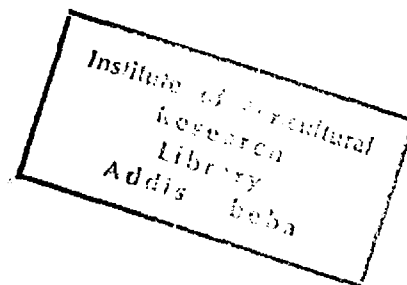


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INSTITUTE OF AGRICULTURAL RESEARCH



RESEARCH IN HORTICULTURAL CROPS  
IN ETHIOPIA

1970 to 1973 EC (1977/78 to  
1980 /81 GC)

Addis Ababa  
Ethiopia

1981

	<u>Page</u>
4.5 Research activities and files on herbs and spices, 1970 to 1973 EC (1977/78 to 1980/81 GC)	81
- Herbs and spices general	81
- Black pepper research	83
- Cardamom research	83
- Coriander research	84
- Fenugreek "	84
- False cardamom research	85
- Ginger research	85
- Long pepper research	86
- Pyrethrum research	86
- Tumeric research	87

APPENDIX

Explanation of the coding system for documenting research activities and results	88
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	<u>Page</u>
- Oromo dinech (Volaita dinech)	34
- Potato research	34
- Sweet potato research	40
- Taro (Colocasia) research	44
- Yam research	45
3. VEGETABLE CROPS RESEARCH IN ETHIOPIA, 1970 to 1973 EC (1977/78 to 1980/81 GC)	46
3.1 Background and Justification	46
3.2 Objectives	50
3.3 Lines of Investigation	51
3.4 Locations	52
3.5 Vegetable crops research activities and files, 1970 to 1973 EC (1977/78 to 1980/81 GC)	53
- Vegetable research	53
- Leafy vegetables	47
Cabbage (head) research	57
Cauliflower research	58
Celery research	58
Ethiopian cabbage (kale) research	58
Lettuce research	59
Swiss chard research	60
- Fruit vegetables	60
Chilli pepper research	60
Green (french) bean research	66
Musk and water melon research	67
Dumpkin research	67
Tomato research	67
- Bulb vegetables	71
Garlic research	71
Leek           "	71
Onion          "	72
Shallot       "	75
4. HERBS AND SPICES RESEARCH IN ETHIOPIA, 1970 to 1973 EC (1977/78 to 1980/81 GC)	77
4.1 Background and Justification	77
4.2 Objectives	79
4.3 Lines of Investigation	80
4.4 Locations	81

the lack of experienced staff coupled with the high mobility of staff. As of 1980, no expert has been assigned to work on this important group of crops. It is thus high-time that people are trained to work on these crops so that comprehensive studies can be carried out and meaningful results obtained.

If the country's potential as a fruit producer was properly exploited Ethiopia could:

1. Stop importing fruits and nuts in different forms and save foreign currency.
2. Satisfy the local demand for fruits and nuts for both direct consumers at reasonable prices and for local agro-industries - wine making, soft drinks, etc.
3. Exploit the world market situation and earn foreign exchange for the country.

#### Citrus

Citrus fruits are among the most important fruits in the world as well as in Ethiopia. These crops have been growing in the country for many centuries. The erratic introductions that have been made by individuals have not been properly documented for cultivar type or quality and have also probably resulted in the introduction of citrus pests and diseases. Recently citrus orchards in Ethiopia have come under close scrutiny and are now suspected of being infected by virus diseases. Generally, virus diseases attack old lines of citrus and reduce tree size and yield. Other diseases which have been introduced are Tristeza and Greening or Stubborn. Even in orchards where no obvious symptoms have been observed and because of the rootstock being used, it is possible that these trees could be symptomless carriers of different virus diseases. Once introduced, it takes many years to detect the presence of a virus disease and when it is detected it is usually too late to do anything and incurs a very heavy investment to rectify the situation.

#### Banana

Like citrus, banana has been grown for a long time in Ethiopia. However, the traditional varieties are very easily spoiled at and after harvest. Work is needed to find the best varieties for the different areas of the country and to study other production needs, particularly water requirements for irrigated production, fertilizer requirements and methods to combat nematodes.

## 1. FRUITS AND NUTS RESEARCH IN ETHIOPIA

1970 to 1973 EC (1977/78 to 1980/81 GC)

There is a large number of fruit and nut crops which could be produced within Ethiopia and for which research would be a profitable exercise. However, due to severe shortage of qualified staff to conduct the research it is possibly to concentrate on only a few of these crops while some others are maintained at an observational level. The main crops being studied are:-

### A. Tropical and sub-tropical fruits

- Banana
- Citrus (orange, mandarin, grapefruit, lemon, lime, sour orange, ortanique)
- Grape
- Papaya
- Pineapple

### B. Deciduous (Temperate) fruits

- Apple
- Peach
- Plum

#### 1.1 Background and Justification

It is a well known fact that fruits and nuts, along with vegetables, complete the food balance to maintain health. Due to Ethiopia's proximity to the equator, range of altitudes and associated climates, a very wide range of different types of fruits and nuts can be produced. Recently there has been a general trend showing an increase in fruit consumption and any fruit brought to the market is rapidly sold, even those of inferior quality. Fruits and nuts are also imported and sold in various forms. This also indicates a demand for fruits and nuts.

Much research is essential if the crops suited to the various parts of the country are to be properly identified along with other techniques to ensure good production. Research has been started at some of the research stations in order to attempt to tackle some of the many problems involved in fruit production. As most of these crops are perennials, results cannot be achieved quickly. Another problem with this work is

### Grapes

Wine making is an important industry in Ethiopia both for home consumption and export. It should also be possible to produce high quality table grapes and other types to be processed into raisins, etc. Work is needed to properly identify the main problems in grape production, find new alternative varieties and means to control major diseases, especially mildews.

### Papaya

This crop is widely accepted. However it is readily spoiled in transport. Work is needed to find varieties with dependable flavours, better handling characteristics, shorter stature and dioecious flowers to maximize production.

### Pineapple

Pineapple is well accepted on the local market but production is limited to only one or two farms. It is necessary to determine the best methods for pineapple production under conditions in Ethiopia and find other areas to expand production. An alternative variety to Smooth Cayenne should also be found should Smooth Cayenne be wiped out by disease.

### Apple, Peach and Plum

These three 'temperate' (deciduous) crops can be readily accepted. Peach has been grown for many generations throughout the traditional highland areas of Ethiopia. The main problems are to identify the most suitable areas for producing these fruits and the varieties giving best yields and having good local acceptance. Economic methods for breaking dormancy are also needed if production is to be carried out on a large scale.

## 1.2 Objectives

1. To identify kinds of fruits and nuts suitable for production under Ethiopian conditions and promote their production and consumption.
2. To identify suitable varieties, the areas of the country where they can best be produced and the technologies to maximize their yields.

3. To identify the major production constraints, particularly pests, diseases and weeds and the means to control these.
4. To identify the fertilizer, water and other requirements of these crops.

## 1.3 Lines of Investigation

### Tropical and Sub-tropical Fruits and Nuts

- nine different species are being observed for their general adaptation at a number of locations.
- banana: work is concentrating on variety trials, and fertilizers and water requirements for irrigated production.
- citrus: work is concentrating on testing and selection of suitable variety/rootstock combinations for the various types of citrus and testing the adaption of these types for different regions of the country. Work has also been started to produce rootstock materials locally. In crop protection for citrus work is being done on citrus scales, virus diseases, and weed control.
- grapes: work is being done in collaboration with the HDA farms where vineyards are established. A survey of existing vineyards will be made to collect interesting materials and assess current production problems. Varieties are also being assessed for their adaptation and resistance to powdery mildew and control measures for this disease are being sought.
- papaya: work is now concentrating on testing varieties with better marketing qualities and yield characteristics.
- pineapple: work is concentrating on determining the most suitable planting materials for conditions in Ethiopia and the fertilizer requirements of these crops.

Deciduous (Temperate) Fruits and Nuts

- seven different species are under observation for general adaptation at Holetta and the production of rootstock materials to increase promising varieties is being carried out at Bekoji and Holetta.
- apple: six varieties are being studied for their adaptation over a wide range of high altitude locations while a trial for intensive production is being carried out at Holetta.
- peach and plum: ten varieties of each are being tested for their adaptation over a wide range of high altitude locations.

1.4 Locations

Tropical and Sub-tropical Fruits and Nuts:  
Awassa, Bako, Melka Werer, Melka Sadi, Nazareth, ARDU, Jimma, HDA farms and vineyards.

Deciduous (Temperate) Fruits and Nuts: Holetta, Bekoji, Kulumsa and high altitude Extension sites.

1.5 RESEARCH ACTIVITIES AND FILES ON FRUITS AND NUTS  
1970 to 1978 EC (1977/78 to 1980/81 GC)

- Fn FRUITS AND NUTS - General  
1977/78 - 1979/80 part of Horticultural Department (Seifu Gebremariam, Dept. Coordinator, Nazareth)  
1980/81 - Fruit and nuts team, Plant Science Department (no team leader, Seifu Gebremariam acting as team leader, Nazareth)

- Fn/pp 27 FRUIT AND NUT TREE DISEASES  
1980/81 - Identification and control of some fruit tree diseases (Ariena van Eruggen)

Tp TROPICAL AND SUB-TROPICAL FRUITS AND NUTS -  
General

- Tp 1 INTRODUCTIONS OF TROPICAL FRUITS AND NUTS  
1978/79 - (Horticultural Development Agency)  
Mango, Avocado, Guava

- Tp 3 SELECTION AND ADAPTATION TESTS FOR TROPICAL AND SUB-TROPICAL FRUITS AND NUTS  
Tp 3.1 (71 onwards) Tropical and sub-tropical fruits and nuts adaptation observations.  
1977/78 - (overall Seifu Gebremariam)

<u>Crop</u>	<u>Locations</u>
Loquat	Nazareth (Koka)
Mango	Nazareth (Koka), Gambella
Cashew nut	Gambella
Passion fruit	Nazareth (Koka), Gambella, Jimma, Bako, EPID sites
Annona spp.	Nazareth (Koka)
Avocado	Nazareth (Koka)
Guava	Nazareth (Koka), Gambella
Macadamia nut	Nazareth (Koka), Jimma, ARDU
Cysternut	Nazareth (Koka), Jimma

1978/79 (overall Seifu Gebremariam)

<u>Crop</u>	<u>Location</u>
Loquat	Nazareth (Koka), Jimma
Mango	" ( " ), Melka Werer, Jimma
Cashew nut	Gambella
Passion fruit	Melka Werer, Jimma, Nazareth (Koka), EPID sites
Annona spp.	Jimma, Nazareth (Koka), Melka Werer
Avocado	Nazareth (Koka), Jimma
Guava	" ( " ), "
Macadamia nut	" ( " ), " , ARDU
Jack fruit	Jimma
Casimiroa	"
(White sapote)	
Brazil cherry	"
(Eugenia uniflora)	
Carob bean	"
Tree tomato	"
Kai apple	"
Manzanilla	"
Rose apple	"

1979/80 (overall Seifu Gebrmariam)

<u>Crop</u>	<u>Location</u>
Mango	Awassa, Bako, Jimma, Melka Werer, Nazareth (Koka)
Avocado	Awassa, Bako, Jimma, Nazareth (Koka)
Guava	Awassa, Jimma, Nazareth (Koka)
Annona spp.	Jimma, Melka Werer, Nazareth (Koka)
Passion fruit	Awassa, Moletta, Jimma, Melka Werer, Nazareth (Koka)
Jack fruit	Jimma, Nazareth (Koka)
Kai apple	" ( " )
Macadamia nut	" ( " ), ARDU
Casimiroa	" ( " )
(White sapote)	
Carob bean	Jimma
Brazil cherry	"

1980/81 (Belachew Haile, Melka Werer - Dantew Mamo - Jimma; Getachew Mengistu - Bako; Shelemew Woldemariam - ARDU; Zewdie Kassa - Nazareth)

<u>Crop</u>	<u>Location</u>
Mango	Awassa, Bako, Jimma, Melka Werer, Nazareth (Koka)
Avocado	Awassa, Bako, Jimma, Melka Werer, Nazareth (Koka)
Guava	Awassa, Jimma, Nazareth, Melka Werer
Annona spp.	Awassa, Jimma, Nazareth, Melka Werer
Passion fruit	Awassa, Bako, Jimma, Melka Werer, Nazareth, ARDU
Jack fruit	Jimma, Nazareth
Loquat	" "
Macadamia nut	" " , ARDU, Tepi
White Sapote (Casimiroa)	" "
Oyster nut	Jimma, Agaro, Anfillo, Metu, Tepi, Wenago, Bedessa
Cocoa	Tepi

**Tp 11 INTERCROPPING WITH TROPICAL AND SUB-TROPICAL FRUITS AND NUTS**

Tp/Cc/Mn 11.1 (75) Intercropping of coffee and macadamia nut at Jimma - Melko (details in file Cc 1.050.1 (75))

TR/Av/Pp 11.2 (80) Intercropping avocado and papaya at Awassa

1980/81 - (Kimya Mohammed)

**Bn BANANA RESEARCH**

**Bn 2 MAINTENANCE OF BANANA COLLECTIONS**

1978/79 - at Jimma

1979/80 - at Jimma

1980/81 - at Jimma and Melka Werer

**En 4 BANANA VARIETY TRIALS AND OBSERVATIONS**  
**En 4.2 (72 revis. 79) Banana variety trial**

- 1977/78 - Gambella, Jimma and ENID sites  
(overall Seifu Gebremariam)  
1978/79 - Jimma trial terminated, started at  
Melka Werer and Nazareth (overall  
Seifu Gebremariam)  
1979/80 - Continued at Melka Werer and Nazareth  
(overall Seifu Gebremariam)  
1980/81 - Continued at Melka Werer (Belachew  
Haile) and Nazareth (Zewdie Kassa)

**En 8 BANANA SOIL NUTRIENT REQUIREMENTS**

**En 8.070.1 (79) Banana fertilizer (N,K) trial at  
Melka Sadi**

- 1979/80 - (Tadele Gebreselassie)  
1980/81 - ( " " )

**En 10 BANANA WATER REQUIREMENTS**

**En 10.070.1 (75) Banana watering interval and water  
duty x spacing experiment at Melka Werer (and Gode)**

- 1977/78 - (Aschalew Alemu, Fekade Selassie Girma)  
last year of trial

**En 10.070.2 (79) Banana watering interval and water  
duty experiment at Melka Sadi**

- 1978/79 - (Fekade Selassie Girma) postponed  
1979/80 - (Eyassu Temesgen)  
1980/81 - (Getachew Alem)

