IAR WORKING PAPER

INITIAL RESULTS OF INFORMAL SURVEY INEWARI AND SENDAFA-ALELTU AREAS OF NORTHERN SHEWA

Hailu Beyene
Chilot Yirga

WORKING PAPER NO.9

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INSTITUTE OF AGRICULTURAL RESEARCH

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PREFACE

This publication is the ninth of the Working Paper Series of the Institute of Agricultural Research. Working papers are designed to present findings of the different research activities carried out by the IAR staff. Working papers are made available in limited numbers for comments and discussion and to inform interested colleagues about research in progress.

This working paper no. 9 describes the informal survey results from two areas of Northern Shewa Administrative Region: Inewari (Jiru Awraja) and Sendafa-Aleltu (Berehe and Abitchuna Awrajas). The survey was undertaken by economists from Holetta Research Center and local extension agents. These initial results will help in the design and development of research programs for the Holetta Research Center. This report should also be useful for policy makers, planners, extension staff, and other organizations involved in agricultural development in the region.

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

Seme Debela
General Manager

ACKNOWLEDGEMENTS

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We would like also to thank Dr. Steven Franzel, Farming Systems Research Advisor of IAR for reviewing drafts of this report and making many valuable suggestions. Thanks are also due to W/t Almaz Kassa and W/t Meskerem Hailemariam for typing this report.

Finally, we would like to express our appreciation for the farmers in the survey area for their patience in answering our questions and for their active involvement in the discussions.

SUMMARY

A diagnostic survey was conducted in three former weredas (Moretina Jiru, Sendafa, and Aleltu) of Northern Shewa Administrative Region in the 1988 crop season. The survey focuses on understanding the objectives and goals of the farm family, the strategies used to attain the goals, and the management challenges and resource constraints facing the farm family.

The study area is located in the highlands of Northern Shewa at an altitude of 2400-2650 m. The soil is dominantly of vertic nature; Vertisols with pockets of dark clay soils locally known as *Koticha* and *Gombore* respectively. The population of the study area is about 161,203 with an awraja population density of 90 people/km^2. The major inhabitants of Inewari (Moretina Jiru Wereda) are Christian Amharas while those of Sendafa-Aleltu are Christian Oromos. The life of the rural population depends almost entirely on agriculture. Most of the farmers are smallholders whose objective is to secure an adequate and sustained supply of food for the family throughout the year. Average land holding varies from 3/4 to 3 ha per household depending on family size and land availability; land availability is greater in Sendafa-Aleltu than in Inewari.

The principal crops grown are teff, wheat, faba bean, chick pea, rough pea and lentils. Other minor crops include fenugreek, field pea, noug, linseed and barley. In Sendafa-Aleltu oats are also planted as a food crop. The major wheat varieties currently under production in order of importance are Gounde, Enkoy and Lakach in Inewari; and Gebre, Lakach and Israel in Sendafa-Aleltu.

The crop management in the study area depends on the soil type and other factors. Two management strategies are widely used in both areas: (1) planting crops that are tolerant to waterlogging during the periods of highest rainfall using drainage ditches; and (2) planting some crops (e.g., durum wheat, lentil and chick pea) late in the season on residual moisture. Area specific traditional management practices to minimize the effects of waterlogging are (1) in Inewari, farmers plant all crops except teff on hand made broad beds and furrows, and (2) in Sendafa-Aleltu farmers plant on ridges-furrows.

The major weeds in the study area are Trifolium sp., Plantagi lanceolata, Falaris paradox, and Guizotia scabra. None of the farmers in Inewari considered weeds as a problem. They do not use herbicides because weeds constitute a major portion of livestock feed. As a result weeding is done late. In Sendafa-Aleltu weeds are also used as animal feed but are not a major feed sources.

The principal objective of keeping livestock in Inewari is for draft power while in Sendafa-Aleltu both draft power and

production of meat and milk are important. In Inewari both oxen and horses are used for plowing while in Sendafa-Aleltu only oxen are used. Generally farmers in Inewari keep fewer livestock than Sendafa-Aleltu farmers. In both areas animal feed is the number one limiting factor followed by animal diseases hindering livestock productivity.

Farmers faced with changing natural and social circumstances are forced to change some of their practices over time. The two major constraints causing these changes are increased population pressure and shortage of land. Some of the trends are (1) the increasing use of weeds from wheat and faba bean fields as animal feed, (2) a decline of faba bean production, (3) an increase of wheat, teff, lentil and chick pea due to diseases and pests on faba bean, (4) the use of horses for land preparation in Inewari and (5) continous cropping and increasing use of chemical fertilizers in place of fallowing and manuring. The major farmer problems limiting production are:

1. Seasonal waterlogging. The high rainfall and the swelling nature of the Vertisols that dominate the study area result in severe waterlogging each year. Despite their attempts, farmer practices do not provide the desired level of surface drainage and are labor intensive. Thus the use of animal drawn implements for making beds might reduce the waterlogging problem and at the same time reduce costs.

2. Scarcity of animal feed. In Inewari animal feed is in short supply because of lack of communal grazing grounds in the main season and seasonal waterlogging. Thus livestock are grazed around homesteads, along roadsides and marginal lands. Weeds are also used as a major source of animal feed. This problem might be addressed through relay cropping and introducing new crop varieties that have a good potential for straw as well as grain yields.

3. Poor soil fertility. Farmers have expressed their concern about the declining yield levels. This is probably attributed to low soil fertility caused by continous cropping. Fallowing has been completely abandoned in Inewari while a few farmers still use this practice in Sendafa-Aleltu area. Fertilizer response trials might be useful to solve this problem.

Other farmer problems that need attention are (1) scarcity of arable land, (2) diseases on faba bean (root rot, chocolate spot and rust) (3) pests (aphids on field pea and pod borer on faba bean) (4) weeds on wheat and faba beans, (5) firewood scarcity, and (6) lack of institutional credit facilities.

INFORMAL SURVEY RESULTS
INEWARI AND SENDAFA-ALELTU AREAS OF NORTHERN SHEWA

1. INTRODUCTION

The need to generate agricultural technologies for resource poor farmers is a challenge in many developing countries. This task demands intimate farmer involvement in the process of understanding the current farming systems, diagonising problems and designing solutions. In this respect the farming systems research (FSR) approach is gaining popularity in many developing countries including Ethiopia. FSR is an approach to agricultural research that uses the understanding of farmer circumstances in a systems context. Farmer circumstances are those factors that affect farmers' decisions with respect to the use of technologies. Thus the understanding of farmer circumstances and problems has an important bearing on the generation of technologies appropriate to farmers.

This paper reports the results of an informal survey conducted with a FSR perspective in three weredas of northern Shewa. The survey focuses on understanding the objectives and goals of the farm family, the strategies used to attain the goals, and the management challenges and resource constraints facing the farm family. More specifically the objectives of the survey are:

1. To describe and understand farmer circumstances (natural, economic and institutional); in the *weinadega* areas of Inewari (Moretina Jiru Wereda), Aleltu Wereda and Sendafa (Berehe Wereda) (Fig 1.1)[1]

2. To identify and prioritize major production problems and constraints limiting farm productivity;

3. To design relevant technologies to alleviate the problems.

2. TARGET GROUPS AND SURVEY PROCEDURES

The survey was conducted by economists from Holetta Research Center and local extension agents residing in the study area. Two target groups were identified based on crop management practices and availability of grazing land. The first target group consists of farmers in the Inewari plateau who use hand-made broad beds and furrows (BBFs); the second target group is composed of farmers in Sendafa-Aleltu who make ridge-furrows.

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[1]According to the new administrative boundaries, Inewari is in Jiru Awraja, Aleltu is in Abitchuna Awraja and Sendafa is in Berehe Awraja.

