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INSTITUTE OF AGRICULTURAL RESEARCH



Sidama Mixed Farming Zone Diagnostic Survey Report

Sidamo Region

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Research Report No. 3/88

INSTITUTE OF AGRICULTURAL RESEARCH

SIDAMA MIXED FARMING ZONE
DIAGNOSTIC SURVEY REPORT

SIDAMO REGION

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Preface

This publication is the third of the Research Report Series of the Institute of Agricultural Research. Research Reports are designed to present findings of the different research activities carried out by the IAR staff. These reports also help to demonstrate to users the application of different methods used to tackle a certain researchable problem. Empirical evidence to substantiate the conclusions is presented.

This Research Report No. 3/88 demonstrates the methodology used to undertake a diagnostic survey in the Sidama mixed farming zone of Sidamo Region. The survey was conducted by an agricultural economist from Awasa Research Center in collaboration with local extension staff of the Ministry of Agriculture. Results of such surveys shed light on farmers' circumstances and production constraints and propose interventions to improve the farming system of the study area.

The Institute would welcome any comments and suggestions on the report; they should be directed to the authors.

Seme Debela
General Manager

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Summary

A diagnostic survey was conducted in the kola (low-altitude) and weinadega (medium-altitude) areas of Awasa, Shebedino, Dale and Aleta Wendo weredas of Sidama Awraja during the 1986 crop season. The objective of the survey was to describe the agricultural production system and thereby identify constraints, problems and opportunities for the development of the system.

The survey zone lies within an altitude range of below 1500 to 2300 m and the topography ranges from flat to extremely hilly. Soils are predominantly red and brown-black and have a pH level ranging from 6 to 7. The annual rainfall is 1000 to 1200 mm and the main rainy season (June through September/October) receives about 530 mm. The western part of the study area (kola target group) is characterized by erratic rainfall while the eastern part (weinadega target group) enjoys a reliable rainfall pattern.

The ethnic composition of the inhabitants of the area is predominantly Sidama while some of the area is inhabited by people of Welaita, Arsi, Gugi, Amhara and Kambata origin. Most of them are Christians, Muslims are next in numbers. The weinadega areas, which are denser in population (over 250 people per sq km), have a longer history in farming than do the kola areas where farming started not more than three decades ago. There are about 158,000 people in the study area organized into 57 service cooperatives, 200 peasant associations and 40 producers cooperatives.

Farmers in the target region pursue different crop enterprises in order to secure their family food supply and satisfy cash needs. Maize, enset (false banana), and haricot bean are the major crops grown in the kola area, by proportion of farmers growing. In the weinadega area, enset, maize, and coffee are the most important. Almost two-thirds of the families in both target groups have cows while only 18% of weinadega and 46% of kola farmers have oxen. Equines, poultry, sheep and goats are owned by less than 40% of the farmers in both target group.

Sole cropping is common in kola areas, except that haricot beans are usually intercropped with maize. In weinadega areas farmers tend to intercrop annual crops and coffee. In the Awasa area many farmers practice relay intercropping of maize and tef. Cultivated area per family is 1.2 ha for kola and 0.8 ha for weinadega. Land is limited, especially in weinadega areas. Crop rotation and fallowing are rare.

Land preparation starts in January and oxen owners plow three times before they plant in March-April. Broadcasting is the common method of planting for annual crops. Row planting is becoming popular particularly in kola. Almost all farmers who are not members of producers' cooperatives use local varieties of crops. The maize varieties commonly used are Asmara and Kenya. Asmara is tall, late-maturing, susceptible to lodging and drought

and is high yielding. Kenya is short, early-maturing and drought tolerant. DAP (diamonium phosphate) fertilizer is used on maize by about one-third of farmers in both target groups. Rates range from about 13 to 50 kg/ha.

Most farmers weed enset, coffee and maize more than their other crops. In both target groups tef is weeded rarely or not at all. Yield levels are low and about the same for the two target groups. Maize yields about 1 t/ha, and haricot bean 0.5 to 0.7 t/ha.

Livestock feed availability is one of the distinguishing features of the two target groups. Because land scarcity is acute in weinadega areas the pasture and grass availability is limited. Though moisture stress imposes limitations upon the availability of grass and pasture, there are relatively bigger communal grazing areas in kola. Moreover, they have a comparative advantage in terms of using crop residues and stovers. In addition to this they practice godantu, that is, they take their animals to distant places in search of feed and water. However, the feed problem remains acute particularly during the dry season.

The foods consumed are similar in both target groups. Wasa, a highly fibrous enset food, and maize enjera are the main starch staples. Hamicho, the rooty part of enset, maize enjera and wasa serve as supplements or substitutes depending on season and circumstances. Cabbage is the most important relish for most farmers throughout the year. A shortage of food usually occurs from April to August.

The principal problems of the farmers in the target region and some of the potential solutions are:

1. Insufficient rain and erratic distribution (kola). Because of the short growing period and low rainfall, the local maize varieties may fail before reaching maturity. Early-maturing varieties that outyield Kenya are required. An on-farm experiment to determine when varieties of varying maturity should be planted would also be useful.
2. Low soil fertility status (kola and weinadega). Nutrients are deficient, particularly phosphorus. Furthermore, fertilizer is not available in the quantity and type desired. On-farm fertilizer trials can determine optimal fertilizer rates for farmers and supply policy makers with information concerning which type of fertilizer to supply to the area.
3. Pests and diseases. Principal problems are stalkborer and cutworm on maize and coffee berry disease on coffee. Research should focus on finding control mechanisms (e.g. resistant varieties) that can be applicable within the resources of farmers. If, however, chemicals are the only means, attempts should be made to convince policy makers to make chemicals available.

4. Weeds. Farmers do not weed or their weeding is insufficient. Three approaches could be used to resolve the weed problem:

a) reducing the labor peak due to overlapping of operations by changing the maturity period of crops

b) using herbicides to solve the problem and release labor for other operations that overlap during the peak period

c) demonstrating weeding time and frequency to make farmers conscious of the yield reduction caused by weeds

5. Draft power shortage (weinadega). For most weinadega farmers, the hoe is the sole method of land preparation. Preparing land with the hoe is very tedious and the seedbed is poor, thus exacerbating weed problems. The problem could be alleviated through:

a) conducting trials on tillage techniques like minimum or zero tillage and on reducing weed infestation through the use of herbicides

b) providing farm credit for the purchase of oxen for nonoxen owners who are credit worthy with due consideration of the potential increment to productivity

6. Resource constraints. Land is scarce, especially in weinadega areas. Maize-bean intercropping can be tested to maximize returns from land. Labor is also a constraint during the peak period, March to June. Cash is scarce throughout the year.

7. Livestock feed shortage. Intervention in the livestock subsector should address the feed problem in the following ways:

a) investigating forage legume intercropping with the existing crops to ascertain that it does not affect their yield

b) using maize varieties whose plant population could be increased so that thinnings could be used for feed without affecting maize yield

c) conserving and using available feeds for use during the dry season

d) identification of forage tree species that can supplement livestock feed during the dry season

8. Livestock diseases. These include anthrax, rinderpest, blackleg, and foot and mouth. All are important in both target groups, especially during the dry season. Improving veterinary services is required.

9. Fuelwood and water for domestic uses are scarce in many kola areas.

SIDAMA MIXED FARMING ZONE
DIAGNOSTIC SURVEY REPORT

1 Introduction

Agricultural research is an integral part of overall development strategy. Therefore it has to contribute to the multiple goals of a national economic development plan that include self-sufficiency in food, more earning of foreign exchange and production of industrial raw materials. To accomplish these objectives, agricultural research has to adopt effective procedures that facilitate the generation of technologies that potentially contribute to the improvement of agricultural productivity. Moreover the research should be oriented towards solving the priority problems that limit productivity. Consequently, it would be appropriate to base improvements on an understanding of the perspectives of small farmers for whom technologies are to be developed and who are also the producers of the bulk of the food for the nation.

Farming systems research (FSR) is being institutionalized in the research services of many developing countries, including Ethiopia, because of the practical approach and procedures it follows in developing technologies that can fit into the systems farmers operate. In farming systems research, station-based technical research is complemented by a system-based on-farm research program in order to produce technologies that are compatible with the farm system for which technology is to be developed. Through on-farm research, priority problems of farmers are identified and, based on these problems, on-farm trials are conducted to derive potential recommendations that can solve the problems. Innovations that are perceived as having the potential to increase productivity are also tested in an on-farm research program. A system-based research program therefore facilitates both the generation and the transfer of technologies that can fit farmer circumstances in all aspects including agronomic adaptation, managerial feasibility and economic viability. This type of research would ultimately produce fruitful results that improve agricultural productivity, which is an important source of economic growth for the nation as a whole.

This paper presents the findings of a diagnostic survey conducted in selected areas of four weredas of Sidama Awraja during the 1986 crop season. In this survey most emphasis is given to cereals and pulses, since these are the enterprises Awasa Research Center currently emphasizes. However as far as possible attention has also been given to coffee, enset (Ensete ventricosum) and livestock, which are widely produced in the area though the center has no professionals working on these enterprises. Attempts have been made to describe the farming system, the resource base, production constraints, opportunities, and also points for intervention in the system. It is the belief of the team that the information included in this report will assist researchers in planning experiments that can solve the priority problems of the farmers in the target region.

1.1 Objectives

The objectives of the survey are:

- a. To describe and understand the current production system in the target region,
- b. To identify and prioritize the major production constraints,
- c. To assist in the design of an appropriate research strategy for the on-farm research program, and
- d. To identify and propose technologies that can solve the problems that limit productivity.

