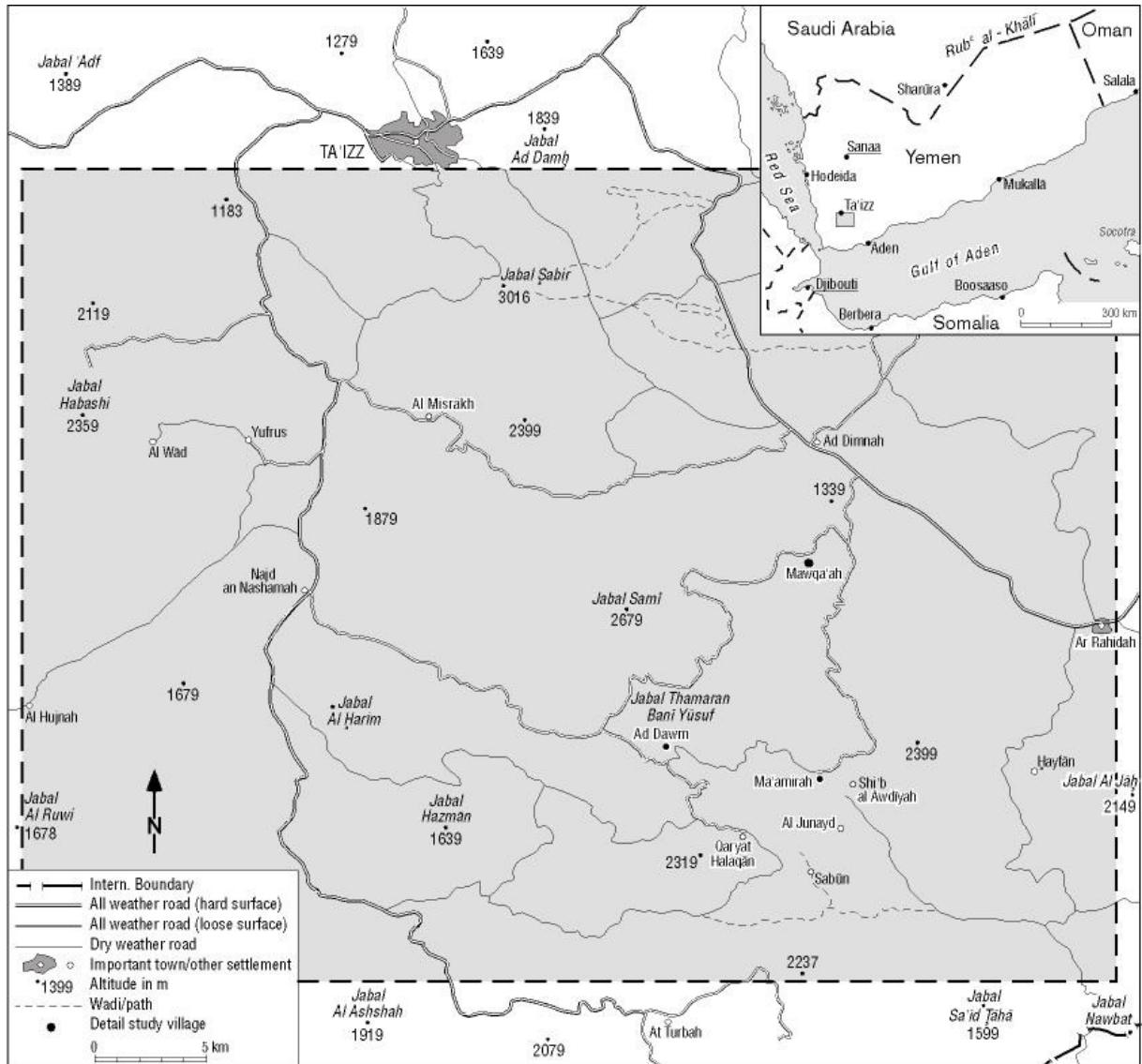


CHAPTER 3: METHODOLOGICAL FRAMEWORK

3.1 Selection of the Study Area

The study area has been selected in Al-Hugariyah Region south of Taiz city, in the southern escarpment of Yemen's western highlands because Q'at, cereals, vegetables and other crops grow also most of the study area located in a large part of Wadi Warazan catchment area. It covers the southern part of Taiz Governorate, south of Saber Mountain to At-Turbah and from Ar-Rahidah in the east to Najd an-Nashamah in the west a joint German Yemeni rural development project. This area is about 1,400 square kilometers, between latitudes $13^{\circ} 10'$ and $13^{\circ} 34'$ N and longitudes $43^{\circ} 48'$ and $44^{\circ} 19'$ E. For the purpose of this study, the area was divided into three levels: the regional, sub regional and sub-sub regional (micro villages') Fig. 3.1.