**CROP PROTECTION FOR BANANA**

**BNM Burrowing nematodes**

**En/BNM 24.1 (77) Testing banana varieties (and onset)  
for resistance to burrowing nematodes**

- 1977/78 - Melka Werer (Ariena van Bruggen)  
completed and reported

**CROP PROTECTION FOR CITRUS**

**Ct/en Pests of Citrus**

**Black Scale (BSC)**

**Ct/BSC 21.1 (80) Survey for and identification of  
parasites on Black Scale infesting citrus in  
Ethiopia**

- 1980/81 - Ghibe State Farm (Tsedeke Abate)

**Citrus Mealy Bug (CIM)**

**Ct/CIM 25.1 (78) Biocontrol of citrus mealy bug**

- 1978/79 - Nazareth (Adhanom Negassi)  
1979/80 - " ( " " ) completed  
and reported

**False Codling Moth (FCM)**

**Ct/FCM 24.1 (78) A new way to dispose of infested  
citrus fruits that may reduce further damage  
by false codling moth.**

- 1978/79 - Nazareth (T.J. Crowe, Adhanom Negassi,  
W.S. Pearson, Araya Kebede)  
1979/80 - Completed - advisory bulletin drafted

**Purple Scale (PUS)**

**Ct/PUS 25 (77) Biological control of purple scale in  
citrus**

- 1977/78 - Sodere and Erer Gota (T.J. Crowe,  
Adhanom Negassi, State Farms)

1978/79 - Continued

- 1979/80 - " (Tsedeke Abate, State Farms)  
1980/81 - " ( " " , Amede W/Mariam)



Red Scale (RSC)

Ct/RSC 23.1 (80) Study on relationship between population dynamics of Red Scale on citrus and climatic factors

1980/81 - Nazareth (Koka) (Tsedeke Abate)

Ct/RSC 25 (78) Biocontrol of Red Scale

1978/79 - Nazareth area (Adhanom Negassi, T.J. Crowe, State Farms)

1979/80 - Continued (Tsedeke Abate, State Farms)

1980/81 - " ( " " , Amede W/Mariam)

Ct/np DISEASES OF CITRUS

Citrus nematode (CNM)

Ct/CNM 21.1 (79) Survey on the occurrence of citrus nematode in grape vine and citrus orchards in Ethiopia

1979/80 - (Eshetu Bekele, Dereje Gorfu, Tiruwork Amogne with cooperation from EDA)

Footrot in citrus (FTC)

Ct/FTC 21.1 (77) Identification of the pathogens causing footrot in citrus

1977/78 - (Ariena van Bruggen)

1978/79 - ( " " " , Almaz Yilma)

1979/80 - ( " " " , " " )

1979/80 - Not programmed

Viruses in Citrus (VIC)

Ct/VIC 21.1 (77) Indexing of citrus for viruses in Ethiopia

1977/78 - Holetta (Ariena van Bruggen)

1978/79 - Continued (Ariena van Bruggen, Almaz Yilma)

1979/80 - Continued (Ariena van Bruggen, Almaz Yilma)

1980/81 - (Admassu Melkeberhan)

Ct/wc WEED CONTROL IN CITRUS

Ct/wc 26 (78) Chemical weed control in citrus

1978/79 - At Abadir (Ahmed Sherif, Mekonnen W/Kidan, State Farms)

1979/80 - Continued at Abadir  
- At Melka Werer (Ahmed Sherif)

1980/81 - At Koka (Tsefaye Tedla)

Gr GRADE RESEARCH

Gr 1 GRAPE VINE INTRODUCTIONS AND SURVEYS

Gr 1.1 Grapevine introductions

1978/79 - Barlinka and Bibier in bulk plus other table, wine, raisin and mildew resistant varieties (Horticultural Development Agency)

Gr 1.2 (80) Survey of vineyards to identify production problems and collect interesting materials.

1980/81 - Dukem, Guder, Abadir (no one assigned)

Gr 3 GRAPE VINE VARIETY ADAPTATION TESTING AND SELECTION

Gr 3.1 Grape vine adaptation testing and screening for suitable varieties for local conditions and requirements.

Gr 3.1.1 (71) Grape vine observation at Koka - Nazareth

1977/78 - 15 varieties (Seifu Gebremariam)

1978/79 - Continued ( " " )

1979/80 - converted to propagation nursery Gr 14

Gr 3.1.2 Grape vine observation at Jimma

1977/78 - 8 varieties

1978/79 - stopped due to poor adaptation

Gr 3.1.3 Grape vine observation at Melka Werer

1977/78 - 7 varieties

1978/79 - stopped due to poor adaptation

Gr 3.1.4 Grape vine observation at Holetta and Bako

1977/78 - a few varieties

1978/79 - stopped due poor adaptation

Gr 3.1.5 (78 expanded 79) Grape vine observation at Abadir and Dukem

1978/80 - 40 lines and varieties in nursery (Seifu Gebremariam)

1980/81 - 40 lines and varieties planted out at Abadir and Dukem (Asfaw, Debre Zeit)

Gr 7 GRAPE VINE MANAGEMENT STUDIES

Gr 7.002.1 (78) Grape vine trellising trial at Koka

1977/78 - (Seifu Gebremariam)

1978/79 - terminated due to disease and other problems

Gr 14 GRAPE VINE PROPAGATION STUDIES

Gr 14.1 Grape vine propagation nursery

1977/78 - at Koka (Seifu Gebremariam)

1978/79 - at Koka ( " " )

1979/80 - at Dukem (rainfed) and Abadir (irrigated)

1980/81 - not programmed

CROP PROTECTION FOR GRAPE

Gr/pp Diseases of Grapes

Downy Mildew (DMW)

Gr/DMW Gr 26.1 (78) Spray trial to control Downy Mildew in Grapes

1977/78 - Holetta and Menagesha (Awgichew Kidane)

1978/79 - discontinued due to lack of staff

1979/80 - Menagesha (Awgichew Kidane)

1980/81 - not programmed

AP 7 APPLE MANAGEMENT STUDIES

Ap 7.040.1 (78) Intensive system of apple production

1977/78 - Holetta (and Koka)

1978/79 - Continued

1979/80 - Continued at Holetta, terminated at Koka

1980/81 - Continued at Holetta (Yilma Abebe)

Bb BUSH BERRIES

Bb 3 SELECTION AND ADAPTATION OF BUSH BERRIES

1977/78 - Black berry, young berry, currant at Holetta

1978/79 - Young berry maintained at Holetta but dropped from official programme

Pc PEACH RESEARCH

Pc 3 PEACH VARIETY ADAPTATION AND SELECTION

Pc 3.1 Peach variety adaptation observation

1977/78 - Holetta, Nazareth, Sudan Interior Mission, Bekoji, Kulumsa, EDID sites

1978/79 - Holetta, Bekoji, Kulumsa, Bako, Sudan Interior Mission, EDID sites

1979/80 - Holetta, Bekoji, Kulumsa

1980/81 - 11 varieties at Holetta (Yilma Abebe), Bekoji, Kulumsa (Shelemew W/Mariam) Extension sites (Semeret K/Yesus)

CROP PROTECTION FOR PEACH

Powdery Mildew (PMW)

Pc/PMW 26.1 (78) Spray trial against powdery mildew in peaches at Holetta

1977/78 - last year of trial

Leaf Curl (LCD)

Pc/LCD 26.1 (78) Spray trial in peaches against leaf curl diseases

1978/79 - Menagesha Spring Farm (Awgichew Kidane)

1979/80 - " " " ( " " )

1980/81 - Not programmed

21 PLUM RESEARCH

21 3 PLUM VARIETY ADAPTATION AND SELECTION

21 3.1 (71) Plum variety adaptation observation

1977/78 - Holetta, Nazareth, Jimma, Sudan  
Interior Mission

1978/79 - Holetta, Fekoji, Kulumsa, Jimma

1980/81 - 12 varieties at Holetta (Yilma Abebe)  
10 at Kulumsa, Fekoji (Shelemew  
W/Mariam), Extension sites (Semeret  
K/Yesus)

Potato

As a food crop, potato is considered to be one of the cheapest sources of energy. Protein production through potato is the highest of the four major agricultural crops (rice, maize, wheat, potato) in the world, and has a good composition with respect to essential amino acids for human nutrition. In addition, potato is an excellent source of Vitamin C and the Vitamin B group.

Potato is a relatively new crop for Ethiopia but it is already well accepted in urban centres and some rural areas. It is eaten boiled and as wat and potato chips - Kesh Kesh - are popular in the big cities. Potato also has a considerable economic value to Ethiopia - potato exports to Djibouti are among the highest of all produce exported from Harer Administrative Region.

At present, potatoes are grown in home gardens and/or small farms in many areas of the country. It is estimated that 20,000 hectares of potatoes are cultivated a year with an average yield of about 5 t/ha. This is an extremely low yield as compared to other developing countries. There are a number of problems that account for this low yield. Results of a recent general survey on production problems and practices indicate that in most of the major potato production areas in Ethiopia, the leading problems are:-

- lack of well adapted varieties
- insufficient good quality seed potatoes
- lack of adequate agronomic techniques
- diseases, especially blights, bacterial wilt and other root rots.

Problems of finding suitable storage and good marketing facilities also need to be solved in order to expand potato production in Ethiopia.

Everything considered, there appears to be a very promising potential for potato in Ethiopia. However, in order to have a viable potato research programme which could make a significant contribution to alleviating food shortages and malnutrition in the country, an integrated and coordinated effort is needed from potato breeders, agronomists, seed, crop protection, soil and storage specialists as well as extension personnel.

### Sweet Potato

Sweet potato is an important part of the diet of our people mainly in the south and eastern parts of Ethiopia. Sweet potato is an important source of carbohydrate and yellow and orange fleshed varieties can be an excellent source of Vitamin A. In the eastern parts of the country the leaves and stems are used to feed cattle.

Sweet potato is a very dependable root crop as it is adapted to a wide range of environmental conditions including considerable periods of drought. It also produces well under irrigation. In addition to these sweet potato can also be grown on marginal soils.

The major problems for peasant farmers and state farms have been identified as:-

- Planting times, spacing and methods
- Harvesting times and techniques
- Sweet potato stem blight
- Sweet potato weevils
- Storage and handling

Research on sweet potato has been going on in Nazareth and other IAR stations since 1972/73. Promising results have been obtained and one variety has been recommended for release to farmers. The results of the work to date are being used to develop a relevant and comprehensive research programme for this crop.

### Anchote

Anchote is a popular root vegetable in the western parts of country where it is indigenous. The tuber has a good protein content, contains carotene and, when, well grown, is virtually free of fibres. As this crop is hardly known outside Ethiopia very little research has been done on it. Within the country it is only produced by peasant farmers in small garden plots. Work has been started to identify lines from indigenous collections which give good yields and have a good quality and also cultural practices which can improve yields.

### Kote Hare

Kote hare (*Dioscorea bulbifera*) is grown in home gardens for food and a cash crop in local market of Keffa, Sidamo and Illubabor Administrative Regions. Although not originating in Ethiopia, it is an important traditional crop for many people of these areas. Kote hare produces both aerial and subterranean tubers which are eaten boiled. As staffing allows it is important that some work is done on identifying high yielding types and cultural practices to maximise yields.

### Oromo or Wollaita Dinech

As with the other indigenous root crops, Oromo dinech (*Eleocharis edulis*) is a home garden vegetable grown by peasant farmers of the western and southern parts of Ethiopia, particularly in Enset growing areas. The starch is known to be in a very easily digestible form and this crop is used traditionally for feeding young children and invalids, and in treating diarrhoea in the form of a broth as well as being eaten whole after boiling. Very little research has been done on this crop so a start has been made to collect and study indigenous types.

### Taro

Taro is an important root crop in the south and south-western parts of Ethiopia where it is found in almost all home gardens. Taro has a higher percentage of starch than most other root crops and could be developed to provide additional carbohydrate for both human consumption and industrial processing. Another useful feature of Taro is its ability to grow under water-logged conditions (wet lands). In other parts of the world Taro grows well under the same conditions as rice. Some work has been started on studying indigenous collections and making introductions from countries where taro is more extensively grown. As staffing allows this work should be continued and expanded to cover cultural practices to improve yields.

### Yam

Yam (*Dioscorea alata*) is not as widely grown as the other indigenous root crops but it is still an important food source for some people of the west and south-west of Ethiopia. A little research on this crop has been started at Jimma which could be expanded in collaboration with institutions, such as IITA in Nigeria, where this crop has been extensively studied.

### Beetroot and Carrot

These two root crops are of recent introduction to Ethiopia where they are grown mainly to supply consumers in the major cities. To date only a few problems have emerged, the main one being the high cost of seed which has to be imported. Studies have started to determine the best areas and techniques for local seed production. These will continue.

### Cassava

Cassava is well known in other parts of the developing world as a high yielding root crop which can tolerate considerable periods of drought. It has been introduced to Ethiopia to be used as a famine insurance crop rather than a major food supply. It has already been found to have a high yield potential in the wetter parts of the country. The main problems with cassava are its poor food quality and the lengthy and tedious methods required to process it, particularly the types which contain toxic substances. Work on this crop is being kept at a low level but should be expanded to test its adaptation and yielding ability in semi-arid parts of Ethiopia.

## 2.2 Objectives

- to improve yields by identifying high yielding, disease and pest resistant varieties and the cultural practices needed to optimize yields.
- to identify the crop protection problems of these crops and means of controlling the most important pests and diseases.
- to find means of producing reliable seed and planting materials locally.
- to improve harvesting, storage and handling techniques.

## 2.3 Lines of Investigation

- Variety improvement: Collection and evaluation of indigenous types, selection from introduced materials and for potato cooperation in the international breeding programme coordinated by the International Potato Centre (CIP).
- Agronomy: study planting times, methods and populations.
- Soil Fertility: for the most important crops study the soil fertility requirements.
- Crop Protection: identification of the most important diseases and pests and methods for controlling these.
- Harvesting, etc.: determine optimum harvesting times and methods for storing root and tuber crops, particularly potato and improved methods for processing enset.
- Seed Production: determine techniques for producing reliable seed (and planting materials) locally.

## 2.4 Locations

- Enset - Debre Zeit and WADU with trials in selected sites in the major enset producing areas. Appropriate technology for enset at Nazareth.
- Potato- the main work is based at and coordinated from Alemaya with trials also being conducted at IAR stations and ARDU and WADU sites.
- Sweet potato- the main work is based at and coordinated from Nazareth with trials at other IAR stations and Alemaya.
- Indigenous root and tuber crops - the main collections are held at Jimma with some work also being done at Bako, Nazareth and Awassa.
- Beet root and Carrot - seed production studies at Zoleffa, Bekoji and Kulumsa.
- Cassava- Jimma, Melka Werer, Nazareth.

