INITIAL RESULTS OF INFORMAL SURVEY
SINANA MIXED FARMING SYSTEM ZONE
BALE REGION

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INITIAL RESULTS OF INFORMAL SURVEY:
SINANA MIXED FARMING SYSTEM ZONE

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FARMING SYSTEMS RESEARCH

March, 1987
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Preface

The Department of Agricultural Economics and Farming Systems Research has initiated departmental publication of a working paper series in the area of agricultural economics and farming systems research. Working papers are made available in limited numbers for comments and discussion and to inform interested colleagues about work in progress in the department's area of research.

This report describes the informal survey work undertaken by a group of researchers and local extension personnel at Sinnan in the South Eastern Agricultural Development Zone, Bale Administrative Region. It is expected that these initial results will help in the design and development of research programs for the newly established Sinnan Agricultural Research Center. Furthermore, this report should be useful for organizations involved in agricultural development in the region. Subsequent formal surveys will be launched in the region to verify and quantify the initial findings of the informal survey and will be made available.

The Department would appreciate receiving comments and suggestions and they should be directed to the author(s).

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INITIAL RESULTS OF INFORMAL SURVEY:
SINANA MIXED FARMING SYSTEMS ZONE

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Steven Franzel [2]

1. INTRODUCTION

Small farmers in many developing countries have often not adopted technologies recommended by research programmes. This is partly due to the inconsistencies of recommended technologies with the farmers’ circumstances.

Farmer circumstances are the natural, economic and institutional features of an area within which farmers have to manage their limited resources to satisfy their priorities. Failure to understand the farm family, the primary client of technologies, and the environment in which it is working will jeopardize the acceptance of any technology.

It is from this context that Farming Systems Research (FSR) has evolved and is being incorporated by many research programmes. The development of FSR and its adoption by many research services is mainly because of its logical approach to research. FSR is oriented towards understanding the needs of farmers and working in an interdisciplinary group to plan research. Research based on the understanding of farmer circumstances facilitates the generation and adoption of technologies.

In FSR, economists, agronomists, other research scientists, and extension staff work as a team both in the diagnosis of problems and in conducting on-farm experiments. The team works together in identifying target groups of farmers, in defining farmer circumstances, identifying and prioritizing farmer problems, and finally in implementing the research programme.

[1] Assistant Research Officer, Division of Agricultural Economics and Farming Systems Research, Sinana Research Centre, Institute of Agricultural Research.

This paper presents the results of an informal survey [1] conducted in the Sinana highlands, Bale Region. It describes farmer circumstances, farmer problems, possible solutions and experimental themes to solve farmer problems.

Survey Objectives

The Sinana survey had several objectives:

1. To identify and prioritize farmers' problems and resource constraints. This will help to allocate the limited research resources on priority problems according to farmers' preferences and objectives.

2. To identify existing opportunities for the farm community.

3. To further define the target group of farmers or recommendation domains by understanding farmer circumstances. These include the natural, economic and institutional features within which the farmer has to manage his limited resources to satisfy his priorities.

4. To design on-farm trials, to provide information to policy makers and to assist basic on-station research to work on the specific priority problems of farmers.

Survey Procedures

A team of economists and agronomists from IAR and extension agronomists from the Ministry of Agriculture (MOA), Bale Region, participated in the informal survey. Survey procedures included the following:

1. Existing secondary information was compiled and discussions were held with local government officials.

2. Peasant Associations (PAs) were the foci for the visits and interviews. The important points considered in selecting PAs were accessibility and representativeness. Farmer interviews were conducted during October-November, 1986.

3. Producer cooperatives were also visited since they are increasing and since their operations are somewhat different than those of individual PA members.

[1] An informal survey is a field study conducted by FSR professionals (economist, agronomist, etc) in which informal farmer interviews, direct observations, and existing information are used to develop an understanding of farming systems and to plan experimentation and other interventions.
4. In any given interview, only a few of the specific topics of the interview guidelines were covered.

5. Sampling of PA's and farmers was not random, i.e., formal random sampling was not followed. However, as far as possible, we selected farmers by chance. Approximately 36 interviews were conducted with 1-5 farmers present per interview.

Target Area

The Sinana survey area is located in Mendeyo Awraja, Bale Region, South Eastern Zone. It is in the southeastern highlands of the country known for its potential production. The target area includes most of Sinana Woreda and parts of Goba and Agarfa Woredas. A map of the area is shown in Fig. 1.

2. FARMER CIRCUMSTANCES

Natural Circumstances

Rainfall

The study area is characterized by bimodal rainfall, namely, the belg season (Feb-June) and the meher season (July-November) as shown in Table 1 and Figure 2. The area receives about 900 to 1000 mm of rainfall per annum or 450-500 mm per season. Crop production is in both seasons. However, more area is under crops during belg because of the unreliability and uneven distribution of the meher rains.

Normally, there is a dry spell between belg and meher during June/July and an extended dry period between meher and belg from November to February. The dry period may extend beyond February or may start early depending on the specific year. Farmers harvest the belg crop during the short dry spell in June/July implying that belg harvests are exposed to increased moisture/rainfall. Land preparation starts with residual soil moisture for meher and with the onset of rainfall for belg.

Temperature

Available temperature data in the study area is very limited, due to the scarcity of meteorological stations. Temperature data for three locations is indicated in Table 2. The mean maximum monthly temperature is 24 degrees (May) and the mean minimum monthly temperature is 2.8 degrees (January). The drop in air temperature begins in October and comes to its minimum in January. This is confirmed by farmers' reports of frost incidence during the period October-January which can cause crop losses during the meher season. Frost in the area is associated with drought or an extended dry season.
## Table 1: Monthly and Annual Rainfall 1980-84 in Four Locations in Sinana-Goba Survey Area

<table>
<thead>
<tr>
<th>Location</th>
<th>Elevation Meters</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Yearly average (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sinana I</td>
<td>2400</td>
<td>5.4</td>
<td>27.8</td>
<td>60.9</td>
<td>115.6</td>
<td>131.2</td>
<td>39</td>
<td>50.3</td>
<td>113.6</td>
<td>128.7</td>
<td>85</td>
<td>32.4</td>
<td>25</td>
<td>766.9</td>
</tr>
<tr>
<td>&quot; II</td>
<td>2400</td>
<td>0.0</td>
<td>23.6</td>
<td>40.3</td>
<td>107.6</td>
<td>131.2</td>
<td>77.7</td>
<td>67.4</td>
<td>120.1</td>
<td>97.4</td>
<td>80.7</td>
<td>24.6</td>
<td>9.3</td>
<td>779.9</td>
</tr>
<tr>
<td>&quot; III</td>
<td>2400</td>
<td>5.3</td>
<td>28.7</td>
<td>93.6</td>
<td>157.4</td>
<td>135.3</td>
<td>53.7</td>
<td>37.1</td>
<td>105.0</td>
<td>168.6</td>
<td>82.0</td>
<td>32.9</td>
<td>15.8</td>
<td>915.6</td>
</tr>
<tr>
<td>Robe</td>
<td>2480</td>
<td>67.5</td>
<td>28.1</td>
<td>100.9</td>
<td>143.0</td>
<td>86.6</td>
<td>34.7</td>
<td>106.9</td>
<td>138.0</td>
<td>83.2</td>
<td>94.0</td>
<td>48.4</td>
<td>26.4</td>
<td>957.7</td>
</tr>
<tr>
<td>Monthly</td>
<td></td>
<td>19.55</td>
<td>27.05</td>
<td>73.52</td>
<td>130.9</td>
<td>109.1</td>
<td>51.3</td>
<td>65.4</td>
<td>119.12</td>
<td>119.5</td>
<td>85.4</td>
<td>34.5</td>
<td>19.13</td>
<td>855.0</td>
</tr>
</tbody>
</table>


## Table 2: Monthly Average Temperatures Recorded for Three Locations (1981-84) Sinana-Goba Survey Area

<table>
<thead>
<tr>
<th>Location</th>
<th>Jan °C</th>
<th>Feb °C</th>
<th>Mar °C</th>
<th>Apr °C</th>
<th>May °C</th>
<th>June °C</th>
<th>July °C</th>
<th>Aug °C</th>
<th>Sept °C</th>
<th>Oct °C</th>
<th>Nov °C</th>
<th>Dec °C</th>
<th>Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sinana I</td>
<td>2.8</td>
<td>4.3</td>
<td>6.6</td>
<td>9.2</td>
<td>8.7</td>
<td>7.8</td>
<td>9.6</td>
<td>9.2</td>
<td>9.1</td>
<td>6.6</td>
<td>4.3</td>
<td>4.1</td>
<td>min</td>
</tr>
<tr>
<td></td>
<td>max</td>
<td>22.7</td>
<td>22.9</td>
<td>23.2</td>
<td>21.3</td>
<td>24.0</td>
<td>22.0</td>
<td>22.1</td>
<td>21.1</td>
<td>20.0</td>
<td>19.3</td>
<td>20.5</td>
<td>21.7+</td>
</tr>
<tr>
<td></td>
<td>min</td>
<td>3.6</td>
<td>5.1</td>
<td>10.8</td>
<td>9.9</td>
<td>9.5</td>
<td>9.2</td>
<td>7.3</td>
<td>8.7</td>
<td>8.1</td>
<td>4.2+</td>
<td>2.9+</td>
<td>max</td>
</tr>
<tr>
<td></td>
<td>max</td>
<td>22.6</td>
<td>22.4</td>
<td>22.8</td>
<td>21.9</td>
<td>20.3</td>
<td>19.7</td>
<td>19.1</td>
<td>19.5</td>
<td>20.2</td>
<td>18.8</td>
<td>20.5</td>
<td>21.6</td>
</tr>
<tr>
<td>Robe</td>
<td>7.2</td>
<td>8.6</td>
<td>6.9</td>
<td>7.2</td>
<td>7.5</td>
<td>7.4</td>
<td>7.1</td>
<td>7.5</td>
<td>6.9</td>
<td>6.5</td>
<td>6.3</td>
<td>3.9</td>
<td>min</td>
</tr>
<tr>
<td></td>
<td>max</td>
<td>21.5</td>
<td>21.7</td>
<td>24.1</td>
<td>22.7</td>
<td>22.5</td>
<td>22.4</td>
<td>21.3</td>
<td>22.0</td>
<td>20.9</td>
<td>20.1</td>
<td>21.4</td>
<td>21.8</td>
</tr>
</tbody>
</table>

*Does not include the 1984 data.

