

CHAPTER 4: RESULTS AND DISCUSSIONS

4.1 Regional

4.1.1 Description of weekly markets in the region

The system of local weekly markets (LWM) in the region is an old tradition. Weekly markets used to be as a place for economic transactions, and for social interactions for instant communications, transfers of information, political discussions, and arbitrating legal conflicts between traders and consumers. It is not uncommon there to solve the problems between people of the area under the rule of the leader (ash-Sheikh).

a) Market distribution

There are some characters that control the distribution of the LWM over the region either in Taiz province or other province. These characters are, population densities, commodities enter the market, location of the market, in which is reachable by great deal of people and finally it must be near and/or easy to reach by the available transportation facilities. Therefore, LWMs were established in the past due to the need and to facilitate distribution of the commodities. Some of the LWMs were used as transit stations for commodities to transfer them to another region (Fig. 4.1a and 4.1b). For example, Al-Musallah's market (No. 10 Fig. 4.1), which is located southeast Al-Mawasit District; in which the agricultural products from Al-Hujjariah, especially from Al-Mawasit, Sama' As-Salu districts areas, such as vegetables (potatoes), coffee and other products were carried to Al-Musallah's market. In turn these products were transferred to Aden by trucks that brought imported commodities from Aden Seaport, to Al-Musallah's market to transfer them to the region or to the area around Taiz and to Tihama region. The other market that was also used as a transit market is Al-Kadaha's market (No. 4, Fig. 4.1), which is located southwest Najd An-Nashamah in Al-Ma'afer District. It was intermediate between products of Tihama region and the commodities coming through Seaports of Al-Hudeidah and Al-Mukhah in one side and commodities come from east (Al-Hujjariyah) in other side. Also Al-Misrakh market (No. 2, Fig. 4.1) as old people there said, was one intermediate market in the region, in which it was a transit station for commodities coming from west region in Tihama and Al-Mukha and east regions such as Ar-Rahidah. In which Ar-Rahidah was the intermediate market of commodities transfer between Aden and Taiz.

b) Market activities

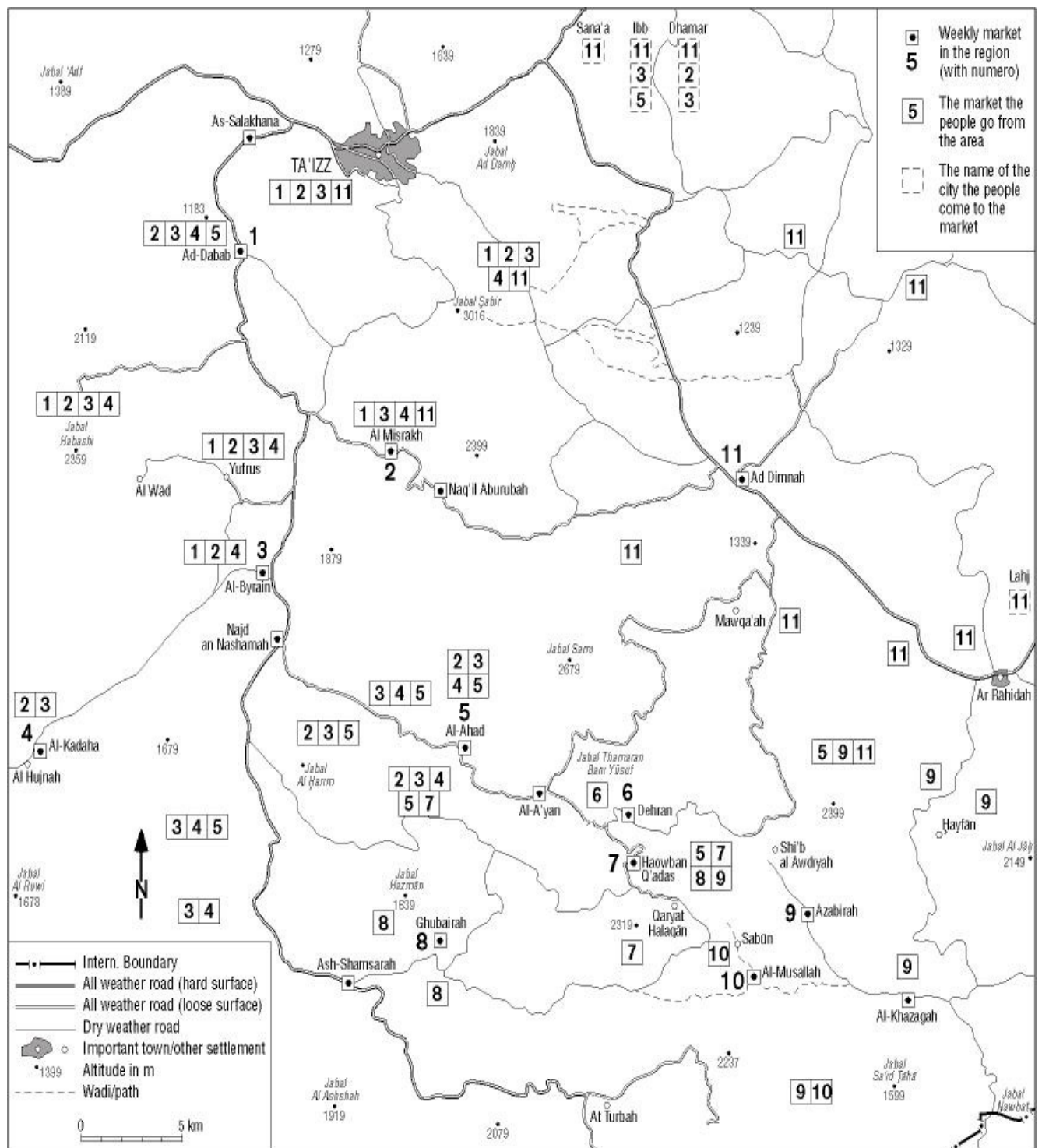
Market's activities are categorized into two systems: the first one is that market provides services to areas; on the other words market serves several villages and districts by providing them with important commodities. The second system is the services of traders in the market and

their movement between markets to exchange benefit between themselves as traders and between them and customers. Traders move between markets in circles to sell and buy in the same time such as these who trade with live animals, and other brought commodities and sell them in the market and some buy their family's need such as instant food and /or Q'at.

Fig. 4.1a shows the area covered by each market, it differs from one market to another according to the location of market in the area and also due to the commodities entering the markets. The important markets have given number, and then the area covered by each market has marked by number of markets where people of that area go to those markets. For example Taiz has marked by 1, 2, 3 and 11 to indicate that the people from Taiz and around used to visit those markets.

While Fig. 4.1b shows movement cycles of traders between markets. It shows several cycles for traders in the area in which it explains the specialty of markets by commodities the traders sold. For instant the circles of live animal traders starts in Taiz, Ahd Ash-Sha'obah, Al-Q'aa'dah, Al-Byrain, and Ad-Demnah; the other circle starts in Ad-Dabab, Al-Byrain, Al-Misrakh and Ad-Demnah and the other one starts in Habil Jabr, Al-Habelain, Q'aa't'bah, Adhalea' and Ad-Demnah. The traders of spices have the circle start in Ad-Dabab, Al-kadaha, Al-Berain, AL-Misrakh and Ad-Demnah. The traders of vegetable have the circle start in the Al-Wadirah, Al-Musalah, Az-Zabirah and Khowalah, and the other circle starts in Ahd Ash-Sha'obah, Al-Q'aa'dah, Al-Byrain, Al-Misrakh and Ad-Demnah. The other trader moved between Al-Haowbn, Dehran, Ghubayrah, and Al-Kadaha, also Ahd Ash-sha'owbah, Al-Byrain, Al-Kadaha and Al-Misrakh.

