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**Production, marketing and consumption
of potatoes in the Ethiopian Highlands
(Holetta, Awassa, Alemaya)**

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PRODUCTION, MARKETING AND CONSUMPTION OF POTATOES
IN THE ETHIOPIAN HIGHLANDS (HOLETTA, AWASSA, ALEMAYA)

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LIST OF ABBREVIATIONS

- AAU - Addis Ababa University
- birr - Ethiopian currency: 1 birr \approx DM 0.87 \approx US \$ 0.45
- CPSC - Central Planning Supreme Council
- DAP - Diammonium phosphate
- FAO - Food and Agriculture Organization of the United Nations
- g - gramme
- ha - hectare
- HDD - Horticultural Development Department
- IAR - Institute of Agricultural Research
- IDR - Institute of Development Research, Addis Ababa University
- kg - kilogramme
- km - kilometer
- NRDC - National Revolutionary Development Campaign (Zemecha)
- q - quintal (1 quintal = 100 kg)
- t - ton

Preface

The basic framework of the study "Production, Marketing and Consumption of Potatoes in Ethiopian Highlands (Holetta, Awassa, Alemaya)" was discussed and agreed on in December, 1979 in Addis Ababa between a representative of the Technical University Berlin-West and representatives of Addis Ababa University, Institute of Agricultural Research and Horticultural Development Department, Addis Ababa (Letter of Agreement, December, 1979). It was agreed that potato-research should take place in three different areas in Ethiopia: the Addis Ababa-Holetta area, the Awassa area, and the Alemaya area. The research team (German-Tanzanian) of the Technical University Berlin-West was to be joined by an Ethiopian Counterpart from the Alemaya Agricultural College for the duration of the project itself.

The institutions and colleges, which functioned mainly as logistic coordinators in the areas selected, are supposed to propagate and influence agricultural development in these areas. It is expected that these institutions will, in turn, inform the Peasant Associations, the Women's Associations, and the Producers' Cooperatives interviewed by the team, about the results of this research.

The research team wishes to thank all Ethiopians who provided invaluable and indispensable assistance during the research period in Ethiopia from May till August 1980. Without their help and cooperation this study would not have been completed.

In particular, we would like to thank L a k e w B i r k e , Chairman of the Agricultural Council of Science and Technology Commission, D u r i M o h a m m e d , President of Addis Ababa University, S a m u N e g u s H a i l e M a r i a m , Head of the Horticultural Development Department, T a y e W o r k u , Head of the Institute of Agricultural Research, G e r e m e w H a i l e , Dean of Awassa Junior College, E p h r a i m M a m o , Dean of Alemaya College, and

T a y e B e z u n e h , Dean of Debre Zeit Junior College for their unbureaucratic support concerning administrative and logistic matters.

In addition, we would like to express our thanks to H a i l e M i k a e l K i d a n e M a r i e m , coordinator of the nationwide potato program. Through his guidance and background information on potatoes in Ethiopia the team was able to cross-check the field research and avoid mistakes.

S h i b r u T e d l a , research officer, and M i s r a k E l i a s , external relations officer of Addis Ababa University, were always ready to help whenever problems arose.

We owe special thanks to all the F a r m e r s and T r a d e r s , men and women, whom we kept from their work and who answered patiently all our questions in long discussions.

The eighteen Ethiopian f i e l d a s s i s t a n t s from Addis Ababa University, Awassa Junior College and Alemaya College did an excellent job during our field research. Without their translation from local languages into Amharic and English and their sensitive approach as we were interviewing Peasant Associations, Producers' Cooperatives, Women's Associations and traders, we would have been unable to present this study.

We would also like to thank the drivers, specifically M a m o H a i l e S e l a s s i e , who drove us about 7,000 km on sometimes almost impassable roads to remote villages without any accident.

We are thankful to the secretaries of Debre Zeit Junior College, who typed almost overnight the first draft of the study, which enabled us to present our findings in a presentable written form already in Addis Ababa.

In Berlin we would like to express our thanks to Georg Dürr and to Douglas Horton, the International Potato Center, Peru, who generously gave their time to discuss controversial points with us.

Mrs. Zunckel should be thanked for her patience and her excellent job in typing the final version of the study.

For the findings and possible errors of the study the team alone is taking all responsibilities.

Addis Ababa
Berlin-West
1980

Hannelore Börgel

1. INTRODUCTION

1.1 Objectives and topical concerns

In the near future, strong pressure on the Ethiopian agricultural sector is expected. A population growth rate of approximately 2.5 % and the improvement of medical care, which probably will reduce the high infant mortality, will necessitate radically new approaches for preventing food shortages. At present, the vast majority of the population of Ethiopia depends on grain crops. In order to counter protein scarcity and insufficient calorie supply, research on different food items is being undertaken by various Ethiopian institutions. In this context, research on potatoes is given high priority.

The main objective of the study "Production, Marketing and Consumption of Potatoes in the Ethiopian Highlands (Holetta, Awassa, Alemaya)" is to analyse the conditions and possibilities for expanding the potato sector in three important areas of Ethiopia. The study does not claim to be representative for the whole of Ethiopia.

More specifically, the study is pursuing the following sub-objectives:

- a) to determine the competitive position of potatoes among other food items grown by potato producers;
- b) to determine the competitive position of potatoes among other food items available to urban and rural consumers;
- c) to determine consumption habits in Holetta, Awassa and Alemaya.

Organization of the report

The potato sector in Addis Ababa-Holetta, Awassa and Alemaya will be considered in the general Ethiopian agricultural framework. A mere technocratic approach limited to aspects of economic efficiency would ignore the Ethiopian revolution and its

enormous impact, especially in the rural countryside. It would thus lead to wrong conclusions on policy and even technical-administrative matters in that specific subject. The organizational structure of revolutionary Ethiopia and the aims of agricultural policy in general and in specific will be considered in Chapter two.

Chapter three will analyse the general food situation, the nutritional situation of single families, nutrition habits and awareness in the countryside and the cities and finally the nutritional value of the potato in comparison with other vegetables.

Our research on technical aspects of potato production in Chapter four will describe the present conditions and methods of potato production and point to possible deficiencies. Economic and socio-economic components and their impact on high cost potato production will be examined in Chapter five and will be related to the technical aspects. Land, labour and financial resources are some of the economic key-factors which need close examination.

Special attention will be given to family labour force, i.e. the distribution of labour within the family. From the socio-economic point of view labour force cannot just be seen as an economic input for production but has to be evaluated as a domestic unit. To what extent are family members available as a labour resource for the potato production? As domestic work is mostly done by women, the analysis has to pay particular attention to female work: in case potato production increases, who is to carry the burden of the work increase? Another relation between the domestic unit and the potato sector can be seen in the return of potato production either in natural form or in cash. What does the potato contribute to the improvement of living conditions within the family in terms of food or income? To investigate this issue, it will be necessary to identify the sources of income from different economic activities within the households in order to find out the relative importance of the potato as one of the possible sources of income. Cost and return in potato pro-

duction shall give information on the profitability.

As a bridge between producers and consumers, a country's marketing system plays an important role in the distribution and supply of food, especially staple food. An insufficiently working marketing system may impede the development of an agricultural sub-sector - like the potato sector - and hamper the introduction of potatoes as a major food item.

In order to expose the suspected bottlenecks, Chapter six will look not only at general supply and demand but also at inter-regional produce flow, marketing channels from producer areas to urban centres, costs and performance of potato trade, market imperfections, seasonality of supply and seasonal price fluctuations. Special attention will be given to the analysis of the intermediate stages of the economy including an enumeration of their costs and calculations of their returns based on local prices and price fluctuation data. This may allow some insight into profits made by different groups of merchants and may give valuable hints of why prices and market policies fail in certain instances or why any competition among traders or market transparency is conspicuously missing.

Finally, we will try - bearing in mind all constraints such as the limited research period, data problems, unreliable answers - to give some recommendations, on the basis of our findings, which might be of interest to those concerned with the decision-making process of a nationwide potato programme in Ethiopia.

1.2 Methodology

1.2.1 The qualitative approach

In rural developing societies, where people are not adjusted to modern life and scientific thinking,¹⁾ scientists face different

1) See Pausewang, S.: Methods and concepts of social research in a rural society, München, 1973.

situations from the ones they are used to in industrialized countries. Social factors limit the use of survey techniques in societies with a low standard of education, with a rather heterogeneous population, without health services, and with a low level of economic development. "The use of questionnaires as a technique to study social factors is a method developed under certain historical and social conditions, in industrialized, highly homogeneous, and highly educated populations"¹⁾.

"Questionnaires limit the scope of the social researcher and tend to prevent a genuine understanding of people's vital problems"²⁾. Due to their rigidity, traditional standardized questionnaires do not allow for the assessment of very specific problems in their appropriate context. Most of the peasants in developing countries have no formal education. Their experience with figures or any kind of quantitative statements results from practical experiences in daily life³⁾. In standardized questionnaires, where peasants are supposed to give exact figures, they are quite often overtaxed or just give figures to please the interviewer. This kind of failure can be largely avoided through a qualitative approach, which gives the investigator the chance to become familiar with the farmers' situations and collect the information he/she needs through an open but structured interview.

For these informal but systematic interviews, general topical guidelines were devised to serve the researchers as a general orientation. Different guidelines had to be devised for different groups. By cross-checking between different groups through participant observation and through evaluation of secondary information which give further reference to the socio-economic conditions of the interviewed persons, misinterpretations of primary information can be limited. The qualitative approach does not imply that quantitative information has no value here. Ra-

1) Pausewang, S.: op.cit., page 197

2) Pausewang, S.: lecture in Berlin, Technical University, Feb. 80.

3) See Chapter 5.3.2, footnote 2, page 104.

ther, the qualitative approach includes questions for quantitative statements. But quantitative statements must be seen in the context of the general socio-economic structure.

For the final evaluation, the qualitative approach requires much more work on the part of the investigators than does the quantitative approach, as he/she has to filter the needed information out of extensive answers. But at the same time he/she is able to see the answers in the context of social problems his/her investigated persons are facing. In the final overall analysis and in the recommendations to improve situations in developing countries, the investigator might be able to give a more reliable picture and more practicable advice for the situation than his/her colleague analysing computerized figures from remote villages.

1.2.2 Selection of the areas

The areas where potato production, trade and consumption habits were to be investigated were chosen in close cooperation with the Ethiopian institutions involved in accordance with the importance of the crop for producers in that area at present or in the near future and also according to the importance the area was assumed to have for the surrounding markets.

H o l e t t a - area, about 40 km west of Addis Ababa, can be considered as an important area for Addis Ababa market in the near future. Strong development is underway. Logistic help for this area was given by the Horticultural Development Department (HDD).

A w a s s a - basin, which includes the trading center Shashamene, about 260 km south of Addis Ababa, is already one of the most important potato growing areas of Ethiopia. Awassa Agricultural Junior College and the Institute of Agricultural Research (IAR) acted as cooperators in this area.

A l e m a y a - area, about 520 km east of Addis Ababa, near Somali and Djibouti boarder, provides potatoes for the export market Djibouti. Alemaya area is facing more serious problems in its agriculture than the two other areas. At present it is highly affected by the drought. Alemaya Agricultural College was assisting the team for the field research.

All three areas selected are situated in the more developed areas of Ethiopia, e.g. along main road connections to Addis Ababa, and include small towns and villages functioning as trading centres for the surrounding area. The very remote villages of Ethiopia are hard to reach by car. It is only recently that the government has started to open state farms all over the country, expecting spill-over effects to the surrounding areas in the long run. But even the three areas analysed by the team have still a long way to go toward social and economic development, especially the villages at a distance from the main road. The development process underway looks promising.

1.2.3 Process of investigation

Primary information was collected from producers and market gardeners in the Addis Ababa-Holetta, Awassa and Alemaya areas as well as from urban and rural consumers and from traders involved in rural and urban trade. In the Alemaya area, interviews with export traders to Djibouti in Dire Dawa were conducted.

Taking into consideration the new administrative and organizational structure of revolutionary Ethiopia¹⁾, the first step taken in each area was naturally to establish contacts with the chairman of All Peasant Associations in the Wereda (sub-district), either with the help of Extension Service people of the Ministry of Agriculture (former EPID) or through the institutions assisting our team - such as HDD, IAR, Junior College of Awassa, College of Alemaya. In case Women's Associations were not linked

1) Description see Chapter 2, page 15 pp.

with the Peasants' Associations, the respective chairpersons were also contacted beforehand.

After explaining the purpose of the research to the chairman, four Peasants' Associations and four Producers' Cooperatives and associated Women's Associations were informed by the chairman about our intentions. The locations of the Peasants'/Women's Associations and Producers' Cooperatives were located around Holetta town, Alemaya town and in the Awassa basin. On the average the villages were about 20 to 40 km away from the towns. Only twice did the team decide to go as far as 85 km in order to find out about the influence of the trading centres in these villages. Beside Peasants'/Women's Associations and Producers' Cooperatives, chairmen of Kebeles¹⁾ were also contacted to obtain permission to interview urban households on consumption habits. The selection of the Kebeles as well as the selection of - on the average - four households from within the Kebeles constituted random samples. Finally, we conducted discussions with Women's Associations within the Kebele.

In Addis Ababa, smaller and bigger hotels and restaurants were included in the investigation as well in order to obtain information on food supply, modes of food-preparation and consumption habits. This selection was also a random sample.

For purposes of our marketing research, we interviewed (in addition to the above-mentioned Peasants'/Women's Associations and Producers' Cooperatives) small traders, wholesalers, commission agents and retailers. Mostly located in the trading centres like Holetta, Awassa, Alemaya, these persons were chosen as a random sample in the markets. For Holetta we focused on the Mercato in Addis Ababa, and for the Alemaya area, exporters from Dire Dawa to Djibouti were interviewed.

1) Description see Chapter 2, page 22.

In the process of interviewing people the team used the qualitative approach described above. Through informal but systematic interviews along general topical guidelines¹⁾, information was collected from different groups. Different guidelines were devised for different groups and for general discussions.

The interview started in the general assembly of the Peasants' Associations, Women's Associations and Producers' Cooperatives. Along the guidelines, but in the frame of the qualitative approach designed for flexibility in new situations, the general discussion usually lasted from 1 to 2 hours. After the general discussion, in which all team members participated, Peasants'/Women's Associations were asked to select up to ten individual farmers who could answer questions on production, three to five farmers who could answer questions on the marketing aspects, and three to five women who could give information on consumption habits and on daily work inside and outside (e.g. small trading, planting) the household. In most cases selected persons were interviewed individually by individual team members.

For Producers' Cooperatives a different approach was chosen. As the Cooperatives understand themselves as a unit, the team did not divide them into individual farmers/women. The Producers' Cooperatives have formed different committees, responsible for production, selling, political agitation, etc. After the general discussion, the team asked for these different committees. The team members then split up among the different committees and interviewed them - on the average 3 to 5 persons - along the guidelines on production and marketing.

Wholesalers, retailers, commission agents were interviewed individually.

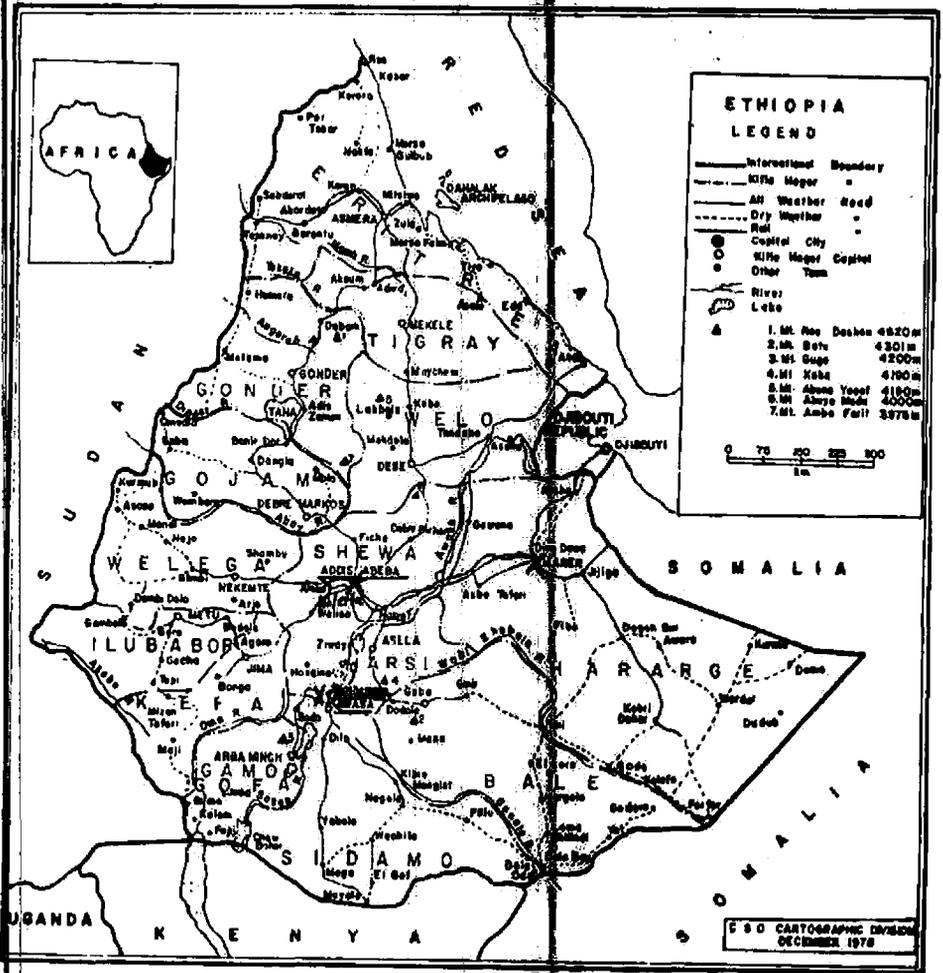
1) Cf. the guidelines for Peasants' Associations, Producers' Cooperatives, Womens' Associations, rural and urban households (nutrition aspect), potato producers, economics of production, marketing of potatoes, family unit. See appendix, page 183 pp.

In the Kebele households individual women were interviewed.

Participant observation was practised by all team members.

Background information on area description, climate and soil, and secondary information collected by Ethiopians beforehand, were gathered in standardized tables (quantitative approach) and evaluated. They also served to cross-check the primary information, as did the discussions with Ethiopian experts on potatoes and with members of the Ministry of Agriculture, Ministry of State Farms, Institute of Agricultural Research, Horticultural Development Department, Ethiopian Nutrition Institute.

To avoid misinterpretations in the marketing sector due to deliberately wrong figures given by wholesalers and retailers, we double-checked these figures against those from official institutions, such as the Ethiopian Fruit and Vegetable Trade Enterprise, Addis Ababa; the Horticultural Development Department, Addis Ababa, the Ketana Office, Shashamene; the Maritime and Transit Corporation, Dire Dawa; the Ministry of Agriculture, Extension Service (former EPID) in Awassa, Shashamene, Holetta; the Ministry of Domestic Trade, License Department, Addis Ababa; the National Bank, Dire Dawa Branch; the Central Statistical Office, Addis Ababa. During the field research, eighteen Ethiopians acted as field assistants, mainly as translators from local languages into Amharic and English.



Source: Ethiopia, Statistical Abstract 1977

ETHIOPIA IN PROFILE

Area: 1.2 m km²

Population: 30 million

Capital: Addis Ababa (pop. approx. 1 m)

Other main towns: Asmara, Dire Dawa, Dessie, Harar

Population density: 25 per km²

Population growth rate: 2.5 % a year

Government: Provisional Military Administrative Council (PMAC)

Head of state: Lt. Col. Mengistu Haile Mariam

Language: Amharic, English and over 100 local languages

GNP: \$ 3 200 m

GNP per capita: \$ 110

Total exports (provisional 1978): \$ 304 m

Total imports (provisional 1978): \$ 511.5 m

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| <u>Main export crops</u> (1977): | Coffee: | 519.3 m birr ¹⁾ |
| | Hides and skins: | 47.7 m birr |
| | Pulses and vegetables: | 43.4 m birr |
| | Oil seeds: | 17.5 m birr |
| <u>Main imports</u> (1977): | Petrol products: | 122.7 m birr |
| | Vehicles: | 96.1 m birr |
| | Machinery: | 80.3 m birr |
| | Textiles: | 72.1 m birr |

Main trading partners: USA, Japan, Germany (FR), Italy

In 1978 the EEC as a whole accounted for 40% of Ethiopia's imports and took 27 % of its exports, and was by far Ethiopia's most important trading partner.

Source: The Courier No. 59, January-February 1980

1) 1 birr = (approx.) 0.36 EUA, US \$ 0.48, UK £ 0.22, FF 2.06.

2. BACKGROUND INFORMATION ON THE ETHIOPIAN AGRICULTURAL SECTOR

2.1 Organizational structure of revolutionary Ethiopia

Ethiopia is an agricultural nation with a population of approximately 30 million.¹⁾ 90 % of the population live in the countryside. About 93 % of the population are analphabets.

For centuries, the land belonged to the feudal government, the royal families, the feudal landlords, the church and monasteries. Only a small part was under private and tribal ownership and as such divided into small plots. More than 50 % of the agricultural population were tenants, who had to pay from 1/3 to 3/4 of the income from the rented land to the owner and were obliged to farm the plots of the feudal with his draught animals and to carry out all kinds of services for him. In addition, the peasants had to pay various taxes to the government.

The revolutionary upsurge in February 1974 set an end to these centuries of exploitation. Far-reaching and radical changes are beginning to affect all parts and social strata of Ethiopia. One of the pillars of revolutionary Ethiopia is the land reform as proclaimed on 29th of April 1975.²⁾

³⁾ The proclamation stated that all rural lands were the common property of the Ethiopian population and called for an immediate re-distribution of land. Without differentiation as to sex, those persons who were willing and able to cultivate the land, including the ex-land-owners, were entitled to obtain land for their livelihood, not exceeding ten hectares per family; on the assumption that an average peasant family could raise both crops and livestock sufficient to meet their domestic needs, the Proclama-

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- 1) For comparison: Ethiopia's area is five times the size of the Federal Republic of Germany, where 60 million people are living.
 - 2) It has been the most effective and radical land reform in Africa so far.
 - 3) Proclamation to Provide for the Public Ownership of Rural Lands No. 31, 1975.

tion prohibited the use of hired labour. This provision did not apply to women with no other means of livelihood or to cases where the holder died, was sick or old, to the wife or husband of the deceased or to his/her children who were not yet of age.

To implement the provisions¹⁾ and to lay the basis for a self-sufficient unit, Peasants' Associations were to be formed on a basis of the traditional village or administrative unit up to 800 ha. Membership was open to tenants, landless persons, hired agricultural workers and landowners with less than ten hectares. Former landlords who had more than ten hectares would be admitted after the completion of land distribution.

The Peasants' Associations were empowered to implement the distribution of land on the basis of equity, considering both the size of a family and the quality of the soil; to supervise land use regulations and administration of public property; to establish judicial committees, service cooperatives and an elementary form of Producers' Cooperative; and to promote the socio-economic infrastructure and villagization programmes.

"The Peasant Associations were to be organized in a five-level hierarchical structure, of which the lowest unit was the local Peasant Association and the highest governing body was the All-Ethiopia Peasant Association. In between, in ascending order, the wereda-level (subdistrict), the awraja - level (district) and the kifle-hager - level (administrative region/ former province). Peasant Associations would each coordinate local Association functions and set up a judicial committee to hear and, if necessary, forward appeals"²⁾.

1) Here only parts of the provisions are cited. For more information, see footnote 3, page 15, and Alula Abate/ Tesfaye Teklu: Landreform and Peasant Association in Ethiopia, IDR, Discussion Paper No. 6, August, 1978.

2) Alula Abate/ Tesfaye Teklu, op.cit., page 16

Realizing the shortcomings of this Proclamation, the government added supplementary proclamations, which defined the duties and responsibilities more clearly.

By 1977-78 there were 28.583 Peasants' Associations with a membership of 7.3 million households.¹⁾

Along with the organization of Peasants' Associations the organization of Women's Associations took place. Each Peasants' Organization was asked to organize the women in their Associations. But due to traditional cultural habits, quite a number of women were reluctant to organize at the beginning. The forming of Women's Associations proceeded much more slowly than the establishment of Peasants' Associations in general. Only recently, on July 17th, 1980, a Proclamation on the formation of Women's Associations on the national level was issued; on the village level practically all women are now organized. Members have to be at least fifteen years old.

During the first phase of the revolution, the Ethiopian agricultural sector could be described as a sector with small private holdings; the feudal landholding structure has been replaced by a system of peasant proprietorship.

At the moment, new forms of Farmers' Organizations are being initiated. "The pattern of the prevailing ownership of the means of production however showed inequalities of land-holding and instruments of production among the peasantry, which the state felt might create conditions for the revival of agrarian capitalism in rural areas"²⁾. The National Democratic Revolutionary Programme of 1976 already stated: "The government shall ensure the rights of individually owning farmers and at the same time it encourages and shall provide the necessary moral and material support to all cooperative endeavours of the peasant masses".

1) Alula Abate/ Tesfaye Teklu, op.cit. page 17.

2) Alula Abata/ Tesfaye Teklu, op.cit. page 19.

Membership as well as leadership in the agricultural cooperatives was restricted to the lower strata of the peasantry, in particular the poor and the middle-income peasants.¹⁾

To counter possible resistance on the part of the peasants, a variety of methods for forming these cooperatives were suggested, governed by three basic principles:

- a) voluntary participation,
- b) mutual benefits,
- c) strict application of democratic centralism.

At present, two kinds of C o o p e r a t i v e s can be observed in the countryside:

- 1) the Service Cooperative,
- 2) the Producers' Cooperative.

Service Cooperatives consist of no less than two Peasants' Associations and membership is open to all members of these Peasants' Associations. Requirements are²⁾:

- a) to promote the use of storage facilities;
- b) to provide agricultural inputs at favourable prices to farmers;
- c) to offer marketing services for the products of the members;
- d) to establish a consumers' shop for members;
- e) to promote agro-industry undertakings.

Various specialized committees - such as credit, financial, education and social committees, and a consumers' cooperative shop - are operating under an executive committee, elected by the delegates from each Peasants' Association.

1) Alula Abata/ Tesfaye Teklu, op.cit., page 19.

2) Alula Abata/ Tesfaye Teklu, op.cit., page 20.

So far Service Cooperatives are spread all over the country. Their services actually differ from area to area, depending on the natural resources and the facilities of the Peasants' Associations. Members of each Service Cooperative decide on a one-time registration fee or, alternatively, in favour of ongoing support for the cooperative.

By 1978, a total of 343 registered Service Cooperatives existed in the country.

On June 24th, 1979, a guideline on the formation of Agricultural Producers' Cooperatives¹⁾ was issued as a policy directive.

The Proclamation divided the development of the Producers' Cooperative into three phases: initially the peasants were to form an elementary type of Cooperative (M a l b a), and then gradually move towards an advanced Producers' Cooperative (W e l b a) and finally reach the highest level, where the advanced Producers's Cooperatives would form a type of commune (W e l a n d) .

The Malba stage could start with a small volunteer nucleus of at least three peasants, or, alternatively, members of a Peasants' Association might transform the Association into a Cooperative. Each member would be entitled to up to 2,000 m² of land varying within an association with the number of family members who joined the Cooperative. Each member was still to own farm implements and livestock, but would already contribute to the Cooperative in the form of capital. The income of individual members would be based on property income and the quantity and quality of labour contributed.

The Malba stage was intended to gradually transform itself to the advanced Producers' Cooperative Welba, in which the contradic-

1) Here cited according to Alula Abate/ Tesfaye Teklu, op.cit., pp. 22-24 (original in Amharic).

tions between private ownership of the instruments of production and collective work would cease to exist. The members would either sell their farm implements and livestock, or voluntarily contribute them to the cooperative. At the Welba stage, each member of the cooperative might hold land up to 1,000 m² and raise livestock and garden crops on their private plots, if granted the approval of the general assembly. Income distribution would be based solely on the contribution of the labour of the members.

Welbas finally were to be transformed into large production units and then would attain the highest stage called Weland. The policy directive indicated that complete development and transformation to the Weland stage was not expected in the near future.

All members of the cooperative were to be organized in production teams, with each team assigned a different type of work, and each member allotted work and work points by the team leader, who would also prepare production and financial plans in consultation with the executive committee, which would follow and report day-to-day activities to the general assembly. The organization of work in these Producers' Cooperatives was thus to have both a vertical and a horizontal division of labour.

The net income of Producers' Cooperatives would be distributed among the members on the basis of their accumulated work points, converted into monetary value on the basis of a variable norm set by the general assembly for different types of work. After the payment of wages, the remainder of the net income was to be kept in the following percentages: 60 % for accumulation, 25 % for precautionary reserve, 13 % for welfare and 2 % for special funds.

At the present, there are 40 registered Producers' Cooperatives, mostly on the Malba level, and 130 Producers' Cooperatives are under consideration for registration¹⁾. The government has ini-

1) Information was given by the Ministry of Agriculture.

tiated a full-scale campaign towards the formation of Producers' Cooperatives and has deployed trained cadres all over the country.

Another way of speeding up agricultural development is seen in the creation of s t a t e f a r m s. The government did not distribute these big-sized farms - formerly run by individuals - to the peasants, but put them under state administration. The Ministry of State Farms, established in 1979, is supposed to develop 1,000,000 ha of land during the next ten years¹⁾. So far 250,000 ha of land have been developed in 12 administrative regions.

The main goals of the state farms are: to reduce the nation's import expenses by meeting local demands for industrial raw materials, to increase the production of cereals for export, and to develop animal and fishery resources. Long-term plans provide for starting agro-industries on state farms. In their surrounding areas state farms are supposed to have spill-over effects and pilot functions.

State farms are being developed through loans secured from the agricultural and industrial bank. At present, 52,700 ha are being developed under the Northern Agricultural Development Corporation, 45,600 ha under the Western Agricultural Development Corporation, 115,000 ha under the Southern Agricultural Development Corporation, and 10,700 ha under Vegetables and Fruits Development Corporations.

Whereas the countryside is organized in Peasants'/Women's Associations and Producers' Cooperatives, cities and towns are organized in urban dwellers' associations²⁾, who have to run their own affairs, solve their own problems, and directly participate in political, economic and social activities. The urban dwellers are organized in a three-level hierarchical structure: the

1) Information received from the Ministry of State Farms and a press release in "Ethiopian Herald", July 10th, 1980.

2) Proclamation No. 104, 1976, "Negarit Gazeta".

lowest level of organization is the Kebele, the next level is the higher Kebele and, finally, the central urban dwellers' association.

Considering the wide scope of the economic challenges and the immense volume of resources and sacrifices required to meet the revolutionary challenge, a new planning organization, namely the National Revolutionary Development Campaign (short: Zemecha) and Central Planning Supreme Council (NRDC and CPSC) was established by Proclamation in October 1978. They are responsible for the elaboration and follow-up of all short-term, medium- and long-term plans as well as for the overall guidance and management of the economy. It has been given all the powers necessary to set priorities, to mobilize the human, financial and material resources required for launching and sustaining development campaign programmes. The NRDC and CPSC central structure has branches at the regional, awraja and wereda level. Branch offices in the 14 administrative regions have already been established, staffed and made operational¹⁾.

2.2 Agricultural structure

Out of a total of 1221.9 thousand km², 840,700 km² of Ethiopia (68.8 %) is agricultural land. On the average, however, only 132,800 km² (10.8 %) is cultivated, while the pasture land and meadows take up about 656,100 km² or 53.7 % of the agricultural land. The synoptic table below shows the pattern of land use in Ethiopia in a given period. Although the figures are from 1972, it can be assumed that, so far, the revolution has brought a radical change only in the organizational structure; not until recently was there a notable increase in land cultivation and marked changes in land use.

1) The team has discussed its research with the branch in Awassa.

Table 1: Land Use in Ethiopia

| | 1967/68 | | 1969/70 | | 1970/71 | | 1972 | |
|----------------------------------|---------------------|------|---------------------|------|---------------------|------|---------------------|------|
| | '000km ² | % |
| Total | 1221.9 | 100 | 1221.9 | 100 | 1221.9 | 100 | 1221.9 | 100 |
| 1 Agricultural land | 841.1 | 68.8 | 840.7 | 68.8 | 840.7 | 68.8 | 840.3 | 68.8 |
| A. Cultivated land | 126.9 | 10.4 | 132.5 | 10.9 | 134.9 | 11.0 | 137.2 | 11.2 |
| Crop land | 99.9 | 8.2 | 104.3 | 8.5 | 106.5 | 8.7 | 108.7 | 8.9 |
| Fallow land | 20.0 | 1.6 | 20.9 | 1.7 | 21.1 | 1.7 | 21.2 | 1.7 |
| Fruits and Stimulants | 7.0 | 0.6 | 7.2 | 0.6 | 7.3 | 0.6 | 7.3 | 0.6 |
| B. Meadows | - | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| C. Pastures | 666.2 | 54.2 | 656.7 | 53.7 | 654.0 | 53.5 | 651.3 | 53.3 |
| D. Swamps | 51.8 | 4.2 | 51.8 | 4.2 | 51.8 | 4.2 | 51.8 | 4.2 |
| 2 Forests | 87.8 | 7.2 | 88.0 | 7.2 | 88.2 | 7.2 | 88.6 | 7.3 |
| 3 Barren land and built-up areas | 172.1 | 14.1 | 172.1 | 14.1 | 172.1 | 14.1 | 172.1 | 14.0 |
| 4 Water and water courses | 120.9 | 9.9 | 120.9 | 9.9 | 120.9 | 9.9 | 120.9 | 9.9 |

Source: Statistical Abstract 1968-1972. Central Statistical Office, Addis Ababa.

The main agricultural products are:¹⁾

| <u>Cereals</u> | <u>Oil seeds</u> | <u>Pulses</u> | <u>Other crops</u> |
|----------------|------------------|---------------|--------------------|
| Teff | Neug | Horse beans | Sugar cane |
| Maize | Linseed | Chick peas | Coffee |
| Barley | Sesame | Field peas | Cotton |
| Sorghum | Ground nuts | Lentils | |
| Wheat | Castor seeds | Haricot beans | |
| Millet | | | |

1) Ethiopian Statistical Abstract 1977.

For 1979 the growth rate for the agricultural sector is given at 7.3 %. Agriculture contributes about 50 % of the GDP and provides the livelihood for almost 90 % of the population. Agricultural exports account for 90 % of the total exports and agricultural raw materials are vital to Ethiopia's limited industrial sector¹⁾. 75 % of Ethiopia's industry is engaged in the processing of farm products²⁾.

Nevertheless, the production of agricultural products for direct consumption is predominant. The surplus product is sold mainly in the regions where it is produced, often simply because of the lack of an appropriate transportation system, which limits the geographical possibilities of marketing.