2.5 RESEARCH ACTIVITIES AND FILES ON ROOT AND TUBER CROPS  
1970 to 1973 EC (1977/78 to 1980/81 GC)

(Report on File) \*

Rt ROOT AND TUBER CROPS

- 1977/78 - 1979/80 - except for potato, part of Horticultural Department (Seifu Gebremariam, Dept. Coordinator, Nazareth).
- 1980/81 - Root and Tuber crops team, Plant Science Dept. (Hailemichael K/Mariam, team coordinator, Alemaya).

At ANCHOTE RESEARCH

At 2 ANCHOTE COLLECTIONS

At 2.1 Evaluation and selection of indigenous anchote collections - anchote nurseries

- 1977/78 - Jimma (I.V. Lewis)
- 1978/79 - " ( " " ; Hanna Assefa)
- 1979/80 - " ( " " ; " " )
- 1980/81 - Maintained as "living museum" at Jimma 10 collections, (I.V. Lewis, Hanna Assefa) Bako (Debitu Beyene), Indibir, Holetta (Yilma Abebe) Nazareth (Terefe Belihu).

At 3 ANCHOTE ADAPTATION OBSERVATIONS AND TRIALS

At 3.1 (76) Anchote adaptation observations

- 1977/78 - One variety at Jimma (I.V. Lewis)\*
- 1978/79 - 10 varieties at Jimma (I.V. Lewis)\*  
Four selections at Bako (Mohammed A/Kadir)\*  
One variety at Nazareth (Seifu G/Mariam)
- 1979/80 - not programmed
- 1980/81 - proposed but cancelled

At 5 ANCHOTE SOWING AND SPACING STUDIES

At 5.020.1 (79) Anchote population trial at Bako

- 1979/80 - (Debitu Beyene)
- 1980/81 - ( " " )

At 5.020.2 (79) Anchote sowing date trial at Bako

- 1979/80 - (Debitu Beyene)
- 1980/81 - Cancelled

Br BETROOT RESEARCH

Br 3 BETROOT ADAPTATION TRIALS AND OBSERVATIONS

Br 3.1 Beetroot variety observation under irrigation

- 1977/78 - Bako, Holetta, Melka Werer (overall Seifu Gebrmariam)
- 1978/79 - Holetta, Bako, Jimma, Melka Werer (overall Seifu Gebremariam)
- 1979/80 - Awassa, Bako, Holetta, Jimma, Melka Werer, Nazareth (overall Seifu Gebrmariam)
- 1980/81 - Not programmed

Br 3.2 Beetroot observation under rainfed conditions

- 1977/78 - Nazareth, Holetta, Kulumsa, Bekoji (overall Seifu Gebremariam)
- 1978/79 - Holetta, Nazareth, Jimma, Bako, ARDU (overall Seifu Gebremariam)
- 1979/80 - Awassa, Bako, Indibir, Holetta, Jimma, Nazareth (overall Seifu Gebremariam)
- 1980/81 - Awassa, Bako, Nazareth (Terefe Belihu)

Br 5 BETROOT SOWING AND SPACING STUDIES

Br 5.1 (79) Beetroot spacing trial

- 1979/80 - Awassa, Holetta, Nazareth (overall Seifu Gebremariam)
- 1980/81 - Not programmed

Br 14 BETROOT SEED PRODUCTION STUDIES

- 1977/78 - Holetta, Bekoji, Meraro, Lemu, Alemaya (overall Seifu Gebremariam)
- 1978/79 - Holetta, Meraro, Bekoji (Seifu G/Mariam)
- 1979/80 - Awassa, Bako, Indibir, Holetta, Jimma, Nazareth (Seifu Gebremariam)
- 1980/81 - Holetta, Bekoji, Meraro (Shelemew W/Mariam, Tamiru Mehrete, Terefe Belihu)

Ca CARROT RESEARCH

Ca 3 CARROT ADAPTATION OBSERVATIONS AND TRIALS

Ca 3.1 Carrot adaptation observation under irrigation

- 1977/78 - Holetta, Melka Werer, Bako (Seifu Gebremariam)
- 1978/79 - Holetta, Bako, Jimma, Melka Werer (Seifu Gebremariam)
- 1979/80 - Cancelled
- Ca 3.2 Carrot adaptation observation under rainfed conditions
- 1977/78 - Holetta, Kulumsa (Bereke Tsehai Tiku)
- 1978/79 - Holetta\*, Indibir\*, Nazareth\*, Jimma Bako, ARDU (Seifu Gebremariam, Bereke Tsehai Tiku)
- 1979/80 - Awassa, Bako, Indibir, Holetta, Jimma, Nazareth (Seifu Gebremariam)
- 1980/81 - Awassa, Bako, Nazareth (Terefe Belihu)
- Ca 5 CARROT SOWING AND SPACING STUDIES
- Ca 5.1 (79) Carrot spacing trial
- 1979/80 - Awassa, Holetta, Nazareth (Seifu G/Mariam)
- 1980/81 - Not programmed
- Ca 14 CARROT SEED PRODUCTION STUDIES
- 1977/78 - Holetta, Bekoji, Meraro, Lemu, Alemaya (Seifu Gebremariam, Bereke Tsehai Tiku)
- 1978/79 - Holetta, Bekoji, Meraro (Seifu G/Mariam)
- 1979/80 - Holetta, ARDU (Seifu Gebremariam)
- 1980/81 - Holetta, Bekoji, Meraro (Shelemew W/Mariam, Tamiru Mehrete, Terefe Belihu)
- Cv CASSAVA RESEARCH
- Cv 2 CASSAVA COLLECTIONS
- Cv 2.1 Cassava nursery to observe behaviour of different lines and select and multiply promising lines
- 1977/78 - 36 lines at Melka Werer
- 1978/79 - 28 lines at Melka Werer, 8 at Jimma, 7 at Metu
- 1980/81 - Melka Werer, Jimma (Teklu Negash, Tsedeke Abate) Bako, Nazareth, Awassa

- Cv 4 CASSAVA VARIETY TRIALS AND OBSERVATIONS
- Cv 4.1 Cassava variety trial under rainfed conditions
- 1977/78 - four selections at Jimma (I.V. Lewis)\*"
- 1978/79 - Continued at Jimma
- 1979/80 - Eight selections at Bako and Jimma
- 1980/81 - Continued at Bako and Jimma (Teklu Negash)
- to start at Metu
- Cv 5 CASSAVA SOWING AND POPULATION STUDIES
- Cv 5.070.1 (78) Cassava study on plant population to obtain optimum yields in both terms of quantity and quality at Melka Werer
- 1978/79 -
- 1979/80 - Not programmed
- Cv 12 CASSAVA HARVESTING STUDIES
- Cv 12.1 (77) Cassava harvesting date trial
- 1977/78 - Melka Werer, Jimma
- 1978/79 - Completed at Jimma, Melka Werer
- 1979/80 - Started at Metu
- 1980/81 - Continued at Metu
- Ey ENSET RESEARCH
- Ey 2 ENSET COLLECTIONS
- Ey 2.1 (80) Collection, preservation and evaluation of enset clones in Ethiopia
- 1980/81 - Indibir, Hossana, Yirgalem, Hageremariam, Sodo (Taye Bizunch, Abraham Bisrat, Teketel Makesso)
- Ey 5 ENSET PLANTING AND POPULATION STUDIES
- Ey 5.100.1 (80) Sequence of transplanting enset to reduce "nursery" time and labour without affecting yield adversely
- 1980/81 - Indibir, Hageremariam, Hossana, Sodo, Yirgalem (Teketel Makesso)

Ev 5.100.2 (80) Enset spacing observation to determine optimum spacing versus production for different conditions

1980/81 - Sidama, Arero, Wolaita, Kembata, Hadiya, Indibir (Teketel Makesso)

Ev 8 ENSET SOIL NUTRIENT REQUIREMENTS

Ev 8.100.1 (80) Effect of inorganic fertilizers (N,P) on different stages of enset growth

1980/81 - Indibir, Hossana, Sodo, Hageremariam, Yirgalem (Tamirie Hawando, Teketel Makesso)

Ev 11 INTERCROPPING STUDIES WITH ENSET

Cc/Ev 11.050.1 (78) Trial to study the effect on coffee yield and growth when interplanted with enset at Wenago

1978/79 - (Mesfin Ameha)

1979/80 - ( " " )

1980/81 - ( " " , Paulos Dubale, Yacob Ejamo)

Ev 11.100.1 (80) Intercropping with enset as the main crop

1980/81 - Indibir, Hossana, Sodo, Hageremariam, Yirgalem (Teketel Makesso)

AE/Ev 15 ENSET PROCESSING EQUIPMENT

AE/Ev 15.1 (77) Equipment for processing the enset corns

1977/78 - (Araya Kebede, M.S. Pearson)\*

1978/79 - ( " " , " " )\*

1979/80 - ( " " , " " )

1980/81 - ( " " , " " , Teketel Makesso)

Kh KOTE HARE RESEARCH

Kh 2 KOTE HARE COLLECTIONS

Kh 2.1 Collection and Selection of indigenous Kote hare

1977/78 - 1979/80 - at Jimma

1980/81 - maintained as living "museum" at Jimma

Kh 3 KOTE HARE ADAPTATION OBSERVATIONS AND TRIALS

Kh 3.1 (80) Kote hare adaptation observation

1980/81 - Awassa, Bako, Nazareth (Teklu Negash)

Kh 5 KOTE HARE PLANTING AND POPULATION STUDIES

Kh 5.050.1 (78) Kote hare population trial at Jimma

1978/79 - (I.V. Lewis, Teklu Negash)\*

1979/80 - Destroyed by wild animals

1980/81 - Cancelled

Od OROMO DINECH (WOLAITA DINECH)

Od 3 OROMO DINECH ADAPTATION OBSERVATIONS

1978/79 - Jimma, Holetta, Bako, Nazareth\*

1979/80 - Not programmed

1980/81 - Existing material being maintained as a "living museum" at Nazareth (Terefe Belihu) Bako (Debitu Beyene) Holetta (Tamiru Mihrete)

Od 5 OROMO DINECH PLANTING AND POPULATION STUDIES

Od 5.043.1 (78) Comparison of crops from stem cuttings and tubers of oromo dinech at Holetta

1978/79 -

Do POTATO RESEARCH

(N.E. Work prior to 1980/81 is documented with the crop coordinator, Hailemichael Kidanemariam at Alemaya)



Do 3 POTATO BREEDING AND SELECTION PROGRAMME

Do 3.1 (74/75) Development of well adapted, high yielding potato varieties with particular emphasis on late blight resistance and earliness

1980/81 - Alemaya, Moletta, Nazareth, Debre Zeit (Hailemichael K/Mariam)

Do 3.2 (80) Development of potato clones resistant to frost

1980/81 - Debre Erhag, Moletta, Agere Selam (Hailemichael K/Mariam)

Do 4 POTATO VARIETY TRIAL AND OBSERVATIONS

Do 4.1 Potato national trials

Do 4.1.1 Potato national yield trial

1978/80 - 10 locations in IAR, ARDU, WADU and AAU (Hailemichael K/Mariam)

1980/81 - 15 selections at Alemaya, Arsi Nezele, Jimma, Nazareth, Awassa, Agere Selam, Moletta, Bekoji, Fore, Indibir, Assela, Wolaita Sodo, Bako, Kulumsa, Wondo Genet, Debre Zeit (overall Hailemichael K/Mariam)

(Do 4.1.2 Potato pre-national yield trial) - not planned.

Do 4.1.3 Potato national observations

1980/81 - 15 selections at Gondar, Bahr Dar, Finote Selam, Awata, Adama Tiba, Extension/Demonstration sites (overall Hailemichael K/Mariam)

Do 4.2 Potato variety trials under rainfed conditions

1977/78 - Nazareth\*

1978/79 - " , Moletta, Indibir\*

1979/80 - Not programmed

Do 5-11 POTATO AGRONOMIC AND FERTILITY STUDIES

Do 5 POTATO PLANTING AND POPULATION STUDIES

Do 5.030.1 (80) Study to determine by comparison different methods the best way to plant potatoes at Alemaya

1980/81 - (Hailemichael K/Mariam, Asrat Shiferaw, Tamrat Gebre Yohannes)

Do 5.030.2 (80) Determine practicality and methods of using stem cuttings for field propagation of potato at Alemaya

1980/81 - (Berga Lemaga, Hailemichael K/Mariam)

Do 5.030.3 (80) Study of the influence of plant population and stem density on the growth and yield of potatoes at Alemaya

1980/81 - (Hailemichael K/Mariam, Berga Lemaga, Asrat Shiferaw)

Do 6 POTATO PHYSIOLOGY STUDIES

Do 6.030.1 (80) Effect of defoliation on growth and yield of potato at Alemaya

1980/81 - (Hailemichael K/Mariam, Mengistu Euluka, Berga Lemaga)

Do 8 POTATO FERTILIZER STUDIES

Do 8.030.1 (80) Fertilizer response of Irish potato, on major soil types occurring in Alemaya Woreda

1980/81 - Alemaya (Tamirie Hawando)

Do 8.030.2 (80) Study on the methods and time of application of fertilizers in potato production at Alemaya

1980/81 - (Tamirie Hawando, Asrat Shiferaw)

Do 8.050.1 (76) Kenya Saraka fertilizer observation  
at Jimma

1978/79 - completed\*

Do 8.080.1 (73) Potato fertilizer requirement  
study at Nazareth

1978/79 - (Seifu Gebremariam, Mesfin Abebe)  
not continued

Do 11 INTERCROPPING STUDIES WITH POTATO

Do 11.030.1 (80) Intercropping studies with potato  
and vegetables (beans, shallots, cabbage)  
and cereals (Maize, sorghum) at Alemaya

1980/81 - (Hailemichael K/Mariam, Tamrat G/  
Yohannes, Berga Lemaga)

Do 12 POTATO HARVESTING STUDIES

Do 12.030.1 (80) Potato extended harvesting study  
at Alemaya

1980/81 - (Hailemichael K/Mariam, Tamrat G/  
Yohannes, Asrat Shiferaw)

Do 13 POTATO STORAGE TRIALS

Do 13.030.1 (80) Study on methods for storing seed  
potato at Alemaya and BDA farms

1980/81 - (Hailemichael K/Mariam, T.H. Jackson,  
BDA, E. Zooth - CIR)