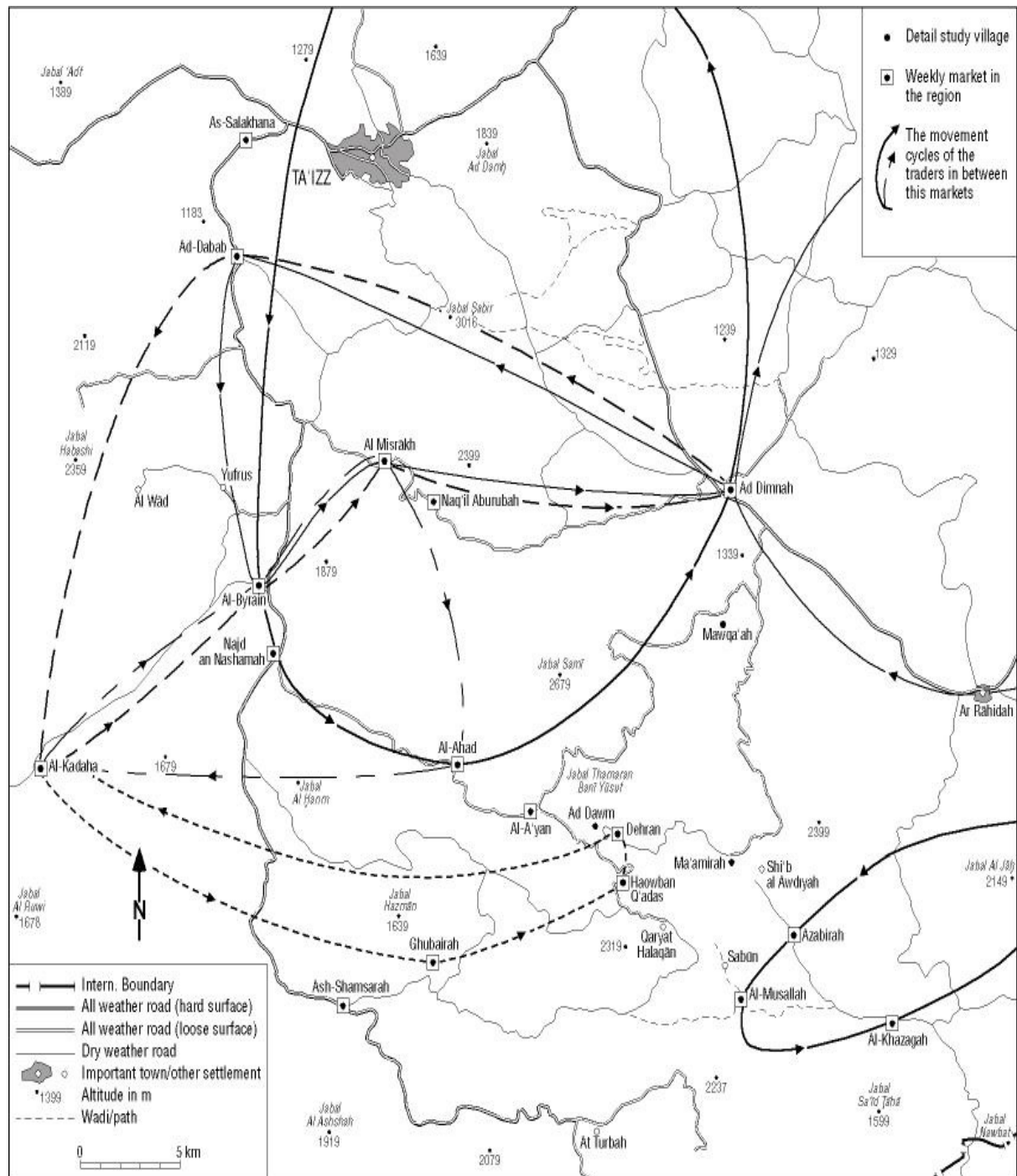
Commodities entering to markets in general are local products either from manufacture or from agriculture and some are imported such as textiles and canned products. The source of manufactured commodities are main cities such as Taiz and central town such as An-Nashmah, Al-Markiz and Tur-Al-Baha. The sources of agricultural products are local valleys in the area, Tihama region (for most of vegetables and fruits), Central Highland such as Dhamar and surroundings areas (for potato and other vegetables), and Sana'a, Sadah, Marib and Al-Jaouf (for grape and citrus product).



Source: Joint Operations Graphic-Map 1: 250.000 TA'IZZ. 1984; own investigations.

Design: Al-Ghory; Cartography: D. Engel

Fig. 4.1a: The local weekly markets in the region



Source: Joint Operations Graphic-Map 1: 250.000 TA'IZZ. 1984; own investigations.

Design: Al-Ghory; Cartography: D. Engel

Fig. 4.1b: The movement's cycles of traders in local weekly market in the region

Traders got the products from the wholesale market in Taiz or directly from production area, which is cheaper for them. More information and detailed description of each market according to the field visit will be in the next section.

4.1.1.1 Markets in Saber-al-Mawadim district

1. Ad-Dabab Market, "سوق الضباب"

Ad-Dabab Market is located in Ad-Dabab valley, in ‘Saber Al-Mawadim’ district. It is an open market, and there are permanent shops which open daily. This market is located to right side of the road from Taiz to At-Turbah. And it is the half way between Taiz and An-Nashmah, is active on Sunday, starting early morning and continues to noon, it covers surrounding villages and several districts. People come from several districts such as Saber, Al-Misrakh, Al-Ma’afer, Jabal Habashi and Taiz either to sell or buy things. Traders come from several areas and these who usually go in the weekly market cycle. Q’at enters market from Saber, Jabal Habashi to sell to consumers.

Table 4.1: Main commodities sold in Ad-Dabab market

Commodity Groups	Commodities	Items	Source
Plant Product	Vegetables	Tomatoes, potatoes, green pepper, leek	Taiz wholesale
	Fruit	Banana, Papaya, melon and seasonal products	Taiz wholesale, local
	Cereals	Sorghum, millet, legumes	Local, and Ibb
	Dried product	Onion, garlic, spices, tea, wazef	Taiz “Ashniny”
	Q’at	Q’at	Saber and Gabal Habashi
	Mats	Mats made from palm leaves	Al-Kadaha
	Straw	Sorghum straw	Tihama
Fishery Products	Fresh		Taiz (al-makha) , Hadramawt
Animal	Live animals	Oxen, goat, sheep, cows, chicken,	Local, Jabal Habashi, Shara’b,
	Fresh meat	camels	Al-kalaiba, Al-Mashawilah
	Dairy product	Cheese	Local
Other commodities	Clothes	Men and women	Taiz
	Shoes	Plastic shoes	Taiz
	Tools	Gardening and plowing tools	From neighbor villages
	Biscuit, canned food and other	Many products	Taiz

Source: By the author, 2004.

Table 4.2: Samples of Traders’ movement

No	Home, Village	Commodities	Sources	Traders’ Weekly cycle
1	Al-Dabab	Spices	Taiz	Sun: 1, Mon & Tue: 4, Wed: 3, Th: 2, Fri: 11
2	Q’adas	Plastic Shoes	Taiz	Sat: Al-Barh, Sun: 1, Mon & Tue: Hajdah, Wed: 3, Th: 2, Fri: 11

Source: By the author, 2004.

4.1.1.2 Market of Al-Misrakh district

2. Al-Misrakh Market, "سوق المسراخ"

Al-Misrakh Market is located in Al-Misrakh area in the center of Al-Misrakh district. This market is approximately 15 kilometer far from Taiz. It is located to the left side of the road from Taiz to At-Turbah. From Najd Qusaim to the left of road from you can enter to the market. It is an open market, and there are permanent shops opened daily, is active on Thursday, starting early morning at 6 o’clock until 1 o’clock in the afternoon. It covers a large area and people come from Bani-Hamad (Al-Mawasit District), Ash-sha’obah, Assenah (Al-Ma’afer District), Jabal

Hbashi district, Saber al-Mawadim district, Shara'b, and from Taiz; either to sell or buy things. Traders come from several areas and these who usually go in the weekly market cycle. Q'at comes from production areas around the market in Saber. This market, as old people in the market said, was one of the intermediate markets in the region, in which it was acting as a transit station between commodities comes from west regions in Tihama and Al-Mukha in one side and east regions such as Ar-Rahidah. In which, Ar-Rahida was intermediate market of commodities transfer between Aden and Taiz and vice versa.

In the past, there was a market located in the area called Jabah, it was not far from the new location and it was active in Sunday and Monday. While there was another market opened on Tuesday in Al-Hirah in Al-Misrakh and in Wednesday there was market in Ras Naqil Abo-Rubah (top head of Abo-Rubah Mountain) in Aq'roud Saber; in Thursday there was market in Al-Wajd in Al-Misrakh. All these markets except one in Ras Naqi Abu-Rubah reorganized to one day in Thursday in Al-Misrakh and it is called Al-Misrakh market.

Table 4.3: Main commodities sold in Al-Misrakh market

Commodity Groups	Commodities	Items	Source
Plant Product	Vegetables	Tomatoes, potatoes, green pepper, leek, carrot	Taiz wholesale, Dhamar
	Fruit	Banana, Papaya, melon, date and seasonal products	Taiz wholesale, local, Tihama
	Dried product	Onion, garlic, spices, tea, Wazef	Taiz "Ashniny"
	Q'at	Q'at	Saber and Gabal Habashi
	Mats	Mats made from palm leaves	Al-Kadaha
Fishery Products	Fresh	Fresh fish	Taiz (al-makha), Hadrmwt
Animal	Live animals	Goat, calf, sheep, cows, chicken	Local, Al-kalaiba
	Fresh meat		
	Dairy product	Cheese	Al-kadaha
Other commodities	Clothes	Men and women	Taiz
	Shoes	Plastic shoes	Taiz
	Tools	Gardening and plowing tools	From neighbor villages
	Biscuit, canned food and other	Many products	Taiz

Source: By the author, 2004.

Table 4.4: Samples of traders' movement

No	Home, Village	Commodities	Sources	Weekly cycle
1	Al-kalaibah	Life animals	Weekly markets	Sun: 1, Wed: 3, Th: 2, Fri: 11
2	Al-Misrakh	Life animals	Weekly markets	Sun: 5, Wed: 3, Th: 2, Fri: 11
3	Ad-Dabab	Spices	Taiz	Sun: 1, Mon & Tue: Al-Kadaha, Wed: 3, Th: 2, Fri: 11
4	Ba'dan in Ibb	Potatoes	Dhamar	Sun: 5, Tue: al-Q'aa'dah, Wed: 3, Th: 2, Fri: 11

Source: By the author, 2004.