By number of cattle per head of population, Ethiopia ranges among the top nations in the world. Yet, the stock-breeding and poultry raising is in primitive condition, as the body weight and productivity of the cattle is very low due to the low quality breed of cattle. The huge number of cattle can be explained through the established tradition of keeping cattle as a sign of wealth. Only in the north-western, southern and Lake areas of the Great Rift Valley, livestock is raised for marketing.

2.3 Agricultural objectives of the government

As stated above, the National Revolutionary Development Campaign and the Central Planning Supreme Council are responsible for the development planning of the country³⁾.

Until a long-range or even medium-range plan can be reasonably worked out, short-term objectives of economic and social development have been identified. They are based upon the most urgent

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- 1) "The Courier", No. 59, January-February 1980, page 13.
 - 2) ABECOR, Country Report Ethiopia, London, August 1979.
 - 3) The information given in this chapter was obtained from the National Revolutionary Development Campaign and Central Planning Supreme Council.

and pressing economic and social problems facing the country. Right after it was established, this Planning Agency launched a First Year Development Campaign. The principal targets set for agriculture were:

1) The cultivation by state farms of an extra 32.600 ha, which were to secure an additional output of 1.64 million quintals¹⁾ of crops, 73 % of which was to be food grains.

2) An additional output of 3.8 million quintals of food crops from peasant holdings and cooperative farms through the provision of fertilizers, improved seeds and cultural practice.

Targets of the First Year Development Campaign were fulfilled, all in all, by over 90 %.

In the Second Year Development Campaign Programme, priority was again given to the agricultural sector. Agricultural GDP is expected to increase by 3.95 %. The major targets for the agricultural sector are:

- 1) to increase the acreage under the state farms by an additional 134,150 ha, and to increase the output by 88 % over the previous year;
- 2) to increase the output of the peasant sector by 13 % mainly through increased supply and improved distribution of fertilizer, better seeds as well as through training in better farming techniques.

The Second Year Development Campaign is still underway, and no figures are available yet. Meanwhile pre-planning activities for the Third Year Development Campaign have started. It was found advisable to prepare and elaborate a series of one year development campaign plans, which will serve as a model for future medium- and long-term planning and at the same time help to solve immediate problems. Planners feel that the preparation and implementation of medium- to long-term comprehensive plans requires

1) 1 quintal = 100 kg

more experience and more specialized institutions than Ethiopia has at the moment.

2.4 Description of the potato sector ¹⁾

Among the above-stated objectives of agricultural development is the increase of the vegetable production, in particular: onion, potato, sweet potato, pepper, tomato ²⁾. Producers' Co-operatives are the main targets for planning vegetable growth, Potatoes are ranging second to onion.

The potato was introduced to Ethiopia in 1858 by a German botanist. But it only became popular toward the end of that century, when a long famine hit Ethiopia and people began eating potatoes out of despair.

Since then, the potato has gradually become an important garden crop in many parts of Ethiopia. It is estimated that 30,000 ha of potatoes are produced per year, with an average yield of about 5 tons per ha. This is extremely low compared to the Netherlands (39 t/ha) and Germany (28 t/ha), Egypt (17.4 t/ha) and Burundi (11 t/ha).

Although very suitable climatic and soil conditions prevail in large parts of the country (70 % of the available agricultural land have an altitude ranging from 1,800 to 2,500 metres and an annual rainfall of more than 600 mm), a number of production problems account for the low yield of potatoes. The dearth of well adapted varieties, of sufficient and high qualities of seed potatoes, of adequate agronomic techniques, as well as diseases, especially late blight, bacterial wilt, and other tuber rots account for the minimal yield. Problems of adequate storage and marketing facilities are equally important and need to be solved in order to expand the potato culture in Ethiopia ³⁾.

1) Information was provided by Haile Mikael Kidane Mariam, except where otherwise stated.

2) Information was given in this range, deliberately stated, by the Ministry of Agriculture.

3) These problems will be discussed in more detail in the following chapters.

The College of Agriculture at Addis Ababa University, in cooperation with the Institute of Agricultural Research of Ethiopia and the International Potato Center in Lima, has organized a Potato Project with the aim of promoting a strong and coordinated research programme. The Potato Project is operated under the auspices of the National Crop Improvement Committee, with the College of Agriculture as the national coordinator.

Beside the lack of sufficient funds and qualified personnel, so far the Potato Project has had limited scope of developing adapted potato varieties which have high-yielding capacities and resistance to one of the major potato diseases, late blight. Well diversified seedlings and other germ plasm were introduced by the International Potato Center and by other reliable sources for the purpose of screening and developing potato varieties which will meet the above requirements.

The yield evaluation of some of the new clones (identified through the Potato Project) indicated that local yields can be more than doubled in the near future¹⁾.

1) One promising sign was shown in July 1980 to the team: One urban dweller not associated with the potato programme in Addis Ababa harvested potatoes of 350 quintals/ha. 18 quintals/ha seed were used. A single tuber weighed 1.850 kg. But so far this is an absolute exception in Ethiopian potato growing.

3. NUTRITION ASPECT OF POTATOES

3.1 Importance of nutrition and the role of potato

In the last two decades the problem of nutrition has become more and more crucial. To the same degree knowledge about the important role which nutrition plays in the development of the individual human being and also of society has increased. The nutritional condition of the population of a country can be seen as a reason for, and also as an effect of social development.

While in industrialized countries overnutrition with all its consequences has become a problem, in developing countries the problem is malnutrition or under-nutrition or both. A nation in which the majority of the population is under- or at least malnourished will hardly be able to develop quickly - the goal of most underdeveloped countries. The capacity of each individual to contribute to a society's development depends largely on his physical and mental wellbeing, which are again both dependent to a high degree on adequate nutrition.

While the interrelation between health and nutrition has been known for a long time, knowledge about the influence of nutrition on mental development is quite new.

Undernutrition does not mean starvation. The affected people do not always feel hungry but they suffer from a permanent insufficient supply of nutrients. This may be of protein, or of calories, or of vitamins, or of all nutrients.

For a long time the supposed low protein content of the normal diet in underdeveloped countries was considered the main problem and reason for undernutrition. This is true for diets which are based on the high-calorie cereals, where the calorie requirements are fulfilled before the necessary amount of protein is taken in and protein malnutrition is the consequence¹⁾. It is

1) Its clinical form is Kwashiorkor.

true also for diets where low-calorie as well as low protein food is consumed, so that the intake capacity of the stomach is insufficient. A protein -plus- calorie malnutrition (PCM) is the consequence¹⁾. But there is another possibility: protein malnutrition is not always due to a low protein diet. The diet may contain just the required amount of protein and total calories, but these calories are supplied by carbohydrates, fat and protein too, so that the valuable protein has to be wasted for energy purposes. Therefore it is important to supply the energy requirement before trying to improve the protein content of a diet; otherwise, all protein supplements will be wasted.

The potato is able to play an important role in the nutrition of a population. It was a major food crop in the South American Andes region, where the potato originated, and it is now a major food crop in most European countries.

"In the developed countries the potato is the only basic food crop in the 'root and tuber' category. After its introduction to Europe in the 16th century the potato remained a botanical curiosity for over a century. The first European country to exploit the potato as a foodstuff was Ireland. In the 18th century the potato became the principal subsistence crop of Irish peasants. Dependence upon the crop was so extreme that crop failures in 1845 and 1846 resulted in widespread famine. In the 19th century potato cultivation spread throughout Europe, and this crop became a major source of food for the peasantry and laboring classes. As a wage good the potato contributed significantly to the urbanization and industrialization of Europe".²⁾

Potato ranks first among the ten major food crops in calorie production per unit area and per day³⁾. Potato comes secondly

1) Its clinical form is Marasmus.

2) Burton, 1966; Salaman, 1949; here cited according to D. Horton: Notes on the potential of potato in developing countries.

3) International Potato Center (CIP), 1974, Annual Report, Lima, Peru.

only to soybean in the production of net utilizable protein per hectare. ¹⁾

These facts, together with the high content of vitamin C, a reasonable content of some B-vitamins and the excellent value of potato protein, make the potato a valuable food crop. The nutritional value, however, particularly the energy, water, protein, carbohydrate and vitamin C values, are all influenced to a greater or lesser degree by the following ²⁾:

- fertilizers
- soil type
- soil moisture
- temperature during growing season
- length of growth
- pesticide control
- planting date
- time of harvest
- method of killing haulms
- geographical location of planting
- variety planted.

3.1.1 Consumption forms of the potato

The potato is used both in human and animal nutrition, whereby animal consumption plays or played a role only in European countries. In Western Europe production and consumption of potatoes has declined in the last few years, while in North America and in developing countries both are increasing.

In Europe less than 10 % of the potatoes consumed are in an industrially processed form, but in North America more than 50 %.

1) Kaldy, M.S., 1972: Protein yield of various crops as related to protein value. Econ. Bot. 26: Here cited according to Kidane Mariam: Consumption forms of potato.

2) See Poats, S.V.: Notes on the nutritional quality of the potato, CIP, April 1980, page 2.

These processed forms are mainly frozen and dehydrated potato products. The frozen products are either french-fried potatoes or semi-prepared potato dishes (e.g. potato pancakes). The dehydrated forms are powders for purée preparation or dehydrated doughs and flakes.

In private households, where fresh potatoes are used, the range of preparation forms is wide. Potatoes are not only boiled or fried but processed into numerous different kinds of dishes. Nearly every small region has developed its own special and typical potato dish. This can be salty or sweet, prepared from raw or cooked potatoes, mixed with cereal flour or without - there are nearly no limitations to the cooks' creativity.

The method of purchase differs from household to household. In former times, the amount of potatoes needed till the next harvest was bought and stored in each household individually, mostly in special installations in cellars. But nowadays this habit is disappearing more and more; potatoes are bought in small amounts throughout the whole year.

In industry potatoes are also used to produce starch and alcohol.

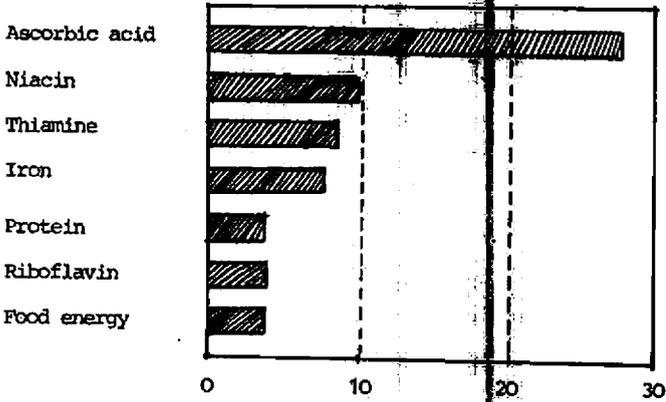
3.1.2 Nutritional content and value of the potato in comparison with some other foodstuffs

Potato (*Solanum tuberosum* L.) is a tuber crop and as such very rich in carbohydrates, which make up about 80 % of its dry matter. The greater part of these carbohydrates is starch, which is indigestible in the raw state but digestible without problems when the potato is cooked.

The water content of the potato is high, about 80 % of fresh weight, and thus the energy content is, compared to cereals or pulses, low. 100 g of potato contains about 90 kcal (377 kJ), while cereals and pulses contain about 350 kcal (1466 kJ) per 100 g. Protein content is also low - about 2 % - compared to cereals and pulses - about 10 % and 20 % respectively - but higher

Figure 1

NUTRITIONAL CONTRIBUTION
of one medium-sized potato to a day's
diet



% of daily allowances for a man 25 years
of age (NRC)

Source: Talburt, Smith: "Potato processing" 1967

than of other tubers like sweet potato, cassava or galla potato (see Table 2). But this low protein content is relative. The potato contains about 80 % water, only 20 % is dry matter where the protein is located. Cereals contain only about 12 % water, so that the large difference in the protein content of these foodstuffs nearly disappears when only dry matter is analysed (see Table 1).

As far as vitamins are concerned, the potato is exceptionally rich in vitamin C (Ascorbic acid). A medium-sized potato (about 60 g) contains on average 10 mg vitamin C. This is about 33 % of the required amount per day, supposing that a normal adult person needs 30 mg per day (FAO recommendation) (see Figure 1).

Potatoes have a higher content of vitamin B₁ (Thiamine) and Niacin than sweet potatoes, galla potatoes and enset (false banana). But the vitam A content is negligible (see Table 3). Calcium content is also low.

Potato protein is of high value because of the rather good balance of its amino acids (see Table 4). Its content of essential amino acids is quite high, nearly 40 %, while for example T'ef protein contains only about 30 % essential amino acids. (About biological value of potato-protein and others, see Table 5.)

To supply the daily requirement of all essential amino acids (except Methionine) about 1 kg of potatoes would be necessary, but 2.5 kg to fulfill the required amount of protein and energy.

Because of the low levels of protein and energy caused by the high water content of the potato, this tuber cannot replace cereals in a diet which is based mainly (because of consumption habits and availability) on cereals; this would only be possible in societies where protein and energy are mainly supplied in the form of animal products, especially meat. But as a supplement to a poor cereal diet the potato is of high value, higher than other tubers. Not only because it is rich in vitamin C (sweet

potato and galla potato are also rich in Ascorbic acid), but because of its higher protein content and quality (compared with these), even when the absolute amount of protein is low.

Another advantage of potato is its multiple use. There are many kinds of possible preparations and this could help to make a monotonous diet more diversified.

Table 2: Composition of potato and other foodstuffs

| | % water | Protein g/100g | Energy kcal/100 g | Fat g/100 g | Cal-cium mg/100 g | Protein g/100 g dry m. | Energy kcal/100 g dry matter |
|---------------------------------|---------|----------------|-------------------|-------------|-------------------|------------------------|------------------------------|
| Potato ^{xx)} | 77.8 | 2.05 | 87 | 0.11 | 9.5 | 9.2 | 392 |
| Sweet pot. ^{xx)} | 69.2 | 1.63 | 124 | 0.6 | 35.0 | 5.3 | 403 |
| Galla pot. ^{x)} | 65.4 | 1.7 | 70 | 0.1 | 9.0 | 4.9 | 202 |
| False ban. ^{x)} | 50.0 | 0.73 | 213 | 0.15 | 82.0 | 1.5 | 426 |
| T ¹ ef ^{x)} | 11.2 | 9.1 | 353 | 2.2 | 110.0 | 10.2 | 398 |
| Maize ^{x)} | 12.0 | 9.5 | 356 | 4.3 | 7.0 | 10.8 | 405 |
| Sorghum ^{x)} | 11.0 | 10.1 | 343 | 3.3 | 39.0 | 11.4 | 385 |
| Wheat ^{x)} | 12.0 | 12.2 | 334 | 2.3 | 36.0 | 13.9 | 380 |
| Barley ^{x)} | 12.0 | 11.0 | 332 | 1.3 | 33.0 | 13.6 | 377 |
| Beans ^{x)} | 11.0 | 22.7 | 348 | 3.0 | 116.0 | 25.5 | 391 |
| Chickpeas ^{x)} | 11.0 | 20.1 | 358 | 4.5 | 149.0 | 22.6 | 402 |
| Lentils ^{x)} | 11.0 | 24.2 | 346 | 1.3 | 56.0 | 27.2 | 389 |

Sources: x) Nutrition survey, Ethiopia; FAO 1959
 xx) Nährwerttabellen Souci, Fachmann, Kraut

Table 3: Vitamin content (per 100 g) of potato and other foodstuffs

| | Vit. C (mg) | Vit. A (I.U.) | Thiamine (mg) | Riboflavine (mg) | Niacin (mg) |
|--|----------------|------------------|------------------|---------------------|----------------|
| Potato | 17 | 0 | 0.11 | 0.047 | 1.22 |
| Sweet potato | 17 | 0 | 0.064 | 0.050 | 0.6 |
| Galla potato | 14 | - | 0.9 | 0.03 | 1.0 |
| False banana | 0 | - | 0.03 | 0.03 | 0.8 |
| T'ef | 0 | 0 | 0.47 | 0.11 | 2.1 |
| Maize | 0 | 450 | 0.45 | 0.11 | 2.0 |
| Sorghum | 0 | 200 | 0.41 | 0.15 | 4.0 |
| Wheat | 0 | 0 | 0.41 | 0.10 | 4.6 |
| Barley | 0 | 0 | 0.46 | 0.12 | 5.5 |
| Beans ¹⁾ | 4.0 | 65 | 0.55 | 0.20 | 1.7 |
| Chickpeas | 5.0 | 300 | 0.40 | 0.18 | 1.6 |
| Lentils | 3.0 | 100 | 0.50 | 0.21 | 1.8 |
| Daily require- ment | 30.0 | 5000 | 1.7 | 1.8 | 20.0 |
| % of daily re- quirement from potato | 50 | 0 | 6.5 | 3 | 6 |

Sources: As Table 2

1) The average of broad beans and sword beans is taken.

Table 4: Essential amino acids in potato (mg/100 g) and amount required daily (mg)

| Amino acids | Amount in potato (mg/100 g) | Daily requirement (mg) | % of the daily requirement in 100 g potatoes |
|-----------------------------|-----------------------------|------------------------|--|
| Leucine | 86 | 727 | 12 |
| Isoleucine | 120 | 550 | 22 |
| Lysine | 120 | 544 | 22 |
| Methionine | 31 | 700 | 4.4 |
| Phenylalanine ¹⁾ | 90 | 258 | 35 |
| Thyrosine ¹⁾ | 66 | - | - |
| Threonine | 79 | 375 | 21 |
| Tryptophane | 31 | 168 | 19 |
| Valine | 110 | 375 | 29 |

Source: See page 37

1) Phenylalanine can replace up to 70 % of Thyrosine requirements, because Thyrosine can be synthesized from Phenylalanine in the metabolism.

Table 5: Biological values of protein and protein mixtures

| Food protein | Mixture % | Biological value |
|--------------|-----------|------------------|
| Egg | 100 | 100 |
| Maize | 100 | 76 |
| Milk | 100 | 94 |
| Wheat | 100 | 57 |
| Beans | 100 | 72 |
| Potatoes | 100 | 98 |
| Beef | 100 | 94 |
| Egg - Potato | 35-65 | 135 |
| Egg - Maize | 88-12 | 114 |
| Egg - Beans | 50-50 | 106 |
| Milk - Wheat | 75-25 | 105 |

Source: Finn Holm, "A new process for production of potato starch and protein". Information, Bioteknisk Institute, 6000 Koldin, Denmark. Here cited according to D. Horton.

3.2 Nutritional situation in three Ethiopian regions: Addis Ababa/Holetta, Awassa and Alemaya

Availability of foodstuffs, consumption habits and supply with nutrients.

Addis Ababa/ Holetta area

Crops grown in this area include nearly all kinds of cereals, such as T'ef, maize, wheat, barley and sorghum. On private land the mostly grown cereal is maize, followed by barley. T'ef seems to be more a commonly planted cereal. Therefore, the private households have to buy it from the markets. The vegetables grown are, in the first place, potatoes and - at the time of investigation - cabbage (kale). But others, such as carrots, beans, peas, beetroot and onions are also found. The mostly consumed vegetable in the observation period (May-August 1980) was cabbage, which formed a nearly daily component of the diet. The basic component of the diet is - besides the T'ef made 'enjera' (see appendix A)¹⁾ - a flour made from beans, called 'chorro', which is used to prepare 'wat'. Additionally to that, cabbage is used and, depending on home production or income of the family, potatoes and other vegetables like carrots, beetroot, sometimes tomatoes and lentils. Practically all vegetables are prepared as 'wat'; the consumption of raw vegetables (tomatoes or carrots) is very rare. Only potatoes are eaten alone, either simply boiled or fried, sometimes prepared as purée, especially for children, sick and elderly people.

As mentioned above, the pancake-like bread 'enjera' is, in this region around Addis Ababa, prepared out of T'ef. 'Enjera' is eaten to all warm meals together with 'wat'; in rural areas sometimes also for breakfast with a paste made out of red pepper (berberi), garlic and oil. The normal breakfast consists of bread (dabbo) made out of wheat (only rarely is maize or barley used) and coffee and tea. Normally all meals are taken at home together with the whole family group and there is no sign of sex- or age-specific preferences. Children begin at the age of about 3 years to eat very hotly seasoned 'wat'.

1) A.9., p. 200; A.10., p. 201; A.11., p. 202

The normal diet of this population is very monotonous, which could be the reason for the extreme use of pepper - to make the food more tasty.

In the consumption of meat there is a big difference between rural and urban areas. It is very low in rural areas - the 'wat' is prepared out of meat only for special events and feast-days, and normal in urban areas - once or twice a week to daily. The same applies to milk and eggs. These two food-items are not unimportant sources of income in rural areas. They are sold and not used for consumption, but in urban areas they form one part of the normal diet, especially eggs which are consumed nearly daily. Butter is used nearly exclusively in small amounts for the preparation of 'wat', and the consumption of cheese is not very common (normal to low-income households).

No great importance is given to fruits. They are not considered necessary and often given only to children. During the time of observation bananas and oranges were the mainly bought fruits.

The consumption of roasted cereals between meals is considerable. For this purpose mainly barley and chickpeas are used, about 3 kg a week, not consumed by the family alone but offered to neighbours and guests, too. The habit of taking coffee or tea several times a day also has its influence on calorie intake. Both coffee and tea are taken with a lot of sugar, at least 5g per cup (100 ml).

Concerning T'ef, exact quantities consumed can only be given for urban families. A family of about 5 members needs 50 kg of T'ef

1) Due to limited time - the research had to be conducted within three months - it was not possible to collect exact data about the quantities consumed. To do that would require longer observation and also weighting each food item consumed, because normally the asked persons do not remember the exact amount of food they have bought (this is a problem not only in developing countries but also in industrialized countries).

a month, one of about 10 members 100 kg per month. The estimated consumption of beans (to prepare 'chorro') may be about 5 kg a month for a 5 member family. All other food consumption, including the amount of oil used for cooking, depends largely on the family income. While in some urban families 2 litres or more oil is consumed per month, there is no consumption at all in some rural families.

The estimated calorie intake through T'ef (100 g contain 353 kcal) is, according to the amount consumed per month, about 1,200 kcal per day (330 g T'ef). Out of 100 kg T'ef they get about 550 'enjeras', meaning that one 'enjera' weighs about 180 g. Normally one person consumes two 'enjera' loaves per day.

'Enjera' is eaten mostly with 'wat' from bean flour ('chorro'). To prepare this 'chorro wat', only onions, oil, water and 'chorro' are necessary. From a recipe given for one meal for about 3 persons, the following calorie content was calculated: out of 250 g onions 105 kcal (439 kj), 615 kcal (2570 kj) out of 175 g 'chorro', 884 kcal (3695 kj) out of 100 ml vegetable oil and 143 kcal (598 kj) out of 20 g butter. That gives a total sum of about 1750 kcal (7302 kj) per meal, equivalent to about 580 kcal (2430 kj) per person.

Assuming that 'chorro wat' and 'enjera' are eaten twice a day, the calorie intake from the main meals is about 2400 kcal (10030 kj) per day. With the bread taken for breakfast, the sugared coffee and the roasted cereals eaten between the meals, the daily calorie requirement will be fulfilled¹⁾.

But this is true only for urban and rural households where vegetable oil or fat (butter) is available, because the majority of energy is supplied by these. Where oil or butter cannot be used, a sufficient supply of calories may be a problem.

1) See appendix Table A12: Energy needs ..., p. 204.

Protein intake seems to be sufficient. According to the above-mentioned quantities of 'chorro wat' and T'ef-made 'enjera', the daily protein intake is about 57 g protein per person per day, which is slightly more than the recommendation given by the FAO¹⁾.

The practised combination of T'ef with beans (cereals with pulses) is also very favourable because of the balance of amino acids. The limiting essential amino acid in T'ef - as in most cereals - is lysine, which is contained in a sufficient amount in beans and other pulses.

The vitamin intake is not so satisfactory. There is a deficient intake of nearly all vitamins, except vitamin B (Thiamin), which is provided by both T'ef and beans. Extremely low is the intake of vitamin C and also of vitamin A, but the latter may be supplemented by the extreme use of red pepper (berberi), which contains a high amount of vitamin A (10,000 I.U. per 100 g). Even irregular consumption of fruits and animal products like eggs and milk improves the vitamin supply, but only in urban areas, where these food items are, at least sometimes, a part of the diet. In rural areas the situation will be critical because of the lack of these consumption habits.

Awassa area

The area around Awassa, about 260 km south of Addis Ababa, can be considered as one of the most fertile regions in Ethiopia. Nearly all kinds of cereals, vegetables and fruits are grown there. The main crops are maize, potatoes and "ensete", the false banana. T'ef, sorghum, wheat and barley are also grown. Among the vegetables, cabbage, onions and sweet potatoes play an important role. Besides these, carrots, beetroot, tomatoes, beans, taro, local (galla) potatoes (*Coleus edulis*), lentils, garlic, and pepper are common. Among the fruits, banana is found nearly everywhere, followed by oranges, papaya and mango. Coffee and

1) Recommended dietary allowances, 1974.

chat are also grown, and sugar cane is very widespread.

The widespread cultivation of vegetables is reflected in the consumption habits of the population. Potatoes, cabbage, carrots, sweet potatoes and beetroot belong to the daily diet. They are used to prepare 'wat', alternatively to the bean flour 'chorro', which still remains the most important basis for 'wat' preparation. In this area 'enjera' is not only prepared out of T'ef but maize is often added. The bread also differs from that in Holetta area. It has not only got a different name - it is called 'kitta' now - but it is baked out of maize instead of wheat flour. Sometimes a mixture of maize and wheat, or maize, wheat and T'ef is used.

As in Holetta area, around Awassa the consumption of meat and animal products differs between rural and urban families. While urban families in general have meat at least once a week, rural families can provide themselves with meat only for feast-days or special events. Eggs are normally sold by rural families to get more cash income, but milk is consumed by the cow-owners or made into butter and cheese, of which not all is taken to the market.

Fruit consumption is higher than in Holetta area, due to general availability. The chewing of sugar cane is common, above all among children.

A particular food of this region is a bread or cake made out of 'ensete' called 'kotcho'. 'Kotcho' is obtained by a very complicated and long-lasting preparation of the pseudostem of the false banana. In some rural families, it is eaten daily instead of 'enjera'. The calorie and protein content of this 'kotcho' is lower than that of 'enjera'.

Generally spoken the nutritional situation in this area is quite good. Food composition is diversified and contains cereals, pulses as well as vegetables and fruit, so that the lack of regular meat consumption and the low amount of animal products consumed is not so grave.

Alemaya area

First of all, it has to be pointed out that the situation in this area was completely different from other years, due to a severe drought which had affected this region for two years up to the time when the research was conducted. This drought, which was similar to that of the years 72/73, had as a consequence a reduction in the consumption of nearly all kinds of foodstuffs, either due to low availability of several food items or to lack of cash income.

Therefore, the observed situation should be considered as a special case which does not reflect conditions and consumption habits in normal years.

The main crops in this area are sorghum and maize. Wheat and barley are not very important. On irrigated land, or in normal years, all kinds of vegetables are grown. Potatoes, sweet potatoes, cabbage, beans, tomatoes, carrots, pumpkin, onions, leeks, lettuce, pepper and even cucumbers. A very important crop is chat, which is the main income source for nearly all farmers.

A clear difference was found between the consumption habits of urban and rural families, which is not only, or even mainly, due to the drought (which naturally affected the peasants more than the urban dwellers), because the peasants are forced to sell a great part of their harvest to get cash income, which is necessary to cover the expenses for their basic needs. The reason may also be that the rural population is mostly Islamic, while the urban people are partly Christians with a different cultural background.

In rural areas "enjera" is made out of sorghum sometimes mixed with barley, maize or wheat - depending on the kinds of cereals available. T'ef is not used at all. In contrast to that nearly all urban families use at least a small amount of T'ef mixed with sorghum for 'enjera' preparation. The method of preparation is also different in rural and urban areas. While the urban

'enjera' is the fermented type, the rural 'enjera' is unfermented and prepared fresh for every meal.

The main base for 'wat' preparation is bean flour ('chorro') in urban families but a flour made from fenugreek (abbish) in rural ones. This 'abbish-wat' is normally prepared in the morning and kept on the fire during the whole day.

Another difference is meal distribution within the day. While in towns a cold breakfast is taken and the main warm meals are lunch and supper, in the countryside the two warm meals are breakfast and supper. The lunch consists of 'enjera' with the red pepper paste, the men take it in the field, together with tea. If there is not enough flour to prepare 'enjera' for all the family members, the women and children have to go without.

The consumption of cereals seems to be higher than in the other two regions. Because of financial inability to buy additional food items, the diet has shifted to the most basic components, cereals. The monthly amount consumed goes up to 180 kg maize and sorghum for a family of nine members.

The calorie intake out of this is about 2,300 kcal (9,610 kJ) per person per day and the protein intake about 60 g per person per day. Since both protein sources are cereals, the quality of the combination is not so favourable but better than a maize diet alone.

The diet is improved very much by the 'wat' out of fenugreek, because fenugreek contains a reasonable quantity of essential amino acids, including lysine which is a limiting factor in almost all cereals. In normal years a porridge-like dish, called 'nufro' out of split beans and maize - an excellent mixture of vegetable protein - belongs to the normal diet.

The remarkable difference between rural and urban households is also reflected in vegetable and fruit consumption. While in the

towns vegetables such as potatoes, carrots, beetroot, cabbage, lentils, beans, sweet potatoes, leeks and tomatoes and fruits, such as mangoes, bananas, guavas, oranges and dates are consumed, in villages and rural areas vegetables are mostly cabbage, sweet potatoes, pumpkin and leeks alone, and as fruits, mostly cactus fruits (which grow wild and are not cultivated) and sugar cane.

Meat and animal products are consumed mainly in the urban areas, except for milk, which also forms part of the normal rural diet. Milk is taken with salt in tea and the women bring it three times a day to their husbands in the fields. Tea is taken with sugar only if milk is not available. Eggs are sold; as in the other two rural areas, they are a source of income. Relatively expensive foodstuffs like meat, different kinds of vegetables and fruits are consumed only in the Moslim fasting period.

3.3 Importance of potato in consumption

Hotels (restaurants) in Addis Ababa

In order to find out something about the use and spread of potatoes in large-scale households, hotels (bigger and smaller ones) in Addis Ababa were visited. According to the information given by the food and beverage managers or the hotel owners, potatoes are used in all restaurants, even though the quantity differs. In medium-size and bigger hotels potatoes are used daily in all kinds of European dishes. They are prepared as soup and as a supplement to meat. The amount prepared a day ranges from 10 kg to 50 kg. Normally, about 100 g potato is served in one dish. In the smaller hotels, where mainly national food is prepared, the potato does not play such an important role. It is used in 'wat' like other vegetables and only sometimes offered with meat and as soup. Between 10 kg and less than 1 kg a day are used. The demand for and consequently the supply of potatoes rises only during the Christian fasting period, when the consumption of animal products and meat is not allowed.

In Holetta area the family households use potato mainly as one component in 'wat', either among other vegetables in vegetable 'wat', in meat 'wat' or as the only component too. Also common is the preparation of fried or roasted potatoes; especially children are fed sometimes with simply boiled potatoes. The preparation of mashed potatoes is not very common.

The frequency of consumption is relatively constant in urban areas, in most families about 2 to 4 times a week throughout the whole year. The amount consumed depends on the family size as well as on the price of potatoes and other vegetables. Even where there is no sign of competition between potatoes and other vegetables, the dependence of potato consumption on the price is higher than that of other vegetables. During the observation period, the price for potatoes was high. Nevertheless, between 2 and 8 kg a week were consumed and all families pointed out that they would consume more if the potatoes were cheaper.

In rural areas potatoes are also consumed but not as regularly as in urban areas. Here the consumption depends to a higher degree on seasonal changes in the supply. During harvest time potatoes are consumed more than in the off-season.

Generally speaking, the potato is highly valued in this region and is consumed in preference to other vegetables.

In the Awassa region, the consumption of potatoes does not seem to be as high as in Holetta, even though more potatoes are grown. The reason for the lower consumption in this area is probably the wide variety of vegetables available. The potato is only one among many other tubers; there are sweet potatoes, taro, galla potatoes and yams. The greater part of the potato harvest goes to the market in Addis Ababa.

Nevertheless, in Awassa town potatoes are consumed daily, but in small amounts (an exception was a family which claimed to consume about 14 kg a week). Between one and two kilograms are eaten

a week (during the observation period), prepared in vegetable 'wat', fired or boiled. The consumption of potatoes is considered "useful" and they are bought during the whole year, less in winter (rainy season) and more in summer (the main post-harvest time).

In the rural areas around Awassa nearly all of the interviewed farmers grow potatoes. Therefore, the seasonal changes in consumption are even more noticeable. While in the off-season, when potatoes have to be bought, consumption is lower than in the town, at harvest time potatoes are eaten nearly daily; especially by the potato producers, but also by non-producers because of the low price of potatoes at this time.

The methods of preparation are the same as in Awassa town. Potatoes are used in vegetable 'wat' and eaten fried or boiled. Sometimes a purée is made out of them.

In Hararghe Province, around Alemaya, the situation is quite different. As mentioned before, this area is affected by a severe drought and the production of potatoes has become quite difficult. During the observation period, it was possible only on irrigated land and consequently there were less potatoes on the market and the prices were even higher than in normal years.

Regular consumption of potatoes was found nearly exclusively in the towns (Alemaya and Harrar). There they form a constant part of the diet, they are eaten daily or at least once or twice a week. The preparation is the same as in the other two regions, mostly 'wat' and sometimes fried or cooked. "Everybody likes potatoes" as one woman declared.

For some rural areas it can be stated that there is almost no consumption of potatoes at all. Asked about their consumption of potatoes such answers were given: "We have not eaten potatoes for the last three years", "we never buy potatoes, we don't need it", "potatoes are too expensive for own consumption" and

"we don't know the use of potato, it gives us stomach ache". Even where potatoes are planted, they are sold, and are one of the main income sources.

In this area consumption not only of potatoes but also of other vegetables has decreased as a consequence of the drought, which forced the people to shift from a more diversified diet to the most basic components, which are cereals.

3.4 Comparison of prices for different food items

As can be seen in Table 6, calories and protein from potatoes are quite expensive. Comparing potato with T'ef in Holetta area, for the same amount of money they get only 39 % of the calories in T'ef out of potatoes and only 26 % of the protein. Potato protein is nearly as expensive as meat protein and 38 % more expensive than milk protein. But they get more calories for 1 birr out of potatoes (approximately 6 times more than from meat and about 2 times more than from milk).

Thus it is clear that the potato is at present - not acceptable as a supplementary food, at least for those of the urban and rural poor who have to buy them in the market. Potato protein is as expensive as protein from animal products, and calories can be got much more cheaply from other tubers, for example sweet potatoes, and from cereals.

But, if prices for potatoes decrease, this tuber could play an important role in improving the dietary situation. And the fact that, in spite of the high price, potatoes are already consumed by a large percentage of the population - even if in small amounts - makes it probable that consumption will rise when conditions are better.