1. Regional level: Covering all of the study area.
2. Sub-regional level: Covering some 25 villages in Al-Mawasit Area, which has been divided into three districts, according to the recent administrative division of 2001; they are Al-Ma'afer, Al-Mawasit and Sama' Districts.
3. Sub-sub-regional level: Covering three villages located in the Wadi (Valley) Warazan catchment area. These villages represent three different landforms, each with a distinct cropping system.
 - 1) Al-Ma'amirah village: on a highland plateau landform, with a mixed cropping system; i.e. grain, and Q'at in a large area of grain production.
 - 2) Addawm village: on a mountain terrace landform, with mainly Q'at-based cropping system.
 - 3) Mawq'a'ah village: in a narrow flood plain landform, with Wadi-irrigated fruit trees and grain cropping system.



Source: Joint Operations Graphic-Map 1: 250.000 TA'IZZ, 1984.

Design: Al-Ghory; Cartography: D. Engel

Fig. 3.1: Map to show location of the study area

3.2 Description of the Study Area

3.2.1 Physical environment

Taiz province lays approximately between latitude 12.5 and 13.8 N and longitude of 42.5 and 43.8 E. According to Schematic Hydro-geological Map of Yemen, in WRAY-35, 1995, most of Taiz province area is laying over the moderate to poor production aquifer. Western and Southern Slopes of the Yemen Mountain Massif Region are characterized by the sequence of mountains varying in elevation from 300 m to 3016 m above sea level, the average annual rainfall vary from 300 to 500 mm, and the climate is arid to semi-arid (Van der Gun, et. al., 1995). However, rainfall exceeds this average in most of the years in good agricultural mountains area. Intensive, fast rainfall is not uncommon which caused in some years damages to terraced agricultural land. The rainfall occurs during the year in spring season (March - April) and summer season (July -

September) (Aldomi, 1986 and Bamatraf, 1993). Farmland is formed in terraces in the mountain steep slopes, designed to shape the landscape of mountain agricultural land. Terraces start small at the top of different slopes, getting wider with going down of slopes to form large terraces in the bottom of Wadis. Terraces are designed and built to reduce soil erosion and to store rainfall water in addition to formed agricultural area. Terraces are protected by semi-impervious channels to control fast runoff and sediment out the terraces farmland to wadis main outlet channels. The soil depth of terraces varies according to terraces location; it ranges between tenth of centimeters in rock terraces land to several meters in the deep soil terraces. The continuous maintenance requirement is the impact of terrace farmland conditions, which negatively counted to the input cost against the low production per unit area.

The soil in the study area is likely formed from two types of bedrock: the first one is sandstone bedrock, which formed radish soil with texture of sandy loam and silt loam, which is found in the plateau; the second one is Tertiary volcanic bedrock, its fragments resulted in forming of black muddy soil with texture of loam and clay loam soil, which is found in most of volcanic slopes.

Water is limited in the study area, like in other parts of Taiz governorate, rainfall is the main source of irrigation water, which is used directly to irrigate the agricultural land addition to water harvesting from the surrounding rangeland. However, groundwater is commonly used to irrigate cash crops and mainly Q'at, during the dry period, water is even transferred from locations with available water to Q'at areas to irrigate it. Digging of wells is common in study area to provide water mainly for Q'at, drought of spring water is the main impact where people dug wells in upper stream of spring. In general, spring irrigation still exists in the study area where water is available and stopped in many places where springs dry out due to uncontrolled digging wells in the upstream.