Fig. 2: Histogram of Monthly Average Rainfall, 1980-84, Sinana - Goba Survey Area.

Source: Table 1 row data.
Relief and Topography

Elevation ranges between 2400 and 2500 meters. The target area faces the Bale mountains in the south and southeast. The area is a plain and it slopes gently, falling towards the north and northeast. Generally, the terrain is suitable for arable farming; as a result the very nature of this flat land has facilitated the expansion of large-scale state farms. State farms occupy about 25% of the cultivated area in Sinana woreda.

Soils

Soils of the area have high clay content and are brown to grayish-black in color. In addition some soils are whitish brown. Lower lying, flat bottom land areas are characterized by black-gray colored soils. Murphy (1958) reported soils of Goba area to be generally slightly to strongly acid, with over 3% organic matter and more than 0.15% total nitrogen. Soil sample analysis of Sinana state farms in 1966 (Table 3) indicated high clay content and soil depths up to 140 cm. The clay content of this black grayish soil ranges from 68.9% to 83.9%. With increased depth the percentage clay increases while the percentage sand and silt decline. The pH level ranges between 5 and 6.35 and generally there is low organic matter (Murphy, 1968).

Observations during the survey indicated that the Sinana station soils, which are black and finely textured, are not representative of the target area soils which are gray to brown.

Socioeconomic Circumstances

History of the area

In general arable farming is new to the area; its start does not exceed three to four decades. Until then the area was inhabited by pastoralists who ethnically are Muslim Oromos. Arable farming began when migrants from Shoa came into the area; these are Christian Oromos whose mainstay is crop cultivation. Generally, there are more indigenous people (Moslems) than migrants (Christians). Today both groups practice mixed subsistence farming, dominated by the production of cereals.

The area has been villagized for the last ten years and no scattered households are left.

Population and settlement

All farmers are organized into peasant associations (PAs) and service cooperatives (SCs). Few farmers (about 5%) are organized into producers cooperatives (PCs). There are 24 PAs, 20 SCs, and 8 PCs. The 24 PAs are villagized into 24 villages in Sinana. The study area includes about 8,650 household heads with about 58,342 family members.
Table 3: Soil Analysis Sinana State Farm

| Profile No. | Depth cm | Clay | Silt | Sand | Textural class | Bulk Density g/cm³ | Organic Matter H/P (kcal) | Organic Matter (01 sen) % | Total N % | Available P, PPM | Exchangeable+Soluble cations Meg/100 gm soil | Total CEC Meg/100 gm soil | Ca: Mg: K
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>1</td>
<td>0-20</td>
<td>75.9</td>
<td>11.7</td>
<td>12.4</td>
<td>Clay</td>
<td>0.95</td>
<td>6.05</td>
<td>1.38</td>
<td>0.126</td>
<td>1.0</td>
<td>2.0</td>
<td>74</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>20-70</td>
<td>67.9</td>
<td>19.7</td>
<td>12.4</td>
<td>&quot;</td>
<td>0.95</td>
<td>6.25</td>
<td>0.69</td>
<td>-</td>
<td>1.8</td>
<td>2.0</td>
<td>80</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>20-120</td>
<td>83.9</td>
<td>5.7</td>
<td>10.4</td>
<td>&quot;</td>
<td>0.95</td>
<td>6.30</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>0-30</td>
<td>57.9</td>
<td>23.7</td>
<td>18.4</td>
<td>&quot;</td>
<td>0.86</td>
<td>5.70</td>
<td>1.1</td>
<td>0.084</td>
<td>1.0</td>
<td>3.1</td>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>30-70</td>
<td>61.9</td>
<td>23.7</td>
<td>14.4</td>
<td>&quot;</td>
<td>0.88</td>
<td>6.30</td>
<td>1.0</td>
<td>-</td>
<td>0.9</td>
<td>2.0</td>
<td>105</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>70-130</td>
<td>69.9</td>
<td>18.7</td>
<td>11.4</td>
<td>&quot;</td>
<td>-</td>
<td>6.35</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>0-10</td>
<td>47.9</td>
<td>21.7</td>
<td>30.4</td>
<td>&quot;</td>
<td>1.0</td>
<td>4.75</td>
<td>6.25</td>
<td>0.406</td>
<td>3.6</td>
<td>3.1</td>
<td>32</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>10-40</td>
<td>74.9</td>
<td>12.7</td>
<td>12.4</td>
<td>&quot;</td>
<td>1.0</td>
<td>5.00</td>
<td>2.59</td>
<td>-</td>
<td>1.0</td>
<td>9.6</td>
<td>36</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>40-80</td>
<td>65.9</td>
<td>19.7</td>
<td>13.4</td>
<td>&quot;</td>
<td>1.0</td>
<td>5.90</td>
<td>2.69</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>80-140</td>
<td>68.9</td>
<td>14.7</td>
<td>16.4</td>
<td>&quot;</td>
<td>1.0</td>
<td>6.35</td>
<td>1.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Land Use

Land use is dominated by grazing areas and cultivated land, as shown in the data for Sinana woreda below:

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Total Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arable land (cultivated)</td>
<td>30,633 ha.</td>
</tr>
<tr>
<td>Grazing area</td>
<td>58,255 ha.</td>
</tr>
<tr>
<td>Forest land</td>
<td>5,523 ha.</td>
</tr>
<tr>
<td>Non-cultivable</td>
<td>1,055 ha.</td>
</tr>
<tr>
<td>Area under villages</td>
<td>3,049 ha.</td>
</tr>
<tr>
<td>Total</td>
<td>98,515</td>
</tr>
</tbody>
</table>

Source: MOA, Sinana woreda.

Goba woreda has a similar land use pattern.

Land Tenure

Land was the communal property of the local pastoralists prior to the arrival of the Shoa migrants. This was one opportunity for the local people to acquire more livestock without any restriction to grazing ground.

Private landholding emerged with the migrants who introduced crop cultivation. Since the 1973/74 land proclamation, the land is state property and is distributed to farmers through peasant associations (PAs) to which every farmer is a member. Land distribution criteria include: population density, family size, soil fertility, farmer performance, and oxen ownership. However, livestock grazing still remains communal, which has worsened feed shortages due to uncontrolled grazing practices and overstocking.

Producers Cooperatives (PCs) have the right to expropriate land from individual farmers, who then are allocated new land from the PA.

Marketing of Agricultural Produce

There are two channels for disposal of agricultural produce: the Agricultural Marketing Corporation (AMC) and the local markets. Robe and Goba are the two biggest markets in the area. In addition, assembly markets are scattered throughout the zone. These include, Selka, Alemgena, Hisu, Meliya and others which are connected to the big markets by feeder roads. More than 80% of the area and farmers are accessible to one or more of the assembly markets.

During market days, observations indicated that barley and wheat are the most important crops marketed. There are some field peas and lesser amounts of other crops. Livestock in the markets include cows, sheep, goat and donkeys. Fuelwood is sold both in the assembly markets and big towns of Goba and Robe. The markets are also supplied with fruits (oranges, bananas, etc.) from neighboring woredas and vegetables (potato, cabbage, etc.), which...
are locally produced. Coffee is another commodity transported to the area and is marketed by full time coffee traders. Donkeys play an important role in transporting produce to markets.

Farmers sell their produce for various purposes:
- whenever they face cash problems
- for usual cash needs
- for taxes (October/November) and contribution fees

The basic cash crop in the area is wheat sold by the household head. Barley, the main food staple, is sold in small quantities, usually by housewives.

Due to government restrictions, there are no wholesale buyers who assemble crops to retail outside the area. Practically all the produce circulates within the region. A few traders buy crops from assembly markets to sell later in Goba or Robe.

Others buy from traders or farmers in the big markets to sell the same day for consumers in that market. Their capacity is very limited and one of them may not buy more than 2-3 quintals. Most farmers sell their produce in assembly markets rather than bringing them to Goba or Robe because of the distance to these markets. Only neighbouring farmers and traders supply the big markets. Crop prices are higher in Goba than Robe because:
- there are more consumers in Goba and few traders
- there are fewer supplying villages due to mountain areas near Goba
- distance to assembly markets is further
- farmers from the mountains are themselves food purchasers. They depend mostly on fuelwood sales for their livelihood.