Table 6: Amount of nutrients from different food items which can be bought for 1 birr (≈ DM 0.87 or US \$ 0.45)

| Area | Potatoes | | Fenugreek | | T'ef | | Maize | | Sorghum | | Beans | | Barley | |
|---------|----------|---------|-----------|---------|------|---------|-------|---------|---------|---------|-------|---------|--------|---------|
| | kcal | g Prot. | kcal | g Prot. | kcal | g Prot. | kcal | g Prot. | kcal | g Prot. | kcal | g Prot. | kcal | g Prot. |
| Holetta | 1740 | 30 | - | - | 4413 | 114 | - | - | - | - | 3480 | 230 | - | - |
| Awassa | 2175 | 37.5 | - | - | 3883 | 100 | 4984 | 141.4 | - | - | - | - | - | - |
| Alenaya | 1740 | 30 | 3770 | 274 | 3530 | 91 | 4272 | 121.2 | 5831 | 161.5 | 3480 | 230 | 3320 | 110 |

Source: Own survey

| Area | Sweet Pot. | | Eggs | | Milk | | Meat | | Lentils | | Butter | | Cheese | |
|---------|------------|---------|------|---------|------|---------|------|---------|---------|---------|--------|---------|--------|---------|
| | kcal | g Prot. | kcal | g Prot. | kcal | g Prot. | kcal | g Prot. | kcal | g Prot. | kcal | g Prot. | kcal | g Prot. |
| Holetta | - | - | 576 | 44 | 750 | 41.3 | 278 | 31.4 | - | - | - | - | - | - |
| Awassa | - | - | 576 | 44 | 1200 | 66 | 348 | 39.3 | - | - | 1430 | 1.2 | 1064 | 36 |
| Alenaya | 6200 | 60 | 432 | 33 | 780 | 42.9 | 348 | 39.3 | 4844 | 339 | - | - | - | - |

Source: Own survey

4. TECHNICAL ASPECTS OF POTATO PRODUCTION

4.1 Climate and soils

As the climate and soils prevailing in a particular area are deciding natural factors for the growth of any crop, it is important to have a close look into them in all three research regions: Holetta, Awassa and Alemaya.

A: Climate in Holetta

The Holetta area, at an altitude ranging from 2000 m to 3400 m above sea level, is situated in the central part of the Ethiopian highlands. Its climate is thus typically that of all highlands. The climate character can be seen in the ombrothermic diagram 1a, drawn on averages of seven years (1970-1976) and in table 7.

Temperature

As can be seen from Table 7, the area has an annual mean temperature of 13.5° C, with monthly mean temperatures ranging from 10.8° C in November to 15.4° C in April. There is usually a wide daily range, indicating that days are quite hot and nights much cooler. The period between October and February is often marked with frost in some nights, whereby the damage caused to crops may differ from year to year. Usually, slopes and wide valleys are less affected. In the year 1972/73, 49 days registered temperatures below zero during this period. Sometimes temperatures may fall below -5° C in some nights of November and December.

Rainfall

The rainfall and its distribution is shown both in diagram 1a and in Table 7. The annual rainfall, with an average of 1054 mm, is quite high. The period from October to February is generally very dry; moderate rains between 60 mm and 75 mm fall from March to May. The main rainy season with rainfalls between 100 mm and 280 mm extends from June to September, with the maximum in August. The distribution of the rains within a month is relatively uni-

Table 7: Monthly temperature and rainfall in Holetta (means for 7 years, 1970-1976)

| | | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Aver. | Total |
|----------------------|-------------------|------|------|------|------|------|-------|-------|-------|-------|------|------|------|-------|-------|
| Temperature (° C) | Monthly means | 12.6 | 14.0 | 15.0 | 15.4 | 15.3 | 14.2 | 13.9 | 13.8 | 13.6 | 12.7 | 10.8 | 10.9 | 13.5 | |
| | Maxima means | 22.9 | 23.7 | 23.8 | 23.9 | 23.7 | 21.8 | 19.1 | 18.7 | 19.7 | 21.4 | 22.0 | 22.3 | 21.9 | |
| | Minima means | 2.3 | 4.2 | 6.4 | 6.8 | 6.9 | 6.6 | 8.7 | 8.9 | 7.5 | 4.0 | -0.4 | -0.5 | 5.1 | |
| Rainfall (mm) | Total rainfall | 20.4 | 31.0 | 59.8 | 67.4 | 74.8 | 102.5 | 259.0 | 281.7 | 138.5 | 9.0 | 7.5 | 2.6 | | 054.2 |
| | No. of rainy days | 8 | 7 | 10 | 12 | 13 | 20 | 27 | 28 | 22 | 4 | 2 | 2 | | 157 |

Source: IAR Station, Holetta

form, especially during the main rainy season, where rains occur nearly daily.

B: Climate in Awassa

The Awassa area, situated in the Rift Valley and lying at an altitude between 1600 m and 1800 m above sea level has generally a warm high-altitude tropical type of climate. This is shown in diagram 1b, drawn on averages of 16 years (1961-1976) and in Table 8.

Temperature

With an annual mean temperature of 19° C, this area is quite warm compared to Holetta (Table 8). The period between February and May is slightly warmer than the rest of the year, otherwise there are no great differences within the year, with monthly mean temperatures ranging from 18.1° C to 20.4° C. The daily range may however be very wide in the dry season (November to February), with daily maxima rising well above 30° C and minima falling close to zero. In the 16-year period, the highest recorded temperature was 35° C in March, and the lowest 0° C in December. Frosts do not occur in this area, and very cold days (below 5° C) are less than ten in a year.

Rainfall

The annual rainfall of nearly 960 mm is very high. The main rainy season (with more than 70 % of the total annual rainfall) extends from March to October, with the heaviest rains (over 100 mm) between April and September. A short fall in amount is characteristic in May/June. The period from November to February is generally dry. The rainfall distribution within a month is not quite as uniform as in Holetta, not even in the main rainy season (July-September), where the number of rainy days is 12 to 15 a month. The intensity of the rains is usually not very high, as only about 7 % of all rainy days have more than 20 mm/day.

Table 8: Monthly temperature and rainfall for Awassa: Means for 16 years, 1961-1976

| | | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Aver- age | Total |
|---------------------------|-------------------------|-------|-------|-------|-------|--------|-------|--------|--------|--------|-------|------|-------|--------------|-------|
| Tempera- ture (° C) | Monthly means | 18.9 | 20.0 | 20.4 | 20.2 | 19.8 | 18.9 | 18.2 | 18.4 | 18.5 | 18.8 | 18.1 | 18.1 | 19.02 | |
| | Maxima means | 27.9 | 28.6 | 29.0 | 27.3 | 26.5 | 24.9 | 23.4 | 23.3 | 24.0 | 25.9 | 26.4 | 27.3 | 26.21 | |
| | Minima means | 9.9 | 11.4 | 11.9 | 13.2 | 13.2 | 13.0 | 13.0 | 13.6 | 13.1 | 11.7 | 9.8 | 8.9 | 11.83 | |
| Rain- fall mm | Total rain- fall | 18.08 | 46.68 | 63.58 | 99.56 | 109.47 | 87.54 | 156.73 | 125.04 | 119.29 | 59.03 | | 30.70 | | 957.4 |
| | No. of rainy days | 4.5 | 8.0 | 11.9 | 16.0 | 15.0 | 14.1 | 19.3 | 17.5 | 20.7 | 11.4 | 7.5 | 3.5 | | 146.4 |

Source: IAR Station Awassa

C. Climate in Alemaya

The Alemaya area which is in the eastern highlands at an average altitude of 1800 m above sea level has generally a highland-type of climate as shown in diagram 1c and Table 9.

Temperature

This area, with an annual mean temperature of 16.3° C and monthly mean temperatures between 14.2° C in December and 18.1° C in May is rather cool, but not as cool as Holetta (Table 9). The period from October to February is slightly cooler than that from March to September. Extremely high and low temperatures are not common, as data from the year 1972 show that the highest temperature of the year was 28.5° C in May and the lowest -0.5° C in November. Although the means of the minimum temperatures are all well above zero (Table 9), there is usually light frost from October to January, the degree of severeness differing from one year to another.

Rainfall

The 13-year average annual rainfall of about 900 mm is very high. Rains occur generally from March to September, with a short decrease in rainfall in May/June giving two maxima: one in April and the other in August. The heaviest rains (over 120 mm) extend from July to September, the period between October and February being generally dry. The character of the rains in this region is however quite different from the other two described areas. Amounts of rain and their distribution within a year vary very much from year to year. Therefore extreme variations can be expected in any year. The distribution of rains within a month are as irregular as within the year, the number of rainy days per month being in most cases less than ten. The year 1980, in which the research was conducted, was exceptionally dry. In the period between April and June there were very little or no rains at all.

Table 9: Monthly temperature and rainfall for Alemaya (means for 15 years, 1956-1970)

| | | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Aver. | Total |
|----------------------|-------------------|------|------|------|-------|------|------|-------|-------|-------|------|------|------|-------|-------|
| Temperature (° C) | Monthly means | 15.0 | 15.6 | 17.2 | 17.5 | 18.1 | 18.0 | 17.0 | 17.0 | 17.0 | 15.9 | 14.9 | 14.2 | 16.3 | |
| | Maxima means | 21.4 | 21.9 | 24.0 | 23.6 | 24.5 | 23.7 | 22.2 | 22.0 | 22.0 | 22.4 | 21.5 | 21.7 | 22.4 | |
| | Minima means | 8.5 | 9.4 | 10.3 | 11.4 | 11.7 | 12.3 | 17.8 | 12.0 | 12.0 | 9.4 | 8.2 | 6.7 | 10.2 | |
| Rainfall mm | Total rainfall | 2.5 | 39.4 | 55.0 | 120.8 | 89.1 | 75.1 | 123.7 | 157.0 | 126.0 | 35.5 | 24.9 | 9.4 | | 858.4 |
| | No. of rainy days | 1.6 | 3.6 | 7.3 | 10.1 | 8.8 | 9.8 | 13.1 | 15.7 | 13.9 | 4.3 | 3.0 | 1.4 | | 92.6 |

Source: Annual Report, 1961 Alemaya College

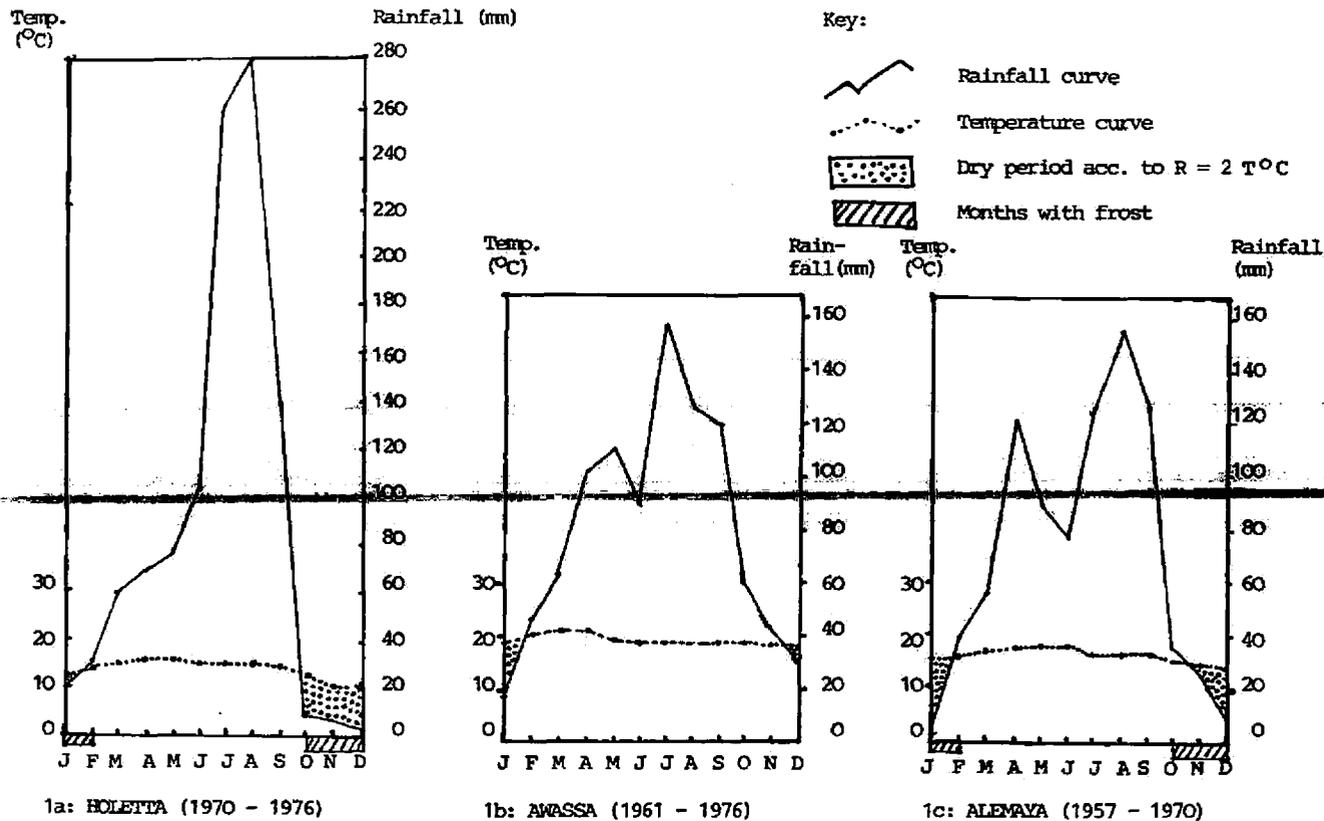


Diagram 1: Ombrothermic diagram of Holetta, Awassa and Alemaya

Soils of Holetta, Awassa and Alemaya

As soil is the basic agricultural resource of any country, soil surveys to identify types and their geographic distribution are an important factor for proposing and planning effective land use programmes. This aspect is now given much consideration in Ethiopia, where several stations of the Institute of Agricultural Research (IAR) are conducting systematic soil surveys in the different parts of the country where they are located.¹⁾

A. Soils of Holetta

The most frequent soils in this area are the red to reddish brown soils, especially between Addis Ababa and Holetta towns. They get darker (very dark grey or very dark grey-brown clay) to the west of Holetta town as one approaches Ambo, where the soils can be considered as black clays (vertisols). Some black soils are found mainly in lowlands and valleys, but sometimes on high plains, too, like between Holetta and Menagesha. These are however only a smaller proportion of all soils. The light reddish brown soils are mostly clay loams (alfisols), sometimes cracking on drying. They are normally shallow and are mainly found on slopes and hillsides. On lower, gentle slopes, deeper red brown soils are found and they become deeper and darker brown (inceptisols) to nearly black (vertisols) in the lowlands. Although these reddish brown soils are analytically mainly of clay texture, they are usually light, thus having good physical properties such as good drainage. They are however generally poor in nitrogen, due to low content of organic matter. The black soils in the lowlands are usually deep and fertile, and are mainly of alluvial origin. They are also usually rich in organic matter. Due to their high clay content, they are however heavy and poorly drained, resulting in water-logging during heavy rains.

1) The description of soils in the three regions is mainly based on information and data from IAR stations and the work of Murphy, H.F. Murphy was formerly the Director of Research and Professor of soil science at the Agriculture College of Alemaya. He conducted an extensive soil survey in the whole country, mainly along the main roads.

While the reddish brown soils are slightly to moderately acidic (pH: 5.5 - 6.7) and poor in phosphorus and calcium, the darker black soils are less acidic hence richer in phosphorus and generally in other ions and nutrients as well. Pottassium is generally well supplied in all these soils. The soils in the lowlands are very suitable for vegetables such as potatoes, especially when some drainage improvement measures are taken. The major problems in this area are:

- (a) soil erosion on the slopes,
- (b) poor drainage in lowlands and
- (c) availability of phosphorus, especially in acidic soils.

B: Soils of Awassa

The soils described here include those of the Awassa caldera (about 700 km² around L. Awassa), the southern part of Shashamene plain and those of the Wonji fault and crater to the northwest of Lake Awassa.

These are generally very fertile soils of volcanic origin, mainly based on ignimbrite, the original floor parent rock of the Rift Valley, and lacustrine deposits. Most of the surface soil in this area is light to dark grey-brown in colour, due to pumice layers in the soils.

The soils around Lake Awassa are mainly virgin eutric fluvisols with a silty texture. They are generally very fertile, deep soils with rich volcanic ashes in the upper part. The surface is dark brown loam upon a light grey-brown sandy loam. The subsoil (20-25 cm) is largely white silt. The profile can be as deep as 150 cm or deeper, mainly of clay with a high organic matter content (hydromorphic type). To the east of the lake, a large swampy area with hydromorphic humic gleya, mainly peat is found. A few patches of saline soils are found in the southern part of the swamp and on the southeastern side of the lake.

The north-eastern part of the basin between Lake Awassa and

Shashamene consists of dark, shallow (20-40 cm) sand loams. Under these is a layer of pumice deposits from the volcanic complex of the CORBETTI - caldera, which varies from a few centimetres to several metres in depth.

In the south-eastern part of the basin, around Oufa and Shemene there is a large area occupied by dark greyish soils (vetric xerosols), consisting of thick ash or pumecerous-sand deposits. Finally, a long strip of colluvial formations with reddish-brown ferralitic cambisols is found between the Somalian plateau and the swampy area to the east of L. Awassa, and continues southwards over Wondo Guenet and south-westwards to the south of Lake Awassa. Here several rivers flow from the Somalian plateau into the swamp, and from the swamp the Black river flows into Lake Awassa.

The soils of the Awassa basin are generally rich in organic matter and total nitrogen. They usually have a high content of available P, K, Mg and Ca. They are generally neutral with pH values ranging from 6.9 to 7.3, deeper soils being usually more alkaline. Approaching the south from Atosha village (25 km south of Awassa) towards Wondo, soils get more reddish and have a very deep profile. Their texture gets more clayish and they become more acidic (pH 5.4 - 6.8) resulting in lack of available phosphorus. Generally the soils of the Awassa basin are very fertile and very well drained, thus they are very suitable for the production of potatoes as well as other vegetables. The problem in this area could be wind erosion due to the loose, light-weight friable character of most of the surface soil.

C: Soils of Alemaya

The soils described here are those of the area within the vicinity of Alemaya College, extending southwards to Harar town and westwards as far as Kersa, on the road to Addis Ababa, 20 km from Alemaya town. These soils are typical for the whole Awraja, in fact for the whole Hararge region¹⁾. The soils in this region

1) Information obtained from Tamirie Hawando, professor for Soil Science at the Agricultural College of Alemaya, Addis Ababa University.

are very similar to those of Holetta in colour, structure and topographic distribution. Granite is the prevailing rock along with limestone and sandstone. The main types of soils in the area are:

- red to red-brown ferralitic/fersialitic soils termed the "Ale-maya soil series", comprising about 80 to 85 % of all soils;
- dark alluvial soils, about 10-15 %;
- black soils, occupying about 3-5 %, and
- red-brown inceptisols - only minor in quantity.

The red/reddish-brown ferralitic/fersialitic soils are usually light, shallow and very well drained, mainly found on hillside slopes. They are loamy in character, although analytically of clay texture, the clay content being higher in the subsoil. Dark alluvial soils occur in alluvial sediments around several lakes occupying extinct lake bottoms in the area. These are very fertile, deep dark grey to black soils which are very suitable for growing potatoes and other vegetables.

Black soils (grumosols, vertisols), which occupy only a small portion of the area, are usually found in the lowland plains. These are quite deep and very fertile soils, generally high in organic matter, too. Due to their high clay content, they adopt a very high plasticity when wet, thus making their handling rather difficult. These soils occur mainly on and around the College, in the Kersa valley and other lowlands. As a result of poor drainage some parts of these fertile lowlands are swampy and can thus be used only for grazing purposes.

The red-brown inceptisols are found on the lowest parts of the hillsides between the reddish and black soils. As these are quite deep, well drained and fertile, they are well suited for intensive agriculture, e.g. vegetable production. However, these are just a minor portion of the soils.

Soils in the area usually contain calcium carbonate (CaCO_3) in the subsoil. Consequently, most of them are slightly alkaline (pH 6.8 - 7.7).

In all soils the phosphorus and nitrogen content is generally low to medium, while K, Mg and Ca are highly available. The black and alluvial soils are especially rich in the latter ions because of their high cation exchange capacity.

Major problems in this area are soil erosion on hillsides and poor drainage in the lowlands.

Climate, soils and potato production in the three areas

In all three described areas, the climate and soils cannot act as limiting factors for the production and expansion of production of potatoes. In origin and physiology, the potato is a moderate-climate plant. Due to its various varieties with different properties, it is even capable of adapting itself (to some extent) to various climatic conditions.

In these areas, temperatures, amount and distribution of rains during the rainy season are generally quite favourable for the production of potatoes. Extremely high and low temperatures occur very rarely. However, the production of potatoes at some higher altitudes of Holetta and parts of Alemaya, where frost occurs from October to February, may be limited.

The amount of rainfall in the vegetation period is generally quite sufficient, except for a few areas (e.g. Alemaya) where supplemental irrigation would sometimes be necessary.

As far as soils are concerned, potatoes can grow on most soils, provided they are neither extremely acidic nor extremely alkaline. The best soils for the growth of potatoes are fertile, light loams, well drained and preferably rich in humus. In the three regions such conditions are widely found, especially in valleys and lowlands, though the degree of fertility may not be very high. Also in higher plains, where soils are even better drained, potato production could be considerably increased, with some soil improvements such as manure and fertilizer application, along with other agronomic measures.

4.2 Cropping system

At present the vast majority of the Ethiopian population depends mainly on cereal crops as their main food source, thus the allocation of land to cereal crops is much greater than for other crops.

In Holetta area about 3/4 of the cultivated land is occupied by cereal crops such as T'ef, wheat and barley; 19 % by legumes such as horse beans, or field peas; and a small area is devoted to oil crops and vegetables.

In Awassa area most of the cultivated land is also devoted to cereals such as maize, barley, wheat, T'ef and finger millet, whereas the area occupied by other crops such as coffee, chat, ensete and vegetables is considerably smaller than that of cereal crops.

The same applies to the Alemaya area, where about 61 % of the cultivated land is occupied by sorghum, 12.8 % by chat, about 5.4 % by sweet potatoes and around 4.1 % by other vegetables¹⁾.

In all these three areas vegetables are planted on the fertile pieces of land. In some places where there is scarcity of irrigation water, the land for vegetables is situated near the water source. Those farmers who do not have any access to irrigation water plant vegetables mainly during the rainy season.

The vegetables grown in these three areas are more or less the same, namely potatoes, cabbage, onions, garlic, beetroot, carrots, pepper, tomato, etc. The potato is one of the most important crops among the vegetables because of its consumption demand and it is also a good source of income.

1) Tamirie Hawando: Soil management practices and soil fertility status as affected by geomorphology and existing cropping patterns in Hamar Zuria Awraja, Eastern Ethiopia; In: Proceedings Fifth Annual Research Seminar, 30 Oct. to 1 Nov. 1974.

Potatoes are usually planted as a single crop. However, some farmers practice intercropping with maize and with harricot beans in some areas of Awassa. The reason given for this practice is that the farmer can harvest more products per unit area.

All the interviewed farmers adopt crop rotation for two main reasons:

- to control certain diseases
- to maintain soil fertility.

The sequence of the crop rotation is not a systematic one. Potatoes are planted after every other season (or year). They may be preceded by legumes and sometimes by cereals or vegetable crops. In some places where special land is allocated only for vegetable production, the rotation of crops on this land is practiced only among the vegetables.

4.3 Varietal concept

Although Irish potato (*Solanum tuberosum* L.) is one of the vegetable crops that is grown in many parts of Ethiopia, there are no standard varieties used by farmers all over the country. There is no government agency or organization that produces enough tuber seeds which are true to type to distribute to the farmers. Thus the potato clones used by farmers differ from locality to locality and even within one locality.

Potatoes used by farmers are given local names which are derived either from the area of introduction or from the colour the tubers have. Different local names may be given to one variety of potato in different localities.

Potato varieties around Holetta area are Rogie, Talian, Nech Hararghie, Wolamo, Saburie and Adama. Rogie is the most common variety because it gives relatively high yields and withstands late blight better than the others. However, it has less market value. The quality of Talian and Nech Hararghie is better than that of Rogie, but these two varieties and the remaining three are highly susceptible to late blight.

Due to scarcity of tuber seeds not all farmers have access to all clones. For example, farmers organized in the Sademo Peasants' Association hardly have any access to the above-mentioned potato types and farmers of the Wolmera Choke Producer's Co-operative have a very limited access to Talian and Nech Hararghie which they said they would like to grow. Farmers organized in the Dil-Betigil Producers' Cooperative are much better off as far as access to different clones of potatoes is concerned. They currently grow Rogie, Talian, Nech Hararghie and Adama, of which Rogie occupies the largest area.

In Awassa area Duramie (Saka) and Yeferengi Dinich are the two most commonly grown potato varieties. Duramie is an early type and it is very susceptible to late blight. Due to its poor yielding ability most farmers resort to Yeferengi Dinich, provided the latter is available. Yeferengi Dinich is more vigorous than Duramie and a late maturing type. It is more resistant to late blight and gives better yields than Duramie.

In Alemaya area Mongor and Sabune are the two varieties of potatoes which are grown by farmers. Sabune is an early type which takes about 3 months to mature. It is less vigorous than Mongor but has a high cooking quality. The tubers are smooth and shallow eyed and as a result it has a high market demand. However, it is very susceptible to late blight.

Mongor is a late type which requires four to five months to mature. It is very vigorous and the foliage requires a wider area than Sabune. It is more resistant to late blight and also gives better yields than Sabune. This type has come to be the preference of the farmers until they get better varieties. Mongor, however, is of low quality because it has deep eyes, its shape is not attractive and its cooking quality is not as good as Sabune's. Its market value is accordingly low.

Attempts made to improve potato varieties

Potato is one of the very important vegetable crops that gives

high yield per unit of land and time. However, the yield of one variety differs from the other, and also depends on environmental conditions. Therefore, finding high yielding varieties which are disease resistant, especially to late blight, and which have good adaptability to the environment will appreciably boost the yield. Attempts were made to screen such varieties several years ago. In 1963 the germplasma collection of potatoes was initiated at the College of Agriculture in Alemaya. Since then, a screening programme for late-blight resistance and high yield from exotic and indigenous potato lines has been pursued¹⁾. According to the results of variety trials conducted in 1971, some promising varieties that yielded far better than the average of 5.3 tons/ha were found (Table 10).

Table 10: Yield and late-blight resistance performance of some varieties of potatoes

| Variety | Yield (qt/ha) ²⁾ | Index of late-blight resistance ^{x)} |
|----------|-----------------------------|---|
| Alpha | 493.7 | 0 |
| Mirka | 424.6 | 1 |
| Desiree | 397.6 | 1 |
| Ginehe | 355.5 | 1 |
| Patrones | 325.0 | 2 |

^{x)} 0 = no blight present; 1 = blight lesions 5-10 per plant;
2 = about 15-25 % of plants affected by blight

Adapted from Taye Bezuneh, Plant Sciences Annual Progress Report, 1971, Vol. 1

1) Taye Bezuneh: Plant Sciences Annual Progress Report, 1971, Vol. 1

2) 1 quintal (qt) = 100 kg

Extending the idea of finding high-yielding and late-blight resistant varieties, a nation-wide potato improvement programme, coordinated by the Addis Ababa University, College of Agriculture of Alemaya, was started in 1974. The project is screening high yielding and late-blight resistant varieties, which will be multiplied and distributed to the farmers. This will make it possible to "increase the productivity of potato cultivation to the level at which the crop makes a significant contribution in feeding the Ethiopian people"¹⁾. Though at the moment the project has insufficient funds (about 2,000 U.S. dollars per year) and is very much understaffed (one specialist and 2 technical assistants), it carries out a number of activities to meet the above-mentioned goal:

- a) Variety and adaptation trials. From the results of the work done so far screening better varieties, some varieties have been selected which are then evaluated against local varieties at different locations for several seasons. The results from 1979 are quite promising (Table 11) and suggest that the potato could be a potential crop in the campaign against hunger in Ethiopia. It is estimated that those varieties which yield 40-60 tons/ha at experimental level, can yield 20-30 tons/ha at production level if the agronomic techniques are improved.
- b) Development of potato varieties resistant to frost.
- c) The utilization of true potato seed for the production of consumer potatoes.
- d) Determination of better methods of planting potatoes.
- e) The physiological basis and practical application of potato propagation by stem cuttings, etc.

In addition to this, other agronomic and physiological trials are being carried out.

1) Haile Michael Kidane Mariam: Potato improvement program proposal, 1980.

Table 11: Tuber yield in tons/ha of some selected clones grown in replicated trials at five different locations in the summer of 1979

| Entry | Variety | Alemaya 1 | Alemaya 2 | Nazareth | Debre Berhan | Debre Zeit | Mean |
|-------|-------------|-----------|-----------|----------|--------------|------------|-------|
| 1 | Al-108 | 34.10 | 26.70 | 13.10 | 15.10 | 38.80 | 25.60 |
| 2 | Al-114 | 21.40 | 6.50 | 12.40 | - | 32.40 | 18.20 |
| 3 | Al-201 | 25.50 | 28.90 | 11.90 | 12.20 | 29.80 | 21.70 |
| 4 | Al-204 | 55.50 | 52.30 | 35.70 | 18.90 | 32.00 | 38.90 |
| 5 | Al-209 | 17.20 | 7.90 | 6.60 | - | 26.00 | 14.44 |
| 6 | AL-212 | 15.90 | 12.60 | 6.60 | - | - | 11.7 |
| 7 | Al-218 | 26.70 | 25.10 | 7.10 | - | 19.60 | 19.60 |
| 8 | Al-253 | 38.00 | 71.50 | 15.80 | - | 22.00 | 36.80 |
| 9 | Al-257 | 19.70 | 21.80 | 6.80 | - | - | 16.10 |
| 10 | Al-500 | 11.00 | 15.80 | 16.00 | - | - | 14.30 |
| 11 | Al-511 | 36.90 | - | - | 21.50 | 30.00 | 29.50 |
| 12 | Al-557 | 50.40 | - | 23.40 | - | 26.20 | 33.3 |
| 13 | Al-563 | 60.20 | 49.20 | 25.4 | 27.5 | - | 40.6 |
| 14 | Al-568 | 51.60 | 38.40 | 31.90 | - | 30.00 | 38.00 |
| 15 | Al-616 | 42.40 | 48.60 | - | 24.70 | 20.70 | 36.60 |
| 16 | Al-624 | 55.20 | 48.90 | 30.00 | - | 32.30 | 41.60 |
| 17 | Al-625 | 37.50 | 48.60 | - | 24.50 | - | 36.90 |
| 18 | Al-634 | 26.81 | 31.40 | 20.50 | - | 25.00 | 25.90 |
| 19 | Al-640 | 57.80 | 46.30 | 24.60 | - | 23.60 | 38.00 |
| 20 | Al-672 | 28.60 | - | - | 18.4 | 19.80 | 22.30 |
| 21 | Local check | 18.30 | 4.00 | 9.8 | 7.9 | 14.90 | 11.00 |
| Mean | | 34.80 | 32.50 | 17.50 | 19.00 | 27.10 | |

Adapted from Haile Michael Kidane Mariam:
Potato improvement program proposal, 1980

4.4 Seed

In the propagation of potatoes, proper selection and use of good seed tubers are essential. The yield and other qualities

of this crop can be no better than the seed used¹⁾. This may lead us to the conclusion that best tubers should be used for planting in order to get good yield. However, farmers, except in some places, e.g. Holetta, where they are well organized in Producers' Cooperatives, use culled tubers and the best ones go for sale.

Potato growers around Holetta area get tuber seeds mainly from local markets and to some extent from previous harvests. Using their own seeds seems to be possible in areas where farmers have access to irrigation and where there is no frost. Growing potatoes during the dry season under irrigation helps to supply seeds for June planting with minimum storage problems, and enables producers to take advantage of high demand when potato production is at the minimum level in non-irrigated areas. Whether farmers produce tuber seeds or buy from markets, they use small-sized tubers for the following planting. The reasons for this are:

- to take advantage of selling large and medium-sized potatoes and
- to cover a larger area with the minimum amount of potatoes.

Due to lack of available seed and/or very high seed prices for the rainfed planting season, many farmers who used to grow potatoes are forced to resort to other crops like cereals.

Farmers in Awassa area too obtain tuber seeds from local markets and from previous harvests. Since many farmers in this area cannot produce potatoes during the dry season for lack of irrigation water and since they cannot store potatoes in good condition from harvest time (September) to planting time (June), they are forced to buy their seeds from local markets. The price by this time is very high (40 Birr/qt.). This also dis-

1) Haile Michael Kidane Mariam: Vegetable growing guide for Eastern Ethiopia. Experiment Station Bulletin 62. College of Agriculture, A.A.U., 1969, p. 46.

courages potato producers.

An example of an area which has access to irrigation water and which can grow potatoes even during the dry season is Wondo Guenet (the geographical boundary of Awassa). However, people around this area claim that potatoes harvested from their land cannot be used for succeeding planting because, they said, the potatoes decay after they are planted. Thus, they sell their potatoes and buy seed tubers from the local market. The problem with seed tubers that Wondo-Guenet farmers have is an interesting area for future study.

Sources of seeds in Alemaya area are the same as in Holetta and Awassa areas. The practice of using very small and undesirable seeds is more common in this area. The main reasons for this are:

- a) access to the Djibouti market, which enables farmers to earn much money by selling medium- and large-sized potatoes,
- b) since the price of potatoes is much higher compared to the other two areas (about 100-150 Birr/qt.) farmers are forced to buy small-sized potatoes in order to be able to cover as much area as possible with a minimum amount of potatoes.

4.5 Cultivation practices

4.5.1 Land preparation

Farmers are aware of the fact that land preparation (ploughing, disking, ridging) should take place before the rainy season begins, because otherwise the soil becomes compact on drying, thus making it difficult for the plant roots to penetrate into the soil. Moreover, further land cultivation becomes difficult.

In Holetta area, land preparation (ploughing, disking and ridgeing) starts about 2 months before planting. These operations are usually performed with oxen and/or by hand. Human labour is usually used to plough virgin land which is a bit difficult for oxen. The tool farmers use for the ploughing of virgin land is

"Yeguraghie Meresha", which has two metal-pointed tips. With this the farmers can dig deeper than oxen ploughs. In a few areas, e.g. Dil-Betigil, Producers' Cooperative, they began using tractors for ploughing virgin land, for which they pay 10 Birr/hour. The land is ploughed 3 times prior to ridgeing. For the second and third ploughing and for disking and ridgeing, oxen are used.

In Awassa area most of the operations are accomplished by oxen. The potato land is ploughed an average of 5 times prior to ridgeing. Disking, an operation which is a bit difficult to perform with oxen, is usually done by human labour using the "Doma" (a mattock-like tool). The operations of land preparation start 3 months before planting.

