1. INTRODUCTION

1.1 Objectives

- To collect and analyze baseline data (socioeconomic indicators) from crop production, livestock production and other agricultural related issues that can later be used as a basis for planning programmes/ projects reflecting local needs and priorities. The indicators can also be used for monitoring and evaluating impacts.
- Assessment of the agricultural situation (both crops and livestock) in the study area and comparison with data available nationally/regionally.
- To identify agricultural problems and to come up with certain suggestions and recommendations for future possible interventions.
- To define areas calling for further research in order to reach the targets aimed in the project better.

1.2 Methodology

The methods used and found appropriate for the study were household interviews aided by a standardized questionnaire, qualitative informal group discussions with men and women headed households wherever possible, observations of the agricultural situation (both crops and livestock), review of secondary data sources such as the livestock population surveys, human population registration (2006), crop assessment report (2006) and other related information.

The estimated beneficiaries of the SSRD project are 1562 households benefiting from the total 1562 ha irrigated land using the scheme and an additional would be beneficiaries of 600 households from the newly proposed schemes in Hawagu, Haterdewar and Adikukuy. SSRDP will have therefore a total of 2162 beneficiary households. Approximately 20% (110 individual household heads) of the total beneficiary households were considered for the household interviews. The sample size is believed to be representative of the population of beneficiaries of the project.

SSRD project has in the past been focusing its activities mainly in eight sites or villages of the Barka and Gash basins of the Gash Barka regional administration found in six Sub Zobas namely Akurdet, Tesseney, Forto, Haicota, Mogollo, and Mensura. The eight sites visited have a total population of 24,001 and 5658 households. The information collected during the study came from the mentioned eight sites be it in the household interviews or group discussions.

The survey team consisted of 12 enumerators of which one was female and the rest were all males. 3 of the enumerators could speak Tigre language fluently while the rest couldn't. Thus the latter were working closely with 9 translators during the household interviews. All of the enumerators are National Service staff of the MoA who recently graduated with BSc in Agriculture from the University of Asmara and deployed to work in the region (See Annex II for details).

Informal group discussions using a checklist were held with a sample of 10-15 people, which included village elders, men and women household heads. Two experienced staff of MoA Gash Barka region, Barentu, along with one or two Sub Zoba experts carried out the discussions. The topics covered during the discussions were farmer associations/organizations, land ownership, crop production, animal production, income and expenditure of households and soil and water conservation. The discussions were held in Sub Zobas Forto, Tesseney, Haicota, Gogne,

Akurdet, Mogollo, and Mensura (See Annex IV Map of Gash Barka Regional Administration).

The procedure followed for data analysis is such that SPSS release 11.0.1 (SPSS Inc, 1989-2001) for windows was used for data entry, data validity check and analysis of the entire household interview data obtained during the survey. The questionnaires were first edited and coded into computer readable forms. This included classification of the variables into qualitative and quantitative ones. The data were then entered into the statistical package: SPSS v11.0.1.

To execute the graphics and figures Microsoft Excel version 2000 was used and Microsoft version 2000 served as a word processor for the final report. The map of Gash Barka Regional Administration, SSRD schemes, precipitation, soil of the region was generated using ArcView GIS version 3.2a (ESRI, 1992-2000) (See Annex IV Maps).

1.3 Scope and Limitations of the Study

The study is an agricultural baseline survey which doesn't boast to comprehensively cover every aspect of agriculture in detail rather it strives to cover most of the facets of crop production (crop types, cultivated land, crop calendar, crop yields, food security, agricultural practices, crop pests, diseases and weeds, crop storage, soil and water conservation, agricultural support services and the like) and livestock production with a reasonable detail within the available limits of human, time and financial resources.

The study has certain limitations such as the fact that the informal group discussions for Rahyaabay and Hawagu were undertaken in Akurdet due to the absence of a bridge/river crossing to the villages during the summer. It is of note that the villages Rahyaabay and Hawagu are only accessible during the dry season because during the summer the rains cause difficulties of road communication especially across the Barka River.

1.4 Population and household Characteristics

Sex and number of households: as shown in table 1.1, the number of households ranges from above 50 in Haterdewar to more than 1500 in Mensura and Alebu.

Table 1.1 Distribution of the total population of the studied villages by sex (number)

Surveyed Village	Sub Zoba	Distribution of population by sex			Number of households
		Male	Female	Total	
Terkina	Mogollo	679	726	1405	397
Rahyaabay[1]	Akurdet	476	425	901	200
Hawagu	Akurdet	1029	939	1968	424
Mensura	Mensura	3443	3303	6746	1564
Adikukuy	Akurdet	160	160	320	82
Haterdewar	Gogne	132	100	232	54
Bultubyay	Haikota	832	731	1563	318
Alebu	Haikota	3724	3624	7348	1731
Wedikiyar	Tesseney	123	157	280	60
Senketkinab	Forto	361	329	690	192
Wakay	Forto	1299	1249	2548	636
Total		12258	11743	24001	5658

Source: MoLG (2007)

Ethnic groups and religion: As shown in the table 1.2 below, the survey studied mainly four ethnic groups: the Tigre (61.8%), Nara (21.8%), Hidareb (14.5%), and Tigrigna (1.8%) in their respective orders. Among the studied ethnic groups the Tigre, Hidareb and Nara have the same religious affiliation: all of them are Moslems; while the 1.9% of the survey population in Mensura practice Orthodox religion.

The Tigre ethnic group are found mainly along the Barka River basin (a seasonal river that originates in the highlands of Logo-Anseba and the Duluk plains and which passes though Sub Zoba Mensura (Mensura and Adikukuy and other villages) and continues westward to Sub Zoba Akurdet (Rahyaabay, Hawagu and others) and finally enters Sub Zoba Dighe where it changes its direction and flows to Zoba Anseba) (See Annex IV Major Rivers of Gash Barka Region). They are also present in and around Sub Zobas Tesseney (Wedikiyar and other villages), and Haicota (Bultubyay and vicinal villages). The Nara ethnic groups are present in the northern part of Sub Zoba Gogne such as Haterdewar and in Sub Zoba Mogollo such as in Terkina village. The Hidareb are present in large numbers in Sub Zoba Forto (for instance in Senketkinab), Mensura, and Haikota.

[1] The scheme has three beneficiary villages: Moshtet, Afridet and Adiseidna. Hence the population indicated is for the same.

Table 1.2 Ethnic groups of the surveyed villages (percent)

Surveyed Villages	Tigre	Hidareb	Nara	Tigrigna	Total
Wedikiar	90.0	10.0	0	0	100.0
Terkina	0	0	100.0	0	100.0
Senketkinab	30.0	70.0	0	0	100.0
Bultubyay	100.0		0	0	100.0
Alebu	30.0	30.0	40.0	0	100.0
Mensura	60.0	20.0	0	20.0	100.0
Adikukuy	70.0	30.0	0	0	100.0
Haterdewar	0	0	100.0	0	100.0
Wakay	100.0	0	0	0	100.0
Rahyaabay	100.0	0	0	0	100.0
Hawagu	100.0	0	0	0	100.0
Total	61.8	14.5	21.8	1.8	100.0

Number of household members: the average number of household members is 5.1. It is highest among the Tigrigna (avg 5.5, std dev. 3.54) and lowest among the Nara ethnic group (avg 4.1, std dev. 2.61) (See table 1.5).

Education: out of the total interviewed household heads 71.8% never went to school and couldn't read and write at all, 7.3% could read and write, 15.5% attended elementary school (1-4 grade), 2.7% attended middle schools (5-7) and 2.7 attended higher education (greater than 12). The level of education of the surveyed population is also tabulated against the surveyed villages. It is of note that none of interviewed households attended secondary education (9-12 grades) (See table 1.3).

Table 1.3 Level of education of the studied villages (percent)

Surveyed Villages	Illiterate	Read and Write	Elementary (1-4)	Middle (5-7)	Higher and above (> 12)	Total
Wedikiar	70.0	10.0	20.0	0	0	100.0
Terkina	80.0	0	20.0	0	0	100.0
Senketkinab	90.0	0	10.0	0	0	100.0
Bultubyay	60.0	30.0	10.0	0	0	100.0
Alebu	70.0	20.0	0	0	10.0	100.0
Mensura	40.0	0	40.0	20.0	0	100.0
Adikukuy	70.0	0	20.0	10.0	0	100.0
Haterdewar	80.0	0	20.0	0	0	100.0
Wakay	90.0	10.0	0	0	0	100.0
Rahyaabay	80.0	0	10.0	0	10.0	100.0
Hawagu	60.0	10.0	20.0	0	10.0	100.0
Total	**71.8**	**7.3**	**15.5**	**2.7**	**2.7**	**100.0**

Family structure and marital status: the marital status of the studied villages is such that 70% are married, 17.8% widowed, and the rest 5.6% and 6.5% are unmarried and divorced respectively (Table 1.4).