1.2 The Study Area

This survey was conducted in selected kola (lowland) and weinadega (middle altitude) areas of four weredas of Sidama Awraja, namely, Awasa-Zuria, Shebedino, Dale and Aleta Wondo (see Figure 1-1). The areas were selected on the basis of their proximity to the agricultural research centre at Awasa and hence the high probability of the transfer of technologies to the nearby farming community. Moreover the representativeness was also one of the criteria in selecting the target region. The rest of the region, i.e., dega (highland), was excluded from the study because of inaccessibility. In addition to accessibility and representativeness, the importance of concentrating on a few areas has been emphasized by the team in order to effectively launch the multidisciplinary survey and the subsequent on-farm trial program.

1.3 The Methodological Sequences of the Survey

The diagnostic survey was conducted during June and July 1986 using the methodology developed by the International Maize and Wheat Improvement Center (CIMMYT) (Byerlee et al.). In this study three stages were followed. The first stage dealt with the selection of the study area and the collection and analysis of secondary data. Based on the background information the target area was delineated and this facilitated the implementation of stage two, the informal survey. In the informal survey farmers were interviewed by a multidisciplinary team that included agronomists and economists. The informal discussion was also supplemented with crops and field observation. On the basis of the outcome of the informal survey, the formal survey was launched using a focused questionnaire.

Farmers interviewed in the formal survey were selected using a stratified random sampling technique. This involved random selection of 37 peasant associations (PAs) in the weinadega area and 20 from the kola area; then farmers were randomly chosen within the selected peasant associations. The sample size was 76 and 57 farmers for weinadega and kola respectively. The sample

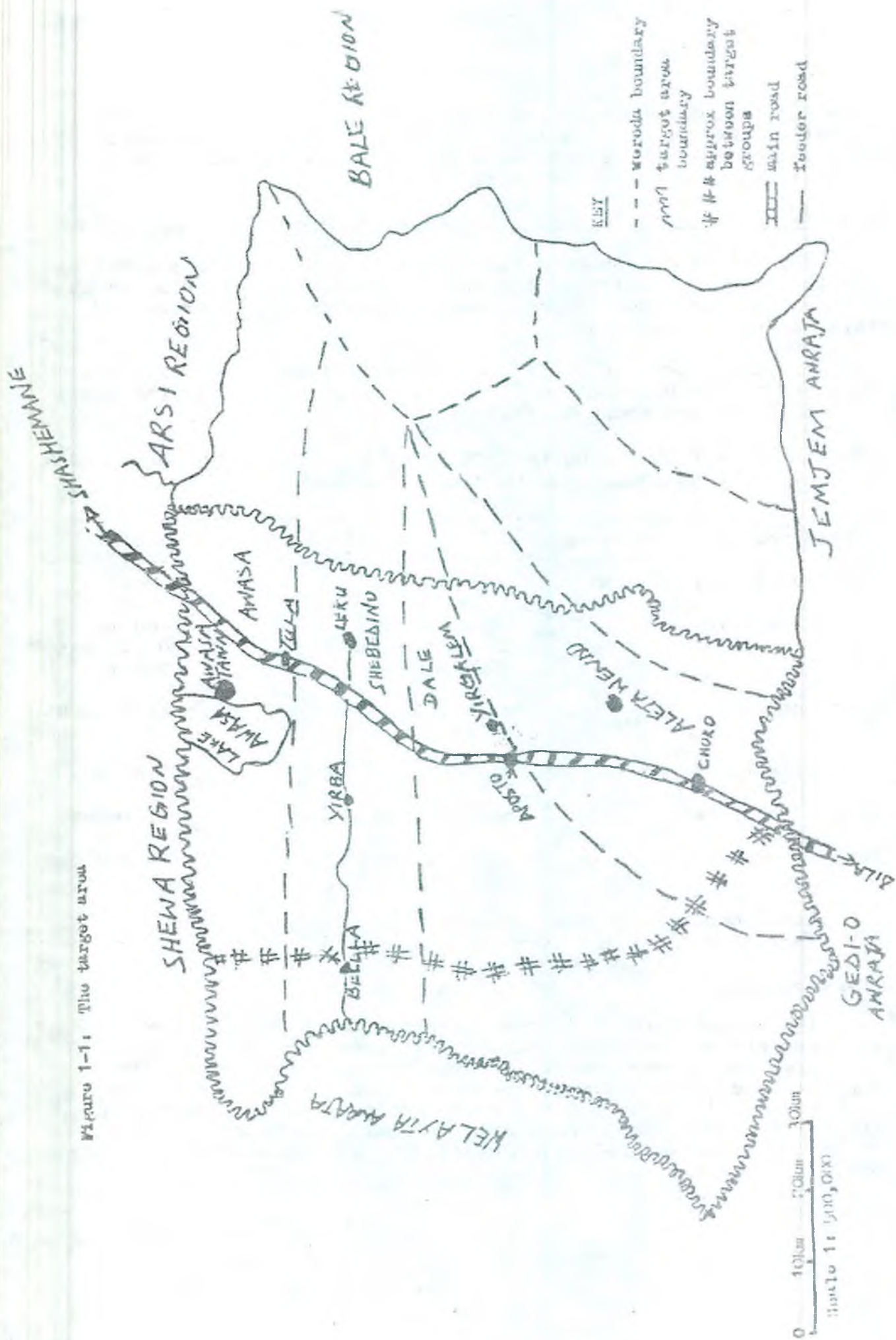


Figure 1-1: The target area

size for the weinadega target group was higher because of more variation observed in the informal survey. The questionnaires were administered by enumerators selected and trained under the supervision of the on-farm research team.

1.4 Target Groups of Farmers in the Study Area

Two target groups were identified during the informal survey and the frequent visits to the area. These were perennial crops cultivators and annual crops growers, located in weinadega and kola respectively.

The different factors, both natural and socioeconomic, that cause variation between the circumstances of farmers in the two target groups are shown in Table 1-1.

Table 1-1: Distinguishing features of the circumstances of farmers in weinadega and kola target groups

Distinguishing features	Weinadega	Kola
Location in survey area	east	west
Climate - rain	1000-1200 mm	<1000 mm
temp	15-20 degrees C.	>20 degrees C.
Altitude	1500-2300 m	<1500 m
Cropping pattern	enset, coffee, maize	maize, enset, coffee, beans
Farm size (average)	0.78 ha	1.2 ha
Access to market	more access	less access
Power source	usually human labor (hoe)	oxen and human labor
Population density	high	low

Weinadega farmers

The target farmers in the weinadega group live in the eastern part of the study area at altitudes from 1500 to 2300 m. This area has higher rainfall, lower temperatures, higher population density and more roads than the western part. The farmers in this group are primarily coffee growers, enset being the major staple food. Farm size is small, about 0.78 ha per farm, and the principal power source for land preparation is the hoe.

Kola farmers

Farmers in the kola target group live in the western part of the study area and are mainly dependent on food crops for their livelihood. Enset is the most important food staple, though maize is also very important. Farm size is larger than in the weinadega and oxen are the major source of power for land preparation. Farm size averages 1.2 ha, population density is low and roads and market infrastructure are weak.

2 Farmer Circumstances

2.1 Natural Circumstances

Rainfall

For the target region the mean annual rainfall ranges from 1000 mm in the western region of the study area (kola) to 1200 mm in the east (weinadega). More than 85% of the rain falls between March and October. The low amount of rainfall and its erratic distribution characterize the western part of the study area where almost all the farmers in the kola target group are located. According to farmers in this target group, the rain finishes in late August and September. Shortage of rain was reported as the major factor that reduced crop yield in the last five years. Crops like maize, of local, late-maturing types, cannot tolerate the severity of moisture stress because the rain is over before the crop is physiologically mature.

According to data for the period 1972-1985 for Awasa, which is located in weinadega, the total annual rainfall is about 1100 mm. The main season in Awasa, which is from June/July to September/October, receives about 529 mm or 48% of the total annual rainfall. The short season belg rain is from March to June and accounts for about 39% of the total annual rainfall. The remaining 13% falls during the dry spell. Farmers in weinadega areas therefore enjoy reliable rainfall and only four months, namely, November, December, January and sometimes February, are considered dry. Even under drought conditions (e.g. 1984/85) these farmers receive relatively good rain as compared to farmers in the kola area. After the drought season of 1984/85 rainfall amount and distribution was found reliable, especially during the year 1986 when this survey was done. The level of confidence in the rainfall amount and distribution for Awasa can be judged from Figure 2-1 which compares mean monthly rainfall with the highest rainfall received in the 20% of the years with lowest rainfall. The figure shows that for the weinadega area, there is considerable uncertainty over the start of the rainy season in March and April and some uncertainty over the end of the season in October. Although data is not available, it is likely that the rainfall is even more uncertain for the kola area.