Do 14 POTATO MULTIPLICATION STUDIES

Do 14.1 (80) Investigation into propagation  
techniques of potato

1980/81 - Alemaya (Hailemichael K/Mariam, Asrat  
Shiferaw, Tamrat G/Yohannes)

Do 14.2 (80) Determination of better and efficient  
methods for multiplying potato seed tubers

1980/81 - Alemaya (Hailemichael K/Mariam,  
Tamrat G/Yohannes, Asrat Shiferaw)

Sp 8 SWEET POTATO SOIL NUTRIENT REQUIREMENTS

Sp 8.020.1 (79) Effect of fertilizer (N,P) on tuber  
yield of sweet potato at Bako

1979/80 - (Asegelil Dibabe)

1980/81 - ( " " )

Sp 8.030.1 (77) Fertilizer (N,P) response of sweet  
potato at Nazareth

1977/78 (Seifu Gebremariam)\*

1978/79 ( " " )\*

1979/80 ( " " )\*

1980/81 (Tamrie Hawando)

Sp 11 INTERCROPPING STUDIES WITH SWEET POTATO

Sp/Mz 11.020.1 (80) Intercropping of maize and  
sweet potato at Bako

1980/81 - (Biru Abebe, Debritu Beyene)

Sp/Sr 11.030.1 (77) Sweet potato and sorghum  
intercropping trial at Nazareth

1977/78 - (Seifu Gebremariam, Yilma Kebede)\*

1978/79 - ( " " , " " )\*

1979/80 - ( " " , " " )

1980/81 - (Terefe Belihu, Yilma Kebede)

Sp 12 SWEET POTATO HARVESTING STUDIES

Sp 12.1 (77) Sweet potato extended harvesting  
trial

1977/78 - Nazareth, Melka Werer, Gambella  
(Seifu Gebremariam)

1978/79 - Continued at Nazareth, Melka Werer,  
Bako

1979/80 - Not programmed

1980/81 - Nazareth, Melka Werer, Awassa, Bako  
(Terefe Belihu)

Sp 14 SWEET POTATO PROPAGATION

Sp 14.1 (79) Sweet potato production of planting material for research and demonstration

1979/80 - Bako, Melka Werer, Nazareth (Seifu Gebremariam)

1980/81 - Bako, Melka Werer, Nazareth (Debitu Beyene, Terefe Belihu, Tsedeke Abate)

Sp 16 SWEET POTATO OBSERVATIONS ON FARMER'S FIELDS

1977/78 - Bako (Mohammed Abdul Kadir)\*

1978/79 - " ( " " " )\*

1979/80 - Not programmed

1980/81 - Bako (Debitu Beyene)

CROP PROTECTION FOR SWEET POTATO

Sp/en PESTS OF SWEET POTATO

Sp/en 21 (80) Survey of insect pests attacking sweet potato

1980/81 - Harer, Sidamo, Kefa, Welega (Bako area) and Nazareth (Tsedeke Abate)

Sp/pp DISEASES OF SWEET POTATO

Sp/SRS SWEET POTATO STEM BLIGHT

Sp/SRS 21.1 (78) Identification of a stem blight in sweet potato

1978/79 - Nazareth (Ariana van Bruggen)\* completed

Sp/SRS 23 BIOLOGICAL STUDIES OF SWEET POTATO STEM BLIGHT

Sp/SRS 23.1 (79) Determine host range of sweet potato stem blight

1979/80 - tomato, chilli, datura, onion at Nazareth (Ariana van Bruggen, Almaz Yilma)

1980/81 - Continued (Almaz Yilma)

Sp/SRS 23.2 (79) Investigation into survival mechanisms for sweet potato stem blight

1979/80 - Nazareth (Ariana van Bruggen, Almaz Yilma)

1980/81 - Nazareth (Almaz Yilma)

Sp/SRS 24 CULTURAL CONTROL OF SWEET POTATO STEM BLIGHT

Sp/SRS 24.1 (78) Screening for resistance to stem blight in sweet potato varieties

1978/79 - Nazareth (Ariana van Bruggen)

1979/80 - " ( " " " " , Almaz Yilma)

1980/81 - " (Almaz Yilma)

Sp/SRS 26 CHEMICAL CONTROL OF SWEET POTATO STEM BLIGHT

Sp/SRS 26.1 (80) Chemical control of sweet potato stem blight using systematic fungicides

1980/81 - Nazareth (Almaz Yilma)

Ta TARO (COLOCASIA) RESEARCH

Ta 2 TARO ADAPTATION TESTING AND SELECTION

1978/79 - Jimma, Metu, Tepi (I.V. Lewis, Teklu Negash)

1979/80 - Not programmed

1980/81 - Metu, Tepi, Wenago, Anfillo, Jimma

Ta 4 TARO VARIETY TRIALS AND OBSERVATIONS

Ta 4.2 (78) Taro variety trials

1977/78 - Jimma (I.V. Lewis, Teklu Negash)\*

1978/79 - Jimma, Metu, Tepi (I.V. Lewis, Teklu Negash)

1979/80 - Jimma, Metu, Tepi (I.V. Lewis, Teklu Negash)

1980/81 - Stopped

Ta 5 TARO PLANTING AND POPULATION TRIALS

Ta 5.050.1 (78) Taro spacing & population trial at Jimma

1978/79 - Jimma (I.V. Lewis, Teklu Negash)\*

1979/80 - " ( " " " " )

1980/81 - Cancelled

Ta 8 TARO SOIL NUTRIENT STUDIES

Ta 8.050.1 (80) Effect of fertilizer (N,P) on the yield of taro at Jimma

1980/81 - Planned but cancelled

Ym YAM RESEARCH

Ym 2 YAM COLLECTIONS

Ym 2.1 Yam nursery - observations on characteristics of yam collections

1978/79 - Three selections at Jimma (I.V. Lewis, Teklu Negash)

1979/80 - Not programmed

1980/81 - Maintained as "living museum"

Ym 4 YAM VARIETY TRIALS AND OBSERVATIONS

Ym 4.2 Yam variety trials

1979/80 - Jimma (I.V. Lewis, Hanna Assefa)

1980/81 - Not programmed

Ym 5 YAM PLANTING AND POPULATION TRIALS

Ym 5.050.1 (79) Yam spacing x population trial at Jimma

1979/80 - (I.V. Lewis, Hanna Assefa, Teklu Negash)

1980/81 - Not programmed

Ym 8 YAM FERTILIZER TRIALS

Ym 8.050.1 (77) Yam fertilizer observation at Jimma

1977/78 - (Teklu Negash)\* not continued

3. VEGETABLE CROPS RESEARCH IN ETHIOPIA

1970 to 1973 EC (1977/78 to 1980/81 GC)

In 1977/78 the Horticultural Department of IAR included thirty crops in its vegetable research section. With the available manpower this was far too large a number on which to maintain valid research activities and the list was reduced in 1978/79 and again in 1979/80 to include only the most important vegetable crops. In 1980/81 the root and tuber vegetable crops were made the responsibility of the Root and Tuber crops team leaving leafy, fruit and bulb vegetables as the responsibility of the Vegetable Crops Team. Of these vegetable crops priority has been given to the four most important for traditional horticultural production as these crops are of major importance for both rural and urban dwellers and also have potential for processing and export. These four crops are: chilli pepper, tomato, onion and shallot. Other crops on which a limited amount of research is continuing are the head cabbage, Ethiopian cabbage, green bean and garlic.

3.1 Background and Justification

Ethiopia, with its wide range of climatic conditions, has the potential to produce a very diverse number of vegetable crops ranging from temperate types in the highlands to tropical and sub-tropical types in the lowlands. However, traditional production of vegetables is limited, the most widespread and extensively used being Ethiopian cabbage, chilli pepper, tomato and shallot, with pumpkin in the hotter drier areas. With the growth of urban centres the production of other vegetables has increased rapidly over the last few decades. The main problem with these recently introduced vegetables is to determine suitable areas and techniques for seed production to make Ethiopia self-reliant in seed supplies which at present have to be imported each year.

### Chilli pepper

It is not known when chilli pepper was introduced to Ethiopia but it was sufficiently long ago for a wide range of types to have been developed within the country. Chilli peppers are now produced in almost all parts of the country and for most Ethiopians food is flat (tasteless) without the addition of chilli pepper. This crop is also a major cash earner for farmers in some localities such as Mareko, and Alaba. The major activity of the Ethiopian Spice Extraction Company is the extraction of oleoresin (red colouring material) from chilli pepper but the factory cannot work at its maximum capacity due to recurrent shortages of the crop. Chilli pepper can also be exported easily and safely as dry pods or the powdered product.

Research into chilli pepper started about ten years ago at Awassa, Bako, Nazareth and Jimma, with investigations into cultural practices and the introduction of exotic varieties. Recently chilli pepper production in Ethiopia has been threatened by a steady decline in yields and in some places complete failure of the crop. As a result a "Hot Pepper Committee" comprising different disciplines was established in 1973. The aim of this committee was to make comprehensive surveys in chilli pepper production areas to identify existing problems on peasant farmers and state farm fields, collect distinctive types of chilli pepper and to develop a comprehensive research programme to tackle these problems.

From the surveys already carried out in Welega and Shewa Administrative Regions, it was found that chilli pepper production is hampered by a complex of problems. Some of these arise from lack of information on proper cultural practices such as raising seedlings, care for plants in the field, proper harvesting and post-harvest handling techniques. Research has already identified some improved cultural practices which should be passed to the farmers. The major threat to chilli pepper production was found to be its disease complex. Some of these diseases have been identified and research started into control measures for these; others are still to be identified. Insect pests, birds and weeds are also major constraints to improving chilli pepper production. Using the team approach these problems can now be tackled in a coordinated way.

### Head Cabbage

Head cabbage is now a popular vegetable in urban centres but its production costs are high due to the need to use imported seed each year. Work has been started to find areas and techniques suitable for producing seed locally.

### Ethiopian Cabbage

Ethiopian cabbage is produced in home gardens in many parts of the traditional farming areas. Little is known of its production problems though it can be severely attacked by aphids, caterpillars and diseases. Two basic methods are used to produce this crop - from cuttings and from seed. The relative advantages and disadvantages of these two techniques are being studied in relation to their effects on overall yields, length of production season and effects on pests and diseases.

### Garlic

Local and external demand for garlic is very high. Ethiopia could export substantial quantities of garlic either fresh or processed. It could also be used by the Spice Extraction Company to extract garlic oil if a reliable and adequate supply were available. The major constraint to garlic production is rust. Routine spraying against rust has been found to be uneconomical. Efforts have been made to find rust resistant clones in Ethiopian materials but this has not been successful. Now efforts will be made to import and screen exotic garlic clones known for their rust resistance.

## 3.2 Objectives

For the four most important vegetable crops the objectives are:-

- to identify high yielding varieties and cultivars resistant to the major pests and diseases, suited to the various purposes for these crops and to test these over a wide range of climatic conditions;
- to identify the major insect pests, diseases and weeds and find means to control these;

For the minor vegetable crops the objectives are:-

- to identify high yielding varieties and areas for producing these;
- to determine economic methods for local seed production.

### 3.3 Lines of Investigation

1. Variety Improvement: To introduce and screen exotic varieties and, where appropriate, collect and evaluate local collections of vegetables, identify varieties/cultivars with pest and disease resistance, test these in multilocal yield trials, and, where possible, limited breeding programmes.
2. Agonomy: determine improved cultural practices by conducting planting date and population trials, improved practices for raising seedlings and comparing the advantages and disadvantages of direct sowing with transplanting, determine optimal irrigation practices for the most important crops.
3. Soil Fertility: determine the correct rates and times for fertilizer application and the use of other soil nutrient amendments as appropriate for the major crops, and their areas of production.
4. Entomology: identify the major pests of vegetable crops and means to control them paying particular attention to American Bollworm.
5. Pathology: identify the major diseases of vegetable crops and means to control these paying particular attention to the identification of resistant/tolerant varieties in cooperation with the horticulturists.
6. Weed Control: identify the major weeds of vegetable crops, determine crop loss and competitive ability and devise control measures to minimise losses due to weeds.

7. Seed Production: determine techniques and areas for seed production paying particular attention to onion.
8. Storage and Handling: as and when the staff situation allows study techniques to improve storage and handling to minimise losses after harvest and wide fluctuations on the market.
9. Utilization: as and when the staff situation allows identify varieties suitable for the food processing industry and products that can be made from these which are acceptable both locally and abroad.

### 3.4 Locations

All work on vegetable crops is coordinated from Nazareth but different locations are used according to the type of the crop.

<u>Chilli pepper</u>	: Awassa, Bako, Nazareth, Jimma
<u>Onion and Shallot</u>	: Nazareth, Woletta, Bekoji, Awassa, Melka Werer
<u>Tomato</u>	: Awassa, Bako, Dobre Zeit, Melka Werer, Nazareth
<u>Garlic</u>	: Woletta
<u>Green Beans</u>	: Awassa, Bako, Woletta, Jimma, Melka Werer, Nazareth, Kulumsa
<u>Ethiopian Cabbage</u>	: Woletta, Indibir
<u>Head Cabbage</u>	: Woletta, Bekoji, Meraro

3.5 VEGETABLE CROPS RESEARCH ACTIVITIES AND FILES  
1970 to 1973 EC (1977/78 to 1980/81 GC)

(\* - report on file)

Vg VEGETABLE RESEARCH

1977-1980 - part of Horticultural Department  
(Seifu G/Mariam, Dept. Coordinator,  
Nazareth)

1980/81 - Vegetable Crops Team, Plant Science  
Dept. (Seifu G/Mariam, Team Coordinator,  
Nazareth)

Vg 2 VEGETABLE COLLECTIONS

Vg 2.1 Vegetable nurseries - evaluation of  
available vegetable cultivars

1977/78 - (overall Seifu G/Mariam)

Chilli pepper	Nazareth, Awassa, Gode
Tomato	Nazareth
Onion	"
Sweet potato	"
Pumpkin	"
Dyrethrum	ARDU
Cassava	Melka Werer, Nazareth

1978/79 and 1980/81 - each crop treated  
separately.

