

(2) J O C V とマ国政府 (Liongwe ADD) との責任分担

現地にて調査結果要約をとりまとめ J I C A 事務所に報告するとともに、リロングウェ農業局にも報告し、その結果、以下の責任分担及び予算措置につき最大限努力する旨、リロングウェ農業局・局長より回答があった。

J O C V : (1) 隊員の増員派遣 (1 ~ 2 名)

          土壤肥料及び村落開発 (井戸掘り) ただし前者を優先

          (2) 隊員支援経費で支出可能な範囲での必要資機材の供与

A D D : (1) 隊員住居の確保

          (2) 人夫 (2 名) の確保



3 2, リロングウエ市場



3 3, リロングウエ市場



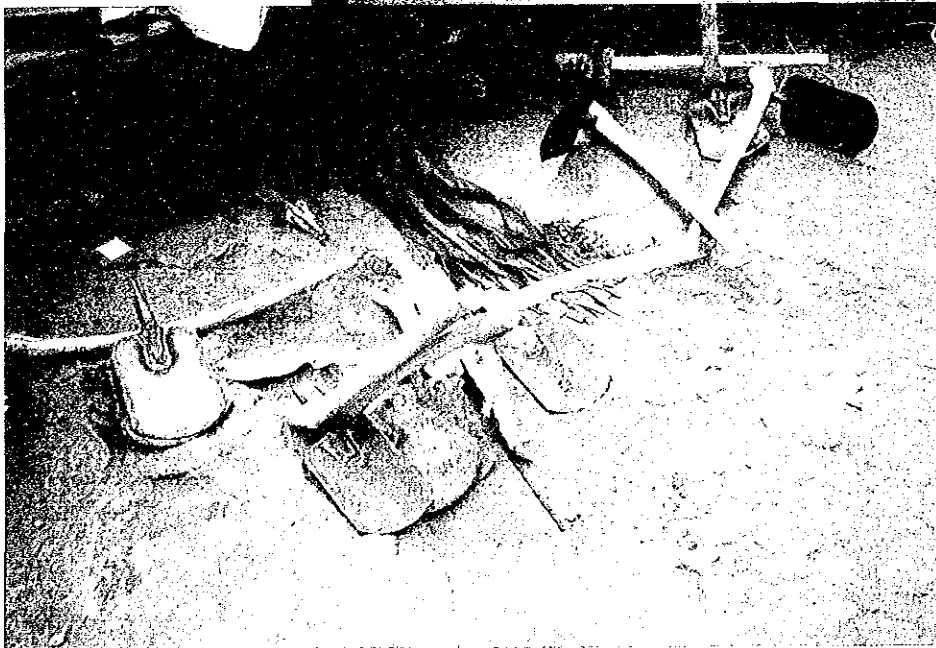
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35. リロングウエ市場

36. リロングウエ市場



37. リロングウエ市場



# CHITEDZE AGRICULTURAL RESEARCH STATION GUIDE

## 1993

### LOCATION

Chitedze Agricultural Research Station, located 16 km west of the City of Lilongwe on the Lilongwe/Mchinji Road, is situated about 13°59'S and 33°38'E at an altitude of 1,097 m above mean sea level.

### STATION SET-UP

The Station was established in 1948. The first field experiments were laid out in the 1949/50 cropping season.

The Station occupies an area of 486 hectares. Two hundred thirty (230) hectares are under arable cropping, 200 hectares are under buildings and indigenous pastures and 26 hectares are under tree plantations to provide windbreaks and fuelwood.

The Station accommodates 40 Professional Officers (scientists with a B.Sc., M.Sc. or Ph.D. degree), 30 Technical Officers (officers with a Diploma), and 79 Technical Assistants (staff with a Certificate in Agriculture). There are also 38 Administrative Support Staff and 500 Industrial Class Employees. The Meteorological Department and the Water Department each have 3 employees. These numbers exclude people employed by the international organizations represented at Chitedze as well as those on study leave.

The Chitedze Rural Hospital has 24 employees and the Local Education Authority Primary School has 34 teachers and approximately 2,100 pupils, while the Pre-School Play Group has 3 teachers and about 60 pupils.

In a nutshell, Chitedze Agricultural Research Station has about 750 working families comprising approximately 6,000 residents.

### CLIMATE

Chitedze has a mean annual temperature of 20° C. The highest temperatures occur in November during which the mean temperature is 24° C, while July is the coolest month with a mean temperature of 16° C.

The Station receives adequate rainfall with a long-term annual mean of 892 mm. About 85% of the rainfall occurs during the five months of November through March. Mean annual evaporation is 1,974 mm.

The Station receives daily sunshine of a mean minimum of 4.9 hours in February up to a mean maximum of 9.6 hours in October; the overall mean is 7.4 hours.

## **SOILS**

The soils of Chitedze Agricultural Research Station represent the majority of the fertile soils that occur on the Lilongwe Plain. The soils have been classified into four soil orders: Alfisols, Oxisols, Entisols and Inceptisols. Twelve soil series of the well-developed Lilongwe catenary sequence are represented at the Station.

The arable soils are well supplied with organic matter and exchangeable cations, although with continuous cultivation major and trace elements are quickly depleted.

## **STATION ORGANIZATION**

There are six Commodity Groups with various Commodity Teams as follows:

1. Cereals (maize and wheat).
2. Grain Legumes and Oilseeds (groundnuts, other grain legumes and oilseeds).
3. Horticulture - Fruits, Vegetables and Tree Crops (tropical fruits, cassava, sweet potatoes and vegetables).
4. Livestock and Pastures (beef and dairy cattle, sheep, poultry and pastures).
5. Soils and Agricultural Engineering (soil fertility, soil survey, soil microbiology, farm machinery and agroforestry).
6. Technical Services (seed services, plant protection, produce inspection, crop storage, Plant Genetic Resources Centre, AGRE DAT and library services)

## **NOTE**

All trials listed in the text are conducted at Chitedze unless otherwise noted. Many of them are conducted at multiple sites as well as at Chitedze, although mention of these sites has been omitted from the text.

# ACTIVITIES OF THE STATION

## A. RESEARCH ACTIVITIES

### 1. CEREALS

#### 1.1 MAIZE

##### GENERAL OBJECTIVE:

The National Maize Improvement Programme seeks to develop high-yielding and stable hybrids, composites and synthetic varieties which are resistant to pests and diseases, for the various ecological zones of Malawi. Maize is grown from under 100m to over 1500m above sea level (a.s.l.). However, the main maize growing areas include the upland (mid-altitude) ecological zone which is more than 600m a.s.l. with moderate temperatures and a fairly long rainy season (4-5 months); and the lowland ecological zone (marginal areas) which is less than 600m a.s.l., characterised by high temperatures, and a short erratic rainy season (3-4 months).

The Rockefeller Foundation provides some financial assistance as well as technical staff for Maize Commodity research work. Dr. R.B. Jones, maize agronomist and Dr. J. Wendt, soil scientist work closely with the National Programme.

##### RESEARCH OBJECTIVES:

1. To develop high-yielding white flint and dent hybrids, composites and synthetic maize varieties with as much resistance as possible to pests and diseases;
2. To develop varieties tolerant to drought and heat stress;
3. To develop and maintain a germplasm bank with materials of diverse origin for use in population improvement programme;
4. To investigate the response of recommended as well as promising maize varieties to fertilizers and plant densities throughout the country; and
5. To develop maize-based intercropping systems.