3.2.2 Agriculture

Agriculture is practiced on terraces of steep mountains since many centuries ago. Agricultural practices are common work of the family members and collective work among female, in addition to rented labor. Table 3.1 and Fig. 3.2 show the change of the cultivated area under each type of the irrigation during the past three decades. The total cultivated area in Taiz Governorate was 250,000 hectares in 1972 and 1986, and then has decreased drastically to 123432 hectares in 1995. The exact reasons are not clear, but this decrease in cultivated area could probably be associated with: [i] degradation of rainfed terrace-agriculture, [ii] encroach of urban areas on farm land, and [iii] in-appropriate data quality of land areas statistics; i.e. over-

estimation of past records. The area of rainfed agriculture in 1972 was 88.4% of the total cultivated area followed by spring irrigated (7.2%), then by the flood irrigated (4%) and finally by groundwater irrigated (0.4%). While in 1995, the rainfed irrigated was 76% of the total cultivated area followed by groundwater irrigated (17%), then followed by flood irrigated (5%) and finally the spring irrigated (2%) Table 3.1 and Fig. 3.2.

In 1972, the cultivated land was 250,000 hectares, and it was occupied by the following crops: -, 218,000 ha cereals, 12,000 ha pulses, 5,000 ha vegetables, 3,000 ha fruits, 1,000 ha, and 2 million trees of coffee and 0.12 million trees of palm date (CSO, 1972). While the cultivated area in 2001 is 123,432 ha and it was occupied by the following crops, 54,170 ha cereals, 2,204 ha vegetables, 1,483 ha fruits, 3,462 ha pulses, 4,649 ha cash crops, 1,956 ha fodder crops; in addition to 53,508 ha of uncultivated land (MAI, 2001).

Table 3.1: Change of the cultivated land (ha) in Taiz governorate of major farming systems

Years	Total area	Cultivated Area	Farming systems				
			Rainfed	Flood	Spring	groundwater	Uncultivated
1972	250,000	250,000	221,000	10,000	18,000	1,000	0
%	100	100	88.4	4	7	0.4	
1986	250,000	250,000	219,800	10,000	18,000	2,200	0
%	100	100	88	4	7	1	
1995	123,432	74,523	56,874	3,495	1,457	12,697	48,909
%	100	60	76	5	2	17	40
2001	123,432	69,924	35,661	23,774	2,098	8,391	53,508
	100	72	51	34	3	12	28

Source: Statistic Yearbook, 1972, Adomi, 1986, Agricultural Statistic Yearbook, 1995, 97 and 2001.

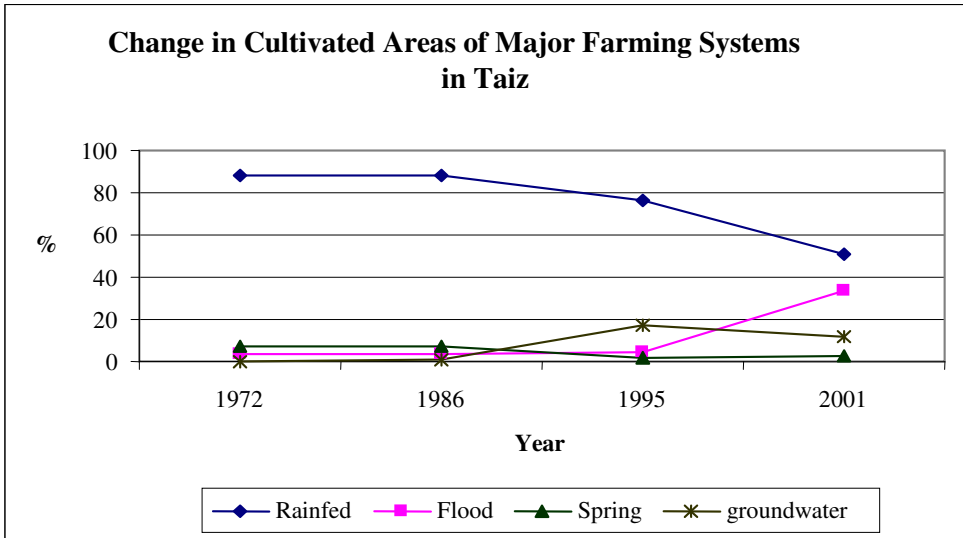


Fig. 3.2: Change in cultivated areas of major farming system in Taiz

The average size of land holding in the governorate varies between 0.25 and 15 ha, 31% of the holder own 15 ha. Land is fragmented, the number of parcels/holding vary from 1 to 15 pieces, 41% of which had 2 -3 pieces (MAF, 1983). Taiz governorate has 13.9% of the number of land holdings (151,906 holders) and 7% of the size of cultivatable land (110,678 ha) in the ROY, according to final results of Agricultural listing of holding in 1993 (CSO, 1997).