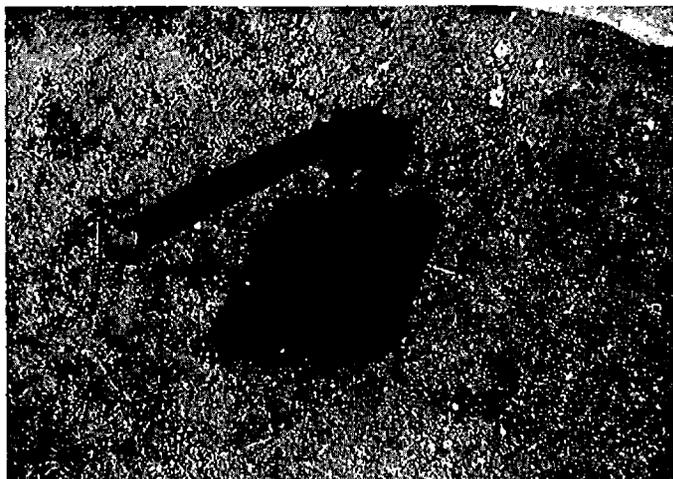
In Alemaya area too, almost all the operations for land preparation are done by hand and/or by oxen. "Dongora" is the most popular tool used by farmers when human labour is used for ploughing, whereas the "local Akafa" (a type of a hoe) is preferred for ridgeing and hilling. The use of tractors is practised less than in the other two areas, except in very well organized producers' cooperatives, such as the Legambo Producers' Cooperative. The land is ploughed only twice and the operation starts only a month ahead of planting.

4.5.2 Seed preparation and planting

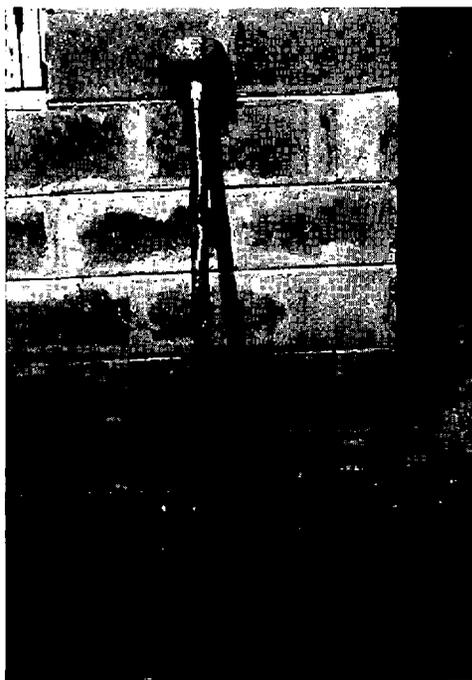
Seed preparation, being one important aspect in securing good quality seed, has a positive effect on the yield. This preplanting activity includes:

- screening, sizing and selecting the best tubers for planting,
- treatment of the seeds (i) against seed-borne diseases, and (ii) to accelerate the sprouting process.

The tubers used by most farmers in Holetta, Awassa and Alemaya areas are small-sized ones. Most farmers prefer planting whole tubers to cut tubers because:



Akafa



Dongora

- cut tubers decay easily, especially if not allowed to suberize,
- cutting tubers may increase the danger of transmitting some diseases from one tuber to another through the instrument used, unless proper sterilisation of the instrument is done after every cutting.

Those farmers who cut the tubers do that in order to reduce the quantity of tubers required for seeding. The direction of cutting is usually lengthwise so that both tuber pieces may have approximately equal number of eyes or buds. The tuber pieces are exposed to air or sprayed with ash in order to promote the healing of the cut surface.

Farmers do not treat the tubers against any seed-borne diseases, and the reason for this might be that they are not aware of this practice; and after all, only a few if any, would be in a position to meet the costs of the chemicals.

Of vital importance is the use of sprouted seeds. Sprouted seeds do not only give better yields than unsprouted ones, but also the vegetation period from planting to harvesting is shortened. This may be an important aspect, especially in those areas where water for irrigation is scarce.

Farmers do not apply any chemicals to accelerate the sprouting process. The length of time taken for the tubers to sprout can be 3-4 months, depending mainly on the length of the dormancy period of each variety. Nevertheless, they let the tubers sprout in one of the following ways:

- tubers are filled into sacks and left to sprout,
- tubers are spread on the groundfloor of their houses and let sprout,
- tubers are piled in or outside their houses and covered with straw or grass,
- tubers are piled in the field and covered with soil,

- tubers are put in pits dug in the soil and covered with straw or grass.

By piling the tubers and covering them, the temperature of the tubers is raised, thus accelerating the sprouting process. The tubers are often not exposed to light, and this causes the formation of weak and pale sprouts.

Planting

Potatoes under irrigation are planted in February/March, whereas rainfed potatoes are planted in June/July. In Awassa, however, where three crops can be obtained in one year, a third planting takes place in October. 1)

The farmers usually plant potatoes in rows. On gentle slopes they form either ridges across the slope or flat beds which may occupy two or more rows. This is done to reduce the danger of soil erosion.

The seed rate applied varies from producer to producer but depends mainly on the variety, tuber size and the spacing used. It was very difficult to estimate the seed rate applied, but on the average it lies between 8 and 11 qt/ha. The figures obtained vary considerably - from 3 qt/ha to over 20 qt/ha. There are several reasons for this:

- overestimation of the area planted with potatoes,
- underestimation of the quantity of seed applied,
- poor, or no record keeping is done. Sometimes the figures obtained depended on the memories of the farmers.

The spacing used by different farmers differ also from producer to producer. However, it depends on:

- the variety planted: in Alemaya for example, the Mongor variety is planted at a spacing of approximately 100 x 60 cm;

1) In the other two areas (Boletta and Alemaya), a third crop is not possible because of frost from October/November to January/February.

- but Sabune, which is less vigorous, at a spacing of 50 x 40 cm;
- fertility of soil,
 - whether under rainfed or irrigation conditions. One producers' cooperative in Holetta area (Dil-Betigil Producers' Cooperative) plants rainfed potatoes at a larger spacing than potatoes under irrigation in order to reduce the chances of late blight infestation. By choosing a larger spacing the vines of the potatoes do not come too close to each other and as a result the potato plants are more aerated than when planted at a closer spacing. This may reduce the chances of the plants being infested by late blight.

4.5.3 Weeding and hilling

Most farmers are aware of the fact that complete weed control is indispensable on arable land and that this operation is imperative on their potato fields, because heavy weed population not only reduces the yield but also hinders harvesting.

There was no thorough identification of weeds on farmers' fields. Nevertheless, both broad leaved and grass weeds are prevalent. In each group both perennial and annual weeds were observed, and most of the weeds are common in all the three areas. Among the observed weeds in Holetta, Awassa and Alemaya the most common ones are:

- *Datura* spp., *Solanum* spp., *Trifolium* spp., *Cynodon* spp., *Synedrella* spp., *Bidens* spp., *Amaranthus* spp. and *Digitaria* spp.

There are different methods adopted to control weeds, some of which are: preventive, cultural, fire, ecological, biological and chemical. Cultural methods, specifically cultivation, are the most common used by potato growers in the three areas to control all sorts of weeds, occasionally supplemented by hand pulling. However, the amount of cultivation that the potato receives is not sufficient to give complete control over weeds. As a result almost all fields do have weeds towards harvesting time.

In the three areas, cultivation is practised twice per growing season. The first cultivation is done when the plants attain a height of 10-12 cm, whereas the second one is performed about one month after the first. Some farmers in Alemaya perform the second cultivation at flowering. Weeding and hilling are done concurrently. In other words, potatoes are weeded and hilled twice.

Since no cultivation or weeding is practised thereafter, perennial weeds get a chance to establish very well and the annual weeds get a chance to set seeds and perpetuate themselves. Enough hilling is done in the three areas and as a result there is not much loss due to greening of tubers except in a very few farms such as Legambo Producers' Cooperative where a little greening was observed.

4.5.4 Fertilizing and manuring

I. Fertilizer application

The application of commercial fertilizers is very common in all three examined areas. The amounts applied are generally low and differ from cooperative to cooperative, from one peasants' association to another and from farmer to farmer. This depends mainly on financial capability, but partly on the awareness of its importance as well. On the whole, it can be observed that cooperatives practise more fertilizer application than individual farmers, and better organized peasants' associations more than less well organized ones. From Table 12, the level of fertilizer application in general and on potatoes in particular can be seen.

In all three areas, the most common fertilizer is Diammonium phosphate (DAP). Although urea is known to all farmers and cooperatives, it is rarely applied, with the exception of some cooperatives in Alemaya area. The preference for DAP is probably because of its phosphor content; phosphor is generally deficient in most of the soils. There is no application of any other fertilizer besides these two.

Table 12: The percentage of interviewed farmers/cooperatives who apply fertilizers

| Crop | Prod. unit | Holetta | Awassa | Alemaya |
|-------------------------------------|----------------|---------|--------|---------|
| Fertilizer application on all crops | Prod. coop. | 67 % | 100 % | 100 % |
| | Indiv. farmers | 30 % | 43 % | 80 % |
| Fertilizer application on potatoes | Prod. coop. | 67 % | 50 % | 100 % |
| | Indiv. farmers | 5 % | 14 % | 38 % |

Source: Own survey

A good knowledge about the importance and application methods of fertilizers was generally observed in all three areas (even though not in all cases). This was especially experienced in some cooperatives in Alemaya area, where the farmers informed the team that urea is especially good for the development of foliage and DAP for development of tubers, and that the combination of the two forms gives the maximum yields. In one cooperative farmers said that they usually apply DAP on the reddish brown light soils of the highlands, and urea for the darker lowland soils. This is a very impressive practice, because the highland light red soils are usually poor in phosphor and the darker lowland ones richer.

Source of fertilizers

All producers' cooperatives and the individual farmers, all organized in peasants' associations, buy the fertilizers from the extension service of the Ministry of Agriculture, which has branches in every wereda (subdistrict).

While cooperatives can buy the fertilizers directly from the extension service of the Ministry of Agriculture, individual farmers have to present their orders through the peasants' associations, which buy the fertilizers and distribute them to the members concerned. Sometimes a peasants' association may

decide to buy fertilizers and distribute them equally among all members, irrespective of the amount of land they possess.

The fertilizers are bought in all cases on credit, with a down payment of at least 10 % of the price in cash, and the rest after harvesting with an interest rate of 1 %.

Amount used for potatoes

The amount of fertilizer used for potatoes in comparison with other crops differs from place to place, depending on the importance of potatoes among other crops. The amount applied is generally lower where potatoes are produced on a small scale, mainly for consumption, and higher where they are a major source of income.

The importance of potatoes among other vegetables is clearly reflected both in the amount of land they occupy and the quantity of fertilizer they receive (Table 13). A good example are the two Cooperatives in Holetta and Legambo Cooperative in Alemaya, with potatoes occupying 50 %, 75 % and 25 % of the area under vegetables respectively. It can also be observed that cooperatives which generally have a larger area under potatoes apply more fertilizers than individual farmers.

Application methods

Rate of application

The amount of fertilizer applied to potatoes differs according to the amount of land under potatoes and also according to the availability of the fertilizers. As mentioned earlier, cooperatives generally apply more per hectare than individual farmers.

As can be seen from Table 14, even in cooperatives, the rate of application is quite low, ranging from 100 kg/ha to 150 kg/ha DAP. The applied amounts, regarding both nitrogen and phosphor are therefore much lower than the amounts required to achieve the maximum possible yields.

Table 13: Fertilizer application on potatoes in some chosen Cooperatives and Peasants' Associations (individual farmers)

| Region | Coop./p.Ass. | Area | | | Fertilizer | | |
|---------|---------------------------|------------|---------------------|-------------------|------------------------|------------------------------|-----------------------------|
| | | Total area | Area for vegetables | Area for potatoes | Total fertilizer (DAP) | Fertilizer on potatoes (DAP) | % of Fertilizer on potatoes |
| HOLETTA | Dil Betigil coop. | 42 ha | 15 ha | 8 ha | x) 20 qt | 12 qt | 60 % |
| | Wolmera choke coop. | 80 ha | 10 ha | 7 ha | 2 qt | 2 qt | 100 % |
| | Individ. farmer (a) | 2.8 ha | 0.1 ha | 0.1 ha | 1 qt | 0.1 qt | 10 % |
| | (b) | 1.5 ha | - | - | 0.5 qt | - | - |
| AWASSA | Wondo Kosha coop. | xx) 440 ha | ? | 6 ha | ? | 6 qt | ? |
| | Indiv. Farmer (a) | 1.5 ha | 0.4 ha | 0.3 ha | 0.5 qt | 0.1 qt | 20 % |
| ALEMAYA | Legambo coop. | 628 ha | 31 ha | 8 ha | DAP+Urea much | DAP much | ? |
| | Rare Chilalu Hundie coop. | 800 ha | 20 ha | xxx) 0.5 ha | 500 qt DAP+Urea | 0.5 qt DAP 0.5 qt Urea | 20 % |
| | Teneke P.Ass. | 680 ha | ? | 0.4 ha | 300 qt | 0.25 qt DAP 0.25 qt Urea | 0.17 % |

Source: Own survey

x) total amount bought = 40 qt DAP; 20 qt distributed to members.

xx) total area = 800 ha; cultivated are = 440 ha.

xxx) next season 1980/81, plan to increase the area under potatoes to 20 ha.

?) figures not known.

Table 14: Rate of fertilizer application in some chosen cooperatives

| Area | Cooperative | Area (ha) for potatoes | Amount per ha DAP | Yields per ha |
|---------|------------------------|---------------------------|---------------------------|------------------|
| HOLETTA | Dil Betigil | 8 ha | 1.5 qt | 120 qt |
| | Wolmera Choke | 7 ha | 1.3 qt ^{x)} | 57 qt |
| AWASSA | Shashena Kekele | 34 ha | 1.0 qt (plan) | 42 qt |
| | Wondo Kosha | 6 ha | 1.0 qt | 70 qt |
| ALEMAYA | Rare Chilalo Hundie | 0.5 ha | 0.5 qt DAP 0.5 qt Urea | 95 qt |
| | Legambo | 8 ha | good amount DAP | 42 qt |

Source: Own survey

x) applied only on 1.5 ha = 2 qt DAP/1.5 ha

Time and method of application

Fertilizer is either applied at the time of planting or during the first cultivation, when the plants are about 10-12 cm high. In a few cases the application is done during the second cultivation, about one month after the first.

Usually, the whole amount is applied at once. However, in Rare Chilalo Cooperative (Alemaya), split application was practised. The first was done during the first cultivation, with 50 kg urea/ha, and the second during the second cultivation, with 50 kg/DAP/ha.

The method of application is more or less similar in all three areas:

- application at the time of planting: fertilizer is broadcast in

the hills on the ridge, then potato tubers placed in and covered with soil;

- post germination application: there are two ways in which fertilizer is applied during the first and/or the second cultivation:

- 1) handbroadcasting - done by spreading the fertilizer over the whole ridge and covering it with soil,
- 2) side dressing - where one or two small furrows are made on one or both sides of the potato row, about 6 cm deep and 10 cm away from the row. The fertilizer is spread into these furrows and covered with soil.

Application of fertilizer before planting is not practised.

II. Manure application

Manure application is practised by nearly all farmers, the only deciding factor being its availability. Almost no cooperatives apply any manure to the common land, but farmers use it on the small piece of land they own individually.

The main reason for not applying any manure on the cooperative land is lack of sufficient supply for the relatively big areas occupied by potatoes and other main crops. But even when some animals are available, they are usually privately owned. This causes a problem, because no farmer likes to give his manure freely to the cooperative, and there are so far no measures of payment or evaluation of any sort if private manure is to be given to the cooperative. Another reason observed in several cooperatives was the fact that the potato fields are usually quite far away from the house (where animals are kept), especially when grown under irrigation. This becomes a problem, especially when there are no means of transport, for example donkeys. Nevertheless, in some cooperatives efforts are being made to get manure, as they recognize its vital function on most of their soils.

On individual fields (of cooperatives and peasants' association

members), manure application is a common practice. Usually manure is applied to the crops around the house, which are in most cases vegetables, cereals like maize, sorghum and especially on ensete in Awassa area. Potatoes are generally given priority over other vegetables as far as manure is concerned.

Application methods

The amount used is normally not much, as the source is always one's own animals, usually one or a few cows, sometimes a goat, a donkey and some hens.

The methods of application to potatoes are more or less similar in all three regions.

These are:

a) Application before planting:

Farmers pile the dung on different spots on the field during the dry season and just before the rains start the decayed manure is spread on the whole field with shovels and then mixed with soil at the first ploughing. This applies to other crops like maize, sorghum, etc. as well.

Only in a few cases is decayed manure applied at the time of planting.

b) Application after emergence frosts:

In most cases decayed manure is applied during the first or/and second cultivation. The application of fresh manure to potato fields is very rarely practised. This was observed for example in Awassa area, where some farmers were afraid of the decayed manure's odour affecting their health.

Green manuring as such is not practised, only sometimes residues of previous crops are ploughed in the soil. Alemaya area is an exception in this respect, because the farmers remove all residues including leaves, stalks and even the stubble of cereals like sorghum. The stalks are used for building houses and stubble as firewood.

4.5.5 Irrigation

Wherever a source of water is available, irrigation is usually practised, and vegetables are always given special priority. An area where irrigation was practised on a large scale was Wondo Guenet in Awassa/Shashamene area, where several rivers flow from the Somalian plateaus. There are thus two main growing seasons in all three areas, the more important one being under rainfed conditions (June/July to September/October) and the other under irrigation in the dry season.

Most cooperatives and farmers who have access to water prefer to grow potatoes under irrigation. The reasons for this are:

- a) the attack of late blight is not very severe in the dry season,
- b) the prices of potatoes are much higher due to the limited supply.

At the same time, scarcity of water is the major limiting factor, which is why many farmers cannot grow any potatoes in the dry season. It is mostly cooperatives which practice irrigation, and some peasants' associations having a common piece of land where vegetables are grown. The main reason for this is the labour and capital required to utilize the water sources available. Supplemental irrigation during the rainy season is not common, except in Hararge region (Alemaya), where the rainy season may be interrupted by long dry periods.

Water sources

Rivers and small streams are the main source of water in these areas. Most of these rivers supply water throughout the year, the amount being more at the beginning and less at the end of the dry season.

Lakes and permanent ponds are sometimes used for irrigation too. This is especially common in Alemaya area, where several lakes

(e.g. Lake Alemaya) are used. Lake Awassa cannot be used for this purpose, because like all other Rift Valley lakes it is very saline.

Dug wells are not very common in other areas, but in Alemaya they are widely found. They are dug in lowlands, usually where there is no river around, but where the ground water level is relatively high. In Kersa area, the water level in a valley was reached just two to three metres below ground level. These wells usually contain water throughout the year, though the amount and level may decrease in very dry periods, forcing the farmers to dig a little bit deeper. Water dams along rivers are not common.

Irrigation methods

The only method used is furrow irrigation. When the water source is a river, a stream or a lake, a canal is dug from this to the field, where smaller furrows direct the water into different plots of various vegetables.

Rare Chilalu Hundie Producers' Cooperative (Alemaya) is the only one among all visited Cooperatives and Peasants' Associations which uses a pump for irrigation¹⁾. Here water from a large pond near Lake Alemaya is used. A canal of about 400 m was dug leading into several small ponds from which the water is pumped into the field.

The water from dug wells is collected using buckets or some other local vessels. It is then poured into a collecting pit, from which a canal leads into furrows supplying water to different plots on the field. Usually several wells are dug on the same field, as the gradient in the lowlands is quite low, making it difficult to supply the whole field with water from only one well.

The irrigating itself starts from immediately after planting to about two to three weeks after planting. The frequency of irriga-

1) Wondo Kosha Coop. (Awassa) has a water pump used to supply water for domestic use only.

tion varies from twice a week to twice a month, depending both on availability of water and on the type of soil. Normally lighter sandy soils are more frequently irrigated than heavier clay soils. Moreover, the amount of water supplied per irrigation is decided by the length of a ridge too. The amount is considered sufficient when the last plant on the row has got some water.

There is no exact time of the day when the irrigating is carried out. This is mainly because the irrigation of potatoes together with other vegetables requires much labour, so that it usually takes the whole day. Irrigation stops by the time leaves start yellowing, about two to three weeks before harvesting.

4.5.6 Diseases, pest and their control

Diseases and pests are one of the major constraints in the expansion of potatoes in Ethiopia and have forced quite a number of farmers to abandon the production of potatoes. Some of the diseases and pests which were found in the areas of Holetta, Awassa and Alemaya are listed here.

Late blight (*Phytophthora infestans* (Mont.) de Bary):

This disease (in Amharic "wag") was found in all three areas. It is a fungal disease and the most serious of all the potato diseases, especially when conditions are favourable for its development. This is the case during the rainy season, i.e. in moist weather. It attacks and kills the foliage and invades the tubers causing rot. The attacked leaves have brown necrotic spots, and if moist weather prevails, the leaves may be killed within a short time.

Of all interviewed farmers none apply any fungicides against this disease; the reasons for this are:

- the fungicides are very expensive,
- most of the farmers do not even know that there are such chemicals.

The only control measures used by the farmers are:

- use of crop rotation,
- avoiding planting cut tubers,
- wide spacing on planting. This was observed only in DIL BETIGIL Producers' Cooperative in Holetta.

Early blight (*Alternaria Solani*):¹⁾

This is another fungal disease which causes considerable problems in the potato production. It should be mentioned however that it has been impossible to get any information from the farmers about this disease, because they presumably classify it as late blight.

Virus diseases:²⁾

Some symptoms of virus diseases could be observed on the vines of the plants. Virus diseases cause a reduction both of the number and the size of tubers produced per plant. Farmers however appear not to be aware of the symptoms of virus diseases.

Bacterial Wilt (*Pseudomonas solanacearum*):³⁾

In all three areas none of the farmers complained of this disease. This is probably because the three areas are situated at high altitudes ranging from 1600 to over 2000 m, where the development of this bacteria is not favoured. However, this disease is reported to be found in some areas of Ethiopia, especially at low altitudes.

Pests:

Potato tuber moth (*Phthorimaea operculella*):

This pest is prevalent in all three areas, especially on potatoes

1) Information gathered from literature.

2) Own observation in the field.

3) Information based on literature.

grown in the dry season. The larvae attack the foliage and feed on the developing tubers. During storage severe losses are encountered if this pest is present. There are no chemicals applied against this pest at farmer level.

Aphids:

Different species of aphids are efficient vectors of various virus diseases. Apart from transmitting virus diseases they also cause mechanical injury to the crop by sucking the sap, thus causing a rapid degeneration of the potato crop. The insect can be controlled by spraying some insecticides, but no interviewed farmers apply any.

Some other pests which are a great threat to the farmers are shown in Table 15.

Table 15: Some pests and their control measures as found in Holetta, Awassa and Alemaya

| Area | Pest | Control measure |
|---------|--|--|
| HOLETTA | Tuber moth Red termites Moles Porcupine | No insecticides applied Some farmers spray ash Directing water into their holes None |
| AWASSA | Tuber moth Red termites Moles Porcupines Centipedes Monkeys Warthogs | No insecticides applied Ash spraying in the field Directing water into their holes None None Frightening and chasing them Frightening and chasing them |
| ALEMAYA | Tuber moth "Koks" 1) Moles Porcupines Monkeys "Midaqua" 2) | No insecticides applied Frightening and trapping None None Frightening and chasing them Frightening and chasing them |

Source: Own survey

-
- 1) A type of bird
 - 2) A type of wild goat

4.5.7 Harvesting and storage

The criteria used by farmers to determine the time of harvest are:

- yellowing and drying of the foliage
- regular time taken by each variety to mature
- observation of the tubers

Harvesting is done manually using either locally made nattocks or hoes. The use of oxen is very rare, and this is because oxen-harvesting causes higher losses due to mechanical injury of the tubers. However, farmers of the Dill Betigil Producers' Cooperative (Holetta area) said they harvest some of their potatoes for consumption by using oxen.

In the Producers' Cooperatives the harvesting is done collectively. After the potatoes have been dug out they are cleaned and then filled into burlap sacks ready for being transported to the market. Potatoes for sale are usually harvested at once if a market is available, but potatoes for consumption are harvested gradually as need arises. Some farmers around Holetta area reported that the potatoes can stay up to 3 months in the ground without sprouting.

During harvesting the farmers are not able to dig out every developed tuber, and these left-overs (ground keepers) germinate in the following season or year if not destroyed by frost or pests. The problem of ground keepers is even more severe when the potatoes are harvested by oxen. These ground keepers have two main disadvantages. First they may act as a medium for transmitting diseases and second they act as weeds for the following crop.

Yields

As seen from Table 16, the yields observed in the three areas differ from area to area and from producer to producer. Generally speaking, the observed yields are very low (60.2 qt/ha compared to the world average of about 150 qt/ha). There are several fac-

tors which account for the low yields such as:

- use of poor yielding varieties which are not resistant to diseases such as late blight,
- no control against diseases and pests,
- use of poor quality seed (small tubers),
- low or no application of fertilizers and manure,
- poor irrigation facilities,
- other improper agronomic techniques.

It is our feeling that, by providing the farmers with improved varieties and by using better seeds and better agronomic techniques, potato production could be considerably increased.

Storage

In all three areas potatoes are stored by some farmers for two major reasons: - for consumption and
- for seed

However, due to the high perishability of the potato and poor storage facilities and methods, most farmers cannot store potatoes for a long time without encountering big losses. Generally speaking, two types of storage were observed:

- 1) Storage in buildings or houses. The potatoes are piled or spread on the ground/floor. Since there is no ventilation to keep the temperatures low, big losses - as high as 50 % - can be encountered. Storage losses may occur due to rotting, sprouting, respiration or storage pests such as the potato tuber moth.
- 2) "Under ground storage". The potatoes are left in the ground without being harvested. This type of storage is not very convenient especially in those areas where frost and pests such as red termites, moles, monkeys, porcupines, centipedes etc. are a great threat to the farmers.

Lack of proper storage facilities is one of the main factors forcing most farmers to sell their potatoes on harvesting, even at low prices. Another reason may be an immediate need for cash.

Table 16: Potato yields¹⁾ of some Peasants' Associations and Producers' Cooperatives in Holetta, Awassa and Alemaya

| | Name of Peasants' Association or Producers' Cooperative | Yield qt/ha | Average |
|---------|---|-------------|---------|
| HOLETTA | - Gelgel Peasants' Association | 25 | 66.8 |
| | - Wolmera Choke Producers' Cooperative | 57 | |
| | - Elala Godju Producers' Cooperative | 65 | |
| | - Dil Betigil Producers' Cooperative | 120 | |
| AWASSA | - Shamena Peasants' Association | 65 | 69.0 |
| | - Wolaita Peasants' Association | 80 | |
| | - Watera and Ketchema Peasants' Association | 56 | |
| | - Edola Peasants' Association | 100 | |
| | - Wondo Kosha Producers' Cooperative | 70 | |
| | - Shashena Producers' Cooperative | 42 | |
| ALEMAYA | - Matokoma Peasants' Association | 20 | 44.6 |
| | - Tinike Peasants' Association | 22 | |
| | - One Producers' Cooperative in Kersa (no name) | 44 | |
| | - Legambo Producers' Cooperative | 42 | |
| | - Chilalu Hundie Producers' Cooperative | 95 | |
| Average | | 60.2 | |

Source:
Own survey

¹⁾ The figures given by farmers on yields are not always reliable, because they were in many cases based on memory, as there were hardly any records kept by the farmers and cooperatives.

5. ECONOMIC AND SOCIOECONOMIC ASPECTS OF POTATO PRODUCTION

5.1 Land use

The land reform proclamation¹⁾ declared all agricultural land the common property of the Ethiopian people. It gave the tillers the inheritable right to the use of land. It organized the peasants in associations and established their collective responsibility for the wellbeing of all individuals within the area.

Land use structure is now either individual and common use in Peasants' Associations, or individual and common use in Producers' Cooperatives.

5.1.1 Use of individual and common land in Peasants' Associations

Each Peasants' Association can occupy an area up to 800 ha. The land is divided among the members of the Peasants' Association. The amount of land given to each member was discussed and decided on by the members of the Peasants' Association during the land distribution phase at the beginning of the revolution. The distribution was influenced by the characteristics of each particular Peasants' Association, e.g. amount of land taken for common use and land fertility. In some cases the peasants received the land which they had been cultivating for the now expelled landlord. It can be stated that there is a shortage of cultivated land for individual use, especially in Halletta and Alemaya areas (see Table 17)²⁾. The amount of land

1) For more detailed information, see chapter 2, page 15.

2) Information given by the interviewed farmers. Reasons for the shortage were seen in the fact that during the distribution phase the density of population in that specific area and its influence on the distribution was neglected. In some Peasants' Associations the cause of land shortage was seen in the law of succession. In these areas every male has a right to a piece of land once he becomes eighteen years old. These Peasants' Associations solved this problem by distributing more and more of the common land to individuals. One association mentioned that in the long run this problem could only be solved by transforming the Peasants' Associations into Producers' Cooperatives.

given to individual families is not big enough to support the needs of the families¹⁾. The average per family varies from 0.75 ha to 1 ha in Holetta area, from 0.50 ha to 5.00 ha in Awassa and from 0.80 ha to 1.00 ha in Alemaya area. The remaining land is used commonly by the members of the Peasants' Associations (see Table 17).

Table 17: Average size of land for individual and common use in Peasants' Associations for Holetta, Awassa and Alemaya

| Area | Land for individual use/ per family | Land for common use/ per P.A. |
|---------|-------------------------------------|-------------------------------|
| Holetta | 0.85 ha | 55.00 ha |
| Awassa | 1.60 ha | 41.00 ha |
| Alemaya | 0.87 ha | 227.00 ha |

Source: Own survey

The intensity of land use differs from region to region according to rainfall and availability of irrigation water. But for all three areas it can be stated that the intensity of land use is very low. The types of crops grown on individual and common land in Peasants' Associations differ from region to region depending on soil type, rainfall and the traditions of each particular region.

The planting of individual land serves partly for direct home consumption. In Holetta area mainly T'ef, wheat, barley and vegetables like potatoes, cabbage, beetroot, onions and pepper are grown.

In Awassa area mainly maize, barley, wheat, T'ef, ensete, coffee, sugarcane, sorghum and vegetables, such as potatoes, tomatoes, beetroot, carrots, cabbage and pepper are planted.

1) An average family has from 6 to 8 members.

In Alemaya area they grow maize, sorghum, barley, wheat, chat, and vegetables like potatoes, sweet potatoes, tomatoes, cabbage, and pepper.

Among the vegetables grown, the potato is one of the farmer's most favoured vegetables. It is grown in all three surveyed areas by every farm form, especially by the farmers on their individual land (see Table 18).

Table 18: Average percentage area of land occupied by potatoes¹⁾ on individual land in Holetta, Awassa and Alemaya

| Area | Average land for individual use/ per family | Land occupied by potatoes | Percentage land occupied by potatoes |
|---------|---|---------------------------|--------------------------------------|
| Holetta | 0.85 ha | 0.14 ha | 16.40 % |
| Awassa | 1.60 ha | 0.25 ha | 15.60 % |
| Alemaya | 0.87 ha | 0.25 ha | 28.00 % |

Source: Own survey

Potato cultivation on small plots gathered around the house is done partly for direct home consumption and partly for selling them in the market.

Table 19: Average percentage area of land occupied by potatoes on common land of Peasants' Associations in Holetta, Awassa and Alemaya

| Area | Total common land | Land occupied by potatoes | Percentage land occupied by potatoes |
|---------|-------------------|---------------------------|--------------------------------------|
| Holetta | 55.00 ha | 1.60 ha | 3.00 % |
| Awassa | 41.00 ha | 2.20 ha | 6.00 % |
| Alemaya | 227.00 ha | 2.90 ha | 1.00 % |

Source: Own survey

1) A quantitative comparison of potatoes with other vegetable crops was not possible.

In all three surveyed areas, cereals and ensete are grown mainly as subsistence crops, whereas coffe, sugarcane, chat and vegetables are mostly grown as cash crops.

Besides producing crops, most of the farmers also keep animals like cows, goats and hens for meat and milk or donkeys, horses and oxen for transport and ploughing.

5.1.2 Use of individual and common land in Producers' Cooperatives

The types of crops grown on common land and individual land (1000 - 2000 m²) of Producers' Cooperatives in Holetta, Awassa and Alemaya are the same as the ones mentioned in the previous section for the respective areas. No animals are kept on the common land of the Cooperatives. The oxen which are used for ploughing as well as the donkeys and horses which are used for transport are owned privately by the members of the Cooperatives.

The crops which are grown on the common land of Cooperatives are meant mainly for sale; among them is the potato.

Table 20: Average percentage area of land occupied by potatoes on common land of Producers' Cooperatives in Holetta, Awassa and Alemaya

| Area | Total land | Land occupied by potatoes | Percentage land occupied by potatoes |
|---------|------------|---------------------------|--------------------------------------|
| Holetta | 54.70 ha | 5.10 ha | 9.20 % |
| Awassa | 400.00 ha | 18.00 ha | 4.50 % |
| Alemaya | 344.70 ha | 1.90 ha | 0.55 % |

Source: Own survey

The percentage area of land occupied by potatoes on common land of Cooperatives is rather low. This is due to lack of seeds,

lack of water and disease problems. However, the members of some cooperatives are willing to increase the area of land occupied by potatoes if they get resistant seeds and enough water.

5.2 Labour structure

Potato production is a comparatively labour-intensive process. To evaluate the chances of expanding potato production in Moletta, Awassa and Alemaya areas, intensive research has to be done on the labour force situation in these specific areas.

Taking the family and household as the smallest economic unit of agrarian production - as labour force cannot be seen just as an economic input for production, but has to be seen in the socio-economic context as well - the work of the different family members: husband, wife, children has to be carefully evaluated. Who is doing what kind of work in order to reproduce the family unit? Which members are engaged in the cultivation of potatoes? How is the labour problem solved at peak times? In case potato production increases, who is to carry the load of added work? Will there be an increase of unpaid female work or will it give women an opportunity to earn money?

5.2.1 Family structure and domestic production¹⁾

The rural family in the areas observed can be described as follows: it has 6-8 family members²⁾, is organized in a Peasants' Association or a Producers' Cooperative, has between one and two ha individual land at its disposal, owns some animals and earns its living by planting and marketing some agrarian products.

The family members are engaged in different types of work. Tra-

1) Domestic production means the continuous work that has to be done in order to reproduce the family. It is more than pure housework. It covers also the cultivation of subsistence crops around the house and their preparation for the family's nutrition.

2) The number of children in the investigated families varied from two to nine. Most families have between four and six children.

ditionally the husband as the head of the family is responsible for managing most of the outside activities of the family. His main functions are: taking care of the whole family in the sense of securing their material existence, building and repairing the house, clearing new land, ploughing and other field activities. His wife is responsible for: all kinds of work centered around the home, like cleaning the house, fetching water, buying or collecting the fire wood, preparing and cooking the meals¹⁾, taking care of the garden around the house, small-scale trading to support family income²⁾, assisting the husband with planting, cultivating, harvesting etc., looking after the animals and taking care of the children. The children help their parents with different types of work in the house, on the field and with the care of animals. Since revolution more children are going to school, that means their manpower in the form of assisting work is decreasing.