##### ACHIEVEMENTS/RESULTS:

1. Last year the programme released two flint hybrids MH17 and MH18, for mid-altitude and low-altitude ecological zones, respectively. In tests, these hybrids compare favourably with local farmers' maize in pounding qualities. They also give as much grain yield as dent hybrids. Other maize varieties developed and released by the programme include MH12 (1978), MH15 and MH16 (1985), Chitedze Composite A (CCA) (1971), CCC and CCD (1985).
2. Early planting of maize with the first good rains gives better yields; late planting has resulted in reduced maize yields of both early and late maturing varieties.
3. Recent trials on row spacing have shown that planting maize on 75cm ridges gives higher grain yields than planting on 90cm ridges, under high fertility conditions.
4. Research results have shown that top-dressing urea on diammonium phosphate (DAP) between 2-4 weeks after emergence gives higher yields than top-dressing before 2 weeks or after 4 weeks. Lower yields before 2 weeks are associated with nitrogen leaching especially on sandy soils and lower yields after 4 weeks are associated with the limited amount of nitrogen supplied by DAP (18%).



### 1.1.1 MAIZE BREEDING

#### HIGHLIGHTS OF THE 1992/93 SEASON:

The highlights of this year's research activities include: hard endosperm hybrids, dent hybrids and populations that are being put together in heterotic patterns. The materials were selected from previous seasons and some of them have been replicated on farmers' gardens across the country, with the objective of testing their suitability to various management practices.

#### MID-ALTITUDE HYBRID PROGRAMME

**OBJECTIVE:** To develop flint/dent hybrids for long season as well as intermediate maturity.

#### TRIALS:

1. MA93-1. National Maize Variety Trial (NMVT)  
**Objective:** To evaluate 16 newly developed hybrids for adaptation in the Mid-Altitude Ecological Zone.
2. MA93-2. Evaluation of Recycled Hybrids  
**Justification:** The Maize Team has frequently been asked to shed some light on the performance of recycled hybrid seed. For instance, some donor agencies may want to know if a farmer is better off planting his recycled MH12 or his local maize. The study will also reveal how much loss in yield one gets from single-, three-way, and top-cross hybrids, in the  $F_2$ ,  $F_3$ ,  $F_4$  and  $F_5$  generations.  
**Entries:**

1. MH12 ( $F_1$ )	2. MH12 ( $F_2$ )	3. MH16 ( $F_1$ )
4. MH16 ( $F_2$ )	5. MH17 ( $F_1$ )	6. MH17 ( $F_2$ )
7. MH18 ( $F_1$ )	8. MH18 ( $F_2$ )	9. LFM
3. MA93-3. Top-cross Trials  
**Objective:** To evaluate new experimental hybrids of variable kernel texture for adaptation in the Mid-Altitude Ecological Zone. Some 300 hybrids were made at Mbawa (1991/92 season), Chitala and Kasinthula (1992 winter season). The best hybrids will be advanced to Intermediate Trials.
4. MA93-4. Top-cross-1 49 Assorted lines x B 7x7 lattice
5. MA93-5. Top-cross-2 49 Assorted lines x B 7x7 lattice
6. MA93-6. Top-cross-3 49 Assorted lines x B 7x7 lattice
7. MA93-7. Top-cross-4 100 CIMMYT-Mx lines x B 10x10 lattice
8. MA93-8. Top-cross-5 100 CIMMYT-Mx lines x B 10x10 lattice
9. MA93-9. Evaluation of Yellow Hybrids  
**Objective:** To test some single-cross yellow hybrids for adaptation to the Mid-Altitude Ecological Zone.  
**Justification:** The Seed Production Industry has indicated for some time that there was some demand for yellow maize by the Feed Producing Industry in the country. Production of such hybrids would be limited to isolated areas or more appropriately during the off-season so that there is no danger of contaminating white maize.

## LOW-ALTITUDE HYBRID PROGRAMME

**OBJECTIVE:** To develop short season hybrids targeted for marginal rainfall areas of the country.

### TRIALS:

1. LA93-1. National Maize Variety Trial
2. LA93-2. Preliminary Yield Trial (PYT) (1) - "A" Top-crosses
3. LA93-3. PYT (2) - AR154 Top-crosses
4. LA93-4. Intermediate Yield Trial (IYT) - MH16 x line
5. LA93-5. 8 x 8 Population Diallel
6. LA93-6. 10 x 10 Diallel
7. LA93-7. SARMEIT Yield Trial
8. LA93-8. Sensako Hybrid Trial
9. LA93-9. PET Trials

## POPULATION IMPROVEMENT PROGRAMME

**OBJECTIVE:** To develop and improve open pollinated varieties of high yielding potential and suitable grain characteristics for smallholder farmers.

### TRIALS:

1. Population Yield Trials  
Objective: To evaluate the performance of some exotic populations in mid-altitude and low-altitude areas.
2. PIP93-1. Preliminary Variety Trials  
Objective: To evaluate the S<sub>2</sub> top-cross hybrids for yield and some agronomic characteristics.
3. PIP93-2. Top-cross-5
4. PIP93-3. Top-cross-6
5. PIP93-4. Top-cross-7
6. PIP93-5. Elite Variety Trial (EVT) 13
7. PIP93-6. International Progeny Testing Trial (IPTT) 34

### 1.1.2 MAIZE AGRONOMY

#### GENERAL OBJECTIVE:

To determine the best cultural practices to sustain optimum yields with economic input levels, e.g., fertilizer types, rates and times of application, use of organic manure, weed control, methods of land preparation, time of planting, plant spacing and density of new varieties, and intercropping systems for both smallholder and estate farmers. Trials are conducted both on research stations and farmers' fields in order to obtain results and recommendations that are reproducible under farmers' conditions.

#### TRIALS:

1. Cowpea Green Manure as a Source of N in a Maize/Cowpea Intercropping System
2. Nitrogen, Manure and Cross-ties Effects on Maize Yield
3. Long-term Effects of Maize/Pigeonpea and Maize/Bambara Nut Intercropping Systems
4. Long-term Effects of Thundulu Rock Phosphate and TSP on Maize
5. Soyabean Spatial Arrangement in a Maize/Soyabean Intercropping System
6. Dwarf Bean Spatial Arrangement in a Maize/Bean Intercropping System
7. Residual Effects of Groundnut Straw on Maize Yield
8. Basal Dressing Fertilizer Source and Placement Method Trial (BFSM92)
9. Top-dressing Fertilizer Source and Placement Method Trial (NFP92)
10. Maize Establishment Trial (MEST92)
11. Relative Reaction of Maize Varieties to Striga infestation (MVRS92)

12. Maize Variety x Nitrogen Management Trial
13. Maize-Pigeonpea Intercropping at Low Fertility Trial (MPLF92)
14. Maize-Pigeonpea Intercropping at High Fertility Trial (MPHF92)
15. Maize-Pigeonpea Intercropping and Pruning Trial (MPP92)
16. Maize Inbred Line Evaluation to Nitrogen Trial
17. Field Trial: Mechanically Activated RP from Thundulu, Local Gypsum from Mponela, Local Dolomite from Optichem and K-Feldspar from Linthipe
18. Maize (Hybrid vs. Local) Response to Fertilizer Demonstration Trial
19. Maize Response to Fertilizer (NPKS) Trial (MRF92)
20. Response of Maize to Phosphorus Placement and Phosphorus Source on Moderately Acid Soils
21. Agroforestry Trials, Number 1-5
22. Response of F<sub>1</sub> and Recycled F<sub>2</sub> hybrids to nitrogen

### 1.1.3 MAIZE PATHOLOGY

#### GENERAL OBJECTIVES:

- (a) To assist in the development of superior germplasm adapted to the growing areas and the farmers' needs;
- (b) To support maize breeding activities in effective disease resistance screening to diseases of economic importance in Malawi;
- (c) To develop integrated disease control strategies suitable for maize growers;
- (d) To offer guidance to the farming community; and
- (e) To monitor disease epidemiologies.