Farmers sell directly to consumers or traders. Most Belg produce is stored and is threshed during the dry season together with meher produce. Thus there are generally more crops in stock during January/February because of the merged yield from Belg and Meher.

The lowest cereal prices are during the Belg harvest in July/August. The highest prices are during May/June, when farmers stocks are depleted.

AMC quotas are set for all PAs through the service cooperatives (SCs). The SC and the PA assign the quota to each member considering family size and expected yield. Usually, the quota per family is 1-2 quintals per season. The collection of the grain is made immediately after harvest: October/November for Belg and January/February for Meher. During these periods AMC fixed prices are slightly higher than local market prices for cereals. Table 4 shows prices of some crops in Robe and Goba for October/November, 1986.
Table 4: **Price Ranges for Crops (Birr per Quintal) in Different Markets, Sinana-Goba Survey Area**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Local Market</th>
<th>Town Markets</th>
<th>Assembly Markets</th>
<th>Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Date</td>
<td>Goba</td>
<td>Robe</td>
<td>Alemgena</td>
</tr>
<tr>
<td>Barley</td>
<td>October/November 1986</td>
<td>30-35</td>
<td>30-35</td>
<td>24-26</td>
</tr>
<tr>
<td>Wheat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Wolandi</td>
<td></td>
<td>65-70</td>
<td>50-55</td>
<td>30-35</td>
</tr>
<tr>
<td>- Enkoy</td>
<td></td>
<td>55-60</td>
<td>40-45</td>
<td>25-30</td>
</tr>
<tr>
<td>Lentil</td>
<td></td>
<td>&gt;90</td>
<td>85-90</td>
<td>-</td>
</tr>
<tr>
<td>Teff</td>
<td></td>
<td>70-75</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Field pea</td>
<td></td>
<td>~60</td>
<td>50-55</td>
<td>-</td>
</tr>
<tr>
<td>Emer wheat</td>
<td></td>
<td>30-32</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Maize</td>
<td></td>
<td>-</td>
<td>40-45</td>
<td>-</td>
</tr>
</tbody>
</table>

A quintal of grain in the local market may be about 120-130 kg by weight.

*Source: Market Observations and Interviews with buyers and sellers.*

Table 5: **Supply and Prices of Inputs (1985/86) Sinana Woreda**

<table>
<thead>
<tr>
<th>Input</th>
<th>Supplied</th>
<th>Price per unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PC</td>
<td>SC</td>
</tr>
<tr>
<td>Fertilizer (DAP)</td>
<td>104 qt.</td>
<td>814.5 qt</td>
</tr>
<tr>
<td>Improved seed</td>
<td>44 &quot;</td>
<td>57 &quot;</td>
</tr>
<tr>
<td>Vegetable seed</td>
<td>30 kg.</td>
<td>40 kg.</td>
</tr>
<tr>
<td>Pesticide</td>
<td>28 &quot;</td>
<td>-</td>
</tr>
<tr>
<td>Sprayers</td>
<td>3</td>
<td>-</td>
</tr>
</tbody>
</table>

*Source: Ministry of Agriculture Sinana Woreda.*

NA: Not Available
- : Not supplied
Input Supply and Farm Credit

Prices of agricultural inputs are fixed and regulated by the concerned government institutions. The supply of inputs to the area include fertilizers, small quantities of improved wheat seed and insecticides.

Membership in a SC is required to obtain inputs. The use of fertilizers in the area is very limited due to the perceived high fertility status of soils, lack of cash, and credit inavailability. Only a few farmers with access to cash use fertilizer, mostly on wheat and barley. Some reported insufficient supply and delay in delivery. Only 927 qt. of fertilizer was delivered to farmers in Sinana woreda in 1985/86 as shown in Table 5.

Prices for fertilizer paid by individual farmers are higher than those paid by PCs. Further, more priority for delivery is given to PCs. As a result PCs use fertilizer on wheat and barley each season. Individual farmers using fertilizer apply at the rate of 50-60 kg/ha.

Generally small farmers are not exposed to improved seeds. However, farmers express interest for improved seeds particularly for wheat as the existing varieties are poor yielding.

Insecticides are the other inputs of economic importance to farmers because of the aphid infestation during the meher season. MOA officials regret the inavailability of the input. Previously carbaryl, effective against aphids, was available in SC shops at a price of 12-13 birr/litre. Currently it is not in stock. No action was taken against the severe out break of aphids this past season, Meher, 1986.

The official government credit institution of the agricultural sector is the Agricultural and Industrial Development Bank (AIDB). It operates in the study area from its office in Awassa about 200 km away and hence its service is not significant to the area. Priority is given to producers cooperatives and service cooperatives that are registered and have legal entity. AIDB has also provided credit for the purchase of oxen and construction of stores for a few PCs and SCs. The credit sources for individual farmers are SCs, relatives, and friends. The form of credit is mainly in kind (grain for food, seed, etc.).

Other institutions involved directly or indirectly in the credit system are Agri-Service Ethiopia and Rural Integrated Basic Service. These institutions provide farmers with longterm credit for purchase of oxen, and/or developing water wells/tines. Farmers' loan repayments are then recycled and allocated for other villages with significant problems.
Extension Services

MOA is the core institution handling extension services for the farm community. In the study area there are 7 Rural Development Centers (RDCs) each controlling not less than five PAs and to whom a total of 31 extension workers (junior college graduates) are stationed. A major problem is that extension workers are heavily involved in responsibilities outside extension:

- collecting taxes and other contributions
- participating in various meetings (PA, PC, etc.)
- members of grain quota purchase committee

The extension services in the target area include the Agricultural Development Programme, Livestock Production, and Natural Resource Conservation and Development.

There are extension demonstration sites including:

- fertilizer rate trials
- weeding time and frequency trials, and
- variety and seed rate trials

In addition, there are "half-hectare" agronomic trials and two farm management study trials. The current activities of extension are flagging because of limited resources, mainly shortage of vehicles and communication facilities.

3. ENTERPRISE PATTERN AND END USE

Farm Enterprises

Singana is a mixed farming zone. Crops are grown for food and cash, and animals are kept for complementary purposes and also to satisfy farmers' cash needs. Crops are produced twice per year (belg and meher). Principal enterprises are as follows:

1. Major crops are barley, wheat, and emer wheat.
2. Minor crops are field pea, maize, lentil, fava bean, fenugreek and flax.
3. Vegetables are potato, onion, and cabbage and are grown in gardens. In most cases there is no surplus.
4. Livestock kept include oxen, milking cows, donkeys, sheep, and goats.

Table 6 shows the approximate percentages of farmers and areas under different crops. Table 7 describes average land holding per household by crop type and yield per unit area.
### Table 6: Proportion of Farmers Growing Particular Crop and Percent Area Cultivated During Belg and Meher, Sinana-Goba Survey Area

<table>
<thead>
<tr>
<th>Season</th>
<th>Barley</th>
<th>Wheat</th>
<th>Lentil</th>
<th>Flax</th>
<th>Fennugreek</th>
<th>Pigeonpea</th>
<th>Pastor</th>
<th>Onion</th>
<th>Potato</th>
<th>Cabbage</th>
<th>Teff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belg</td>
<td>88</td>
<td>92</td>
<td>78</td>
<td>55</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>29</td>
<td>11</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Meher</td>
<td>100</td>
<td>78</td>
<td>78</td>
<td>73</td>
<td>17</td>
<td>17</td>
<td>13</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Belg</td>
<td>48</td>
<td>22</td>
<td>15</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Meher</td>
<td>54</td>
<td>21</td>
<td>16</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Raw data, informal survey in Sinana Area.

### Table 7: Area Per Family by Crop Type and Average Yield per Season, Sinana Goba Survey Area

<table>
<thead>
<tr>
<th>Crop</th>
<th>BULG</th>
<th>MEHER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average area</td>
<td>Yield per ha.</td>
</tr>
<tr>
<td></td>
<td>Mide</td>
<td>Average</td>
</tr>
<tr>
<td>Barley</td>
<td>6.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Wheat</td>
<td>2.7</td>
<td>0.5</td>
</tr>
<tr>
<td>Ewheat</td>
<td>2.0</td>
<td>0.3</td>
</tr>
<tr>
<td>Fieldpea</td>
<td>1.9</td>
<td>0.3</td>
</tr>
<tr>
<td>Maize</td>
<td>1.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Flax</td>
<td>1.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Lentil</td>
<td>0.5</td>
<td>0.1</td>
</tr>
<tr>
<td>Fava bean</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Fenugreek</td>
<td>1.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Teff</td>
<td>1.0</td>
<td>0.2</td>
</tr>
</tbody>
</table>

NA: Not available.
Barley, wheat and emer wheat are the priority crops in order of importance for both seasons. Nearly all farmers grow barley in both seasons. Barley accounts for about half the area cultivated in both seasons but is slightly higher for meher. The proportion of farmers growing wheat is over three-quarters in both seasons but is higher for the belg season. About 20% of the cultivated area is under wheat in each season. An equal proportion of farmers (78%) grow emer wheat in both seasons and the area under the crop is similar, about 10% of cultivated area.

Field pea is the major pulse among the minor crops. Faba bean, lentils and fenugreek are planted by some farmers, usually during belg. Flax is the most important oil crop and is cultivated in belg. However only a very small area is allotted to the crop. Maize is planted as a garden crop and is used for home consumption.