4.1.1.3 Markets of Al-Ma'afer district

3. Al-Byrain Market, "سوق البيرين"

Al-Byrain Market is located in the valley of Al-Byrain in A'ozlat As-Swa, which is part of Al-Ma'afer district. The market is located to right side of road from Taiz to At-Turba in one

kilometer before An-Nashamah. It is an open market and there are permanent shops opened daily, it is active on Wednesday, starting in the early morning while some traders gather on Tuesday night, and it continues to the afternoon on Wednesday. The market serves a large area, many people come to the market from several districts such as Al-Mawasit (Al-Aalowm, Bani-Hamad and Q'adas), Al-Ma'afer (Ash-sha'obah and As-Senah), Sama', AS-Salu, Jabal Habashi, Al-Mesrakh, Saber and also from Shara'b and Taiz to buy or to sell commodities

Traders come from several areas, such as Shara'b, Ibb, Dhamar and these who usually go in the weekly market cycle. Q'at comes from production areas around the market in Al-Mawasit, Jabal Habashi and Saber. It is mainly famous for live animals trading, a lot of live animals enter the market especially oxen from Shara'b. Also domestic animals such as cows, sheep, and goat sell to consumers and/ or to dealers to sell in other markets.

Table 4.5: Main commodities sold in Al-Byrain market

Commodity Groups	Commodities	Items	Source
Plant Product	Vegetables	Tomatoes, potatoes, green pepper, leek, Carrot	Taiz wholesale, local
	Fruit	Banana, Papaya, melon, date and seasonal products	Taiz wholesale, Tihama, local
	Cereals	Sorghum, millet, legumes	Local, Taiz and Ibb
	Dried product	Onion, garlic, spices, tea, Wazef	Taiz "Ashniny"
	Q'at	Q'at	Saber, Al-Mawasit and Gabal Habashi
	Mats	Mats from palm leaves	Al-Kadaha
Fishery Products	Fresh	Fresh fish	Taiz (al-makha), Hadramawt
Animal	Live animals	Oxen, goat, sheep, cows, chicken,	Local, Jabal Habashi, Shara'b,
	Fresh meat	camels	Al-kalaiba, Al-Mashawilah
	Dairy product	Cheese	Al-Kadaha, local
Other commodities	Clothes	Men and women	Taiz
	Shoes	Plastic shoes	Taiz
	Tools	Gardening and plowing tools	From neighbor villages
	Biscuit and canned food	Many products	Taiz

Source: By the author, 2004.

Table 4.6: Samples of traders' movement

No	Home, Village	Commodities	Sources	Weekly cycle
1	Al-Misrakh	Mats	Al-kadaha	Sat & Sun: 5, Mon & Tue: 4, Wed: 3, Th: 2
2	Al-Mashawelah	Sugar & tea	Taiz	Mon & Tue: 4, Wed: 3
3	Suhban Ibb	Cereals	Ibb	Sun: 5, Tue: Al-Q'aa'dah, Wed: 3
4	Ibb	Cereals	Dhamar	Sun: 5, Tue: 4, Wed: 3
5	Al-Mikhlef	Life animals	Weekly markets	Sat: Aswaiq', Sun: 1, Mon: Hajdah, Tue: Al-Q'aa'dah, Wed: 3, Th: Taiz, Fri: 11
6	Ad-Dabab	Spices	Taiz	Sun: 5, Tue: Al-Q'aa'dah, Wed: 3, Th: 2, Fri: 11

Source: By the author, 2004.

4. Al-Kadaha's Market, "سوق الكدحة"

Al-Kadaha Market is located in Al-Kadaha area in Al-Mashawelah Asofla in Al-Ma'afer district. This market is located southwest of An-Nashamah, to enter to Al-Kadaha market is from Al-Byrain on the right side of the road from Taiz to At-Turbah passing by valleys between Jabal

Habashi and Al-Ma'afer districts. It is an open market, and there are permanent shops opened daily, it is active on Tuesday, traders start to gather from Monday afternoon especially for these who trade in local cheese, because al-Kadaha market is specialized in local cheese products as many animals live in the area. The market continues its activity until the late afternoon on Tuesday.

Old people in the market said that the market in the past during Imam's time was active for three days a week; Sunday, Monday and Tuesday. The commodities came to market from Tihama and from Al-Hojjaryah. Important commodities were sold in the market, live animals and local cheese, which was made in neighboring villages due to availability of milk; cheese is still sold in the market till today. It was used as a transit market between the commodities coming from Tihama region and Al-Hujjariyah area. Now it is specialized only in selling of local cheese and the products made from date palm trees, such as mats and other stuff. Live animals (cows, sheep, and goat) are sold for domestic use and for the other market for meat.

The market serves a large area, in which many people come to the market from several districts such as Al-Ma'afer (Mashwelah Soflah, Ash-sha'obah, Assenah, Al-Byrain and Al-Kalaibah), Al-Mawasit (Al-Aa'lowm, Bani-Hamad and Q'adas), Sama', Jabal Habashi, Al-Misrakh, Saber and Maqbanah; either to sell or buy things. Traders come from several areas and these who usually go in the weekly market cycle. Q'at comes from production areas around the market in Jabal Habashi and Saber.

Table 4.7: Main commodities sold in Al-Kadaha market

Commodity Groups	Commodities	Items	Source
Plant Product	Vegetables	Tomatoes, potatoes, green pepper, carrot, leek	Taiz wholesale
	Fruit	Banana, Papaya, date and seasonal products	Taiz wholesale, local
	Dried product	Onion, garlic, spices, tea, Wazef	Taiz "Ashniny"
	cereals	Sorghum, millet	Local and Ibb
	Q'at	Q'at	Saber and Gabal Habashi
	Mats	Stuff made from palm leaves	Local (al-Kadaha)
Fishery Products	Fresh		Taiz (Al-Makha), Hadrmout
Animal	Live animals	Goat, sheep, cows, chicken	Local, Jabal Habashi
	Fresh meat		
	Dairy product	Cheese	Local
Other commodities	Clothes	Men and women	Taiz
	Shoes	Plastic shoes	Taiz
	Tools	Gardening and plowing tools	From neighbor villages
	Biscuit and canned food	Many products	Taiz

Source: By the author, 2004.

Table 4.8: Samples of traders' movement

No	Home, Village	Commodities	Sources	Weekly cycle
1	Q'adas	Mats & cheese	Buy from the market	Sun: 5, Mon: 4 Tue: 7, Wed: 6, Th: 8, Fri: 7
2	Al-Misrakh	Mats	Buy from the market	Sat & Sun: 5, Mon & Tue: 4, Wed: 3, Th: 2
3	Al-Mashawelah	Tea & sugar	Taiz	Mon & Tue: 4, Wed: 3
4	Ibb	Cereals	Ibb	Sun: 5, Tue: Al-Q'aa'dah, Wed: 3

Source: By the author, 2004.

5. Al-Ahad Market, ”سوق الأحد أو سوق أحد الشعبويه”

Al-Ahad Market is located in Ash-sha’obah village, in Al-Ma’afer district. It is an open market and there are permanent shops open daily to sell Q’at and other commodities. This market is located in the way between An-Nashamah and Al-A’yan, it is active on Sunday starting early morning. Some traders gather from Saturday night, and it continues to Sunday at noon or little bit later. It covers a large area, many people come to the market from several districts, such as Al-Ma’afer (Ash-Sha’obah, Al-Klaibah and Al-Gabziah), Al-Mawasit (Al-Aa’lowm, Bani-Hamad, Q’adas and Assenah), Sama’ and As-Salu, either to sell or buy things. Traders come from several areas and these who used to go in the weekly market cycle. Q’at comes from production areas located around the market such as Bani-Yosif, Sama’, Q’adas and Saber. Al-Ahd market is used as a daily transit station for Q’at that comes from Al-Mawasit and Sama’ districts, especially in the season of Q’at production, either to sell it in the market to consumer or to transfer to other markets in the region.

Table 4.9: Main commodities sold in Al-ahd Market

Commodity Groups	Commodities	Items	Source
Plant Product	Vegetables	Tomatoes, potatoes, green pepper, leek	Taiz wholesale, local
	Fruit	Banana, Papaya, melon and seasonal products	Taiz wholesale, local
	Cereals	Sorghum, millet, legumes	Local, and Ibb
	Dried product	Onion, garlic, spices, tea, Wazef	Taiz “Ashniny”, al-Mukha
	Q’at	Q’at	Saber, Sama’, and al-Mawasit
	Straw	Sorghum straw	Tihama
	Mats	Stuff made from palms leaves	Al-Kadaha
Fishery Products	Fresh	Fresh fish	Taiz (al-Mukha), Hadramawt
Animal	Live animals	Goat, sheep, cows, chicken,	Local, other market,
	Fresh meat		
	Dairy product	Cheese	Local
Other commodities	Clothes	Men and women	Taiz
	Shoes	Plastic shoes	Taiz
	Tools	Gardening and plowing tools	From neighbor villages
	Biscuit and canned food	Many products	Taiz, An-Nashamah

Source: By the author, 2004.

Table 4.10: Samples of traders’ movement

No	Home, Village	Commodities	Sources	Weekly cycle
1	Al-Misrakh	Mat & related products	Al-Kadaha	Sat & Sun: 5, Mon & Tue: 4, Wed: 3, Th: 2
2	Al-Markiz	Goat, sheep	Buy from the market	Sun: 5, Mon: Taiz, Tue: Al-Q’aa’idah, Wed: 3, Th: Taiz, Fri: 11
3	Al-A’zaa’z	clothes	Taiz	Sa: Aswaiq’ in Ibb, Sun: 5, Tue: Maitam in Ibb, Wed: 3, Th: 2, Fri: Al-Markiz
4	Al-A’zaa’z	Vegetables	Tihama & Ma’bar	Sun: 5, Mon & Tue: Al-Q’aa’dah, Wed: Al-Barh or Taiz, Th: 2, Fri: 11
5	Al-Kalaibah	Vegetable	Ma’bar	Sun: 5, Mon: villages in Asinah, Tue, An-Nashamah, Wed: 3, Th: 2, Fri & Sat: Nagd Q’usaim
6	Suhban, Ibb	Cereals	Ibb	Sun: 5, Tue: Al-Q’aa’dah, Wed: 3,

Source: By the author, 2004.