#### TRIALS:

1. Assessing the Effect of Helminthosporium Blight on Yield and Growth of Maize Varieties Commonly Grown in Malawi
2. Helminthosporium Blight Virulence and Yield Loss Assessment Trial
4. Maize Streak Virus Epidemiology and Yield Loss Assessment Trial
5. Rearing Cicadulina as Maize Streak Virus Vectors

### 1.2 WHEAT

The overall goal of the wheat research programme is to provide growers with appropriate packages of production practices with improved varieties for different wheat producing areas that would increase local wheat production, hence saving on foreign reserves.

#### GENERAL OBJECTIVES:

- (a) To improve rainfed wheat production by smallholder farmers in cool highland areas of Tsangano, Bembeke, Ntchisi and Nchenachena;
- (b) To improve wheat production by smallholder farmers on irrigated rice schemes during cool months, such as at Likangola in Zomba;
- (c) To improve wheat production under irrigation on estates in rotation with tobacco, such as at Mchinji and Kasungu;
- (d) To select high yielding cultivars that are adaptable to high and/or low altitudes;
- (e) To select cultivars that are resistant to lodging, diseases and pests, and that have grain of suitable quality for bread making;
- (f) To determine the fertilizer, spacing and seedrate requirements for wheat, barley and triticale;
- (g) To determine the best time to sow wheat under rainfed and irrigated conditions in different ecological zones; and
- (h) To develop farming systems where wheat is one of the principal crops.

#### **BREEDING TRIALS:**

1. National Wheat Variety Trial (NWVT)
2. Preliminary Wheat Variety Trial (PWVT)
3. F<sub>5</sub>, F<sub>6</sub> and F<sub>7</sub> Populations
4. Southern Africa Regional Wheat Evaluation and Improvement Nursery (SARWEIN)
5. International Bread Wheat Screening Nursery (IBWSN)

#### **AGRONOMY TRIALS:**

1. Effect of Residual Nitrogen Applied to Maize on the Yield of Wheat
2. Intercropping Trials
3. Soil Moisture Conservation Trial

#### **ACHIEVEMENTS:**

1. From adaptation trials cv Kenya-nyati was recommended for dryland conditions and cv's Gamtoos and Loerie for irrigated conditions.
2. Leaf rust (*Puccinia recondita*) and spot blotch (*Helminthosporium sativum*) were identified as common wheat diseases under Malawi environmental conditions.
3. Several wheat and barley field cultural packages regarding dates of planting, seedrates and fertilization were recommended.

#### **PRESENT AND FUTURE RESEARCH EFFORTS:**

1. Selection and testing new introductions.
2. Fertilizer test requirements for new cultivars.
3. Water requirement trials of irrigated wheat.
4. Long term NPK trials under continuous monocropping.
5. Cropping systems development.

#### **1.3 CIMMYT**

The International Maize and Wheat Improvement Centre (CIMMYT) concentrates on increasing the productivity of resources committed to maize and wheat production in developing countries. Though its primary emphasis is on crop improvement, CIMMYT also devotes some time to crop management and social science research. Within the Southern Africa region, CIMMYT currently maintains a staff of two maize breeders and one maize agronomist based in Harare, Zimbabwe and one economist based at Chitedze Agricultural Research Station.

The main concerns of the regional program based at Chitedze are the provision of training in on-farm research techniques, evaluation of on-farm trials, and policy analysis; the study of technological change in maize production in the region, with emphasis on Malawi; and the economic analysis of both breeding strategies and crop management research in maize.

## **2. GRAIN LEGUMES AND OILSEEDS**

### **2.1 GRAIN LEGUMES**

#### **2.1.1 GROUNDNUTS**

##### **GENERAL OBJECTIVES:**

- (a) To develop groundnut varieties in demand by various producers, processors and ultimate consumers; and
- (b) To find methods of increasing the yield and quality of the crop.

##### **2.1.1.1 GROUNDNUT BREEDING**

###### **TRIALS:**

1. Yield Assessment of Four Recommended Groundnut Varieties and a Selection from CG7
2. Virginia Groundnut Varieties Yield Trial
3. Confectionery Groundnut Varieties Yield Trial
4. Oil Groundnut Varieties Yield Trial
5. Smaller Runners Groundnut Variety Trial
6. Red-skin Groundnut Variety Trial

##### **2.1.1.2 GROUNDNUT AGRONOMY**

###### **GENERAL OBJECTIVE:**

To develop suitable cultural practices for the various groundnut varieties in different agroecological zones of Malawi in order to increase the yield of groundnuts per unit area of land.

###### **TRIALS:**

1. The Effect of Ridge Spacing on the Performance of CG7 Groundnut Varieties
2. Long-term Rotations (see 2.1.1.3 SADC/ICRISAT Groundnut Agronomy Trials)

##### **2.1.1.3 SADC/ICRISAT GROUNDNUT PROJECT**

The SADC/ICRISAT Groundnut Project, which is based at Chitedze Agricultural Research Station, was established in 1982 at the request of the Southern African Heads of State at the Lusaka Summit Conference in 1980. In 1984, the Project became one of the components of the SADC Grain Legume Improvement Program (GLIP), with ICRISAT retaining responsibility as the executing agency for regional groundnut research.

The Project serves the ten SADC Member States and its primary objective is to improve groundnut production. Groundnut is an important crop to smallholder farmers in the region and is the principal source of protein and oil but also provides a significant source of smallholder cash income.

Diseases, particularly early leaf spot and rosette virus disease, are a major constraint in most SADC countries. In addition, another constraint is the lack of suitable varieties adapted to the varied agroecological conditions, particularly to low and unreliable rainfall.

To this end, we place major emphasis on the development of high-yielding germplasm that is adapted to specific requirements and having resistance to diseases. We also direct considerable research effort towards the development of integrated disease management practices which include use of genetic resistance, judicious use of chemicals, and cultural practices which minimise the yield-reducing effects of early leaf spot and rosette diseases.

#### GROUNDNUT BREEDING TRIALS:

1. SADC Regional Groundnut Variety Trial (spanish) - 23 test entries, repeated at two other locations in Malawi, and in four other SADC countries.
2. SADC Regional Groundnut Variety Trial (virginia) 23 test entries, repeated at one other location in Malawi, and in three other SADC countries.
3. Advanced Groundnut Variety Trial (spanish) - 30 test entries.
4. Advanced Groundnut Variety Trial (virginia) (2 trials) - 84 test entries.
5. Preliminary Groundnut Variety Trial (spanish and virginia) - 25 test entries.
6. ICRISAT Center Preliminary Early Groundnut Variety Trial (2 trials) - 103 test entries.
7. ICRISAT Center Preliminary Confectionery Groundnut Variety Trial - 60 test entries.
8. ICRISAT Center Preliminary Foliar Diseases Resistant Groundnut Variety Trial - 33 test entries.