Sweet potato and cassava in Root and Tuber Crops  
Team

Chilli pepper, tomato, onion, pumpkin in  
Vegetable Crops Team

Dyrethrum in Herbs and Spices Team

Vg 3 VEGETABLE ADAPTATION TESTING AND SELECTION

1977/78 - (overall Seifu Gebremariam)

Anchote	Nazareth, Bako
Roselle	"
Cassava	Nazareth, Bako, Melka Werer, Awassa
Sugar cane	Gambella
Tomato	Bako, Gode, Nazareth
Eggplant	Nazareth
Leek	Nazareth, Holetta
Head cabbage	Bako, Holetta, Nazareth

Ethiopian cabbage	Bako, Holetta, Nazareth
Musk melon	Nazareth, Melka Werer
Water melon	" , " " , Gode
Cucumber	" , " "
Gherkin	" , " "
Globe Artichoke	Holetta
Beetroot	Bako, Nazareth, Holetta Melka Werer=
Swiss chard	Holetta
Carrot	Holetta, Nazareth Melka Werer, Bako
Celery	Holetta
Okra	Nazareth, Melka Werer, Gambella

1978/79 - Sugar cane, egg plant, cucumber, gherkin,  
okra, - cancelled from overall programme

- other crops treated separated according  
to overall groups viz

under root crops - anchote, cassava,  
beetroot, carrot

under vegetables - tomato, leek, head  
cabbage, Ethiopian cabbage, musk and  
water melon, Swiss chard, celery

- retained for general observation:  
globe artichoke - Holetta  
Roselle - Nazareth

Vg 4 VEGETABLE VARIETY TRIALS AND OBSERVATIONS

Vg 4.1 Observation on vegetable production under  
rainfed conditions

1977/78 - (overall Seifu Gebremariam)

Tomato	Nazareth
Onion	Nazareth, Debre Zeit, Awassa,
Shallot	Holetta
Shallot	Nazareth, Holetta, Kulumsa
Garlic	Holetta, Bekoji
Sweet potato	Bako, Nazareth, Kulumsa, Arsi Negele, Dhera
Head cabbage	Nazareth, Holetta, Alemaya, Bekoji, Meraro
Ethiopian cabbage	Holetta, Bekoji
Pumpkin	Nazareth, Debre Zeit, Dhera
Lettuce	Nazareth, Holetta, Kulumsa,
Beetroot	Nazareth, Holetta, Kulumsa, Bekoji

Swiss chard	Nazareth, Holetta, Kulumsa, Bekoji
Sugar beet	Nazareth, Holetta, Bekoji, Holetta, Asela
Carrot	Holetta, Kulumsa, Assela
Celery	Nazareth, Debre Zeit
Green beans	

1978/79 - overall Seifu Gebremariam

Beetroot	Holetta, Nazareth, Jimma, Bako, ARDU
Carrot	Holetta, Nazareth, Jimma, Bako, ARDU
Swiss chard	Holetta, Jimma, Nazareth
Sugar beet	Holetta

- all other crops treated separately

1979/80 - sugar beet cancelled from programme  
other crops treated separately.

### Vg 8 VEGETABLE FERTILIZER TRIALS

Vg 8.000 (77) Fertilizer trials for vegetables at Nazareth

1977/78 - (overall Seifu Gebremariam)

Tomato  
Onion bulb  
Onion seed  
Potato  
Sweet potato

1978/79 - each crop treated separately

### Vg 14 VEGETABLE SEED PRODUCTION

Vg 14.1 Vegetable seed production

1977/78 - no crops specified

1978/79 - (overall Seifu Gebremariam)

Leek	Holetta
Beetroot	Holetta, ARDU
Carrot	" "
Celery	Holetta
Swiss chard	"
Cauliflower	"

Vg 14.2 (78) Sowing date observations to optimise seed production at Holetta

1978/79 - no crops specified

### Cf CAULIFLOWER RESEARCH

1977/78 - Nazareth, Holetta (Bereke Tsehai Tiku)  
1978/79 - Holetta (Bereke Tsehai Tiku)  
1979/80 - Not programmed

### Cy CELERY RESEARCH

Cy 4 CELERY VARIETY OBSERVATION

Cy 4.1 (77) Observation on celery production under rainfed conditions

1977/78 - Holetta, Kulumsa, Assela (Bereke Tsehai Tiku)  
1978/79 - Not programmed

Cy 4.2 (77) Celery variety observation at Holetta

1977/78 - (Bereke Tsehai Tiku)  
1978/79 - ( " " " )  
1979/80 - (Seifu Gebremariam)  
1980/81 - Not programmed

Cy 14 CELERY SEED PRODUCTION

1977/78 - Holetta (Bereke Tsehai Tiku)  
1978/79 - " ( " " " )  
1979/80 - " (Seifu Gebremariam)  
1980/81 - Not programmed

### Ck ETHIOPIAN CABBAGE (KALE) RESEARCH

Ck 2 ETHIOPIAN CABBAGE COLLECTIONS

Ck 2.1 Collection and evaluation of Ethiopian cabbage

1977/78 - Holetta (Bereke Tsehai Tiku)  
1978/79 - " ( " " " )  
1979/80 - " ( " " " )  
1980/81 - Not programmed

Ck 4 ETHIOPIAN CABBAGE VARIETY OBSERVATIONS AND TRIALS

Ck 4.1 (77) Observation on production of Ethiopian cabbage under rainfed conditions

1977/78 - Holetta, Bekoji (Bereke Tsehai Tiku)  
1978/79 - " , Jimma ( " " " )  
1979/80 - " , Indibir (Seifu Gebremariam)



- Ck 4.2 (77) Ethiopian cabbage adaptation trial  
1977/78 - Bako, Holetta, Nazareth  
(Bereke Tsehai Tiku)  
1978/79 - Holetta, Indibir (Bereke Tsehai Tiku)\*  
1979/80 - Not programmed
- Ck 5 ETHIOPIAN CABBAGE PLANTING AND POPULATIONS STUDIES  
Ck 5.1 (77) Comparison of crops from seedlings and cuttings of Ethiopian leaf cabbage at Holetta  
1977/78 - (Bereke Tsehai Tiku) not started  
1978/79 - ( " " " )  
1979/80 - (Seifu Gebremariam)  
1980/81 - Holetta (Tamiru Mehrete, Seifu G/Mariam)
- Ck 14 ETHIOPIAN CABBAGE SEED PRODUCTION  
1977/78 - Holetta (Bereke Tsehai Tiku)  
1978/79 - " ( " " " )  
1979/80 - Not programmed
- Lt LETTUCE RESEARCH  
Lt 2 LETTUCE ADAPTATION OBSERVATIONS  
1978/79 - Jimma (Teklu Negash), Indibir (Bereke Tsehai Tiku)  
1979/80 - Jimma (Teklu Negash)  
1980/81 - Not programmed
- Lt LETTUCE VARIETY TRIALS AND OBSERVATIONS  
Lt 4.1 (77) Observation on lettuce production under rainfed conditions  
1977/78 - Nazareth, Holetta, Kulumsa (Bereke Tsehai Tiku)  
1978/79 - Nazareth, Holetta, Jimma (Bereke Tsehai Tiku)  
1979/80 - Awassa, Indibir, Holetta, Nazareth (Seifu Gebremariam)  
1980/81 - Not programmed
- Lt 5 LETTUCE PLANTING AND POPULATION STUDIES  
Lt 5.1 (78) Lettuce production comparing direct sowing with transplanting at Nazareth and Holetta  
1978/79 - (Bereke Tsehai Tiku)\*  
1979/80 - (Seifu Gebremariam)  
1980/81 - Not programmed

Sw SWISS CHARD RESEARCH

- Sw 3 SWISS CHARD ADAPTATION OBSERVATION  
1977/78 - Holetta (Bereke Tsehai Tiku)  
1978/79 - Holetta, Jimma, Nazareth (Bereke Tsehai Tiku)  
1979/80 - Holetta, Jimma (Seifu Gebremariam)  
1980/81 - Not programmed
- Sw 4 SWISS CHARD VARIETY OBSERVATIONS AND TRIALS  
Sw 4.1 (77) Observation on Swiss chard production under rainfed conditions  
1977/78 - Nazareth, Holetta, Kulumsa, Bekoji (Bereke Tsehai Tiku)  
1978/79 - Holetta, Jimma, Nazareth (Bereke Tsehai Tiku)  
1979/80 - Holetta (Seifu Gebremariam)  
1980/81 - Not programmed
- Sw 14 SWISS CHARD SEED PRODUCTION  
1978/79 - Holetta (Bereke Tsehai Tiku)  
1979/80 - Holetta, ARDU (Seifu Gebremariam)  
1980/81 - Not programmed

FRUIT VEGETABLES

C1 CHILLI PEPPER RESEARCH

- C1 1.1 (79) Survey of Chilli pepper production areas to make systematic collections for evaluation and future improvement programmes and to identify problems and cultural practices in different regions  
1979/80 - (Seifu Gebremariam, Almaz Yilma, Tsedeke Abate)  
1980/81 - (Seifu Gebremariam, Almaz Yilma, Tsedeke Abate)
- C1 1.2 (80) Chilli pepper nursery to evaluate introduced materials  
1980/81 - Nazareth (Seifu Gebremariam, Almaz Yilma) (combined with C1 2.1)

C1 2 CHILLI PEPPER COLLECTIONS

C1 2.1 (80) Chilli pepper nursery for maintenance, evaluation and characterization of indigenous chilli pepper collections

1980/81 - Nazareth, Awassa, Bako (Seifu G/Mariam, Gezahegne Tadesse)

C1 3 CHILLI PEPPER BREEDING AND SELECTION PROGRAMME

C1 3.1 (77) Chilli pepper general selection programme - chilli pepper nursery at Nazareth

1977/78 - 70 lines (Seifu G/Mariam, Ariena van Bruggen)

1978/79 - 20 selections plus local varieties (Seifu G/Mariam, Ariena van Bruggen, Almaz Yilma)

- 115 lines plus 10 varieties (Seifu Gebremariam, Almaz Yilma)

1979/80 - Continued

1980/81 - Not programmed

C1 3.2 (78) Santaka chilli selection programme for mildew and virus resistance at Jimma

1978/79 - (I.V. Lewis)\*

1979/80 - Continued

1980/81 - Not programmed

C1 3.3 (77) Collection and selection of Birds Eye chilli at Gambella

1977/78 -

1978/79 - Not programmed

C1 3.4 (77) Upgrading of important chilli pepper varieties/lines to produce uniform types for local production

1977/78 - Bako (Mohammed Abdulkadir)\*

1978/79 - Bako ( " " )\*

1979/80 - Bako (Debitu Beyene)

1980/81 - Bako, Nazareth, Awassa, Jimma (Debitu Beyene, Seifu G/Mariam, Gezahegn Tadesse, I.V. Lewis)

C1 4 CHILLI PEPPER VARIETY TRIALS AND OBSERVATIONS

C1 4.1 (77) Observation on chilli pepper production under rainfed conditions

1977/78 - (Gebreselassie, Awassa)

1978/79 - Bako, Nazareth, ARDU (Seifu G/Mariam)

1979/80 - Awassa, Indibir, Nazareth (Seifu G/Mariam)

1980/81 - Not programmed

C1 4.2 (77) Chilli pepper variety trial

1977/78 - 7 varieties at Bako and Didessa (Mohammed Abdulkadir)

1978/79 - 6 varieties at Didessa and Gute (Mohammed Abdulkadir)

1979/80 - Not programmed

C1 5 CHILLI PEPPER PLANTING AND POPULATION STUDIES

C1 5.1 (79) Chilli pepper direct sowing versus transplanting

1979/80 - observation at Bako (Debitu Beyene, Seifu Gebremariam)

1980/81 - Bako, Awassa, (Debitu Beyene, Gezahegn Kebede, Seifu G/Mariam)

C1 5.2 (79) Chilli pepper direct sowing date trial under strictly rainfed conditions

1979/80 - Bako, Didessa (Debitu Beyene, Seifu Gebremariam)

1980/81 - Bako, Didessa, Wamma, Nazareth (Debitu Beyene, Seifu G/Mariam)

C1 5.3 (80) Effect of seed rate on vigour and disease incidence in chilli pepper seedlings

1979/80 - Bako (Debitu Beyene, Seifu G/Mariam)

1980/81 - Bako, Awassa (Debitu Beyene, Seifu Gebremariam)

C1 5.4 (79) Chilli pepper plant population trial

1978/79 - Bako (Mohammed Abdulkadir)\*

1979/80 - Bako, Didessa, Wamma, Bir Sheleko, Dabus (Debitu Beyene, Seifu G/Mariam)

C1 5.091.1 (77) Chilli pepper (Birds Eye) spacing observation at Gambella  
1977/78 - (?) not continued

C1 8 SOIL NUTRIENT REQUIREMENTS FOR CHILLI PEPPER

C1 8.020.1 (78) Chilli pepper fertilizer trials at Bako - Effect of NP fertilizer and manure on chilli pepper production at Bako

1978/79 - (Asegilil Dibaba)\*  
1979/80 - ( " " )  
1980/81 - ( " " )

C1 8.021.1 (78) Chilli pepper fertilizer trials at Didessa - Nitrogen and phosphorus rate trial for unmanured chilli pepper at Didessa

1978/79 - Bako local (Asegilil Dibaba)\*  
1979/80 - Continued (Asegilil Dibaba)  
1980/81 - Continued + K (Asegilil Dibaba)

C1 8.023.1 (78) Chilli pepper fertilizer trials at Gute - Nitrogen and phosphorus rate trial for chilli pepper at Gute

1978/79 - (Asegilil Dibaba)

C1 14 CHILLI PEPPER SEED PRODUCTION

C1 14.1 (78) Production of reliable and good quality foundation seed of improved chilli pepper varieties/lines

1978/79 - Bako local at Bako (Mohammed Abdulkadir)  
1979/80 - Not programmed  
1980/81 - Bako local, Marako Fana (Debritu Beyene, Mesfin Tessera, Seifu Gebremariam)

C1 16 CHILLI PEPPER DEMONSTRATION AND EXTENSION INVESTIGATION

C1 16.1 (78) Observation on performance and demonstration of recommended practices for chilli pepper production under farmers conditions with Peasant Associations and Settlement Projects.