Table 1.4 Marital statuses of the studied villages by ethnic group (percent)

Ethnic group	Married	Unmarried	Divorced	Widowed
Tigre	75	8.8	1.5	14.7
Hidareb	68.8		12.5	18.8
Nara	57.1		14.3	28.6
Tigrigna	50		50	
Total	70.1	5.6	6.5	17.8

The average age of mothers as shown in table 1.5 is 40.2 while the average age of fathers is 54. However, there is differences among the four ethnic groups studied (no significance test carried out, though). This implies that on average husbands are 14 years older than wives. And the average number of household members is 5, the maximum being recorded among the Tigrigna and Tigre ethnic groups.

Table 1.5 Average ages of mothers and fathers, household size and number of children below ten by ethnic group

Ethnic group	Average age of mothers		Average age of fathers		Number of household members		Number of children below ten
	N	Mean	N	Mean	N	Mean	Mean
Tigrigna	2	36.5	-	-	2	5.5	-
Nara	16	44.1	13	56.9	21	4.1	1
Hidareb	13	39.8	12	54.5	16	5.1	1.6
Tigre	53	40.4	47	50.9	68	5.5	1.6
Total/ Mean	84	40.2	72	54.1	107	5.05	1.4

Social organizations and institutions: the National Union of Eritrean Women and National Union of Eritrean Youth are mainly active at Sub Zoba level and not at village level.

Each *Kebabi* (consisting of 1 to more than 10 villages) has its own Village Development Committees. This body has sub committees such as for water use with three members. The members are responsible for collection of money needed for operation and maintenance of water supply infrastructures. Likewise they do also have agriculture and education committees. The members of the former deal with issues like collection of taxes of land and livestock, organizing campaigns for soil and water conservation, pest outbreak control and agriculture related activities such as assisting families of fallen hero's during the armed struggle, women headed households, the old and disabled in weeding and harvesting crops. Members of the latter also follow the state of education in the village. For instance they deal with issues of drinking water for students, attendance of students, school dropouts control and other related issues.

Spate Water Users Associations have also been introduced to the villages where there is a SSRD scheme by MoA in collaboration with MoLG. The associations were introduced to ensure efficient and sustainable operation and maintenance of the schemes so that the members can make full use of it. The association is supposed to carry out maintenance of the schemes making use of the annual fees contributed by members, interest made on deposits, fines, loans from banks and lending institutions, grants and donations, contribution from members for emergencies, and fund raising events. It has also the duty of ensuring equitable distribution of

water to the farmer plots, mediate disputes amongst members and others regarding any issues affecting the irrigation system, liaise/act as a bridge and collaborate with government departments and other concerned agencies, ensure the fund's collected and properties are properly managed and well accounted for and facilitate efficient communication amongst members.

In Alebu, for instance, there is a SSRD project. The scheme irrigates 420 ha of cropland and each member of the scheme owns 2 ha bringing about the total beneficiaries to 210 households. The association has established an executive committee with one chairman, one secretary, and one treasurer and three to four members. The annual fee of 100 ERN collected so far has generated a total sum of 8000 ERN since the establishment of the scheme. According to the group discussions the scheme needs maintenance of the main diversion structure and land leveling. The existing structure doesn't hold water uniformly because of the uneven slope/bumpy nature of the land. This resulted to soil erosion from farmers' plots and breakage of the embankments. The funds so far collected are not enough to cover the cost of maintenance.

Likewise in Senketkinab (a village in Sub Zoba Forto) the Spate Water Users Association has also been established. The executive committees and subcommittees for closer follow-up of diversion weir, diversion bunds, gates to the irrigated land and three guards for protection of irrigated land from freely grazing animals have been established recently.

The study has observed the existence of functioning but feeble community structures such as the Village Administration, Village Development Committees and the Spate Water Users Association. It is important to assist the communities to restructure their organizations to produce the intended results in agriculture and natural resource management. This could be achieved through upgrading the capacity of the communities in planning, management and control of common property for instance communal rangeland, and self interest groups comprising households with similar interests, for instance Spate Water Users Association, Herders Association and etc.

2. CROP PRODUCTION

2.1 Land acquisition mechanism

To produce crops one of the major rudiments is access to land above and beyond capital and labour requirements. Most households interviewed during the survey control their own plots. Very few have no access to land and therefore they rent or borrow land from land owners.

Table 2.1 Percentage distribution of land acquisition mechanisms in the study areas

Study Areas	Government	Village Allocation	Inheritances	Renting	Borrowing	Total
Wedikiar	20.0	10.0	70.0	-	-	100.0
Terkina	-	-	100.0	-	-	100.0
Senketkinab	80.0	-	20.0	-	-	100.0
Bultubyay	70.0	-	30.0	-	-	100.0
Alebu	80.0	10.0	10.0	-	-	100.0
Mensura	-	10.0	60.0	30.0	-	100.0
Adikukuy	-	10.0	80.0	-	10.0	100.0
Haterdewar	-	-	100.0	-	-	100.0
Wakay	-	-	100.0	-	-	100.0
Rahyaabay	10.0	-	90.0	-	-	100.0
Hawagu	-	-	100.0	-	-	100.0
Total	23.6	3.6	69.1	2.7	0.9	100.0

Several land acquisition mechanisms are practiced in the study areas. Inheritance is the most important land acquisition mechanism (69.1%) followed by government allocation (23.6%). Land is also rented (2.7%) and borrowed in the studied villages (0.9). Among the surveyed villages, it is only in Mensura where land is rented (See table 2.1). The village consists of three ethnic groups: the Tigre, Hidareb and Tigrigna. The latter are recent settlers in the area and don't have land inherited from their forefathers hence they rent land from the landowners in the village. This is so despite the fact that the practice of tenancy is illegal in Eritrea.

2.2 Crop types

The major staple crops grown in the surveyed areas are sorghum (93.6%), pearl millet (28.2%) and sesame (1.8%). The latter is grown by a relatively fewer households interviewed because it requires considerable input of labour for good results. The following figure shows the percentage of households cultivating the major staple crops in the surveyed areas.

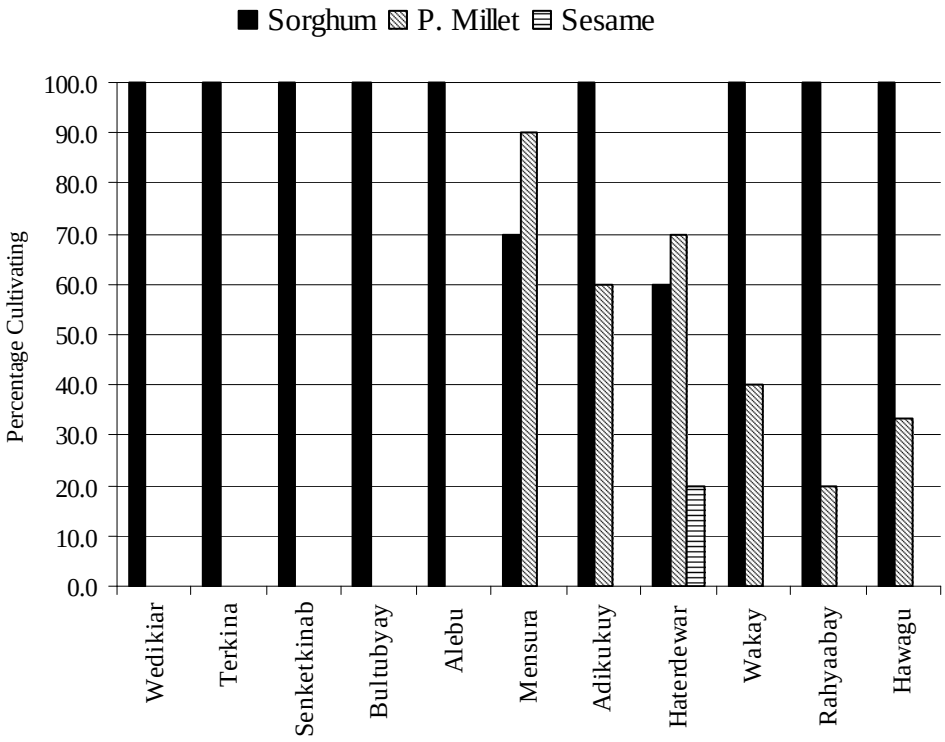

Figure 2.1 Percentage of households cultivating the major staple crops by surveyed areas

Other crops besides the staple crops are also grown such as pumpkin, okra, water melon in Terkina SSRD and Mogoraib river diversion schemes by very few of the interviewed households. Despite the possibility for growing horticultural crops (vegetables and fruits) along the Gash and Barka river banks, none of the interviewed households own a garden or some sort of a commercial farm. The major reason for this phenomenon is the lack of capital (for purchasing motor pumps and accessories, seeds etc), lack of technical know how and lack of labour.