#### GROUNDNUT PATHOLOGY TRIALS:

1. Preliminary Screening of Groundnut Germplasm for Resistance to Early Leaf Spot. Some 1022 groundnut germplasm lines from South America, West Africa and southern Africa are being evaluated for resistance against early leaf spot.
2. Advanced Screening of Groundnut Germplasm and Breeding Lines for Resistance to Early Leaf Spot. (Set I). Some 96 lines selected from the 1990/91 and 1991/92 crop season trials as having resistance to early leaf spot are being further evaluated under high and low disease pressure situations.
3. Advanced Screening of Groundnut Germplasm and Breeding Lines for Resistance to Early Leaf Spot. (Set II). Some 38 lines selected from the 1991/92 crop season are being further evaluated under high and low disease pressure.
4. Yield Response of 15 Groundnut Genotypes to Fungicidal Control of Early Leaf Spot.
5. Economic Evaluation of Fungicidal Control of Early Leaf Spot Using Either One or Two Sprays of Chlorothalonil under Low and High Disease Pressure Situations.
6. Effect of Time of Onset of Early Leaf Spot on Yield of Four Groundnut Genotypes. The treatments include 10 spray regimes.
7. Effect of Date of Sowing on Early Leaf Spot Development and Yield. Dates of sowing were: 18 December 1992, 2 January 1993 and 18 January 1993.
8. Effect of Crop Rotation on Early Leaf Spot Development.
9. Effect of Different Doses of Neem Cake Extract and Neem Oil on Severity of Early Leaf Spot and Yield.
10. Screening of 1374 Groundnut Germplasm and Breeding Lines for Resistance to Rosette.
11. Effect of Different Doses of Neem Cake Extract and Neem Oil on Rosette Incidence and Yield.
12. Screening of Forty  $F_3$  Segregating Populations from Crosses Made for Rosette Resistance. Over 300  $F_4$ ,  $F_5$  and  $F_6$  plant progenies previously selected for resistance are also included in the rosette disease nursery for confirmation of resistance.

## **GROUNDNUT AGRONOMY TRIALS:**

1. A complex 6-year rotation trial is being conducted in collaboration with the national groundnut research team. The objective is to study the rotational effects of legumes, maize and cassava, grown in association or in monoculture, on the soil environment, and on the yield of each crop.

Disease, pest and weed incidence will be monitored to establish the effects of rotation and intercropping, and changes in soil fertility in subsequent years will be measured.

### **2.1.2 OTHER GRAIN LEGUMES**

#### **RESEARCH HIGHLIGHTS: DEVELOPING IMPROVED CROP LINES**

Some varieties have been identified which have superior qualities.

#### **1. SOYABEANS**

- (a) **Ocepara-4 (Ex-Argentina):** Highly resistant to root-knot nematode  
Suitable for cultivation in rotation with tobacco  
Grain yield potential > 2500 kg/ha  
Medium size, cream coloured seeds  
100-120 days to maturity
- (b) **Duocrop (Ex-USA):** Resistant to root-knot nematode  
Suitable for cultivation in rotation with tobacco  
Large whitish/cream seeds  
120 days to maturity
- (c) **Santa Rosa (Ex-USA):** High yield potential > 3000 kg/ha  
Small size, dark cream coloured seeds  
Long maturity duration > 120 days
- (d) **427/5/7 (Ex-Zimbabwe):** High yield potential > 3000 kg/ha  
Medium-large, yellowish cream seed, whitish hilum  
120 days to maturity
- (e) **Magoye (Ex-Zambia):** High capacity for self-nodulation, hence nitrogen fixation  
Grain yield potential < 2000 kg/ha  
Small size yellowish cream seed  
Medium maturity duration < 120 days  
Retains green leaf up to maturity  
Tolerant to drought  
Most suitable for smallholder cultivation

## 2. PIGEONPEAS

- (a) ICP 9145 (Ex-ICRISAT): Released variety - High grain yield potential > 2500 kg/ha  
Highly resistant to Fusarium wilt disease  
Medium size whitish cream coloured seeds  
Long maturity duration 180 days
- (b)-(d) ICPL 87105, ICPL 86005 and ICPL 151 (C) (All Ex-ICRISAT) High capacity for multiple harvesting  
Grain yield potential 2000 kg/ha  
Early maturity duration < 120 days  
Small brown coloured seeds  
Suitable for sole cropping  
Suitable for machine harvesting
- (e) QP 38 (Ex-Australia): Grain yield potential of < 2500 kg/ha  
Very large dark brown seeds  
Medium maturity < 200 days

## 3. COWPEAS

- (a) Sudan I: High yield potential > 2000 kg/ha  
Extra-early maturity < 80 days  
Medium size cream coloured seeds
- (b) IT82E-16: High yield potential > 2000 kg/ha  
Extra-early maturity < 80 days  
Large reddish purple seeds  
Okra leaf-type.

### 2.1.2.1 SOYABEAN BREEDING AND AGRONOMY

#### GENERAL OBJECTIVES:

- (a) To evaluate soyabean genotypes obtained from international research centres for adaptation to various agroecological zones in terms of high grain yield potential and resistance to major disease and insect pests;
- (b) To develop high yielding and self-nodulating varieties of soyabeans for the smallholder farming systems;
- (c) To develop suitable technologies for the production of soyabeans for different cropping systems for the smallholder and the estate farm; and
- (d) To develop suitable technologies for winter soyabean production in rice-based irrigation farming systems.

#### TRIALS:

1. Advanced Soyabean Variety Evaluation Trial
2. Preliminary Soyabean Line Screening Nursery - 1
3. Preliminary Soyabean Line Screening Nursery - 2
4. Preliminary Soyabean Line Screening Nursery - 3
5. Breeders Seed Multiplication Plots



## 2.1.2.2 PIGEONPEA BREEDING AND AGRONOMY

### GENERAL OBJECTIVES:

- (a) To develop improved pigeonpea lines of either short or long maturity duration with high grain yield potential and resistance to Fusarium wilt disease;
- (b) To develop suitable technologies for pigeonpea production under different farming systems; and
- (c) To encourage the production of pigeonpea.

### TRIALS:

1. Promising Pigeonpea Line Evaluation Trial
2. Breeders Seed Multiplication Plots (ICP 9145)

### 2.1.2.2.1 ICRISAT PIGEONPEA PROJECT:

ICRISAT's Regional Pigeonpea (*Cajanus cajan* (L.) Millsp.) Improvement Project at Chitedze Agricultural Research Station was started in January 1992, to improve the productivity of pigeonpea in southern African countries and thereby increase total food production, improve the supply of protein in the human diet and introduce pigeonpea into new crop production systems. The project is funded by the African Development Bank and implemented by ICRISAT.

The major objective of the research is to develop pigeonpea cultivars with high stable yield, resistance to diseases and pests, and consumer acceptance. Emphasis is placed on developing medium- and long-duration Fusarium wilt-resistant varieties with high yield, light seed colour, large seed size and relatively early maturity. In addition, ICRISAT is investigating new cropping systems using improved short-duration pigeonpea varieties.

We collaborate with the national agricultural research system (NARS) in developing research programmes, work plans, mutual visits, and in exchanging information and germplasm.

### TRIALS:

1. Germplasm Evaluation Nursery - 1198 world collections are being evaluated for adaptability and other desirable characteristics.
2. Crossing Block - 32 diverse pigeonpea lines are grown to be used in the hybridization programme.
3. Evaluation of Pigeon pea Selections - 338 individual selections made during the 1991/92 crop season will be tested for uniformity, seed yield, earliness and other desirable traits.
4. F<sub>1</sub> Progeny Testing - 75 progenies obtained from 1991/92 crosses.
5. Wilt Screening Nursery - 33 test entries grown for seed increase.
6. Nematode Screening Nursery - 12 test entries grown for seed increase.
7. Characterization of Pigeonpea Dwarfs - 8 test entries grown to study the growth response of genotypes with dwarfing genes.
8. Evaluation of 8 Large Seeded Pigeonpea Cultivars for Seed Yield
9. Yield Losses Assessment Trial.
10. Evaluation of Short- and Long-duration Pigeonpeas Intercropped with Maize, Cowpea, Beans and Groundnut - 22 treatments.
11. Preliminary Observation Pigeonpea Nursery - 20 test entries.
12. Extra-short Duration Pigeonpea Trial - 20 test entries.
13. Medium-duration Pigeonpea Trial - 16 test entries.
14. Long-duration Pigeonpea Trial - 18 test entries.

