth, performs well under low soil phosphorous, resistant to angular leaf spot, halo blight, powdery mildew, yield potential 2000 kg/ha</td>
<td>Suitable for highlands with long growing season</td>
</tr>
<tr>
<td>Beans</td>
<td>Maluwa</td>
<td></td>
<td>Medium seeds, red speckled, determinate in growth, requires modest levels of nitrogen and phosphate (20 kg/ha), yield potential 2000 kg/ha</td>
<td>Suitable for Lilongwe plains</td>
</tr>
<tr>
<td>Crop</td>
<td>Variety</td>
<td>Maturity period</td>
<td>Attributes</td>
<td>Recommended agro-ecologies</td>
</tr>
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<td>------------</td>
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<td>---------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Pigeon pea</td>
<td>Mwaiwathu alimi</td>
<td>160 to 180 days, medium duration</td>
<td>Resistant to soil borne diseases like Fusarium wilt and leaf spots, non-determinate growth habit, stems are woody and green in colour, flowers are yellow and pods are green, each pod contains 6 to 7 seeds, yield potential at 2000 kg/ha</td>
<td>More suited to central and northern regions where livestock damage are prominent</td>
</tr>
<tr>
<td>Pigeon pea</td>
<td>Chitedze pigeon pea 1</td>
<td>Medium duration</td>
<td>Susceptible to Fusarium wilt but resistant to leaf diseases such as leaf spots, base flowers are red, pods are green, good for ratooning, large seeded, easy to dehull, yield potential at 2500 to 3000 kg/ha</td>
<td>More suited to central and northern regions where livestock damage are prominent</td>
</tr>
<tr>
<td>Pigeon pea</td>
<td>Chitedze pigeon pea 2</td>
<td>150 to 180 days, medium duration</td>
<td>Susceptible to Fusarium wilt but tolerant to most of leaf diseases, non-determinate in growth, stems are green in colour, flowers are bright yellow and pods are green, seeds are medium in size, yield potential at 2500 kg/ha</td>
<td>More suited to central and northern regions where livestock damage are prominent</td>
</tr>
<tr>
<td>Pigeon pea</td>
<td>Kachangu</td>
<td>190 to 240 days, long duration</td>
<td>Moderately resistant to soil borne diseases like Fusarium wilt and leaf spots, stems are woody and green in colour, flowers are ivory cream and pods are green, dry seeds are creamy white in colour, yield potential at 2500 kg/ha, Seed coat easy to remove, good for dehulling.</td>
<td>Suitable for southern region</td>
</tr>
<tr>
<td>Pigeon pea</td>
<td>Sauma</td>
<td>220 to 270 days, long duration</td>
<td>Resistant to soil borne diseases like Fusarium wilt and leaf spots, stems are woody and green in colour, flowers are bright yellow and pods are green, seeds are cream coloured and oval shaped with a white hilum, yield potential at 2500 kg/ha</td>
<td>Suitable for southern region</td>
</tr>
<tr>
<td>Groundnut</td>
<td>Chalimbana 2005</td>
<td>130-140 days</td>
<td>Virginia type, large seeded, tan in colour, 45% oil content, 2000 - 2500 kg/ha yield potential, moderately resistant to rosette and early leaf spot</td>
<td>Medium to high altitude areas</td>
</tr>
<tr>
<td>Groundnut</td>
<td>CG7</td>
<td>130-150 days</td>
<td>Virginia type, large seeded, red in colour, 48% oil content, 2000 - 2500 kg/ha yield potential, tolerates drought</td>
<td>Medium to high altitude areas</td>
</tr>
</tbody>
</table>
### Legume Varieties cont’d

<table>
<thead>
<tr>
<th>Crop</th>
<th>Variety</th>
<th>Maturity period</th>
<th>Attributes</th>
<th>Recommended agro-ecologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundnut</td>