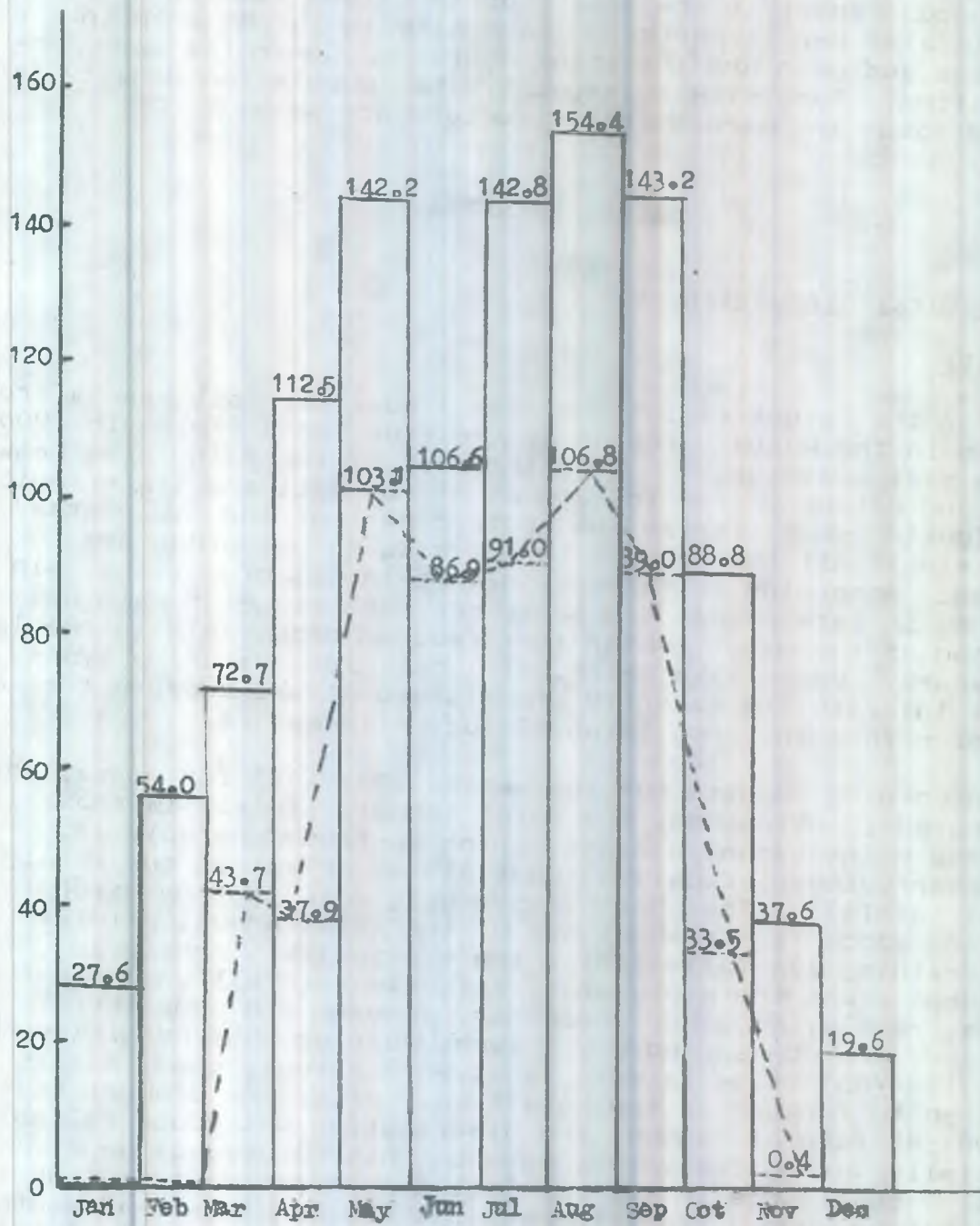


Figure 2-1: Probability analysis of monthly rainfall in Awasa (1972-1985). The broken line shows the highest of the lowest 20% of the means for each month.

Temperature

Like rainfall amount and distribution there is a distinct difference in the temperature of the areas of the two target groups. In the kola area, the high temperature is 20 degrees Centigrade with temperatures highest from October to March and April. However the temperature in the weinadega area is relatively lower, ranging from 15 to 20 degrees. The maximum annual temperature recorded at Awasa Research Center, which is in the weinadega target group, is 26.8 degrees, the minimum is 12.1. From December to March the temperature is relatively high. It is lower between June and September, the period of high relative humidity and high rainfall.

Topography and soils

The topography of the area varies from very flat to gentle slopes, which is common in kola, to very sloping topography that characterizes most of the weinadega area. The Awasa area is relatively flat, as compared to the rest of the weinadega area. The erosion problem, which is relatively serious in kola, is related to the bareness and susceptibility of the soil rather than to the slope, which is comparatively flat or gently sloping.

Approximately 60% of the soil, especially in weinadega areas, is red in color. This is followed by brown to black soils. Most soils in Awasa weinadega areas are Eutric Fluvisols, which are grayish in color. This soil, low in bulk density, is derived from pumic materials. Soils around Aposto and western Aposto are dominantly red in color and are mainly Chromic Luvisols. Pellic Vertisols that have more than 30% clay content cover areas from Aposto to Wondo. However, the northwestern parts of Aposto are mainly covered by Orthic Acrisols, which are usually very acidic and have low base saturation (Regional Planning Office for Southern Ethiopia 1985). Almost all these soils are found in the weinadega target region where there is less erosion problem. Murphy (1968) also describes soils of the weinadega areas as reddish brown to dark reddish brown with textures that include loam, clay loam, sandy loam and clay. The pH level ranges from 6 to 7 and the texture is sandy loam in the Awasa area, becoming dominantly clay loam around Yirga Alem. Soils in the Awasa area are well drained. Soils in these areas are deficient in P and have good response to fertilization according to soil sample studies (Desta Beyene 1982).

Soils in the western part of the study area (kola) are Eutric Nitosols. A considerable portion of these areas have Chromic Luvisols and the northwestern part is dominated by Moltic Andosols (Regional Planning Office 1985). About 58% of the farmers in kola mentioned having croplands that are mainly brown or black in soil color. Approximately 33% of the respondents mentioned red soil color. In addition to low soil fertility, there is a serious erosion problem in kola areas. Many places adjacent to Blatie catchment are seriously eroded and surface soils are removed in most of the areas. As a result of these

problems, deep gullies have formed in many areas leaving the land unutilizable for both grazing and crop husbandry. A public relief project is going on through the soils and water conservation department of the Ministry of Agriculture.

2.2 Socioeconomic Circumstances

Population

Sidama Awraja has a high population density. The population density for the awraja as a whole is 232.8 people per square kilometer (1984 census) and the household size is 5.4 and 5 for weinadega and kola respectively. The four weredas (Awasa Zuria, Shebedino, Dale and Aleta Wondo) have a total population of 1,021,063, of which about 94% belongs to the rural areas. The weinadega and kola zones of these weredas are inhabited by roughly 50% and 20% respectively of the total number of rural people; the other 30% belong to dega (highland) areas. Thus, in the study area there are about 158,000 people, 65% residing in the weinadega and 35% in the kola target group, with about 36 service cooperatives in the former group and 21 in the latter.

The ethnic composition of the population of the study area is dominantly Sidama. However, there are areas partly inhabited by people of Welaita, Arsi, Gugi, Amhara and Kembata origin. Most of the people are Christians although there are some Muslims. The weinadega areas, which are densely populated (over 250 people per sq km,) and where enset and coffee are concentrated, have a longer history in farming than the kola areas where farming started recently, probably not more than three decades ago. Previously the areas known as kola were inhabited by pastoralists. But now settled cultivation is as predominant as in the rest of the region.

Size of arable holding

As in other regions of Ethiopia, farmers in the target region obtained their land after the 1975 land reform proclamation. Consequently, there is no tenant-landlord relationship in the farming community. The farmer has no right to sell, hire or mortgagage his land.

The size of land held by each household is very small in the weinadega target group. More than 50% of the farmers mentioned have less than 0.5 hectare. This is mainly attributed to the population pressure, particularly the demand for coffee land. In the prerrevolution era the land in this zone served as a source of prosperity for the landlords who used to own most of the coffee farms. Moreover the long tradition of enset culture has been attracting many people to this area since enset is considered a reliable source of food for farm families even under drought conditions. As a result the size of holding continues to decline with no option for further expansion.

Farm size in the kola target group is relatively better though about 40% of the farmers have less than 0.5 hectare. In many cases farmers cultivate small areas because of the risk associated with the climatic hazards, especially uncertainty in the amount and distribution of rain and the shortage of oxen. Farmers depend more on livestock husbandry as opposed to crop production, which was started only recently when compared to the weinadega zone.

Farmer organization

There are about 200 peasant associations (PAs), about 45 service cooperatives (SCs), and approximately 40 producers cooperatives (PCs) and preproducers cooperatives in the weinadega and kola areas of the four weredas. However, more than half of all these associations are in weinadega areas.

Credit facilities

Very few sources of credit exist in the target area. Access to institutional credit, particularly the Agricultural and Industrial Development (AID) bank, is very limited, especially for farmers who are not organized into producers cooperatives. Farmers who are not members of these cooperatives cannot get credit since they are considered to be too risky and not credit-worthy. The AID bank and the Coffee Improvement Project (CIP), which operates in coffee areas, provide credit through registered service cooperatives to coffee farmers. The repayment of this credit is usually made at harvest time through the official marketing agencies, the Coffee Marketing Corporation (CMC) and the service cooperatives. There is no other alternative credit source, be it the traditional trader, the shopkeeper, lenders or other formal credit societies.

Food crop growers have no access to credit. They can purchase farm inputs only in cash and only if these inputs are readily available. Since many of the farmers could not repay the farm credit offered to them in the past, credit is no longer made available. According to the credit policy, cooperatives should have legal entity (be registered), have good performance and also have the ability to repay if credit is to be offered to them. In coffee-producing areas farmers are obliged to market their coffee through the service cooperatives irrespective of their membership and the credit service they get from the cooperative. However in kola areas where the bulk of the farm produce is cereals, farmers are usually not obliged to market their crops through the SCs.

Markets and communication

The Addis Abeba - Moyale road, which is tarmac, passes through the target region (Figure 1-1). Feeder roads also connect the various places in the target region with the main road. However, they are poorly maintained and vehicles travel with difficulty, especially during rainy seasons. Communication

is a severe problem, particularly in kola areas which are in some cases as far as 50 km from the all-weather roads. This is less problematic in weinadega areas since most of the rural roads there are well constructed.

Because of transport problems the marketing system is not efficient in kola areas. Therefore informal local transactions play an important role. In rare cases farmers go to Awasa, Yirga Alem, Tula, Leku and Aleta Wendo, which are active markets in the weinadega region. In these markets the main participants are the producers (farmers) and the consumers. Private traders are not active except for part-time traders who are engaged in farming and who sell their own produce in retail trade.

Although the Agricultural Marketing Corporation (AMC) does not operate in the area, the Coffee Marketing Corporation (CMC) is active, particularly in weinadega areas. Of the farmers interviewed from this area about 78% mentioned coffee as the major crop marketed. It is also the main crop marketed by about 35% of the farmers interviewed from kola. About 33% of the kola farmers mentioned maize as an important market crop; in addition they also mentioned haricot bean and tef. Livestock is marketed in most of the local areas as well as in the big towns, coming mostly from kola areas.