2.3 Soil types

Based on FAO-UNESCO system of soil classification, the soils of the surveyed areas fall into three orders namely vertisols, leptosols, fluvisols and cambisols. Based on the USDA system, however, the following orders namely vertisols, entisols and inceptisols are found.

Vertisols are found in Alebu (Sub Zoba Haicota), Adikukuy (Sub Zoba Mensura), Wedikiar (Sub Zoba Tesseney) and to a lesser extent in Mensura (Sub Zoba Mensura) villages. They are fertile, deep soils with high water holding capacity. They have swelling and cracking properties when wet and dry respectively. During the rainy season such soils become sticky and muddy so much so that they hinder normal farming practices such as ploughing. During the dry season they form deep cracks. They have also poor drainage and erosion is common among such soils. The distribution of such soils is similar to what farmers locally call ‘Badob’.

Inceptisols are soils with moderate fertility and moderate water holding capacity. They are deep soils with yellow/brown colour and with moderate erodibility. They are easy to work on and relatively well drained. Such soils are found in Bultubyay, dominantly in Mensura, Haterdewar, plains of Solib and Hawagu and from Terkina village all the way to Mogollo.

Entisols are grey in colour, low to moderate water holding capacity and with low fertility on barren sands as well as soil on bed rock and high fertility on recent alluvium. Such soils have shallow depth on bedrock and moderate depth on recent alluvium. Erodibility of such soils is moderate and has workability ranging from moderately hard to easy. Such soils are mineral soils without natural genetic horizons or with only the beginnings of such horizon. They have little or diagnostic horizons. They are found in Wakay, Senketkinab, Rahyaabay and Terkina villages (See Annex IV Soil Map of Gash Barka region).

2.4 Land holding and location of plots

The average land holding (both cultivated and uncultivated) per household is 2.57 hectares. It is highest in Wedikiar (5.2 hectares) and lowest in Senketkinab (1.5 hectares) (See table 2.2).

Location of land plots is such that 6.4% of total interviewed households have their plots within less than 15 minutes walking distance; 30% within 30 to 60 minutes walking distance; while the rest 30% have their plots located more than an hour walking distance from the village (See table 2.3). The location of the plots relative to the main canal, on the other hand, is such that close to 50% of the interviewed households have their plots within less than 15 minutes walking distance; about 30% of the plots within 15 to 30 minutes walking distance and the rest of the plots are located from 30 minutes to more than an hour walking distance from the main canal (See table 2.4).

The number of plots owned per household ranges from one to five. 79.1% of the interviewed households own only one plot; 18.2% own two plots while less than 3% own greater than two plots (table 2.5).

Table 2.2 Average size of plots in hectares in the study areas

Surveyed Villages	Mean	Std. Dev.	N
Wedikiar	5.2	5.45	10
Terkina	1.8	0.92	1
Senketkinab	1.5	1.08	10
Bultubyay	1.7	0.48	10
Alebu	2.0	0.47	10
Mensura	2.0	1.07	10
Adikukuy	3.5	2.22	10
Haterdewar	1.9	1.08	10
Wakay	3.1	1.91	10
Rahyabay	2.2	1.29	10
Hawagu	3.4	1.63	10
Mean/Total	**2.57**	**1.6**	**110**

Table 2.3 Percentage distribution of location of plots from village in the study areas

Surveyed Villages	Less than 15 minutes	15 to 30 minutes	Half an hour to one hour	More than one hour	Total
Wedikiar		40.0	10.0	50.0	100.0
Terkina	10.0	20.0	50.0	20.0	100.0
Senketkinab		20.0	60.0	20.0	100.0
Bultubyay		80.0		20.0	100.0
Alebu		10.0	10.0	80.0	100.0
Mensura	30.0	20.0	40.0	10.0	100.0
Adikukuy		20.0	40.0	40.0	100.0
Haterdewar	30.0	70.0			100.0
Wakay		10.0	60.0	30.0	100.0
Rahyaabay		70.0	10.0	20.0	100.0
Hawagu			50.0	50.0	100.0
Total	**6.4**	**32.7**	**30.0**	**30.9**	**100.0**

Table 2.4 Percentage distribution of location of plots from main canal in the study areas

Surveyed Villages	Less than 15 minutes	15 to 30 minutes	Half an hour to one hour	More than one hour	Total
Wedikiar	10.0	20.0	20.0	50.0	100.0
Terkina	10.0	50.0	40.0	-	100.0
Senketkinab	50.0	50.0	-	-	100.0
Bultubyay	40.0	60.0	-	-	100.0
Alebu	40.0	30.0	30.0	-	100.0
Mensura	70.0	30.0	-	-	100.0
Adikukuy	90.0	10.0	-	-	100.0
Haterdewar	70.0	30.0	-	-	100.0
Wakay	70.0	30.0	-	-	100.0
Rahyaabay	70.0	20.0	-	10.0	100.0
Hawagu	20.0	10.0	40.0	30.0	100.0
Total	**49.1**	**30.9**	**11.8**	**8.2**	**100.0**

Table 2.5 Percentage distribution of number of plots owned by households in the surveyed areas

Surveyed Villages	Number of plots				Total
	1	2	3	5	
Wedikiar	60.0	20.0	20.0	-	100.0
Terkina	90.0	10.0	-	-	100.0
Senketkinab	80.0	20.0	-	-	100.0
Bultubyay	90.0	10.0	-	-	100.0
Alebu	100.0	-	-	-	100.0
Mensura	70.0	20.0	-	10.0	100.0
Adikukuy	60.0	40.0	-	-	100.0
Haterdewar	80.0	20.0	-	-	100.0
Wakay	80.0	20.0	-	-	100.0
Rahyaabay	90.0	10.0	-	-	100.0
Hawagu	70.0	30.0	-	-	100.0
Total	**79.1**	**18.2**	**1.8**	**0.9**	100.0

2.5 Crop calendar

The crop calendar for the surveyed villages is depicted in the table below. Planting is carried out from June to July depending on the start of rainfall because it is variable in amount and erratic in nature.

Table 2.6 Crop calendar for the major staple crops such as sorghum, pearl millet and sesame in the surveyed villages

Agricultural activity	Months of the year
First ploughing	March to June
Planting	End of June to July
Intercultivation (soft ploughing)	July to August
Weeding	July to September
Harvesting and threshing	October to January

2.6 Crop yields

Crop yield is the result of a number of factors to mention but a few: soil, variety of seed, amount and frequency of rainfall and cultural practices such manuring, fertilization, pesticide application, weeding, and control of pests and diseases. The crop yields for sorghum for 2006 cropping season, as found from the household interviews, are presented in figure 2.2.

Sorghum yield is highest in Terkina as compared to the other villages surveyed. All the other villages other than Bultubyay and Terkina, recorded yields below 5 quintals per hectare. This result doesn't tally with the average yield of 12 quintals per hectare in spate irrigated fields for Gash Barka region[2]. Pearl millet yield is also shown in figure 2.3 for the surveyed areas.

[2] MoA Gash Barka Annual report (2006)

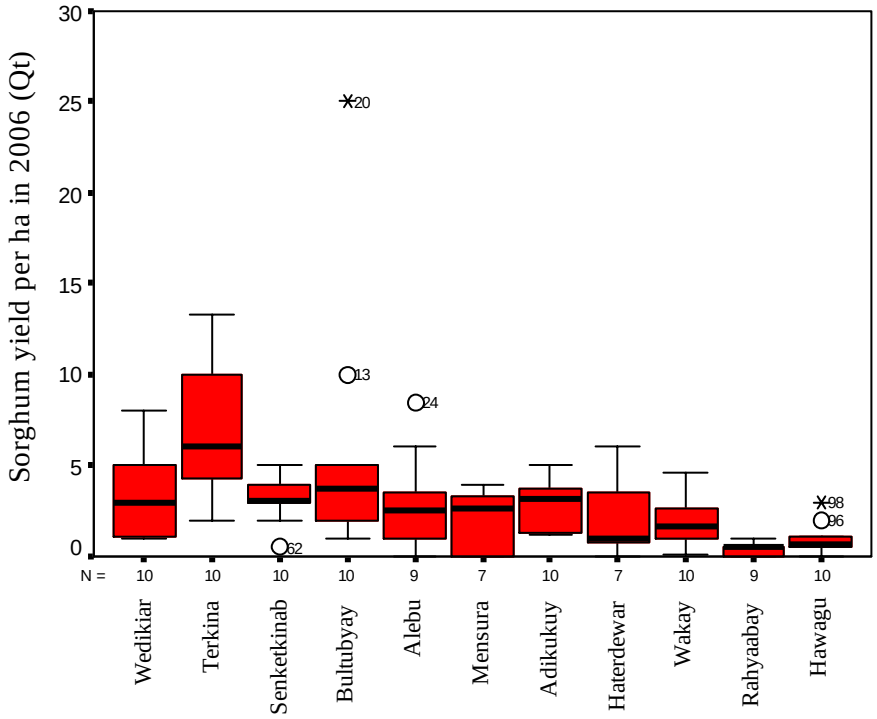

Figure 2.2 Sorghum yields per hectare (quintals) in 2006 in the surveyed villages