3.2.3 Population

The total area of Taiz province is 11254 square kilometer and the population is 2,198,871 inhabitants (Census, 1994), therefore, the population's density is 196 inhabitants per square kilometer it is equivalent to 13.9% of the total population of the ROY, with yearly population growth of 4%; with average, 50.94% for female and 49.06% for male. The resident population in Taiz 2,026,991 inhabitants, from them 1,653,834 inhabitants (81.6%) dwelling in rural area, while 373,157 inhabitants (18.4) dwelling in urban area. The household size is 6.82 and 6.19 persons in urban and rural, respectively; with average size of 6.30 persons. The life expectancy at birth is 58.68 years and 63.09 years for male and female, respectively; with average of 60.84 years.

The population of Taiz governorate known as youthful because the mean age is about 20.4 years and the median age is 13.4 years. However 52% of the population in Taiz Governorate is below 15 years age and 40% between 15 and 50 years of age. This will affect the economic resources because the productive population is small and the percentage of dependency (support) per family is high. In other words, the average percentage of the economic dependency is 539.3 persons; i.e., every 100 economically active persons support 539.3 persons including themselves; while it is 459.4 and 560.92 among the urban and rural population, respectively. Every household has to sustenance or support in the average of 5 persons (CSO, 1994).

Population of Taiz governorate at 10 years old and higher distribution in economic activities are 44% are employee, 34% are self employed, 2% are employer, 18% unpaid family workers, 0.1% unpaid workers, and finally 2% not stated.

Illiteracy among the total population of Taiz governorate is 51.1%; i.e., 76.46% and 31.66% in rural area for female and male, respectively; and 45.43%, and 21.41% in urban area among female and male, respectively. Therefore, 48.9% of the population at 10 years old and higher in Taiz governorate are literacy; 28.68% are able to read and write only; 8.89% have primary level of education; 6.26% have preparatory level; 0.35% have diploma before secondary level; 3.08% have secondary level; 0.36% have diploma after secondary level; 1.1% have university level and above and finally 0.14% not stated (Census, 1994).

3.2.4 Social services and infrastructure

In the mid of 1970's during the oil-boom effect in the region North Yemen was one of the countries affected indirect by the boom. The flow of the remittances and the aid to North Yemen enhanced the government to initiate the constitution to establish the Local Development Associations (LDA). The idea of establishment the LDA started in 1964, then in 1966 and 1967 started again in Anis and in Al-Hujjaryah, while the LDA became active according to the constitution in the middle of 70s (Al-Saidi, 1992). He adds that cooperation in Yemen is not new but it was from ancient time during building the terraces in the mountain areas and during the first Marib Dam, even if it impossible to prove this because of the lack of documented information. The goals of their activities put them in the position taking part of the responsibilities in the development of Yemen. So the main goals to them were to build roads, schools, clinics, and water supply systems. The sources of the money for LDA were from: The Agricultural Zakat (2.5% of the product), a certain percentage from the airline ticket and cinema ticket, taxes on trucks and taxies, certain percentage of customs duties and financial aid and support by the government for some specific projects and assistance by the foreign donors (Al-Saidi, 1992).

However, cooperation of the people in the villages coincides with share of the LDA to build earth roads to connect between rural and urban areas. Therefore, the length of earth roads increased in Taiz governorate from 223 km in 1972 to 341.7 km in 1978 then it reached 562 km in end of 1999 (Table 3.2). Building of roads in mountain areas was difficult and not easy but with cooperation and effort of people it was done and became the main connection between rural and urban areas. The decreasing of the length of earth roads between 1978 and 1988 is due to asphaltting of earth roads. By end of 1999, length of asphalt roads was 384.2 km (Table 3.2).

Table 3.2: Development of asphalt and earth roads in km in Taiz governorate

Year	1972	1978	1988	1991	1993	1997	1999
Asphalt Roads Km	0	193	324	334.5	361.5	380.2	384.2
Earth Roads Km	223	341.7	292	351.1	396	447	562
Total Km	223	524.7	616	685.6	775.5	827.2	946.2

Source: Compiled by Author from CSO for 1972, 78, 89, 91, 93, and 2000.