## RESEARCH SUCCESSES

Currently, in collaboration with the national programme, ICRISAT is evaluating over 1400 diverse pigeonpea lines for adaptability, seed quality, seed yield and resistance to diseases and pests. Already, the national programme has released a *Fusarium* wilt-resistant long-duration variety (ICP 9145) for cultivation by farmers in Malawi.

### 2.1.2.3 COWPEA BREEDING AND AGRONOMY

#### GENERAL OBJECTIVES:

- (a) To develop improved cowpea lines with potential for adaptation to various agroecological zones in terms of high grain yield and resistance to diseases, especially *Aschochyta* blight, and major insect pests; and
- (b) To develop suitable technologies for cowpea production for estate and smallholder farming systems.

#### TRIALS:

1. Advanced Cowpea Line Evaluation Trial (OGL/ACLET)
2. Intermediate Cowpea Lines Evaluation Trial (OGL/PCLT)
3. Cowpea International Trial (CIT) No. 1: Extra-early Maturity - 192
4. CIT No. 2: Medium Maturity - 192
5. CIT No. 3: Savanna Adaptab - 392 (Grain cum Fodder)
6. CIT No. 4: Vegetable Type (Ex-ITA) (Grain cum Leaves)
7. CIT No. 5: Dual Purpose - 592 (Grain cum Leaves)
8. CIT No. 6: Striga Resistant
9. CIT No. 7: Virus Resistance and Field Indicator Nursery (VRFIN) - 792
10. Maize/Cowpea Intercropping Trial

## 2.2 OILSEEDS

### 2.2.1 SUNFLOWER BREEDING AND AGRONOMY

#### GENERAL OBJECTIVES:

- (a) To test sunflower genotypes from local and international sources for adaption to various agroecological zones in the country;
- (b) To develop improved varieties of hybrid and open-pollinated sunflower which are resistant or tolerant to pests and diseases, with high yielding potential and having high edible oil content; and
- (c) To develop suitable agronomic practices for both the smallholder and estate production.

#### PRESENT ACTIVITIES ARE CENTRED ON:

1. Sunflower Time of Planting
2. Sunflower Fertilizer Types Evaluation
3. Sunflower Population Density Trial
4. Timing of Undersowing Sunflower in Maize
5. Evaluation of Various Fungicides on Foliar Diseases of Sunflower
6. Hybrid Sunflower Variety Trial

### **3. HORTICULTURE**

#### **GENERAL OBJECTIVES:**

- (a) To generate and develop technologies to increase and improve the production of horticultural crops, i.e., vegetables and fruit trees, by the farming community, including introduction and evaluation of germplasm and the development of cultural practices;
- (b) To multiply and disseminate planting materials to the farming community; and
- (c) To maintain and propagate basic improved plant materials with emphasis placed on quality, yield and disease-free materials to improve support for research programmes, as well as for sale to farmers, private and government institutions.

Chitedze Fruit Nursery (Kandiyani) - The nursery sells improved fruit tree seedlings to farmers, private and government institutions, including mangoes, guava, banana suckers, citrus, and others.

#### **3.1 ROOTS AND TUBERS**

##### **GENERAL OBJECTIVES:**

- (a) To screen sweet potato germplasm for resistance to sweet potato virus disease;
- (b) To identify sweet potato varieties which are early maturing;
- (c) To identify sweet potato varieties which meet consumer acceptance quality needs;
- (d) To screen cassava germplasm for resistance to cassava mealybug, African mosaic disease and cassava bacterial blight; and
- (e) To modify and improve on local processing techniques and evaluate introduced processing equipment, tools and other postharvest technologies under local conditions.

##### **TRIALS:**

1. Sweet Potato Varieties for Intercropping with Maize
2. Sweet Potato Uniform Yield Trial
3. Sweet Potato Potential Yield Trial
4. Sweet Potato Advanced Yield Trial
5. Sweet Potato Preliminary Yield Trial
6. Cassava Genotype x Environment
7. Cassava Uniform Yield Trial
8. Field Transmission Rate of Cassava Mosaic Virus Disease through Whitefly Natural Feeding Habits
9. Preliminary Cassava Yield Trial of IITA Material
10. Cassava Mosaic Virus Diseases Yield Loss Assessment (B)

### **3.2 INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE - EAST AND SOUTHERN AFRICA ROOTCROPS RESEARCH NETWORK: IITA/ESARRN IN COLLABORATION WITH THE NATIONAL PROGRAMME**

East and Southern Africa Rootcrops Research Network (ESARRN) is an intercountry working partnership of 11 countries in East and Southern Africa. It collaborates with several participating root crops scientists from National Programmes and other organizations and provides a regional service for germplasm and information exchange. The ESARRN Coordination Office is located at Chitedze Agricultural Research Station.

#### **OBJECTIVES:**

The overall objective of the project is to expand Malawi's cassava and sweet potato production through

- 1) Accelerating multiplication, distribution and adoption of improved cassava and sweet potato varieties which have already been tested.
- 2) Multiplying improved cassava and sweet potato varieties at 10 primary and 35 secondary multiplication sites throughout the country; these sites will continue to be major sources of planting material.

## **4. LIVESTOCK AND PASTURES**

### **4.1. LIVESTOCK**

#### **GENERAL OBJECTIVES:**

To obtain information about suitable breeds, feeding and management practices of livestock for increased meat, milk and egg production. This is in line with meeting the national goal of becoming self sufficient in meat and dairy products and to export any surpluses.

#### **4.1.1 ANIMAL BREEDING**

**OBJECTIVE:** To improve the existing breeds and evaluate potentially suitable breeds for Malawi's production conditions.

#### **ACTIVITIES:**

1. Range performance testing/selection of Malawi Zebu cattle.
2. Evaluation of Sahiwal breed on Friesian x Malawi Zebu dairy cattle.
3. Exotic dairy breed evaluation. Breeds are Aryshire, Brown Swiss, Guernsey, Jersey and Holstein/Friesian.
4. Evaluation of Sahiwal x Friesian x Malawi Zebu cows under smallholder farms.

#### **4.1.2 ANIMAL NUTRITION**

**OBJECTIVE:** To improve the feeds, feeding and management of livestock.

**ACTIVITIES:**

1. Seasonal stall-fattening based on treated maize stover and forage legume utilization.
2. Supplementation of dairy cows with agro-industrial byproducts.
3. Evaluation of different levels of nutrition for the exotic dairy crossbred cows at Chitedze.
4. Evaluation of locally prepared feeds for layers (based on soyabeans, maize, fish, sunflower, meat meals).

#### **4.1.3 PROPOSED RESEARCH PROGRAMMES (GOATS)**

- (a) Dry season goat fattening.
- (b) Evaluation of goat productivity under village conditions.

#### **4.2 PASTURES**

**GENERAL OBJECTIVES:**

- (a) Evaluation of introduced grasses and legumes known to have animal production potential in environments similar to those found in the country;
- (b) Identification and evaluation of indigenous plant resources that have potential for pasture, fodder or browse in the country;
- (c) Upgrading of the animal productivity value of natural pastures through the introduction of superior and appropriate species of pasture plants;
- (d) Quantification of the animal production capability of selected grass/legume swards in terms of input and output factors capable of economic evaluation.