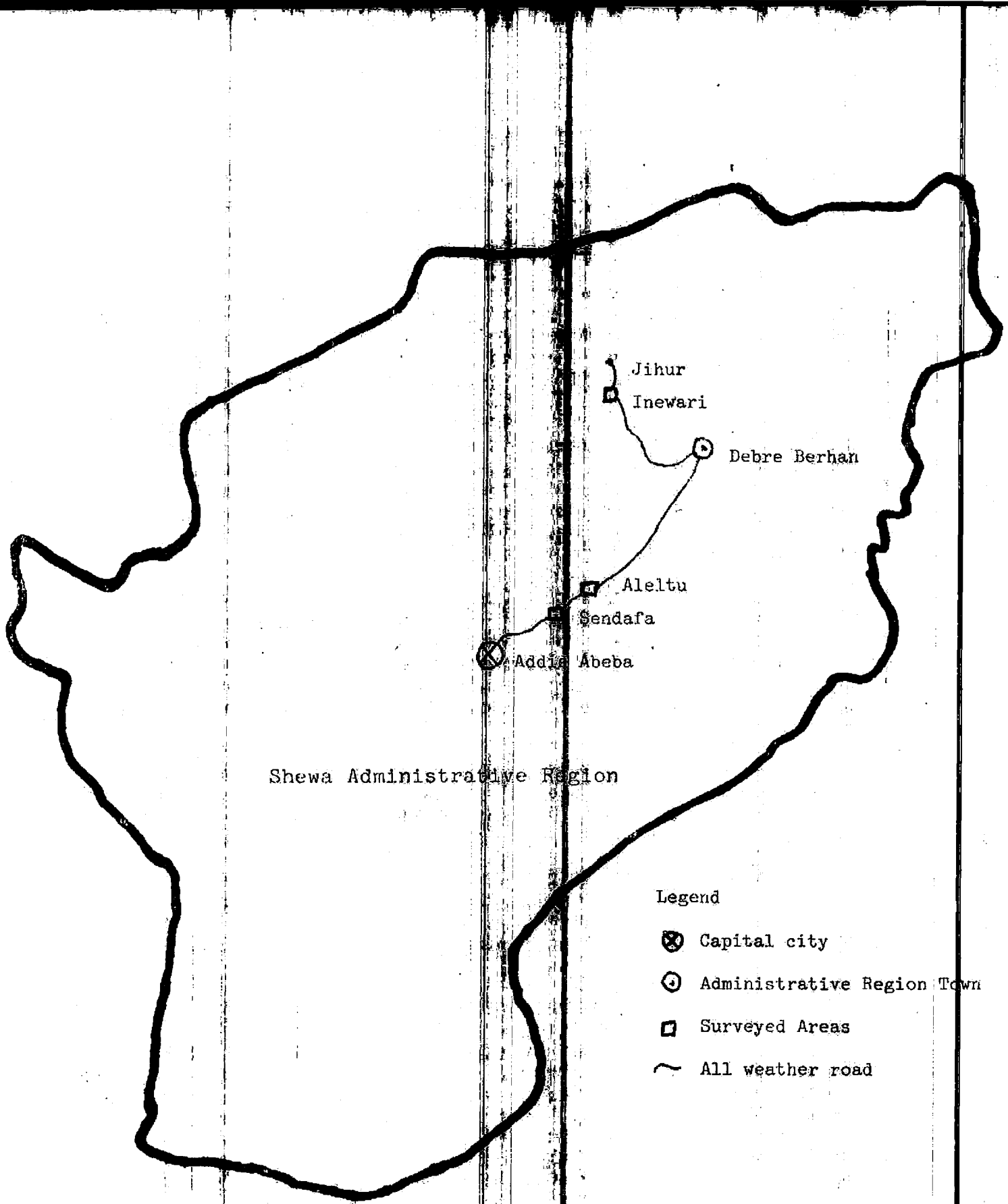


Figure 1.1. Surveyed areas in Northern Shewa

Both groups cultivate vertisols and the primary purpose of their land preparation methods is to minimize the effects of waterlogging. After delineating the two target groups, a total of 28 farmers (11 from the BBF group and 17 from the ridge-furrow group) were randomly selected and interviewed from the two target groups based on the information obtained from the wereda MOA officials. These areas were purposively selected to study the drainage problem which characterizes the surveyed areas and to understand farmers' management strategies to minimize the waterlogging problem.

The study area is located in the *weinadega* highlands of northern Shewa (Sendafa, Aleltu and Inewari). The Inewari plateau lies 9° 40'N and 39° 15'E at an altitude of 2,600 m, 194 km north of Addis Abeba. The Sendafa-Aleltu area is located 38 km north of Addis Abeba along the Addis Abeba-Debre Birhan asphalt road at altitude of 2400 to 2650 m.

3. BACKGROUND INFORMATION

Natural factors

Climate. Meteorological data is available from agricultural development weather stations in the study area. Since data are not reliable for past years only data of recent years are used. The mean monthly rainfall has averaged 864.7 and 958.8 mm at Inewari and Aleltu for seven and five years respectively (Figure 3.1). Both target groups experience a distinct dry season from October through January followed by the rainy season traditionally known as the *belg* season from March through May/June. The main rainy season extends from June to September.

Soils and topography. Murphy (1968) described the area about 16 km from Addis Abeba (not far from Sendafa-Aleltu) as rolling plain or prairie. The soils in the prairie area are dark gray-dark brown to very dark gray brown and are generally clay loam to clay in texture with a rather impervious clay subsoil. He also noted 97% of these prairie soils between Addis Abeba and Debre Birhan are acid, with over 50% of them being medium or high in acidity. Kamara et al. (1988) described soils at the Sheno sub-center which are similar to soils in Sendafa-Aleltu about 23 km away. Kamara described the soils as Vertisols based on the pedon characteristics, the presence of wide and deep cracks, the slickensides occurring within the set depth limit, and the physical and chemical properties. Farmers in the area classify the dark black soils as *koticha* and the dark clay loam soils as *gombore* depending on their color, workability and suitability for different crops.

The topography of Inewari is flat. Several authors (Tekalign et al. 1988) have reported that the soils of Inewari plateau are