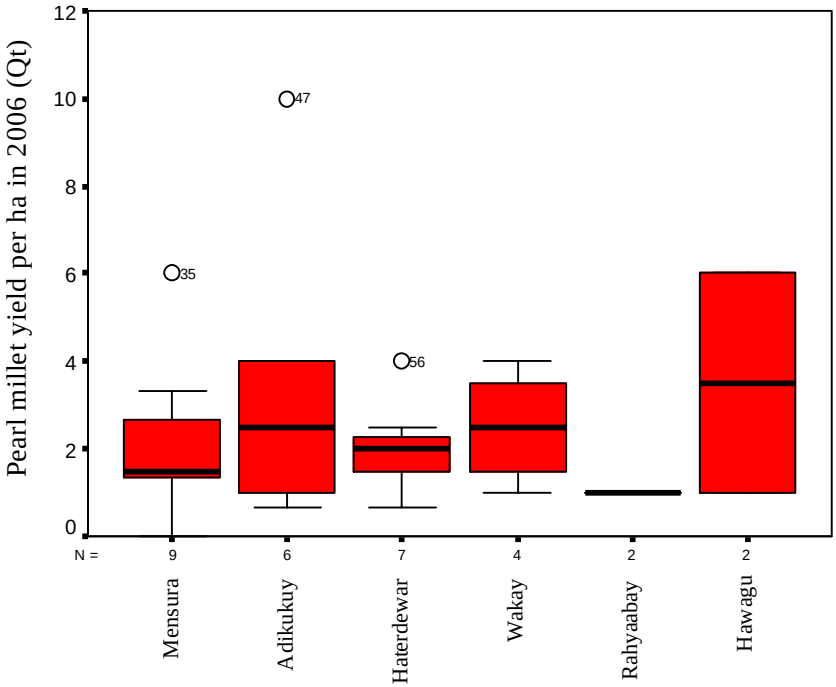

Figure 2.3 Pearl millet yields per hectare (quintals) in 2006 in the surveyed villages

2.7 Food security

The following table shows the percentage of food secure people cross-tabulated against the surveyed villages. Food security differs from one village to the other and from year to year. Averaged over all the villages studied the percentage of food secure people is only 10%.

Table 2.7 Percentage of food security against the surveyed villages during 2006

Study Villages	More than 12 months	9-12 months	6-8 months	3-5 months	1-2 months	Less than one month	Total
Wedikiar	10.0	10.0	10.0	60.0	10.0	-	100.0
Terkina	30.0	-	30.0	20.0	10.0	10.0	100.0
Senketkinab	-	20.0	30.0	40.0	-	10.0	100.0
Bultubyay	20.0	10.0	40.0	-	20.0	10.0	100.0
Alebu	-	20.0	40.0	10.0		30.0	100.0
Mensura	20.0	-	20.0	30.0	10.0	20.0	100.0
Adikukuy	20.0	10.0	50.0	10.0	10.0	-	100.0
Haterdewar	-	30.0	40.0	20.0	10.0	-	100.0
Wakay	-	-	40.0	20.0	20.0	20.0	100.0
Rahyaabay	-	-	10.0	20.0	10.0	60.0	100.0
Hawagu	10.0	-	20.0	20.0	20.0	30.0	100.0
Total	**10.0**	**9.1**	**30.0**	**22.7**	**10.9**	**17.3**	**100.0**

2.8 Coping mechanisms to food shortages

In the event of food shortages there are quite a number of mechanisms that farmers utilize. Averaged over all the studied villages, sale of animals is the most important coping mechanism followed by petty trading (which includes sale of water using draft animals, selling *Tokoba*, forest product made from doum palm leaves, selling *Agefa*, doum palm leaves used for house making, and selling wood). Selling wage labour is the third most important coping mechanism followed by cash/food for work and assistance from relatives. Renting pack animals, taking cash or food on credit and other sources of income such as livestock fattening, gold quarrying, milk sale is less common (only 10%) as coping mechanisms in the studied villages (See table 2.8).

Table 2.8 Percentage and score of the importance of coping mechanisms in case of food shortages

Study Villages	Sale of Animals	Petty Trading	Selling Wage Labour	Participating in Cash /Food for work	Assistance from Relatives	Taking Cash/Food on Credit	Renting Pack Animals	Others
Wedikiar	7	4	5	3	7	1	0	0
Terkina	4	5	4	1	3	0	1	0
Senketkinab	8	1	5	4	1	0	1	1
Bultubyay	2	6	0	0	2	0	0	0
Alebu	0	9	4	2	0	2	0	0
Mensura	9	4	2	3	1	1	0	2
Adikukuy	4	1	5	2	1	2	1	1
Haterdewar	3	2	2	5	0	1	0	0
Wakay	9	1	6	1	6	0	3	0
Rahyaabay	7	3	0	1	1	0	0	1
Hawagu	9	0	1	3	0	0	0	0
Total Score	**62**	**36**	**34**	**25**	**22**	**7**	**6**	**5**
Percent	**31%**	**18%**	**17%**	**13%**	**11%**	**4%**	**3%**	**3%**
Rank	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**

2.9 Agricultural practices

Ploughing and Planting: all farmers practice ploughing and planting between end of June and mid July and sometimes as late as end of July. The implements used for planting/ploughing are usually camels, donkeys, oxen and tractors when available. Oxen are employed for ploughing/planting in Mesura while camels are common in other surveyed villages. Suluka is also used in some of the surveyed villages such as Senketkinab and Wakay and other villages due to shortage of draught animals[3]. Planting/ploughing is done by family labour (most villages), and hired labour (e.g. Senketkinab, Wakay).

Table 2.9 Animal rent per day in ERN for planting during 2007 cropping season in the studied villages

Villages	Camel rent with owner	Camel rent without owner	Donkey without owner	Oxen rent with owner
Wedikiar	200	100	-	-
Mensura	200	-	-	400
Mogollo	-	-	75	-
Hawagu	-	-	-	300
Terkina	-	-	-	-
Forto	200	-	-	-

[3] In most of the surveyed villages most households have oxen but do not have the habit of using it for ploughing. They use camels or donkeys instead. So shortage implies strictly to shortage of the latter draught animals.

Weeding: weeding is practiced between July and September by hand in all the surveyed areas. Weeds have become one of the major problems among the surveyed villages because of inadequate land preparation and because farmers don't properly weed their crop fields. Soft ploughing, usually carried out when the plants reach knee height, is rarely practiced in the surveyed villages. At the same time first ploughing is not a common practice. The MoA Gash Barka region carried out training programmes this year regarding this matter. Most of the respondents in Terkina, Senketkinab and other villages during the survey did actually carry out first ploughing this year and have now understood the benefits of the practice.

Harvesting and threshing: is practiced between October and January. Harvesting is done by hand and threshing usually by hand or oxen or camels.

Intercropping and crop rotation: intercropping is practiced to minimize crop failure usually observed in monocropping and to produce two crops with different purpose at the same time and space. In some of the surveyed villages such as Terkina and Haterdewar sorghum or pearl millet is intercropped with cowpea or with local unidentified crops called *Heta* and *Kambela*. Sorghum is also intercropped with sugarcane in Tekawda[4]. Crop rotation is not practiced in the surveyed villages.

Crop storage: in good rainfall years, farmers have excess produce lasting for more than a year. During such good times farmers in Haterdewar, Terkina, and to a lesser extent in Bultubyay store their produce in a cylindrical shaped grain store called 'Suga' made up of animal dung, wood, tree branches and woven doum palm leaves with a capacity to store 7-10 quintals. It stores grains for about two years. According to a study report by NPA/DF (1996), the store is ineffective and crop damage by rodents and pests such as weevil, ants and insects is often up to 15-20%. This kind of store is common among Kunama and Nara ethnic groups.

Guffet, which is dominantly used by Tigre ethnic groups is made by weaving specially treated doum palm leaves and has a capacity of holding one quintal of grain. It is widely used nowadays because of low agricultural production. The *Deregeb*, similar to *Guffet* but with a larger capacity (7-15 quintals) is also common among the Tigre and are made by women. Both storage facilities are vulnerable to rats, termites and storage pests. Farmers place the containers on a raised platform of wood to protect them from termites.