Potatoes, onion, cabbage and beet root are not irrigated except in PC’s that have access to irrigation. Potato is the most important vegetable. Vegetable growers are mainly in those villages along the main roads and close to big towns (Goba and Robe).

Most families have a pair of oxen, one donkey, a milking cow and a few have sheep and goats.

Generally more area is cultivated during belg than meher. However, some farmers in particular areas cultivate more area during meher than belg. The following are some of farmers' reasons for cultivating more area in a specific season:

1. Most farmers cultivate more area during belg because of:
   - Frost problem during meher (October-November). In meher, they plant only frost tolerant crops and/or plant wheat on high frost-free fields.
   - Belg crops have better yield, are heavier seeded, and are better for food, because of sufficient rainfall and better land preparation.
   - Meher rainfall is unreliable, pest and disease attacks are thus greater.
   - There is less time for meher land preparation after belg harvest.
   - Overlapping of belg harvest and meher land preparation and planting limits meher cultivation.

2. Some farmers plant more during meher, because:
   - the weed problem is greater during belg since during meher frost kills the weeds,
   - they have few family members and are thus unable to complete belg harvest in a timely manner; the extended meher dry season facilitates harvesting.
Cultivation of pulses is limited due to the following:

- Cereals are high yielding and are the main food staples.
- Pest and disease incidence is higher on pulses.
- Cereals are preferred to pulses.
- Pulses require new or virgin land.
- In the past five to six years, cereals and pulses have received an equal price per unit; since cereal yields are higher than pulse yields it is economically more rational to produce cereals.

Barley is the main food staple and is sold for cash in small quantities. Wheat is the main cash crop and supplements barley for food. Emer wheat is produced mainly for food. Field pea is a cash source and relish. Flax is used mainly for cash sales. Vegetables and maize are mostly produced for food and are sold only if there is surplus.

Food Consumption Patterns

Securing a reliable food supply is the priority objective of the family. This is attained by production of cereals, especially barley.

In the area there are different food habits among the migrant Christians and local Muslims. The basic preferred food for the local Muslims is genfo (porridge) and for the migrant Christians, enjera. Currently consumption of genfo is decreasing as Muslims shift to enjera. The basic reason for the shift is:

- The decreasing production of dairy products. Genfo requires milk or butter as a relish. Enjera on the other hand, can be consumed without dairy products, that is with vegetables and/or pulses.

- Genfo require more flour than enjera.

- Genfo has higher fuel and labor requirements; it must be prepared for every meal while enjera may be prepared only once in several days.

Enjera is made from barley and genfo is made from wheat and emer wheat. In the absence of barley, enjera is prepared from wheat and or maize. Genfo can also be made from barley. Substitutes for enjera and genfo are: (1) dabo (bread) and (2) kintche (porridge) made from wheat or emer wheat and (3) besso (porridge) made from barley.

Preferred relishes are butter, milk and honey for genfo and vegetables and pulses for enjera. Field pea among pulses is preferred. Meat is rarely consumed. Muslim families sometimes prepare spaghetti: Dough is made from flour (wheat or emer wheat) and is spinned by hand and polished with butter or oil. It is then sun dried to be boiled later.
Spices, oil, salt, and coffee are among the foods purchased throughout the year.

Target area farmers generally experience food shortages during May/June before the belg harvest. Shortage of relishes are more pronounced than starch staple shortages, due to the lesser area planted to pulses used for relish. Shortage of starch staples occurs during crop failure and in the worst conditions, families may run out of food beginning from March.

During the shortages, farmers buy food crops by selling livestock (sheep, goat, calves). In severe cases, cows may be sold. Oxen and donkeys are the last to be sold.

**Fuel and Water**

Firewood is extremely scarce; women reported spending a quarter to half day looking for firewood every other day. The problem is especially severe during the wet periods. Sources of fuel include: forest trees, cow dung, straw and stover of crops, and cactus planted around homesteads.

Cow dung is solely used for fuel. It is baked, caked and dried. Crop stover from the belg harvest is also used for fuel; because of its high moisture it cannot be stored, or piled for long and used as livestock feed. Muslim families do not use crop residue for fuel.

There is a community forest development programme raising tree seedlings and distributing them to the PA for planting. However, the program is not successful due to lack of supervision.

Water is not a problem for human beings and livestock except in a few villages, e.g., Selka and Gamora. In these villages, the problem is significant particularly in the dry period from October/November to February/March. During this period livestock have to travel about half a day for water and this reduces watering frequency. Women transport water, for domestic use by donkeys, travelling about two to three hours per day.

4. **RESOURCE AVAILABILITY AND USE**

**Land**

Farm size is about 2-3 ha. Farmers allocate about half of their land for belg and half for meher cultivation.

The PA sets aside land for grazing and a special grazing area is devoted to oxen. In most villages, additional land for cultivation is available, while in a few it is not available, e.g., Ali, and Robe Zuria. Land is not available in villages
neighboring state farms or near towns. In some villages it is possible to get additional land only for belg because of limited frost free areas for meher, eg. Haiko Mezera.

Any member can get additional land by applying to the PA. The PA considers the following: farmers' performance, oxen, family size, previous holding, and area under request. Land can be given only if it is not an oxen grazing area. Most farmers do not want to expand their cultivated area, they reported that they have exhausted their resources, do not have oxen or additional labour, etc.

Wheat is grown on less fertile land to avoid lodging and to avoid *Guizota Scabra*, a common weed which is less of a problem on barley since barley grows quickly and matures early. Wheat is also preferred on vertisols - locally called Ambocha or Guracho. Barley soils are locally called Gali or Dalecha, are brown to gray in color, have good drainage, and are lighter and considered more fertile than the black soils. Pulses and oil crops are usually planted on new land. Vegetables and maize are garden crops, planted on soils with high organic matter called Areda.

In general, there is no rotation, except that some farmers rotate barley and wheat. There is no fallow except that belg fields are fallow in meher and vice versa. No double cropping is practiced.

**Labour**

The family is the main source of labour. Family size is about 6-8 persons. As shown in Table 8, most field activities are handled by men while women work at home, collect fuelwood and water, and do the marketing.

<table>
<thead>
<tr>
<th>Responsibility of Men</th>
<th>Responsibility of Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land preparation; ploughing</td>
<td>Take care of the house and children</td>
</tr>
<tr>
<td>Planting, weeding, harvesting</td>
<td>Fuelwood and water collection</td>
</tr>
<tr>
<td>Threshing and storing</td>
<td>Milking, gathering dung and baking for fuel</td>
</tr>
<tr>
<td>Marketing when in bulk, eg. AMC quotas in local markets</td>
<td>Marketing; taking crops to markets and buying consumer goods or food from markets</td>
</tr>
<tr>
<td>Herding oxen</td>
<td>Weeding garden crops eg. vegetables</td>
</tr>
<tr>
<td></td>
<td>Seed cleaning or winnowing</td>
</tr>
<tr>
<td></td>
<td>Transporting harvested crops for piling</td>
</tr>
</tbody>
</table>
Children are in school, limiting available family labour. Farmers blame schools for taking their children away from farm activities. Children help families only during vacations and off-school hours. The son (over 8-10 yrs) helps the father while daughters are left with mothers. It is more difficult for the Muslim men and women to assume the responsibilities of their spouses than for the Christians to do so.

The husband is the decisive figure in the family. However, the wife contributes to decisions before action is taken. For example, they advise their husbands about the area devoted to various crops; for woman, the area under food crops (barley) is of greatest interest.

Figure 3 shows the crop calendar for Sinana area farmers. There are about 4-5 ploughings for belg and 3-4 ploughings for meher before planting. One ploughing is then done for seed covering. Farmers plant at the beginning of the rainy seasons: March and July. Immediately after planting, they begin ploughing fields for the next season's crop.

The busiest periods of the year for farmers are:

1. July/August, when farmers harvest belg crops, plough and plant meher crops and thresh some of the belg harvest for meher seed and food.

2. October/November, when farmers prepare land for belg. This must be completed before the soil loses its moisture, and before the oxen feed shortage in the coming months.

3. January/February, when farmers harvest barley and thresh the belg and meher harvest.

In general there is no specific slack period. During labour peaks, additional labour is obtained from hiring and exchange labour (jigi). Sources of hired labour are:

1. Village people who have less area, youths who are not registered in the PA, and students (part time).

2. Migrants from areas where crops have failed because of drought or other reasons. eg. Ali, Sanbitu, Agarfa, Sheneka.

3. Migrants from areas that do not produce belg crops.

Some labour costs are as follows:

Permanent labor: 80-100 birr/year and 2 mide (1/3 ha) of crop land.

Casual labor:
- Ploughing: 1-2 birr plus lunch per day (5 hrs)
- Harvesting: 2 birr plus lunch per day (8-10 hrs)
- 7-10 bir/mide plus lunch (2-3 working days) for
Figure 3: Crop Calendar in Sinana Goba Survey Area

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Plowing</td>
<td></td>
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</tr>
<tr>
<td>Planting</td>
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<td>***</td>
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<td></td>
</tr>
<tr>
<td>Weeding</td>
<td></td>
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<tr>
<td>Harvesting</td>
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<td></td>
</tr>
<tr>
<td>Threshing</td>
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<td></td>
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</tr>
</tbody>
</table>

Belg: 4-5(6) plowing before planting.

Meher: 3-4 plowing before planting.

Early start or late finish.