Farm inputs like fertilizer and improved seeds are not available in most markets, although they are sometimes available through the service cooperatives. Farm inputs sold at markets are limited to local types such as manufactured farm implements.

The price range summarized for different crops (Table 2-1) indicates the variation from one harvest season to the next. Generally there was a reduction in the price of crops between October 1985 and October 1986. The high price recorded during September to November 1985 was mainly because of the poor harvest in the previous crop year, which was a famine year in most parts of the country. The reduction in price during the harvest of 1986 was as much as 30% for some of the crops like tef and barley. This was probably due to the good harvest obtained in the 1986 crop season.

Table 2-1: Summary of price range for the major crops
September 1985 to October 1986 (birr/100 kg)

Type of crop	Sept-Feb. 1985-86	March-May 1986	June-August 1986	Sept-Oct. 1986
Tef	115	110	91	82
Wheat	86	81	75	73
Barley	83	66	64	58
Maize	46	53	45	38
Faba bean	86	86	89	76
Field pea	108	102	92	89

Source: Data collected through MOA wereda office.

3 The Farming System

3.1 Farmers Objectives and Priorities

The primary goal of farmers is the satisfaction of family food needs day by day and year in year out. In the kola areas, this is achieved by growing different crops that are sources of basic starch staples. However farmers in weinadega areas achieve their objectives by growing cash crops like coffee, which can generate cash that can ensure adequate purchases of basic food grain in addition to the main staple food, enset. The livestock enterprise also plays a significant role in ensuring the attainment of farmer objectives and priorities, contributing either by supplementing family food with animal protein or by ensuring cash needs, a subordinate objective for the farm family.

Food consumption and availability

There is no significant difference in the food consumption pattern of weinadega and kola areas. Table 3-1 shows the main, supplement, substitute and preferred dishes and relishes for farmers in both target groups [1]. Wasa, a highly fibrous enset food, and maize injera are the main starch staples for the farmers in the study area. Hamicho, the rooty part of enset, maize enjera, and wasa serve as supplements or substitutes, depending on seasons and circumstances. The two most preferred foods are tef enjera and bula, which is the most refined (least fibrous) and palatable food made from enset. However, these foods are rarely eaten. A considerable number of farmers also mentioned wasa and maize enjera as preferred foods since these are often at their disposal and the availability is more certain than the crops that command high price, such as tef.

Cabbage (Brassica spp.) is the most important relish for most farmers throughout the year. This is followed by milk and milk products. Milk is the main supplementary relish for many farmers. Meat, which is rarely eaten, and milk are the two most preferred relishes.

1. Supplement in this report means food that is added to or consumed with the main dish while a substitute dish is one that replaces the main dish.

Table 3-1: Main, supplement substitute and preferred dishes and relished for farmers

	Foods	Kola % respondents	Weinadega % respondents
<u>Staples</u>			
Main	maize enjera	35	12
	wasa (enset)	63	89
Substitute	maize enjera	42	29
	hamicho (enset)	40	41
	wasa	7	17
Supplement	maize enjera	64	74
	wasa	30	17
	hamicho	2	4
Preferred	tef enjera	40	38
	bula (enset)	28	25
	wasa	23	28
	maize enjera	9	7
<u>Relishes</u>			
Main	cabbage	77	83
	milk	21	14
Substitute	milk	32	55
	nufro	28	14
	cabbage	18	14
Supplement	milk	25	18
	nufro	30	16
Preferred	milk	39	54
	meat wot	54	46

Food calendar

The availability of main starch staples and relishes during the different months of the year is indicated in the food calendar in Table 3-2. A shortage of food usually occurs from Miazia (April) to Nehassie (August) for families in both target groups. This shortage occurs since the stored food grain is finished several months before the new harvest and most of the crops in the field are not ready for consumption. As indicated on the food calendar, the availability of wasa and maize enjera declines from May to August. Substitutes include hamicho and maize green cobs. About 49% and 33% of the respondents from weinadega and kola respectively obtain wasa, maize and hamicho through purchases from the market.

Concerning relishes, in the weinadega area there is little change in availability in different months of the year. In kola areas, milk is scarce during the dry season, December to February.

Table 3-2: Food calendar; main dishes and relishes available by month

	% responding that food is available											
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug

% responding that food is available												

Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug												

Weinadega target group												
<u>Main dishes</u>												
Wasa	80	82	85	89	89	89	84	84	80	74	53	47
Maize enjera	16	13	15	12	12	12	12	12	12	10	12	11
Hamicho	-	-	-	-	-	-	-	-	-	5	9	5
Tef	-	1	-	1	1	1	1	1	1	-	-	-
Green maize cobs	-	-	-	-	-	-	-	-	-	4	26	32
<u>Relishes</u>												
Cabbage	83	84	80	82	82	78	78	82	82	83	80	80
Milk	16	16	16	14	13	13	13	14	15	16	16	16
Meat	1	1	1	4	4	3	3	-	-	-	-	-
Kola target group												
<u>Main dishes</u>												
Wasa	58	61	70	70	70	61	61	61	61	51	40	37
Maize enjera	32	37	37	39	39	37	37	37	37	32	28	23
Hamicho	-	-	-	-	-	-	-	-	-	4	7	4
Tef	2	2	1	2	2	1	-	-	-	-	-	-
Green cobs	-	-	-	-	-	-	-	-	-	7	25	33
<u>Relishes</u>												
Cabbage	91	75	75	93	93	93	72	72	72	74	75	75
Milk	25	25	25	7	7	7	25	25	25	15	25	25
Meat	2	2	3	3	3	2	1	1	-	-	-	-

Cash

Cash income is a subordinate objective that is dominated by family food requirements, especially in the kola target group. Table 3-3 shows the major cash sources for the farmers in the target area. In the weinadega area, coffee is by far the most important source; others include livestock and livestock products. In the kola area livestock sales are the most important; coffee, maize and livestock products are also important sources of cash income. Calves, sheep, goats and usually chickens are sold when there is an urgent need for cash or when there is no crop to be sold.

Table 3-3: Relative importance of crops, livestock and off-farm work as a cash source

Source of cash	Kola = No 57		Weinadega = No 76	
	No	% deriving	No	% deriving
Crop - coffee	20	35	59	78
- maize	19	33	5	7
- others	11	19	15	20
Livestock	29	51	22	29
Livestock products	14	25	17	22
Off-farm work	9	16	13	17

Although not as important as crops and livestock sales, some households also receive funds from family members working off the farm, mainly on state farms and public relief projects like the soil and water conservation or the "food for work" program which is being undertaken by the Ministry of Agriculture.

3.2 Enterprise Pattern

Farmers in the target region pursue different crop enterprises in order to secure their family food supply and also satisfy various cash needs. Maize, enset, coffee, tef and haricot beans are the major crops grown by the farmers. Minor crops like sweet potato are becoming popular, especially in kola areas. The approximate area and percent of growers of the major crops are set out in Table 3-4 below. The crops do not correlate perfectly with target groups since there are intermediate areas between kola and weinadega where farmers grow coffee.

Table 3-4: Area and growers of main crops

Crop	% growers		Hectare/grower		Ha/sample farm	
	Kola	Weinadega	Kola	Weinadega	Kola	Weinadega
Maize	98	92	0.72	0.30	0.70	0.28
Enset	72	93	0.23	0.28	0.16	0.26
Haricot bean	51	20	0.25	0.15	0.13	0.03
Coffee	44	80	0.15	0.23	0.07	0.18
Tef	23	13	0.53	0.18	0.12	0.03
Mean					1.18	0.78

In most of the weinadega areas farmers interplant coffee with low densities of maize, haricot bean, tef and sometimes sorghum. Usually fields are planted with coffee and enset either separately or together and food crops are often intercropped within the two perennial crops.

However in the kola target group almost all the crops are grown in pure stand except that haricot bean is usually interplanted with maize. In the Awasa area many farmers practice relay intercropping of maize and tef. Relay intercropping is growing two or more crops simultaneously in the same field during part of the life cycle of each. Tef is used as a relay intercrop since it tolerates the moisture stress in late September and October.

The livestock enterprise also plays an important role in the farming system of the target region. Its major objective in both target groups is to satisfy food and cash needs. However farmers in kola areas also keep livestock for draft purposes and for prestige. In weinadega areas, the use of oxen cultivation is uncommon so most farmers sell their male calves immediately after weaning. As shown in Table 3-5, more oxen are owned by farmers in kola areas and 46% of farmers there use oxen for draft purposes or plowing. Most farmers in weinadega areas do not use oxen for plowing since the cropping system does not require much land preparation; only 18% own oxen. However the distribution of cows in the two target groups is virtually identical. Almost two-thirds of the farmers interviewed had two or more cows. The figures indicated in Table 3-5 should be considered as a minimum since farmers understate the exact number of their livestock out of fear of taxes or for other reasons.

Table 3-5: Type and number of livestock owned

Classes of livestock	Kola		Weinadega		Owners(%)	
	Sample	Owners	Sample	Owners	Kola	Weinadega
Oxen	0.80	1.90	0.30	1.40	46	18
Cows	2.80	3.30	2.55	2.98	84	85
Calves	0.10	1.50	0.24	1.64	7	14
Sheep & goats	0.80	2.90	0.46	1.75	28	26
Equines	0.30	1.30	0.14	1.22	23	12
Poultry	1.60	4.00	1.28	3.23	40	39

The high number of cows owned per family is an indication of the importance of cows either for realizing the satisfaction of daily food needs or indirectly through the sale of milk and butter or calves and heifers when there is a food shortage and crops are not available at home. Sheep, goats and poultry are kept mainly to satisfy immediate cash needs of the family or to slaughter on holidays and other occasions, especially after the crop harvest when cash shortage is not a problem. Farmers in the study area keep equines for transport; the donkey is the main animal so used.