The activities of the Local Development Association (LDA) also included building clinics, water project, schools ...etc. In the beginning of 1970s, cooperation among people in rural areas change to building schools after roads had been opened. Then the LDA shared with people in villages to build clinics and that coincided with the investments of government and the aid from Arab Oil States and other foreign countries like People Republic of China (Al-Saidi, 1992).

Development of education was taking place in North Yemen especially from mid of 1970s in which number of schools and students gradually increased with increasing of population and investment of government in educational constructions. Involvement of cooperation of people in rural areas and sharing of the LDA in constructing of schools played as important role in developing education among new generations of children. Two systems of education used to be in the country: the general educational system and the other one is called AL-Ma'ahed AL-A'lmiya (it revoked in 2001 and was merged into the general education system). Table 3.3 shows development of number of schools and students from early 1970s to 1999/2000 for general education, and Al-Ma'ahed Al-A'lmyah.

Table 3.3: Development of educations, constructions and students in Taiz governorate from 1972 to 1999/2000

Ed. Sys	Year	Basic*				Secondary				Total Students		Total	
		School	Classes	Students		School	Classes	Students		M	F	School	Classes
				M	F			M	F				
General Education	1972	200	--	30052	5720	1				30052	5720	201	
	1976	350	1645	59836	13049	9	66	2893	314	62729	13363	359	1711
	1988/89	1128	6787	226254	89383	138	479	19229	2255	245483	91644	1166	7266
	1990/91	3363	7545	243538	106541	451	602	21416	4141	264954	110682	3814	8147
	1996/97	1057	11524	325843	173644	393	1534	48177	15399	374020	189043	1450	13058
	99/2000	1023	11871	275650	177224	429	1983	50011	24760	325661	201984	1032	13854
Al-Ma'ahed Al-A'lmyah	1988/89	145	729	23497	4617	21	53	1273	107	24770	4724	166	782
	1990/91	170	910	26006	7030	19	97	1572	194	27578	7224	189	1007
	96/1997	184	1840	47644	21022	221	244	5946	1524	53590	22546	405	2084
	99/2000	191	2322	41699	33973	103	376	7136	4560	48835	38533	192	2698

Sources: Compiled from CSO for 1972, 1976, 1989, 1991, 1997 and 2000. * From first class to the 9th class.

3.3 Data Collection and Analysis

This research has depended heavily on data collected and collated using the following tools:

- Quantitative interview with households using questionnaire in the three detailed study villages
- Qualitative interview with group of people using questionnaire in the villages in the sub-region
- Conducting field study in Q'at field in Addawm village with 6 farmers in 1997 and 1998 to determine the amount of water uses for Q'at, and to economic evaluation
- Conducting field study in two fields of sorghum in Al-Ma'amirah village to economic evaluation in 1997 and 1998.
- Interview random traders and random consumers in weekly markets, to understand the trader's movement between markets and the area served by each market.
- Mapping

3.3.1 Regional level

In this area the following works were conducted.

1) Thematic maps of

a) Estimation of Q'at cultivation in the area, the map filled during field survey observations

b) Location of periodic markets, trader's movement cycle between the markets and

estimation area served by each market. The maps filled according to the information gathered from random traders and consumers in each market.

2) Estimation of economical relation among sub-regions: information gathered from random traders in each market, economical resource is tabulated for each market.

3.3.2 Sub-regional level

The collected data for the sub- regional analysis have been obtained through interviews using qualitative questionnaires to key informants in 25 villages in Al-Mawasit District (it became Al-Ma'afer, Al-Mawasit and Samia' Districts in 2001), with special reference to the selected Wadi Warazan catchment area and the area around Sabun and Masalla.