Last year crop production was not enough so much so that only 34.5% of the interviewed households stored their produce for more than six months. As much as 40.9% of the interviewed households stored their produce for less than 6 months (See table 2.11). 24.5% did not store at all because of deficit production (24%), selling the produce in market (4%), and due to immediate consumption (72%) (See table 2.10).

[4] Tekawda is a village in Sub Zoba Gogne, 31 kms from Gogne town and 16 kms from Haterdewar village.

Table 2.10 Reasons for not storing crop produce in the surveyed villages

Reasons	N	Percent
Immediate Consumption	18	72
Deficit in production	6	24
Sold in market	1	4
Total	25	100

Table 2.11 Period of time that farming households store their produce in the surveyed villages

Surveyed Villages	For less than 6 months	For 6 months to 1 year	For 1 to 1.5 years	For 2 years	Doesn't store	Total
Wedikiar	70.0	20.0	10.0	-	-	100.0
Terkina	-	30.0	10.0	10.0	50.0	100.0
Senketkinab	50.0	30.0	-	-	20.0	100.0
Bultubyay	30.0	30.0	10.0	-	30.0	100.0
Alebu	20.0	50.0	-	-	30.0	100.0
Mensura	-	40.0	20.0	-	40.0	100.0
Adikukuy	30.0	60.0	-	-	10.0	100.0
Haterdewar	40.0	60.0	-	-	-	100.0
Wakay	20.0	-	-	-	80.0	100.0
Rahyaabay	100.0	-	-	-	-	100.0
Hawagu	90.0	-	-	-	10.0	100.0
Total	**40.9**	**29.1**	**4.5**	**0.9**	**24.5**	**100.0**

Manuring/Chemical fertilization: farmers in the surveyed areas think that manuring increases pest infestation and soil temperature and hence do not use manures. Farmers also lack capital to buy fertilizers and are often unavailable to them. Fertilization is commonly used by commercial farm owners along the Barka and Gash river basins. It is not applied for staple crops such as sorghum, pearl millet and sesame because it is often unavailable to them and because farmers lack the capital to buy them.

Composting: composting is not common in the surveyed villages because there are few crops and forest residues to use for this purpose. It is well established fact also that, after natural pastures, the next largest source of feed for livestock in the region is crop stubble on harvested fields, with sorghum residue being the most important by a large margin (See table 2.12). This often leads to a situation where by organic matter levels in the soils become very low and moisture infiltration is reduced. In some of the villages studied manure is also used for household fuel instead of being applied to cropland.

Table 2.12 Amounts of crop residues harvested from crops grown in the region, 2005

Type of crops	Total Crop Production (Tons)	Total Crop Residue Production (Tons)
Sorghum	135,463.5	243,834.3
Pearl Millet	7,204.6	6,476.9
Sesame	11,520	2,953.8
Cotton	2,231.9	1,014.5

Pesticide/ Herbicide application: out of the total interviewed households during the survey, only one household head responded that he used insecticide (Malathion) for his staple crops last year. And during one of the group discussions held in the survey, one farmer in Alebu said he used herbicide (2, 4 D) last year to protect his sorghum field from broad leaved weeds. The herbicide was effective, according to him.

Fallowing: in some of the surveyed villages farmers are aware of the decline of soil fertility when land is cultivated continuously and hence the need for fallowing. For instance in Terkina and Mensura farmers used to fallow their land long time ago. Nowadays land is in short supply and don't practice fallowing anymore. In Rahyaabay and Hawagu farmers leave their land fallow, if at all, because they either lack manpower or traction animals or tractors. They don't seem to understand the benefits of fallowing. The same is also true for Senketkinab, Wakay, Alebu, Wediakiar and Bultubyay, Haterdewar villages.

2.9 Crop pests, diseases and weeds

Some of the plant pests observed in 2007 cropping season are stock borer and cricket in sorghum. The latter was observed in Sub Zoba Forto and the former in Shambuqo. Grasshopper, locally called *Godebo*, has become one of the major problematic pest outbreaks during 2007 cropping season mainly attacking sorghum and pearl millet in almost all Sub Zobas of the Gash Barka region. The pest attacks the crops at their early stages. Tree locust was also observed near pearl millet and sorghum fields in Sub Zoba Forto. Other pests such as beetles, desert locust, army worm, aphids are also seen in the region.

Bean fly was also observed in the newly introduced common bean plant in the region mainly in Sub Zobas Mogollo, Shambuqo, Goluj, Tesseney, Forto and Haicota. The pest attacks the plant at early growth stages. During vegetative stages jassids, caterpillar, leaf minor, whitefly were observed in the Sub Zobas mentioned above.

Very rarely does one see blight in sorghum (Sub Zoba Shambuqo) this cropping season. Smut were common last year (2006) due to the absence of chemical seed treatment in Tesseney processing plant for the improved seeds and this year smut is also expected to be seen again as the processing plant is not yet employing chemicals due to lack of chemicals in the country. Last year and the years before other plant diseases such as rust, leaf spot, rotting and downy mildew were observed in the region.

Sudan grass (Sorghum halpensis), locally called *Adar*, is spreading in Sub Zobas Tesseney (for instance Wedikiar), Sub Zoba Goluj, Sub Zoba Forto (to a lesser extent in Senketkinab and Wakay), Sub Zoba Haicota (Bultubyay, Alebu) and Sub Zoba Akurdet (Hawagu and Rahyaabay). The weed has spread as close into the center of the region from Sudan into Sub Zoba Gogne (e.g. Haterdewar). The weed is absent in sub Zoba Mogollo and Sub Zoba

Mensura. The parasitic weed, striga, infestations are very high in Wakay and Senketkinab while it is relatively lower in other surveyed villages but it is absent in Terkina, Rahyaabay, and Hawagu (See table 2.13)

Other weed types such Amanranthus spp. (*Hamli adgi*), Xanthium spp. (*Ishok kebelie*), Convolvolocea spp. (*Meantatiel*), Datura spp. (*Mezerbae*), Malvaceae spp. (Wild okra) (*Bamya*), Zygophallacea spp. (*Kakito*), Commelina spp. (*Me'ekori may*), Corchorus spp. (*Molokia*), Eragrotis spp. (*Tafftafo*), Setaria spp. and others are observed in the surveyed areas.

Table 2.13 Percentage of respondents who responded 'yes' to occurrences of striga and Sudan grass in their fields among the surveyed villages

Surveyed Villages	Striga	Sudan Grass
Wedikiar	40.0	80.0
Terkina	0.0	0.0
Senketkinab	70.0	40.0
Bultubyay	20.0	70.0
Alebu	10.0	50.0
Mensura	40.0	0.0
Adikukuy	30.0	0.0
Haterdewar	10.0	30.0
Wakay	90.0	40.0
Rahyaabay	0.0	40.0
Hawagu	0.0	50.0
Average	**28.2**	**36.4**

2.10 Soil and water conservation

Farmers traditionally construct wooden bunds called locally *Sheyal* across their farmlands to conserve soil and water and minimize soil erosion in all of the villages surveyed. Activities related to soil and water conservation is weak in most of the villages because farmers are busy in other income generating activities such as animal selling, selling doum palm leaves, daily labour work and the other activities to overcome the food shortage they face in spring. In other words activities related to soil and water conservation often have low priorities, as the primary aim of communities is to ensure food security. The reason is different especially in Mensura where most land owners rent their land. This leaves farmers with little incentive to invest in soil and water conservation measures in their farmlands. Even the landowners in the village have their farmlands showing off serious erosion problems, for instance in a place called Bar'arey, farm land near Mensura. The farmers in the area responded that they could reverse the situation in the area if they are provided with the needed capital to do the job. The extremely high cost to rehabilitate the place is a disincentive to them.

The local government body along with MoA sub branch offices in the Sub Zobas has also taken initiatives in mobilizing communities to carry out soil and water conservation measures twice a week from February to July each year. Some of the activities carried out last year (2006) were construction and maintenance of soil and stone bunds, maintenance and

construction of check dams, stone collection, feeder road construction and maintenance, concrete work, gabion work stone collection, and canal silt clearing in diversion schemes, and construction and maintenance of ponds (See table 2.14).