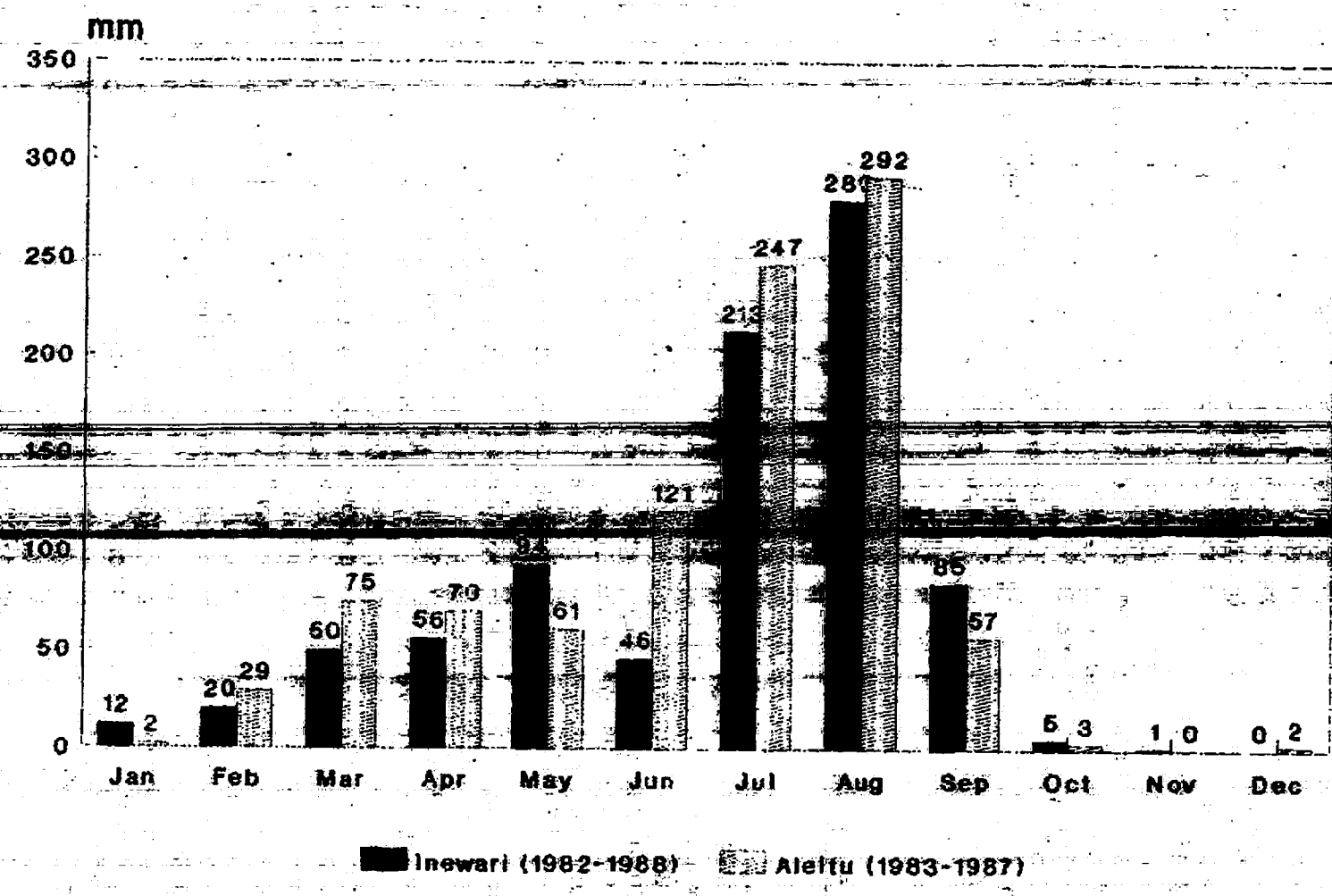


Figure 3.1. Average monthly rainfall

vertisols characterized by waterlogging. Distribution of clay, pH, N and P in the soil profiles of Inewari vertisols are shown in Table 2.1.

Table 2.1. Major characteristics differentiating the Inewari and Sendafa-Aleltu target groups

	Inewari	Sendafa-Aleltu
Main crops	Wheat, teff, faba bean, chick pea, lentil	Tef, wheat, faba bean, lentil, chick pea, oats
Farm size (ha)	1.8	3.0
Oxen/farm	1.3	2.1
Land preparation method	Hand-made broadbeds	Oxen-made ridge-furrow

As shown in Table 3.1 the percentage of clay decreased with depth while pH increased; total N and organic matter followed a decreasing pattern with increasing profile depth.

Table 3.1. Distribution of clay, pH, N and P in the soil profiles of Inewari vertisols

Depth	pH (1:2.5)		Clay	N			Avail. P Bray II
(cm)	H_2^0	$CaCl_2$	(%)	(%)	C:N	C:P	(PPM)
0-78	5.89	4.93	62	0.11	11.4	103.2	0.6
78 -105	6.12	5.05	62	0.12	10.5	75.8	1.4
105-128	7.48	6.52	30	0.03	8.8	49.7	9.6
128-200	7.43	6.37	30	0.01	3.0	10.6	55.0

Source: Tekalign Mamo et.al, 1988.

Socioeconomic factors

Population. According to CSO (1985) based on the 1984 census, the population is estimated to be 59,689 for Moretina Jiru Wereda (Inewari), 38,102 for Aleltu Wereda and 63,412 for Berehe Wereda (Sendafa). The rural population for Moretina Jiru is 98.5% for Aleltu 96.7% and for Berehe 96.7%. In all three weredas the proportion of females is higher in the urban areas while the male population exceeds the female population in the rural areas

(Table 3.2). Considering the total population in the three weredas both in the rural and in the township areas, males constitute 50.5% of the total population.

The major inhabitants of Inewari are Amharas while those of Sendafa-Aleltu are Oromos. The religion of both areas is predominantly Christianity. The life of the rural population depends almost entirely on agriculture. The Inewari area has been farmed for centuries; information could not be obtained on the history of farming in Sendafa-Aleltu.

Farmer organizations: All of the farmers are organized into peasant associations (PAs). There are about 144 PAs, 27 service cooperatives (SCs) and 10 producer cooperatives (PCs) in the three weredas. Table 3.3 depicts the number of each organization in the three weredas.

Table 3.2. Population by sex groups, population density and total area in the three weredas.

	Moretina Jiru	Aleltu	Berehe	Total
Rural F	26,965(48.3%)	18,277(49.6%)	30,289(49.6%)	75,481(49.1%)
M	28,820(51.7%)	18,583(50.4%)	30,691(50.4%)	78,094(50.9%)
Rural Total	55,785(93.5%)	36,860(96.7%)	60,930(96.1%)	153,575(95.3%)
Township total	3,904(6.5%)	1,242(3.3%)	2,482(3.9%)	7,628(4.7%)
Grand total	59,689(37.0%)	38,102(23.6%)	63,412(39.3%)	161,203(100%)
Area (km)2	528.17	567.09	704.13	1,799.39
Population density (No. people/km2)	113.0	67.2	90.1	89.6

Source: Central Statistics Authority (1984).

Table 3.3. Farmer organizations in Inewari, Aleltu and Sendafa weredas.

Type of organizations	Moretina Jiru	Aleltu	Berehe	Total
PAs	43	47	54	144
SCs	13	6	8	27
PCs	1	2	7	10
Total	67	55	69	181

Source: MOA wereda offices

Peasant associations are administrative in nature; their main objective is maintaining law and order. They also administer the land regulation proclamation and collect taxes. The main function of SCs is to distribute agricultural inputs, such as fertilizer, and other manufactured products to farm families at reasonable prices. Some SCs also purchase grain from farmers and deliver to the Agricultural Marketing Corporation (AMC). A producer cooperative is a group of farmers who together cultivate a common holding for the benefit of the group. Most of the PCs in the study area are at an early stage of development in terms of organizational set-up, work discipline, financial capability and number of members. None of them have obtained legal entity. Seven of the 10 PCs are in the Sendafa area. The present status of the Sendafa PCs is shown below (Table 3.4).

Table 3.4. Present status of PCs in Sendafa area, 1988

Name of PCs	No. of members	Total area owned (ha)	No. of oxen pairs	Capital (in birr)
Lencho	13	55	13	7,560
Choba	9	68	13	7,750
Chebi	13	71	13	10,400
Ripa	15	44	16	9,600
Dabe	13	55	13	10,400
Bereh	24	42	27	16,200
Giror	10	34	10	6,000
Total	97	369	105	67,910

Extension and fertilizer distribution . Agricultural extension services in the study area are provided by local development agents (DAs) stationed at SCs. The DAs are supervised by wereda MOA officials stationed at the respective wereda towns. There are six, five and two development stations at Inewari, Aleltu and Sendafa weredas respectively. All but two of the five stations in Aleltu are operating. Agricultural extension activities in the survey area include:

1. Demonstration of new agricultural technologies to farmers
2. Promotion of rural socio-economic development
3. Promotion of cooperatives with the goal of eventually establishing producer cooperatives
4. Feeding back problems and experiences of development efforts to research and other concerned bodies.
5. Distribution of agricultural inputs (mainly fertilizer) to farmers.

As outlined above the objective and activities of the extension service are clearly stated and understood by the DAs, But in reality (except the promotion of fertilizer use) the achievements at the field level are minimal because of a number of problems (lack of transport, very few incentives to the DAs lack of farm inputs, and poor information flow). With respect to fertilizer promotion the extension activity has been successful. The amount of fertilizer distributed in the study area is shown below.

As shown in table 3.5, 1,395.7 tonnes of fertilizer have been distributed during the 1988 crop season in the three weredas. Out of the total fertilizer distributed in the last four years 86.9% is DAP and 13.1% is urea. Although the most limiting nutrients as well as the appropriate fertilizer type and rate for the area are not yet determined, the current fertilizer supply (more DAP and very little urea) seems in line with the farmers' preference for DAP.

Table 3.5. Fertilizer distributed to farmers in the three weredas from 1985 to 1988 (tonnes)

	Moretina-Jiru		Aleltu		Berehe		
Year	DAP	Urea	DAP	Urea	DAP	Urea	Total
1985	241.30	-	28.65	1.0	217.35	23.95	511.35
1986	295.60	-	96.95	2.35	263.40	41.50	699.80
1987	369.80	40.9	70.00	26.65	400.00	50.00	957.35
1988	299.00	16.6	220.00	30.00	594.10	236.00	1395.70

Fertilizer supplies in the study area have increased by about 40% per year in the last three years. Presently, the most important problem with respect to fertilizer in the study area is not lack of awareness among farmers about the economic advantages; rather, it is unavailability of fertilizer in the desired quantity, time and place.