1978/79 - 20 farmers around Bako (Mohammed Abdulkadir)  
1979/80 - Around Bako (Debritu Beyene)  
1980/81 - Around Bako, Awassa, Marako (Debritu Beyene, Seifu G/Mariam, Socio-Economics staff and extension personnel)

CROP PROTECTION FOR CHILLI PEPPER

C1/en PESTS OF CHILLI PEPPER

AMERICAN BOLLWORM (ABW)

C1/ABW 26.4 (79) Chemical control of American bollworm in Chilli

1979/80 - Melkassa, Awassa, Bako (Adhanom Negassi)\*  
1980/81 - Nazareth, Awassa, Didessa (Gezahgne Kehede, Kumsa Gamanae, Mesfin Tessera, Tsedeke Abate, Wondimu Tefera)

Gall Mite (GLM)

C1/GLM 26.1 (79) Chemical control of gall mites in chillies

1979/80 - Bako, Awassa, Nazareth + observation at Mareko (Adhanom Negassi)  
1980/81 - Not programmed

Termites (TER)

C1/TER 26.1 (77) Chemical control of termites in chilli peppers

1977/78 - Awassa, Bako (T.J. Crowe, Gezahgne Tadesse, Berhane Habte)  
1978/79 - Awassa, Bako, Didessa (T.J. Crowe, Gezahgne Tadesse, Berhane Habte)  
1979/80 - Bako, Didessa (Mesfin Tessera)  
1980/81 - Bako, Didessa (Kumsa Gamanae, Mesfin Tessera, Tadesse G/Medhin, Tsedeke Abate)

C1/CPD DISEASES OF CHILLI PEPPERS

C1/CPD 24.1 (77) Screening of chilli pepper varieties for resistance to viruses and other diseases

1977/78 - Nazareth, Awassa (Gebreselassie, Amare, Ariena van Bruggen)  
1978/79 - Nazareth (Ariena van Bruggen)  
1979/80 - Nazareth ( " " " , Almaz Yilma

CI/CPD 24.2 (79) Selection for horizontal resistance in chilli pepper to diseases

1979/80 - Nazareth (Almaz Yilma, Ariena van Bruggen)

1980/81 - Nazareth, Awassa, Bako (Almaz Yilma, Debritu Beyene, Gezahgne Tadesse, Habtu Assefa, Mesfin Tessera)

CI/CPD 26.1 (79) Identification of the main cause of bleaching of pepper pods by chemical control of insects, fungi, and bacteria

1979/80 - Bako (Debritu Beyene, Almaz Yilma)

1980/81 - Bako (Almaz Yilma, Habtu Assefa, Tsedeke Abate, Mesfin Tessera)

CI/BLS Bacterial Leaf Spot

CI/BLS 23.1 (77) Inoculation techniques with bacterial leaf spot in chilli pepper

1977/78 - (?) Woletta\*

CI/BLS 26.1 (77) Chemical control of bacterial leaf spot in chilli pepper

1977/78 - Bako, Awassa, (Gebreselassie, Ariena van Bruggen)

1978/79 - Bako, Awassa (Ariena van Bruggen, Almaz Yilma)

1979/80 - Awassa (Almaz Yilma, Ariena van Bruggen, H. de Frangville)

1980/81 - Nazareth (Almaz Yilma, Habtu Assefa)

Powdery Mildew (PMD)

CI/PMD 26.1 (77) Chemical control of powdery mildew in chilli pepper

1977/78 - Arba Minch, Abadir, Nazareth (Ariena van Bruggen, Gobrselassie, Bayou)

1978/79 - Nazareth (Ariena van Bruggen)

1979/80 - Dropped from programme

WEED CONTROL IN CHILLI PEPPER

CI/wc 26.1 (73) Chemical weed control in chilli pepper

1978/79 - Bako (?)

1979/80 - Bako (?)

CI/wc 23.1 (80) Trial to assess weed competition and crop loss in chilli pepper

1980/81 - Nazareth, Awassa (Tesfaye Tedla)

CROP PROTECTION FOR TOMATO

Tm/en PESTS OF TOMATO

American Bollworm (ABW)

Tm/ABW 26.1 (77) Chemical control of American Bollworm in Tomato at Melkassa Nazareth

1977/78 - (Adhanom Negassi)

1978/79 - Not programmed \*

1979/80 - (Tsedeke Abate)

1980/81 - ( " " )

Tm/pp DISEASES OF TOMATO

Tomato Diseases (TOD) - General

Tm/TOD 24.1 (77) Screening of tomatoes for resistance to viruses and other diseases

1977/78 - Nazareth, Melka Werer (Ariena van Bruggen)

1978/79 - Not programmed

Tm/TOD 26.1 (77) Screening of fungicides against late blight and Septoria leaf spot in tomato, including analysis of some epidemiological data

1977/78 - Not conducted due to climatic conditions

1978/79 - Nazareth, Awassa (Ariena van Bruggen)

1979/80 - Nazareth, Awassa (Ariena van Bruggen, Almaz Yilma)

1980/81 - Nazareth, Awassa (Almaz Yilma, Kimya Mohammed, Habtu Assefa)

Virus Vectors (VIV)

Tm/VIV 26.1 (77) Control of virus vectors in tomato seedbeds

1977/78 - Nazareth - postponed

1978/79 - Nazareth (? Adhanom Negassi) \*

1979/80 - Melka Werer (Abahu Demissie, Tsedeke Abate)

1980/81 - Melka Werer (Abahu Demissie, Tsedeke Abate)

WEED CONTROL IN TOMATO

Tm/we 22.1 (80) Determine critical period of weed competition for tomato and extent of crop loss due to weeds

1980/81 - Nazareth, Melka Werer (Tesfaye Tedla)

GULE VEGETABLES

Ga GARLIC RESEARCH

Ga 1 GARLIC INTRODUCTIONS

Ga 1.1 (80) Garlic nursery I - importation of garlic clones known to be resistant to garlic rust and evaluation of these under Ethiopian conditions

1980/81 - Holetta (Seifu G/Mariam, Shelemew W/Mariam, Tamiru Mehrete)

Ga 2 GARLIC COLLECTIONS

Ga 2.1 (77) Garlic nursery II - collection and evaluation of indigenous garlic lines for rust resistance and other characteristics

1977/78 - Holetta (Bereke Tschai Tiku)

1978/79 - Continued

1979/80 - "

1980/81 - 25 lines at Holetta (Tamiru Mehrete)

Ga 4 GARLIC VARIETY TRIALS AND OBSERVATIONS

Ga 4.1 (77) Observation on garlic production under rainfed conditions

1977/78 - Holetta, Bekoji (?)

1978/79 - Not conducted

1979/80 - Holetta, Indibir

1980/81 - Not programmed

Lk LEEK RESEARCH

Lk 3 LEEK ADAPTATION TESTING

1977/78 - Nazareth, Holetta

1978/79 - Holetta - not conducted

1979/80 - Cancelled

Lk 14 LEEK SEED PRODUCTION

1978/79 - Holetta (?)\*

1979/80 - Cancelled

On ONION RESEARCH

On 1 ONION INTRODUCTIONS

On 1.1 Onion nursery I - evaluation of onion varieties for production under Ethiopian conditions

1977/78 - Not conducted - no importations arrived

1978/79 - " " " " " "

1979/80 - 25 varieties at Nazareth (Seifu G/Mariam)

1980/81 - Nazareth (Seifu G/Mariam, Getachew Boru, Daniel Asrese)

On 4 ONION VARIETY TRIALS AND OBSERVATIONS

On 4.1 (77) Observation on onion production under rainfed conditions

1977/78 - Nazareth, Debre Zeit, Awassa, Holetta (overall Seifu Gebremariam)

1978/79 - Holetta, Indibir, Nazareth, Jimma, \* Bako, ARDU (overall Seifu G/Mairma)

1979/80 - Awassa, Bako, Indibir, Holetta, Jimma, Nazareth (overall Seifu Gebremariam)

1980/81 - Not programmed

On 4.2 (77) Onion variety trials under irrigation

1977/78 - Gambella

1978/79 - Not programmed

1979/80 - Awassa

1980/81 - Nazareth, Awassa, ARDU (Daniel Asres, Gezagne Tadesse, Getachew Boru, Seifu G/Mariam, Shelmew W/Mariam)

On 5 ONION PLANTING AND POPULATION STUDIES

On 5.1 (77) Onion sowing date trial for bulk production

1977/78 - Nazareth, Debre Zeit, Gambella (overall Seifu Gebremariam)

1978/79 - Nazareth, Melka Werer, Holetta (overall Seifu Gebremariam)

1979/80 - Bako (Debitu Beyene) Nazareth, Melka Werer (Seifu Gebremariam)

1980/81 - Nazareth, Melka Werer, Awassa (Belachew Haile, Daniel Asres, Getachew Boru, Gezagne Tadesse, Seifu G/Mariam)

- On 5.2 (77) Comparison of direct seeding versus transplanting of onion
- 1977/78 - Not conducted due to lack of land
  - 1978/79 - Nazareth, Holetta (Seifu Gebremariam)\*
  - 1979/80 - Awassa, Bako, Melka Werer, Nazareth (overall Seifu Gebremariam)
  - 1980/81 - Awassa, Melka Werer, Nazareth (Belachew Haile, Getachew Boru, Gezahgne Tadesse, Seifu G/Mariam)
- On 5.3 (77) Effect on bulb yield and maturity of pruning of the leaves and/or roots of onion seedlings during transplanting
- 1977/78 - Not conducted due to lack of land
  - 1978/79 - Nazareth, Holetta (Seifu G/Mariam)\* trial terminated.
- On 5.4 (77) Onion bulb production spacing and population trial
- 1977/78 - Nazareth (Seifu Gebremariam)\*
  - 1978/79 - " ( " " )
  - 1979/80 - " ( " " )
  - 1980/81 - " ( " " ) , Daniel Assres, Getachew Boru)
- On 8 ONION SOIL NUTRIENT REQUIREMENTS
- On 8.020.1 (79) Fertilizer requirement for onion bulb production at Bako
- 1978/80 - (Asgelil Dibabe)
  - 1980/81 - Not programmed
- On 8.030.1 (78) Fertilizer requirement for onion bulb production at Nazareth
- 1978/79 - (Seifu G/Mariam, Mesfin Abebe)\*
  - 1979/80 - Continued
  - 1980/81 - (Sahlemedhin Sertsu)
- On 8.080.2 (79) Fertilizer requirement for onion seed production at Nazareth
- 1978/79 - (Seifu G/Mariam, Mesfin Abebe)\*
  - 1979/80 - Continued
  - 1980/81 - (Sahlemedhin Sertsu)

- On 10 ONION WATER REQUIREMENT STUDIES
- On 10.080.1 (80) Water requirement study on onion production under irrigation at Nazareth
- 1980/81 - (Getachew Alem, Wossenie W/Yohannes)
- On 14 ONION SEED PRODUCTION STUDIES
- On 14.1 (77) Foundation onion seed production
- 1977/78 - Nazareth (Seifu Gebremariam)\*
  - 1978/79 - Nazareth - Melkassa and Koka, Melka Werer (Seifu Gebremariam)
  - 1979/80 - Nazareth, Melka Werer (Seifu G/Mariam)
  - 1980/81 - Nazareth, Melka Werer, Awassa (Almaz Yilma, Belachew Haile, Getachew Boru, Gezahgne Tadesse, Seifu G/Mariam, Tsedeke Abate)
- On 14.2 (77) Study on production of onion seed from onion sets
- 1977/78 - Melka Werer, Nazareth, Holetta (Seifu Gebremariam)
  - 1978/79 - Continued
  - 1979/80 - "
  - 1980/81 - Awassa, Melka Werer, Nazareth (Belachew Haile, Daniel Assres, Getachew Boru, Gezahgne Tadesse, Seifu G/Mariam)
- On 14.3 (77) Effect on yield and seed quality of storage time of onion bulbs after harvest
- 1977/78 - Nazareth, Melka Werer, Holetta (Seifu Gebremariam)
  - 1978/79 - Continued
  - 1979/80 - "
  - 1980/81 - Nazareth, Melka Werer, Awassa (Belachew Haile, Daniel Assres, Getachew Boru, Gezahgne Tadesse, Seifu Gebremariam)
- On 14.4 Onion planting and population studies for seed production
- On 14.4.1 (77) Onion seed production spacing trial
- 1977/78 - Nazareth (Seifu G/Mariam)
  - 1978/79 - " , Holetta (Seifu G/Mariam)
  - 1979/80 - " (Seifu G/Mariam)
  - 1980/81 - " ( " " )
- On 14.4.2 (80) Onion seed planting date trial to determine optimum growing seasons for onion seed production
- 1980/81 - Nazareth, Melka Werer, Awassa (Belachew Haile, Daniel Assres, Getachew Boru, Gezahgne Tadesse, Seifu G/Mariam)

Sh SHALLOT RESEARCH

Sh 1 IMPORTATION OF SHALLOT VARIETIES

Sh 1.1 (80) Importation and evaluation of exotic shallot clones for disease resistance and other desirable characteristics

1980/81 - Holetta, Nazareth (Seifu G/Mariam, Yilma Abebe)

Sh 2 SHALLOT COLLECTIONS

Sh 2.1 (77) Shallot nursery - collection and evaluation of indigenous shallot types for disease resistance and other characteristics

1977/78 - 14 lines at Holetta\*

1978/79 - 28 lines at Holetta and Nazareth

1979/80 - Continued

1980/81 - 10 lines at Holetta (Yilma Abebe)

Sh 4 SHALLOT VARIETY TRIALS AND OBSERVATIONS

Sh 14.1 (77) Observation of shallot production under rainfed conditions

1977/78 - Nazareth, Holetta, Kulumsa

1978/79 - Nazareth (Seifu Gebremariam)

1979/80 - Nazareth, Bako, Indibir, Holetta, Jimma, Awassa (overall Seifu Gebremariam)

1980/81 - Not programmed

CROP PROTECTION FOR ONION, SHALLOT AND GARLIC

On/en PESTS OF ONION, SHALLOT AND GARLIC

Shallot Pests (SMP)

Sh/SMP 26.1 (78) Observation on control of shallot fly and mite complex

1978/79 - Mekele (Adugna Haile)\*

1979/80 - Continued

1980/81 - Not programmed

On/dp DISEASES OF ONION, SHALLOT AND GARLIC

Leaf diseases of onion (LDO)

On/LDO 26.1 (77) Spray trial against leaf diseases of onion

1977/78 - Bako (?)