Table 2.14 Soil and water conservation measures carried out in Gash Barka region during 2006 dry season[5]

SWC measure	Unit	Mensura	Tesseney	Haicota	Laelay Gash	Shambuqo	Mogollo
Soil bund	ha	100	-	70	-	-	120
Stone bund	ha	100	-	-	-	-	-
Terrace maintenance	ha	-	300	20	-	-	-
Check dam construction	m^3	110	-	140	5500	-	-
Stone collection	m^3	110	-	600	3028	-	500
Feeder road clearing	km	210	-	20	-	10	-
Feeder road maintenance	km	-	-	-	-	74.5	45
Concrete work (RD schemes)	m^3	-	-	1800	-	-	1800
Gabion work (RD schemes)	m^3	82	-	-	-	203	-
Stone piling (RD schemes)	m^3	-	-	-	-	-	153
Canal silt removal	m^3	140	-	-	-	-	-
Pond construction	No.	-	-	-	1	-	-
Pond maintenance	No.	1	-	-	1	-	-

2.11 Spate irrigation schemes

The region is witnessing very quite impressive increases in irrigation activities mainly through spate diversion schemes. Such schemes started during the armed struggle in Kulentebay (Sub Zoba Forto) and Mogoraib (Sub Zoba Gogne). The schemes were small and implemented by farmers to divert small seasonal spates into farmlands. It was after independence, in 1994, that proper small scale spate diversion schemes were constructed in Lemissa (Sub Zoba Mogollo) funded by GTZ and implemented by MoA Gash Barka.

As clearly depicted in Figure 2.3, cultivated area under spate irrigation was below 1000 ha until 2002. It then showed a precipitous increase from 2002 onwards reaching 7,881 hectares in 2006.

[5] MoA Gash Barka Annual Report 2006

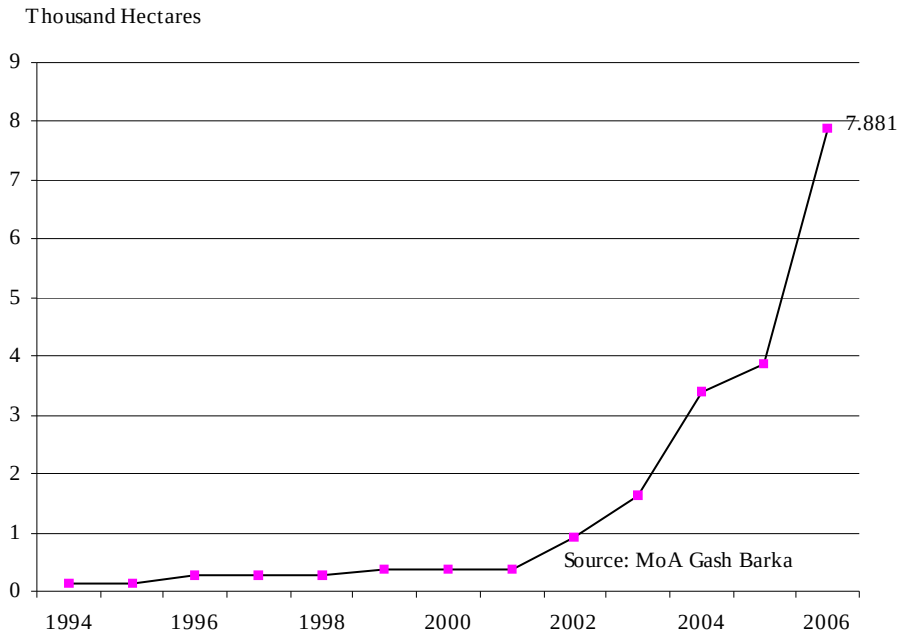

Figure 2.3 Cultivated areas under spate irrigation in Gash Barka region of Eritrea, 1998-2006

2.12 Agricultural support services

Supply of seeds

As shown in table 2.15 seeds are obtained from different sources. The major source is what farmers save for themselves (50.9%), followed by seeds provided by government (29.1%). The next most important source is seeds purchased from market (16.4%) and borrowed from relatives/neighbours (3.6%).

Table 2.15 Percentage distribution of seed source in the surveyed villages

Surveyed Villages	Government	Saved from last season	Borrowed from neighbor/relative	Purchased from market	Total
Wedikiar	-	70.0	20.0	10.0	100.0
Terkina	30.0	70.0	-	-	100.0
Senketkinab	30.0	50.0	-	20.0	100.0
Bultubyay	90.0	10.0	-	-	100.0
Alebu	10.0	20.0	-	70.0	100.0
Mensura	60.0	40.0	-	-	100.0
Adikukuy	10.0	60.0	10.0	20.0	100.0
Haterdewar	20.0	70.0	-	10.0	100.0
Wakay	-	80.0	-	20.0	100.0
Rahyaabay	60.0	20.0	10.0	10.0	100.0
Hawagu	10.0	70.0	-	20.0	100.0
Total	**29.1**	**50.9**	**3.6**	**16.4**	**100.0**

Quite a number of improved varieties of sorghum including ICSV210, PP290, and Gedem Hamam; and the so called Kona and Hagaz improved varieties of pearl millet were released and distributed to farmers by NARI in 2001. The productivity of PP290 locally called as Shambuqo, an early maturing crop, reaches 3 tons per hectare provided rainfall is between 350 mm and 650 mm with good distribution, and good soil with good drainage and optimum application of fertilizer and other cultural practices. The yield for ICSV210 locally called Bushuka reaches 3.6 tons per hectare under situations mentioned for PP290 except the fact that the variety requires a longer growing season usually from June to October and rainfall usually between 450 mm and 850 mm[6].

As shown in the figure 2.4, the use of improved seeds is increasing from time to time. The percentage coverage of improved seeds versus the total cultivated land rose from 7.7 in 2004 to 8 in 2005. It then almost doubled in 2006 covering 15.8 percent of the total cultivated land. Despite rapid dissemination of improved seeds, the expected improvement of productivity has not been realized for various reasons. One of the major reasons being smut infestations, poor distribution of rainfall, and lack of other appropriate cultural practices.

[6] Source: NARI report 2002

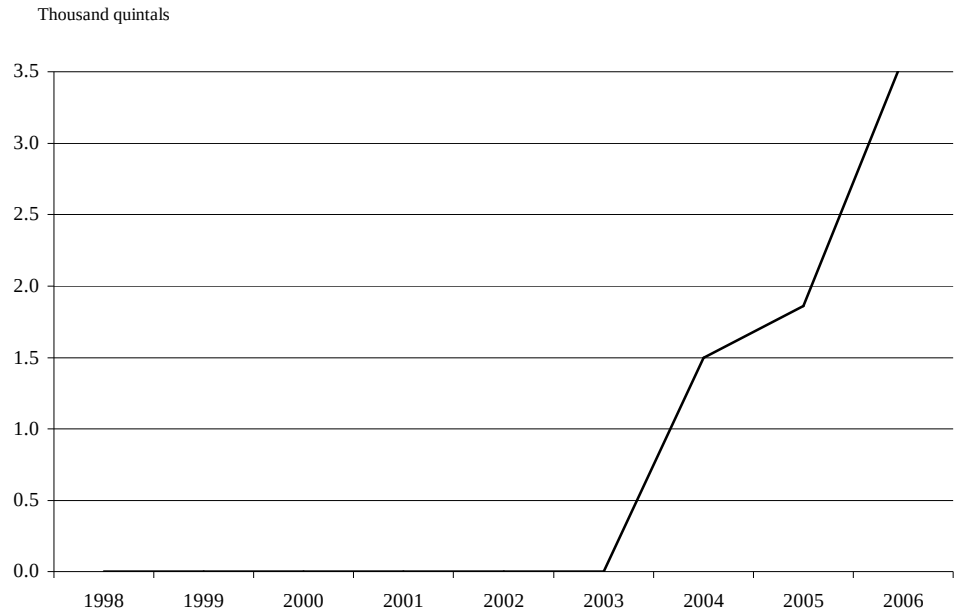

Figure 2.4 Improved seeds of cereals distributed in Gash Barka region of Eritrea, 1998-2006

Seeds collected from 2006 cropping season of improved sorghum varieties, pearl millet and local sesame varieties were 5898 quintals. This seeds were bought from farmers and mechanically purified in Tesseney seed processing plant. The pure seeds in total were 3849.56 quintals which were then redistributed free of charge to farmers for 2007 cropping season. For instance in Rahyaabay 15 kgs of PP290 (improved sorghum variety), and Hagaz (improved pearl millet variety) were provided free of charge to each farmer having a plot of land in the SSRD scheme. According to the informal group discussions, 17 ha of land were planted with PP290, 13 ha with Hagaz and the rest 60 ha of land with local sorghum variety, *Embulbul*, during the 2007 cropping season in Rahyaabay SSRD scheme. Farmers chose local sorghum variety than the improved seeds because they think that the latter requires more water than the former. They also believe that the Sudan grass weed locally called *Adar* was seen in their village along with the coming of the new varieties since 2003 and that is a cause for mistrusting of alien varieties. It is of note that the seed processing plant in Tesseney started functioning properly in 2005.