<td>Nsinjio</td>
<td>120-140 days</td>
<td>Virginia type, large seeded, tan in colour, 45% oil content, 2000 kg/ha yield potential, resistant to rosette disease</td>
<td>Medium to high altitude areas</td>
</tr>
<tr>
<td>Groundnut</td>
<td>Chitala</td>
<td>90-120 days</td>
<td>Spanish type, tan in colour, 40% oil content, 1500 kg/ha yield potential, medium sized seed, can be cultivated in dambos, resistant to rosette disease</td>
<td>Low altitude areas</td>
</tr>
<tr>
<td>Groundnut</td>
<td>Baka</td>
<td>90-120 days</td>
<td>Spanish type, pale tan in colour, 40% oil content, 1500 kg/ha yield potential, seed smaller than Kakoma, can be cultivated in dambos, resistant to aphids which transmit rosette disease</td>
<td>Low altitude areas</td>
</tr>
<tr>
<td>Groundnut</td>
<td>Kakoma</td>
<td>90-120 days</td>
<td>Spanish type, tan in colour, 40% oil content, 1500 kg/ha yield potential, medium sized seed, can be cultivated in dambos, resistant to rosette disease</td>
<td>Low altitude areas</td>
</tr>
<tr>
<td>Groundnut</td>
<td>ICGV-SM01724</td>
<td>130-140 days</td>
<td>Virginia type, high yielding, resistant to rosette disease, medium duration, and have medium seed size.</td>
<td>Medium to high altitude areas</td>
</tr>
<tr>
<td>Groundnut</td>
<td>ICGV-SM01731</td>
<td>130-140 days</td>
<td>Virginia type, high yielding, resistant to rosette disease, medium duration, and have medium seed size.</td>
<td>Medium to high altitude areas</td>
</tr>
<tr>
<td>Groundnut</td>
<td>ICGV-SM08501</td>
<td>130-140 days</td>
<td>Virginia type, high yielding, resistant to rosette disease, medium duration, and have medium seed size.</td>
<td>Medium to high altitude areas</td>
</tr>
<tr>
<td>Groundnut</td>
<td>ICGV-SM08503</td>
<td>130-140 days</td>
<td>Virginia type, high yielding, resistant to rosette disease, medium duration, and have medium seed size.</td>
<td>Medium to high altitude areas</td>
</tr>
<tr>
<td>Groundnut</td>
<td>ICGV-SM01514</td>
<td>90-120 days</td>
<td>Spanish type, short duration, high yielding compared to Kakoma, resistant to rosette disease and have a medium seed size.</td>
<td>Low altitude areas</td>
</tr>
<tr>
<td>Groundnut</td>
<td>ICGV-SM99551</td>
<td>90-120 days</td>
<td>Spanish type, short duration, high yielding compared to Kakoma, resistant to rosette disease and have a medium seed size.</td>
<td>Low altitude areas</td>
</tr>
<tr>
<td>Groundnut</td>
<td>ICGV-SM99556</td>
<td>90-120 days</td>
<td>Spanish type, short duration, high yielding compared to Kakoma, resistant to rosette disease and have a medium seed size.</td>
<td>Low altitude areas</td>
</tr>
</tbody>
</table>
### Legume Varieties cont'd

<table>
<thead>
<tr>
<th>Crop</th>
<th>Variety</th>
<th>Maturity period</th>
<th>Attributes</th>
<th>Recommended agro-ecologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cowpea</td>
<td>Sudan 1</td>
<td>Medium (70-80 days)</td>
<td>Survives intermittent drought, susceptible to pests and diseases</td>
<td>Low to high altitude areas</td>
</tr>
<tr>
<td>Cowpea</td>
<td>Mkanakaufi</td>
<td>Early-medium (70-80 days in mid altitude areas and 60-70 days in low altitude),</td>
<td>Tolerant to drought, susceptible to pests and diseases, resistant to Striga elegans</td>
<td>Low to medium altitude areas</td>
</tr>
<tr>
<td>Cowpea</td>
<td>IT82E-16</td>
<td>Early to medium (72-80 days)</td>
<td>Tolerant to drought, susceptible to pests and diseases</td>
<td>Low to high altitude areas</td>
</tr>
</tbody>
</table>