1978/79 - Trial completed

On/LDO 26.2 (77) Chemical control of alternaria and other leaf diseases on onion

1977/78 - Nazareth (Ariena van Bruggen)

1979/79 - Nazareth - Menagesha, Akaki (Ariena van Bruggen, Akalu Sahelu, EPID)

1979/80 - Melka Werer (Almaz Yilma, Ariena van van Bruggen, Ahmed Sherif)

1980/81 - Not programmed

On/LDO 26.3 (79) Chemical control of leaf diseases of onion using stickers and spreaders

1979/80 - Nazareth (Ariena van Bruggen, Almaz Yilma)

1980/81 - Not programmed

White Rot (WRT)

Sh/WRT 23.1 (80) Study on pathogenicity of white rot pathogen (Fusarium) on shallot

1980/81 - Holetta (Awgichew Kidane)

Sh/WRT 26.1 (79) Chemical control of white rot on shallots

1979/80 - Mekele, Wolmera - Holetta (Almaz Yilma, Ariena van Bruggen, Awgichew Kidane, Adugna Haile)

1980/81 - Wolmera - Holetta (Almaz Yilma, Habtu Assefa, Yilma Abebe)

On/we WEED CONTROL FOR ONION, SHALLOT AND GARLIC

On/we 22.1 (80) Assessment of crop loss and critical period of weed competition for onion

1980/81 - Nazareth (Tesfaye Tedla)

4. HERBS AND SPICES RESEARCH IN ETHIOPIA  
1970 to 1973 EC (1977/78 to 1978/79 GC)

4.1 Background and Justification

Research into herbs and spices started in 1969 as part of the coffee diversification programme based at Jimma Research Station. Some observations on herbs and spices have been done at other IAR stations but to date the major activities have concentrated on traditional coffee production areas as these areas have the potential to produce high value spices which are much in demand both within Ethiopia and on the world market. The other reason for concentrating on herbs and spices compatible with coffee growing areas was the threat of CBD and the need to gradually introduce improved techniques of coffee production to coffee farmers. Both of these could lead to a loss in yields and hence income for coffee farmers and the production of spices could provide an alternative cash income. At the national level Ethiopia depends largely on coffee to earn foreign exchange but, as a luxury crop, the coffee market suffers from wide fluctuations in prices on the world market. Many of the spices compatible with coffee are high value crops with a ready world market. Substantial production of these crops could provide Ethiopia with an additional much needed source of foreign exchange earnings.

The crops being studied by the Herbs and Spices team are considered in three groups according to their economic importance.

- High priority - ginger, tumeric, cardamom, fenugreek
- Second priority - Black pepper, cinnamon, false cardamom, long pepper
- Low priority - a wide range of other herbs and spices maintained under observation

Ginger

Ginger is a spice which has been used for flavouring food since ancient times. It also has local medicinal value. Ginger is used extensively in preparing traditional Ethiopian dishes and could be used more widely to improve the local diet as it is known to aid digestion. Apart from local demand, there is a great demand on the world market for this crop either fresh or processed. The climatic conditions in the coffee forest zone of Ethiopia are very favourable for ginger production. It can be

produced either as a mono-crop or intercropped with coffee but to date ginger production is very low in Ethiopia. A number of problems have been identified which are now being investigated through research.

Tumeric

There is a high local demand for tumeric as both a spice and a dye. The rhizome is ground into a fine powdery and used as a colouring agent for bread, butter and other local foods. In other parts of the world, there is a high demand for this crop as it has a wide range of uses. Most of the coffee growing areas including Crozib Bonga (Kefa), Didesa (Kefa, Wellega), Gibe valley, Mizan Teferi and Arba Minch have been found suitable for cultivation of tumeric. If this crop was produced on a large scale the local market could be well supplied and Ethiopia could earn foreign exchange by exporting it. So far few problems have been identified in tumeric production and emphasis has been given to identifying areas where the crop is adapted, the collection and selection of good quality and yielding cultivars and cultural practices. This is only a start and several problems remain which need the attention of research.

Cardamon

The seeds of cardamon are used as a stimulant and for flavouring food as well as confectionary. This cardamon, though of higher quality, is similar to the indigenous Korarima - Aframomum sp. and is often used mixed with it. There is a substantial external demand, particularly in north European countries as well as local demand where prices have been as high as EB 100/kg because of limited production. This cardamon is well adapted to coffee forest areas at lower altitudes with high rainfall and temperature. Cardamon was introduced some years ago and further research to expand production is essential.



### Fenugreek

Fenugreek is found in nearly every market in Ethiopia and has been cultivated since ancient times for use as a food and spice and for medicinal purposes. It is grown as a strip crop in highland regions between 1800 and 2200 m a.s.l. The major constraint to producing fenugreek is its susceptibility to powdery mildew. If production could be increased in yield and area, this crop could be exported as there is a demand for it for the pharmaceutical industry.

### Second priority herbs and spices

The two indigenous spices, long pepper and false cardamom occur semi-wild in the coffee forest areas. There is considerable demand for both crops on the internal market and there is an external demand for false cardamom but not for long pepper. Very little has been done to study the production capacity of these crops. Work has now been started to make collections and study the adaptation of these crops.

Black pepper and cinnamon are important spice crops both outside and within Ethiopia. Presently both have to be imported; cinnamon to be used as flavouring and black pepper in preparing local dishes. Black pepper has been introduced and established at Tepi but these are affected but some unidentified problems and cannot be used immediately for propagation and further research. However, root cuttings from Brazil and seed from Costa Rica have been planted under quarantine at Jimma. Once released from quarantine these can be used for adaptation and other trials.

Two trees of *Cinnamomum camphora* are growing well at Jimma. These are not the source of cinnamon which comes from the bark of *Cinnamomum zeylanicum*. Arrangements have already been made to import true cinnamon and research can start when the plants have established.

## 4.2 Objectives

### Immediate

- Collect from both within the country and from exotic sources as many cultivars, lines and varieties of spices, select the best and study their adaptability at coffee substations and other places.

- 80 -

- Study cultural practices, including soil nutrient needs, to optimise production of the major spices.
- Conduct surveys to identify the major pests and diseases of spices.

### Long term

- Study the genetic variation in the most important spices and herbs so that varieties/lines resistant to major pests and diseases and with high quality and yield characteristics can be identified.
- Select potential spice and herb production areas in Ethiopia and come up with specific lines or varieties which can be recommended for peasant farmers or large scale spice production.
- Study all cultural practices including soil requirements and efficient methods for controlling the important diseases, pests and weeds so that recommendations can be given along with seeds and planting material.
- Multiply and distribute seeds and planting materials of varieties/lines selected for good yield and quality.

## 4.3 Lines of Investigation

- |              |  |
|--------------|--|
| Tumeric      | - adaptation testing, land preparation methods, time of harvesting and population studies. |
| Ginger       | - collection and selection, adaptation testing, cultural practices and intercropping.      |
| Cardamom     | - adaptation testing, cultural practices, intercropping and propagation studies.           |
| Fenugreek    | - screening for mildew resistance and adaptation tests.                                    |
| Minor spices | - collection and evaluation of indigenous and introduced materials.                        |

#### 4.4 Locations

All work on herbs and spices is coordinated from Jimma Research Station, with observations and trials also at Tepi, Senago, Metu, Anfillo, Bako, Awassa and Bebeke.

#### 4.5 RESEARCH ACTIVITIES AND FILES ON HERBS AND SPICES 1970 to 1973 EC (1977/78 to 1980/81 GC)

##### Es Herbs and Spices Research

1977/78 - 1979/80 - herbs and spices section, Horticultural Department (I.V. Lewis, section coordinator, Jimma)

1980/81 - Herbs and Spices Team, Plant Science Department (I.V. Lewis, Hanna Assefa, team coordinators, Jimma)

##### Es 3 OBSERVATIONS ON ADAPTATION AND VARIATION IN HERBS AND SPICES

###### Es 3.1 (69) Observation on the general performance of herbs and spices

1977/78

at Jimma - Anise, basil, black cumin, bean herb, bishop's weed, chive, dill, fennel, majoram, mint, pepper, parsley, rosemary, rue, tarragon, (coriander lavender, thyme, sage, lemon grass, vetivar grass, also proposed) (I.V. Lewis)

at Nazareth - majoram, mint, thyme, sage, lemon grass, chives, bixa (Seifu G/Mariam)

at Gambella - bixa

1978/79

at Jimma - anise, basil, black cumin, bean herb, bishop's weed, chive, dill, fennel, majoram, mint, pepper, parsley, rosemary, rue, tarragon (I.V. Lewis, Hanna Assefa)

1979/80

at Jimma and some coffee sub-stations Tepi, Metu, Wenago, Gojeb. - false cardamom, shallot, garlic, chives, dill, chervil, celery, tarragon, wormwood, bixa, borage, safflower, caraway, black cumin, bishop's weed, camphor, quinine, horse radish, coriander, Madagascar periwinkle, white cumin, tumeric, lemon grass, cardamom,

fennel, gloriosa lily, hyssop, sweet bay, lavender, lemon balm, mint, apple mint, spear mint, penny royal, Japanese mint, parsley, natcharli, black pepper, long pepper, basil, oregano, majorum, not majoram, rue, rosemary, sage, summer savory, winter savory, thyme, fenugreek, periwinkle, vetivar grass, ginger. (I.V. Lewis, Hanna Assefa)

at Awassa - mint, basil, black cumin, white cumin, rue, thyme, bixa, roselle, (Seifu Gebremariam)

at Holetta - rue, thyme, bixa

at Nazareth - mint, basil, chive, rosemary, rue, thyme, lemon grass, vetivar grass, fennel, bixa, roselle (Seifu Gebremariam)

at Bako - rue, thyme, bixa, roselle

at Melka Werer - bixa, roselle

1980/81

at Jimma and some coffee sub-stations - rue, thyme, majoram, chive, rosemary, sage, vetivar grass, lemon grass, savory, bixa, mint, periwinkle, coriander, lavender, basil, parsley, lemon balm, fennel, wormwood (I.V. Lewis, Hanna Assefa)

at Awassa - rue, thyme, rosemary, sage, vetivar grass, lemon grass, mint, coriander, (Kimya Mohammed)

at Bako - black cumin, white cumin (Debritu Beyene)

at Holetta - rue, thyme, rosemary, vetivar grass, lemon grass, basil, parsley, mint, coriander, fennel, (Yilma Abebe)

###### Es 3.2 (80) Studies on the variability of selected herbs and spices and the induction of variability in selected species at Jimma and Tepi.

1980/81 - (Mesfin Amha, I.V. Lewis, Hanna Assefa)

**CEOF PROTECTION FOR HERBS AND SPICES**

- Hs/en 21 (80) Survey and collection of pests of herbs and spices  
1980/81 - Jimma, Tepi, Wenago, Metu, Anfillo, possibly Awassa and Bako (Million Abebe)
- Hs/pp 21 (80) Survey and identification of diseases of herbs and spices  
1980/81 - Jimma, Tepi, Metu (?)

**Bp BLACK PEPPER RESEARCH**

- Bp 1 **BLACK PEPPER INTRODUCTIONS**  
1980/81 - cuttings from Brazil, seed of 2 varieties from Costa Rica at Jimma (I.V. Lewis, Hanna Assefa)
- Bp 3 **BLACK PEPPER ADAPTATION STUDIES**  
1977/78 - 1979/80 - Tepi (I.V. Lewis, Hanna Assefa)  
1980/81 - Tep, Wenago, ( " " , " " )
- Bp 7 **MANAGEMENT OF BLACK PEPPER**  
Bp 7.055.1 (80) Observations on the growing conditions required to produce yields of good quality and quantity of black pepper at Tepi.  
1980/81 - (I.V. Lewis, Hanna Assefa)

**Cr CARDAMOM RESEARCH**

- Cr 1 **CARDAMOM INTRODUCTIONS**  
1980/81 - one line at Jimma (I.V. Lewis, Hanna Assefa)
- Cr 2 **CARDAMOM COLLECTIONS (NURSERIES)**  
1980/81 - Tepi, Wenago (I.V. Lewis, Hanna Assefa)
- Cr 3 **CARDAMOM ADAPTATION TESTING AND SELECTION**  
Cr 3.1 (78) Cardamom adaptation trial to select areas suitable for cardamom production  
1978/79 - Metu (I.U. Lewis, Hanna Assefa)  
1979/80 - " ( " " , " " )  
1980/81 - Metu, Anfillo, (I.U. Lewis, Hanna Assefa)

**Cr 5 CARDAMOM PLANTING AND POPULATION STUDIES**

- Cr 5.1 (78) Comparison of cardamom establishment and yield from seed and colonial propagation.  
1978/79 - Metu (I.U. Lewis, Hanna Assefa)\*  
1979/80 - Postponed for lack of cuttings  
1980/81 - Wenago, Tepi (I.U. Lewis, Hanna Assefa)

**Cr 11 CARDAMOM INTERCROPPING STUDIES**

- Cr 11.055.1 (80) Cardamom intercropping trial with banana and onset at Tepi  
1980/81 - (I.U. Lewis, Hanna Assefa)

**Cr 14 STUDIES ON MULTIPLICATION OF CARDAMOM**

- Cr 14.1 (78) Cardamom seed longevity and seed treatments and their effects on germination  
1979/80 - Jimma (I.U. Lewis, Hanna Assefa)  
1980/81 - " ( " " , " " )

**Cd CORIANDER RESEARCH**

**Cd 3 CORIANDER ADAPTATION, SELECTION STUDIES**

- Cd 3.1 (78) Coriander variety adaptation and production observations  
1978/79 - Jimma (I.U. Lewis, Hanna Assefa)  
1979/80 - Jimma, Awassa, Bako  
1980/81 - Jimma, Awassa, Holetta (I.U. Lewis, Hanna Assefa, Kimya Mohammed, Yilma Abebe)

**Fk FENUGREEK RESEARCH**

(also covered under Highland Pulses)

**Fk 1 INTRODUCTION OF FENUGREEK**

- 1979/80 - 3 varieties at Jimma (I.U. Lewis)\*  
1980/81 - Still under quarantine (I.U. Lewis)

**Fk 3 FENUGREEK SELECTION AND ADAPTATION STUDIES**

- Fk 3.1 (78) Screening of fenugreek material for powdery mildew resistance in relation to growing season  
1978/79 - Holetta, Jimma (Asfaw Tilaye, I.U. Lewis)  
1979/80 - Ginchi, Debre Zeit, Holetta, Jimma (Asfaw Tilaye, I.U. Lewis)

Fk 3.2 (80) Comparison of adaptation of local fenugreek collections

1980/81 - Jimma (I.U. Lewis, Hanna Assefa, Teklu Negash, Dامتew Mamo)

Fr FALSE CARDAMOM RESEARCH

Fr 2 COLLECTION AND EVALUATION OF INDIGENOUS FALSE CARDAMOM

F3 2.1 (80) Collection evaluation and selection of false cardamom found in Ethiopia

1980/81 - Jimma, Tepi (I.U. Lewis, Hanna Assefa, Teklu Negash, Dامتew Mamo)

Fr 3 FALSE CARDAMOM ADAPTATION, SELECTION STUDIES

Fr 3.1 (77) False cardamom production observation and selection

1977/78 - Jimma (I.U. Lewis)

1978/79 - Last year of observation \*

Gg GINGER RESEARCH

Gg 1 GINGER INTRODUCTIONS

1980/81 - 9 lines at Jimma (I.U. Lewis, Hanna Assefa)

Gg 2 COLLECTION AND EVALUATION OF GINGER CULTIVARS

Gg 2.1 (78) Collection and selection of high yielding ginger cultivars

1978/79 - 8 lines at Jimma, 1 at Tepi and Metu (I.U. Lewis, Hanna Assefa)

1979/80 - Continued

1980/81 - Jimma (I.U. Lewis, Hanna Assefa, Teklu Negash, Dامتew Mamo)

Gg 3 GINGER ADAPTATION TESTING AND SELECTION

Gg 3.1 (80) Comparison of adaptation of ginger cultivars of different origins and selection of suitable cultivar/area combinations.