3.3 Resource Availability and Use

The availability of land, labor, capital and power are the most important production factors that influence the decision-making process of farmers. Farmers in the target region therefore allocate their limited resources to both crop and livestock enterprises in order to meet their priority needs, which are food and cash. The farmers manage their farming system based on the available resources and time and also with due consideration of the influences of their priorities and the circumstances under which they carry out their farm work. The understanding of the resource base, as described below, will assist in planning technologies that can fit the resource endowments of the farmers.

Land

The availability of land differs between the two target groups. In kola areas, land is generally not a scarce resource. Relatively bigger farms are held by farmers in this target group, with 1.2 ha the average land holding of the sample farmers (see Table 3-6). Farmers may tend to underestimate their holding size because of suspicion of taxes or other factors.

Table 3-6: Size of land holding per household for kola and weinadega target groups

Size (hectare/ household)	Kola		Weinadega	
	% responding	Average land size	% responding	Average land size
<0.5	42	0.46	52	0.38
0.5-1.0	28	0.83	30	0.84
>1.0	30	2.82	18	1.76
Mean	100	1.2	100	0.78

The size of land held by each household in weinadega areas is relatively smaller, with 0.78 ha the average holding of the sample farmers. About 52% of these farmers have less than 0.5 ha and only 18% more than 1 ha. Land is generally a scarce resource in this target group.

Labor

The household is the main source of labor for farmers in the target area. However, the head of the household is the only one working on the farm full time. The other family members, particularly women and children, take part in the farming activities during the busy periods, like weeding, planting and harvesting. Only 4% of the respondents from kola and less than 2% of those from weinadega hire casual labor. At peak periods farmers overcome the labor shortage by using customary labor exchange systems like wonfel and debo [1]. About 70% and 63% of the respondents from kola and weinadega respectively use wonfel as a source of labor. Debo was mentioned by 33% and 22% of the respondents from kola and weinadega respectively.

The enterprise calendar

Close examination of the crop calendars for the two groups (Tables 3-7 and 3-8) and the farmers decisions in labor allocation clearly indicate strong farmer priorities for a reliable supply of staple food for the family. In almost all farmers' decisions subsistence objectives dominate the allocation of resources.

In both target groups, land preparation, especially for maize, starts in the same month, Tir (January). Farmers in

1. Wonfel is a labor exchange system in which the person being helped would in turn help the person who provided him labor. No food or beverage is provided. Debo is a labor exchange system in which the person being helped gives food and beverage.

Table 3-7: Crop calendar for kola areas (% responses)

Crops and operations	Sept		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		June		July		Aug		
	E	L	E	L	E	L	E	L	E	L	E	L	E	L	E	L	E	L	E	L	E	L	E	L	
Maize																									
Land preparation																									
	1st								16	6	21	8	20	11	4	2									
	2nd								2	2	6	14	10	8	8	4									
Planting																									
											2	2	17	13	11	10									
Weeding																									
	1st												8	35	18	13	4								
	2nd													11	23	17	8	8	8	8	7	2			
Shilshalo																									
Harvesting																									
		4	5	11	4	14	6	2	1					1	2	2	7	8	3	2					
coffee																									
Land preparation and planting																									
															21	3	1								
Weeding																									
		6		1											1	10	17	7	9	5	6			2	
Picking																									
		2	3	6	10	12	9	8	9	4	2														
hset																									
Land preparation and planting																									
											1	1	5	2	21	8	1								
Weeding																									
		6	1	1									2	1	11	19	17	18	10	12	9	6	5	4	
eff *																									
Land preparation																									
											1	1	4	3					6	5	5	12	10	3	
Planting																									
		1													1	2					2		8	3	
Weeding																									
Harvesting and threshing																									
				3		6	3	1												3					
aricot bean *																									
Land prep.																									
	1st							1	1	6	3	17	3	9	3	3	2	1		11	2	21	1	1	
	2nd							1		1	4	2	12	6	3	5	2			1	6	10	9	3	2
Planting																									
		1										1	2	12	2	6	5					8	11	2	
Weeding																									
	1st	1	1											7	8	4	6	1						13	2
	2nd	4	2												8	14	10	4	6	2	1	2			
Harvesting and threshing																									
		4	1	5	2	9														11	5	5			1

Percentages do not add to 100 because not all farmers reported doing a particular activity.

E - Early L - Late

* - Calendar for belg (short season) planted crop for crops harvested twice a year.

Table 3-8: Crop calendar for weinadega areas (% responses)

Crops and operations	Sept		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		June		July		Aug			
	E	L	E	L	E	L	E	L	E	L	E	L	E	L	E	L	E	L	E	L	E	L	E	L		
Maize																										
Land preparation																										
1st									32	2		27	2		7											
2nd									2	13		16	19		22	11		10								
Planting									1	2		4	3		23	10		23	5							
Weeding										1		2		5	7		31	44		39	20	14	7	5	1	2
Shilshalo																		3	2		4	1				
Harvesting and threshing	11	9	11	4	21	2	4																			
Coffee																										
Land preparation and planting														1	1	53	10						3			
Weeding	9	6	2	2									1	1	3	20	26	18	25	9	19	7	12	2		
Picking	7	14	13	12	25	22	26	20	20	8																
Enset																										
Land preparation and planting									2	2			6	6	49	13										
Weeding	7	2	1	1	1		2	3					1	1	11	39	41	30	25	16	18	11	10	6		
Teff																										
Land preparation																						8	2	5		
Planting																						6	6	5		
Weeding																										
Harvesting																										
Haricot bean *																										
Land preparation									9	3		14	5	10	4	2		1			1		7	3	2	
Planting												2	1	5	1	4	1						1	3	1	
Weeding														4	8	6	11	2	3				1			
Harvesting and threshing	2		1	2			1													3	2	5	1	1		

Percentage do not add to 100 because not all farmers reported doing a particular activity.

E - Early L - late

* - Calendar for meher (main season) planted crop for crops harvested twice a year.

weinadega areas start land preparation in January because the hoe, which is the sole method of land preparation for most farmers, is not efficient enough to finish plowing on time. Farmers in kola start plowing early in order to be ready to effectively utilize the first rain shower, which is unpredictable. Although there is no significant difference in the crop calendar of the two groups it can be observed that many farmers in weinadega start land preparation for maize earlier than those in kola. This is mainly due to the difference in the time of onset of rain. Since rain starts late in kola, land preparation and planting are also delayed. The most important features of the farming system in the two target group as illustrated in the crop calendar can be summarized as follows.

a. A long period is allotted to land preparation (January-April) to spread labor so as to avoid overlapping of operations during planting time. This does not however include enset and coffee, for which land preparation and planting are done simultaneously in April.

b. Planting is concentrated during the period March (Megabit) to April (Miazia), which is a very busy period.

c. Particular attention is given to weeding enset, maize and coffee during June and July as compared to the other crops that require weeding simultaneously. This distinguishes the major crops from others like tef, which are not weeded at all.

d. Harvesting time for most crops is September to December.

About 56% of the sample farmers from kola and 71% of those from weinadega mentioned March to April and May to June as the two busiest periods for farming. Principal activities in both areas during March to April are land preparation, planting and weeding maize and enset, and land preparation and planting coffee. During May to June farmers are weeding maize and coffee.

Maize receives initial priority in planting at the start of the rain; 84% of the farmers in kola and 74% of respondents from weinadega mentioned concentrating on planting maize during February to March and sometimes early April. Enset and then coffee take priority after maize planting is completed. However, many farmers in kola areas put haricot bean among the priority crops planted early; some give it equal priority with maize and enset. In terms of being busy, weeding comes next to planting for most farmers in the two target groups. April to June is the peak period for weeding almost all crops. Farmers give much attention to maize and enset weeding. Coffee is also given due attention by weinadega farmers since it is a priority crop for generating cash income.

Harvesting is also a busy period, particularly for farmers in kola areas. However, since harvesting is done over a relatively long period it is not as difficult to complete as work

during the two other busy periods of planting and weeding.

The seasonal labor peak is more severe in kola because of the bigger area under field crops and hence the more severe problem, especially at weeding time. However in weinadega areas the degree of severity of the problem is less since the total farm size per individual household and the percent of the total area under field crops are very small as compared to those in kola areas.

Capital

The major capital items owned by the farmers in the study area include livestock, farm tools and equipment, and stored grain. Livestock is the main asset. Farmers are dependent on both stored grain and livestock for daily cash needs.

Table 3-9 sets out rough estimates of the levels of cash income from different sources in 1985/86. The average annual cash income is about birr 461 and 475 for respondents from kola and weinadega respectively. Crop sales contribute the major proportion of the cash income, approximately 36% and 41% for kola and weinadega respectively. Cash income from crops is higher for weinadega because of coffee, which is the dominant cash earner for farmers in this target group. In percent of respondents, livestock and livestock products come second to crops as a cash source in both target groups. However the percent of cash received from livestock is lower than cash income from off-farm sources.

The cash income obtained from different sources is used to cover the various farm and home expenses. Table 3-10 shows the major items of expenditure during 1985/86. The total expenditure was about birr 329 and 318 for kola and weinadega target groups respectively. About 20% and 22% of the expenditures of the sample farmers of kola and weinadega respectively goes to the three main farm expenses: tools, seed, and fertilizer. Clothing and food constitute the major proportion of cash expenditure, about 64% and 62% for kola and weinadega. Almost all farmers paid tax during the 1985/86 season. The proportion of cash spent for tax payment was high because of the inclusion of a surtax imposed to cover relief and rehabilitation costs of drought-affected regions in the country. In addition, expenses for food were high because of poor harvests during the 1985/86 season.