4.1.1.4 Markets of Al-Mawasit district

6. Dehran Market “سوق دهران”

Dehran market is located in Sailat (water's channel) Dehran in Addawm village in Bani-Yosif, in Al-Mawasit district. It was in the past a big market, but now it is continuing to active only for three hours in Wednesday. Three to four traders come to the market only to sell local cheese and sweet from al-Kadaha, fruit from Mawq'a'ah valley and green onion and garlic from Sama'. While, during Q'at season it is active daily as wholesale market. Q'at traders come from Taiz, Hodeidah, and from neighboring areas to buy and sell Q'at and transfer it to other markets. During Q'at season market is starting at 4 o'clock in the afternoon, and continues to next morning. Q'at comes to market from Bani-Yosif, Q'adas (Al-Mawasit District) and from Sama' District.

Table 4.11: Samples of traders' movement

No	Home, Village	Commodities	Sources	Weekly cycle
1	Q'adas	Mats & cheese	Al-Kadaha	Sun: 5, Mon: 4 Tue: 7, Wed: 6, Th: 8, Fri: 7
2	Sama'	Fruit	Mawq'a'ah	Mon: Faofala, Tue: 7, Wed: 6, Fri: 7/11

Source: By the author, 2004.

7. Hawban Q'adas Market, "سوق حوبان قدس"

Hawban Q'adas market is located in Al-Hawban area in Q'adas, in Al-Mawasit district. It is an open market, and there are permanent shops opened daily. This market is located in the way between Al-A'yan in the west and Halaq'an in the east, is active on two days (Friday and Tuesday) starting in both days early morning and continuing to 12 noon. People on Friday's market more than that at Tuesday's market. It covers al-Mawasit (Bani-Yosif, Bani-Hamad and Q'adas) and Sama' districts and many people come either to sell or to buy things. Traders are from the region and these who used to go in the weekly market cycle. Commodities are sold in the market to consumers while, in Q'at season, Q'at is sold to traders to transfer it to other markets.

Table 4.12: Main commodities sold in Hawban Q'adas market

Commodity Groups	Commodities	Items	Source
Plant Product	Vegetables	Tomatoes, potatoes, green pepper, leek	Taiz wholesale, local
	Fruit	Banana, Papaya and seasonal products	Taiz wholesale, local
	Dried product	Onion, garlic, spices, tea, Wazef	Taiz "Ashniny"
	Mats	Stuff made from palms leaves	Al-Kadaha
	Q'at	Q'at	Al-Mawasit, Sama'
Fishery Products	Fresh	Fresh fish	Taiz (al-mukha), Hadramawt
Animal	Fresh meat	goat, sheep, chicken, calf	Local,
	Dairy product	Cheese	Al-Kadaha
Other commodities	Clothes	Men and women	Taiz
	Shoes	Plastic shoes	Taiz
	Tools	Gardening and plowing tools	From neighbor villages
	Biscuit and canned food	Many products	Taiz, An-Nashamah

Source: By the author, 2004.

Table 4.13: Samples of traders' movement

No	Home, Village	Commodities	Sources	Weekly cycle
1	Q'adas	Mats & cheese	Al-Kadaha	Sun: 5, Mon: 4 Tue: 7, Wed: 6, Th: 8, Fri: 7
2	Sama'	Fruit	Mawq'a'ah	Mon: Faofala, Tue: 7, Wed: 6, Fri: 7/11
3	Q'adas	Dry spices	Al-Ahad	Sun: 5, Tue: Azariq'a, Fri: 7
4	Bany-Hamad	Fresh fish	Taiz (al-Mukha)	Sun: 5, Tue & Fri: 7, Wed:3, Th: 8

Source: By the author, 2004.

8. Ghobirah Market “سوق غبيرة”:

Ghobirah Market is located in al-Aifoa' in the area called Ghobirah in Al-Mawasit District. It was a big market in the past, live animals came to the market from Al-Byrain, Ahad Ash-Sha'obah and from Al-Barh. Fruits and vegetables came to the market from neighboring valleys. While, now very little of leeks and dates during the season of the date are sold in the market, few traders and few people come to the market from neighboring villages. The reduction of market activity is due to the new towns which exist near to the asphalt road, is called As-Samsarah, which is located 5 kilometers to the west and has a lot of shops selling all commodities, such as live chicken, vegetables, wheat, flour, fruit ...etc. Few traders come to the market, one sells local cheese and sweet, another one sells sweet and another has a small shop and on Thursday (market day) he spreads some of commodities in front of his shop to help activating the market as a tradition habit. Two people have goat and sheep come to sell them as a source of income for their families, also, fresh fish is available in the market. It is obviously that Q'at is not common in the market but if people need it, they have to go to As-Samsarah. People come to the market from neighboring villages and students of the school near to the market.

Table 4.14: Samples of traders' movement

No	Home, Village	Commodities	Sources	Weekly cycle
1	Q'adas	Mats & cheese	Al-Kadaha	Sun: 5, Mon: 4 Tue: 7, Wed: 6, Th: 8, Fri: 7
2	Bany-Hamad	Fresh fish	Taiz (al-Mukha)	Sun: 5, Tue & Fri: 7, Wed:3, Th: 8

Source: By the author, 2004.

9. Central Market, “السوق المركزي” (سوق الزبيره)

Central market is located in the valley of Az-Zabirah in Q'adas, in Al-Mawasit district. It is an open market, and there are permanent shops opened daily, it is active on two days Friday and Monday, starting in both days early morning to 11 am. But it is active daily for Q'at especially during the high production season. It covers a large area so that many people come from neighboring villages in several districts such as Al-Mawasit (Q'adas), As-Salu, Hayfan (Aa'roq', Aa'mour and Ahkoum) and Al-Maqaterah (Tour-al-Bahah) either to sell or to buy things. Traders are from the region or these how used to go in the weekly market cycle. People visit Friday's market more than that at Monday's market. Q'at comes to market from Q'adas and Bany-Yousef,

it is sold to consumers in the market and during Q'at season it is sold to traders from out of the region to transfer it to other markets in south district such as Lahj and to Al-Q'abitah district.

The market started approximately 15 years ago, in the beginning it started by one person who used to bring Q'at and sell it to people after Friday prayer, then some other people were gathered to sell other commodities. Then it expanded and became common on Friday, with increasing of Q'at flows to the market it opened on Monday and then it became daily for Q'at. When Q'at is rare in Q'adas and Bani-Yousif, some Q'at comes from Adhalea'.

Table 4.15: Main commodities sold in Az-Zabirah market

Commodity Groups	Commodities	Items	Source
Plant Product	Vegetables	Tomatoes, potatoes, green pepper, leek	Taiz wholesale, local
	Fruit	Banana, Papaya, mango and seasonal products	Taiz wholesale, local
	Dried product	Onion, garlic, spices, tea, Wazef	Taiz "Ashniny"
	Q'at	Q'at	Q'adas, Bani-Yousif, Adhalea'
	Straw	Sorghum straw	Tour-Al-Baha
Fishery Products	Fresh	Fresh fish	Taiz (al-Mukha), Hadramawt
Animal	Fresh meat	Calf, chicken	Local
Other commodities	Clothes	Men and women	Taiz
	Shoes	Plastic shoes	Taiz
	Biscuit and canned food	Many products	Taiz, Tour- Al-Baha

Source: By the author, 2004.

Table 4.16: Samples of traders' movement

No	Home, Village	Commodities	Sources	Weekly cycle
1	Ahkoum	Canned food	Tour- Albaha	Sun: Al-Wadirah, Mon: 9, Tue: Khowalah, Wed & Th: Tour- Al-Baha, Fri: 9
2	Ahkoum	Live chicken	Ahkoum, Ar-Rahida	Sun: Al-Wadirah, Mon: 9&10 Tue: Khowalah, Wed & Th: villages in the area, Fri: 9 &10
3	Aa'mour	Vegetables	Taiz wholesale market	Sun: Al-Wadirah, Mon: 9, Tue: Khowalah, Wed & Th: villages in the area, Fri: 9

Source: By the author, 2004.

10. Al-Musallah Market, "سوق المصلى"

Al-Musallah Market is located in Al-Mussallah in Al-Ahkoum, in Hayfan district. It is an open market, and there are several permanent shops opened daily. This market is located in the way down from Q'adas to Al-Ahkoum and it was the main market in the past during colonization of British to Aden. It was an intermediate station for commodities produced in Al-Mawasit areas such as vegetables (potatoes), coffee and other products and imported commodities through Aden seaport. Products in the region were carried to Al-Musallah market and transferred to Aden by trucks that brought imported commodities to transfer them to the region or to the area around Taiz and to Tihama.

Nowadays, it is active on two days (Friday and Monday) starting in both days early morning until 11 am. It covers the villages around it from Al-Ahkoum and Sabon in Q'adas.