P W EW B: Sequence of crops, P = pulse, W = wheat, EW = ener wheat, B = Barley.

There is no sequence of plowing. The given sequence is applicable in both seasons. For new land pulse fields plowed first; on older fields pulse fields are the last to be plowed.

Source: Farmer interviews.
harvesting and piling.

**Threshing:** 20-40 kg of grain for about 10 qts clean seed threshed.

**Capital**

Cash sources are primarily from wheat (sold in bulk), and barley (sold in small quantities throughout the year). Sales of livestock and vegetables also contribute to cash earnings. Cash income from off-farm activities are limited, and include working on state farms or neighbouring farms. Cash is needed to buy food, and other expenses (medical, clothing etc.).

Families experience cash shortage during the months of May/June before the belg harvest when stocks are finished or are reserved for food. During this period there is no way of earning income.

**Draught power**

Livestock used for draft purposes include oxen, donkeys, horses and cows. Most families appear to have a pair of oxen, a donkey, and cows.

It is not possible to rent draft animals. Non-owners often get oxen in exchange for labour. Oxen owners benefit from better and more timely land preparation and planting. Uses of draft animals include:

- Oxen: ploughing, threshing, transporting in the field.
- Donkeys: transport to markets, water and firewood collection.
- Cows: threshing.
- Horses: transport for human beings.

5. **CROP HUSBANDRY**

**Barley**

**Barley varieties**

Common varieties grown are:

- **Arous or Balticha.** Its characteristics include: Red colored in belg, white in meher, big seeded, problem of lodging, good for enjera (basic food), two rowed heads, tall, better yielding (3-4 qt/mide or 18-24 qt/ha under good conditions) and has a high market demand. This variety is the most widespread variety and is grown by most farmers.

- **Burtuji.** Characteristics include: Four rowed heads, no problem of lodging, higher yielding than Arous, less market...
I demand, preferred for genfo. The variety is grown mostly during meher; the problem in belg is that rainfall at harvest time can cause sprouting if harvesting is delayed. This variety is usually planted in bottom lands.

**Barsedet.** Characteristics include: Small-seeded, low yielding, grown by few, suited to higher elevations, good for besso and kolo. Yield is 2-2.5 qt/mide (12-15 qt/ha) under good conditions.

**Barley Belg Management**

Land is plowed 4-6 times; usually land is plowed more frequently for belg crops than for meher crops because more time is available and to overcome the belg weed problem. There is at least a 15-20 day interval between plowings for better crop residue incorporation, to facilitate the following plowing, and to suppress weeds and pests by exposing the soil and turning it under again. Farmers claim that these contribute to better yields.

Plowing is completed in November three months before planting. Farmers would like to plow closer to their planting dates but during December through February, the dry season, there is insufficient feed for draught animals and the soils are very hard.

Planting is done during March/April after the rains have started. Barley is the last crop to be planted, since it grows quickly and matures early. Planting must be done before the end of April. Seed is broadcast and the local maresha is used for covering seed. Seeds from meher are used for belg and there is no seed cleaning, but winnowing is practiced. Seed rates range from 120-160 kg/ha.

Weeds are more problematic for belg crops than meher because of high rainfall and warmer weather than during meher. However, almost no weeding is done except the cutting of some weeds using sickles. Farmers claim they lack time, i.e., they prefer to plow for meher than weed belg barley. They also claim that pulling weeds may harm seedlings and that weeds come late in the season doing little harm. However, several farmers reported significant yield reductions due to weeds.

Only a few farmers use fertilizer. Two methods of application were reported:

1. Broadcasting with the seed, before or after planting.
2. Dissolving quantities of DAP in water and keeping the solution for about 16-24 hrs. Then the seed is mixed into the solution, dried, and later broadcasted. Under such practices 50kg. DAP may cover about 2 ha. According to farmers' reports this resulted in better germination and crop stand than planting without fertilizers.
Some farmers are sure of the benefits of fertilizer but the present value of money today is much higher to them than the return they can earn next season. Also they do not want to risk their limited cash resource on crops that they are not sure of harvesting, due to drought, frost or aphid attacks on meher crops.

Manuring fields for fertility maintenance is not common as dung is used for fuel. Also, fields are far from the villages making transport of dung difficult. Compost is applied to garden crops, such as maize and fava bean.

Previously, before villagization, a few farmers reported applying manure on less fertile soils for barley. Manure was stored in pits for 3-4 months and distributed using maresha or baskets. The disadvantages of manuring were reported to be (1) lodging with sufficient rainfall (Belg) and (2) has toxic effect (burning crops) with moisture stress, especially during meher.

Barley is harvested during July/August after pulses are harvested. Barley is harvested when the crop turns gray and when the head bends down slightly. Most of the crop is not threshed immediately; rather it is piled and kept until the dry season in January/February. This is done because farmers are ploughing and planting their meher crops and thus lack time for threshing. Some is threshed before the dry season for food, seed, and cash needs.

**Barley meher management**

Three to four ploughings are done before planting; most ploughing is done during the months of April/May.

Planting is in August after the rains have gained momentum. Dry planting is risky, as the crop may suffer from cutworm or moisture stress. If there is poor germination, farmers in-fill or replant about 10-15 days after planting. Late planting is more risky in meher than in belg: drought, frost, disease and pests are big problems for late planted barley.

Aphids are the most important insect pest. During the 1986 season, a severe infestation was observed mainly on late planted crops and some crops failed completely. Early planted barley successfully escapes aphid damage. Aphids are usually more of a problem during dry periods. Farmers claimed carbaryl 85% is an effective control method but the chemical is no longer available.

Harvesting is in January/February. Barley is kept piled for a while before threshing, to promote uniform and even dryness, to facilitate threshing, and to facilitate awn removal.
Wheat

Wheat Varieties

Common wheat varieties are:

**Wolandii**: This variety is recently introduced, white colored, large grain, awnless, early maturing (4 months) and is preferred for genfo (food). It is tall, weed suppressing, easy to harvest and thresh and has a high market price. It is grown by most farmers and is increasing in popularity. Wolandi needs relatively fertile soil and good seed bed preparation. Wolandi is not grown in some villages, e.g., Halkomezena, where farmers claim it does not germinate well for unknown reasons.

**Guracho**: This is an old variety; it has black or brown seed; small grains, is susceptible to frost and is thus grown only on high, frost free fields during meher. It is not grown much in belg because of the weed *Guizota scabra*. Guracho is less preferred for food, but makes good Araki (local alcoholic drink). It is suited to higher elevations, is decreasing in popularity, and is difficult to thresh.

**Enkoy**: This variety has red color, medium grain size, is preferred for enjera, and is lower yielding than Wolandi. It is short in height and thus is more susceptible to weed problems. It is also not easily harvested and threshed because it is susceptible to shattering and sprouting. It has low market demand relative to Wolandi, is early maturing and is grown by state farms in the area.

**Laketch**: This variety is no longer used; it has short height and is frost susceptible.

**Kenya**: Kenya is no longer used. It is resistant to shattering (meher), and sprouting (belg). It has been replaced by enkoy and the seed is no longer available.

Wheat Meher Management

Land preparation is similar to barley, but may be less intensive if time and oxen are limiting. Wheat is planted before barley, but is harvested later because it is late maturing. Planting is in March/April after there is sufficient rainfall. Seed rates vary between 100 and 150 kg/ha.

Weeding is not done; farmers reported it is not necessary and time is limiting. Harvesting is in August, and generally wheat yields are lower than barley yields.

Wheat Belg Management

There is less wheat production in meher, because of the frost problem from October to January. Wheat is grown mostly on high, frost-free fields.
Three to four ploughing are done before planting. The wheat is planted at the end of July if there is sufficient rainfall. Delayed planting, e.g., in late August, will expose the crop to moisture stress, pests (Aphids), and disease (Rust) as was the case during the 1986/87 season. Harvesting is done during January/February.

Pulses and Other Crops:

These are given less attention in the survey area. They are grown mostly during belg.

Field pea: This is the major pulse grown. Land preparation is not done except on new land, which may be plowed 2-3 times. Field peas are planted and harvested before cereals. Field peas are low yielding during belg; this is associated with increased field losses due to the difficulty of handling the crop at harvest time. In meher, frost and pests are the major problems. Field peas are never weeded.

Faba bean: Field operations are similar to field pea. Fava bean is low yielding due to pests (boll worm) and disease (rust and chocolate spot). Fava bean performs poorly on previously cropped fields; lodging and high vegetative growth without seeds are the principal problems.

Lentils are grown in both seasons. In belg, they are late maturing, do not evenly mature, and revegetate (tiller) at harvest time. During meher, better yields are achieved. Harvesting is tedious due to its short height.

Fenugreek is harmed in meher by frost and in belg by lodging and rotting. Flax has a good market price but is grown only on new soils.

6. LIVESTOCK HUSBANDRY

Most farmers have at least a pair of oxen, a milking cow, and one donkey. A few also have horses, sheep and goats.

Breeding

For cows, age at first mating is 3-4 years. Mating is continuous and uncontrolled. The calving interval ranges between two and three years depending on feed availability. The average calf crop is 7-15 calves depending on the breed. Culling is at the age of 15-18 years.

There is no specific calving period. However, more calves are born during September/October and March to May. Farmers prefer to have calves during wet periods: September/October and June-
July/August. During this period, there is ample feed (grass), continuous milk, and sufficient water. There is no special housing for cattle; calves and small ruminants are kept in the house with the family.