5.2.2 Labour structure on individual land in Peasants' Associations and Producers' Cooperatives

The potential labour force in all three observed areas are the members of the family. Labour employed from outside during peak harvest times - since the revolution it is officially not allowed - was conceded only by very few associations.

The cultivation of individual land is linked more to subsistence production than the cultivation of common land is. It can be generally stated that all family members are engaged in cultivating the individual land. The kind of cultivation³⁾ done by the different family members is strongly influenced by traditional labour division.⁴⁾

- 1) Daily food preparation of wat, tea and coffee, is very labour intensive. Baking injera several times a week (see appendix p.200), processing spices, butter and cheese, and milling grain occupy a lot of time.
- 2) Quite a number of women have to walk a long distance to the markets, some every day, some once or twice a week. Babies are carried on the back.
- 3) See cropping system, chapter 4.2, page 62, and cultivation practices, chapter 4.5, page 69.
- 4) See chapter 5.2.1, page 93.

Except for ox ploughing, a male domain, all kinds of field work is done by women in Holetta and Awassa area, while in Alemaya moslem women - due to their tradition - generally do not work in the fields. Here they supply their husbands and sons, working in the field, with tea and food once or twice a day. Normally they are engaged in small marketing and housework.

For the observed associations and cooperatives it can be stated that in general availability of labour is not a limiting factor for expanding potato production. The problem can be seen in work organization. If work organization within the family were well planned, there would be sufficient labour for agricultural and other activities, like housework, small-scale trade, taking care of animals etc. With the present work organization there is no underemployed labour, neither male nor female, to fall back on.

5.2.3 Labour structure on common land in Peasants' Associations and Producers' Cooperatives

In Peasants' Associations and Producers' Cooperatives only the heads of the families, that means normally the husbands, are registered as members. Only in some exceptional cases, like widows, or in the very few really progressive Producers' Cooperatives, are women also entitled to become registered members. This practice affects the distribution of work credits for work on common land. In general the heads of the families are entitled to work on common land in Peasants' Associations and Producers' Cooperatives. Only during peak seasons are other members of the family asked to help on common land. Distributed working credits for the family-helpers - if given at all - are given to the head of the family¹⁾, the registered member. Women's Associations are used as a labour reservoir. They participate in weeding, watering the vegetables and seedlings, harvesting and transporting the

1) That means increased cash income will be at the man's disposal; women, despite their work, will remain economically dependent on him.

harvest to the store or market. As seasonal and unpaid labour¹⁾ they are not fully integrated and accepted workers and therefore also excluded from major decision-making within the Peasants' Associations and Producers' Cooperatives.

The number of working days on the common land in Peasants' Associations and Producers' Cooperatives depends on the constitution of the individual Association or Cooperative. In Peasants' Associations they generally work for one or two days per week²⁾. Both in Peasants' Associations and Producers' Cooperatives the members are organized in different working groups. Each group has a group leader. The group leaders are responsible for the organization and control of work in their groups. In case of Cooperatives the group leaders are also responsible for the evaluation of work performed by members of their groups. They evaluate the work by using the point method. A member gets one point whenever he works on the common land of a cooperative. He gets more points if he works longer than the given working time or during free time. The size of family is not considered in this system. Individual productivity and work performance are the only criteria. Payment for collected work points is usually in kind. But the more cash-oriented production is cultivated, the greater are the chances to receive payment in cash rather than in kind. This practice usually influences the family's food supply. While income in kind can satisfy immediate consumption, cash income integrates the families more into the money-market system with all its negative and positive effects, i.e. fluctuations of prices for staple food etc. At present in discussion is whether the cultivation of common land should develop more cash crop, while cultivation of individual land becomes more home consumption (subsistence production) oriented. A tendency to cash crop production on common land can be seen already.

1) To collect detailed figures about frequency and duration of additional unpaid family labour in order to judge its present extent and the increase of female workload turned out to be extremely difficult. It is not considered as work but more as granted help.

2) It depends on the size of common land and whether shifting rounds are organized.

Labour intensity on common land is not affected by this tendency. The average amount of common land is still small. It can be stated in general that available labour in Peasants' Associations and Producers' Cooperatives is sufficient to perform all the necessary common land agricultural operations. But again, as said already in the previous section, a well-planned work organization which fully integrated the female labour force, could ease bottlenecks during peak times. This would imply women having access to all kinds of agricultural preparations. Only in three Producers' Cooperatives in Holetta could it be observed that women were fully registered members with all rights and duties. But even here some differences were still observed. Potato production, which involves ox-ploughing two to three times, was a male preserve. This indicates that not all available labour can be activated according to need.

5.3 Financial resources

Family reproduction, the daily, continuous supply of a family with necessary food can be partly achieved by direct supply of cereals and vegetables from common and individual land in Peasants' Associations and Producers' Cooperatives. In addition to this, a certain supply with monetary income is necessary for survival. Nowadays, reproduction consisting only of values in kind, and subsistence production are no longer realistic. Clothing, medicine, school material are only a few of the necessary requirements that force people to obtain a cash income. Income flows of households have to be considered both under kind and cash aspects in order to evaluate the performance of potatoes as a possible source of better cash and/or kind income for Peasants' Associations and Producers' Cooperatives in general and for the individual family in particular.

5.3.1 Sources of income and expenditure of households

5.3.1.1 Rural households

In Holetta area T'ef is the food item on which most of the farm-

ers' income has to be spent. The families are forced to buy T'ef on the market, as individual land in this area is usually occupied by vegetables and the products from common land are mainly sold in nearby markets, including Addis Ababa. Expenditure for T'ef amounts to 30 - 50 birr¹⁾ a month, for vegetables 8 - 10 birr, of which about 3 birr are paid for potatoes. Usually, vegetables are bought together with potatoes once or twice a week. Of one or two birr spent on vegetables 0.50 birr go for potatoes. Compared with urban customers, the amount of vegetables and potatoes bought by rural customers is relatively small. Vegetables, including potatoes are considered as complementary food, high-priced potatoes even as luxury goods.

Table 21: Holetta: income - expenditure²⁾ (average household)

| Income source ³⁾ | | | Expenditure ⁴⁾ |
|--|--|---|---|
| in kind from individual land | by selling from individual land | by marketing other products | |
| potatoes onions other vegetables | vegetables (mostly potatoes, onions), cereals (T'ef, maize, barley), gesho ⁵⁾ | milk, eggs, homemade butter, cheese, butter trading | T'ef, vegetables (potatoes, beans, carrots, onions, coffee, salt, sugar, meat, clothing school material |

Source: Own survey

- 1) For an average family with 6-8 members.
- 2) This table does not claim to be complete. It only gives an impression of different income sources in Holetta according to interviews. Quantitative statements cannot be made.
- 3) Common land in peasants' associations and producers' cooperatives is certainly an income source in kind, but mostly in cash. The cash income is not passed over to individual families, but kept in reserve for investment in most cases. Therefore it is not listed here as any income source.
- 4) The order of specification indicates priority.
- 5) Gesho is used as ferment for the preparation of the Ethiopian liquors tella and arreki.

The interviewed families in Holetta area receive their income to a small extent in kind from individual land (subsistence production) and through small-scale selling from individual land in nearby markets¹⁾. This is done mostly by women. Beside products from individual land, these traders sell home-made butter and cheese or even buy and resell these products. The income is spent mainly on food items.

In Awassa area, ensete and maize are planted as staple food crops on almost each individual plot and are consumed. Yet, nearly every family has to buy additional maize and T'ef. Expenditure for maize amounts to 20 - 35 birr²⁾ per month per family and for T'ef 40 - 50 birr. If possible, T'ef will be substituted by maize, as this is much cheaper in this area. Expenditures for vegetables come to eight to ten birr per month. This figure includes 0.50 birr for potatoes, bought once or twice a week.

Table 22: Awassa: income - expenditure³⁾ (average household)

| Income source | | | Expenditure |
|------------------------------|---------------------------------|-----------------------------|-----------------|
| in kind from individual land | by selling from individual land | by marketing other products | |
| ensete | maize | butter | maize |
| maize | potatoes | cheese | T'ef |
| vegetables | coffee | tella | vegetables |
| potatoes | | arreki | - potatoes |
| T'ef | | | - cabbage |
| | | | coffee |
| | | | salt |
| | | | sugar |
| | | | spices |
| | | | oil |
| | | | clothing |
| | | | school material |
| <u>Source:</u> Own survey | | | |

1) See also chapter 6 on marketing aspects.

2) Estimated prices for 4-6 person households.

3) See footnotes 2,3,4 to Table 21, Holetta, page 98.

In Awassa area, selling potatoes contributes to a great extent to the family's income. While women sell small portions, e.g. one basket, which they carry themselves and split up in the market into little piles, men market bigger amounts, transporting them in sacks with donkeys or horsecarts to retailers¹⁾. The amount traded by women per week is up to 1/2 quintal, men trade on average one to two quintals per week.

In contrast to Holetta and Awassa areas, the Alemaya area was considerably affected by the drought. One interviewed cooperative was even enrolled in the government subsidized "food for work" programme, as all other income and food sources had dried up. Sons were sent to less affected areas, to support their families from there. Quite a number of women walked miles every day to collect wood and sell it, or to buy some vegetables in other villages and resell them in the markets or along the road in order to get cash. As the most stable income source for quite a number of families, the only chance was the marketing of chat²⁾. Due to the drought and lack of irrigation a number of families relied completely on cash income from daily small-scale trading in order to buy the necessary food. When earnings are low, vegetables and potatoes for personal consumption cannot be bought.

Table 23: Alemaya: income - expenditure³⁾ (average household)

| Income source | | | Expenditure | |
|------------------------------|---------------------------------|---|-------------|----------|
| in kind from individual land | by selling from individual land | by marketing other products (reselling) | | |
| sorghum | chat | potato-reselling | sorghum | |
| maize | | chat | maize | |
| | | wood | salt | |
| | | chicken | oil | |
| | | eggs | berbere | |
| | | sheep | abish | clothing |
| | | tea | tea | school- |
| | | milk | coffee | material |
| Source: Own survey | | | | |

1) See chapter 6 on marketing, page 114 pp.

2) Chat is a green leaf, chewed by most people in Haraghe Province. Consumed in high amounts, it is a habit-forming drug. It is also exported to Djibouti.

3) See footnote 2,3,4 of Table 21, Holetta, page 98.

So as not to decrease profit, women quite often prefer to resell potatoes and vegetables without taking any amount for personal consumption. There is a preference for marketing potatoes, as they are considered one of the most profitable trading crops. These potatoes are grown under irrigation or shipped to Alemaya area from areas not affected by drought. Animals, like sheep, are sold once a year, in order to finance school material or cloth. When chat prices go up, the profits are also used for these items rather than for buying vegetables or improved seed potatoes.

In those years where the interviewed families had been less affected by the drought, they drew income in kind from their individual land, especially from sorghum and maize, the area's staple foods. They store them inside their houses up to six months. But usually there is not enough to feed the entire family and additional sorghum and maize have to be bought in the market.

For the interviewed rural households in Holetta, Awassa and Alemaya areas, it can be stated that the money which is obtained by individual farmers from selling potatoes is normally spent for current home requirements, including food. No money is invested for the intensification of potato production or other crop production. The amount of money the individual farmer obtains by selling small amounts of potatoes is too little to suffice even for daily expenses.

Proceeds from potatoes planted on common land in Peasants' Associations are spent on investments for the entire association, such as water pumps, tractors, seed, fertilizers, constructing stores and cooperative shops.

This applies to the common land of Producers' Cooperatives as well. But here, the proceeds are divided up according to the law for Producers' Cooperatives.

5.3.1.2 Urban households¹⁾

The urban households differ in their income-expenditure structure from rural ones. A further difference exists between the capital Addis Ababa and the small town households in Awassa, Shashamene and Alemaya.

The majority of the city/town households do not cultivate individual land. Only in some cases small plots up to 500 m² (Shashamene) are owned and cultivated by citizens. The majority depend completely on purchasing foods. Most of the expenditure goes on T'ef. Vegetables and potatoes are bought to a much greater extent in urban areas, especially in Addis Ababa, than in rural areas.

Table 24: Addis Ababa: income - expenditure (average household)

| Income sources | | Expenditure |
|---|--|--|
| wage work | additional female work | |
| average monthly income of male worker birr 70,-/80,- | beverage selling food selling cotton spinning selling of gabi ²⁾ | T'ef vegetables potatoes meat, eggs milk wood, charcoal coffee sugar salt clothing school material rent electricity water |
| Source: Own survey | | |

1) The estimates given in this chapter are drawn from the interviewed Kebeles. They can only be considered as a very small section. These figures are not necessarily representative for Addis Ababa area. For a detailed analysis of a food budget, additional research has to be done.

2) Gabi is an Ethiopian cotton blanket worn by men and women against cold and rainy weather.

The average monthly income of a worker in Addis Ababa is 70.-/80.- birr. The minimum wage by law is 50.- birr per month¹⁾. Most of his monthly salary the worker spends on food. For T'ef, an average family needs about 50 kg per month, for which about 40 birr has to be paid. Workers' families substitute T'ef with maize, which is much cheaper. One quintal costs about 33 birr. 30 birr out of the food budget go for vegetables and about 12 birr for potatoes.

For wood and charcoal the families spend another 20 birr. Most of the wives improve their husbands' salary by small-scale selling.

In the towns of Awassa and Shashamene, as stated above, only few families can draw a small portion of their income from small plots up to 500 m² or little gardens around their houses. Like in Addis Ababa, the majority depends on purchasing their entire food supply. Husbands' income is normally supplemented by beverage and food selling, cotton spinning, fruit trading, and the preparation and selling of arreki and tella.

Table 25: Awassa/Shashamene: income - expenditure (average household)

| Income sources | | | Expenditure |
|---|--|---|--|
| wage work | additional female work | in kind from individual land | |
| average monthly income male worker ²⁾ around 50 birr | tella selling arreki " cotton spinning gabi selling | maize potatoes onions carrots cabbage tomatoes ensete | T'ef maize potatoes beans eggs, cheese milk, butter rent |

Source: Own survey

- 1) The upper income limit by law is 1,500.- birr. Traders' incomes are not affected by the income limit.
- 2) No exact figure can be given. But it is less than the average monthly income of a worker in Addis Ababa. Most probably close to the minimum wage per month required by law.

For Alemaya none of the interviewed households stated that they had a small plot, from which they got income in kind. Their main income basis is the husband's salary and small-scale trading by wives, mostly fruit, vegetables and spices.

Table 26: Alemaya: income - expenditure (average household)

| Income source | | Expenditure |
|--|--|---|
| wage work | additional female work | |
| average monthly income of male worker ¹⁾ around 50.- birr | fruit trading vegetable trading spices trading | T'ef sorghum bread vegetables potatoes eggs, milk oil rent |

Source: Own survey

5.3.2 Costs and returns of potato production²⁾

The costs of potato production vary from area to area depending on the intensity of different operations in the three areas, the different levels of inputs and the prevailing differences in costs of materials like seeds, fertilizers, etc.

1) See footnote 2 on page 103.

2) In addition to the analysis of the main economic factors of production, an attempt was made to collect some data from individual farms, Peasants' Associations and Producers' Cooperatives, which could give a general picture of the productivity as well as the profitability of potato production. The most acute problem was the availability of the required data. Most of the farms do not keep records of their farm activities due to lack of awareness or inability to write. The information given by them was based entirely on memory. Those farmers who keep records - for common land of Cooperatives and Peasants' Associations - keep either incomplete or not orderly records. None of them keeps routine farm records in a way necessary for an accurate analysis - i.e. arranging them according to types of crops, types of operations, different types of costs, etc. For this reason, the information from those farmers who do not keep records was determined by assuming that the costs incurred for different operations for potatoes are proportional to the amount of land which the potatoes occupy. (contd. on page 105 ...)

The highest costs of production are found in Alemaya, followed by Holetta and then Awassa (see Table 29).

The prevailing highest costs of production in Alemaya are essentially the result of the high costs of seed potatoes and the relatively intensive irrigation (due to drought) practised in this year.

Table 27: Average man-day required to produce 1 ha of potatoes in Holetta, Awassa and Alemaya

| Operation | Holetta | Awassa | Alemaya | Total average |
|-------------------------|------------|------------|------------|---------------|
| Ploughing/disking | 88 | 118 | 120 | 109 |
| Planting/fert.spreading | 19 | 33 | 30 | 27 |
| Cultivation/ridging | 94 | 100 | 96 | 97 |
| Irrigation | 20 | 12 | 40 | 24 |
| Spraying | - | - | - | - |
| Harvesting | 20 | 20 | 15 | 18 |
| Total | 266 | 283 | 301 | 283 |

Source: Own survey

- 2) (contd. from page 104) However the accuracy of this method is very limited, since the time and the amount of money needed to complete the same type of operation differ from crop to crop. For example, the time needed to plant 1 ha of potatoes is not the same as the time needed to plant 1 ha of maize. On the other hand, the amount of fertilizer needed for 1 ha of beans is not the same as the amount of fertilizer needed by 1 ha of potatoes, etc. In cases where the area occupied by potatoes was not known, one of the following methods were used:

- a) Estimating the area by asking the number of ox-days used to plough the land.

This method has three main sources of error:

- i. Different oxen have different ploughing performance;
- ii. Different farmers have different standards of skill of using oxen;
- iii. The ploughability of the soils differs from farm to farm.

- b) Estimating the area by the amount of seeds used.

This method has the following potential errors:

- i. The amount of seeds used per ha differs from farmer to farmer;
- ii. The size of seed tubers used differs from farmer to farmer.

In spite of all the disadvantages pointed out, these methods were used to determine the required information from farmers. As a check, the information was compared with known data from the vicinity. However, it should be borne in mind that the results obtained from the analysis should be regarded as being representative only for the year in which the research was conducted since the analysis was based only on data from one year (1979/80). The above-mentioned restrictions prevented a cost-benefit analysis.

Table 28: Level of inputs (material) per ha

| Material | Holetta | Awassa | Alemaya | Total average |
|-----------------|---------|--------|---------|---------------|
| Seeds (qt) | 8.6 | 11.3 | 8.1 | 9.3 |
| Fertilizer (kg) | 100.0 | 140.0 | 60.0 | 100.0 |
| Chemicals (l) | - | - | 0.2 | 0.0 |

Source: Own survey

Table 29: Average costs (in birr) of producing 1 ha of potatoes in Holetta, Awassa and Alemaya

| Operation | Holetta | Awassa | Alemaya | Total average |
|-----------------------------|---------|--------|---------|---------------|
| Ploughing/ disking | 230.00 | 236.00 | 240.00 | 235.00 |
| Seeds | 369.00 | 282.00 | 576.20 | 409.00 |
| Planting/ fert.spreading | 37.50 | 66.00 | 60.00 | 54.50 |
| Cultivation/ ridging | 189.00 | 200.00 | 192.00 | 193.67 |
| Irrigation | 40.00 | 25.00 | 80.00 | 48.00 |
| Fertilizer | 74.00 | 102.00 | 42.40 | 72.80 |
| Chemicals | - | - | 4.40 | 1.47 |
| Spraying | - | - | 2.50 | 0.83 |
| Interest | 9.50 | 0.34 | 1.40 | 3.75 |
| Harvesting | 40.00 | 40.00 | 30.00 | 36.67 |
| Total | 1003.75 | 951.00 | 1229.50 | 1056.02 |

Source: Own survey

The standard of yields of the three areas surveyed differ from one area to another and from farm to farm. Yields in all three areas are low.

This is the result of a number of factors¹⁾. Some of them are:

1) For detailed information see chapter 4.

- 1) The use of varieties of seeds which have low yields and weak resistance to pests and diseases.
- 2) The use of poor agronomic practices, such as
 - inadequate ploughing
 - inadequate time of planting
 - inadequate depth of seed holes
 - inadequate spacing between the rolls and within the rolls, etc.
- 3) Lack of proper plant protection measures for the control of serious pests and diseases.
- 4) Lack of using fertilizers.
- 5) Scarcity of water.

The highest yields are found in Awassa area (69 qt) followed by Holetta area (66.8 qt) and then Alemaya area (44.6 qt)¹⁾.

The yields in Awassa and Holetta are higher than the average for the country (53 qt), whereas Alemaya is lower.

The difference of yields observed in the three areas are due to ecological and economic factors. With the exception of its altitude, Awassa has the most suitable conditions for potato production. That is true for both ecological and economic factors²⁾:

- ecological factors
 - Awassa has more fertile soil than the other two areas - it has volcanic soil with suitable structure for potato production;
 - Awassa has the most suitable rainfall.

Although the highest yields (Table 30, 31 and 32) and lowest costs of production (Table 29) are found in Awassa, this area is the least profitable for potato production followed by Holetta. Alemaya area, where the yields are lowest (Table 30, 31, 32) and

1) See Tables 30, 31, 32.

2) See chapter 4.1, page 50 pp.

the costs of production are highest (Table 29), is the most profitable area for potato production. This is due to the relatively high prices which are found in Alemaya and Holetta areas respectively.

The prevailing high prices can be explained as being due to low production in Alemaya and Holetta areas and high market demand from Djibouti, Alemaya area and Addis Ababa respectively; whereas the low prices in Awassa are due to its unsuitable location with respect to big markets.

Table 30: Profitability of potato production in Holetta, Awassa and Alemaya by lowest prices

| | Holetta | Awassa | Alemaya | Total average |
|--------------------------------|---------|---------|---------|---------------|
| Yields per ha (qt) | 66.75 | 69.00 | 44.60 | 60.12 |
| Price per qt (birr) | 24.00 | 10.00 | 40.00 | 24.67 |
| Returns per ha (birr) | 1102.00 | 690.00 | 1784.00 | 1192.00 |
| Transport costs per ha (birr) | 1481.25 | 161.00 | 115.00 | 585.75 |
| Production costs per ha (birr) | 1003.75 | 951.00 | 1229.50 | 1061.42 |
| Total costs per ha (birr) | 1155.00 | 1112.00 | 1344.50 | 1203.83 |
| Profit per ha (birr) | -50.00 | -422.00 | +439.50 | -10.83 |

Source: Own survey

Table 31: Profitability of potato production in Holetta, Awassa and Alemaya by average prices

| | Holetta | Awassa | Alemaya | Total average |
|--------------------------------|---------|---------|----------|---------------|
| Yields per ha (qt) | 66.75 | 69.00 | 44.60 | 60.12 |
| Price per qt (birr) | 30.00 | 18.00 | 73.00 | 40.33 |
| Returns per ha (birr) | 2002.50 | 1242.00 | 3255.50 | 2166.67 |
| Transport costs per ha (birr) | 148.25 | 161.00 | 115.00 | 585.75 |
| Production costs per ha (birr) | 1003.75 | 951.00 | 1229.50 | 1061.42 |
| Total costs per ha (birr) | 1152.00 | 1112.00 | 1344.50 | 1203.83 |
| Profit per ha (birr) | +850.50 | +130.00 | +1911.00 | 963.83 |

Source: Own survey

Table 32: Profitability of potato production in Holetta, Awassa and Alemaya by highest prices

| | Holetta | Awassa | Alemaya | Total average |
|--------------------------------|----------|----------|----------|---------------|
| Yields per ha (qt) | 66.75 | 69.00 | 44.60 | 60.12 |
| Price per qt (birr) | 40.00 | 35.00 | 130.00 | 68.33 |
| Returns per ha (birr) | 2670.00 | 2415.00 | 5798.00 | 3627.67 |
| Transport costs per ha (birr) | 148.25 | 161.00 | 115.00 | 585.75 |
| Production costs per ha (birr) | 1003.75 | 951.00 | 1229.50 | 1061.42 |
| Total costs per ha (birr) | 1152.00 | 1112.00 | 1344.50 | 1203.83 |
| Profit per ha (birr) | +1518.00 | +1303.00 | +4453.50 | +2424.83 |

Source: Own survey

5.3.3 Credit programme for rural production

To improve the critical agricultural situation of the farmers in Ethiopia, the Ministry of Agriculture has started a programme of trying to give farmers all sorts of necessary help which could enable them to improve their farming activities.

One of the most important aids which the farmers get from the Ministry of Agriculture is credit. The credit is given to the farmers not in monetary form, but in material form, such as seeds, fertilizers, chemicals, etc. It is given in monetary form only when the material which the credit is intended for is not available from the store of the Ministry of Agriculture, e.g. machines, material for buildings, etc. This system of giving credits in material form has three main advantages:

- 1) It saves time for the farmer. Instead of having to look for such materials, the farmer gets them directly from the Ministry of Agriculture.
- 2) It ensures the right use of the credit, i.e. use for agricultural purposes and not others.
- 3) It increases the likelihood of paying back the credit, since the credit will be used only for productive purposes.

The channel used to give the farmers credit is through their organizations, i.e. through Peasants' Associations and Producers' Cooperatives respectively. The Peasants' Associations or Producers' Cooperatives make lists of all the items which are intended to be taken as credit and send them to the branch of the Ministry of Agriculture in the subdistrict (Wereda). There the credit commission people assess the contents of the order sent to them. Those items which are feasible are supplied to the organization concerned. If it is a Peasants' Association the individual farmers receive their credits from the Service Cooperative shop.

Table 33: Credits taken by Peasants' Associations and Cooperatives in 1979/80¹⁾

| Area | Name of Peasants' Association or Cooperative | Amount in birr |
|---------|--|----------------|
| HOLETTA | Higher Kebele (Addis Ababa) | 12,000 |
| | Dil Betigil Producers' Cooperative | 4,241 |
| | Gelgel Peasants' Association | 2,700 |
| | Elala Godju Producers' Cooperative | 2,200 |
| | Wolmera Choke Producers' Cooperative | 2,000 |
| AWASSA | Wondo Kosha Producers' Cooperative | 60,000 |
| | Producers' Cooperative | 32,000 |
| | Shamena Peasants' Association | 3,825 |
| ALEMAYA | Tinike Peasants' Association | 22,500 |

Source: Own survey

The credit itself is given on down payment basis. That means the farmer pays first 15 % of the value of the intended material and the remaining 85 % is given at credit. The credit is paid back with interest of 1 %.

The time within which the credit should be paid pack is not fixed. It is determined by the harvest time. However, the time can be prolonged, if it is proved by the extension people from the Mi-

1) This Table shows only the amount of credit taken by some Peasants' Associations and Producers' Cooperatives. Figures from other interviewed Peasants' Associations and Producers' Cooperatives were not available.

nistry of Agriculture that the farmer has not harvested enough to enable him to pay back all his credits. The same procedure is followed for credit for durable items (water pumps, tractors, lorries, etc.) taken by Peasants' Associations or Producers' Cooperatives. After every harvest the extension people go to assess the income of the farmer and decide how much credit should be paid back for that particular year.

However the farmers sometimes face problems of getting credits in time. This has three main reasons:

- a) shortage of the materials asked for,
- b) transport problems, and
- c) inefficiency of the distributors (credit officers).

All these factors have a negative impact on farming practice, because they delay farming activities, and a delay in any farming activity causes a reduction of yields.

6. MARKETING OF POTATOES

6.1 Introductory remarks

As a bridge between producers and consumers a country's marketing system plays an important role in the distribution and supply of food; especially of staple food. An efficient marketing system can promote agricultural production by giving the producers a sufficiently high farmgate price as an incentive to increase their output and by guaranteeing the consumers a sufficiently low retail price to make the item concerned a desired and competitive component of their diet.

This, of course, implies that the marketing margin, in other words the difference between farmgate and retail price, be as low as possible while remaining a fair remuneration for the various necessary services rendered during the marketing process. In the technical sense it also guarantees smooth physical transfer of the produce over time and space allowing only inevitable losses and depreciations to occur.

Correspondingly an inefficient marketing system, represented by too high a marketing margin, may impede the development of an agricultural sub-sector and hamper the introduction and acceptance of the goods concerned as a major food item.

In the case of Ethiopia the need was felt to investigate the presently existing marketing system for potatoes, to identify its technical and economic deficiencies and to suggest appropriate measures aimed at creating an efficient marketing system.

The marketing of potatoes, with which the following chapters deal exclusively, cannot be seen in isolation but as one segment of agricultural marketing.¹⁾ Thus, even though potatoes have a special position among other vegetables because of their bulkiness, perishability and other peculiarities, many of the findings

1) See also chapter 1.1.

of this research hold true for other vegetables as well.

Wherever in the following analysis the peculiarities of one of the three areas's marketing systems do not allow a general statement, they will be given special attention; otherwise it is assumed that the findings apply to all three marketing systems.

6.2 Present performance of the potato marketing system

6.2.1 Links in the marketing chain and their functions

The primary link in the marketing chain for agricultural products is the producer. In Ethiopia four different kinds of potato producers can be identified:

- Producers' Cooperatives¹⁾: Previously privately owned land has been united and potatoes are grown among other products on the common field. Members also have individual land up to 2000 sqm at their own disposal.
- Peasants' Associations²⁾: Members, apart from the work on their private land, plough a plot of common land and either share or invest the profits from the common land for development purposes.
- Urban Dwellers Associations (Kebeles): These are the urban equivalent of the rural Peasants' Associations. In these the members (in addition to their normal job) cultivate some common land.
- Private Farmers: Organized in Peasants' Associations they grow potatoes on their private land. If they are semi-subsistence oriented, they sell the amount exceeding their subsistence needs or, if they are market oriented, they sell the whole harvest, possibly keeping some potatoes for home consumption. This ap-

1) For the structure of Producers' Cooperatives, see chapter 2, page 19.

2) For the structure of Peasants' Associations, see chapter 2, page 16.

plies also to the individual land of farmers organized in Producers' Cooperatives.

A second link is the broker. He performs the auxiliary function of bringing the producer and the potential buyer together without acquiring title to the product or physically handling it. Where he is employed and payed by one wholesaler, he is in charge of the acquisition of new suppliers in order to ensure a steady flow of potatoes to the wholesaler. His function becomes important in off-seasons when produce is scarce and wholesalers compete for the farmers' harvests.

The third link to be identified is the wholesaler. His function is not merely buying from producers and selling to retailers but also the collection of potatoes within greater areas, the correction of short-term supply and demand fluctuations through storage and the channelling of the goods into the various outlets. In several cases he also deals with the production of seed potatoes. Besides ordinary wholesalers who figure as a bridge between farmer and retailer, there is the type of wholesaler who at the same time also acts as a commission agent or sales agent for other wholesalers and exporters.

Another link is the retailer who can be:

- Children or women who sell very marginal amounts and qualities in irregular places like in the streets or in front of their houses or farms.
- The retailer who regularly serves little streetcorner or local markets (gulets). His turnover and capital are generally too small to buy an entire quintal-sack of potatoes and therefore has to purchase fractions from large-scale retailers who also sell to small retailers.
- The retailer in well-established rural and urban markets who can be met in the same place every market day or even has his own stand. He sells from one quintal in 4-5 days up to one

quintal or more per market day when business is good.

The urban green-grocer selling all kinds of fruit and vegetables (among them potatoes) in solid houses or shops; usually to a limited clientele.

- The urban supermarkets with separate vegetable departments that serve the very restricted high-income segment of the population.



Small-scale selling in piles

All those different retailers supply different strata of the population and thus the quality and prices of potatoes, their presentation and the selling techniques applied vary considerably.

As potatoes are traded and distributed as a fresh and unprocessed vegetable, the processing function lies exclusively with the last link in the marketing chain, the final consumer. According

to size and demand the following consumers can be distinguished:

- Private households,
- Hotels and Restaurants,
- Public buyers like schools, hospitals, authorities, army, etc.,
- Food factories.

6.2.2 Marketing channels and major outlets

In this chapter the flow of potatoes within the three research areas will be traced to the major outlets, whose characteristics will also be described. A marketing channel is the sequence of intermediaries and markets through which goods pass from producer to consumer¹⁾.

6.2.2.1 Holetta and Addis Ababa area

The first research area presents a very complex marketing channel; the major outlet for the producing area around Holetta is the 46 km distant capital Addis Ababa with its approximately 1 million inhabitants.

Potatoes in the Holetta area are mainly harvested in September/October. This depends on the availability of irrigation water and the competitive position of potatoes compared to other food crops, if they are planted anti-cyclically so that they can be harvested in the off-season.

According to the type of producer, the potatoes are directed into different channels. Private farmers, who usually lack means of transport to send their crop to Addis Ababa, are not in a position to organize joint transport with neighbouring producers and depend on selling their harvest to local wholesalers. It used to be a common practice to sell the whole harvest before the potatoes were ripe to one wholesaler, who came to the field, esti-

1) FAO, Marketing Guide No. 1: "Marketing Problems and Improvement Programmes", 4th printing, 1975.

mated the yields, advanced some money, and, at harvest, organized the lifting, packing and transport, employing his own labourers. One producers' cooperative stated that they had obtained 3000 birr from one plot of land following this practice; this year, however, they obtained 6000 birr from the same plot, having taken over the marketing themselves.

With increasing marketing knowledge and growing problem awareness this practice is diminishing but still not abolished. The other choice farmers have is to lift and pack the potatoes themselves and transport them on donkeys to the road at least if their field is not accessible by truck. This practice is also very common for Peasants' Associations and Producers' Cooperatives that lack means of transport.

Especially in times when the demand for potatoes exceeds the supply, wholesalers send brokers to the producers to fix a verbal contract. This, in connection with some credit, advanced money and provision of sacks oblige the farmer to deliver the harvest to that particular wholesaler. Such a commitment keeps the producer from exploring other economic alternatives. The farmer who might urgently need cash for the purchase of farm implements, seeds for the new planting or for other purposes like medical care, etc. is, especially at harvest times, in the weaker bargaining position and will therefore accept the wholesalers' offer. Of course the broker makes offers that hardly reflect the real market situation; instead he will always pretend to have problems selling the potatoes at the price the producer demands.

Peasants' Associations and Producers' Cooperatives, provided that they have the means of transport and have been given some extension, are in a position to assume a greater part of the marketing activities themselves. They organize lifting, packing and transport to Addis Ababa themselves by assigning their members to that work. Donkeys are rented for 50 cents/sack from their members and road transport to Addis Ababa costs them 2 birr/sack on a rented truck. One cooperative stated that they took advantage

of the tractor and trailer they possess collectively with three neighbouring cooperatives and paid only 15 birr for 20 litres of diesel fuel and 10 birr for the driver.

Once they have shipped the potatoes to Addis, they will only be accepted in the central wholesale market in the 'Bernda' district by one of the two wholesalers/sales agents who have a monopoly for deliveries from areas in the vicinity of Addis Ababa. Another drawback facing the potential seller is that highly organized brokers and workers force them to take their 'services' so that they have to pay a brokerage fee for a very dubious service, nor can they do the unloading themselves. Farmers stated that they have to pay brokers 50 cents/quintal and 20 cents/quintal to the carriers.