People visiting the market are from these areas I mentioned before and they are not much and they come either to sell their products of the valley or those who come to buy things for their families. Also a few traders are from the region or these who used to go in the weekly market cycle come to the market to sell their commodities. Q'at comes from Q'adas and Bani-Yosif and is sold in the market to the consumers.

Table 4.17: Main commodities sold in Al-Musallah market

Commodity Groups	Commodities	Items	Source
Plant Product	Vegetables	Tomatoes, potatoes, green pepper, leek	Taiz wholesale, local
	Fruit	Banana, Papaya, mango and seasonal products	Taiz wholesale, local
	Dried product	Onion, garlic, spices, tea, Wazef	Taiz "Ashniny"
	Q'at	Q'at	Q'adas, Bani-Yousif, Adhalea'
Fishery Products	Fresh	Fresh fish	Taiz (al-Mukha), Hadramawt
Animal	Fresh meat	Calf, chicken	Local
Other commodities	Clothes	Men and women	Taiz
	Shoes	Plastic shoes	Taiz
	Biscuit and canned food	Many products	Taiz, Tour- Al-Baha

Source: By the author, 2004.

Table 4.18: Samples of traders' movement

No	Home, village	Commodities	Sources	Weekly cycle
1	Ahkoum	Live chicken	Ahkoum, Ar-Rahida	Sun: Al-Wadirah, Mon: 9&10, Tue: Khowalah, Wed & Th: villages in the area, Fri: 9 & 10
2	Ahkoum	Vegetables	Taiz wholesale market	Sat: Tur-Al-Baha, Sun: Al-Wadirah, Mon: 10, Tue: Khowalah, Wed : Araboa' Market in Al-Maq'aterah, Th: Al-Farsh in Asabiha, Fri: 10

Source: By the author, 2004.

4.1.1.5 Markets of Khadir district

11. Dimnat Khadir Market, "سوق دمنة خدير"

Dimnat Khadir Market is located in Ad-Dimnah in Dimnat Khadir district. It is an open market, and there are several permanent shops opened daily. The market is located near the main asphalt road in the half way of road connecting Taiz and Aden through Ar-Rahidah, it is active on Friday starting early morning and continuing to late afternoon, traders gather from Thursday night.

According to information from old people I had meet in the market, the market started about 60 years ago and it was only near the building of the governor, which still exists. However, it enlarged after 26 of September 1962 revolution, especially in the mid of 1970s during the rule of Al-Hamdi. In which, permanent shops were in expansion to sell local and imported commodities. It covers surrounding villages in Khadir district and the people come from Saber, Hayfan, As-Salu, Sama', Al-Q'abitah, Mawiyah, Taiz and from other cities such as Ibb, Dhamar,

Lahj and Sana'a either to sell or to buy things. Traders come from several areas and these who usually go in the weekly market cycle. The main character of this market is that it holds a very big market for live animals, in which live animals come to the market from neighboring areas and that coming by animals traders from other areas and markets either for sell or exchange between traders. Q'at is available daily in the market but it is great deal in Friday market as huge numbers of people come to the market. Q'at comes to the market from Saber, Sama', Al-Mawasit and from Mawiyah to sell it in the market to the consumer.

Table 4.19: Main commodities sold in Ad-Dimnah Khadir market

Commodity Groups	Commodities	Items	Source
Plant Product	Vegetables	Tomatoes, potatoes, green pepper, carrot, leek	Taiz wholesale,
	Fruit	Banana, Papaya, melon, date orange, and seasonal products	Taiz wholesale, local, Tihama
	Cereals	Sorghum, millet, legumes	Local, and Ibb
	Dried product	Onion, garlic, spices, tea, Wazef	Taiz "Ashniny"
	Q'at	Q'at	Saber, Sama', Al-Mawasit, Mawiyah,
	Mats	Stuff made from palm leaves	Al-Kadaha
	Straw	Sorghum straw	Tihama, local
Fishery Products	Fresh	Fresh fish	Taiz (al-Mukha), Hadramawt
Animal	Live animals	Oxen, goat, sheep, cows, chicken,	Local, Shara'b, Al-Habilin,
	Fresh meat	camels	From other markets
	Dairy product	Cheese	Al-kadaha
Other commodities	Clothes	Men and women	Taiz
	Shoes	Plastic shoes	Taiz
	Tools	Gardening and plowing tools	From neighbor villages
	Biscuit and canned food	Many products	Taiz

Source: By the author, 2004.

Table 4.20: Samples of traders' movement

No	Home, Village	Commodities	Sources	Weekly cycle
1	Al-Misrakh	Live animals	Weekly markets	Sun: 5, Wed: 3, Th: 2, Fri: 11
2	Ad-Dabab	Spices	Taiz	Sun: 1, Mon & Tue: 4, Wed: 3, Th: 2, Fri: 11
3	Ba'dan- Ibb	Potatoes	Dhamar	Sun: 5, Tue: Al-Q'aa'idah, Wed: 3, Th: 2, Fri: 11
4	Hais	Dry Vegetables	Tihama & Taiz	Sat & Sun: Asahoul, Mon: Ashorman, Tue: Al-Q'aa'dah, Wed: dh-Asufal, Th: Mawiyah, Fri: 11
5	Al-Habilain	Live animals	Habilain	Sat: Habil Jabr, Sun: Al-Habilain, Mon: Q'a'tabah, Tue & Wed: Al-Habilain, Th: Adhlea', Fri: 11

Source: By the author, 2004.

4.1.2 The Q'at situation analysis

4.1.2.1 History of Q'at in Yemen

Trees of Q'at are growing in Yemen and in the eastern mountains and mid of Africa, also it was found as wild plants in the region of Turkistan and Afghanistan (Al-Q'erby 1998). Related to history of Q'at and the beginning of its growth in Yemen, several ideas and theories had been written, in which some of them said that the origin of Q'at is in Yemen and other said Ethiopia is the origin of it and each side has his explanation. However, those how wrote on fiver of Yemen

is the origin of Q'at, due to that the Hararian people believe that the Q'at origin is Yemen and when a group of religious and civic leaders who met one day to determine a suitable site to established a new city, they chose Harar due to it as suitable landscape, elevation and many rivers and streams occurred in the area. But it was soon discovered that the air of Harar town had a depressing effect on the people and made them tired and very lazy. The council met again to discuss the problem and they agreed that the holy tree of Alexander the Great “Dhu al-Q’arnayn” was the cure. Then a mission of merchants was gone to Yemen to fetch the Q'at and thus the first Q'at is said to have come to Harar and indeed to Ethiopia (Krikorian, 1987, Getahun, et. al., 1973 and Asayedy, et. al.).

While, in the other side who wrote in favor that Ethiopia is the origin of Q'at, such as (Shujaa', 2000); he rejects all theories and ideas that the Q'at was originated in Yemen because it was not mentioned in the book called “Feature of Arabic Peninsula” (*S'fat Jazirat Al-Arab*) for Abi al-Hasan al-Hamdani who died at 334 AH, 945 AD, in which he described Yemen in details and he reported about available plants in Yemen during his time so, if the plant of Q'at was available in Yemen at that time al-Hamdani would have mentioned it. Shujaa' continued his arguments on Q'at and he said that Q'at entered Yemen during the thirteenth century because the scholar Ibn kebn Al-Tabari who died in 842 A.H. wrote about Q'at and Ibn A'alwan who died in 665A.H asked in his book to forbid Q'at.

In the book called “*Masalik al-absar fi-mamalik al-amsar*”, its author Al-'Umari Fadle Allah who dead in 749 AH- 1348 AD, said that, Q'at entered Yemen in the end of seventh century A.H (thirteenth century A.D.). That was during Rasulian King “Al-Mua'id Daoud” which ruled from 696 AH -1216 AD to 721AH- 1321AD, when an Ethiopian Muslim man came to Yemen and closely worked with King Al-Mua'id, and he got his trust, then he talked to the King about Q'at tree and he convinced him to bring it from Ethiopia to plant it in Yemen. Then the king sent a merchant to Ethiopia to bring Q'at tree. Then it was planted in Yemen, after while when Q'at branches were grown well and when they were ready for chewing, the King asked the Ethiopian man about effects of Q'at chewing, he said it decreased food appetite, drink and sex. Then the King said “what are the pleasures remaining for us in this life, I swear by Allah never eat it” (Al-'Umari, 1927).

Another story indicated that Q'at and coffee plant was transferred from Ethiopia to Yemen by Shaykh al-Shadhli, the reputed founder of Mocha and patron saint of coffee, first brought coffee and Q'at and he was given nickname as Abu Azahrain or Father of Flowers. It is said that he brought these two plant's cuttings, from Ethiopia to a Yemeni town called Al-A'udain (which means the two branches), which was named in honor of the two cuttings, one of Q'at and one of

coffee which were planted there when they were first brought to Yemen. At the present time, neither Q'at nor coffee is grown in the immediate vicinity of Al-A'udain, though coffee is still found further towards the east up in the Wadi Dour toward Ibb, while Bilad Sharr on the same road is an important source of the supply of Q'at in Ibb province (Kennedy, 1987).

Q'at was first used in the thirteenth century, and that initial use was as a “tea” among *Mashaykh al-Sufia* and religious men to increase their mystic experiences and Q'at use increased for the same reason among first class and rich people (Schopen, 1979). However, Q'at chewing became tradition in Yemen from 1873, and its growth expanded and reached to Haraz and Hofash then it became an important cash crop in Yemen from the end of nineteenth century. And load of two thousands camels of Q'at was exported to Aden yearly; and from twentieth century it expanded to cover poor people, women and students (Schopen, 1978).