Marketing and transportation. The farming system in both target groups is highly subsistence-oriented. Cash, though highly needed, is scarce and its availability is limited to certain months of the year. The major sources of cash income are from the sale of grain mainly tef, lentil and chick pea in small quantities whenever the need for cash arises. Cash availability is highest during harvesting, i.e., from December to February. Thereafter the ability to acquire cash diminishes as the amount of available grain declines. The second important cash source is livestock sales. Livestock are sold only in special circumstances when the family is badly pressed for cash. Such situations include crop failures, marriage arrangements, and funeral ceremonies. Most farmers experience cash deficit from July to December. This is also a period of food shortages and a

time when farmers need cash as a down payment to purchase fertilizer. During this period farmers try to off-set the cash deficit through earnings from off-farm activities. Such activities include collecting and selling firewood and working as casual laborers on other farms.

In both target groups the Agricultural Marketing Corporation is active. The AMC through its agents, SCs, purchases grain at fixed prices immediately after harvest. As it is true for many of the agricultural areas, farmers have quotas to deliver to AMC. The minimum grain quota mentioned by farmers was 100 kg, while the maximum was 500 kg per household. The other channel for grain disposal is the local market where farmers sell grain in small quantities and purchase consumer goods and household utensils. Grain prices in the local market vary from month to month and year to year depending on the volume of the general harvest. Farmers obtain farm inputs such as fertilizer and improved seed from SCs. In most cases the quantity available is less than the demand. As a result fertilizer as well as consumer goods are rationed to farmers.

Transportation in the study area is fairly well developed. The Sendafa-Aleltu area is served by one asphalt road that connects Addis Abeba to Debre Birhan. The Inewari area is connected to Debre Birhan by an all-weather road that runs from Debre Birhan to Jihur, a small village 15 km from Inewari. Although there is a road network there is still a transportation problem due to the limited number of public vehicles that serve the area.

Credit facilities. Farmers in the study area recognize the advantages of institutional credit. Farmers need credit to purchase draft animals, farm inputs (mainly fertilizer) and to cover household expenses. The most dependable source of credit for individual farmers are relatives and neighbors. The amount extended to a needy farmer at any point in time is very small (less than 100 birr). Interest rates vary considerably from locality to locality and are negotiated by the lender and the borrower.

Institutional credit is limited and is accessible only to SCs; individual farmers do not have direct access to institutional credit. However, they may obtain credit through SCs in which they are a member for the purchase of fertilizer. The Ethiopian Commercial Bank and the Agricultural and Industrial Bank of Ethiopia provide credit to SCs for the purchase of fertilizers and grain mills in the study area. The criteria for extending credit to SCs are repayment ability, legal entity and the performance of the SCs under question.

4. ENTERPRISE PATTERN AND FOOD CONSUMPTION

The principal crops grown in the study area are tef, wheat, faba bean, chick pea, rough pea and lentils. Other minor crops include fenugreek, field pea, noug, linseed and barley. In Sendafa-Aleltu, farmers also plant oats as a food crop. Table 4.1 shows the percentage of farmers growing the major crops and growers' mean area for each crop.

The main objective of the farmer is to secure an adequate and sustained supply of food for the family throughout the year. Farmers employ all the factors of production available to the farm family and use different crop and livestock management strategies aimed towards fulfilling their food production objectives. Despite their attempts, most farmers in both target groups occasionally experience food deficits, mainly from July to October. This gap is closed through food purchases from nearby local markets.

Table 4.1. Crop areas and percentage of growers in the study area (ha)

Major crops	Inewari		Sendafa-Aleltu	
	Growers mean area	% farmers growing	Growers mean area	% farmers growing
Wheat	0.71	100	0.81	100
Tef	0.41	100	0.82	100
Faba bean	0.25	86	0.55	100
Chick pea	0.23	86	0.44	50
Lentil	0.40	43	0.50	50
Rough pea	0.16	85	0.32	40
Oats	0	0	0.25	50

All the farmers in both target groups grow wheat and tef. Farmers devote much of their resources and time on these two crops.

The dominant starch staples are wheat and tef; they are mixed together to prepare *injera*. Other food complements include dried roasted grain (*kolo*), boiled grain (wheat, faba bean, field pea chick pea and lentils) (*nifro*), porridge prepared from wheat or tef flour (*genfo*), and bread made out of wheat flour alone or mixed with faba bean flour. *Injera* with *wat*, locally prepared stew, constitutes the daily meal. Usually *wat* is prepared from relish crops (faba bean, lentil, chick pea or rough pea), cooking oil, salt and pepper. Legume crops consumed as a relish or as a complement in the form of *kolo* or *nifro* are the major sources of

protein. Beef, mutton and chicken are also occasionally consumed mainly during religious festivals and wedding ceremonies. The most important local beverages are *tella* and *araki* (local spirit) brewed from wheat. The consumption of local beverages is associated with harvest and religious ceremonies; otherwise it is considered to be a luxury. Traditionally farmers who use exchange labor (*wonfel*) provide the laborers with *tella*.

The food habits in the area seem to be unchanged over time, except that faba bean as a relish is being replaced by the other legume crops because of pests and diseases on faba bean.

5. RESOURCE AVAILABILITY AND USE

Land

All of the farmers are smallholders; land is allotted to farmers by PAs depending on family size and available cultivable land. Land is more scarce in Inewari than in Sendafa-Aleltu. Land holdings vary from 3/4 ha to 3 ha per household depending on family size. Every farmer owns and cultivates several plots of land scattered over an area of one to three km from each other. This enables farmers to exploit different soils and micro-climates: they plant various crops at different locations over the season so as to minimize the risk of crop failure and at the same time to meet the family's need for a variety of crops. In Inewari farmers do not have adequate grazing land; thus their objective of producing food is coupled with producing enough feed for the livestock throughout the year.

Labor

The family is the principal source of labor. Other sources of labor are exchange labor traditionally known as *wonfel* and hired labor. *Wonfel* is a traditional system in which neighboring farmers work together in turns on each others' fields. The farmer who calls for *wonfel* as a matter of duty provides his fellow farmers with lunch and local drinks. The main agricultural operations for which additional labor is required are BBF construction at planting in Inewari, and tef weeding and harvesting in both target groups. The wage rate in Inewari for BBF construction fluctuates between 2.50 and 3.00 birr per work day supplemented with lunch. In both target groups for the other operations, the wage rate is 2.00 birr per work day supplemented with lunch, Compared with the official wage rate which is 2 birr per day, the farmers' rate is higher.

The busiest period of the year is from July to August, the major activity being BBF construction in Inewari and land preparation of tef and wheat planting in both target groups. February and March are the two months when agricultural

operations are at a minimum.

Draft power and tools

Draft animals in the study area include oxen, horses and donkeys. In Inewari both oxen and horses are used for plowing. Draft teams may include a pair of oxen, a pair of horses or a team of an ox and a horse. A pair of horses or a combination of a horse and an ox forming a team require one additional person who guides the pair during plowing. Since the majority of the farmers own only one horse or ox, they have developed a traditional system known as the *maka'alo* to acquire a team of draft animals for plowing. The *maka'alo* system is a mutually beneficial arrangement in which two neighboring farmers pool their oxen or horses to form a team needed for plowing their fields in turns. Draft power hiring is not generally practiced in the study area, however, human labor is exchanged for the services of draft power. In the most common arrangement a farmer who wishes to use a pair of oxen or horses for one day works on the owners' field for two days. In Inewari, the services of a pair of draft animals for one day may be exchanged for a donkey load of tef or wheat straw paid at harvest time or during the period of critical feed shortage. During the critical feed shortage period (April-July) a bundle of straw may be sold for about 8-15 birr per donkey load. In Sendafa-Aleltu exchange of oxen services *(wonfel)* and the *makand* system are equally important.

In Inewari, the use of horses for plowing is becoming very important. This shift from oxen use to horses might be attributed to several factors.