Table 3-9 : Level of cash income from different sources.
1985/86

Sources of cash income	Kola		Weinadega	
	birr/year	% of total cash income	birr/year	% of total cash income
Crop sales	165	36	196	41
Livestock and livestock products	148	32	98	21
Off-farm work	148	32	180	17
Total	461	100	475	100

Table 3-10: The major items of farm and home expenses.
1985/86

Purpose of expenditure	Kola			Weinadega		
	% spending	Amount spent birr/year	% of total expenditure	% spending	Amount spent birr/ha	% of total expenditure
Farm tools	47	18.7	6	53	12.8	4
Seeds	42	21.1	6	64	23.5	7
Fertilizer	33	27.0	8	29	33.0	10
Tax	98	53.6	16	96	53.4	17
Food	51	81.4	25	60	79.2	25
Clothing	65	127.5	39	66	116.7	37
Total		329.3	100		318.6	100

Power

The availability and use of draft animals (oxen) is one of the distinguishing features between the two target groups as indicated in Table 3-11 below. About 53% of respondents from kola and 81% of those from weinadega mentioned having no oxen. Only 33% and 7% of the sample farmers from kola and weinadega respectively have two or more oxen.

Table 3-11: Oxen ownership

No. of oxen owned	% respondents	
	Kola	Weinadega
No. ox	53	81
1 ox	14	12
2 or more oxen	33	7

Table 3-12 shows the method of land preparation used in the two target groups. Approximately 79% of the respondents from weinadega area use the hoe as the primary method of land preparation. Only 5% of the farmers have a pair of oxen for plowing; about 12% use mekenajo, an arrangement in which two farmers combine their oxen for common use, usually used by farmers who have only one ox. In kola areas where relatively many farmers own oxen, the use of oxen for land preparation is very common.

Table 3-12: Method of land preparation

Method	% respondents	
	Kola	Weinadega
Hoe	42	79
Own oxen	33	5
Mekenajo	12	12
Borrowed oxen	10	3

3.4 Crop Husbandry in the Farming System

Selection of fields

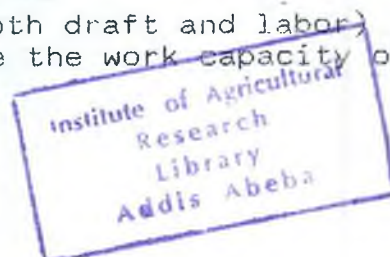
Farmers select fields for the various crops on the basis of the fertility of the soil. However, in weinadega areas the choice of land and soil is very limited since land is in short supply and mostly planted with perennial crops. Nevertheless, as far as possible fertile lands are often allotted to enset and maize.

In both target groups crop rotation and fallowing are uncommon. A very small number of farmers who grow tef select fallow lands in order to reduce weed infestation. Only 18% of the respondents from kola and an insignificant number from weinadega mentioned relay cropping, especially maize and haricot bean. The purpose is to produce two crops in one year; beans are relay cropped into the maize before the maize tassels.

Land preparation and planting

To reduce the draft requirement both oxen and hoe cultivators start land preparation immediately after harvest when the soil is easy to work. According to the farmers interviewed, exposing the soil to the external climatic factors through early plowing has two advantages:

1. Decomposition of roots and leaves from the previous crop and its importance in improving the fertility of the soil. This practice also increases aeration and reduces weed infestation.
2. Reduction of power requirement (both draft and labor) during planting, which is important because the work capacity of



oxen is lower because of shortage of feed during the dry months. Also during the period before planting, the soil is dry and hard to work.

Maize land preparation starts earlier in weinadega areas since the onset of rain is also earlier. The first plowing is in January and is usually done using the hoe. Most farmers in kola who own oxen plow three times before planting maize. However the frequency of plowing is highest for tef fields. Belg land preparation for haricot bean and tef coincides with maize weeding in kola areas. Land for meher planting of haricot bean and tef is plowed starting from June and extending usually up to early August. Because the soil is moist and oxen are physically strong land preparation is not as difficult as in the belg season where the operation starts when the soil is dry.

Digging holes for enset and coffee is done annually and usually completed within the month of April. The digging is done to replace old plants or to start plantations in new areas. The seedlings, which are raised in nurseries, are transplanted immediately after the holes are dug.

Farmers in the target region usually use the broadcast method of planting annual crops. Row planting of maize is becoming popular, particularly in kola areas. Farmers prefer to apply fertilizer, now used more widely, on row-planted crops. Also the drought has prompted farmers to economize on seed. The range of seed rate for maize is 40-50 kg/ha, which is almost double the recommended rate (25-30 kg/ha). Farmers use a high seed rate in order to obtain thinnings for livestock feed.

The varieties of maize commonly used are locally known as Asmara and Kenya. Asmara is a tall, long-maturity type susceptible to lodging and drought but is a higher yielder than Kenya. Kenya is short, early maturing and drought tolerant but gives low yields. Most farmers prefer Asmara and about 79% and 57% of weinadega and kola respondents respectively use this variety. Almost all farmers use local varieties of maize except producers cooperatives that use the variety A511 with a seed rate that is near to the recommended level. The planting time for maize is in March and early April. However homestead gardens are planted early and sometimes dry planted to have green cobs available to alleviate the July to August hunger period.

During the belg season, in March, crops like haricot beans and tef, which are harvested twice a year, are planted simultaneously with maize. Beans are either planted in pure stand or intercropped with maize. Like maize, beans are sometimes row planted, especially when seeds are in short supply. The seed rate for pure stand beans is about 50 kg/ha, which is above the recommended rate. Meher beans planting is usually in July when the beans are usually planted in pure stand. Tef planting follows beans, usually in August. The seed rate for tef is about 20 kg/ha.

Relay intercropping of tef and maize is practiced by many farmers in the Awasa area. Tef is planted after the maize is weeded; during August to September the maize is harvested leaving the tef free to exploit the residual soil moisture.

Fertilizer management

Fifty-seven percent of farmers from weinadega reported soil fertility problems, particularly with maize. Weinadega farmers claimed that low soil fertility, although not as pronounced as with maize, is also a problem for haricot bean and coffee production.

About 67% of farmers in kola mentioned low soil fertility was causing low maize yields on their farms.

The use of fertilizer in the study area is usually dependent on the availability of fertilizer and cash. About 29% and 35% of the respondents from weinadega and kola mentioned using DAP (diammonium phosphate) for maize. The rate varies from about 13 to 50 kg/ha depending on the method of planting. Usually maize is row planted to economize on fertilizer. The rate is far below the station recommendation, which is 69-92 kg/ha nitrogen, or the MOA blanket recommendation, which is 41 kg/ha nitrogen and 46 kg/ha phosphate (100 kg/ha DAP to be applied at planting and 50 kg/ha urea top dressed). Farmers apply all their fertilizer (DAP) at planting. The use of fertilizer for beans and tef is rare and the rate is also lower.

Farmers use manure mainly for enset and coffee and sometimes for maize. The application is on a daily basis and depends on the amount of livestock. Usually sandy soils are manured before plowing, especially in kola areas. The use of crop residue for soil fertility maintenance is uncommon in both target groups.

Weeding

The frequency and timing of weeding is dependent upon the priority given to the crop in the farming system. Most farmers in both target groups give particular attention to weeding maize and enset. Maize is weeded once or twice at one-month intervals after germination using the hoe. About 49% and 54% of weinadega and kola respondents respectively mentioned weeding frequency of maize to be twice. Others weed less frequently. Farmers who use oxen plowing, especially in kola areas, do shilshalo (oxen cultivation) after the first weeding but before the second weeding. The research recommendation is for two handweedings, 25 days after planting for the first weeding and 55-58 days after planting for the second.

Enset and coffee are weeded frequently. Enset is usually weeded by women, who use hoes in order to ridge soil around the crop. Coffee weeding usually involves slashing; weeds are left and are cleared before harvest. In kola areas, beans are weeded twice. Beans in weinadega areas are weeded frequently since they

are intercropped with coffee, which is weeded frequently. In both target groups, tef is weeded rarely or not at all, because weeding tef is tedious.

The common weed species considered problematic by most farmers are Chrysanthemum americanum, Nicandra physalodes, Bidens pilosa spp., Galinsoga pasiflora and Snowdonia polystacha. These weeds affect maize, haricot bean and tef more than enset and coffee which can suppress the weeds.

Pests and diseases

Stalk borer and cutworm are pests of primary importance in maize production for farmers in both target groups. Next most serious is armyworm, which is sporadic by nature and is especially a problem in kola areas. Coffee farmers repeatedly mentioned coffee berry disease (CBD) as their biggest problem. Enset suffers from the attack of enset bacterial disease, which is locally known as shame. Some farmers also mentioned aphids (kuchach) as being problematic for haricot bean. Farmers do not have any traditional control technique for pests or diseases. Coffee farmers use chemicals like Captafol and Dilan which are recommended by researchers to control CBD. These chemicals are usually distributed through CIP and MOA. Sporadic pests like armyworm are controlled by endosulfan, which is distributed free of charge whenever the problem occurs.

3.5 Livestock Husbandry in the Farming System

Breeding and management

Producer cooperatives with dairy farms have started modern breeding techniques. However, individual farmers who are dependent on indigenous breeds of cattle control breeding by allowing only good-looking bulls to graze with cows or heifers in heat. The average age at first mating is usually four years. April is the most common mating month; most farmers prefer the months from April to July for births since this is the time when feed is available. About 77% and 70% of respondents from weinadega and kola respectively mentioned a calving interval of 1.5 to 2 years. The calf crop per cow ranges from 5 to 8. The average calf crop tends to be higher for farmers in kola.