4.1.2.2 Agricultural practices and recent changes in land use

Nowadays agricultural practices do not differ from that in the past concerning working in the land but the crop growing and the purpose of the crop has been slightly changed. According to the information from old people, in the past produced crops were combining grain (sorghum, millet, wheat, etc), vegetables, legumes, sugarcane, fruits, coffee and a little Q'at. The purposes of grain products are food and straw is animals fodder; the other crops were grown for consumption and selling the surplus. Q'at was also grown for consumption and for selling surplus to neighboring villages in exchange with grain and it was not considered as the main source of income. In the recent decades the crop pattern changed in which grains (sorghum and millet) and Q'at are the most crops grown in the study area. Vegetables and fruits are grown only in a little amount in the valleys close to the water. The purpose of growing sorghum and other grain crops is for consumption of grain while in most areas it changed to produce Q'at; the crops are grown for the purpose for animal's fodder and/or leaves used for Q'at market to keep Q'at fresh and protect it from hot and direct sunlight.

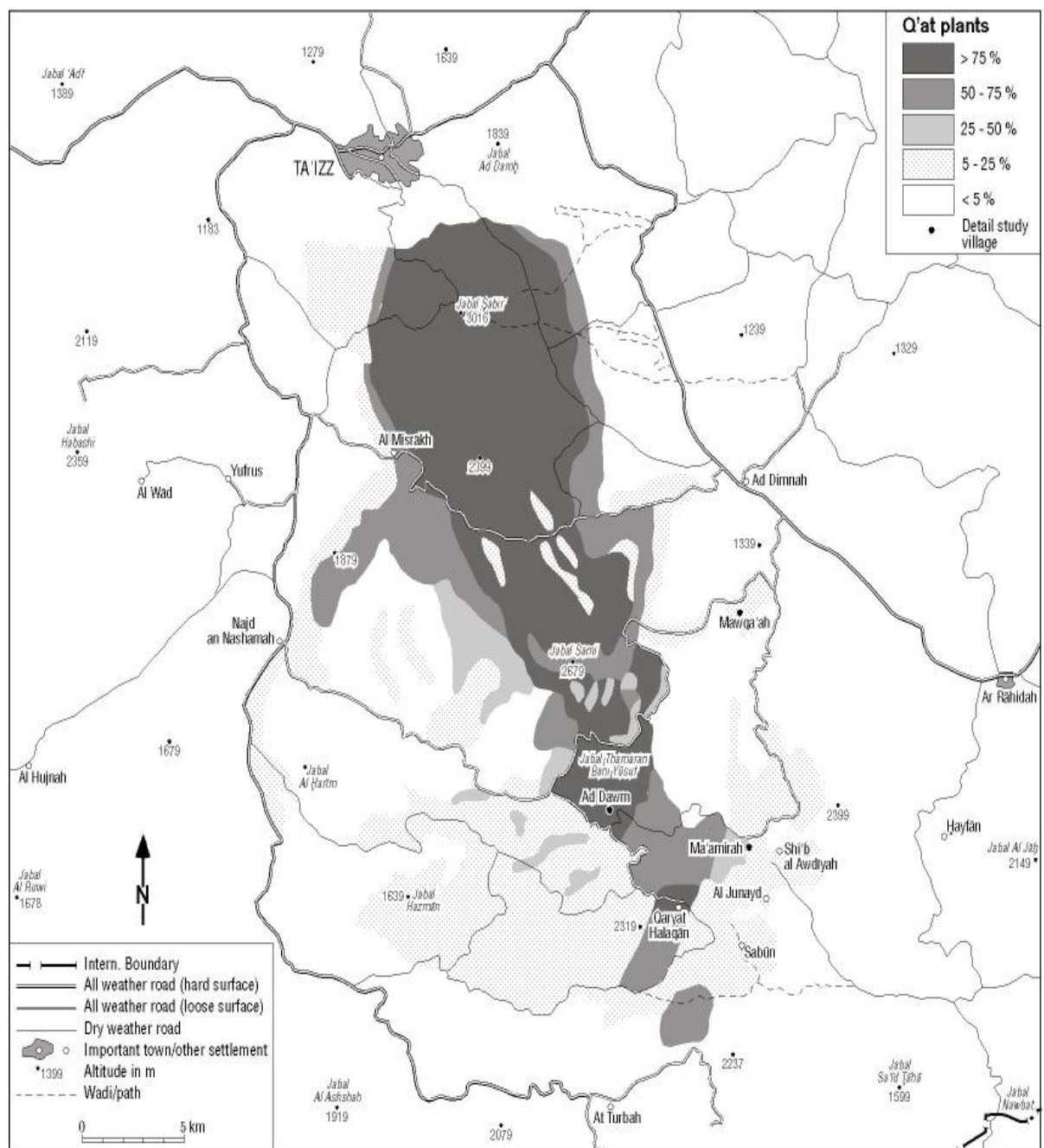
Q'at became the main source of income for Q'at growers in areas where it occupies most of the cultivated land. Q'at has been spread over most of the cultivated land in the region. For instant it occupied the land in high mountain areas from Jabal Saber to the south in Al-Misrakh district, Sama' district, part of Al-Maa'fer district, large part of Al-Mawasit district and part of As-Salu district. Q'at occupies in some village's area more than 90% of cultivated land such as in Saber, Sama', Al-Mawasit (Bani-Yousef and Q'adas), while in some other areas it does not exceed 5% of cultivated land such as Al-Aa'lum in Al-Mawasit district (Fig. 4.2). Even though the suitable elevation for Q'at is above 1200 meters (Revri, 1983), Q'at is not grown in large parts

of the study area, i.e., in al-Maa'fer (Al-Mashawiila, Al-Kalaibah, and Al-Gabziah), al-Mawasit (Al-Aa'lum, Bani-A'bass), As-Salu and Hayfan. Maybe the reasons are that the people do not have experience with Q'at cultivation, shortage of water and migration of people (whole families) to cities or combination of both such as in Hayfan district. In eastern part of study area close to Ar-Rahidah in Hayfan district where terraces are in good shape but even grain crops do not grow in some terraces due to migration of young generation men and women to cities for better life leaving old women (mother or grandmother) in the house, because these latest preferred to stay in their house as birthplace.

In the 28 study villages distributed in sub-region in Al-Mawasit district (divided in 2001 into three districts, Al-Ma'afe district with its center in An-Nashamah, Al-Mawasit District with its center in Al-A'ayn and Sama' district with its center in Hawrah) that were visited during field work Fig. 4.3. According to the information from old people in these villages, the production in most of these villages was grain (sorghum, millet, wheat, corn), vegetable (potato, sweet potato, green onion and garlic), fruits (Guava, mango, fig, pomegranate, banana, papaya), coffee, and Q'at was grown in the corner of the villages land and in specific areas such as in the high mountain terraces. In recent years cropping pattern has been changed in which Q'at expands in large areas and in the land that was used to grow coffee and grain. In some villages where it was grown in small areas in the corner of the village it covers now 70% to 90% of the cultivated land and in some other villages it does not exceed 25% but it is in expansion. In Wadi Al-Haraybah in Bany-Yousif where coffee and sugarcane were grown, recently Q'at dominants most of the cultivated area, there can seldom be found some coffee trees in a Q'at field as indication for tradition of coffee growing habit. Expanding of Q'at has pointed out among foreign planners and Yemeni officials that (1) there has been a decline in Yemen coffee production; (2) there has been a significant increase in Q'at production; (3) coffee and Q'at growing under similar climatic conditions; (4) Q'at is so much more lucrative, and so much easier to care for that farmers have en masse uprooted their coffee trees and replaced them with Q'at trees; (5) this is harmful to the economy of the country because coffee brings in foreign exchanges and Q'at does not (Kennedy 1987, Tarcici 1972, World Bank 1976).

In the villages at the study area crops such as sorghum and millet are grown for double purposes the grains is human food and the straw is the animal's fodder. Nevertheless, the shortage of grain (wheat and floor) is covered by buying from the imported amounts in the market. In Q'at production area sorghum and millet is grown as intercropping with Q'at in which the leaves used to prepare Q'at to the market and the remaining of straw used to feed the animals. While the demand of the family's food such as wheat, floor, rice and so on are bought from the

markets. Also animal fodder is bought from the amounts coming from Tihama region to cover the demand in Q'at production area.