**PRESENT ACTIVITIES ARE CENTRED ON:**

- (a) Agronomic evaluation of both local and introduced star and guinea grasses at Chitedze;
- (b) Integration of legumes into the cereal production systems on the Lilongwe plain;
- (c) Regional participation in evaluation of sorghum and pearl millet forages under the SADC/ICRISAT Sorghum and Millet Improvement Program; and
- (d) Evaluation of protein fodder banks.

## **5. SOILS AND AGRICULTURAL ENGINEERING**

### **5.1 SOILS**

#### **5.1.1 SOIL FERTILITY**

##### **MANDATE AND OBJECTIVES:**

The Soils Commodity Team has a mandate to conduct advisory and routine analytical services, and soils research in the areas of soil chemistry, soil physics, soil fertility, soil and water management and plant chemistry.

##### **OBJECTIVES:**

##### **ANALYTICAL AND ADVISORY SERVICES**

- 1. To conduct routine soil and plant analyses for making fertilizer and other ameliorative recommendations to farmers, and for quality control checks of export quality products such as tung oil;**
- 2. To maintain and service laboratory equipment;**
- 3. To assess the quality and suitability of water, feedstuffs, manures and fertilizers;**
- 4. To review and standardise the analytical methods and management procedures between Bvumbwe, Chitedze and Bunda College of Agriculture; and**
- 5. Organise a database of soil and plant analytical data for easy retrieval.**

##### **RESEARCH PROGRAMME**

- 1. To investigate the fertility status of Malawi soils;**
- 2. To determine and evaluate environmental factors which influence and/or control soil chemical and physical characteristics under field and laboratory conditions;**
- 3. To investigate the effects of land management practices and/or cultivation methods on soil loss and surface runoff;**
- 4. To determine and investigate the leaching, retention and transformations of applied fertilizers and other agrochemicals in arable and non-arable soils; and**
- 5. To assess the agronomic usefulness of indigenous fertilizer materials such as rock phosphate, limestone and sulphur deposits.**

##### **TRIALS:**

##### **FERTILIZER USE-EFFICIENCY STUDIES**

- 1. Fertilizer Nitrogen and Phosphorous Management under Rainfed Conditions  
Site: Lisasedzi**
- 2. Time and Multiple Split Fertilizer Nitrogen Application**

##### **COMPUTER SIMULATION MODELLING**

- 1. Agrotechnology Transfer Using Biological Modelling  
Sites: Chitedze - 3 sites (one on station and two on farmers' fields)  
Lisasedzi - 3 sites (all on farmers' fields)  
Chitala - 2 sites (one on station and the other on farmers' fields)**

### 5.1.2 SOIL SURVEY

#### MANDATE:

Soil survey is a field investigation, supported by laboratory data which results in the production of soil resource inventories. The information that results from soil surveys is useful in

1. The selection of representative sites for agronomy trials and research sites;
2. The transfer of agronomic research findings from one area of a country to another;
3. Land evaluation; and
4. Land use planning.

#### OBJECTIVES:

The Soil Survey Commodity Team has been carrying out soil surveys with the general objective of producing better soil resources inventories throughout the country. In the Regular Soil Survey Programmes, the main objectives are as follows:

1. Produce maps of actual soils for the whole country;
2. Improve on earlier surveys by Young and Brown covering the Northern and Central Regions of the country by carrying out more detailed surveys; and
3. Carry out a land evaluation of the whole country at different scales of detail.

In the ad hoc or short-term surveys, the main objective is to produce the soil resources inventory and land evaluation which is going to serve the purpose of the user/client.

### 5.1.3 SOIL MICROBIOLOGY

#### GENERAL OBJECTIVES:

- (a) To improve yields of food legumes and pasture/fodder legumes through biological nitrogen fixation;
- (b) To identify legume varieties that have a high capacity for fixing nitrogen and recommend such varieties to farmers;
- (c) To determine soil physico-chemical factors that limit nitrogen fixation by legumes in Malawi, and nitrogen fixation/nodulation response to varying levels of such factors;
- (d) To select effective Rhizobium strains for use in manufacturing Rhizobium inoculants for Malawi; and
- (e) To produce Rhizobium inoculants for legumes which respond to inoculation.

#### EXPERIMENTS IN PROGRESS:

1. Persistence of Soyabean Rhizobia in Field Soils. Established 1991.
2. Evaluation of Soyabean cv Magoye and Herton 147 in Malawi. Est'd 1992.
3. Bean Varietal Response to Seed Pelleting and Increasing Inoculation Rates. Est'd 1992.

#### 5.1.4 AGROFORESTRY

##### GOAL:

The overall goal is to improve agricultural sustainability and food security of Malawi's farmers and to alleviate land-use pressures on the natural resource base.

##### GENERAL OBJECTIVES:

Malawi is facing serious problems of declining agricultural productivity and natural resource degradation. These problems are exacerbated by the increasing dependence on imported fossil-fuel based inputs, limited price incentives and credit opportunities for smallholder farmers, lack of appropriate technologies, and poor research-extension-farmer linkages. The overall goal of the Agroforestry Commodity Team is to help improve agricultural productivity and self-sufficiency with more dependable socio-economic benefits to rural households on a sustained basis. The programme focus is:

1. To develop new or improved agroforestry technologies targeted primarily at priority problems of smallholder farmers;
2. To coordinate agroforestry efforts country-wide; and
3. To provide technical support to the A.D.D.s for more effective on-farm testing and extension activities in agroforestry.

Primary objectives are a) to improve soil fertility, crop yields, and animal nutrition; b) to limit the use or need of expensive fossil-fuel based inputs, c) to reduce runoff and soil erosion on steep hillsides; and d) to provide supplementary fuelwood and building material. With wide-scale adoption, the integral and ecological nature of agroforestry will help to curtail deforestation, overgrazing, and loss of biological diversity.

Research underway involves on-station experiments, site-testing, and on-farm trials depending on the level of technology development and the problem area being addressed. Activities conducted are broadly categorized as follows:

1. Collecting and screening germplasm of multi-purpose trees.
2. Evaluating alley shrubs, spacing, pruning regimes, leaf manure management, and labour inputs.
3. Assessing indigenous agroforestry systems and trees.
4. Evaluating and promoting the farm integration of Acacia albida.
5. Interplanting fruit and other multi-purpose trees with annual crops.
6. Planting contour strips of vetiver and napier grass with leguminous hedges and/or fruit trees on steep hillsides.
7. Planting live fences and multi-purpose trees in or on boundaries of homesteads and gardens.
8. Establishing and evaluating fodder banks for intensive livestock enterprises.
9. Assessing effects of short-term woodlot/tree fallows with root/tuber crops.
10. Studying socio-economic factors affecting adoption of agroforestry technologies.



## TRIALS AND ACTIVITIES:

### CHITEDZE:

1. Leucaena Alley Cropping Trial I (3 soil fertilities x 3 N rates x 3 leaf times of application x 3 maize populations x 3 maize varieties).
2. Leucaena Alley Cropping Trial II (3 soil fertilities x 3 N rates x 3 P rates x 3 maize populations).
3. Leucaena Alley Cropping Trial III (2 P sources x 3 leaf placements x 2 maize residue management practices x 2 P placements).
4. Leaf Management and N-Supplementation (3 N rates x 4 leaf application methods/times x 2 P rates).
5. Hedge Species & Spacing (3 species x 3 spacings + 3 controls).
6. Hedgerow Screening (9 species + 3 controls).
7. Sesbania Pruning (3 heights x 3 methods + 1 control).
8. Double Species Hedgerows (3 fast growing species x 3 slow ones + 3 controls).
9. Tree Germplasm Collection and Screening (60+ species).
10. Screening Tree Species for Live Fencing (10 species).
11. Methods and Rates of Applying Tree Leaf Manure on Maize (3 species x 3 methods x 2 rates).
12. Comparing Promising Alley Shrubs and Their Management with Maize (5 species + 2 controls).
13. Nursery production of trees for the season's activities.
14. Expansion and management of vetiver grass nursery.
15. Seed orchard establishment and related assessments of Gliricidia sepium and Leucaena diversifolia.