1. Horses can survive on low-quality feed.
2. Horses are multipurpose animals, i.e., in addition to plowing they are used as pack animals and to transport human beings.
3. The cost of acquiring or replacing a pair of horses is less than for a pair of oxen.
4. On flat plots, a pair of horses is about twice as fast as a pair of oxen in terms of draft power output.
5. The topography of Inewari which is flat is suitable for horses.

All of the interviewed farmers use inexpensive and locally available farm tools. The traditional animal drawn implement (maresha) is the major implement for cultivation. Other farm implements include the hoe, axe, sickle, wooden shovel and fork.

6. CROP HUSBANDRY

Land preparation/planting

Land preparation commences at the onset of rainfall mainly in March or April (Figure 6.1). The frequency of plowing depends on the requirement of each crop, onset of rainfall, strength of draft animals and the history of the field. Tef fields are plowed more frequently than others because of the crop's special requirement for a fine seed bed. Table 6.1 shows the number of plowings for each crop in the two target groups.

Table 6.1. Number of plowings for the major crops in Inewari and Sendafa-Aleltu*

Crop	Inewari	Sendafa-Aleltu
Wheat	2-3	3-4
Tef	3-4	5-6
Faba bean	1-3	1-2
Chick pea	2-3	2-4
Rough pea	2-3	2-4
Lentils	2-3	2-4
Fenugreek	2-3	2-4

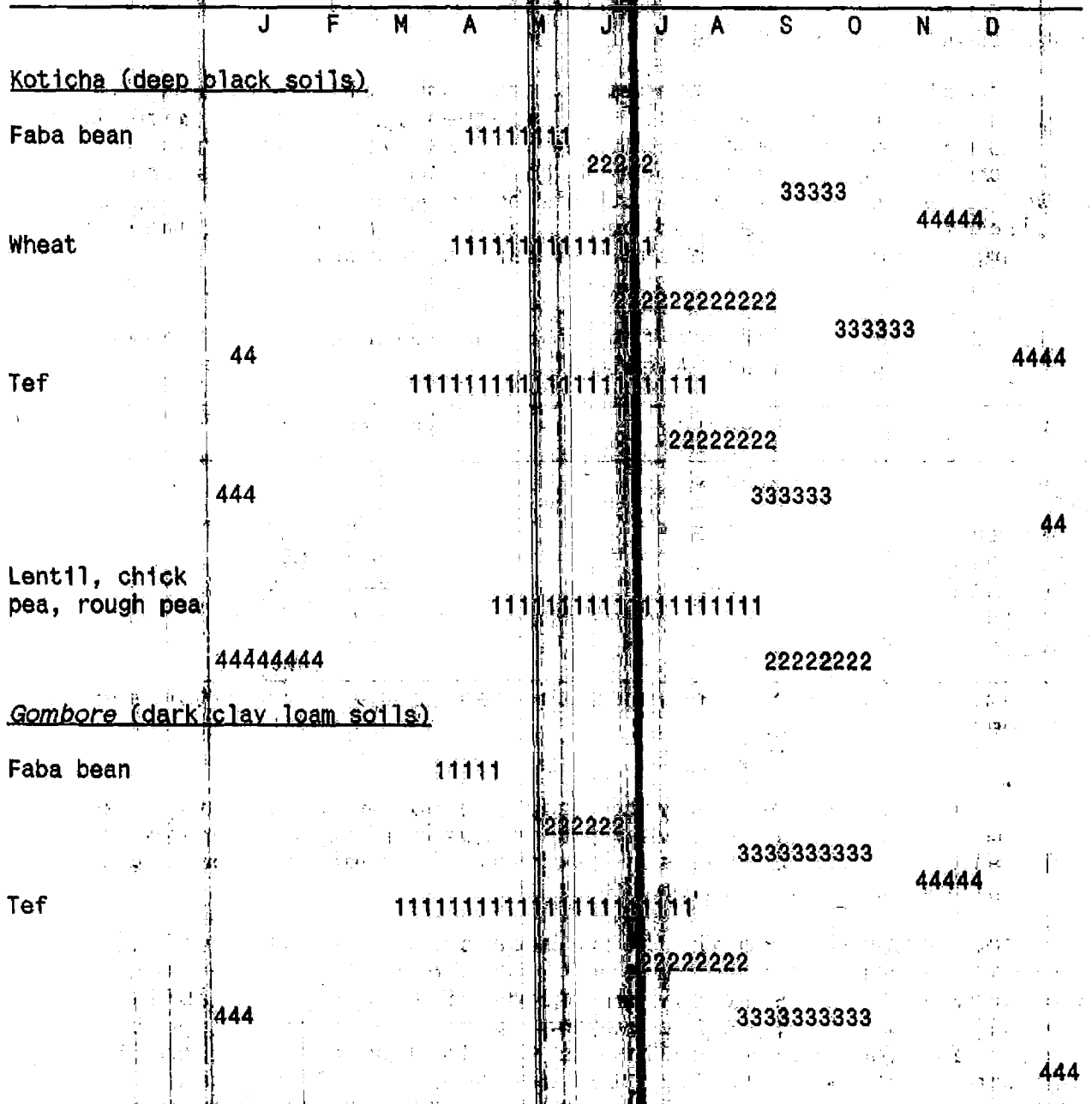
* Number of plowings includes the last pass to cover broadcast seed.

In Inewari, farmers try to keep the number of plowings to a minimum because they believe that frequent plowing coupled with high rainfall loosens the soil excessively thereby exposing the soil to severe soil erosion.

Crop management in the study area depends on the soil type. The soil is very hard to cultivate before it gets sufficient moisture; it becomes sticky and muddy after receiving sufficient rainfall. Moreover, at the beginning of the rainy season draft animals are too weak to cultivate the land because of poor body condition; this results from the dry season feed shortage. Farmers are conscious of their environment and have devised different management strategies in their struggle to ensure adequate and sustained supply of food for the family. Two management strategies are applicable in both target groups:

(1) Farmers plant crops and crop varieties that have a marked degree of waterlogging tolerance during the periods of highest rainfall (July to August). Such crops include tef, linseed, noug and oats.

Figure 6.1. Crop calendar for Inewari area and Sendafa-Aleltu area



(2) Farmers plant durum wheat, lentil, chick pea, and rough pea late in the season on residual moisture.

In addition to these common management strategies, location-specific cultural practices to address the waterlogging problem are discussed below.

Inewari. In the Inewari area hand made BBFs are the traditional management practice to minimize the effects of waterlogging. BBFs are slightly raised beds constructed by demarcating furrows at a certain distance and scooping out the soil by hand. These raised beds are about 80 cm wide, with 40 cm furrows in between. They are established each year on about 35,000 hectares of land (Getachew et al. 1987). The construction of BBFs is a back breaking operation requiring about 16 workdays per hectare. Before making BBFs farmers broadcast the seed on the flat seed bed and then make furrows with oxen. They scoop out the soil from the furrows by hand and cover the seed; at the same time they form the beds.

Other crop management practices at Inewari aimed at addressing the waterlogging problem include.

i) Planting crops (mainly tef) which are relatively tolerant to waterlogging on the bottom land, flat, waterlogged fields during mid-July to mid-August.

ii) Sowing crops highly sensitive to waterlogging such as faba bean and wheat on BBFs.

iii) Planting lentil, chick pea, rough pea and fenugreek late on BBFs from late August to early September. Some farmers plant these crops on the flat vertisols in mid-September after the moisture level has declined.

iv) Planting linseed late in the season in the furrows between adjacent beds cropped to faba bean. Farmers do this to efficiently utilize the available area and to minimize soil erosion.