Qualitative information, in the 25 villages was collected from the key people in villages using a questionnaire, which enquired on the following information (see appendix 1, for detailed questionnaire):

1. Migration within and out of the country
2. Source of water for domestic use and agriculture, number of wells, springs and cost of water transfer, its location source and cost of it at source and at consumption point.
3. Land rental and practices of land sell now and in the past, as well as present prices per unit land.
4. The distribution of families according to land they own
5. The change in cropping pattern (type of crop growing now and in the past), estimation of percentage of the Q'at cultivated area in the village and estimation of the farmland production cover family consumption.
6. Type and source of food consumed 30 years ago and now,
7. Social services (schools and clinics) and infrastructure
8. Duty of family members in agriculture and the situation of collective work in agriculture among male and female
9. New technology entering the village and effect of migrants on innovation
10. The social structure (administration and duties)

The concepts behind the information collected through the questionnaire are to drawdown the data as follows:

- i. Estimation of Q'at cultivation percentage and its reason
- ii. Estimation of number of wells
- iii. Map showing direction of transfer water to irrigate Q'at and water's cost at the source (well) and at the consumption point.
- iv. Found the types of agro-chemical used in Q'at and way of applications (type of mixture)
- v. Relationship between percentages of Q'at cultivation in the villages and how the agriculture production covers the family need.
- vi. Q'at markets and its channels and map showing transferring of Q'at within the region
- vii. Estimation of internal and external migrants before and after 1990 and its consequences
- viii. Collect documents about water right and its problems
- ix. Rental land and its reasons and roles

3.3.3 Sub-sub-regional 'social micro study' level

The data collected from three micro study villages (Al-Ma'amirah, Addawm and Mawq'a'ah) were grouped to the following categories or methods:

1. Interviewing family household using quantitative questionnaire.
2. Mapping of the following features:
 - Expansion of Q'at cultivation between 1990 and 1998 using aerial-photograph, in al Ma'amirah and Addawm.
 - Distribution of cultivated land related to selected families, in al-Ma'amirah and Addawm.
3. Conducting field evaluation study in 1997 and 1998, in Q'at field in Addawm village with 6 farmers, selected randomly in different locations, to determine the amount of water uses for Q'at, to economic evaluation and agro-chemical uses; according to farmer's habit and the time they used to sell their Q'at, without any influences from us. Regarding water part, Only supplementary water recorded and take into the calculation of water used in Q'at field, rainfall was not included in the calculation due to lack of data. In general, rainfall was part of the amount of water consumed by Q'at field. Therefore, and in general, the amount of water used on Q'at fields, rainfall and supplementary irrigation water added in winter, or when the rainfall interval is large, to fulfill the water requirements of Q'at to complete its growth to reach the harvesting stage. Data sheet has been designed to collect data about type of activities practiced in the field, type of labor male or female, family labor or hired labor; amount, source and time of irrigation; amount, type and time of adding agro-chemicals, and

finally the return (see appendix 1 for detail). All water quantities used in irrigation were known from the size of container of tanker or the bottle of 20 liters. While, the quantities of chemicals were known as they bought them from the stores in ml for liquid and in oz or gram for powders.

4. Conducting field evaluation study in two fields of sorghum in Al-Ma'amirah village to economic evaluation in 1997 and 1998. Data sheet has been designed to collect data about type of activities practiced in the two fields; type of labor male or female, family labor or hired labor; input materials such as fertilizer, animal manure and seed, and finally output of all products has been written down (see appendix 1 for detail). The data collected from two fields for two years 1997 and 1998 in Al-Ma'amirah village.

The quantitative questionnaire was used to collect data from three micro study villages (Interview applied to 92 households in Al-Ma'amirah village, 61 households in Addawm village and 18 households in Mawq'a'ah village), consisting of the following aspects (see appendix 1, for detail questionnaire).

- a. Water: domestic use, and water right, b. House-hold information, c. Demographic structure of families, d. Migration information " within Yemen and abroad ", e. Livestock, f. Land Tenure-ship, g. Land Rental, h. Agricultural Crops (input and output), i. Household Economy, j. Seasonal timetable of crop (i.e., Sorghum and Q'at) and k. Labor daily rate

From the information collected through the questionnaire it can drawdown data as follow:

- i. Demographic structure of the family
- ii. Per capita water in summer and winter in the three villages
- iii. Household economy (Q'at in the family expenditure) in the three villages
- iv. Land tenure-ship in the three villages
- v. Sorghum timetable (Crop Calendar)
- vi. Migration of male and its effect on daily labor rate in the three villages
- vii. Duties of the family member in the different agricultural activities in the three villages
- viii. Source of income of the family from non-agricultural activities