### SITE-TESTING TRIALS

### LOCATION AND NO. OF SITES

Hedge Screening for Alley Cropping (5 species + 2 controls)	LADD x 1; BLADD x 2; KADD x 5; NADD x 2; SLADD x 4; MZADD x 2; KRADD x 2
Hedge Screening/Spacing for Alley Cropping (2 spp. x 2 spacings x 2 N rates + controls)	LWADD x 2
Leucaena Hedgerow Spacing on Steep Hills (3 spacings x 2 slopes + controls)	LADD x 2
Leucaena Hedgerow Spacing (2 spacings + 2 controls)	MZADD x 1
Hedge Screening for Alley Cropping of Maize and Forage Legumes (2 hedge species x 5 crop combinations + 2 controls)	MZADD x 1
Contour Strips of Grass, Leucaena, and Fruit Trees (3 widths + 1 control)	LADD x 1
Contour Grass Strips/Hedgerows (2 grass species +/- hedgerows + 1 control)	KADD x 1
Contour Grass Strips with Bananas (2 grass species with bananas + 1 control)	MZADD x 1
Live Fencing (4 to 6 species)	NADD x 2; SLADD x 2; KRADD x 2

Effects of <i>Leucaena</i> Leaves on Maize and Sorghum with and without Inorganic N Supplementation (2 crops x 9 treatment combinations)	NADD x 1
Establishing Nurseries of Vetiver Grass	SLADD x 1; MZADD x 1; NADD x 1
<b>ON-FARM TRIALS</b>	<b>LOCATION AND NO. OF FARMERS</b>
Hedge Screening for Alley Cropping (3 species x 3 fertilizer inputs + 2 controls)	BLADD x 4; LADD x 2; MZADD x 3; KRADD x 2
Prototype Testing of Alley Cropping with <i>Leucaena leucocephala</i> and Maize with/without Fertilizer	Multiple farmers in LADD
Evaluating Fodder Banks to Improve Supplementary Feed to Livestock Enterprises	Multiple farmers in LADD
Evaluating Live Fences Around Home and Dimba Gardens	Multiple farmers in LADD and NADD
Testing the Potential for Intensifying/Introducing Fruit Trees with Food Crops in Dimba/Home Gardens	Multiple farmers in LADD
Studying the Management and Use of Indigenous Trees in Smallholder Farms	Multiple farmers in LADD, KADD and SLADD
Evaluating the Systematic Establishment of <i>Acacia albida</i> on Smallholder Farms	Multiple farmers in LADD and MZADD
Evaluating the Planting of Cassia and Neem Trees on and around Homesteads	Multiple farmers in NADD
Effects of Indigenous Trees on Maize and Soil Fertility	Multiple farmers in LADD, KADD and SLADD
Evaluating Alley Cropping of <i>Gliricidia sepium</i> Maize	LADD x 5; multiple farmers in NADD
Assessing the Potential of Contour Strips of Vetiver and Napier Grass with <i>Cassia spectabilis</i> to Control Runoff and Erosion	LADD x 5
Evaluating Socio-economic and Bio-agronomic Impacts of Short-term Woodlot/Fallows with Roots/Tubers	LADD x 10

#### ACHIEVEMENTS:

1. Development of alley cropping hybrid maize with *Leucaena leucocephala* and *Gliricidia sepium*. This work has also shown that maize yields of 2 to 3.5 tons ha<sup>-1</sup> can be obtained under alley cropping with leucaena on nutrient poor or depleted soils in the absence of inorganic fertilisers. Alley cropping also provides availability of foliage for livestock feed with the resulting animal manure to crops.
2. Systematic farm integration of *Acacia albida* shows that smallholder yields of local maize beneath these trees can be maintained at 2 to 3 tons ha<sup>-1</sup>.
3. Development of fodder banks where leucaena is recommended and *Gliricidia* also shows promise in this regard.

#### **5.1.4.1 MALAWI - ICRAF AGROFORESTRY PROJECT**

The International Center for Research in Agroforestry (ICRAF) has a Country Programme based at Chitedze Agricultural Research Station. This is a collaborative programme implemented under the auspices of the Malawi National Agroforestry Commodity Team. The project currently has one socioeconomist responsible for on-farm research, with special emphasis on Lilongwe ADD. The main aim of the project is to involve farmers in the development and evaluation of agroforestry technologies; assess the impact of agroforestry on rural households, communities and the environment as a whole; and to identify important socio-economic factors in the technology adoption process.

### **5.2 AGRICULTURAL ENGINEERING**

#### **5.2.1 FARM MACHINERY**

##### **GENERAL OBJECTIVES:**

- (a) To develop and test appropriate technologies which could be used on the farm;
- (b) To assist manufacturers and users with equipment design, production and distribution, including spare parts availability;
- (c) To design technologies which relieve labour and energy bottlenecks;
- (d) To assist on farm machinery extension in the country; and
- (c) To liaise with international agricultural engineering institutions.

##### **EQUIPMENT/MACHINES THAT HAVE BEEN TESTED:**

1. Grain Dehuller
2. Groundnut Sheller
3. Maize Shellers
4. Planter from Botswana
5. Multipurpose Toolbars from the Netherlands
6. Hydraulic Ram
7. Rice/Wheat Weeder
8. Conventional Ox-cart
9. Chitedze/Agrimal Multipurpose Tool Frame
10. Solar Cooker/Heater
11. Cassava Peelers and Grinders
12. Hand Hoes
13. Philippino Wooden Ploughs
14. Eicher Tractor from India
15. Tinkambi Tractor from Swaziland
16. Sprayers

##### **CURRENT RESEARCH WORK**

1. Grain Processing - Grain Dehulling Machines
2. Soil Tillage and Permanent Ridges in Crop Production
3. Comparative Test of Maize Shellers: Chitedze vs. IITA
4. Use of Cows for Draught Power
5. Cassava Processing Equipment
6. Braking Systems on Ox-Carts

## **B. TECHNICAL SERVICES**

### **1. SEED SERVICES**

The Seed Services Section (formerly the Seed Technology Unit) was established in 1976, as an independent institution within DAR, responsible for seed quality control in Malawi. The section comprises a seed inspectorate wing and a seed testing branch. There are four seed labs in Malawi situated at Baka, Lifuwu, Bvumbwe and Chitedze. The central lab at Chitedze is one of the 9 laboratories in Africa that are accredited by the world-wide International Seed Testing Association (ISTA). With the establishment of seed services, the country has the capacity to produce good quality seed of all important agricultural crops according to international standards. Currently self-sufficiency in certified hybrid maize and tobacco seed has been attained.

#### **GENERAL OBJECTIVES:**

- (a) To ensure that good quality seed is produced and made available to the farming community in Malawi;
- (b) To implement the Malawi Seed Act;
- (c) To conduct research in seed science and technology;
- (d) To develop appropriate seed certification and testing standards; and
- (e) To promote the use of good seed.