Sendafa-Aleltu area. As in the Inewari area, waterlogging is a serious problem in Sendafa-Aleltu area. Farmers' strategy is fundamentally the same as that of Inewari farmers. However, in Sendafa-Aleltu the hand made BBFs are replaced by ridges and furrows made by ox plows and planting is done on the ridges. Ridges and furrows traditionally known as *dirdaro* or *shurbe* are slightly raised narrow strips of soil about 20 cm wide with narrow drainage ditches between them that allow excess water to drain off. Ridges and furrows are made on heavily waterlogged, dark black soils traditionally known as *koticha*. In addition to ridges and furrows farmers also dig drainage furrows across the contour at about 4m spacings. Drainage furrows are made on dark

clay loam soils traditionally known as *gombore* soils; these have fewer drainage problems than koticha soils. The specific crop management practices in Sendafa-Aleltu include:

i) Planting tef on well prepared seed beds on the flat, bottom land, waterlogged soils.

ii) Planting crops susceptible to waterlogging such as faba bean and wheat using ridges and furrows on the *koticha* soils. Faba bean, wheat and barley are planted on the *gombore* soils using drainage furrows. In most cases faba bean is planted on upland *gombore* soils that have fewer drainage problems. Drainage furrows are also made.

iii) Planting lentil, chick pea and rough pea on the flat vertisols during September. These crops depend on residual moisture.

Ridges-furrows and BBFs have the same function, i.e, to minimize the effects of waterlogging. However, they differ in method of construction, size and effectiveness.

i) Ridges are narrow, about 20 cm in width and are constructed using the local plow pulled by a pair of oxen. BBFs are constructed by hand and are wider, about 80 cm on average.

ii) Ridge making is easier than BBF making and does not require much labor input as compared to flat planting. BBF construction is tedious and demands additional labor (16 mandays per ha) at planting.

iii) In a ridged field more land is taken up by furrows, since they are made at every 20 cm intervals. In the BBF system furrows are made at 80 cm spacings thus leaving more area for crops to grow.

Despite these differences:

1. BBFs in Inewari and ridge-furrows in Sendafa-Aleltu area enable farmers to (1) reduce waterlogging and thus utilize the lands more efficiently than would have otherwise been the case and

2. Plant a wider variety of crops especially those sensitive to waterlogging, e.g., faba bean and wheat. This has two advantages:

i) Farmers can plant different crops at different times during the rainy season; this minimizes the risk of total crop failure caused by natural hazards. For instance farmers can plant tef or any other late planted crop whenever, as sometimes happens, an early planted crop such as faba bean or

barley fails.

ii) It allows them to meet the family's requirement for a variety of crops. Farmers need different crops for different purposes (staple foods, cash sources and for preparing local drinks).

Although the farmers' management practices as noted above have a number of advantages, they are by no means without limitations. First, hand made BBFs and ridge-furrows do not provide the desired level of surface drainage: as a result yields are low. Second, farmers in Inewari lack suitable implements; thus they are obliged to perform the back-breaking operation of establishing BBFs by hand each year. This has resulted in labor shortages at planting time and lower returns to labor.

Farmers select crops and crop varieties suitable for the area based on their degree of waterlogging resistance. The varieties used tend to be unresponsive to fertilizer application and have low yield potential.

Planting time is governed by rainfall. Under normal circumstances in Inewari planting starts in June with faba bean and ends in September or early October with chick pea, lentil, fenugreek and rough pea (Figure 6.1). Faba bean is planted early on BBFs in Inewari most often during June or rarely in early July. Depending on the rainfall pattern, the earlier the crop is planted, the better. In Sendafa-Aleltu, planting also starts with faba bean but the planting date on the *gombore* soils is a bit earlier than on the *koticha* soils. Faba bean planting on the *gombore* soils starts during the end of May and extends up to mid-June. At planting time faba bean seed is broadcast at the rate of 160-185 kg/ha and then covered with soil during BBF construction or ridge making.

Wheat is planted on BBFs in Inewari and ridges in Sendafa-Aleltu during mid-July to late August. The method of planting is broadcasting and the seed rates vary considerably from 60 to 140 kg/ha.

Tef is planted on finely prepared seed beds on flat bottom waterlogged fields. In Inewari planting begins during mid-July and extends to the end of August, but in Sendafa-Aleltu planting starts during early July and extends to the first week of August. At planting time in both target groups, the field is plowed: family members pack the soil to level it and at the same time clear weeds from the fields. Then, seed is broadcast; fertilizer is broadcast either before or immediately after planting.

All the late planted crops, chick pea, lentil, rough pea and fenugreek are planted from early September to early October on residual moisture. In Inewari they are planted on BBFs or on the

flat vertisols; in Sendafa-Aleltu they are planted exclusively on the flat *koticha* soils. These crops have a special ability to extract and efficiently utilize the available residual moisture.

Farmers do not generally select seeds; most use seeds from the produce of their previous season. A few farmers purchase seed from the local market especially if their crop failed the previous season.

Farmers' seed rates are compared to recommendations in Table 6.3. Farmer seed rates are lower than the recommended seed rate for most of the crops. However, it is important to note that the actual cropped area on BBFs and ridges is less than the amount on flat soils, for which the station recommendations are made. Thus farmers' seed rates are not as low as they seem to be.

Table 6.2. Seed rates of farmers and research recommendations for the major crops (kg/ha)

Crop	Farmer seed rates	Station recommendation
Tef	20-40	30
Wheat	60-140	175
Faba bean	160-185	200
Field pea	80-140	175
Lentil	-	70-80
Rough pea	80-160	-

- Means not available
Source: Station recommendations are from Holetta

Crop rotation

Crop rotation is a well established practice in both target groups. The main objective is to maintain soil fertility and reduce disease incidence. The most common rotation in the survey area is cereals followed by pulses. The domihant rotations are:

Inewari:

1. chick pea or rough pea or lentil ------> wheat or tef.

2. faba bean ------> wheat/tef.

Sendafa-Aleltu:

Wheat or tef ------> chick pea or lentil.

Faba bean is declining in importance in the rotations due to pest and disease problems.

Wheat varieties

Farmers have several criteria for wheat variety selection (Table 6.3). The most important criteria are resistance to waterlogging, quality and quantity of total biomass per unit area, and yield. The wheat varieties currently under cultivation in Inewari in order of importance, are Gounde, Enkoy, Lakach, Gojam, Enat-Sende and Manze.

Table 6.3. Farmers' evaluation of common wheat varieties in the survey area

Criteria	Varieties			
	Gounde	Enkoy	Lakach	Gebre
1. Resistance to waterlogging	high	low	low	high
2. Straw quality as animal feed	good	fair	poor	good
3. Yield	medium	high	high	low
4. Performance under unfertilized and weedy condition	good	poor	poor	good
5. Height	tall	medium	-	-
6. Color	white	red	white	-
7. Taste/Baking	good	good	poor	-

- Information not available

Gounde is a local variety widely grown by farmers. It is awnless, vigorous, has high straw quality for animal feed, and has good baking and taste qualities. Although it is not a high yielder, it performs well under waterlogged and unfertilized conditions. Due to its vigorous nature, it competes fairly well with weeds.

Enkoy is an improved bread wheat variety characterized by farmers as a high yielder when fertilized properly, medium in height, early maturing and has fair straw quality as animal feed. It also has good baking quality but fetches a low market price because of its red seed color.

Lakach is also an improved bread wheat variety characterized by farmers as a higher yielder when fertilized properly. But Lakach has poor straw and baking quality.

The varieties Gojam, Enat-Sende, and Manze are all local varieties, short to medium in height, and leafy. They respond poorly to fertilizer application and are fair yielders with good straw quality for animal feed. But all are susceptible to aphids because of their leafy nature; as a result their importance is

decreasing in the farming system.

The wheat varieties in Sendafa-Aleltu include Gebre, Enkoy, Lakach and Israel. Enkoy and Lakach in Sendafa-Aleltu are characterized by farmers as high yielders, highly sensitive to waterlogging and responsive to fertilizer.

Gebre is a local variety characterized as low yielding and having good straw quality. It performs fairly well under waterlogged and unfertilized conditions compared to the improved varieties.

In both target groups the improved varieties Enkoy and Lakach are planted when farmers have access to fertilizer on well drained soils and on BBFs or ridges. The local varieties are planted in (1) heavy rainy seasons when waterlogging is likely or (2) when fertilizer is not available or inadequate.