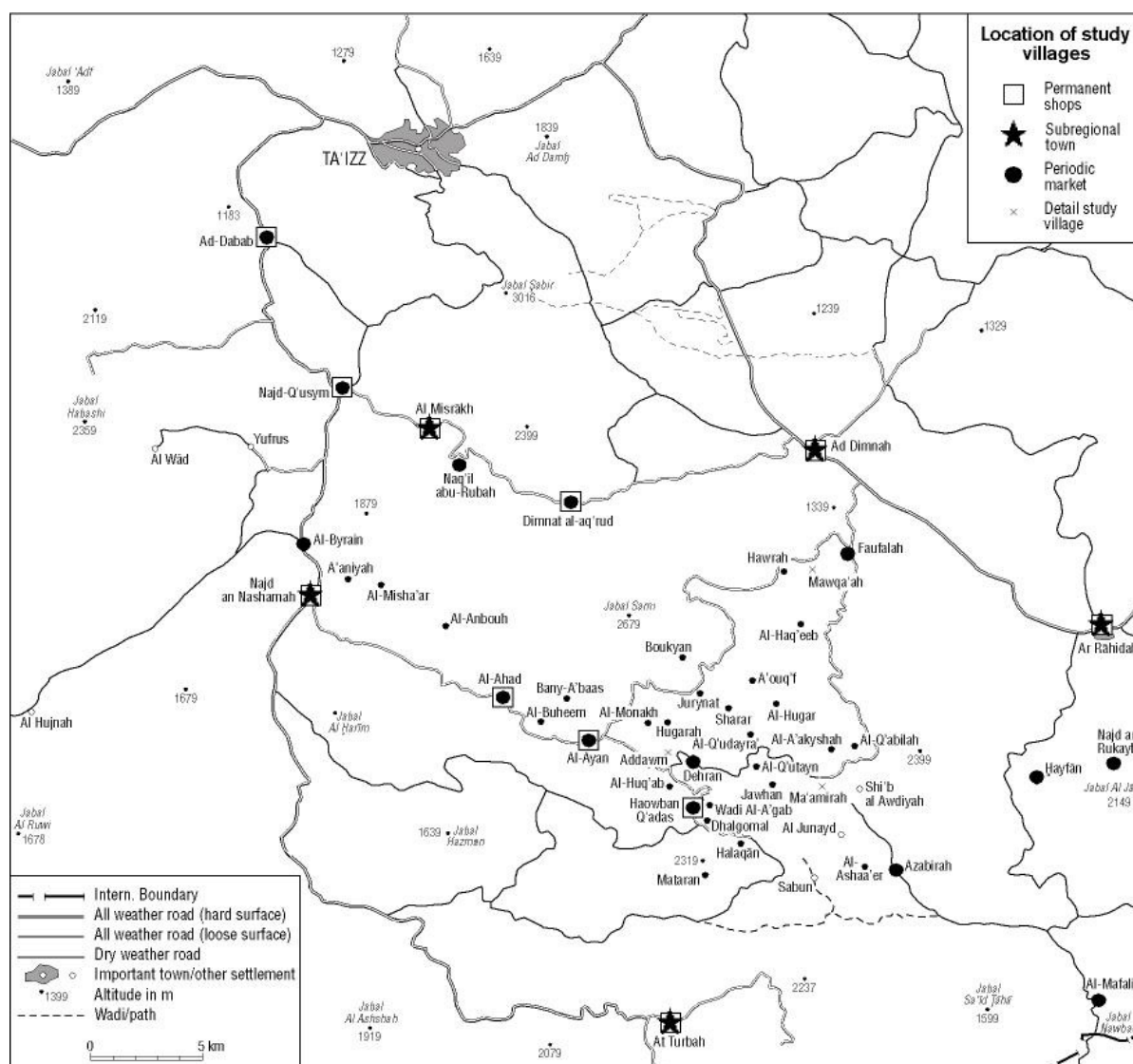
Source: Joint Operations Graphic-Map 1: 250.000 TA'IZZ. 1984; own investigations.

Design: Al-Ghory; Cartography: D. Engel

Fig. 4.2: Cultivated area with Q'at in the region in %

So that, the areas of Q'at growing became markets for imported and local agricultural products. Swagman (1985) said that grain traditionally was grown only for home consumption, as it is still. He also added grain production has been in decline for many years while importation of grain has been increasing. Expansion of Q'at mostly happened from mid of 1970s and up as the old people said and that is right because the age of Q'at trees in most of the villages does not exceed thirty years. Q'at planted in Jabal Razih terraces increased from 15% to 30% over four

years (1977-1980), while grain production declined due to its low profitability and high labor expenses (Kennedy 1987, Weir 1983, Steffen et al. 1978).



Source: Joint Operations Graphic-Map 1: 250.000 TA'IZZ. 1984; own investigations.

Design: Al-Ghory; Cartography: D. Engel

Fig. 4.3: Distribution of the study villages in sub-region study area

4.2 Sub-Regional

4.2.1 Effects of Q'at

Growing of Q'at in Yemen is not a problem as such, but the problem is its effect on the resources, i.e., 1) human; 2) land; 3) groundwater; and 4) environment.

1) Effects on human are related to a) agro-chemicals sprayed on Q'at; b) family's relationship, economic and education. First: effect of agro-chemicals sprayed on Q'at and their effect on human body and health. Agro-chemicals are transmitted to Q'at consumers as it is consumed daily by people of both sexes. Q'at growers on the other side sprayed Q'at by several pesticides and they do not aware about the effect of the poison on consumer's health,

because they only think about income from selling Q'at. The aim of Q'at growers on pesticide sprayed on Q'at is not to protect plants from pest or diseases but it is to enhance the Q'at growth. So with long run of chewing Q'at, the poison will accumulate in the consumer's body what will be the reason of occurring of harmful diseases. Even though it is not clear now, but may occur in the near future and it will be the disaster in Yemen. Second: effect on family relationship, economy and education, because Q'at consumes part of the family income, during Q'at session father spend time far from children either out of home with his friends or at home with old members of family, in which many people do not like noise of children during Q'at session. So children do not get enough time with their parents to advise them as it must be required for their education.

2) The effect on land of Q'at goes further in which Q'at expand nowadays in good agriculture land which was used to grow grain crops and coffee. Area used by Q'at has been increased from 43000 ha in 1972 (CSO, 1972) to 102,934 ha in 2000 (CSO, 2000). The reason of Q'at expansion may relate to land ownership, because land ownership splits into three parts; 83% of land is private land, 3% owned by the government, and 15% belongs to *Waq'f* or called "*Aradhi al-waq'f*". So that Q'at expanded easily in private land and that is the problem because people are looking for a crop that have good demand and income and that is the reason of Q'at expanded on land of grain and coffee.

3) Effect on groundwater: With expansion of growing of Q'at demand for water to irrigate Q'at increased and with absence of rules and laws to control digging wells. So Q'at farmers randomly dug wells in their land even in some cases the distance between neighboring wells is few meters in a terrace. Therefore a lot of water is pumped to irrigate Q'at to fulfill the demand of Q'at in the market. This problem nowadays is the main issue because Yemen is one of the poorest countries conserving water resources the per capita is 150 cubic meters of water per year. Q'at occupies 25% of irrigated land and it is an evergreen crop and it is a drought resistance plant. Q'at consumes about 480 MCM/year (Abas et al, 1999), for that, farmers choose groundwater to irrigate Q'at and they dug wells. The yearly water depletion from Sana'a basin due to increase of wells to irrigate Q'at reaches 224 MCM compared to recharge of basin by only 42 MCM. The level of groundwater decreased from ½ meter in 1972 to more than 10 meters in 1995 (Asaqaf, et al, 1999).

In study area also number of well has been increased in the last 3 decades seeking for water for domestic use and to irrigate Q'at. Therefore, in the 28 villages in the study area that were visited, numbers of wells dug vary from 1 to 74 wells per village in the average of 19 wells per village (Table 4.21 and Fig. 4.4). These wells are hand digged except for water

project wells, and depth is varying between 2 to 45 meter and not all wells have water. Some of them dry out during dry winter and also when total seasonal rainfall is small. Random digging of wells in many places caused disappearance of water from springs and in turn water right of land that irrigated from these springs is stopped or suspended.

Table 4.21: Village's name, number of wells, % of Q'at and agriculture production cover the family needs

No.	Village name	No. of Wells	% of Q'at in the village	% of Agricultural production Covers the Family needs
1	Al-Ma'amirah	43	10	25
2	Addawm	23	85	50
3	Mawq'a'ah	6	3	25
4	Al-A'akyshah	35	10	30
5	Jawhan	74	15	30
6	Al-Oudayra'	7	60	88
7	Al-Monakh	7	95	75
8	Hugarah	1	85	100
9	Al-Q'utayn	16	25	25
10	Al-Hugar	2	20	25
11	Wadi Al-A'gab	18	70	25
12	Jurnat	10	90	50
13	Sharar	20	90	33
14	Al-Q'abilah	11	12	25
15	Al-Ashaa'er	12	3	25
16	Al-Haq'eeb	10	10	25
17	Hawrah	9	50	33
18	Boukyan	9	66	25
19	Bany-A'baas	4	60	25
20	A'ouq'f	11	75	33
21	Halq'an	64	95	50
22	Mataran	70	50	25
23	Dhalmal	20	90	50
24	Al-Huq'ab	8	60	25
25	Al-Buheem	6	0.8	25
26	Al-Anbuh	16	15	8
27	Al-Misha'ar	7	10	16
28	A'aniyah	19	5	16
	Average	19	45	35

Source: By the author, 2004.