Feeds and feeding

The availability of livestock feed is one of the factors that distinguishes the two target groups. Because land is generally scarce in weinadega areas the availability of pasture and grass is also limited. However, kola farmers have relatively bigger communal grazing areas though moisture stress limits the amount of grass that can be made available to the animals. Besides, the relative importance of food crops in this target group limits the amount of pasture land to be used for livestock feed. However farmers have comparative advantage in terms of using crop residues and stovers as a source of feed when crops

are removed from the fields. In addition, many farmers in kola areas practice godantu; that is, they take their animals to distant places, such as Blatie, in search of feed and water. More than 50% of the farmers in kola areas send their animals on godantu; usually the family heads go with the animals after they finish planting in April so that their mobility does not affect crop management since they will be back in time for weeding.

Farmers in the study areas mentioned acute feed shortages during the dry season. More than 50% of the farmers in kola area mentioned December to February as the most critical period for feed. Farmers in the weinadega target group also mentioned this period as the months when they face a feed shortage. About 54% and 29% of farmers in kola and weinadega respectively provide their animals with crop residue during periods of feed shortage. For about 32% of farmers in kola and 55% of farmers in weinadega, ensset leaves are an important supplementary feed during the dry season. Nearly a quarter of the farmers in both target groups depend solely on grass for livestock feed.

Approximately 84% of farmers in kola and 53% from weinadega give feed priority for certain classes of animals: three-fourth in both groups give priority to milking cows and about 32% of farmers in kola give it to draft animals.

Milk production

The feeding priority mentioned above reflects the trend towards having more milking cows than draft animals, particularly for farmers in weinadega areas. The shortage of grazing areas in weinadega areas and of grass owing to moisture stress in kola areas often reduces the amount of milk obtained per head of milking cows. Both milk yield and the length of lactation are dependant on a steady supply of feed. The length of lactation in the study area averages about 7-8 months.

Because there is critical feed shortage during the dry season, milk yield is very low in both target groups (Table 3-13). The average milk yield obtained is only 1-2 liters per day during the dry season and about 2 liters per milking cow during the wet season.

Table 3-13: Comparison of milk yield in dry and wet season

Milk yield liter/day		Wet season %		Dry season %	
		Kola	Weinadega	Kola	Weinadega
< or equal	1	16	25	49	43
	2	32	28	26	33
	3	7	16	-	-
	4	25	18	-	-

Farmers in both target groups use different feed supplements in order to maintain a steady milk supply. Table 3-14 shows different feed supplements given to milking cows in both target groups. Hay, enset leaves and atela (brewing by-products) are the three most common supplements.

Table 3-14: Feed supplements used to maintain a steady milk supply

Type of feed supplement	% respondents	
	Kola	Weinadega
Maize stover	17	10
Grass hay	28	43
Enset leaves	29	36
Atela (brewing by-product)	25	17
Bole (salty soil)	9	13

Consumption of milk and milk by-products is higher in the kola area, because milk is an important supplements substitute relish and even the main relish for farmers in kola areas.

Livestock disease and disease control

The most common livestock diseases are anthrax, gebito, rinderpest, furte, blackleg Abagorba and foot and mouth. Ticks are the most common external parasites. Farmers use roots and leaves of plants as traditional control methods. Animals are vaccinated once every year against common diseases. Farmers mentioned that visits by veterinary service staff are infrequent, especially in kola areas. Because of the prevalence of disease the cattle population is declining according to the farmers interviewed. Livestock diseases are sometimes considered to be more severe than the feed problem, especially during the dry months when farmers start land preparation.

4 System Trends, Constraints and Development Opportunities in the Farming System

4.1 Trends in the Farming Systems

Farmers were asked if they had changed any of their farming practices during the past 10 years. One third of farmers in the kola target group mentioned having replaced hoe cultivation with oxen cultivation. The rationale behind this change according to the farmers is the tedious nature of hoe cultivation; a bigger area per unit time can be prepared using oxen. About 35% mentioned they increased their crop area as a result of shifting from hoe to ox cultivation. A few farmers also mentioned a shift from ox to hoe cultivation because of the death of oxen from disease or their sale after crop failure during a drought period.

About 21% of the farmers also mentioned row planting of maize as a recent development in the system of crop husbandry. Economizing on seed and fertilizer and ease of routine operations like weeding were mentioned as the main reasons for shifting from broadcasting to row planting of maize.

New practices adopted by farmers in the weinadega target group are identical to those of the kola. However the changes in the weinadega target group are relatively less than in the kola because of perennial cropping and intercropping which make this system less suitable for oxen cultivation and row cropping. About 14% of weinadega farmers mentioned row planting of maize as a new practice. Approximately 10% changed from hoe cultivation to ox plow. About 20% of these farmers claimed to have increased their crop area after they started using oxen.

Though the number of oxen is increasing in the kola region, about 49% of the respondents mentioned a decline in the total number of livestock owned. Forty-five percent of weinadega respondents also mentioned a decline in their livestock numbers. Disease and sales are the major factors. Farmers had to sell their animals because of the frequent crop failures encountered during the past decade, particularly during the 1984/85 season.

4.2 Basic Constraints on System Development

Understanding weather-induced instability and risk and farmers' response mechanisms is essential for developing improvements. Both intraseason and interseason variability in the weather influences farmers' practices. The subsistence nature of farming has increased as climatic changes have reduced production. This has reduced farmers' dependence on markets, particularly in kola areas, and hence limits the purchase of inputs and the disposal of farm products. Formal exchange transactions have little place in the kola farming system and therefore the objective in using the market is largely to support subsistence.

Table 4-1 presents the hazards experienced by farmers in the two target groups. About 84% of the respondents from kola mentioned severe loss of output in maize because of the early finish of rains. Diseases and pests are also associated with the unfavorable weather and were mentioned as important hazards by 65% of kola farmers. Stalk borer and cutworms are the most common pests that affect maize production. Cutworms and sometimes armyworms are observed especially when there is poor distribution of rain during the germination and establishment stage of the crop. The amount of livestock feed, particularly in the dry season, is highly affected by the unreliable rainfall pattern. This has a direct effect on crop production since the draft capacity of oxen is affected.

Enset is also affected by drought and by an unidentified disease in kola areas; 54% of the farmers mentioned lower yield because of lack of adequate rain. Fifty-eight percent also reported high yield loss in haricot bean production because of shortage of rain and 67% claimed that poor soil fertility is important in reducing maize yield.

In the weinadega group, pests and disease are the primary causes of poor yield. Approximately 64% and 58% of the farmers reported disease and pest problems in coffee and maize production respectively, and about 18% in enset. Early finish of rainfall and low soil fertility in maize were also mentioned by over half of those interviewed from weinadega. Although the informal survey discussion with farmers and field observations found severe weed infestation in both target groups the problem was not given high priority by farmers in this survey.

Table 4-1: The incidence of factors recognized as hazards by farmers

Problem	% responding	
	Kola	Weinadega
Early finish to rains and maize does not mature because of short rainy period	84	60
Low soil fertility in maize	67	57
Pest and disease in maize	65	58
Pest and disease in coffee	37	64
Shortage of rain for haricot bean	58	13
Low soil fertility in haricot bean	39	22
Shortage of rain for enset	54	47
Pest and disease in enset	23	18

Table 4-2 shows yield data according to the farmers' estimates. Yield levels appear to be about the same for the two

groups, though the factors contributing to low yield differ. For instance, the shortage of rain is the main problem in kola areas causing maize yield reduction while poor land preparation, inadequate weed control, and low soil fertility contribute to poor maize yield in the weinadega area. The yield data are a good indication of the low level of productivity of the farming system.

Table 4-2: Yield levels of four major crops grown in the two target groups

Crop	Yield (kg/ha)	
	Kola	Weinadega
Maize	880	920
Coffee*	1050	1010
Tef	510	440
Haricot bean	700	500

Source: Farmers' estimates, farm surveys, June 1986.

* The yield of coffee reported is for genfel, or dried berries.

Farmers use all possible options within their resource capability to improve production. Unless they are backed by improved production techniques, it would be impossible to step up productivity beyond the present level.

4.3 Constraint Management in the Farming System

Measures taken by farmers in managing different hazards are presented below. Farmer problems and possible solutions are summarized in Table 4-3. Problems are discussed in this section and solutions in the following section.

Uncertainty in the amount and distribution of rain in kola areas

The attempts made to reduce uncertainties caused by erratic rain do not usually involve sophisticated management strategies. Most of the measures are crop centered and limited to diversifying crops and effectively using fast-growing or drought-tolerant crops. Crops like haricot bean and sweet potato have a short growing cycle. Especially sweet potatoes are gaining popularity because of their capacity to survive under moisture stress. Some farmers also take advantage of a double harvest from haricot bean and sweet potato, using the short season belg and the main season meher rains. There are no management alternatives in maize production for alleviating the lack of rainfall except for adjusting the time of planting.

Table 4-3: Principal problems and possible solutions

Problems	Priority weinadega kola		Possible solutions, opportunities
Uncertainty in the amount and distribution of rain for maize	medium	high	<ul style="list-style-type: none"> - early maturing varieties - drought-tolerant varieties - proper time of planting
Low soil fertility	high	high	<ul style="list-style-type: none"> - use of appropriate fertilizer rate and type - crop rotation with legumes - use of manure
Stalk borer and cutworm on maize	high	high	<ul style="list-style-type: none"> - use of resistant varieties of crops - use of chemicals
Coffee berry disease	high	low	<ul style="list-style-type: none"> - use of resistant varieties of crops - use of chemicals
Weeds in tef, maize and haricot beans	high	medium	<ul style="list-style-type: none"> - changing the maturity period - use of herbicides - demonstrating of weeding time and frequency
Poor land preparation	high	medium	<ul style="list-style-type: none"> - minimum or zero tillage techniques - use of oxen
Land shortage	high	medium	<ul style="list-style-type: none"> - intercropping maize and beans
Labor shortage (March-June)	medium	high	
Cash shortage	high	high	

Table 4-3 continued

Water unavailable for domestic use	low	high	- wells
Fuelwood shortage	low	high	- planting of trees - development of agroforestry
Livestock feed shortage	high	high	- use of forage legumes - use of thinnings by increasing maize plant population
Livestock diseases (December-February)	high	high	- use of veterinary medicines - increasing the frequency of visits by veterinary service

Low soil fertility status

Degradation in the fertility of the crop fields was mentioned as a problem by most farmers in both target groups. The problem is related to the shortage of land in weinadega areas and the lack of knowledge of soil maintenance practices in kola. Only a few farmers practice crop rotation and fallowing to deal with low soil fertility. These practices are also limited to kola where there is less population pressure. The use of manure is exclusively for enset and homestead maize. However, farmers are not in a position to use chemical fertilizer because of lack of cash, especially in kola areas. Farmers also complained that the fertilizer was not available at the right time or that the amount was insufficient. About 23% and 21% of the farmers in kola and weinadega respectively reported fertilizer was not available at all. Approximately 40% of the respondents from kola and 25% of those from weinadega did not use fertilizer because they lacked cash. Since coffee is more widely grown in weinadega, cash is more available. However the use of fertilizer in kola continues to be a problem since cash income there is unreliable.