Weed management

The major weeds in the survey area are Trifolium sp., Plantago lancolate, Falaris parodoxa, and Guizotia scabra. Hand weeding is the sole practice to control weeds. None of the interviewed farmers either recognized weeds as a problem or used herbicide on their crops. In Inewari, hand weeding of tef, wheat and faba bean is the general practice while in Sendafa-Aleltu only tef is weeded. Tef fields get the first and maximum attention in terms of weeding. Tef is weeded as early as possible usually during late August or early September depending on the time of planting. Farmers usually weed tef one time.

In Inewari, weeds from wheat and faba bean fields constitute a major portion of livestock feed. Thus, the two crops are weeded late after the weeds are mature enough to be fed for livestock. They are weeded once over an extended period of time (mid-September to early November) in such a way to secure continuous and sustained supply of feed for the livestock. On the other hand tef fields are weeded early over a relatively short period when the weeds are short and immature. The weeds removed from tef fields are piled in and around the field on open patches of land. In the following season the piled weeds are spread over the field and than plowed under so as to incorporate them into the soil.

Tef weeding demands more labor than wheat or faba bean weeding because tef is weeded early before the critical stage of weed competition. Weeds are short and immature making weeding difficult. According to farmers' estimates tef weeding requires 32-60 mandays per hectare, faba bean and wheat require 16-24 mandays per hectare. Weeding labor estimates for wheat and faba bean are liable to error because weeding is carried out on an ad hoc basis over an extended period of time. As a result farmers

could not recall accurately the amount of labor spent on these crops.

The late planted crops (e.g., lentil, chick pea and rough pea) are rarely weeded. In Inewari farmers who plant these crops on BBFs pull out the major weeds to feed their livestock, but those farmers who plant on the flat vertisols do not weed at all. In the latter case the land is plowed thoroughly at planting in such a way to kill the weeds.

Pests and diseases

Crop pests are one of the major problems causing changes in cropping patterns. The most economically important pests are aphids on faba bean at flowering, pod borers on faba bean at pod setting; cricket on teff at the early stage of crop development and cut worm on chick pea, lentil and late-planted wheat. The incidence of pod borer though sporadic is economically important; complete failure of faba bean due to this pest is a common experience. As a result, farmers are forced to decrease or even give up faba bean production. Instead they grow lentil, chick pea and rough pea which are nearly perfect substitutes for faba bean in terms of end use. Inspite of its low yield, lentil production is also favoured by the relatively high price it enjoys in the local market compared to chick pea and rough pea. Root rot is the most important disease on faba bean followed by rust and chocolate spot.

Fertilizer and manure use

Fertilizer is the main purchased input used by farmers. They believe that fertilizer increases yield provided that sufficient doses are applied. Fertilizer is purchased from SCs on credit with a down payment. Fertilizers are supplied to SCs by MOA. Since fertilizer is distributed to SCs in limited quantities, farmers face a problem of getting as much as they want. This has a great implication on the types of crops fertilizer is used on and on the rate used. As a result the most important crops, tef and wheat, receive whatever fertilizer is available. In both target groups all the interviewed farmers had used fertilizer on their tef and wheat crops (Table 6.3).

The fertilizer rate used varies from year to year and from farm to farm depending on the availability and the individual farmers' financial position. Generally Inewari farmers use exclusively DAP while farmers in Sendafa-Aleltu use both DAP and urea (Table 6.3). Moreover, in both target groups a higher fertilizer rate is used on tef than on wheat. The rate used in Inewari ranges from 50 to 100 kg/ha diamonium phosphate (DAP) on tef and 50 to 75 kg/ha on wheat. In Sendafa-Aleltu about 75% of the farmers interviewed used only DAP at the rate of 75-100 kg/ha on tef and 50-75 kg/ha on wheat. About 25% of the interviewed

farmers used 50-100 kg/ha DAP with 50 kg/ha urea on tef; and 50-75 kg/ha DAP with 25-50 kg/ha urea on wheat crop.

The method of application of DAP on tef and wheat is broadcasting at the time of planting. Those farmers who use both DAP and urea on wheat mix the fertilizer and broadcast the mixture at planting. But on tef only DAP is applied at planting; urea is broadcast when the crop reaches two leaf stage.

Table 6.3. Farmers' fertilizer rates in Inewari and Sendafa-Aleltu (kg/ha)

	Inewari			Sendafa-Aleltu		
Crop	DAP	Urea	% farmers using	DAP	Urea	% farmers using
Tef	50-100	0	100%	75-100	0	75%
				50-100	50	25%
Wheat	50-75	0	100%	50-75	0	75%
				50-75	25-50	25%

In the study area a considerable amount of farmyard manure is obtained as a by-product of livestock. The farm family, though aware of the value of farmyard manure as organic fertilizer, use much of it as fuel to solve the critical fuel shortage of the area. Moreover, caked and sun-dried farmyard manure has a good demand in the local market; one donkey load is sold for 5-10 birr. Despite its domestic use as a fuel source or source of cash, quite a number of farmers apply manure on faba bean fields. However, its use as organic fertilizer is declining as villagization is progressing because houses are located at far distances from fields.

In Inewari, during the main rainy season, a large hole is dug near the homestead for collecting farmyard manure. After mid-September water is added into the hole on the conserved manure. It is mixed thoroughly and made into cakes and dried in the sun. The caked, sun-dried manure is piled and conserved for both domestic use as a fuel and for sale at the local market.

Harvesting, threshing and storage

The time of harvesting depends on the sowing date and the variety used. Harvesting starts with faba bean in November followed by wheat and tef in December through January. From January to early February chick pea, lentil, rough pea and fenugreek are harvested. Harvesting is done manually using a sickle for faba bean, wheat and tef. The late planted crops such

as chick pea and lentil are pulled out by hand at the stage farmers feel appropriate. The harvested crop is then piled for a while until harvesting is completed. Threshing follows immediately after harvesting.

All crops are stored in locally constructed grain silos known traditionally as *gotera*. *Gotera* are placed near the homestead mostly at the back of the house. Storage pests do little damage to the stored grain. Weevils, which attack all except tef, and mice are occasional problems. Farmers use pesticides against weevil which they buy from SCs. Locally made traps and domestic cats are used against mice.

7. THE LIVESTOCK SUBSYSTEM

The livestock subsystem is highly integrated with the crop subsystem forming a mixed farming system. Livestock provide draft power essential to plow the land and in return receive crop residues crucial for their survival. The principal objective of keeping livestock in Inewari is to raise animals that provide replacement draft power necessary for the continuation of the system. The production of primary commodities such as meat and milk is a secondary objective for Inewari farmers. For Sendafa-Aleltu farmers draft and meat/milk are equally important. Another implicit reason for keeping livestock is as a means of security; livestock are capital items that can be easily liquidated into cash in times of emergencies. Herd size for each type of animal is shown in Table 7.1.

Table 7.1. Type of animals and herd size of sample farmers in the two survey areas

Animal	Herd size (no.)	
Type	Inewari	Sendafa-Aleltu
Oxen	1.3	2.1
Bull	0.2	0.5
Cow	1.0	2.2
Heifers	0.2	0.3
Calves	0.4	1.9
Sheep	3.0	2.6
Horses	1.0	.8
Donkeys	0.5	0.9

Figure 7.1. Livestock feed supply calendar for Inewari

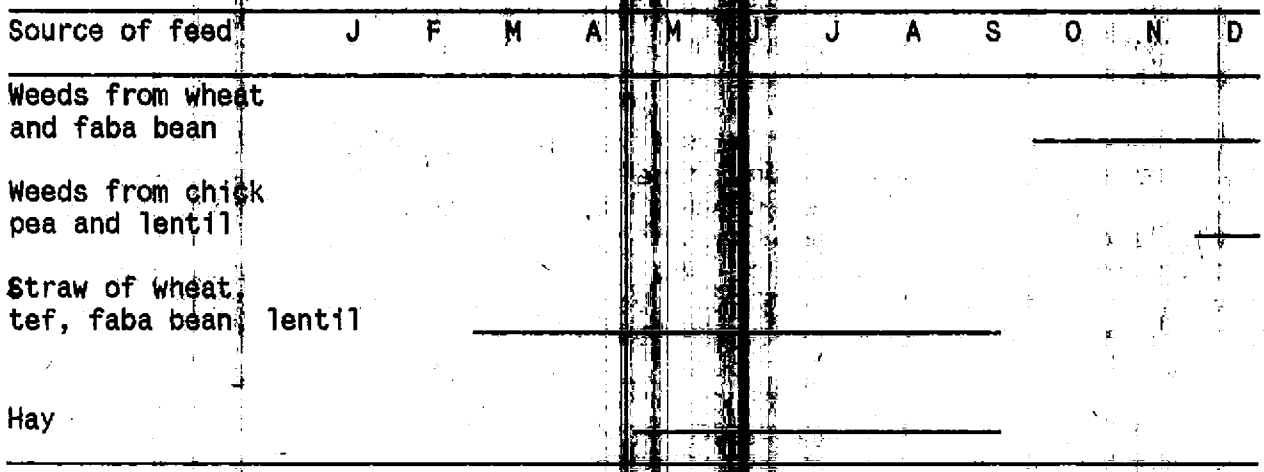


Figure 7.2. Livestock feed supply calendar for Aleltu-Sendafa.