Most farmers, however, agree that the PP290 sorghum variety gives higher grain yield and its stalk is thoroughly eaten by livestock and it is not easily eaten by birds.

Having appreciated the advantages of improved varieties of sorghum and especially pearl millet, three farmers in Mensura and environs have taken the lead in multiplication of improved seeds. Last year (2006) those farmers produced improved seeds and sold it for 70 ERN per *ribat*[7].

[7] 1 Ribat equals 4 kgs

Tractor and Thresher hire service

To ameliorate the shortage of draught animals in the region, MoA has been providing tractor services since independence. The cost of tractor service since 1994 is indicated in the table 2.16 below. It is clear that in 1994, the service was heavily subsidized. The price of tractor hire service increased to 92-112 Birr/Hour in 1995. Right now, the price has almost doubled as compared to 2003.

Table 2.16 Price of tractor hire services per hour, 1994-2007

Year	Price of Tractor Hire services
1994	38-48 Birr/Hour
1995	92-112 Birr/Hour
1998	71-80 ERN/Hour
1999	71-80 ERN/Hour
2003	170-194 ERN/Hour
2007	290-375 ERN/Hour

Some of the implements used for planting/ploughing are rented in the surveyed villages. The villages visited had government or private tractors during planting/ploughing this season but were not sufficient enough to cover all their fields. The tractor services provided by government are highly demanded by farmers because they are offered to them at subsidized prices. The price of tractor hire services for various tractor types are shown in tables 2.17 for both government and private.

Table 2.17 Prices of tractor hire services per hour in ERN during 2007 cropping season

Tractor type	Government Garages		Private	
	3 Disc plough	Disc Harrow	3 Disc plough	Disc Harrow
New Holland 110/90	290	350	-	-
FIAT 100/90; Landini; FORD	275	320	-	400[8]
Massey Ferguson	220	275	-	-
John Deer	315	375	-	-
Challenger[9]	1100	1500	-	-

During 2006 cropping season, the price of thresher hire service from Government Garages was 400 ERN per hour while private owners of such machines charge 50 ERN per quintal.

[8] The price for private disc harrowing may reach up to 500 ERN per hour depending on demand.
[9] Challenger is a big tractor which covers about 4-5 ha in 1 hour while the other tractors mentioned above cover 1 ha in 1 hour on average during planting.

Agricultural training services

The MoA in the region, in collaboration with MoA HQ when needed, arranges training to farmers, and extension agents. The following is a table summarizing the training activities carried out during the year 2006.

Table 2.18 Agricultural training provided during 2006

Type of training	Number of trainees	Content of training	Number of days of training	Beneficiary Sub Zobas
Home economics	1216 mothers	-Food preservation and preparation -Child and mother care -General hygiene and health -General Agriculture	14	Akurdet, Gogne, Shambuqo
Smokeless stove making	130 mothers	-Benefits of smokeless stove -Making smokeless stove	14	Akurdet, Gogne
General agriculture	2436 farmers	-Crop production, protection -Horticulture -Livestock production	5	All Sub Zobas
General agriculture	1260 contact farmers	-Crop production, protection -Horticulture -Livestock production	10	All Sub Zobas
Introduction to Moringa tree	300 farmers	- Introduction -Use and nutritional values of the tree	5	All Sub Zobas
Forestry and Wildlife	1560 farmers	-Forests and wildlife	1	All Sub Zobas
Surveying	3 MoA Gash Barka Staff	-Surveying using total station	10	Haicota, Goluj and Mogollo
Experiences sharing tour	30 farmers	-Spate irrigation scheme in Sheeb	5	5 Sub Zobas
Fruits and vegetable production	22 farmers	-Fruits and vegetable	5	Gogne
Community rangeland development	18 farmers	- Animal feed, water, SWC in rangelands, VLEA	2	Laelay Gash , Goluj
Animal diseases	25 veterinary assistants	- Vaccination, disease control and eradication etc	5	All Sub Zobas

Crop protection services

Pests, such as Grasshopper outbreaks observed this cropping season (2007), desert locusts, and diseases, such as smut and the like, are controlled by MoA. It mobilizes airplanes, if deemed necessary or vehicles mounted with sprayers to control disease or pest outbreaks. Besides, MoA sells pesticides, herbicides, and motorized or manual sprayers at subsidized prices.

Agricultural training services

The total number of staff of the region is 301 both technical (196) and supporting staff.[10] This means that there are on average 14 subject matter specialists at the Sub Zoba level implying that MoA has a good number of subject matter specialists at Zoba and Sub-Zoba levels. It has, however, no intermediate and frontline extension staff. Contact farmers are presently acting as frontline extension staff which has proved inadequate to achieve the expected results.

2.13 Crop production constraints

As shown in the table below unfavourable rain has been ranked to be the first constraint for higher yields. This production limit has been identified by MoA Gash Barka branch. The branch has worked closely with farmers in identifying sites where small scale/large scale diversion schemes could be constructed to alleviate lack of moisture all over the region.

The second constraint to crop production has been found to be shortage of draft animals. Part of the solution to the problem is provision of tractors at subsidized prices, which the Government Garages is doing at the moment. Other constraints are also listed down in the table below.

Table 2.19 Ranked crop production constraints in the surveyed areas

No	Crop production Constraints	N	Score	Rank
1	Access to market	110	**41**	**11**
2	Ownership of land	110	**45**	**10**
3	Low market prices	110	**126**	**9**
4	Lack of capital	110	**153**	**8**
5	Shortage of land	110	**157**	**7**
6	Tractor shortages	110	**254**	**6**
7	Pests	110	**361**	**5**
8	Shortage of seeds	110	**416**	**4**
9	Shortage of labour	110	**449**	**3**
10	Short of draft animals	110	**545**	**2**
11	Unfavourable rain	110	**755**	**1**

[10] MoA Gash Barka Annual Report 2006

3. LIVESTOCK REARING

3.1 Livestock size

According to this survey, estimated livestock population per household is depicted in the table below.

Table 3.1 Livestock population per household for the surveyed villages

Surveyed Villages	Oxen		Cattle other than oxen		Camels		Goats		Sheep		Donkeys	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Wedikiar	0.10	0.32	2.70	4.60	1.30	2.67	12.90	12.17	9.20	12.13	1.30	0.82
Terkina			1.30	2.26	0.10	0.32	5.00	7.90	0.60	1.90	0.40	0.52
Senketkinab			1.00	2.11	1.20	1.48	10.00	7.47	7.70	7.67	1.00	0.94
Bultubyay			2.20	2.49	0.50	0.53	2.80	4.05	0.50	1.58	1.00	0.67
Alebu			0.20	0.63			1.70	3.13	1.50	4.74	0.70	0.67
Mensura	0.20	0.63	2.80	2.94	2.70	3.37	8.70	7.76	10.10	15.84	0.90	0.57
Adikukuy			0.10	0.32	2.40	3.31	8.10	16.00	7.20	13.87	0.80	0.79
Haterdewar	0.70	1.34	1.00	1.70	0.30	0.48	6.50	8.83	2.00	4.22	0.70	0.48
Wakay			1.10	1.91	4.50	6.08	15.30	16.74	8.60	13.49	1.00	0.94
Rahyaabay			3.60	6.19	0.50	1.58	3.40	6.67	0.10	0.32	0.30	0.48
Hawagu			1.60	2.76	1.10	2.47	10.50	17.87	5.80	9.75	0.80	0.92
Average	**0.3**	**0.8**	**1.6**	**2.5**	**1.5**	**2.2**	**7.7**	**9.9**	**4.8**	**7.8**	**0.8**	**0.7**

3.2 Grazing arrangement and livestock feed

Vegetation for livestock grazing is quite dense comprising doum palms and other riverine vegetation along major rivers in the surveyed villages such as the Gash, Barka and Sawa. It provides shade during the dry season. Because of the fact that the area has quite fertile soils and relatively high rainfall (average annual rainfall is about 450 mm), the pasturelands along Gash River boast a high carrying capacity. During the dry season the source of water for livestock is usually shallow hand dug wells on riverbeds and riverbanks which are in the immediate environs/vicinity of the water points. This leads to concentration of animals at the water points, which results to devegetation, and trampling of the grazing lands. The riverine vegetation is also exposed to tree cutting for firewood and forest clearing for agriculture. Hence livestock are dispossessed of the vital shade and grazing area during the hot/dry season.
As mentioned above the grazing of livestock is by and large concentrated around water points during the dry season but spread throughout the pasturelands during the rainy season. Due to this fact and other reasons most livestock are dispossessed of the vital shade and grazing area during the dry season. Therefore, most of the livestock feed during the year is standing hay with low nutritional value because the rainy season is quite short.