#### **ACTIVITIES:**

1. Conduct routine inspections on registered seed crops grown by the commercial sector and smallholder farmers for certification purposes.
2. Test seed according to international standards for germination and purity as part of the certification process.
3. Routinely monitor the quality of seed, including imported and carry-over seed, in the trade.
4. Conduct regular training sessions for extension and marketing personnel in order to upgrade their skills in seed production, storage and distribution.
5. Advise institutions within the country on seed issues.

**TRIALS:** Research is being conducted in a number of areas including:

1. Seed Vigour and Viability
2. Seed Storage
3. Varietal Purity
4. Seed Dormancy
5. Seed-borne Diseases

### **2. PLANT PROTECTION AND QUARANTINE SERVICES**

#### **2.1 PRODUCE INSPECTION**

#### **GENERAL OBJECTIVES:**

- (a) To ensure that, where avoidable, no exotic pests and diseases of plant quarantine importance are introduced into the country;
- (b) To ensure that agricultural produce being offered to the consumer is, as much as possible, free from contamination with pesticides, infestation with pests or infection with diseases; and

- (c) To execute the Plant Protection Act No. 11 of 1969 under the Plant Protection Regulations (Import and Export) of 1969. ACTIVITIES:

**ACTIVITIES:**

- (a) Port of Entry Inspections (Import Crop Inspections): The main ports of entry are Kamuzu International Airport and Mchinji, Ntcheu and Dedza border posts. All incoming plants and plant products are inspected on arrival at the ports of entry to ensure no foreign or exotic pests and diseases are introduced into the country.
- (b) Export Crop Inspection: All produce that is destined for export is inspected and phytosanitary certificates issued according to conditions of the various importing countries. Warehouses are also inspected.
- (c) The Section is also vested with the authority to issue plant import permits and phytosanitary certificates.

## **2.2 PLANT PROTECTION**

**GENERAL OBJECTIVES:**

The major objective is to increase crop yields by:

- (a) Reducing disease pressure on the plants through use of chemicals;
- (b) Reducing disease pressure on plants by using cultural practices which are scientifically accepted and convenient for the farmer to use;
- (c) Finding ways of using chemicals or equipment which will allow the local farmer to make a reasonable profit; and
- (d) Reducing disease pressure by breeding for resistant or tolerant varieties.

**ACTIVITIES:**

- (a) The Section renders advisory services on pest management to the farming community, including diagnosis of pests and diseases.
- (b) The Section is a caretaker of all the grant pesticides and is responsible for issuing them. If there is an insect pest problem the Section is responsible for seeking proper advice from the experts for the concerned parties.
- (c) The Section runs and assists other commodities in screening for disease resistant varieties.
- (d) The Section organizes seminars and training sessions for staff and support staff in matters related to pathology in each commodity.

## **3. CROP STORAGE**

**GENERAL OBJECTIVES:**

- (a) To develop improved and appropriate storage technologies for reducing on-farm storage losses in food crops as a means of sustaining sufficient food availability at household level;
- (b) To train extension staff and others involved in handling and storage of food grains on proper postharvest husbandry; and
- (c) To act as an advisory unit and services team on technical issues pertaining to postharvest problems in the country.

#### CURRENT RESEARCH:

1. Inherent susceptibility of maize varieties/lines to infestation by the maize weevil (Sitophilus zeamais). Results from this work are incorporated into ongoing maize breeding programmes.
2. Storability of new maize hybrids (MH16, MH17 and MH18) under on-farm storage conditions.
3. Screening various bean, pigeon pea and cowpea varieties for resistance/tolerance to attack by bruchids during storage.
4. Screening indigenous plants for grain protection properties. The objective is to identify local plant materials which can be utilized to protect cereals and pulses against major storage insect pests.
5. Testing field populations of weevils (Sitophilus species) for resistance to pirimiphos-methyl (Actellic). This is ongoing work to monitor development of resistance/tolerance to storage insecticides currently in use.

#### OTHER ACTIVITIES:

Monitoring for the presence of the Larger Grain Borer (LGB), (Prostephanus truncatus), in areas bordering Mozambique and Zambia, and in stocks of imported grains, i.e., for drought relief and refugees. LGB is a very destructive insect pest of stored maize and dried cassava which is rapidly spreading in Africa.

#### RECOMMENDATIONS:

1. After investigations into the effects of traditional storage structures in relation to drying and keeping quality of maize, some modifications to these structures were recommended. These include raising the platform to 1 metre above ground, fixing ratguards to keep out rats, use of good roofs with a wider overhang to minimize wetting of produce, and general store hygiene.
2. Admixing of 2% pirimiphos-methyl (Actellic) dust to grains for protection against insect infestation during storage is recommended. The application rate is 40g dust per 90kg bag of shelled grain or 80g dust per bag of cobmaize.
3. The use of diffused light stores for storage of Solanum potato seed. This structure was demonstrated in major Solanum potato growing areas of Dedza and Ntcheu, and has been recommended for production of good quality potato seed.

## 4. PLANT GENETIC RESOURCES CENTRE

The disappearance of certain plant species, varieties or landraces can be attributed to deforestation, population pressure and the introduction of modern varieties. To prevent further loss of plant genetic resources, this centre was established at Chitedze Agricultural Research Station. Resources considered for conservation will include field and pasture plants and their wild relatives, forestry plants, flower plants, medicinal and other endangered plant species.

#### GENERAL OBJECTIVES:

- (a) To promote the exploration, collection, conservation, characterization, documentation and utilization of Malawi plant genetic resources;
- (b) To identify, plan and formulate Malawi's plant genetic resources conservation priorities and strategies;
- (c) To hold short-term active collections of indigenous or adapted plant genetic resources and develop the most appropriate measures and facilities for conserving them;

- (d) To handle the in-situ conservation of crop, forestry, pasture, ornamental, medicinal and other indigenous or exotic plants in collaboration with other plant science related organizations in the country;
- (e) To foster cooperation and encourage the development of biotechnology in the conservation and utilization of plant genetic resources in Malawi;
- (f) To directly serve plant breeding and plant research needs of the country by holding a broad plant genetic resource base of both indigenous and exotic species;
- (g) From time to time to evaluate, review problems and recommend to the Government preventive measures to be taken against genetic erosion of plant genetic resources; and
- (h) To collaborate with the SADC Regional Gene Bank and other relevant international organizations in the formulation and execution of plant genetic resource activities that are most relevant to Malawi's needs.

## **5. AGRICULTURAL ECONOMICS, STATISTICS AND DATA PROCESSING (AGREDAT)**

### **GENERAL OBJECTIVES:**

- (a) To provide statistical advice to the researchers for the planning and analysis of their experiments;
- (b) To provide data processing facilities and advisory services to the researchers;
- (c) To conduct economic evaluations on research technologies that are to be released to the farmers;
- (d) To develop sampling procedures for use by the researchers; and
- (e) To service DAR and ARC management machinery by acting as their Secretariat.

## **6. LIBRARY**

Chitedze Library is the central library for an extensive documentation system being developed throughout the Ministry of Agriculture. Through a computerized catalogue, access is provided to the holdings of Chitedze Library, as well as branch libraries located at the major research stations and in other departments of the Ministry. Chitedze Library receives approximately 400 journals and newsletters and has about 40,000 books, reports and other documents.

The main objective of the Library is to provide information support to the Station's researchers and workers, although it is open to the public. It is implementing this by developing and organizing a large collection of material on agriculture and related topics; by using the latest technology, CD-ROM, to search international databases for articles of relevance to research being carried out in Malawi; and by developing cooperative efforts in Malawi and internationally for interlending and document supply.