**Feeds and Feeding**

Feed is extremely scarce during the dry season, especially from January to March. Even during the grazing season, grass is not in abundant supply.

Grazing is communal and oxen are grazed separately and given priority for the best grazing ground. Farmers take turns looking after the herds. In some cases herdsmen are hired. The grazing problem is particularly severe on calves, since grazing areas are located far from villages. No fodder crops are grown by farmers.

The feed problem has resulted in a drastic decrease in dairy cows; farmers maintain their oxen because they are so important for cultivation. The decrease in dairy cows is forcing changes in human foods, from genfo to enjera, as reported in the section on foods. Farmers reported that feed shortages have the following results:

1. Less working hours for oxen; delay in field operations.
2. Reduced frequency and area of ploughing per day.
3. Extended calving intervals.

Water is a problem in a few villages, which are located far from permanent sources of water (rivers) and seasonal sources (streams and ponds). Cattle are watered once per day or every other day in areas where water is a problem.

**Milking**

Milking is done by housewives twice per day in the morning and evenings. The number of milking cows on average is two during the wet period and none or one during dry periods. Milk yield is 1-2 litres/day/cow during the wet season and 0.5-1 litre/day/cow during the dry season. Most cows are dry during January/February, the period of feed shortage.

**Diseases**

Diseases do not appear to be an important problem. There are vaccination and veterinary services. Some reported diseases are: diarrhea, skin disease, anthrax, foot and mouth disease, ticks, lung disease and bloating. There is also a local curative medicine for *Aba gorba* (rinderpest) and lung disease processed from plant roots.

In the past 5-6 years many livestock died because of the drought. During the last two years, many horses died for unknown reasons.
Marketing:

Livestock serve as a source of cash and security for the family in case of crop failure. Depending on the degree of the problem all types may be sold. Preferred types for sales are: small ruminants, calves, heifers, bulls and cows in order of priority. Oxen and donkeys are the last to be sold and are difficult to sell. Oxen are sold in markets.

There is a high demand for oxen during September/October; prices are high, 200-300 Birr/ox, and they are in good condition. Oxen are needed at this time to start ploughing for the belg season.

7. PRODUCER COOPERATIVES

Producer Cooperatives (PCs) are farmer organizations whose members pool their resources (land, labour and capital) for common production. The members' land and oxen are brought together and members work together in groups. Produce is distributed among members according to the amount of work each has done, based on fixed work points. In this report, PC's are treated separately, because of their management differences as compared to individual farmers. It is observed that most of the natural circumstances are similar for the two groups.

There are about 14 PCs (8 in Sinana and 6 in Goba) in the target area of which only two are registered. In this report, only those PCs' considered to be strong and performing well according to an MOA report are discussed. The weak ones tend to be PC's in name only, with members operating as individual farmers. Table 9 presents data on all PCs in Sinana woreda.

Enterprise Pattern and Input Supply

The major crops grown are barley and wheat. Minor crops include emer wheat, field pea and vegetables. Livestock, particularly oxen, are kept for land cultivation.

Table 10 shows that for 3 cooperatives examined, most of the belg cultivated area is planted to barley. In relation to wheat, farmers reported that barley is tolerant of rainfall at harvesting, can escape the weeds because it matures early, has high yields, and good seed filling.

Land is allocated to crops depending on the following criteria: For meher, crops are planted on weedy fields since weeds are less of a problem during meher. Brown, gray (gali) soils are also preferred because they have better moisture retention. Frost free fields are also used. For belg, less weedy, black Ambocha soils are preferred.
<table>
<thead>
<tr>
<th>Name of PC</th>
<th>Year started</th>
<th>Members</th>
<th>Family members</th>
<th>Arable</th>
<th>Grazing</th>
<th>Forest</th>
<th>Vegetable</th>
<th>Total No. Oxen</th>
<th>Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hora Boka</td>
<td>1980</td>
<td>166</td>
<td>449</td>
<td>165.5</td>
<td>298.5</td>
<td>40</td>
<td>16</td>
<td>520.9</td>
<td>163</td>
</tr>
<tr>
<td>Besasso</td>
<td>1980</td>
<td>109</td>
<td>379</td>
<td>165</td>
<td>349</td>
<td>2</td>
<td>4</td>
<td>521.8</td>
<td>182</td>
</tr>
<tr>
<td>Hawlo</td>
<td>1981</td>
<td>44</td>
<td>128</td>
<td>77</td>
<td>79</td>
<td>-</td>
<td>4</td>
<td>160</td>
<td>51</td>
</tr>
<tr>
<td>Selko</td>
<td>1982</td>
<td>54</td>
<td>182</td>
<td>179</td>
<td>200</td>
<td>-</td>
<td>-</td>
<td>404</td>
<td>84</td>
</tr>
<tr>
<td>Bemena</td>
<td>1983</td>
<td>38</td>
<td>105</td>
<td>101</td>
<td>60</td>
<td>80</td>
<td>1</td>
<td>242</td>
<td>58</td>
</tr>
<tr>
<td>Gemora</td>
<td>1980</td>
<td>30</td>
<td>103</td>
<td>66.2</td>
<td>20</td>
<td>-</td>
<td>0.5</td>
<td>65.7</td>
<td>77</td>
</tr>
<tr>
<td>Wason Barera</td>
<td>1984</td>
<td>14</td>
<td>78</td>
<td>42</td>
<td>80</td>
<td>-</td>
<td>-</td>
<td>122.0</td>
<td>31</td>
</tr>
<tr>
<td>Kubsa</td>
<td>1980</td>
<td>30</td>
<td>123</td>
<td>90</td>
<td>80</td>
<td>40</td>
<td>-</td>
<td>210.0</td>
<td>43</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>485</td>
<td>1547</td>
<td>887.6</td>
<td>1116</td>
<td>184</td>
<td>25.5</td>
<td>2266.78</td>
<td>689</td>
</tr>
</tbody>
</table>

Source: Sinana, Woreda MOA.
Table 10: **Producer Cooperatives Area**

by Crop Type and Season

<table>
<thead>
<tr>
<th></th>
<th>Besaso</th>
<th>Selka</th>
<th>Hora Boka</th>
<th>Total</th>
<th>Besaso</th>
<th>Selka</th>
<th>Hora Boka</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC</td>
<td>Barley</td>
<td>Wheat</td>
<td>FP</td>
<td>Em.W</td>
<td>Flax</td>
<td>FB</td>
<td>Lentil</td>
<td></td>
</tr>
<tr>
<td></td>
<td>62</td>
<td>20</td>
<td>32</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>31</td>
<td>32</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>85</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>178</td>
<td>52</td>
<td>34</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>PC</th>
<th>Meher</th>
<th>Area ha.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Besaso</td>
<td>57</td>
<td>27</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Selka</td>
<td>51</td>
<td>38</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Hora Boka</td>
<td>44</td>
<td>102</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>152</td>
<td>167</td>
<td>29</td>
</tr>
</tbody>
</table>

PCs have access to fertilizer; they apply fertilizers on wheat and barley fields at the rate of 50-100 kg/ha DAP. Less or more fertilizer may be applied depending on the fertility of the soil.

Producer cooperatives have access to fertilizers at prices less than for individual farmers. PCs never face shortages or delays in delivery of inputs. Concerning improved seeds, one variety of wheat, Enkoy, is provided to the PCs.

Pesticides are provided through MOA. Aphids are the most important insect pests. There is trained manpower for spraying. The severity of aphids in the PC fields is less than for individual farmer fields because of earlier planting.

**Resource Availability and Use**

**Land**

Land is not a limiting resource. PCs can expropriate individual farmers' land; these farmers are then allocated new land by the PA. At present, land holding per member is not higher than the average individual holdings. But PCs are entitled to expand at their request and capacity.

PC executive committee members and MOA extension staff plan how much area will be covered by each crop. The plan may then be amended by the general assembly of the PC.
Labour

Members are the primary source of labour for the PC's activities. Members are grouped into teams, each handling specific responsibilities in turns, e.g., herding, crop production, vegetable production, etc. The crop calendar is similar to that of individual farmers. However, PCs complete land preparation and planting earlier than do individual farmers.

For land preparation, cereal fields are plowed about 3-4 times before planting in both seasons. Plowing for belg takes place in September/October and for meher in April/May/June.

Pulses on new lands require 2-3 ploughings, but on old fields one ploughing is sufficient. Frequent ploughing may result in lodging.

Planting is accomplished earlier than for individual farmers. Pulses are the first to be planted, followed by wheat and barley. Planting for meher takes place in July; for belg in late March.

There are two labour peaks during:

1. January/February when belg land preparation and threshing and meher harvesting and threshing takes place. Crop losses are caused by rodents and shattering and are partly due to labor shortages.

2. July/August, when belg harvesting and meher planting coincide.

The PC has access to free labour during the peak periods from PA members and youth associations. In general, PA members surrounding a PC have to work 1-2 days per season during land preparation and planting; youth association members help with weeding. Weeding is done for barley and wheat in belg; one hand weeding is sufficient. Other crops are not weeded.

Capital

The source of capital is members' contributions, entrance fees, sales of crops, vegetables and livestock products. There is also credit available from service cooperatives and banks. Cash expenditures are for taxes, purchases of agricultural inputs, vegetable seeds, and construction of stores and offices.