3.3 Migration arrangements and seasons

As pointed out earlier on, livestock pressure to the region especially along the major rivers (Gash and Setit) is high mainly due to livestock migrating from Anseba, Barka and even Northern Red sea zones during the dry season (April to June) resulting to overgrazing and shortage of animal feed. Even though farmers have the habit of storing crop residues as a dry season feed reserve, most of it is consumed early in the rainy season before new grasses emerge leaving the animals weak for ploughing and other purposes. To cope with these problems livestock are forced to migrate to Gash and Setit rivers where grass and water are abundant. During the rainy season livestock migrate because all wells are silted with floods and dry season grazing area is ploughed with crops. Let us now see the situation in some of the villages one by one.

Alebu: the village is close to river Gash. There is enough drinking water for livestock through out the year. Livestock travel 30 minutes from grazing area to water point. The pasturelands have enough fodder to carry the livestock population in the area. Since the pastureland is a common property of the community, between February and March livestock migrate from Barka and impose pressure on pastureland leading to a condition where fodder resources become short. Only milking cows & camels stay around the village. Camels migrate to river Setit in September and return back to Barka in June. Cattle migrate to Setit River in May and June in search of grazing land. The respondents stated that they have the habit of storing crop residue as dry season feed reserve that feed milking cows and weak animals from April to June till the growth of new grasses. Even some of them buy crop residue in case of feed scarcity.

Haterdewar: the main source of water for livestock is hand dug wells in Mogoraib River. In April and May, which is the hottest month of the year, they dig wells as deep as 10 meters on the riverbed. The pastureland has got sufficient grass for the villagers' cattle. However, the pressure of livestock migration from Barka and Northern Red sea region, leads to overgrazing and shortage of fodder from April to June. The villagers are not used to the system of volunteer livestock exclusion area. However, here is the habit of crop residue storage as dry season feed reserve that feeds their livestock with out discrimination (less precedence is given to draft animals). The reserve feed is consumed early in the rainy season before new grass emerges leaving oxen weak for ploughing. This situation leaves planting overdue and hence reduction of crop yields. During rainy season livestock migrate to Gash and Setit rivers in search of grazing land and drinking water because all wells are silted up with floods and the dry season grazing area is ploughed and planted with crops.

Bultubyay: during the dry season water is not a problem because they have shallow hand dug wells on Gash riverbeds called 'shiyakh'. In early rainy season there is water problem for livestock because those hand-dug wells are filled with sediments brought by the river. During May and June rain shower is not continuous and not enough in amount to satisfy the animals. During this time animals in the village get water from the pond constructed near the village. During rest of the rainy season usually water from rain accumulates around the villages and is enough for livestock. Pastureland around the village lasts only until March because livestock from Barka come to the village for grazing. After this time usually during April, May and early June animals walk long distances looking for grazing land. This problem of walking long distances is solved when grass starts to grow during the rainy season around the village. The source of feed for animals during the dry season includes sorghum and pearl millet stover and dry grass. They store the feed over locally made shed and lasts until early July. There is animal

feed problem during April, May and June. When the problem is acute they migrate to Setit River usually in June and return back by August.

Wedikiar: livestock are raised on an extensive system that relies on a natural pasture and crop residues. There is no dry period livestock water shortage because they normally have shallow hand dug wells called 'shiyakh' on Gash riverbeds. In early rainy season there is drinking water problem for livestock because those hand dug wells are filled with river flood sediments. During rest of the rainy season usually after July water from rain accumulates around the villages and is enough for livestock. Since the pasturelands are communal, the fodder around the village lasts until March because livestock from Barka come to the village in search of grazing land. Usually during April and June there is shortage of pasture for grazing in most areas. Available pasture and crop residue runs out over the period between April and July. Animals have to migrate or walk long distances in search of grazing areas. Animals lose weight progressively. Losses of livestock from starvation are reported especially during drought years.

3.4 Livestock health

The major livestock diseases in the Sub Zoba by villages are shown in the table below.

Table 3.2 Major livestock diseases in the Sub Zobas surveyed

Animal Type	Sub Zobas						
	Gogne	Haicota	Tesseney	Forto	Mogollo	Akurdet	Mensura
Cattle	CBPP, Trypanasomiasis, FMD	CBPP, Trypanasomiasis, Coccidiosis (calves)	CBPP, Trypanasomiasis	FMD, CBPP, Coccidiosis (calves)	CBPP, Trypanasomiasis, FMD	CBPP, FMD	FMD, CBPP, Coccidiosis (calves)
Camels	Mange, Urinary tract infection, Pneumonic Pasteurellosis, camel pox	Trypanasomiasis, Mange, Pneumonic Pasteurellosis,	Trypanasomiasis, Mange, Pneumonic Pasteurellosis,	Mange, Pneumonic Pasteurellosis, Urinary tract infection	Mange, Pneumonic Pasteurellosis, Trypanasomiasis	Mange, Pneumonic Pasteurellosis	Trypanasomiasis, Mange,
Sheep	Heart water, PPR	PPR, sheep pox	PPR, mange	Hearst water, mange	PPR, heart water, Contagious agalactia	PPR, heart water	Heart water, contagious agalactia
Goats	CCPP, mange	CCPP, goat pox	Heart water, CCPP, mange	Heart water, mange	CCPP, mange, contagious agalactia	CCPP, heart water	Heart water, goat pox
Poultry birds	Newcastle, fowl pox	Newcastle, fowl pox	Newcastle, fowl pox	Newcastle, fowl pox	Newcastle, fowl pox	Newcastle, fowl pox	Newcastle, fowl pox
Donkeys	African horse sickness	African horse sickness	African horse sickness	African horse sickness	African horse sickness	African horse sickness	African horse sickness

3.5 Constraints in livestock production

The major constraints in livestock production are livestock diseases, inadequate veterinary services, poor grazing grounds, easy diseases transmission, and expansion of agriculture and lack of information base on disease epidemiology (pathogen-host-environment relationships).

4. Recommendations

Seed production, multiplication, and distribution

The initiatives already taken in Mensura by three farmers to produce multiply and distribute improved seeds to other fellow farmers inside their village and outside is commendable. It augments MoA efforts to disseminate improved seed varieties, which so far has reached 15.8% of the total cultivated land in the region in 2006. However, the farmers need to attend several trainings to strengthen their capacity and knowledge regarding technical aspects of seeds and seed production, such as genetic and physical purity, germination rates, absence of weed seeds and diseases such smut, testing, storage, multiplication (such as isolation distance, removal of weaker plants and weeds, standard cultural and harvesting practices) and certification. The procedures are not difficult for farmers to pursue and accomplish.

Community organizations/associations/committees

The study has made clear that the existing community structures including the village administration and village development committees, water users associations are already functioning but are feeble. Therefore, the communities need to be mobilized, organized and trained to improve their capacity in planning, implementation, monitoring and evaluation of development programmes.

It is necessary to assist communities simplify their organizations for effectiveness, into those with responsibilities for planning, management, and control of common property, e.g. communal rangeland, irrigation water users association, herders associations etc.

Land ownership

It is observed, for instance, in Mensura that some farmers who don't have interest in farming simply because of their complete ownership traditional rights rent their land. This is in contradiction to Proclamation 58/1994 which aims to ensure that all rural Eritreans have appropriate access to land, both agricultural activities and for housing.

The *tselmi*[11] land tenure system assures lifetime usufruct rights so it would not need modification in this aspect except the need to convert the rights into usufruct rather than complete ownership.

Synergy between irrigation, fertilization and other proper practices

Low soil moisture limits nutrient uptake and yields in semiarid areas such as Gash Barka. So when crops are released of this constraint, they can effectively use much more fertilizer. MoA should, therefore, work towards the introduction of chemical fertilizers in spate irrigated cereals or other crops. The availability of fertilizer makes spate irrigated or generally irrigated investments more profitable. Therefore, grain harvest can definitely grow in the future provided there is synergy between the expansion of irrigation and fertilizer use. Farmers can also benefit more from optimum applications of chemical fertilizers provided that a package of agricultural inputs such as improved varieties, and controlling mechanisms for crop diseases, pests, and weeds are employed. Improved varieties of crops can realize their full genetic potential through optimum application of chemical fertilizers and good cultural practices.

[11] The Tsilmi is a land tenure system practiced in Gash Barka region where land is inherited from forefathers.

Suggestions for further research

- Traditional grain storage systems in the region
- Study on wild edible plants which have importance in alleviating food insecurity in the region
- Study on intercropping practices observed between traditional grain crops (sorghum, and pearl millet) and local traditional (*Heta*, *Kambela* etc) crops in Sub Zoba Gogne
- Animal diseases epidemiological studies
- Study on toxicity of plants (both broad leaved and grasses) to animals