Disease, pests and weeds

Problems from disease, pests and weeds are partly weather induced and partly caused by poor management. Diseases and especially pests like cutworms and armyworms are usually associated with low rainfall. Farmers in the study area do not have traditional methods to control disease and pests. Producer cooperatives and some well-to-do farmers use insecticides and pesticides when pest and disease problems occur. Only sporadic pests like armyworms are controlled using chemicals distributed free of charge. Weeds are important problems in teff, maize and haricot beans. The use of herbicides is uncommon. All crops are weeded manually except tef, which is not weeded at all. It is planted on relatively weed-free lands such as fallow land, in order to avoid weeds.

Poor Land Preparation

For about 79% of weinadega farmers the hoe is the sole method of land preparation. In addition to the shortage of oxen, the lack of knowledge of how to use them in land preparation is also a limitation. This problem is of only medium priority for the farmers in kola areas.

Resource limitation: land, labor and cash

Approximately 80% of the farmers from weinadega and 70% of those from kola have land holdings less than one hectare from which to feed their families. The possibilities for expansion are very limited because of the shortage of land, especially in weinadega areas. Because farmers manage multiple crops, farm operations overlap. Thus labor is short from March to June when farmers are planting and weeding. These shortages are especially

severe in the kola area. New technologies may not be adopted by farmers if they require extra labor during the busy period.

Of all factors, the lack of cash most limits farmers, particularly during planting when farm inputs like seeds and fertilizer are purchased. Since farmers do not have access to institutional credit most of them do not buy improved seeds and fertilizers even if these inputs are locally available. In planning technologies for the farmers their cash limitations must be taken into account.

Water resources and fuel shortage

The weinadega areas have water available for domestic use. However, the kola zones of Awasa, Dale and Shebedino have acute water shortages. About 37 peasant associations in Shebedino and 17 in Dale have no permanent water supply. Therefore most of the farmers in these areas go long distances to find water for their livestock and for home use.

Fuel is another important problem, especially in the kola areas of Awasa and part of Shebedino. Many places in these areas are without trees. Shortage of fuelwood is especially acute during the time when crops are in the field. There is relatively enough fuel in the weinadega target group. Here, most of the land is covered by natural vegetation and community forests. The nature of the cropping system, i.e. the existence of tree crops like coffee, has to some extent reduced the fuelwood problem since shade trees are frequently planted along with coffee seedlings.

Dry season feed shortage and diseases in livestock husbandry

Low milk production and poor draft animal performance are mainly caused by the lack of feed during the dry season. On top of this the prevalence of certain livestock diseases reduces livestock productivity.

December to February is the most difficult period for feed. Leaves and tops from enset and other trees are used as feed supplements by many farmers. Soon after, crop residues are fed to animals directly in the field since pasture lands are overgrazed during the three dry months. Many farmers take their animals to far places in search of feed and water when pasture lands are overgrazed and when crop residues are not available. Only a very few farmers preserve grass hay for dry season feed. Generally farmers do not grow fodder crops and their animals are totally dependent upon communal grazing areas and crop residues. In drought years, the feed shortage is severe and beyond the management capability of the farmers. Control measures against disease are often limited to the use of the roots and leaves of certain plants. The use of modern medicines is uncommon except for vaccination against specific diseases, with vaccines provided by the Ministry of Agriculture (MOA) free of charge. Veterinary services are not readily available at times when farmers need

them.

4.4 System Opportunities and Development Proposals

The information collected in this report is important for developing an integrated research agenda for the target region. On-farm trials that are to be included in the research program should be carried out based on the representative agro-economic circumstances of the target farmers. The research strategy to be implemented in the Sidama area should address the identified constraints discussed in this report.

Maize variety and time of planting trial; kola target group

The amount and distribution of rain was mentioned as the most difficult problem, which farmers, particularly in kola areas, could not manage. This is one major factor that limits maize yield. Because of the short growing period or low rainfall the existing varieties, which are of a late type, fail before they reach maturity. Moreover the uncertainty in the onset of rain poses a limitation on the time of planting, given the early finish of rain. On-farm experimentation is required to determine the extent to which time of planting and choice of variety affect yield. Results will show the impact of short-cycle varieties planted late, long-cycle varieties planted early, etc., and can assist farmers in deciding when to plant which type of variety.

Maize fertilizer trial: both target groups

Farmers in both target groups mentioned low soil fertility as a major factor limiting maize yield. Awasa Research Center's own recommendation for fertilizer on maize (92 kg N and no phosphate) is based on work done only at the center; this may not be relevant for farmers in the area. MOA's recommendation of 41-46 nitrogen/phosphate is based on the pooling of trial results nationwide and may also not be relevant for local farmers. On-farm fertilizer trials can determine optimal fertilizer rates for farmers and supply policy makers with information concerning which types of fertilizer to supply to the area.

Haricot bean variety trial: both target groups

Haricot bean yield was reported to be low because of the shortage of rain, poor varietal potential and management problems. The on-farm research program should address the varietal problem through testing varieties that are higher yielders than the local one under current farmer management and the moisture level available for the production of the crop. On-farm experiments will also be important for determining farmers' preferences concerning variety types, color, size, taste and other criteria.

Haricot bean and maize intercropping trial:
both target groups

Haricot bean, planted either as an intercrop or in pure stand, is especially prevalent in kola areas. It is usually intercropped with maize, especially during the belg season. However the bean:maize ratio is low compared to the yield of beans that could be obtained. Results of intercropping trials of maize and beans conducted at Awasa Research Center indicated the possibility of increasing yields of intercropped beans without affecting maize yield. Therefore an intercropping trial should be conducted on farmers' fields to identify the arrangement of planting that is most conducive to bean production without lowering maize yields, thereby increasing returns on labor and other inputs invested in the maize field.

Land preparation and tillage methods: weinadega target group

The hoe, which is very tedious, is the sole method of land preparation in weinadega areas. The quality of the seed bed is usually poor, exacerbating weed problems. The problem could be alleviated through one or both of the following possibilities:

a. Conducting trials on tillage techniques like minimum or zero tillage so that the problem caused by the lack of oxen could be resolved and weed infestation reduced through the use of herbicide. Tests should be conducted on station before going to farmers' fields.

b. Provision of farm credit for the purchase of oxen for farmers without them who are credit worthy. Consideration should be given to ensure that the farmers will be able to repay their loans, that is, that feed is available and that the oxen will contribute to increased productivity. Both of the alternatives mentioned are policy related since they require inputs such as herbicides and credit.

Weeds

Weed infestation is also an important factor that reduces crop yield. Farmers do not weed or their weeding is insufficient because operations overlap or because farmers lack knowledge about the effects of weed infestation.

Three approaches could be used to solve the weed problem:

a. Reducing the labor peak caused by the overlapping of operations. This could be done by changing the maturity period of crops. For instance, a second weeding of maize in kola areas could be made feasible by introducing early-maturing tef and bean varieties. These could be planted later than at present, thus releasing labor from land preparation of tef and haricot bean.

b. Using herbicides to solve the weed problem and release labor for other operations such as land preparation for bean and tef.

c. Demonstrating weeding time and frequency in order to make farmers conscious of the yield reduction caused by weeds. Here the crop calendar should be considered since the optimal time of weeding for one crop might not be acceptable because operations overlap, i.e., farmers could give prior attention to harvesting belg beans instead of weeding maize. Every proposed change must be considered in the systems perspective.

Pests and disease

Stalk borers and cutworm on maize are problems of high priority. Armyworms on maize and aphids and an unidentified pest that bores into pods and stems of haricot beans are of medium priority. Pests tend to be more prevalent in kola areas. Disease problems are of little importance in field crops; they are serious for enset and coffee. Enset bacterial disease locally known as shame and coffee berry disease (CBD) are the diseases of primary importance.

The use of pesticides and insecticides is not commonly known; control techniques should be developed. Research in crop protection involves policy issues like the importation of chemicals. Thus attempts should be made to convince policy makers that, if chemicals are the only means of control, they should be made available. However the immediate task should focus on control mechanisms available to farmers now, with priorities in terms of both crop and the pest or disease severity.

Livestock feed: kola target group

Even though livestock is a very important component of the farming system in the target region, especially kola, crop-related on-farm trials are more important in the short run to alleviate the immediate issue of food shortage. However, because of their direct or indirect effects on crop production the research program should tackle feed and disease problems, of primary importance especially in the kola target group. This should help to build the capacity of oxen during the dry season.

Interventions in the livestock subsystem should address feed problems in the following ways:

a. Investigating forage legume intercropping techniques with maize that would not affect maize yield.

b. Using maize varieties whose plant population could be increased, so that thinnings could be used for livestock feed without affecting maize yield. Because thinning for livestock feed is the current farmer practice, farmers use a high seed rate and a high plant population.

c. Conserving and using of available grass species and crop residues as dry season feed source.

d. Identifying fodder tree species that can supplement livestock feed during the dry season.

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