Generally farmers in Inewari keep fewer livestock than Sendafa-Aleltu farmers. A typical farmer owns one to two oxen, one milking cow with a calf, a few sheep and one horse or one donkey. In both target groups animal feed is the number one constraint hindering livestock productivity. The critical feed shortage period is April to July. In Inewari, every available cultivable field is under crop production, as a result during the main rainy season livestock have no place to graze. In Sendafa-Aleltu, though farmers have small plots of land for grazing as well as for hay making purposes, animal feed is still insufficient. Seasonal waterlogging aggravates the feed shortage. During the wet season, livestock are grazed around homesteads, along roadsides and on uncultivated patches of land deliberately left for this purpose among cropped fields. Figures 7.2 and 7.3 show the feeding calendars for the two target groups.

Inewari farmers faced by the critical feed shortage are forced to integrate food and feed production. Farmers' strategies to ensure adequate feed supply for the livestock include:

1. Weeding their wheat and faba bean fields late at the time when the weeds are mature enough to be fed for the livestock. In most cases, weeding takes place over an extended period of time (September through November) in such a way to ensure a continuous supply of animal feed for the period. All the plant parts except the roots are transported to the homestead with the help of donkeys either to be fed as fresh or conserved for later use.

2. Planting wheat varieties that yield a reasonable amount of straw of acceptable quality. To this end farmers plant the local wheat varieties such as *Gounde* which give good quality straw but low grain yield.

3. Collecting and conserving crop residues of the major crops (e.g.; tef, wheat, faba bean, barley, and lentil) to supply livestock during the dry season.

4. In both target groups, farmers leave aside a small portion of their arable land for making hay. In Aleltu-Sendafa farmers are allotted small plots of land by the PA specifically meant for hay. Hay and tef straw are fed to oxen before and after they work.

After harvest livestock of all ages and classes graze freely on the communally owned land.

Animal disease is the second most important constraint limiting livestock productivity. Rinderpest and anthrax are the two most common and economically important diseases. In most cases farmers use their traditional knowledge and local medications (roots and herbs) to treat diseases. It is only occasionally that the services of veterinarians is sought.

8. SYSTEM TRENDS PRINCIPAL FARMER PROBLEMS AND PROPOSED SOLUTIONS

The major problems impacting on the farming system are:

1. Population pressure,
2. Seasonal waterlogging,
3. Scarcity of land for both crop production and grazing,
4. Shortage of oxen,
5. Crop diseases and pests,
6. Shortage of fuelwood and
7. Cash constraints

Farmers faced with these constraints and management challenges are obliged to change some of their practices over time to cope with the new situation arising in the system. Some of the trends observed are:

1. Shortage of animal feed (most critical in Inewari) has led to the use of weeds from wheat and faba bean fields for animal feed. Farmers give up higher yields than would have been realized through early weeding in favor of feed production.

2. The area cropped to faba bean is decreasing from year to year while the area devoted to wheat, tef, lentil and chick pea is increasing. This is mainly due to diseases such as root rot, rust and chocolate spot and pests such as pod borer and aphids on faba bean.

3. Shortage of oxen in Inewari has led to the use of horses alone or paired with oxen for land preparation. This gradual shift from oxen use to horses might be attributed in part to shortage of grazing area and high replacement costs of oxen.

4. Fallowing which had been an important traditional practice as a means of maintaining soil fertility is now completely abandoned in Inewari and replaced by the use of chemical fertilizers. Despite the delay and the meager quantity, fertilizer use on tef and wheat is increasing.

5. Lack of firewood has resulted in the increasing use of manure as fuel. Manure had previously been used to fertilize faba bean fields. The use of manure as fuel in the short-run has a negative effect on yield and in the long run contributes to poor soil structure and low organic content of the soil.

CONCLUSION

Most of the farmers in the study area are smallholders whose primary objective is to secure adequate food for the family. Waterlogging is the major problem in crop production and the two target groups have different strategies to overcome the drainage problem. The major problems in crop and livestock production are listed in Table 9.1. Potential solutions for these problems are also suggested. If an attempt is made to implement the suggestions, some of the problems will be alleviated.

Table 9.1. Summary of principal problems and possible solutions

Farmer problems	Evidence/Justification	Priority	Possible solutions suggested
1. Seasonal water logging	- use of hand made BBFs in Inewari and drainage furrows in Aleltu-Sendafa - late planting on residual moisture - use of land races which have low yield potential but have marked degree of water logging tolerance	very high	- use of animal drawn implement for improved drainage - develop and test varieties adaptable to water logging
2. Scarcity of arable land	- small holding due to division and sub division of lands in response to population pressure - no communal grazing land during the main rainy season in Inewari - farmer perception	high	- intensification of crop production through double cropping - introduction of crop varieties with higher quantity and quality of biomass
3. Scarcity of animal feed	- grazing restricted to road sides and marginal areas - no grazing land in Inewari and very limited in Sendafa-Aleltu - poor body condition of livestock during the dry season - farmer reports and concern	high	- relay cropping of forages with cereals - introduction of browse species
4. Poor soil fertility	- continuous cropping (no fallowing in Inewari and decreasing trend in Sendafa-Aleltu - increasing use and demands of chemical fertilizer placement - use of manure as fuel source	high	- soil analysis to determine the most limiting nutrients - fertilizer trials to determine appropriate rates, time of application for fertilizer
5. Diseases on faba bean crop - root rot - chocolate spot - rust	- personal observation of scientists - farmer and local extension agents report - shift from faba bean to other late planted legume crops	high	- chemical treatment - screening of varieties against these diseases

Farmer problems	Evidence/Justification	Priority	Suggested possible solutions
6. Pests - Aphids and pod borer field pea and faba bean - cut warm on chick pea and on late planted wheat	- personal observations - farmer and DA reports	high	- chemical treatment - Develop resistant varieties
7. Late weeding of wheat and faba bean	- weeding takes place after the weeds are nature enough to be feed for livestock September through October - personal observation	medium	- solve the animal feed shortage so that farmers can weed earlier
8. Use of local wheat varieties that are low yielding and not responsive to fertilizer application	- farmer preference of the land races for their straw quality and acceptable degree of performance under stress conditions - large acreage under local varieties	medium	- developing tests improved varieties that have marked degree of water logging tolerance and reasonable yield potential under stress conditions
9. Shortage of draft power	- majority of farmers owned either one ox or horse. - shift from oxen to horse use - many of the farmers use the *wekanajo* system to acquire a team of draft animals	medium	- make available farm credit for purchase of draft animals - increase feed availability
10. Seasonal food deficits	- farmer reports - low yield levels	medium	
11. Fire wood scarcity	- increasing use and sale of caked and sun-dried farmyard manure - deforestation	medium	- promote agroforestry scheme - planting multi-purpose trees around the homestead
12. Unavailability and delay of chemical fertilizer	- very low supplies - delayed planting - farmer and DAs report	medium	
13. Labor shortage at planting	- high wage rates at this time (3 birr/day plus lunch) - over lapping of operations	medium	
14. Cash constraints	- unavailability of cash at the desired time - lack of alternative cash sources	medium	- promotion of farm credits

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