1980/81 - Jimma, Wenago, Anfillo, Tepi, Metu (I.U. Lewis, Hanna Assefa, Teklu Negash, Dامتew Mamo)

Gg 11 GINGER INTERCROPPING STUDIES

Gg 11.1 (78) Study on the effect of intercropping ginger with regularly planted coffee on the growth and productivity of the two crops

1979/80 - Teip, Anfillo (I.U. Lewis, Hanna Assefa)

1980/81 - Continued

Gg 12 GINGER HARVESTING STUDIES

Gg 12.1 (80) To study the effect of extended harvesting and irrigation on the yield and quality of ginger

1980/81 - Jimma (I.U. Lewis, Hanna Assefa, Teklu Negash, Dامتew Mamo)

Lo LONG PEPPER RESEARCH

Lo 2 LONG PEPPER COLLECTION AND EVALUATION

Lo 2.1 (80) Collection and evaluation of indigenous types of long pepper including a survey of cultural practices and problems of this crop.

1980/81 - Jimma, coffee sub-stations, forest coffee areas, (I.U. Lewis, Hanna Assefa, Teklu Negash, Dامتew Mamo)

Pt PYRETHRUM RESEARCH

Findings to date have been summarized in the bulletin "Pyrethrum for Home Use" IAR 1980

Collections of pyrethrum are being maintained at Moletta and Bekoji.

Tu TUMERIC RESEARCH

Tu 2 COLLECTION AND EVALUATION OF TUMERIC CULTIVARS

Tu 2.1 (78) Collection, evaluation and selection of tumeric cultivars.

1978/79 - Jimma, Tepi, Wenago (I.U. Lewis, Hanna Assefa)

1979/80 - Continued

1980/81 - Existing material put into Tu 3

**Tu 5 TUMERIC PLANTING AND POPULATION STUDIES**

**Tu 5.1 (79)** Effect of size of planting material  
in relation to time of harvest on the  
yield of tumeric

1979/80 - Metu (I.U. Lewis, Hanna Assefa)

1980/81 - Jimma, (I.U. Lewis, Hanna Assefa, Teklu  
Negash, Damtew Mamo)

**Tu 5.2 (78)** Determine optimal time of harvest in  
relation to spacing for tumeric yield  
and quality

1978/79 - Jimma (I.U. Lewis, Hanna Assefa)\*

1979/80 - Continued

1980/81 - "

**Tu 7 TUMERIC MANAGEMENT STUDIES**

**Tu 7.1 (80)** Comparison of different land preparation  
and management methods in relation to  
spacing on the production of tumeric

1980/81 - Jimma (I.U. Lewis, Hanna Assefa, Teklu  
Negash, Damtew Mamo)

**Tu 8 TUMERIC SOIL NUTRIENT STUDIES**

**Tu 8.050.1(80)** Effect of N<sub>2</sub> fertilizer on yield of  
tumeric at Jimma - Melko

1980/81 - (Paulos Dubale)

**Tu 12 TUMERIC HARVESTING STUDIES**

**Tu 12.1 (80)** Determine the optimum harvesting time  
for good yield and quality of tumeric

1980/81 - Wenago (I.U. Lewis, Hanna Assefa, Teklu  
Negash, Damtew Mamo)

APPENDIX I

Explanation of the coding system for documenting research  
Activities and Results

1. Introduction

The coding system that has been developed uses a system of letters and numbers to indicate:-

1. The subject (object) or subjects of the research activity (letters);
2. The type of research activity and number of such activities (numbers);
3. Where appropriate, the location for the research activity (numbers); and
4. the year when the research activity started.

A system of letters has also used to indicate the department and section under which the research activity was conducted, but this is no longer a compulsory part of the code although it appears on the files for each research activity.

The code is made up as follows:-

eg. Tf/TFF 25.1 (78) where:

- Tf is the code for tef;
- TFF is the code for tef fly;
- 25 is the type of research activity - chemical control;
- .1 is the first chemical control trial of tef fly; and
- (78) is the year where this trial was started.

For location specific research activities the code appears as follows:-

Sr 8.020.3 (79) where:

- Sr is the code for sorghum;
- 8 is the code for a soil fertility investigation;
- 020 is the code for Bako Research Station;
- .3 is the third fertility investigation on sorghum at Bako Research Station and;
- (79) is the year when this investigation started.

Some of the department and section codes are still used but they are now part of the subject codes.

Mb/en 21.1 (80) where:-

- Mb is the code for mung bean
- en is the code for a general investigation on insect pests;
- 21 is a survey and identification investigation;
- .1 is the first such investigation on parts of mung bean; and
- (80) is the year this investigation started.

## 2. Subject of the research activity

Each crop or crop group is represented by two letters in upper and lower case while domestic animals, pests, diseases and major weeds are represented by three capital letters.

### 2.1 Crops

Ab - adzuki bean	Cl - Chilli (Capsicum) also hot pepper, pepper, berberi
Ac - apricot	Cm - cucumber
Af - african finger millet	Cn - cashew nut
Ai - anise	Co - cotton
Ak - artichoke	Cw - carob bean
Al - almond	Cr - cardamom
An - annona species	Cs - casimiroa
Ap - apple	Ct - citrus
As - asparagus	Cu - currant
At - anchote	Cv - cassava
Ar - avocado	Cw - cowpea
Ra - barley	Cx - caraway
Rb - blackberry	Cy - celery
Rc - black cumin	Df - deciduous fruits (general)
Rh - bean herb	Di - dill
Rn - banana	Dw - durum wheat
Bo - boretch	Ek - Ethiopian kale (cabbage, gommen)
Rp - black pepper	Ep - egg plant
Br - beetroot	Fc - field crops
Bs - basil	Fg - fig
Bu - buckwheat	Fk - fenugreek
Rw - bread wheat	Fl - fennel
Ex - bixa	Fn - fruits and nuts
Ez - brazil cherry	Fp - field pea
Ca - carrot	Fo - forage crops
Cb - cabbage	Fr - false cardamom
Cc - coffee	Fv - fruits and vegetables
Cd - coriander	Ga - garlic
Ce - cereals (in general)	Gb - green (french) bean
Cf - cauliflower	Gc - grain crops
Ch - chickpea	Gf - grape fruit
Ci - chive	Gg - ginger
	Gk - gherkin
	Gn - groundnut
	Gp - grass (rough) pea

- III -

Gr - grape	Oc - oil crops
Gv - guava	Od - oromo dinech
Ha - haricot bean	Ok - okra
Hb - horse bean	On - onion
Hg - horse gram	Or - orange
Ho - horticultural crops	Ot - ortanique
Hy - hyacinth bean	Oy - oyster nut
In - industrial crops	Pa - pineapple
Jf - jack fruit	Pc - peach
Ka - kai apple	Pf - passion fruit
Kn - kote hare	Pi - pepper (Piper species)
Kn - kenaf	Pk - pumpkin
Lb - lime bean	Pl - plum
Le - lemon	Po - potato
Lg - lemon grass	Pp - pigeon pea
Li - lime	Pr - pear
Lk - leek	Ps - parsley
Lm - lemon balm	Pt - pyrethrum
Ln - lentil	Pu - pulses
Lo - long pepper	Pv - papaya
Lp - lupin	Qn - quince
Lq - loquat	Ri - rice
Ls - linseed	Rm - rosemary
Lt - lettuce	Ro - rosselle
Lv - lavender	Rt - roots and tubers
Mb - mung bean	Rs - rapeseed
Md - mandarin	Ru - rue
Mg - mango	Sa - sage
Mj - marjoram	Sb - soybean
Ml - mulberry	Sc - sugar cane
Mm - musk melon	Sg - sugar beet
Mn - macadamia nut	Sh - shallot
Mo - moth bean	Sm - sesame
Mt - mint	Sn - sunflower
Mz - maize	So - sour orange
Nc - nectarine	Sp - sweet potato
Ng - noug (neug, nug, noog)	Sr - sorghum
Vg - vegetables	St - strawberry
Vv - vetiver grass	Su - suf (safflower)
Wb - winged bean	Sw - swiss chard
Wc - weeds	Ta - taro (colocasa)
Wd - Wolaita dinech	Tb - tepary bean
Wm - water melon	Tg - tarragon
Wn - walnut	Th - thyme
Ww - wormwood	Tm - tomato
Yb - young berry	To - tobacco
Ym - yam	Tp - tropical fruits and nuts
Ys - yssop (Hyssop)	Tr - triticale
	Tf - tree tomato
	Tu - tumeric



2.2 Domestic Animals

CTL - cattle  
 GOT - goats  
 SHD - sheen

2.3 Pests, Diseases and Weeds

ABW - American bollworm  
 ANB - antestia bug  
 APD - aphids  
 AST - Ascochyta tarda  
 ATH - anthracnose  
 BAF - barley fly  
 BCE - bacterial blight  
 BCD - bacterial diseases  
 BCW - bacterial wilt  
 BLS - bacterial leaf spot  
 BNF - bean fly  
 BNM - burrowing nematodes  
 BNT - bunt  
 BWV - black bean pod weevil  
 BSC - black scale  
 BTR - black tef beetle  
 CPD - coffee berry disease  
 CFG - chafer grub  
 CIM - citrus mealy bug  
 CKT - crickets  
 CLM - coffee leaf miners  
 CLW - cotton leaf worm  
 CNM - citrus nematode  
 COP - cotton pests (general)  
 COW - cotton wilt  
 CPD - chilli (pepper) diseases  
 (general)  
 CIW - cutworm  
 CYL - cyperaceae weeds  
 DWM - downy mildew  
 EYE - eye spot  
 ERG - ergot  
 FTC - foot rot in citrus  
 GIE - Gibberella stilboides  
 GIX - Gibberella xylaroides  
 GPH - grass hoppers  
 HEL - Helminthosporium  
 HMV - Hemileia vastatrix  
 LBT - late blight  
 LCP - leaf curl in peach  
 LEO - leaf diseases of onion  
 LFS - leaf spot  
 LYC - Lycaenidae  
 MZA - maize aphid  
 MZD - maize diseases (general)  
 NMT - nematodes  
 PND - powdery mildew  
 PTM - potato tuber moth

PUS - purple scale  
 ROD - rodents  
 REC - root-rot/wilt complex  
 RSC - red scale  
 RS, - red spider mite  
 RKN - root-knot nematodes  
 RST - rust  
 RTW - red tef worm  
 SEB - striped blister beetle  
 SCD - scald  
 (Rhynchosporium)  
 SEP - septoria  
 SHF - shoot fly  
 SHL - sorghum head lygus  
 SHP - shallot pests  
 SMG - smudge  
 SMT - smut  
 SPS - sweet potato stem  
 blight  
 SSL - sesame phyllody  
 SEC - worhum chafer  
 SRU - stem rust  
 STR - striga  
 TBT - target blight  
 TER - termites  
 TEF - tef epilachna  
 TFF - tef fly  
 TOD - tomato diseases  
 WDO - wild oats  
 VDL - wild lettuce  
 WRT - white rot  
 VID - virus diseases  
 VIC - virus diseases in  
 citrus  
 VIV - virus vectors

- 2.4 Disciplines - capital letters indicate a major discipline area (equivalent to the old department structure) while small letters indicate minor discipline (equivalent to a section)

AE - agricultural engineering  
 Ag - agronomy  
 AN - Animal Science, including forage crops etc.  
 bd - breeding  
 ce - cereals  
 CP - crop protection  
 eg - energy (for rural development)  
 en - entomology  
 FC - field crops  
 fm - farm management  
 fn - fruits and nuts  
 fo - forage crops, range management and pasture  
 HF - Home Science  
 HO - horticulture  
 hp - handling of agricultural products  
 pp - plant pathology  
 PS - plant Science  
 SE - Socio-economics  
 sf - soil fertility  
 Sl - soil survey and land evaluation  
 sk - Soil and Water Conservation  
 SS - Soil Science  
 vt - veterinary work  
 we - weed control

### 3. Type of Research Activity

- Except Crop Protection

1. Surveys to assess a general situation and collect base-line data/and trials and observations on newly introduced materials while they are under quarantine restrictions.
2. Collection, evaluation and maintenance of indigenous materials and the maintenance of basic collections used in crop and animal improvement programmes.
3. Crop/Breed development through tests of adaptation and selection and the implementation of breeding programmes.
4. Testing of promising materials (cultivars/types/breeds) derived from 1 and/or 2, and/or 3 above through both widespread (multilocational trials) and trials for particular areas and/or conditions.
5. Studies on planting dates, rates (populations and spacing), methods and types of planting material to optimise the potential in promising materials.

4. Location codes (always three numbers)

- 001 - ARDU sites
- 010 - Awassa Research Station - HQ
- 011 - Arsi Negele
- 012 - Arba Minch
- 020 - Bako Research Station
- 021 - Bidessa
- 022 - Angar Bidessa (Angar-Gutin)
- 023 - Gute
- 024 - Wamma
- 025 - Nedjo
- 030 - Alemaya College of Agriculture
- 031 - Debre Zeit area (Yerer and Kereyu awraja)
- 040 - Holetta Research Station
- 041 - Bedi
- 042 - Sheno
- 043 - Ginchi
- 044 - Indibir
- 045 - Chenchä
- 050 - Jimma (Melko) Research Station=
- 051 - Gera
- 052 - Agaro
- 053 - Anfillo
- 054 - Metu
- 055 - Tepi
- 056 - Wenago
- 057 - Bedessa
- 060 - Mekele Research Station
- 061 - Kobo
- 070 - Melka Werer Research Station and the Middle  
Awash
- 071 - Upper Awash
- 072 - Lower Awash
- 080 - Nazareth (Melkassa II) Research Station
- 081 - Melkassa I
- 082 - Koka
- 083 - Mieso
- 090 - Gode
- 091 - Gambella
- 092 - Numera
- 093 - Beles
- 100 - WADU and Enset production areas

Year

This is shown by the last two numbers of the year in brackets eg. (76), (79), (60), (80) and follows the Gregorian calendar.