Yields and Disposal of Agricultural Produce

Yield trends are shown in Table 11. PC yields seem to be higher than individual farmers for wheat but about the same for barley and other crops.
Table 11: Yield Trends: Average Field Per Hectare From Two Producer Cooperatives

<table>
<thead>
<tr>
<th>Crop</th>
<th>1981/82</th>
<th>82/83</th>
<th>83/84</th>
<th>84/85</th>
<th>85/86</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barley [1]</td>
<td>8.13</td>
<td>12.94</td>
<td>11.6</td>
<td>17.2</td>
<td>16.74</td>
</tr>
<tr>
<td>Wheat [1]</td>
<td>10.32</td>
<td>16.02</td>
<td>13.35</td>
<td>9.72</td>
<td>15.1</td>
</tr>
<tr>
<td>Emer Wheat</td>
<td>9.16</td>
<td>5.7</td>
<td>6.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Flax</td>
<td>1.33</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Field pea</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>9.55</td>
<td>5.35</td>
</tr>
<tr>
<td>Fava bean</td>
<td>6.5</td>
<td>-</td>
<td>4.6</td>
<td>4.95</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: PC office row data
[1] Applied fertilizer

Crop disposal is similar to that of individual households; produce is (1) distributed among members for consumption and seed (2) supplied to AMC to fulfill quotas, or (3) sold in the free market. Barley is mainly distributed among members and supplied to the AMC to fulfill the quota. Most wheat goes to AMC or is sold in the local market; some is distributed among members. Almost all emer wheat is distributed to members. Vegetables and field peas are sold in the local market.

Vegetable Production

Vegetables such as potato, beet root, carrot, shallot, cauliflower, onion and tomato are grown on rainfed fields in belg. One PC uses irrigation to produce vegetables in meher. There are different planting dates to ensure continuous supply and reduce the work burden.

Problems of vegetable production are:

1. Market prices: There is little demand and low prices for the produce during the belg harvest because most people produce vegetables in their own gardens. Beet root and cabbage sold for 5 cents per 2 kg., carrot and potato for 5 cents per kg, and shallot and cauliflower 25 cents per kg. during the belg harvest. Price per unit does not cover the cost of production. During the dry period, however, prices rise considerably. Beet root, cabbage, carrot, and potato are sold for 25 cents/kg, and shallot and cauliflower for 60 cents/kg.

2. High labour requirement: in one PC 79 members are assigned to vegetables while only 60 to crop production.

3. Disease: Rust, leaf blight, potato tuber on potatoes.
Priority Problems

Priority problems for the PCs are not necessarily in order of priority:

1. Pests (Aphids) on wheat and barley; belg and meher seasons
2. Frost and unreliable meher rains
3. Shortage of labour for timely land preparation and harvesting
4. Shortage of draught power
5. Fuelwood problem
6. Low prices for vegetables caused by surplus production and lack of demand during belg season.

8. SYSTEM TRENDS, PRINCIPAL FARMER PROBLEMS AND POSSIBLE SOLUTIONS

System Trends

The major system trends and their interactions are shown in Figure 4.

In general there is an increase in crop area cultivated and a decrease in livestock numbers.

Reasons for the increase in crop area are as follows:

- increased population and migrants from Shoa
- increased family needs for food and cash
- lower yields due to reduced fertility, more weeds, etc.
- increased extension service, i.e., government pressure to increase crop cultivation
- increased market demand and AMC quota

Several trends are also noted concerning the relative importance of different crops:

- Barley and wheat are increasing in area
- Field pea is becoming more popular
- There is an increase in the number of farmers growing maize, but maize holdings per family are not increasing.

The livestock population, especially calves and dairy cows, are decreasing due to:

- villagization, which causes an increased distance to grazing area
- reduced grazing area and confined grazing due to increased cultivation.
- expansion of neighboring state farms, which are taking over grazing land from the PA's.
Fig. 4: A flow chart of system trends and interactions in Sinana - Bale Highland

- **Crop loss**
  - Decrease Livestock (cows)
    - Decrease Field manuring
      - Decrease Dung quantity
        - Difficulty in calf rearing
          - Increase calf mortality
            - Long home-farm distance
              - Villagization
    - Decrease Grazing area (cows)
      - Prohibition of Gedantu (movement of livestock to nearby areas)
    - Low yield
      - Increase cult-area
        - Increase food need
          - Increase Population
            - Immigration
              - Reduction eating Genfo
                - Low milk yield
            - Shift main diet to enjera and wat
              - Increase Horticultural crops for relish
        - Increase fuel wood shortage
          - Decrease butter availability
            - Increase field manuring
              - Increase dung quantity
                - Decrease field manuring
                  - Decrease livestock (cows)
Another trend appearing in the system is the change in food habits among Muslims from gunfo to enjera because:

- Enjera can be eaten with vegetables and pulse whereas gunfo requires dairy products. Dairy products are increasingly unavailable due to the decrease in dairy cows.
- Enjera requires less firewood and preparation time than gunfo.

**Principal Problems and Possible Solutions**

Table 12 summarizes the principal problems of Sinana area farmers and some possible solutions. Below, each problem is discussed and some possible experiments to address each problem are outlined. Next varietal screening, which addresses many of the identified problems, is discussed. Finally technology development for producer cooperatives, which differ somewhat from individual farmers, is examined. The trials listed in this section are tentative; they will be finalized during the appropriate review meetings of the Institute of Agricultural Research.

**High Priority Problems and Possible Solutions**

1. **Aphid damage on barley and wheat**

   More than half of the farmers reported the problem. There is no available chemical and hence no control measures taken towards solving the problem. Yield losses are high in meher, e.g., this season some farmers let their animals feed on the green crop as they were sure nothing would be harvested. The problem is severe on late planted cereals and is associated with shortages of rainfall, which facilitates the development of the pest. Farmers reported that with early planting there is a risk of cutworm. The following experiment is designed to quantify yield losses from aphids in order to persuade policy makers to supply farmers with chemicals to fight aphid attacks. In addition, breeders should screen varieties for aphid tolerance.

**On Station/On Farm Trial: Yield Loss Assessment due to Aphid control of barley and wheat**

   **Interest/objective:**
   a) show yield losses attributable to the pest.
   b) convince policy makers to supply chemicals to treat crops against aphids.
   c) assess impact of planting dates for solving the problem.

   **Treatments:**
   a) Early planting; with and without insecticide spraying. Early planting means the earliest possible farmers planting date.
<table>
<thead>
<tr>
<th>High Priority Problems</th>
<th>Evidence (Justification)</th>
<th>Possible Solutions, Opportunities</th>
</tr>
</thead>
</table>
| 1. Aphids on Barley and Wheat | High crop losses are reported and observed. | Chemical Treatment (Insecticide)  
- Loss assessment  
- Earlier time of planting  
- Varietal screening for Aphid tolerance |
| 2. Shortage of dry season feed | Farmers report and observations, extended dry season, lack of forage crops etc. | Agroforestry  
- Forage legumes and crop mix  
- Screen forage varieties  
- Introduce browse species  
- Better crop residue management  
- Improved natural pasture |
| 3. Shortage of fuel wood | Women travelling about half a day searching for fuel wood, no trees planted around homesteads, use of dung. | Introduce suitable tree species  
- Multipurpose trees (fuel wood, livestock feed etc) |
| 4. Weeds damage on belg barley | Farmers report, observation of various weed species, labour peak at weeding. | Herbicide trials  
- Select weed tolerant varieties  
- Introduce rotations |
| Medium Priority Problems | Possible Solutions |
| 5. Family food shortage | Shortages reported in May/June, previous season crop used up, no crop ready for harvest. | Early maturing varieties  
- Introduction of new crops harvested just before or during the period of food shortage |
| 6. Peak period labour shortage: July/August | Overlapping of operations Belg harvest, meher land preparation and planting. | Early maturing belg varieties  
- Reduced ploughing/degrees of tillage |
| 7. Low soil fertility | Low yields, no fertility maintenance practice, limited use of fertilizers | Fertilizer application of appropriate levels of N & P  
- Introduce new crops and rotation  
- Plant green manure crops during fallow season |

Table 12: Principal Problems And Possible Solutions
<table>
<thead>
<tr>
<th>Medium Priority Problems</th>
<th>Evidence (Justification)</th>
<th>Possible Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Unreliable meher rain</td>
<td>Uneven distribution, late start, insufficient rainfall</td>
<td>- Drought resistant varieties</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Early planting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Early maturing varieties</td>
</tr>
<tr>
<td>9. Frost</td>
<td>Low air temperature October-January, is followed by dry</td>
<td>- Frost resistant varieties</td>
</tr>
<tr>
<td></td>
<td>period</td>
<td>- Early planting</td>
</tr>
</tbody>
</table>
b) Late planting (10-15 days after early planting); with and without insecticide spraying.

c) Early and late plantings with seed treatment (cut worm) and spraying.

Treatments should be on adjacent plots. This trial will be conducted only during the meher season.

Spraying period: When the pest appears or between tillering and boot stage.

Loss assessment will be measured by surveying the study area to see what percentage of farmers are suffering from high, medium, low losses due to Aphids.

2. **Shortage of Dry Season Feed**

There is a dry season feed shortage following the meher season. The problem is severe during January/February and particularly for calves. Grazing is communal and grazing areas are located far from villages. Accordingly, livestock (cows and calves) numbers are decreasing. Oxen lose weight and as a result crop production is affected: there are delays in land preparation and planting; less oxen working hours; and poor seedbed preparation.