The potatoes reach the retail level as soon as they are purchased at current prices from the wholesalers. As was outlined above, various types of retailers can be distinguished. In contrast to other areas, in the capital, Addis Ababa, all different types are represented. One group of large-scale retailers, apart from selling to the final consumer, has specialized in selling to smaller retailers whose turnover and capital is too small to buy an entire quintal of potatoes at one time. Such large-scale retailers are usually located near the wholesaler's stall or even rent some space on the wholesaler's compound for their operations. The retailers that serve Addis streetcorner and local markets (gulets) purchase the potatoes, as mentioned, from those intermediary wholesalers and carry it on foot or in a taxi to the city districts or suburbs. The quality of these potatoes is, in accordance with the purchasing power of their customers, medium to low.

A very important well-established market is the fruit and vegetable section of the central 'Mercato', the biggest open-air market in Africa. It is attended by retailers who have their own stand and pay a rental fee of 4 birr/month to the municipality. As their business is close to the two wholesalers, transport costs are only 1 birr/quintal per carrier.

The Addis greengrocers, whose number is estimated to be 700 to 800, also obtain their potatoes from the central wholesalers or commission agents. Potato quality is generally medium to high, according to the stratum of population supplied. Varying with the distance from 'Mercato', transport costs add up to 3 birr/q per taxi.

There only remain to be mentioned the supermarkets that serve only a negligible quantity of high-income customers, and the casual child or woman seller who handles marginal amounts of potatoes; possibly some that other retailers could not sell.

6.2.2.2 Awassa area

The greater the producer-consumer distance and the bigger the outlet, the more complex is the marketing channel. In Awassa there is a dual marketing system. One channel directs potatoes straight into Awassa town, the other via Shashamene to Addis Ababa. The less complex marketing channel consists of the potato farmers who bring their harvest twice a week to Awassa town, gather in one corner of the market and sell directly to the retailers that attend the market. From their farm they either take their own or a borrowed donkey, or jointly rent a pick-up car, which costs them according to distance and road conditions, around 2 birr/q. Within-market transport is performed on wheel barrows for which the retailer is charged 15 cents/q. The 10-15 retailers then sell to the town people by piling up heaps of potatoes. Most of them do not sell more than one quintal per market day and if they expect problems with the remaining potatoes towards the end of the market, they increase the weight of the piles and thereby attract new customers. The above findings also apply by and large to the nearby Shashamene market, which is attended by the same farmers.

As, not only at harvest times, the Awassa/Shashamene area cannot dispose of all their crops on those two local markets, producers also sell to the Shashamene wholesalers. These collect the potatoes directly from the farmers' fields; the farmers pack the

tubers into extra-large sacks that weigh up to 1.7 q. The full truck, provided the expected demand for potatoes is sufficient, is then directed to Addis Ababa to the wholesaler or sales agent who has specialized in receiving potatoes from areas remote from Addis Ababa. A dual buying technique is applied: If the wholesaler is expecting the price of potatoes to rise within the very near future, he will buy the whole truck-load on the spot and remit the money some days later to the Shashamene wholesaler. If he expects the price to drop, he will merely act as the wholesaler's sales agent leaving him the price risk and the risk of spoilage. The money gained for the truck load will be remitted when the commodity is sold. As a commission fee, for the use of storage capacity and for the unloading of the truck, the wholesaler has to pay 2.50 birr/q. He also bears the transport costs, which consist of two components. First of all the Ketana office¹⁾ charges, a fixed tariff for the distance covered on roads that are under the administration of the highway authority. In addition to that, a payment has to be made to the owner of the truck for the collection of potatoes from the farmers' fields and as a compensation for the unrealistically low official tariff. While the Ketana tariff is 3.40 birr/sack, the additional payment amounts to 4.75 birr/sack according to distance to farmers, number of farmers and road conditions. Even though not officially confirmed, there is a strong belief that bribes have to be paid to the Ketana clerks before a truck is obtained.

Once the load has arrived in Addis Ababa, potatoes reach the retailers level as described for the Holetta and Addis Ababa areas.

6.2.2.3 Alemaya area

The design of the marketing channels in the Alemaya area is dominated by the very important outlet of Djibouti; however, there is also one marketing channel reaching the urban consumers though of minor importance.

1) Ketana is the regional office of the Ministry of Transport which administers and assigns privately owned trucks.

As distance to the market and population are again very small, the marketing of potatoes in this area is very simply structured, involving few or no intermediaries. For example, the local Alemaya market is served either by the private farmers' wives, who sell potatoes from their private land to gain some cash family income or by some female traders, who buy potatoes directly on the farm, carry them to the market and subsequently sell them. This has gained particular importance, as at the moment a severe drought is affecting the harvest forcing the women to contribute to the family income by assuming some trading activities. There is, perhaps, some money to be spent for taxi transportation, provided there is a taxi service connecting Alemaya with the area of production. There are also four retailers in Alemaya that are supplied directly from the farmers and sell to large-scale buyers like hotels, hospitals, army canteens, etc.

The second marketing channel to Djibouti is in turn very complex. The Alemaya wholesalers or commission agents collect potatoes in the wider Alemaya area with the help of some brokers and forward them to the Dire Dawa exporters. These collect the produce from various wholesalers or commission agents in different potato growing areas like Alemaya, Kombolscha, Kersa etc. At the bidding of agents working for the Djibouti importers they load potatoes and other vegetables on to the train to Djibouti every Monday to arrive there just in time for the week's main market.

In order to indicate the income and foreign exchange relevance of potato exports, the latest figures of the tonnage shipped to Djibouti by the 17 official Dire Dawa exporters are given:

| | |
|------------|----------|
| Jan. 1980: | 205.9 to |
| Feb. 1980: | 224.2 to |
| Mar. 1980: | 267.2 to |
| Apr. 1980: | 208.1 to |

6.2.3 Technical aspect of potato marketing

Even though a technical aspect is distinguished from the economic aspect of potato production, it should be kept in mind that technical inefficiencies and bottlenecks always have economic consequences, inasmuch as they influence the level and structure of marketing costs. Technical aspects, therefore, are not totally non-economic but rather deal with findings concerning the physical transfer of potatoes over space and time.

6.2.3.1 Transport

The physical transfer of potatoes over space involves the functions of transport, packing, handling and storage.

The basic problem with regard to transportation is the availability of means of transport, especially during the main harvest times, when a great stress is put on a nation's transport system.

At the grass roots level, for the private farmer, for Peasants' Associations and Producers' Cooperatives restricted availability of means of transport consists of a lack of donkeys to carry the crop to the main roads or to the market places. At a higher level it means that farmers cannot dispose of their harvest in time, because all the trucks administered by the Ketana office are being used elsewhere and they have to wait for their turn. A major drawback, as far as access to transport capacity is concerned, is that trucks will only be rented to them if they hold a valid trading license. Thus private farmers, Peasants' Associations and Producers' Cooperatives cannot negotiate directly with the Ketana. Instead they have to apply for transport services through the local extension office. Once this very bureaucratic process, which hinders the producers from organizing the transport themselves, has been gone through, an additional freight rate, besides the official Ketana tariff, has to be negotiated in a process in which producers are certainly in the weaker, dependent position. They have to dispose of their crop quickly, because otherwise they would suffer financial losses, whereas the truck

owner can refuse transport without suffering any losses, as there is plenty of demand for his services.

In this manner rates are achieved that are considered exploitative by the producers.

As to the roads connecting main roads and potato fields, it can be said that they are generally in very bad condition, narrow and winding, making access to the fields often difficult or impossible for bigger, more profitable trucks, or at least retarding the transport operations unnecessarily. Of course, this is reflected in the payment the truck owners demand.

Access to the Addis Ababa central markets was observed to be hindered by narrow, unpaved roads frequented by small traders, customers and cattle and also by inadequate loading and unloading facilities, making the delivery of goods an unnecessarily long-lasting and inefficient operation. Better utilization of means of transport, through night-time transport and handling, is hampered by bad, unsafe road conditions and the impossibility of unloading at night.

6.2.3.2 Packing and handling

In Ethiopia potatoes are traded in sacks that weight from 50 kg up to 1.7 q, the latter being the sacks with extra tops. While the half-quintal sack can just be lifted and moved by one man, at least two or three men are necessary to handle the very big sacks. Questioned why they supply farmers with the very big sacks or make them use those, traders stated that they are forced to do so, because truck owners charge them according to the number of sacks instead of their weight. Yet it has been observed that traders, even though they like to receive big sacks, refill the extra potatoes into new sacks, weighing 1 q, before they forward them. Another problem the excessive weight of the sacks imposes is that retailers are forced to buy great quantities of potatoes often exceeding the amount they can sell within reasonable time. Of course, overfilled and excessively heavy sacks, in



Overfilled sacks with extra tops



Potato traders in
Awassa area

connection with careless handling during the loading and unloading processes, aggravate the spoilage problem.

The number of packing/repacking and loading/unloading operations, apart from causing costs lead to a deterioration of the produce itself; therefore it is proposed that those operations be reduced to a minimum. At present this is not being done.

Wholesalers who provide the producers with sacks, in order to retrieve their sacks and to take advantage of the excess weight, repack them into the next wholesaler's sacks instead of having one single sack through the whole marketing process. This practice is also performed because no agreement about grading and standardization of produce exists between producer and buyer. If the trader has to deliver a certain high quality he has to do the grading and screening operations himself.

6.2.3.3 Storage

The storage of food crops becomes important when delays in the rapid flow from the producer to the consumer have to be bridged, either for speculative reasons or in order to build up food reserves.

Neither at the farm level, nor in the trading sector, nor among consumers, was storing for the last two purposes observed to a great extent; short-term potato storage (up to 2 weeks) was practised by wholesalers as well as larger retailers. Generally it can be asserted that no specially created storage facilities exist and that, at present, potatoes are stored inadequately either in loose form directly on the ground or in sacks. These are often kept in rather warm places, are sometimes exposed to direct sunlight and rain, and usually several sacks are put on top of each other.

The losses that occur during the marketing process as a result of inadequate storage can hardly be expressed in exact figures;

certainly they increase marketing costs.

Medium-term storage of potatoes, in order to take advantage of price fluctuations, either for speculative purposes or to even out greater imbalances in supply and demand, is again prevented by lack of knowing how to build appropriate facilities in conjunction with the traders' uncertainty about the economic benefits of storage and consequently their hesitation to invest money in it.

As perishables, potatoes are - in contrast to durable food items like grains - not suitable for building up long-term food reserves in order to ensure a nation's food supply during shortages.

6.2.4 Economic aspects of potato marketing

6.2.4.1 Market fluctuations

Market instabilities find their most obvious expression in fluctuating prices for the goods concerned. But the prices themselves merely reflect long, medium or short-term changes in the supply and/or demand side of the market. The causes of supply and demand shifts for potatoes in Ethiopia will be outlined here.

6.2.4.1.1. Determinants of supply

Because of their water requirements during the growing cycle, potatoes can only be grown under rainfed conditions during the rainy seasons and during almost the whole year on irrigated land. As most of the potato producers have neither any irrigation facilities nor access to irrigation water, the main harvest time for potatoes is determined by the prevailing weather conditions, upon which all farmers in the potato growing area depend. Thus there is a relatively short period of time when all the farmers try to bring in and sell their harvest and thus glut the markets and impose a high demand on limited marketing facilities (e.g. transport). Only farmers growing potatoes anti-cyclically on irrigated land can do their business in the off-season and enjoy higher prices and efficient transport.

A sudden non-arrival of rain, even if it does not prevent harvesting, leads to low yields and consequently to a lower supply on the market. Exactly this situation was found by the research group in the Alemaya area where, because of a severe drought, either the planted potatoes failed to sprout or yields were confined to hand-irrigated plots of land.

Apart from supply fluctuations due to weather conditions, there can also be economic reasons for changes in the supply of potatoes. The long-term farmgate price level is perceived by the producers as an incentive or disincentive for potato cultivation. The economic position potatoes assume compared to competitive crops also determines supply. If the cultivation of other crops results in higher rewards, producers will in the long run switch to those crops - and vice versa. This, apart from soil suitability etc., is one reason for preferring chat, rather than vegetable, production in the Alemaya area.

6.2.4.1.2 Determinants of demand

In contrast to supply, the need for potatoes as such remains fairly stable over the year because they can be consumed in a wide range of different dishes.

Only during the Easter fasting days, when the Christian part of the population is not allowed to eat any meat, do potatoes become a very important substitute in the diet for those days and consequently the demand rises.

On the micro level, i.e. the isolated decision of the single household whether to buy potatoes or a substitute, probably the most important fact is the prevailing retail price level. The higher the price level the more consumers are inclined to devote their limited financial resources to competitive goods, but low prices increasingly encourage further income strata of the population to afford potatoes.

6.2.4.1.3 Price fluctuations

As a direct consequence of departures from the supply and demand equilibrium, price instabilities develop. These can be of erratic, cyclical or trend-following nature.

As to the erratic price fluctuations, it can be said that they develop mostly because of unforeseen short-term incidents and that their impact does not persist for a longer period of time. Among causes can be large-scale purchases of various powerful demanders, the non-appearance of a major delivery, etc. Retailers from the Awassa market reported that the price of potatoes went up after some Shashamene wholesalers came and provided themselves with greater quantities thus causing market disturbances to the consumers' disadvantage. The impact of sudden bad weather or a drought which destroys the crop entirely or in part has admittedly longer lasting, yet diminishing effects on the price level.

These erratic price instabilities can usually not be clearly isolated and pointed out in a price-graph that shows only the average monthly retail prices of one area.

Cyclical price fluctuations that influence the price level in the medium term can be caused by periodical appearances of surpluses or scarcities as determined by main harvest times, for the goods concerned and also those for competitive commodities as well as by periods of high demand like the fasting days. The monthly average retail price curves for one kg of potatoes in Addis Ababa from 1974 until 1980 show very clearly the occurrence of cyclical price fluctuations with the highest peaks around March; prices then decline to a low (June, July) before they reach a second minor peak around August/September and drop again slightly before the relatively steady rise to the March peak sets in (see Fig. 2, page 131).

The Alemaya average wholesale price-curves for one kg of the varieties 'Sabuneh' and 'Bongor' could only be traced back for one year. They show the peaks in March and April, and the lows in

the months September to December coinciding with the main harvest times and the off-season for potatoes in that area (see Fig. 3, page 132).

Factors that determine the long-term instabilities or trends can be among others, structural surpluses or scarcities, shifting to more profitable crops or substantial changes in the consumers' income or preferences.

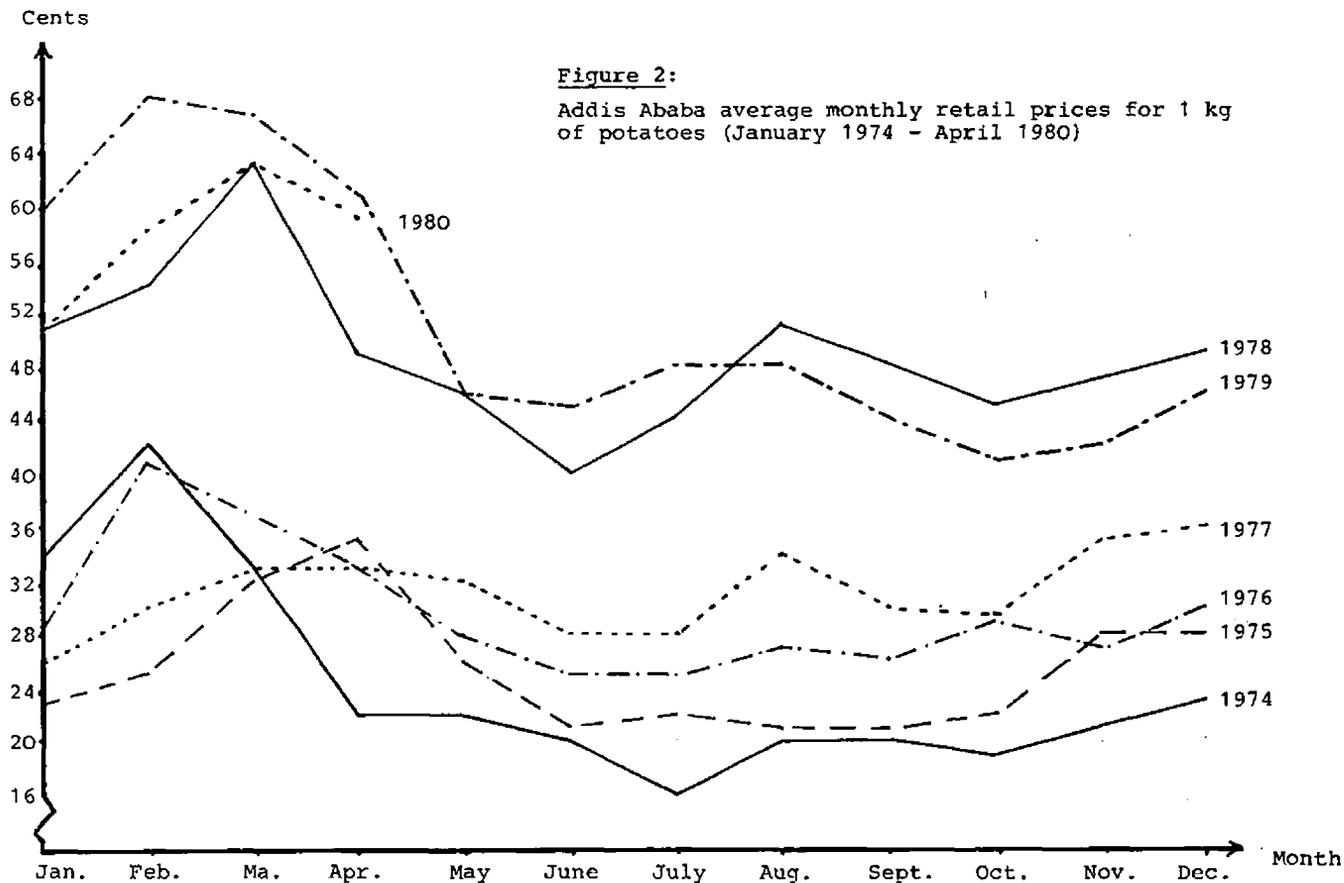
Apart from price fluctuations, the current price of any commodity also has a rather stable range which is known as the general price level. Due to the high and steady demand from the Djibouti outlet with its capacity to accept high consumer prices, the general price level for potatoes in the Alemaya area is higher by far than in the other research areas. In the Awassa area, however, the stable price range is much smaller because this area supplies a very narrow local market and, as far as the supply of the Addis Ababa market is concerned, is in competition with other potato growing areas. The same applies to the Holetta area even though it is, because of its nearness to Addis Ababa and consequently low marketing costs, a privileged supply area, whereas remote places like Awassa can rather be interpreted as additional cultivation areas to satisfy the urban demand.

6.2.4.2 Market deficiencies

Market deficiencies will be understood as factors that keep the marketing system from reaching highest economic efficiency.

6.2.4.2.1 Marketing information, market transparency

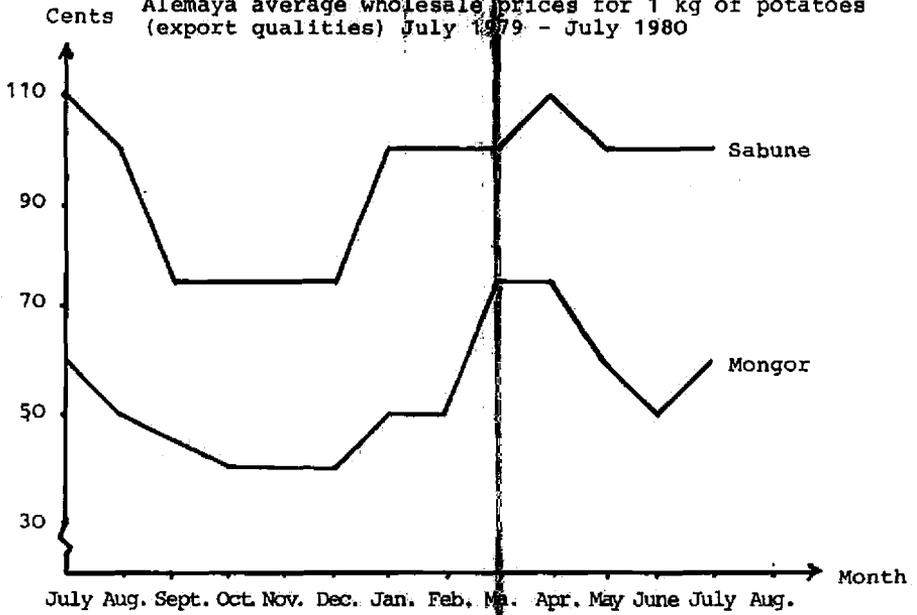
In general it can be said that the potato producers lack the necessary marketing information and market transparency. The private farmers, engaged in the work on their fields usually, but above all at harvest times, do not have the time and do not want to spend the fare to collect information about prices and conditions for which they can sell their crop in town. So unless they are informed by relatives, friends or neighbours they often carry



Source: Own survey

Figure 3:

Alemaya average wholesale prices for 1 kg of potatoes
(export qualities) July 1979 - July 1980



Source: Own survey

their produce to the market without having the slightest idea of what to expect. This, of course, provided the wholesaler is also willing to do business directly with them without involving a broker. In the contrary case the free-lance or employed broker takes advantage of the producers' ignorance and offers them low farm-gate prices that do not reflect the real market situation. Slightly better off are Peasants' Associations and Producers' Co-operatives that are beginning to set up marketing committees, but unless some committee members are set free to investigate the market, they are also subject to brokers cheating. The advice they receive from the Ministry of Agriculture Extension, Programming and Implementation Department, refers mainly to mere production techniques; whereas there is hardly any marketing extension beyond encouragement to found marketing committees and maybe information about the level of farm-gate prices of potatoes the extension service adviser has experienced while visiting other farmers. No advice has been given so far on such very important topics as standardization of produce and packages; nor on marketing techniques for perishables including storage.

As brokers seem to have divided among themselves the areas in which they are going to contact farmers, one producer is hardly ever visited by more than one broker; thus he cannot get better market transparency by comparing various offers. It has already been shown that brokers also apply various techniques to bind the farmer, such as credit, advancement of money, provision of sacks, etc.

There are no public media, such as rural radio stations, newspapers or the like that might inform producers and consumers about current farm-gate and retail prices.

Under the essential condition that they really work in the farmers' interest, are farmer-controlled and government-licensed, initiatives like the foundation of a market regulating 'Service Cooperative' are to be welcomed. The purposes they should serve are to inform cultivators about current prices, to supervise the

weighing of the delivery in the wholesaler's stall and to promote the abolition of the cheating practices that producers are still exposed to. For those operations, a fee of 1 cent per kilo of produce - as experienced in Alemaya - seems justified.

6.2.4.2.2 Competition

The intensity of competition encountered on one market depends, among other factors, on the number of participants, the existence of collusion and barriers to entry.

It has been observed that the intensity of competition, on the wholesaler's level, in all three research areas is very limited, if it exists at all. The Addis Ababa wholesale market for potatoes is dominated by two privately owned wholesale institutions that have, in addition, made agreements on the division of the market supply areas, thus being clear monopolists. One of them concentrates on the areas within a certain radius around Addis Ababa, the other one on the contrary receives potatoes from remote growing areas like Awassa, Shashamene, Wondo Guenet, Wolayta, Gamo Gofa, etc. Well-informed sources reported that the wholesalers meet every morning and, on the basis of the delivered quantities, agree upon the current price or a certain price margin, thus clearly practising collusion.

The barriers to entry into that market are extremely high, even insurmountable. First of all, on the whole market there do not seem to be any unused facilities at the potential newcomer's disposition; secondly, greater amounts of starting capital would be necessary to set up a new business, probably demanding outside capital; and thirdly, the 'market insider', already colluding would be disposed against such an initiative and there is wide scope for special pricing policies at their disposition to let the newcomer's business fail.

The about 10-15 Shashamene wholesalers are also reported to collude and to cooperate as far as the determination of farm-gate

prices are concerned, but they, once they send potatoes to Addis Ababa, also face the wholesalers' monopsonistic power. The Alemaya wholesalers even though they can, in cooperation with the local 'Service Cooperative', determine the current prices, are still exposed to the oligopsonistic power of the 17 licensed exporters in Dire Dawa. To all potential newcomers applies that, besides the knowledge a delicate and risky business like the marketing of perishables requires, without relations, without being members of the market-dominating ethnic group and neither having the high starting capital nor the technical marketing facilities, it is extremely difficult or impossible to gain entry to those markets.

The retail level is, on the contrary, characterized by higher intensity of competition. Even though it cannot be excluded that e.g. one potato selling greengrocer takes advantage of the favourable location of his shop and thus claims an area-monopoly enabling him to charge higher prices, it can be generalized that the number of retailers supplying a certain area is too high to allow complete collusion. (E.g. the number of small potato retailers on the various Addis Ababa markets is large; in Awassa about 20 attended the market, in Alemaya about 10.) Yet it has been observed that, towards the end of the market, they heavily compete with each other to dispose of their goods by adding more potatoes to their piles. The lower the level and the quantity sold, the easier it is to become a retailer as the required starting capital and marketing knowledge are not high. A very severe constraint however is the number of stalls available, the space on the already crowded markets and a probably hostile attitude of 'market insiders' towards newcomers.

6.2.4.3 Marketing costs and margins

If we ignore the practice where farmers sell the entire harvest from one field to the wholesaler, the following marketing activities are accomplished on the farm:

- digging of the potatoes (I)

- packing them into sacks (II)
- transportation to the gathering point (III)

If in addition to this producers perform the transport to the wholesaler's stall:

- loading of the truck or trailer (IV)
- transport to the wholesalers (V)
- unloading (VI)

Because of the great differences between and within the research areas as far as marketing activities, costs and margins are concerned, a calculation considering all different features cannot be given and would rather lead to the confusion of the reader. Instead, a depiction of one rather typical and average case in each area will be put forward. The figures stated hereafter and the results determined cannot be considered representative for the whole year but only for the time the research was conducted (May to August 1980).

The direct variable marketing costs of the average Holetta potato producer that accomplishes five out of the six marketing activities add to the pure production costs (14.44 birr/q; Table 34) with 3.73 birr/q, consisting of digging, packing and loading costs (0.83 birr/q), transport costs to Addis Ababa (2 birr/q) on a truck or tractor, brokerage fee (0.50 birr/q), unloading (0.20 birr/q) and 'storage' in wholesaler's stall (0.20 birr/q). From the wholesaler they receive a payment averaging 25 birr/q. The retailers buy one quintal for at least 30 birr and sell it for 35 birr ('Mercato' average) to 60 birr (average greengrocers price in Addis Ababa district). As in this case the local wholesaler does not have to bear any transport costs, his costs mainly consist of fixed costs like rent (530 birr/month), trading license (5 birr/month) and the labour cost for permanent workers. The Addis wholesalers were reluctant to answer any questions regarding costs and prices and therefore these can only be estimated on the basis of a supposed monthly turnover of at least 6000 q. They amount to 0.50 birr/q at the very maximum.

The retailers located at 'Mercato' pay 1 birr/q for on-market transport. Their fixed monthly expenditures are approximately 5 birr for the trading license, a rent of 4 birr for the stand and 70 birr as a remuneration for their labour. They distribute among all vegetables traded. Assuming that potatoes make up a maximum of 40 % of their business and the monthly turnover be 15 q, 2.11 birr/q would add as proportional fixed marketing costs, thus totalling their potato marketing costs 3.11 birr/q.

The typical and average urban greengrocer, assuming that his transport cost for potatoes average 2 birr/q and proportional fixed marketing costs to 2.76 birr/q totalling 4.76 birr/q. (Assumptions: license 5 birr/month, rent 32 birr/month, own and (two) employed labour 170 birr/month, potatoes share max. 20 %, and monthly turnover of at least 15 q).

Table No. 34:

Marketing costs and margins (Addis Ababa)

The following table summarizes all the figures stated above:

| | Birr/q | Birr/q | of retail ^o price | | of wh. ^o price | | of prod. ^o costs | | of net fg. ^o price | |
|-----------------------------|------------------|-------------------|------------------------------|-------------------|---------------------------|-----------|-----------------------------|-----------|-------------------------------|-----------|
| Production costs | 14.44 | 14.44 | 41.2 | 24.1 | 48.1 | | 100 | | 57.7 | |
| Farmers marketing costs | 3.73 | 3.73 | 11 | 6.2 | 12.4 | | 25.8 | | 14.9 | |
| (Transport) | (2.20) | (2.20) | (6) | (3.7) | (7.3) | | (15.2) | | (8.8) | |
| Farmers net return | 6.83 | 6.83 | 19.5 | 11.4 | 22.7 | | 47.3 | | 27.3 | |
| net farm gate price | 25.00 | 25.00 | 71 | 41.7 | 83.3 | | 173.1 | | 100 | |
| Wholesalers marketing costs | 0.50 | 0.50 | 1.4 | 0.5 | 1.7 | | | | | |
| Wholesalers net return | 4.50 | 4.50 | 12.8 | 7.5 | 15 | | | | | |
| Wholesalers price | 30.00 | 30.00 | 85.7 | 50 | 100 | | 207.7 | | 120 | |
| Retailers marketing costs | 3.11 | 4.76 | 8.9 | 5.1 | | | | | | |
| (Transport) | (1.00) | (2.00) | (2.9) | (1.7) | | | | | | |
| Net return to retailer | 1.89 | 25.74 | 5.4 | 3.1 | | | | | | |
| Retail price | 35.00 | 60.00 | 100 | | 116.6 | 200 | 242.4 | 415.5 | 140 | 240 |
| | Mercato retailer | City green grocer | Mercato retailer | City green grocer | Mercato to | City g.g. | Mercato | City g.g. | Mercato | City g.g. |
| Marketing margin | 10 | 35 | | | | | | | | |

Source: Own survey

For the Awassa research area two main cases will be considered:
First: the producer takes his potatoes to the local market.
Second: the producer has the potatoes picked up by the wholesaler, who ships them to Addis Ababa.

First case: The farmer's marketing costs for the Awassa local market amount to 3.55 birr/q, consisting of digging, packing, on-farm transportation costs and costs for market attendance, as well as of transportation costs on a pick-up truck (2 birr/q). The selling price to the retailer was 13 birr/q. On-market transport costs to be borne by the potato retailer 0.15 birr/q and 0.50 birr/q brokerage fee plus proportional fixed costs of the retailer 0.20 birr/q summing up to 0.85 birr/q total retailers marketing costs. The retail price averaging 19.6 birr/q.

Second case: Farmer bears digging, packing and transport costs to gathering point, which are 1.05 birr/q. For a big sack of potatoes (average weight assumed to be 1.6 q) the wholesaler pays an average of 12 birr (= 8 birr/q) to the producer. This price in reality of course depends on the distance to the farmer's field; the farther he lives off the main road, the lower the wholesaler's offer. The wholesaler bears the transport costs for the collection of potatoes by paying an additional sum of money to the truck owner and apart from that for the shipment to Addis Ababa (Ketana official rate: 3.40 birr/q plus average additional payment to the truck owner: 4.75 birr/q) plus a brokerage fee of 0.25 birr/q, plus local tax 0.5 birr/q; variable costs are 8.90 birr/q. Taking into consideration the fee of the Addis Ababa wholesaler or sales agent (2.50 birr/q) that he will be taking off from the final remittance, the variable marketing costs total 11.4 birr/q, proportional fixed costs again assumed to be 0.5 birr/q at the very maximum, the total direct marketing costs amount to 11.9 birr/q. The current price he obtains on the Addis Ababa market will - as in the above example - be at least 25 birr/q.

Table No. 35: Marketing costs and margins (Awassa area)

| | birr/q | % of ret. price |
|---------------------------|------------------|-----------------|
| <u>First case:</u> | | |
| Production costs | 15,2 | |
| Farmers marketing costs | 3.55 | 18.1 |
| Net farm gate price | 13.00 | 66.3 |
| Retailers marketing costs | 0.85 | 4.3 |
| Net return to retailer | 5.15 | 26.2 |
| Retail price | 19.6 | 100 |
| <u>Source:</u> | | |
| Own survey | Marketing margin | 4.4 |

Second case:

| | birr/ | birr/q | of ret. ^a .pr. | of ret. ^a .pr. |
|---|------------------|-------------------|---------------------------|---------------------------|
| Production costs | 15.2 | | | |
| Farmers Marketing costs | 1.05 | | | |
| Net farm gate price | 8.00 | | 22.9 | 13.3 |
| Shashamene wholesalers marketing costs | 11.4 | | 32.6 | 19.0 |
| ↑ whole salers net return | 5.6 | | 16 | 9.3 |
| Selling price to Addis sales agent | 25.- | | 71 | 41.7 |
| Addis wholesaler/sales agents marketing costs | 0.5 | | 1.4 | 0.8 |
| Wholesalers net return | 4.5 | | 12.8 | 7.5 |
| Wholesale price | 30.0 | 30.0 | 85.7 | 50 |
| Retailers marketing costs | 3.11 | 4.76 | 8.9 | 5.1 |
| Net return to retailer | 1.89 | 25.74 | 5.4 | 3.1 |
| Retail price | 35.00 | 60.00 | 100 | 100 |
| | Mercato retailer | City Green Grocer | Mercato | City Green Grocer |
| Marketing margin | 27.00 | 52.00 | | |

Source: Own survey

For the Alemaya research area also the two main cases will be considered:

First: The farmer's wife sells small amounts of potatoes on the local market.

Second: Producer sells high-quality potatoes to local wholesaler or commission agent to be finally exported to Djibouti.

First case: The farmer bears the costs of digging and packing. His wife carries the potatoes on foot to the local market, where she receives 45 birr/q for medium quality. Their total marketing costs will be 0.68 birr/q for digging, packing and 0.20 birr/q for transport and market attendance. Total 0.88 birr/q.

Second case: The producer bears the marketing costs of digging, packing, loading and the transport to the wholesaler or commission agent's stall. Digging, packing and loading/unloading 1.35 birr/q, transport, medium distance on a pick-up truck 2 birr/q plus 1 cent per kilo of produce as a fee to the local 'Service Cooperative' = 1 birr/q total farmers marketing costs: 4.35 birr/q. For the variety Sabuneh he receives 100 birr and for Bongor 60 birr/q.

The wholesaler or commission agent receives a commission of 5 % to 10 % of the value of the entire potato-load he sends to Dire Dawa (7.5 and 4.5 birr/q respectively). He has to bear loading costs of 1 birr/q and a brokerage fee of 0.25 birr/q and proportional fixed costs of 1.5 birr/q (assumptions: rent 10 birr/month, licenses 10 birr/month, own and employed labour 140 birr/month, potatoes 80 q). Total of 2.75 birr/q marketing costs. The next link, the Dire Dawa exporter has to bear the transport costs from Alemaya to Dire Dawa and from Dire Dawa to Djibouti (2.50 birr/q, 5 birr/q). In addition to that, the unloading and loading costs on to the train (1.5 birr/q), the commission (7.5 and 4.5 birr/q respectively) and for export formalities (2 birr/q) as well as some proportional fixed costs, again assumed to be 0.50 birr/q at the very maximum. The whole exporters marketing

costs then total 19 or 16 birr/q. As the exporters also were largely reluctant to give any figures, the team had to rely on figures not investigated by themselves but stated by well-informed followers of marketing events. According to their information, the Dire Dawa exporters receive an average of 2.50 birr/q of potatoes from the Djibouti importers.

Table No. 36: Marketing costs and margins (Alemaya area)

First case:

| | Birr/q | % of retail price |
|--------------------------|--------|-------------------|
| Production costs | 28.89 | 64.2 |
| On-farm marketing costs | 0.68 | 1.5 |
| Net farm-gate price | 44.80 | 99.56 |
| Off-farm marketing costs | 0.20 | 0.4 |
| Retail price | 45.00 | 100 |
| Marketing margin | 0.20 | |

Source: Own survey

Second case:

| | Sabuneh Birr/q | Bonger Birr/q | Sab. %cost price D.D. | Bonger %cost price D.D. |
|--|-------------------|------------------|--------------------------------|----------------------------------|
| Production costs | (28.89) | (28.89) | 22.8 | 35.9 |
| Farmers marketing costs | 4.35 | 4.35 | 4.3 | 5.4 |
| Net return to farmer | 100.00 | 60.00 | 79.1 | 74.5 |
| Wholesalers/ commission agents marketing costs | 4.75 | 1.75 | 3.7 | 2.1 |
| Price at wholesalers stall | 107.5 | 64.5 | 84.9 | 80.1 |
| Exporters marketing costs | 19.0 | 16.0 | 15 | 19.9 |
| Cost-price at ex- porters Dire Dawa | 126.5 | 80.5 | 100 | 100 |
| cif Djibouti (estimated price) | 250 | | | |
| Marketing margin | 123,5 | | | |

Source: Own survey

7. SUMMARY AND RECOMMENDATIONS

7.1 General remarks

The study was conducted in three different areas in Ethiopia, the Addis Ababa-Holetta area, the Awassa area, the Alemaya area. The findings apply only to these areas and are not representative for all of Ethiopia.

The aim of the study was to evaluate whether the potato will be able to contribute to the improvement of the food situation in Ethiopia. The analysis of the conditions and possibilities for an expansion of the potato sector had

- to determine the competitive position of potatoes among other food items grown by potato producers,
- to determine the competitive position of potatoes among other food items available to urban and rural consumers,
- to determine consumption habits.

The potato sector was considered within the general Ethiopian agricultural framework under nutrition, technical, economic, socio-economic and marketing aspects. The field research had to be carried out within three months. Therefore the team does not claim to have covered all detailed questions and problems of the potato sector. Detailed problems have to be considered through additional research on potatoes, specifying particular questions. Yet the team claims to have collected all major problems of the potato sector under different aspects and is giving its recommendations strictly on this basis. The team therefore considers its work only as a first but also important contribution for the further development of the potato section in Ethiopia.

The deficiencies and recommendations for the potato section will be listed at full length according to the chapters of this study.

Generally it can be stated that revolutionary Ethiopia has excellent pre-conditions for improving agricultural deficiencies. Agricultural reform has introduced a well-developed organizational infrastructure through Peasants' Associations, Women's Associations, some Producers' Cooperatives and Urban Dwellers' Associations. Farmers are aware and willing to improve their situation. But it is the shortage of trained people and the shortage of money and technical facilities which disappoint the farmers and hinder development. Present agricultural management in the form of the extension service and bottlenecks in agricultural research are the biggest obstacles for further development.

Assuming the awareness and willingness of the farmers, with little but well-organized effort, better agricultural results could be obtained. The weekly meetings of the associations and cooperatives could be used for serious technical instruction on production and marketing. So far this chance has not been taken, except for political instruction. Well trained extension people could run instructions on production, marketing and financing. Each Peasants' Association, Women's Association and Producers' Cooperative could select two or three members who should undergo special training on production and marketing matters.

Beside these instruction and training programmes on the rural basis, agricultural research on national level has to be developed further. Agricultural research, coordinated now by the Institute of Agricultural Research (IAR), Addis Ababa, should receive national and international support in the form of funds and personnel. Ethiopian researchers should undergo special training programmes for different agricultural products, like potatoes, maize, sorghum, etc. either in Ethiopia under the guidance of international experts - as long as there is lack of Ethiopian experts - or should be enrolled in short-term training programmes abroad. These training programmes should be worked out in close cooperation with the Ethiopian institutions and Agricultural Colleges of Addis Ababa University.

7.2 Nutrition aspects of potatoes

The nutrition habits of the rural population in the three regions show clear differences. Although the basic food items are 'enjera', bread and 'wat', the methods of preparation and the raw materials are different. 'Enjera' is made out of T'ef in Holetta area, out of T'ef and maize in Awassa area and out of sorghum in Alemaya area. In Alemaya area the 'enjera' is also unfermented and more a kind of flat bread.

The bread in Holetta area (called 'dabbo') is normally made out of wheat, while in Awassa area maize is used to make bread ('kitta'). In Awassa region also another kind of bread ('kotcho') is prepared out of the false banana.

'Wat' is in all three regions mainly based on flour from pulses; beans in Holetta area, peas in Awassa area and fenugreek in Alemaya area.

Vegetables play an important role mainly in the Awassa region, not as much in Holetta and even less in Alemaya area.

Food habits in urban areas are quite similar in the Holetta, Awassa and Alemaya regions.

Potatoes are consumed in all three regions, mainly as a component of 'wat' but also boiled or fried. Consumption is higher in towns than in rural areas and depends on seasonal changes in supply and prices.

In Holetta area, including Addis Ababa, the main problem seems to be the vitamin C intake. It is due to the low consumption of fruits in both rural and urban areas. Even the consumed potatoes are not able to supply the required amount of vitamin C. The vitamin C deficiency is not only latent but visible, many people suffer from inflamed gums and in rural areas even younger persons have lost their teeth (both typical signs of vitamin C deficiency).

Because ascorbic acid is water soluble it cannot be stored in body tissues, so that a regular supply is necessary. To solve the problem concerning vitamin C, people should be taught to eat at least one fruit per day and also to use more potatoes in their diet, at least when prices are low.

The problem with vitamin A is different. Vitamin A is a fat soluble vitamin, which means that it can be stored in body tissues (especially in the liver). Therefore a regular supply is not as necessary as it is in the case of vitamin C. Nevertheless it would be favourable to include carrots in all 'wat' preparations, where no red pepper is used ('alicha wat').

To solve the problem of protein intake in the rural areas, people should be convinced to consume the eggs they get from their hen, at least one egg every two days for each family member. And emphasis should be put on consuming this egg together with potatoes. The ideal egg:potato ratio would be 1:2 (in weight), but this will hardly be possible. But even a higher amount of potatoes in this ratio will improve the protein value of the diet.

In Awassa area, nutrition does not seem to be a problem. Because of the variety of food items consumed, supply with vitamins is sufficient. Protein is provided by different kinds of cereals, tubers and other foodstuffs.

To improve the diet even more, it would be good to supplement the 'kotcho' made out of false banana - which contains nearly no vitamins or protein - with other more favourable foodstuffs, and sweet potatoes with Irish potatoes.

Of high value would be the consumption of fish, a habit which is unfortunately not common in this area, even though there are many lakes around.

The same suggestion has to be made for Alemaya area; this source of animal protein is not utilized here either.

To make reasonable suggestions for the improvement of the nutritional situation in Alemaya area is quite difficult. For the rural population in this region affected by the drought, it is even hard to get the necessary basic foodstuffs. To suggest a higher consumption of animal products - besides fish - or of expensive vegetables would be senseless, they are not capable of buying them.

What could be done is to teach them to use more the best combination of cereals and pulses they have - such as maize with beans (nufro) and fenugreek with sorghum. The vitamin C intake could be improved by higher consumption of the wild-growing cactus fruits and of sweet potatoes, which are relatively cheap compared to other vegetables.

The wheat distributed in the "food-for-work"-programme should - if possible - be replaced either by maize and beans or partly by fenugreek.

In all three areas it was noticeable that the people had chosen the best combination of vegetable protein available - T'ef with beans in Holetta area, different kinds of cereals with pulses in Awassa and maize with beans or sorghum with fenugreek in Alemaya area.

The average calorie or energy intake seems to be sufficient, but it will become insufficient when exceptional physical conditions demand a higher supply. In such periods, there is also the danger that the protein contained in the diet may be used for energy purposes and not as protein as such. Exceptional physical conditions include all kinds of infection, pregnancy and lactation.

A tendency observed is to feed sick people with a quantitatively even more restricted diet - the quality may be better - and no special care or consideration for pregnant and nursing women was found. They eat what they have always eaten, sometimes a little bit more, but not of higher nutritional value.

There is also no adequate child nutrition. When breast feeding is stopped (fortunately it is common up to two or three years), the children participate mostly in the normal adults diet. Sometimes additional milk is given, but often this milk is not boiled, which may result in frequent diarrhoea. Also here the potato could play an important role for improvement.

Housegardens are common in Awassa area, not so much in Holetta area and nearly unknown in Alemaya area. Therefore it would be good to put more emphasis on this in Holetta area and to introduce them in Alemaya area. Even if the plot of land is small, some vegetables and fruit trees could be grown there.

A possible method to acquaint the people with housegardens would be the introduction of schoolgardens. There is a big chance for good results; some women reported that their children grow vegetables around the house just for fun.

In addition, on national level efforts should be made to improve the population's awareness of the importance of nutrition by nation-wide official campaigns, such as a radio programme about good consumption habits. The literacy campaign could be used for nutritional education as well.

Nevertheless, in some areas at all times and in all areas outside harvest times potatoes are considered to be a luxury article because of the price. Price comparison indicates that protein from eggs, meat or cheese is not dearer than that from potatoes. It is only the urban households who have more cash income that can consume more potatoes than rural ones.

But even if it were possible to convince rural families through intensive counselling¹⁾ that extended potato cultivation on individual and common land of Peasants' Associations and Producers'

1) According to information from the Home Economics Department of the Ministry of Agriculture, home economists are already engaged in this kind of extension. They plant demonstration fields within peasants' associations with vegetables like carrots, spinach, cabbage, beetroot. They teach women both cultivation and preparation. The objectives are to introduce these new vegetables in the
(contd. on next page)

Cooperatives could improve their nutrition situation, a significant danger has to be mentioned: if the sale price of potatoes is high the producers may prefer to sell their crop rather than consume it. To avoid this problem, the following steps might be taken:

- to distribute vegetables/potatoes from the common land to the members of the Producers' Cooperatives/Peasants' Associations. This means to pay not only in cash, but also keep the kind-payment. Even if the cooperatives are highly "cash-crop oriented", a particular amount of cereals and vegetables should be planted for consumption by themselves. In case they distribute potatoes during harvest time to the member families these could add the potato to their daily diet. Also the cooperative- or kebele-shops could be used to sell more food items at lower than the market prices and could so enable the rural families to provide themselves with a greater variety of food items. This would mean an improvement of nourishment, particularly in areas where the potato is considered as a "luxury", which cannot be afforded.
- to give extension service to the household to plant their individual land with potatoes for consumption. This extension could be connected with teaching the importance of potatoes as a daily foodstuff and also with preparation advice. But still this teaching and giving of advice will face the problem of the economic forces that press people to continue with intensive selling. Giving up or reducing this marketing behaviour is not a matter of awareness. This problem can be solved only if economic alternatives are created that guarantee an entire livelihood for the family.

1) (contd. from page 149) planting of the back-yard land with priority given to consumption. They do not include the potato, because it is considered as already traditionally planted. But there is no significant attention given to the problem that although potatoes are cultivated they might not be consumed, because of their favourable profitability as cash crops.

7.3 Technical aspects of potato production

Although the soils and climatic conditions of the three areas are conducive to potato production, the extent to which potatoes are grown is relatively low and the obtained yields are extremely low. As stated above, deficiencies in potato production can be summarized as:

- 1) Lack of improved varieties and certified seeds,
- 2) No or inadequate control measures against diseases and pests,
- 3) Limited water source and poor irrigation facilities,
- 4) No or low application of fertilizers and manure,
- 5) Other improper and ineffective agronomic techniques.

Lack of improved varieties and certified seeds

One of the main reasons for the low yields of potatoes is that presently the farmers use local or land varieties which are poor yielders and not resistant to diseases, especially to late blight. This is one of the problems which has forced some farmers to abandon the production of potatoes and resort to other vegetables or cereal crops. In fact, Ethiopian experts assumed that the area for potato production has decreased in the past few years.

Although efforts have been made in the nation-wide potato programme coordinated by the Agricultural College in Alemaya, to screen high-yielding varieties which are resistant to diseases, the released varieties are not yet in the hands of the farmers. The reason is that presently there is not any government institution or agency which is in a position to multiply the seeds of these improved varieties in quantity and distribute them to the farmers. At present some varieties have been given to the Horticultural Development Department (HDD) for multiplication. Since the capacity of the HDD is limited, some other agencies have been established to supplement the HDD in multiplying the seeds.

Due to lack of storage facilities most farmers are compelled to buy tuber seeds from local markets. But some farmers are not even

able to get the seeds from their local markets when they need them for planting and in most cases the prices of tuber seeds are very high, especially for the main planting season. Due to this they are forced to buy small-sized and inferior seeds so that they can plant a big area with the amount of seeds they can afford. Those farmers who cannot meet the high prices of tuber seeds get discouraged and decide to plant other crops.

To improve the present state as far as lack of improved varieties and certified seeds is concerned, the following measures are suggested:

- 1) Full technical and financial support to the nation-wide potato programme so that it can intensify its research work in screening for high-yielding and disease-resistant varieties with good adaptability to the potato growing areas.

In the planned breeding programme a national collection of land varieties should be included as one source of breeding material. This will raise the chances of finding improved varieties with better adaptability to the local surroundings.

- 2) Establishment of close collaboration between research institutions, seed multiplying agencies, seed distributing or marketing board and the Extension Service of the Ministry of Agriculture. The Extension Service should motivate and teach the farmers the necessary agronomic techniques.
- 3) In order to supply farmers with certified seeds free of diseases an agency responsible for seed control should be established. As an incentive to farmers the prices of such certified seeds should not be very high, or should be subsidized.

Lack of or inadequate control measures against diseases and pests

The most prevalent and serious disease in all three areas was found to be late blight. No chemical control against this disease is practised. The reason for this is that fungicides are

too expensive for the farmers and most of them are not even aware of the existence of such chemicals.

The present control measures against late blight, such as increasing the spacing during planting, or adopting crop rotation, or using whole instead of cut tuber seeds are only preventive and cannot be effective enough to control the disease. During the rainy season, when the conditions for the development of this disease are favourable, the farmers are helpless and encounter big losses. Since the use of fungicides such as captan against this disease is too expensive for farmers, the use of certified seeds from improved varieties which are high-yielding and resistant to diseases can be considered as the only feasible solution to this problem.

Potato tuber moth was found to cause considerable damage both in the field as well as after harvesting and no insecticides are applied against this pest. The following measures could be adopted to control this pest¹⁾:

- a) Use of insecticides such as Diprex, Thiodan, Gusathion, etc.
- b) Avoid rough soil surface. Compact hilling is the most important control measure because oviposition on the tubers is prevented.
- c) When lifting potatoes, it is important to avoid oviposition on the tuber before they are properly protected in the store. All tubers that have been dug out have to be bagged and removed before late afternoon every day.

The control measures used against other pests such as spraying ash in the field against red termites; or frightening and chasing away of monkeys, warthogs etc.; or directing water into the dwelling holes of moles are not very effective. These pests remain a great threat to some potato growers.

1) Recommendations made by Eberhard Bohlen to control this potato pest in Tanzania, see Bohlen, E.: Crop pests in Tanzania and their control, Berlin/Hamburg, 2nd edition, 1978.

It is the feeling of the authors however that the gathered information on the existence of different diseases and pests cannot be claimed to be complete because farmers are not quite aware of all of them. Furthermore, our own observation was limited because the research was conducted in the off-season and not in the main rainy growing season.

Irrigation sources and facilities

Irrigation was found to be one of the most important limiting factors for the expansion of potato production, and in fact the most important one during the dry season. It is therefore important to make maximum use of the limited available water sources.

- On the rivers and streams available in some areas, which contain much water in the rainy season and less or no water in the dry season, dams could be constructed to preserve water for the dry season. This is currently practised on a very small scale. Due to the labour and capital required for such activities, it is advisable to make it collective work, which can be organized by Cooperatives and Peasants' Associations. With some technical assistance and advice, the utilization of these water reserves could be significantly increased.
- Wells can be dug in most areas, where the water level is not very deep, but this has not yet been extensively practised. In order to promote these activities, a thorough water survey programme should be launched to locate suitable areas for such projects.
- The potentiality of several lakes and ponds has not yet been fully exploited. Lakes and ponds are normally situated at lower altitudes in a particular area. Farmers living close to the lake or pond cannot make use of this water even if the difference in height is just a few metres. Here, a pump would be necessary. Since the water is not to be pumped many hundreds of metres higher than the water level, a pump of a moderate

power and of a reasonable price can serve the purpose. Such pumps should be made available to farmers and be bought on credit basis. Extension service units should give the necessary technical assistance and advice.

Fertilizer and manure application

Fertilizer application

Since 1967, and especially after the revolution, fertilizer demand by small-scale farmers has increased steadily, making up about 65 % of the total imported fertilizers in Ethiopia¹⁾. However, in these three areas, it was observed that:

- nearly all Cooperatives, Peasants' Associations (on common land) and some individual farmers apply fertilizers to their crops - including potatoes when grown - but the amount used is quite low. The amount applied seems to be much lower than the estimated amount (60-70 % of the recommended amount in the FAO Report²⁾);
- some newly formed cooperatives and many individual farmers do not apply any fertilizers at all;
- Even when fertilizers are applied, sometimes wrong methods are used, resulting in less effectiveness of these fertilizers.

The main reasons for the above problems are briefly discussed below and some improvement suggestions are made:

1) Financial inability to buy any or enough fertilizers:

Although the terms and conditions of fertilizer purchase are convenient (credit with 10 % down payment), the amount to be paid in cash still seems to be too great, especially for the newly formed cooperatives without any start capital and for some individual farmers.

1), 2) FAO, 1979: Report on Fertilizer Demonstration and Pilot Credit Scheme 1967-78 in Ethiopia.

2) Poor access to fertilizers (availability):

Due to lack of storage facilities at most of the extension service units in Weredas there is usually not enough fertilizer in stock when farmers need them. The extension units have to collect or order them from higher offices. This may take so much time that the farmers do not get the fertilizers in time.

To avoid this, enough stores should be constructed in every Wereda to permit a continuous supply. Moreover, transport facilities should be improved to make a better connection between extension headquarters, Wereda offices and farmers.

3) Ignorance or underestimation of the importance of fertilizers:

Some farmers are not convinced of the high advantages of fertilizer application. As a result of this, they prefer to spend the money they have on other items rather than buying fertilizers.

This can be avoided through intensive advice and practical demonstrations on their fields, carried out by extension units and other agricultural institutions. One of the most difficult aspects of ensuring farmers' enthusiastic cooperation is that of convincing them of the direct personal advantages of adopting new farm methods¹⁾. However, experience has shown that the results of demonstrations on fertilizer application are always so convincing that fertilizers are considered as the best means to win the farmers' confidence.

4) Lack of knowledge on proper application:

- which type of fertilizer on which soil type
- time of application
- required (recommended) amount
- methods of application
- split application/all at once, etc.

1) Moczarski, S.Z.: Farmer participation in agricultural extension programmes - in FAO, 1978, Training for agriculture and rural development.

Advice to farmers on more effective application methods should be given more emphasis; for example:

- a) Fertilizers should not be allowed to come into contact with tuber seeds, because the chemicals spoil the tuber or the young roots and shoots.
- b) If a good amount of fertilizer is to be supplied, it is always advisable to split the amount in order to provide the plants with enough nutrients at the appropriate time and to avoid losses. But it is wrong to apply urea first at the time of planting, and DAP much later. If splitting is necessary, then the reverse would be preferable, applying first DAP and then urea, but neither of them should be applied too late.
- c) Where there is evidence of good availability of phosphorus, urea should be preferred to DAP, because it contains nearly three times as much nitrogen as DAP. Whenever DAP is applied, an effort should also be made to supplement it with urea, in order to increase the nitrogen content.

In connection with giving advice to farmers on proper application practices, it would be advisable to take such measures as make the field work of the extension officers easier and more effective. Such measures are for example:

- carrying out investigations on soil fertility, land evaluation and soil classification,
- recommendations on: - which type of fertilizer, on which soil, at which rate, at which time (stage of growth), by which methods, for which crop, etc.
- these and other recommendations or guides should be prepared by research institutes and other agricultural institutions, and all extension officers should have all this information in a short, clear form such as booklets, charts, etc.

Manure application

Manure application would be very necessary for most soils in these areas, to increase organic matter, as a supplement to the low level of fertilizer application, and also to improve the soil structure, to allow better growth conditions for potatoes and other crops in general.

Since manure scarcity is the major problem, and there are no manure markets existing, it is very difficult to overcome the problem. However, with respect to some bottlenecks observed in the field, some improvements could be possible. These are:

- In Cooperatives, where individual members are willing to give their manure on payment basis, such Cooperatives should try to find means of paying for the manure or evaluating it otherwise.
- Where manure is available, but transport is the problem, extension units (or other available institutions) should make an effort to render some assistance - e.g. tractors, etc.
- Farmers should be advised not to remove all plant residues from the field, as long as they are not infested by diseases dangerous to potatoes.
- Advice on use and preparation of composts should be given.

Other improper agronomic techniques

Seed preparation and planting

It was observed that sprouting mostly takes place in the absence of light, as a result of which weak and pale green sprouts are formed. These sprouts have two main disadvantages:

- They break off very easily during planting;
- The plants formed from them are weak and give poor yields, especially when unfavourable conditions prevail.

In most cases the sprouting is not uniform, some tubers are oversprouted and some undersprouted, the consequences of which are that the plants reach maturity at different times. Sometimes the farmers leave the potatoes in the ground without harvesting and 3-4 weeks prior to planting they are harvested and allowed to sprout. By this time some tubers have already germinated. The buds of the germinated tubers are removed and the tubers are allowed to sprout again. This practice has three main disadvantages:

- It promotes the formation of weak plants because some reserve nutrients in the tuber have already been used for the first germination.
- By removing the buds the tubers are injured and this increases the danger of the tuber being infested by diseases.
- The tubers may decay.

Suggestions:

- Use of better methods and conditions for sprouting. Sprouting should take place under diffused sunlight so that sturdy green sprouts are formed.
- The tubers for seed should not be left in the ground until they germinate. They should be harvested well ahead of time and permitted to sprout under favourable conditions.

The use of small, culled tubers is another bottleneck. Small tubers do not only give poor yields, they also promote virus diseases¹⁾.

The practice of cutting tuber seeds, although not very common among the farmers, is still worth mentioning, because it promotes not only the transmission of diseases from one tuber to

1) Virus diseases cause reduction of both the number and size of tubers per plant.

another, but also the danger of decay, if the tuber pieces are not treated with fungicides or allowed to suberize properly.

Suggestions:

- Use of medium-sized tubers (50-60 g or as big as a hen's egg). The use of bigger tubers may prove to be uneconomic, because the increase in yield due to the use of bigger tubers may not be able to compensate for the increase in cost due to the high price of seeds.
- Avoid use of cut tubers unless the tubers are free from diseases and the tuber pieces are allowed to heal sufficiently.

Other improper production techniques observed are:

- Wrong spacing; sometimes too wide and sometimes too close.
- Low seed rate.
- Sometimes the plant populations were not in pure stands, although the farmers claimed to have only one variety on one piece of land. In Legambo Producers' Cooperative for example, clones of Saburie were observed among the clones of Mongor. This practice has two main disadvantages:
 - the different clones do not mature at the same time,
 - impairment of the quality of the produce.

To avoid such practices, it is important that farmers are taught proper agronomic techniques.

As far as weeding, harvesting and storage are concerned, the following can be suggested:

- Proper weeding should be done. The frequency of weeding (only twice during cultivation and eventually supplemented by land pulling) is not enough to keep the potato plants free from weeds.

- Shallow cultivation should be preferred to deep cultivation in order to reduce the danger of mechanical injury to the roots and tubers.
- Potatoes should be harvested 2-3 weeks after the leaves have started yellowing in order to give the potatoes time to ripen and so that the tubers may attain a firm skin which, reduces the danger of the tubers being infested by diseases.
- The foliage of the potatoes should be cut when the vines start yellowing, especially for seed production. The main reason is to block the transfer of pests and diseases from the foliage into the tubers and to speed up the ripening process.
- The practice of leaving potatoes in the field without harvesting them is connected with the following problems:
 - danger of frost damage especially in Holetta and Alemaya areas where frost may occur in the months of October to January/February;
 - more losses due to pests such as moles, porcupines, monkeys, warthogs, centipedes, red termites, etc. may be encountered;
 - hinders planting of other crops on the same piece of land.
- Storage facilities should be improved. Since the installation and running of air-conditioned stores may be too expensive, simple and cheap stores made out of local materials should be preferred. Such stores can be of multipurpose use and should be well aerated.
- Potatoes should not be harvested by oxen because they increase the loss due to mechanical injury of the tubers and intensify the problem of ground-keepers.
- There should be a distinction between the storage of ware potatoes, consumption potatoes and tuber seeds. Potatoes for sale and for consumption should be stored under conditions which do not allow sprouting or greening of the tubers. They should not

be exposed to light or to high temperatures. Tubers for seed should be stored under conditions which allow sprouting by the time the tubers are required for planting. They should be stored in cool, well-aerated places, and should not be exposed to direct sunlight.

7.4 Economic and socio-economic aspects of potato production

1) Since the Declaration of Land Reform on the 29th April, 1975 all land in Ethiopia belongs to the peasants. The structure of land use is characterized by three forms:

- individual use,
- common land use of Peasants Associations,
- common land use of Producers' Cooperatives.

The amount of individual land depends on:

- the density of population of that particular area,
- the amount of land taken for common land of the Peasants' Association,
- the fertility of the land.

The average for individual use is 0.85 ha for Holetta, 1.60 ha for Awassa and 0.87 ha for Alemaya.

The area of common land of Peasants' Associations differs from Peasants' Association to Peasants' Association and from region to region. The average for Holetta is 55 ha, Awassa 41 ha and Alemaya 237 ha.

The amount of land owned by the Producers' Cooperatives differs also from Cooperative to Cooperative and from region to region depending on the number of people who joined the Cooperative, the amount of land previously owned by the individual member and the area of land given to the members for individual use. The average is 54.7 ha for Holetta, 400 ha for Awassa and 344.7 ha

for Alemaya. The amount of land for individual use in the Producers' Cooperatives varies from 1000 m² to 2000 m² for all three areas. Generally there is a shortage of land in all three areas¹⁾. To compensate for this problem, it is very important to teach the farmers to apply better methods of using the land to preserve soil fertility and prevent soil erosion, such as:

- the use of crop rotation,
- the use of fertilizers,
- making terraces across the slopes,
- planting trees around the fields to reduce wind (wind erosion).

The types of crops grown in any particular area are the same for individual, common land of Peasants' Associations and common land of Cooperatives.

In Holetta area they grow mainly T'ef, wheat, barley, and vegetables like potatoes, cabbage, beetroot, onions, pepper.

In Awassa area they grow maize, barley, wheat, T'ef, ensete, sugar cane, sorghum and vegetables such as potatoes, tomatoes, beetroot, carrots, cabbage, pepper.

In Alemaya area they grow maize, sorghum, barley, wheat, chat, and vegetables like potatoes, sweet potatoes, tomatoes, cabbage, pepper.

The average percentages of land occupied by potatoes on individual land are: in Holetta 16.4 %, in Awassa 15.6 % and in Alemaya 28 %.

The percentages of land occupied by potatoes on common land of Peasants' Associations are: in Holetta 3 %, in Awassa 15.6 % and in Alemaya 2.9 %.

1) Reasons are listed under chapter 5 footnote 2, page 89.

The average percentages of land occupied by potatoes on common land of Producers' Cooperatives are: in Holetta 9.2 %, in Awassa 4.5 % and in Alemaya 0.55 %.

In comparison with individual land, the percentage area of land occupied by potatoes on common land of Peasants' Associations and on common land of Producers' Cooperatives is very low. This is due to lack of seeds, water and disease problems. This can be solved by:

- supplying the farmers with resistant varieties of seeds,
- giving the farmers credit which could enable them to buy chemicals for plant protection, water pumps, etc.

Because of the hard labour, the high financial inputs and skill required for potato production, it should be considered for long-term planning to expand potato production on the common land of Producers' Cooperatives and common land of Peasants' Associations¹⁾ respectively, because:

- the bigger size of common land make it profitable to introduce mechanization in the long run²⁾, which in the future could reduce the hard labour;
- the Producers' Cooperatives and Peasants' Associations can manage to buy the costly inputs like new varieties of best seeds, fertilizers, water pumps, etc.;

- 2) The analysis of labour structure is differentiated according to the existing farm forms:
- for individual land,
 - for common land of Peasants' Associations and
 - for common land of Producers' Cooperatives.

1) This suggestion applies to large-scale production of potatoes. It does not mean the individual farmers should not grow potatoes or should be discouraged to grow on their individual land.

2) Immediate high-level mechanization would impose heavy social costs on the society unless the non-agricultural sectors are well developed to absorb the labour force to be released from the agricultural sector.

The potential labour force for individual land is the family, whereas that for common land of Peasants' Associations and common land of Cooperatives are the registered members. Only the heads of the families are allowed to become members of Peasants' Associations and Cooperatives respectively. This restriction has two major negative impacts:

- It creates an artificial shortage of labour in peak seasons;
- It limits the rights of the female members (most heads of the families are male) to take part in planning and decisions on the economic activities of the village. They are only considered as additional helpers.

Every member of the Peasants' Association who is physically and mentally fit should be allowed to join and participate fully in political, social and economic activities of the village. To include women as full participants in agricultural work and avoid labour shortage is of course only recommendable, if at the same time the work load of the female housework is decreased and finally divided equally between women and men. In the rare cases where women were fully registered members of Producers' Cooperatives their work assignment was additional work load besides their extremely labour-intensive housework. Evidently it will be a long way - because of traditional and cultural habits - for women to be considered as equal labour force¹⁾. But in the meantime it should be considered how to ease the work load on women, e.g. by introducing appropriate household technology like improved cookers or starting kindergarten inside Women's Associations²⁾.

The work on common land in Peasants' Associations and Producers' Cooperatives is evaluated by work points. So far only individual productivity and work performance is considered. In future the size of the family should also be included. Some Associations and Cooperatives are already discussing this change.

1) That women are an equal labour force is shown in cases where Women's Associations became active themselves and cultivated land and planted potatoes all by themselves (see appendix A.13., page 205).

2) The Home Economic Department is already practising some of these.

On individual land work is done every day with exception of Sundays and Fridays for the Christians and Moslems respectively and one or two days on which the head of the family works on the common land of the Peasants' Association; whereas on the common land of the Cooperative, work is done on average 5 days a week. More working time could be saved for other productive activities if the working habits of the farmers were improved, e.g.

- by increasing the number of working hours per day (an extreme example for this is Alemaya where the farmers start working at 11:00 o'clock),
- by effective use of the time in which the farmer is on the field.

Both, misplanning of work organization and misuse of the given working time very often cause unnecessary apparent shortage of labour on individual and common land of Peasants' Associations and on common land of Producers' Cooperatives. This weakness could be avoided by improving the work morale of the farmers. This could partly be influenced by well-planned labour organization for individual and common land of Peasants' Associations and on common land of Cooperatives.

- 3) The financial resources for the individual family and the Peasants' Associations and Producers' Cooperatives as units are in all three observed areas generally low.

Income flows in rural areas consist partly of kind and partly of cash income. Most of the cash income for individual families is obtained by small-scale selling from their individual land or home-made products like butter, cheese, tella and arreki. In the drought-affected area of Alemaya vegetables are bought up from less affected areas and resold in Alemaya area. This is mostly done by women. The families of one interviewed Producers' Cooperative were even enlisted in the government-subsidized 'food-for-work'-programme.

The income in kind includes in Holetta area vegetables, in Awassa - besides vegetables - ensete and maize, and in Alemaya sorghum and maize.

Cash income is mostly spent on food. Expenditure goes in the first place on T'ef (30-50 birr a month), then on vegetables (about 10 birr). Only a small amount is spent on potatoes. Spending on potatoes depends heavily on the price. Vegetables including potatoes are considered as supplementary food.

The income flow from common land of Peasants' Associations and Producers' Cooperatives to individual members is so far mostly in kind. The cash income from selling is not in any case passed on, but kept in reserve for investment. At present it is discussed whether the cultivation of common land should develop more towards cash crop orientation while the cultivation of individual land is more home consumption (subsistence production) oriented. A tendency to cash crop production on common land can already be seen.

The financial resources of urban families differ in their income-expenditure structure from those of rural ones. The majority depends completely on purchase of food. Again most of the expenditure goes for T'ef or in very poor families for maize. But the portion spent on vegetables and potatoes is much bigger in urban areas, especially in Addis Ababa, than in rural areas.

The costs of potato production vary from area to area. The highest costs of production are found in Alemaya, followed by Holetta and then Awassa.

High-costs potato seeds and intensive irrigation are the reasons for the costly production in Alemaya (drought-affected).

Awassa area, which obtains the highest yields and the lowest costs of production, is the least profitable for potato pro-

duction, followed by Holetta. Alemaya area, where yields are the lowest and costs of production the highest, is the most profitable area for potato production, due to relatively high prices. High prices in Alemaya area are the result of low production and high demand from Djibouti. For Holetta area the demand from Addis Ababa market influences the prices. The low prices in Awassa area result from its unsuitable geographical position for big markets.

Price policy has an important impact on consumption and production of potatoes. A programme promoting potato production has to consider the present price policy.

- 4) The majority of individual farmers and the Peasants' Associations and Producers' Cooperatives lack the capital to enable them to purchase high-class agricultural inputs like seeds, fertilizers and chemicals for plant protection. This affects the standard of yields severely. The present credit system is in a very unsatisfactory condition. To obtain credit, the farmers sometimes have to wait until the time of planting or applying fertilizer is over. Reasons for this are found in lack of qualified trained people in the credit sector (extension service) and in transport deficiencies. Only recently the Ministry of Agriculture started a programme for Peasants' Associations and Producers' Cooperatives as units to assist farmers. Under this programme credit is given to the farmers not in monetary form but in material form such as seeds, fertilizers etc. The individual farmer can obtain a credit in material form by asking his organization to file his demand to the extension service. He then will be served through the Service Cooperative shops. The individual farmer cannot ask directly for assistance.