Emphasis should be given to providing fodder without reducing area for food crops. However, during the survey some farmers showed interest in devoting part of their land to feed crops.

2.1 **On-Station Trial:** Forage Lequme/Barley (Relay cropping)

**Observation Trial**

**Trial Objective**

The objective of the trial is to supplement dry season feed by relay cropping forage crops with barley. The trial will evaluate the relay crop's effect on the yield of barley.

**Materials and Method**

The trial will be conducted in both seasons, belg and meher, for two years.

**Plot:** 10m x 10m

**Treatments:**
1. sole cropped barley
2. snail medic x barley
3. barrel medic x barley
4. common vetch x barley
5. *trifolium quartinianum* x barley
6. subteranean clover x barley
7. perennial rye grass x barley
Non-Experimental Variables

Land preparation: 4-5 oxen ploughing (meher)
3-4 oxen ploughing (belg)

Planting date: Barley - earliest farmers planting date
Forage - 30-35 days after planting barley

Barley variety: Local or new variety pending results of meher barley at Sinana station

Planting method: Half broadcasted and half row planted barley

Seed rate: Barley - 75% of 85 kg. row planted
- 75% of 100 kg. broadcasted
Vetch 20-25 kg/ha

Fertilizer: Farmers average or 100 kg/ha DAP on barley
Other forages 10 kg/ha

Weeding: 1 weeding at 30-35 days (just after forage seed is broadcast).
2.2 On-Farm Trial: Perrenial Legume on Farmers Fields.

Trial Objective
To alleviate feed shortage. To observe perrenial legume crop establishment on farmers fields.

Materials and Methods

Belg and meher seasons
Plot size: 10m x 5m

Treatments: Alfalfa with fertilizer, alfalfa without fertilizer and fodder beet with manure

Sites: 3 sites
Replications: 2 reps/site

Non-Experimental Variables

Land preparation: 3-4 oxen ploughings

Planting date: As soon as reliable rain shower appears

Planting method: row planting

Spacing: Alfalfa - 30cm between rows
Fodder beet - 50 cm between rows and 30 cm between plants

Fertilizer: Alfalfa 100 kg/ha DAP at planting and one plot without fertilizer

Manure: Fodder beet 15 tons/ha at planting

Weeding: One hand weeding - 30 days after planting. Flexible, depending on the level of weed infestation. Cultivate fodder beets with hoe (heaping the soil).

Harvesting time: Alfalfa - at 50% flowering
Fodder beet - whenever feed is necessary during the dry season.

Method of feeding: After wilting to avoid bloating.
2.3 **On-Station Trial: Browse species**

Browse species will be screened on station. These will provide firewood as well as livestock feed.

3. **Shortage of Fuelwood**

Fuelwood is extremely scarce, due to the failure of PA nurseries and the uncertainty farmers face about being able to harvest any trees they plant. The fuelwood problem will be partially addressed by the browse species introduction mentioned above.

4. **Weed damage on belg barley**

Weeds are a high priority problem during the belg season. Farmers allocate weed-free fields for wheat and weedy fields for barley, since barley grows fast and weed competition is lower. However, observations and information indicates that weeds are a problem in barley fields. Farmers do not weed their crops; reasons include: lack of experience, fear that hand weeding harms barley seedlings, assumption that weeds do not compete with crops, and overlapping of operations (i.e., priority is given for meher land preparation at the time of belg weeding).

**On-Farm Trial: Yield loss assessment due to weeds on barley.**

**Trial Objective**

a) Estimate economic importance of weed competition.
b) Obtain farmer assessment of herbicides.

**Materials and Methods**

Superimposed on farmers fields at weeding time during belg season only.

- **Plot size**: 5m x 10m
- **Design**: RCBD
- **Replication**: 2 reps x 7 sites
- **Treatments**:
  1. 2,4-D applied 30 days post emergence or when 4-5 leaves on the crop.
  2. Illoxan 10 days post emergent + 2,4-D 30 days post emergence.
  3. One hand weeding - mid to late tillering.

**Method of application**

1. 2,4-D: 1 lit. + 250 lit. of water per hectare.
2. Illoxan: 2.5 lit. + 250 lit. of water per hectare

**Non-Experimental Variables** will be kept at the sample farmers' practice.
Medium Priority Problems and Possible Solutions

5. **Family Food Shortage**

In some years, following a poor belg harvest, some families run short of food in May and June before the belg crops are harvested. Early maturing varieties, especially of barley, can help to alleviate this problem. This is discussed further under Varietal Screening.

6. **Peak Period Labour Shortages**

There is a serious overlapping of activities during July/August, the period of belg harvesting and meher land preparation and planting.

6.1 **Early Maturing Varieties**: The development of earlier maturing barley and wheat varieties for the belg season, can greatly help ease the labor constraint during July/August. Variety screening is discussed in the following section.

6.2 **On-station Trial: Degree of tillage trial**

This trial explores the possibility of reduced tillage combined with herbicides as an alternative to the farmers' intensive tilling practices.

Treatments:
1. Farmers plowing practice (4-5 times with maresha)
2. Minimum tillage: 2 times with maresha with broad spectrum herbicide in intervening period

7. **Low Soil Fertility**

Many farmers report that soils are fertile and there is no need for fertilizer. However, it appears that soil fertility is poor causing low yields. Furthermore, with no rotation, continuous cropping and no fertility maintenance, the problem will get worse.

**On-Farm Trial: Fertility trial Barley and Wheat**

This trial will test the response of barley and wheat to phosphate and nitrogen under farmers conditions.

**Materials and Methods**

Design: RCBD, 3 replications x 4 sites for each crop
Plot size: 50 sq.m
Varieties: Wheat: Wolandi
Barley: Aruso
Treatments: 3 x 3
Levels of N: 0, 30, 60 kg/ha
P205: 0, 30, 60 kg/ha
Trial nature: Superimposed on sample farmers fields.
Duration: Two years for the two seasons (belg and meher)
Non-experimental Variables: All factors to be kept at sample farmer practice, except the treatment fertilizer.

8. Unreliable meher rain and frost

In the screening of new barley and wheat varieties, drought resistance and frost tolerance will be monitored to assess varietal performance.

Varietal Screening

On Station/On Farm Trial: Varietal Screening (Barley/Wheat)

Local varieties are low yielding, susceptible to frost, aphids and drought. The objective of varietal screening trial is to identify varieties with combined characteristics to overcome the problems better than the local varieties. Since barley and wheat have been grown in the Sinana area for only 30 years, it is possible that varieties better adapted to the area can be identified.

Necessary varietal characteristics to be screened for or monitored on station include:

1. Weed tolerance
2. Frost tolerance (especially wheat)
3. Aphid tolerance
4. Early maturing
5. Drought resistance (meher barley)
6. Flexible harvesting time (less shattering problem when dry and less sprouting problems when wet)
7. Lodging resistance
8. Good response under low fertility

1. On Station Trial: Barley variety trial.

This trial will test and screen improved barley varieties on station before testing on farmers fields.

Materials and Methods

Plot size: 10m x 5m
Design: RCBD
Treatments: 1. Barley varieties
AHOR Ardu-12
HB-17 Holker
HB-42 Local check
2. Fertilizer and seed treatment:
   For each variety:
   - one plot with fertilizer and seed treatment
   - one plot without fertilizer and seed treatment
Non-Experimental Variables

<table>
<thead>
<tr>
<th>Land preparation</th>
<th>3-4 oxen ploughings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planting date</td>
<td>the earliest possible farmers planting date</td>
</tr>
<tr>
<td>Planting method</td>
<td>row planted</td>
</tr>
<tr>
<td>Weeding</td>
<td>25-30 days and 40-45 days after planting</td>
</tr>
</tbody>
</table>

2. **On Farm Trial: Wheat Variety Verification Trial**

**Trial Objectives**

To test the performance of improved wheat varieties under farmers' conditions and management levels.

**Materials and Methods**

- **Plot size**: 10m x 5m 2 reps/site
- **Design**: RCB: in 5 sites
- **Treatments**: varieties of wheat
  - Improved: Dashen, K6295-4a, ET-13
  - Localcheck: Enkoy, Wolandi

Non-Experimental Variables

- Land preparation: planting method, seed rate, weeding, fertilizer rate: left to the sample farmer level. Fertilizer may be fixed according to users average in the area.
- Planting date: the earliest possible farmer planting date.
- Duration of the trial: for two years in both seasons ie. 4 seasons (2 belg + 2 meher).

**Technology Development For Producer Cooperatives**

As shown in the section on producers cooperatives, the PCs have some differences and some similarities with individual farmers. Since both groups have the same natural and physical circumstances it is likely that the above experiments are relevant with two exceptions.

1. **Aphids on Barley and Wheat**: This problem is of lesser priority to the PCs since they plant early and they have access to chemicals. Observations during meher, 1986, do not indicate heavy infestation of the pest on PC fields.

2. **Shortage of dry season feed**: The problem is of less priority because they have less livestock, more grazing land, and they conserve crop residues.
Also PCs face one problem not faced by individual farmers:

1. Low prices for vegetables: Vegetables receive low prices due to surplus production and lack of demand during the belg season. PCs should give less emphasis for vegetables during the season and release labour and land for field crop production.