The started credit programme of the Ministry of Agriculture with its differentiation into material and cash credit seems to be an adequate beginning to improve the situation. The problems in the credit sector as well as in other above des-

cribed sectors are mostly problems of the implementation of the extension service. It therefore should be ensured that people working in the extension service on production and credit problems are well trained persons. Through seminars and short-term courses they could be trained for their service. Each Peasants' Association and each Producers' Cooperative should delegate some of their members to receive this special training.

7.5 Marketing aspects of potatoes

Technical efficiency

The technical functioning of the marketing of potatoes, the smooth physical flow of the produce from the farmer to the consumer, is first of all not assured because of the non-availability of means of transport to someone who has urgently to dispose of the crop, above all at harvest times.

Access to the producers' site is in most cases hampered by bad, narrow roads making the use of several means of transport (donkey cart, truck) and too many loading and unloading operations a necessity. Short-term storage facilities on the traders' level are either not available or not suitable for potato storage. Storage for longer periods than 2 weeks has not yet been developed. Too big and too heavy sacks are being used, requiring too much labour to handle them and increasing the risk of spoilage during transport. The unloading facilities in the central wholesale markets and main reloading and transfer points are not sufficiently developed to guarantee time-saving delivery or transfer operations.

All these factors that are keeping the marketing system for potatoes from functioning at a higher level of efficiency call for mere technical as well as organizational recommendations in order to overcome the bottlenecks and deficiencies mentioned.

Economic efficiency

In order to evaluate the economic efficiency one has to refer to the underlying objectives and equate a high achievement of the goals with high efficiency.

As neither guaranteeing a high farm-gate price nor guaranteeing a low consumer price had been identified as the sole objectives of this study and as the simultaneous achievement of both objectives would be contradictory one has to analyze the 'in between', the marketing margin, and to develop measures to decrease its spread. The marketing margin as such is composed of two elements: One being a remuneration of the often costly services that are rendered in the marketing process and the other being unearned profits accruing to one or several elements of the marketing chain.

One factor that can be in favour of high unearned profits is a low intensity of competition as has been determined on the wholesalers' level, above all in Addis Ababa, where the lowest intensity of competition, the monopsonistic has been encountered. Such a monopsonistic position can be protected against newcomers and against at least a dual marketing system by naturally existing barriers to entry and by artificially created ones. It has been found out that there are almost unsurmountable natural barriers at the moment and that there is wide scope for creating artificial ones by carrying out tactical price-policies.

Another factor favouring high profits and a low degree of competition is collusion believed to be practiced - not necessarily directly and very intensely - on practically all levels of the marketing process but especially on the wholesalers' level.

An analysis of marketing costs and margins shows that marketing margins are lowest where producers directly supply retailers on the local markets without involving any further intermediaries. This of course is only feasible when the market is very near and the farmer can spare time to perform the marketing functions.

The further the final outlet the more labour services (transport, loading, unloading, short-term storage etc.) are incorporated and have to be remunerated. The very same potatoes that reach the Awassa local market with a marketing margin of 4.4 birr/q pile up a marketing margin of 27 and 52 birr/q resp. in case they are sent into the urban outlet of Addis Ababa and make the farmers' share of the retail price decrease from 66 % to 23 % and 13 % resp. In other words, without even being processed on the way to the consumer the final retail price of potatoes consists to 77 % and 87 % resp. of costs and profits accrued in the marketing process.

According to our own calculations, whose evidence is confined to the time when the research was under way, these proportions cannot offer the farmers an incentive to maintain or even increase production because the farm-gate price lies under the production costs (see page 138) and farmers having no storage facilities sell their produce immediately in order to avoid even greater losses by not selling at all. In the other research areas the prevailing farm-gate price at least did not confront producers with direct losses but in how far it served its incentive function can, considering the absence of profitability-data of other crops, hardly be judged.

The validity of these data is, as outlined above, confined to the research period because supply and demand disequilibria frequently change the current market prices for potatoes. As pointed out, these price fluctuations, in conjunction with the high share of marketing costs, prevent the farm-gate and retail price from fulfilling dual incentive functions. And there are no measures under way nor institutions in charge of stabilizing these prices.

Technical and institutional/organizational recommendations

To overcome one of the main bottlenecks in agricultural marketing - that is the availability of transport capacity at reason-

able prices - it is suggested to review and - if necessary - alter the Ketana policy towards non-licensed producers of potatoes who want to take over a greater portion of the marketing activities through organizing the transport to the buyers. That would in many cases enable them to sell more directly to their customers by-passing brokers and wholesalers that now almost exclusively organize transport. A more open Ketana policy would also enable several producers to take advantage of more profitable collective large-scale transport.

Not only producers' access to transport capacity is indispensable but also a fair price for transport services. A reviewed Ketana tariff manual considering not only freight rates for transport on roads under the Highway authority but also for the distance covered while collecting potatoes would have to guarantee truck owners an adequate remuneration for their operations and can, apart from giving producers higher security in transport costs, keep them from being subject to truck owners' exploitation. Furthermore the practice of charging rates according to the number of sacks instead of their total weight should be abolished because it leads the merchants to utilize the very awkward big sacks.

This reorganization would go along very well with a government policy to improve the conditions of rural roads - not necessarily constructing new paved roads but rather providing level and sufficiently wide roads to main agricultural growing areas.

Considering the storage problem as a primarily technical problem, measures have to be developed to enable growers, traders and consumers to store potatoes for a longer period of time than is being done now. The technical development should be executed in agricultural research institutions like the Agricultural Colleges. Its dissemination to the users can be ensured by establishing the missing link between research and extension. As the rural extension workers from the Ministry of Agriculture reach rural producers as well as consumers it is recommended that they

be put in charge of the storage extension. An indispensable prerequisite is of course that they themselves be informed about favourable storing techniques. Therefore seminars or courses at the developing research stations should be held and made compulsory. As very often capital is the limiting factor apart from the know-how, a rural small-credit programme especially for that purpose and under the administration of the extension service should go along with such extension activities.

Apart from advice on storage techniques the scope of rural extension should be extended towards agricultural marketing as well. As the problems arising in the marketing of cereals seem to be minor in comparison to the delicate marketing of perishables (like potatoes) emphasis should be laid on that topic. Peasants' Associations and Producers' Cooperatives are the already established multiplying agents of such know-how and would have to be contacted and advised first. The still very important elements in the agricultural cultivation community, the private farmers, organized in Peasants' Associations, should not be left out of such a programme. They can be reached efficiently through offering extension arrangements in the form of farmers meetings on district level. All the farmers, Peasants' Associations and Producers' Cooperatives interviewed so far would really appreciate any extension given to them about those topics.

It is strongly believed that those activities lead to a higher awareness among the producers and would enable them to recognize exploiting techniques like the big, unweighed sacks, and the function of the brokers; further also increase their market transparency and hopefully unite them to take collective action towards the abolition of obsolete marketing practices and redundant marketing elements.

With regard to the size and the contents of the packing material 'sack': First of all the size should be decreased to a weight not exceeding 50 kg to ensure easier handling, less spoilage and more adequate ordering policies of the small traders, not forcing

- Training and extension programmes for the managers of the potential Cooperatives would have to be offered.
- A high-level control-board would have to be established to prevent any mischief to the members' disadvantage committed by the executive committee members. Members should be taught how to control the working of the committees as well.

Measures that aim at increasing market transparency are not easily achieved in a country with a high percentage of illiteracy and few radio receivers in rural areas. Therefore market information services in newspapers or on rural radio programmes are targets that might be envisaged in the long run but do not serve the immediate information of market participants. But what would plead against a notation of market prices and a compilation of market information within Cooperatives and Peasants' Associations done by members of the recommended marketing committees?

These committees could also be organized to serve as the farmers' consultant, to answer questions regarding market prices, conditions and marketing techniques; moreover they could serve as the collectives' agent, bargaining with the traders, and as an arbitration agent in case of conflicts between farmers and merchants. They could arrange central weighing stations and crop gathering points to avoid weight and transport tariff cheating.

Considering storage as a primarily economic measure to balance heavy price fluctuations for ware potatoes caused by supply/demand disequilibria, financial and advisory help should be given for the development and the later implementation of agricultural storing techniques. Preferably first of all on the farm level, as producers seem to suffer most from price fluctuations and in view of an increased potato production deserve the initial incentive impacts. However, such measures should not be confined in the long run to the farm level.

Generally it has been found out that, apart from very few exceptions, e.g. storage techniques, all the know-how with regard

to potato marketing is present somewhere and with someone.

The difficulty is mainly in the implementation of measures based on such theoretical know-how. The main weakness is still that the implementation of 'right' measures based on that know-how is impeded by the missing link between the experts-and-research-institution-level, the political level and the implementation-level and that the conveyance and co-ordination of information between all elements and all levels is not properly organized.

APPENDIX

A.1. Interviewed Peasants' Associations, Women's Associations and Producers' Cooperatives

Holetta area:

I. Cooperatives:

1. Elala Godju Producers' Cooperatives
Founded in March 1980
Members - 72
Women - 34, men - 38
2. Dil Betigil Producers' Cooperative
Founded in June, 1979 (was started before declaration)
Members - 74 (3 left)
- 71 (30 newcomers)
-101 - present number
Women - 30, men - 71
3. Wolmera Choke Producers' Cooperative
Founded in December, 1979
Members - 44
Women - 20
Men - 24
4. Mesrak Shola-ber Producers' Cooperative
Founded in 1979
Members - 114
Women - 33
Men - 81

II. Peasants' Associations

1. Sademo Peasants' Association
Founded in 1975
Members - 250
2. Gelgel Kebele Peasants' Association
Founded in 1975
Members - 350

III. Women's Association

1. Sademo

2. Gelgel

Addis Ababa

1. Producers' Cooperative

Makanissa, Furi and Sarris vicinity Producers' Cooperatives

Founded in 1979

Members - 580

2. Women's Association - Higher Kebele 18

3. Kebele 13 (5 households)

4. Hotels:

Finfine Hotel

Ras Hotel

Guion Hotel

Harambee Hotel

Metro Hotel

Piazza Hotel

Dehab Hotel

Tekezie Hotel

Awassa Basin

I. Producers' Cooperatives

1. Shashena Kekele Producers' Cooperative

Founded in 1979

Members - 150

Women - 2

Man - 148

2. Wondo-Kosha Producers' Cooperative

Founded - 1975

Members - 160

3. Gelma Producers' Cooperative

Founded in June, 1978

Members - 517

Women - 83

Men - 434

II. Peasants' Associations

1. Watera and Ketchema Peasants' Association

Founded in 1975
Members - 601
Women - 20
Men - 579

2. Shamena Sefera Peasants' Association

Founded pre revolution, then abolished due to
conflict between Arsi and Shea originators.
Re-established in 1978
Members - 156
Women - 10
Men - 146

3. Edola Peasants' Associations

Founded in 1975
Members - 574
Women - 7

III. Women's Associations

Shashamene:

Founded - 1977
Members - 530
Wondo Kosha: -
Members - 160

Tula

Founded - 1979
Members - 700

Kebele

Higher 2, Kebele 05 - 3 households
Higher 1, Kebele 05 - 4 households

Alenaya area

I. Producers' Cooperatives

1. Mulleta Hula Communism Producers' Cooperative
Founded in 1979
Members - 113
Women - 0
2. Legambo Producers' Cooperative
Founded in 1975
Members - 320
Women - 7
3. Rare Chilalu Hundie Gembeta Producers' Cooperative
Founded in 1979
Members - 227
Women - 1
4. Producers' Cooperative (no name yet), Kersa
Founded in 1980
Members - 15
Women - 0

II. Peasants' Associations

1. Tinike Peasants' Association
Founded in 1975
Members - 770
Women - not known
2. Oltheha Peasants' Association
Founded in 1975
Members - 750
Women - 0
3. Hassen Gie Peasants' Association
Founded in 1975
Members - 400
Women - 6
4. Matokoma Peasants' Association (Kersa)
Founded in 1975
Members - 550
Women - 55

III. Women's Associations

1. Legambo
 Figures unknown
2. Matokoma
 Founded in 1978
 6 committee members (disolved)
3. Rare Chilalu Hindi Gembeta
 Founded in 1979
 Members - 160
4. Alemaya Kebele
 Founded 1978
 Members - 346

IV. Kebele

1. Alemaya (2 households)
2. Bate (1 household)
3. Harrar (4 households)

APPENDIX

A.2. Guidelines for Peasants/Associations/Producers' Cooperatives

Organization

- when founded (by whom/how many members/male/female)
- registration fee
- acres (% individual/common)
- meetings (irregular/regular)
- committees (production/selling etc.)
- member of service cooperative (what service receiving)
- contacts between different Peasant/Women Associations/ Cooperatives
- how organised on nationwide level

Objectives

- basic objectives while founded
- any changes in the objectives so far
- future plans, e.g. change from Peasant Association to Producers Cooperative (reasons, who gave advise/by whom assisted during transition phase)
- production orders by the government

Discussion topics

- main problems of association (how discussed and solved/ decision-making process)

Measurement of work

- on common land
- on individual land
- family size of single member considered
- who distributes working points

Share of profit (common land)

- % kept in common fund
- % shared among members
- % invested (on what)

Extension service

- on which subject
- by whom
- how often
- any complains

Finance

- self supporters/government/district supported

A.3. Guidelines for Women's Associations

Organization

- when founded (by whom/how many members, number of children)
- how organized on nation wide level
- meetings (irregular/regular)
- how do single women participate
- contacts with Peasant Associations/Producers' Cooperative

Discussion topics

- main problems of association/typical conflicts
 - problems within the family
 - care about children
 - household, food, health

Economic activities

- land preparation
- trading
- handicraft
- any income out of these activities/how distributed
- small credit

Extension service

- advice in household work
- advice in food preparation
- advice in child care/health
- training programmes conducted by government (literacy campaign, vocational training etc.)

A.4. Interview guidelines for households (family/large scale) on nutrition aspects

Place

Date

Urban/farm household

Family size

General information

Age structure within the family (or household)

Sources of income of the household

Potato producer/consumer

Living conditions: (also by observation)

Number of rooms

Floor (soil, wood, stone)

Sleeping conditions

Hygienic conditions (sanitary)

Kitchen or fireplace

Household equipment (also electric equipment)

Water supply and sewage

Electricity

Fuel (for cooking)

Specific information on nutrition

Number of meals per day; at which time, intervals

Eating between meals

Eating place (at home, in the field)

Who participates in that meals (number and kind of persons)

Breakfast

Main meal

Dishes

Most frequent dishes

Composition of these dishes

Preparation of the basic components

Cooking methods

Use of oil, fat and spices

Use of potatoes

As part of these dishes

Alone

Provenance of the potatoes (own production, bought; when bought, where)

Used as alternative or replacement for other tubers or vegetables?

Reasons (taste, nutritional value etc.)

Time of potato consumption

Only at harvest time

Throughout the whole year

From own storage or bought

Any seasonal changes in potato consumption

How often do they consume potatoes (number of potato dishes per week)

Quantity used for one meal

Any specific obstacle to consume more potatoes?

Small cattle holding

Gardening (also by observation)

Vegetable

Importance for own food supply

Preference for a special food stuff, reasons

Distribution of food

Preference for men

Preference for children

Preference for pregnant and lactating women

Are there special food or dishes for special persons or events

Children, pregnant and lactating women, elderly persons,
men festivities, periods

Feeding of infants

Lactation

Post-lactation

Urban family households

(Questions as under "specific information on nutrition")
in addition (also by observation)

Prices of potatoes

Prices of potatoes compared to other tubers

Storage of potatoes at home

Relatives in rural areas (non-market source for food)

Large-scale households

Size

European or national dishes

Use of potatoes in these dishes

Number and kind of potatoe dishes; preparation

Prices

Supply and demand - seasonal changes

Purchase and storage

A.5. Interview Guidelines for Potato Producers

General information

- Form of organization: Peasants' Association or Producers' Cooperative
- Size of land - common land or individual land
- Types of crops and size of land for each crop
- Approximate yields of each crop
- Potatoes: - Reasons for growing potatoes; since when; area; future plans for expanding potato production
 - If no potatoes - reasons

Specific information about potatoe production

Climate:^{+) Temperature - (max., min. etc.)}

Rainfall - distribution, amount, intensity

Soils: types; physical and chemical properties

Cropping systems: - allocation of land for potatoes

- single cropping or mixed cropping
- monoculture or crop rotation
- Crop rotation: sequence; frequency or reoccurrence

Varieties: - types of different varieties

- origin local or imported
- characteristics - yields, resistance ability, earliness, quality
- attempts made to improve varieties.

Seeds: - source - local market, own, research stations, other government agencies

- size - big, medium, small
- condition - certified or uncertified
 - sprouted or fresh, injured or healthy
- extension services (supply with seed etc.)

^{+) Information about climate and soils was gathered from research stations and other relevant sources (literature)}

Land Preparation

- clearing, ploughing, discing, ridging
- time of the year
- how often
- depth of ploughing
- tools, machines, animals used and their sources
time and labour required

Seed Preparation and Planting

- sprouting: treatment (chemicals, exposure to different conditions)
length of time required for sprouting

Seed Preparation and Planting (Cont'd)

- Sprouting (cont'd) - length and condition of the sprouts
- condition of tubers: - firm or shrunk
 - cut or whole
 - if cut - method, treatment, advantages and disadvantages
- planting: - time of planting
 - method of planting: - rows or no rows
 - ridges, beds, plain
 - if in ridges- furrow,
shoulder,
on top and
why
 - depth of planting
 - tools and/or machines used
 - rate of seeding and spacing; reasons for that spacing

Cultivation and Weeding

- time and frequency of cultivation
- tools, machines or animals used
- types of weeds (broad-leafed/grass)
- method of weeding: - hand weeding, herbicides, mechanical
if herbicides applied: source, form, method
- time and frequency of weeding
- hilling: - reasons, time, tools, frequency, method

Fertilizing and Manuring

- Fertilizers: - source and price
 - types of fertilizers
 - rate of application
 - time, method, equipments
- Manure: - source and types of manure
 - condition of manure - fresh/decayed
 - methods of manuring
 - time of manuring
 - rate of application
- Any problems encountered in obtaining and applying fertilizers and manures
- Assistance/Advice rendered to overcome the problems (from Extension service; research stations and/or other government institutions)

Irrigation

- whether necessary
- if necessary: - source of water (river, lake, pond, well)
 - location of water source
 - method of directing water from source to the field (pumps, canals etc.)
 - availability of water throughout the year
 - method: - furrow, basin, sprinkler etc.
 - time and frequency of watering

Pests, Diseases and their Control

- which kinds of pests, which kinds of diseases
- seasonal incidence and degree of infestation
- methods of control: - local chemicals, resistant/tolerant varieties
 - if chemical control:
 - source, amount, form, interval of application and devices
 - extension services (advice, assistance)

Harvesting and Storage

- time of harvesting
- determining criteria
- tools, machines and/or animals used
- method harvesting - (all at once/gradually,defoliation)
- condition of harvested tubers by different methods
- yields
- ground keepers
- Storage: - reasons (for sale,consumption,seed)
 - methods and length of storage
 - where stored
 - storage losses and causes
 - problems
 - extension service (advice etc.)

A.6. Guidelines for Economics of Production

1. Factors of Production

- a) Land: - Ownership of the land (Peasants' Association or Cooperative; individual or common land)
 - Size of the cultivated land (in ha)
 - Types of crops grown
 - Size of plots for different crops
 - Distance of plots from domicile
- b) Labour force:
 - Number of members in the family or Cooperative
 - Division of work in the family,Peasants' Association, Cooperative,individual/common land.
 - Need of temporary labourers (when and for which crops)
 - Payment of temporary labourers for different types of work
 - Number of temporary labourers employed and the number of days worked
 - Possibilities and problems of getting temporary labourers (when and why)

c) Working animals: -

- Use of animals for farm activities
- Ownership of the animals used
- Number of days on which the animals are used
- Price of hired animals per day
- Types of work for which the animals are used
- Problems the farmers face by using these animals

d) Machines and Equipments:

- Use of machines and equipment for farm activities
- Ownership
- Types of machines and equipment used
- Number of each type of machine and equipment used
- Number of days on which the different types of machines and equipment are used
- Price of hired machines and equipment per day
- Types of work on which the machines and equipment are used.

e) Money: - Credit

- Amount taken
- Uses of the credit
- Interest rate/duration
- Conditions of getting credit

2. Analysis of Costs of Production

a) Ploughing:

- Number of ploughings before planting
- Number of people needed for every ploughing
- Number of animals needed for every ploughing

b) Seeds:- Amount of tuber seeds used

- Price of tuber seeds per quintal
- Transport costs of tuber seeds per quintal

c) Planting:

- Number of people needed for planting
- Number of days used for planting

d) Cultivation:

- Number of cultivations
- Number of people needed for every cultivation

e) Irrigation:

- Means of irrigation (by canals or pumps)
- Frequency of irrigation per week
- People worked on irrigation
- Crops irrigated

f) Fertilizer:

- Types of fertilizers applied
- Amount of each fertilizer used
- Price of each type of fertilizer per quintal
- Types of crops for which the fertilizers are used

g) Chemicals:

- Types of chemicals for plant protection used
- Amount of each type of chemicals used
- Price for each type of chemicals per unit (e.g. litre)
- Types of crops to which the chemicals are applied

h) Harvesting:

- People needed for harvesting
- Number of days taken for harvesting
- Transport costs per quintal from the fields to the house and from the house to the market
- Total amount of potatoes harvested

3. Proceeds and their uses

- Amount of potatoes used for own consumption
- Amount of potatoes stored for seeds
- Amount of potatoes sold
- Expenditure of the money obtained from selling potatoes

APPENDIX

A.7. Interview guidelines for the marketing of potatoes

Market oriented farming of potatoes

Subsistence or market-oriented farming
Share/quantities of produce marketed
Marketing alternatives
Marketing extension
Share/kind of different buyers
Transport media to buyer/distances/costs
Qualities/standards
Prices received
Price fluctuations

Farm budget

Prices of all inputs relevant to potato production (e.g. land, labour, oxen, machinery, seeds, fertilizer, chemicals etc.)

Credit

Interest rates

Wholesalers

Number of wholesalers in specific area
Role/share of potatoes among total sellings
Kind of different suppliers
Contractors or commission agents involved, how remunerated
Quantities/qualities/prices of potatoes purchased
Time of purchase
Main market outlets and customers/different shares
Export activities
Prices
Price fluctuations (any ideas or records kept)
Labour employed/costs
Means of transport/own - hired/problems/costs
Storing activities/joint storage/duration/problems/costs
Losses: handling, storage
Rents, licence fees, taxes, other costs
Farmer credit
Problems/bottlenecks perceived by wholesaler

Retailer

See 'wholesaler' - corresponding questions have to be asked at the retailers level

Other intermediaries

See 'wholesaler/retailer' - plus: organizational structure and kind of specific activity

Market

Market regulatory agencies

Market laws/regulations

Entrance barriers (fees, qualifications, collusion etc.)

Market transparency (information on prices, demand, qualities etc.)

Through meetings, acquaintances, newspaper, radio etc.)

APPENDIX

A.8. Interview Guidelines for Family Unit

Place:

Date:

Sex:

Family size:

General remarks:

1. General Information

Membership of household in Farmers' Association/Producers' Cooperative.

- who is registered member?
- male
- female
- children
- worktime on common/coop. land
- assignment of additional family labour on com./coop.land
- female, children
- for what kind of work
- when?
- measurement/payment of performed work
- measured/paid
- unmeasured/unpaid
- returns from this work to the household
- no returns, saved in a common fund
- in cash; what amount results from potato production?
- in kind; " " " " " "
- member of a service cooperative
- payed fees
- benefits and services used by the family

2. Land Use by Family Unit (Individual Land)

- size of land)
- distance from house)
- what is planted?)
- quantity and quality of yields)
- used worktime)
- who performs the agricultural work?) general
- female) and
- male)
- children) potato in
- used tools) specific
- plough)
- other small tools)
- used fertilizer, manure, seed)
- storage facilities)
- which crops/what amount/sold)
- which crops/what amount/consumed)

3. Non-Agricultural Activities of Family Members

- domestic work and children) - what is
- animal-care) exactly done?
- small poultry) - who does it
- cattle) (female,male
- goats) children?)
- sheep) - used time
- handicraft) - does it
- tella and arreki-preparation) create any
- selling activities) income?

4. Income sources

- income in kind) -amount of vege-
- from work on common land) tables,cereals
- from work on individual land) in general and
-) potatoes in
-) specific
- cash income
- through potatoes as a cash crop
- other sources
- use of cash
- for family consumption
- for other purchases and activites, which?
- who takes the decision about spending
- male
- female
- does the family take any credit?
(amount, conditions, purpose)

5. Household expenditures

- nourishment/household-purpose)
- vegetables)
- cereals)
- others)
- clothing) quantity,
- school materials) prices
- health)
- rent, electricity, other fees)

6. Potato-Marketing (Individual Land)

- who does it?
 - farmer
 - farmer' wife
 - children
- what amount sold?
- to whom is it sold?
 - merchant
 - broker
 - retailer
 - consumer
- prices received
- what market facilities do they have?
(transport, baskets, sacks, stalls)

APPENDIX

A.9. Preparation of 'enjera'

The T'ef-made 'enjera' is prepared in the following way: First, the T'ef-seeds are sifted and washed. Then the grain is milled to make flour out of it. The required amount of T'ef flour is mixed with a small amount of water to get a stiff dough. This dough is immersed in water and remains there for about 3 or 4 days. Sometimes a negligible amount of yeast is added. After that - when fermentation has taken place and a sour dough has been formed - the excess water is poured off. A small amount of this dough is mixed with freshboiled water to get a liquid white mass. This part is mixed with the bigger rest and more water is added till it also becomes liquid. This final dough is poured on to a large pottery plate (diameter about 0.8 m), which has been rubbed with a special spice.

Baking takes about two minutes; during it the pottery plate is covered. Out of 5 kg T'ef they get about 30 'enjas', and this amount lasts for about 3 to 4 days. Each 'enjera' weighs between 150 g and 200 g (equivalent to about 600 kcal each) and the normal consumption is about two 'enjas' per day per person.

APPENDIX

A.10. Preparation of 'wat'

To prepare for example 'chorro wat', onions and bean flour ('chorro') are needed. The onions are sliced and boiled with a small amount of water. Then red pepper and oil are added and more water and salt. This liquid is boiled again and the bean flour and more spices are added, butter if available. The 'wat' is then boiled for about 30 minutes. To prepare 'wat' for 2 to 3 persons, the following quantities are needed: 150-200 g bean flour; 3 to 5 middle-sized onions; about 100 ml oil and 1 spoonful (20 g) of butter.

APPENDIX

A.11. Preparation of 'kotcho' out of false banana (ensete)

The raw material for food preparation consists of the carbohydrates (starch) stored in the parenchymatic tissue of pseudostem and corm (trunk) of the false banana ('ensete').

To obtain the raw product, all leaves of the plant are cut off, the pseudostem is stripped until only the edible part remains. The earth around the corm is loosened, and the roots are cut. The pseudostem is then cut so that a small column remains attached to the corm. With a stick worked under the corm, and by pushing against the pseudostem, the plant is lifted from its hole. The harvest is brought to the 'workshop', an open but shaded place in the plantation (in eastern Sidamo roofed with ensete leaves). There some boards about two metres long are placed at an angle of about 40° against a horizontal pole fixed between two large ensete plants (or against the roof of the workshop). The ground under the boards is covered with ensete leaves. A woman, sitting in front of each board, keeps a leaf sheath with her foot as high up on it as possible with the convex side against the boards. Holding a sharp piece of bamboo with both hands, she scrapes (downwards) the part of the leaf sheath below her foot. Starch, mesophyll and short pieces of fibre fall to the ground, the scraped fibre strands remain on the boards. The leaf sheath is then moved down to scrape the next higher part, and so on until the whole sheath is finished.

The scrapings are stored close to the workshop in pits 1 metre in diameter and depth with walls and bottom carefully covered with fresh ensete leaves.

The innermost part of the trunk of an older plant needs no scraping as it does not contain fibres: it is treated with a wooden stamper and the pieces are added to the pit, where

a woman stamps down everything with her feet until the silo is full. Then it is closed with ensete leaves and stones. A few days later, the silo is opened to compress its contents once more.

After three to four weeks, strongly fermented ensete is added and mixed with the contents of the silo; after seven to eight weeks, a last rearrangement follows.

The total fermentation process takes from a few weeks to over one year; the older the product, the more people appreciate it. A slightly fermented product is already suitable for consumption. To ensure a regular supply, each plantation has several silos¹⁾.

The fermented product is pressed to remove the acid fermentation liquid, the doughlike material is mixed with spices and butter and baked into large thin breads ('kotcho'). Boiled cabbage leaves are eaten with them.

The dough-like fermented material that remains after the acid fermentation liquid has been removed, can be boiled with niger seed oil or butter to make a kind of porridge that is wrapped in an ensete leaf. A high-grade product is obtained by squeezing parenchymatic scrapings of the pseudostem and dehydrating the collected juice. This product is tightly packed in ensete leaves and left in a silo for fermentation. It is prepared as a kind of porridge called bulla²⁾.

1) Huffnagel et al., 1961; Smeds, 1955; Taye Bezuneh & Asrat Felleke, 1966.

2) Taye Bezuneh & Asrat Felleke, 1966.

APPENDIX

A.12. Energy needs according to German Nutrition Society, 1975

Recommended intake¹⁾

| | <u>Age</u> | <u>Male</u> | <u>Female</u> |
|----------------|-------------|-------------|---------------|
| Adults: | 25 years | 2600 kcal | 2200 kcal |
| | 45 years | 2400 kcal | 2000 kcal |
| | 65 years | 2200 kcal | 1800 kcal |
| Children: | 0- 6 months | | 600 kcal |
| | 7-12 " | | 900 " |
| | 1- 3 years | | 1200 " |
| | 4- 6 " | | 1600 " |
| | 7- 9 " | | 2000 " |
| | 10-12 " | 2400 kcal | 2100 kcal |
| | 13-14 " | 2700 " | 2400 " |
| 15-18 " | 3100 " | 2500 " | |
| Pregnant women | | | 2600 kcal |
| Nursing women | | | 2800 " |

1) These amounts are based on requirements for persons engaged in light work. Additional requirements for others as follows:

| | |
|-----------------------|------------|
| light to heavy work: | + 600 kcal |
| heavy work: | + 1200 " |
| extremely heavy work: | + 1600 " |

APPENDIX

A.13. Land cultivation and potato planting done by Women's Associations (3 cases)

The Women's Associations perform a lot of activities. Some of them spin cotton and sew 'gabi' and 'natela' out of the woven material. Others process spices, pack them and sell them in their own Women's Association shops. Also 'enjera', bread and tea are sold, like the above-mentioned products, through their own shops. Beside this, some Women's Associations also plant their own land, others are asking for land.

The three following examples of land cultivation by Women's Associations show the importance of vegetable/potato growing for these women and also explain their aims in doing so. They are interested in cultivating land together. They are looking for sources of income for the development of their Women's Association, but also for an improved and cheaper supply with vegetables/potatoes, both for themselves and other members of the Farmers' Associations and Kebele.

Furthermore these examples should give some ideas how particularly urban women, who normally do not cultivate any kind of land and have to buy all vegetables from the market, may improve their own and also the urban food supply.

- 1) One urban Women's Association of 237 members cultivates in a small town an area of about 1 ha. In the first place they grow pepper, but also lettuce, carrots and onions. For the future they are planning to plant potatoes as well. All worksteps, except ploughing, are performed independently by themselves. For the purpose of ploughing they hire a male worker with oxen and pay him.

They sell the pepper and the other vegetables directly from the field. Members of the Women's Association can

buy these vegetables at a reduced price. E.g. for one kilo of onions, members pay 30 cents, non-members 40 cents. The proceeds from the sales are saved in their common funds. They use them for financing the new purchase of seed; they intend to expand their land and to build a shop for selling spices and food.

For the next season they plan to cultivate 1/2 ha potatoes and 1/2 ha onions. They report that they are quite experienced in planting potatoes, because they have already planted them for several years on small plots around their houses.

- 2) Another urban Women's Association has asked the 'Kebele' for land. The land has already been allocated to them, the only problem is it is very far away from the village. Thus they try to exchange it.

They plan to cultivate potatoes, carrots, cabbage, onions and lentils because they expect a high profit by selling them - particularly if marketing them "off season". The seed will be bought on the market. The land cultivation will be done without ox plough; they want to try to do it by themselves by using the hand hoe. The harvested vegetables will be sold on the market - at a lower price for the Kebele women.

- 3) This Women's Association belongs to a Producers' Cooperative, established in a settlement area. They have got 160 members. During weeding, harvesting and transport to the store they are assigned as additional labour on the cooperative land. The majority of these women are also completely responsible for the work on individual land, because their husbands work daily on the cooperative land. Thus these women are really experienced in land cultivation.

Last year 1/4 ha land was distributed to this Women's Association. The men ploughed it with oxen. After this, the women exclusively grew potatoes on this plot. But because of drought the potatoes did not germinate and additionally they faced problems with red termites and moles. The same happened to the 20 ha cooperative land planted with potatoes. The women had to give the land back to the Cooperative; now it has been cultivated with maize by the Cooperative.

The women complain that they did not get any kind of help from the extension service. Only the cooperative maize cultivation received extension. Despite of this failure they are planning to plant potatoes again on even more land. Every woman has to contribute 25 cents to buy seed from the market and in September they will plant 1 ha potatoes again. They know how to fight the red termites with ash, but still the problem of missing irrigation facilities exists. They are planning to sell the complete harvest and use the earnings for the development of the Women's Association. Potatoes for own consumption have to be planted on individual land.

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The Post-Graduate Training Centre for Agricultural Development, an affiliate of the Institute of Socio-Economics of Agricultural Development, Faculty of International Agricultural Development of the Technical University of West Berlin has been engaged, since 1962, in preparing university post-graduates for employment in the foreign technical cooperation programmes of the Federal Republic of Germany, public administration, and international organizations such as the FAO, UNDP, ILO, World Bank, etc. The training programme is, therefore, oriented to the study of agricultural development in the tropics and sub-tropics. A maximum of 20 participants is accepted in this one-year course. Of these, 3-5 participants come from developing countries and most of the others are from Germany. Since many courses are taught in German, each participant must have a M.Sc. from Germany.

A significant component of the training programme is to carry out a study including a 3-month practical training abroad (called in-service-training) for which the participants of the Training Centre are divided into small groups. Each group stays in a developing country for about twelve weeks in order to undertake a specific task on a specific problem of agricultural development under close supervision of an experienced staff member of the Centre.

Aims of the analytical study are the following:

1. to gain firsthand practical experience and insight into the technical, economic, social and political structures and processes in developing countries;
2. to apply professional methods which have been learned in the first part of the training programme, and
3. to contribute, through the results of the study, to the development activities of the host country.

In 1980, the in-service-training groups were sent to Ethiopia, India, and Togo.

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