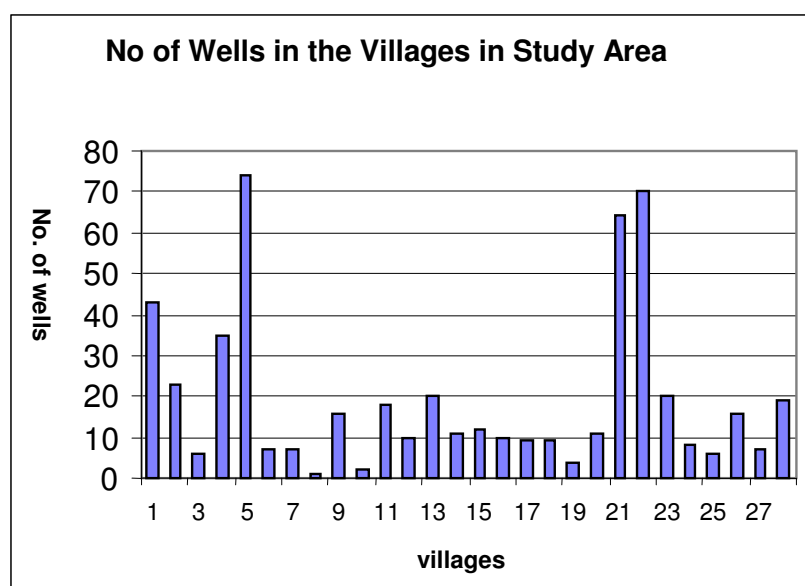


Fig. 4.4: No. of wells in the villages in the study area

4) Effect on the environment, Q'at expansion and its requirement for agro-chemicals and the way of using them and lack of information about these chemicals with farmers is a disaster. Because part of pesticides use on Q'at go direct or indirect to the soil. By irrigation residues are spread horizontally in subsurface and vertically deeper in soil profiles and in the end it will dissolve and reach to groundwater. The residues on soil will absorbed by plants and then plants will be consumed by animals as feed and/or by human beings as food or stimulant like Q'at, so that pesticides residues will reach the human body. On the other hand residues that reach the groundwater will reach human being direct by drinking water or by consumption of crops irrigated from that water. Therefore, the cycle of random use of poison will continue and effects of it will not stop but it will be in continual cycle. The other effect of random uses of chemicals will effect the stability and the balance of biological live, in which new varieties of pests and diseases will be found with resistance to these chemicals (Mogahed, 1999 and Thabit, 2001). So that environment problems become worse and worse due to introduce new or stronger chemicals. Also the beneficial insects and small organisms which increases soil fertility will disappear, so that the balance of natural biological control will be reduced and the soil's fertility will be poor and for long run the land will not be sustainable for production of any crops even the Q'at.

Q'at also has direct effects on environment and human health as follow: First: marketing of Q'at need plastic bags to protect it from evaporation and keeping it as fresh as possible till it reaches consumers hand. Also plastic bottles of mineral water used during Q'at sessions have two problems, 1) plastic products causes several diseases for the human being such as lever cancer, and dangerous disease that called Venyl Chlorid disease which causes cirrhosis (fibrosis of lever) and then stop of growing of extremities bones. And 2) plastic products pollute

environment in which plastic did not dissolve by natural bacteria so that its life cycle in ground will take longer time and will reduce fertility of agricultural land. Spreading of plastic all over the surfaces in cities and in countryside damages the sight of cities (Abas et al, 1999). Second: chewing of Q'at normally takes place inside rooms and people gather to chew Q'at and discuss the hour issues. But bad habit is that 65% of Q'at's chewers are smoker and they smoke cigarette or "Hubble-bubble"; water pipe or "*madaa'h*". In Q'at's sessions smokers and non-smokers' people or friends are gathered to chew Q'at and they set close to each other in the room. So that effect of smoke will not stop on smokers but also will reach non smokers from smoke they absorb during Q'at session which in some case continue to more than 4 hours. On the other hand these who smoke water pipe: several people share in one pipe for several hours and due to that the probability of transmission of chest diseases among them will be high.

4.2.1.1 Increase of agro-chemicals use for Q'at

Q'at is a plant consumed daily within most of Yemeni's people male and female; therefore the farmers are encouraging to fulfill the daily market demand by two ways. First one is expansion of Q'at growing on others crop's land as it was mentioned before and second one is by increasing use of pesticides and fertilizers to encourage growing of new leaves and branches of Q'at trees. Normally chemicals are used to protect plants from pests and diseases. While, the aim of Q'at farmers in using chemicals is to encourage growth of plant's leaves to reach high production to cover increasing market demands. Q'at farmers can be divided into two categories related to their knowledge about pesticides and their effects on human health. First one (large part), which is that most of farmers may not have any ideas about the effect of poisons they are using for Q'at on consumers or on themselves and on environment. Second one, these who have knowledge about chemicals; they get it from specialists working in agricultural projects in regions. However, farmers spray Q'at by pesticide and they harvest it to market before safety time of poisons finished. On the other words each poison used in agriculture has a specific period of time to wait for before harvesting. But farmers neglect this phenomenon and harvest Q'at before safety time of poison finished. Because profit from selling Q'at in market is the main aim for them, neglecting the problems that will happen to consumers from chewing poisoned Q'at.

Effect of wrong practices for random use of agro-chemical such as DDT, which is forbidden in the world, mixing of several chemicals in one dose and distribution of agro-chemicals and selling them in the same shop of food are the challenges for human live and health even if effects are not appeared yet. The chemicals used on Q'at are hardly to know due to

different education levels of Q'at farmers and chemical's dealers. Q'at farmers use poison to enhance growth of branches and new leaves in one hand and in other hand type and amounts of pesticide are used due to their desires and not to description of specialist or that on the container. Farmers will not hesitate to use high toxicity chemical such as DDT and Landin if they have an idea that these chemicals will enhance plant growth (Thabit, 2001, Thabit et. al, 2000). Unfortunately, people consume Q'at daily with poison even if they knew that Q'at was sprayed by poison few days ago. Therefore, results of these problems are not widely clear now, but may occur in future if research is conducted in this field to prove the bad prospects of health situation and environment.

If it's assumed that there is one of forbid pesticides and the idea or information with Q'at farmer that this pesticide is good for Q'at. The question will be raised; will the Q'at farmers use this poison or not? The normal answer is not, but in the reality it will be used and safety time will not take same consideration because of the profit that Q'at farmers will gain from Q'at sold in market. On the other words Q'at farmers will harvest a Q'at if the price in market is good even if safety time of poison is not finished. The result of field study by Al-Mola 1993 found that about 39.2% of farmers had harvested Q'at after 3-6 days from last spray, 41.1% harvested after 7-10 days of last spray and 5.4% harvested after 11-15 days from last spray.

From interviews of farmers in Q'at area and dealers of chemicals it concludes that the chemicals used in Q'at can be summarized in Table 4.22, which are divided into several groups. The most groups are Hydro-carbonic compound, the Organic-Phosphorus compound, and the Organic-Carbamat compound. The first is Hydro- carbonic compound such as DDT, Toksafin, Aldrin, Landin and etc, it is considered as the most dangerous compound which is transferred to human being tissue and into embryo and it also caused skinniness of testis. Some of this compound has stability in environment and tend to dissolve in fatty media. The fine residues are likely to aggregate and adhesive to soil particles in soil's layers. This compound of pesticide is affected on nerve system of human being and causes cancer of testis, prostate, and breast. The second compound is the Organic-Phosphorus compound, which mostly effects on nerve system and causes death but also causes swellings on lymph glands, spleen and liver (Thabit, 2001, Al-Hadrani, 1999 and Al-Ghashm et. al, 1988). Kennedy during his field work in late of 1970s sums up to that the Q'at farmers which used small amounts of chemicals and they were aware on using pesticides because of its effect on consumer. In 1987, Kennedy wrote: "As the cultivation of Q'at has spread, however, the Q'at plant has encountered more entomological enemies. Especially in Haraz, Hajja, and parts of Ibb and Taiz provinces chemical insecticides are in limited use. Sometimes the farmers are not aware of the exact composition, or of the health consequences of

these. However, the potentially negative effects of the leaves before marketing, and also, according to agricultural experts I spoke to, the potency life of the DDT in most of the insecticides is only a few weeks. In this case, the poison becomes inactive long before it gets to the chewer. Further ameliorating checks are the customary careful cleaning of each leaf, a part of the ritual of chewing, and the fact that chemically treated Q'at is often shunned by the buyer because of its moldy or bitter taste. Nevertheless, the long-term effects of this practice are potentially very harmful to health.”

Table 4.22: Pesticides and other chemicals used in Q'at*

Trade Name	Common Name	Chemical Group	LD 50 mg /kg	Safety Time (day)
A. Insecticide:				
1. Deptrix 80 sp	Trichlorfon	Organo-Phosphorus comp.	560-630	14
2. Dimethoate 40% EC 3. Perfikthion 40% EC 4. Roxion 40% EC 5. Dantox 40% EC 6. Roger 40% EC	Dimethoate	Organo-Phosphorus comp.	215	14
7. Diazinon 60% EC	Diazinon	Organo-Phosphorus comp.	100 –150	21
8. Malathion 50% EC	Malathion	Organo-Phosphorus comp.	1500-1800	14
9. Samicidin	Fenvalerate	Organo-Phosphorus comp.	400	14
10. Supracid 40% EC	Methidathion	Organo-Phosphorus comp.	29	14
11. Actilic 50% EC	Permiphos Methyl	Organo-Phosphorus comp.	2050	14
12. Dicarbam 85% wp 13. Carbcid 85% wp 14. Carbaryl 85% wp 15. Seven 85% wp	Carbaryl	Organo- Carbamat	500-800	14
16. Agrinat 90 17. Lannate	Methomyl		17-24	10-14
18. Gesarol /Guesarol	DDT	Chloro-Hydrocarbonic	113-118	
19. Talstar 25 EC	Bifenthrin	Pyrethroid	1358	10-14
B. Fungicides:				
1. Nimrod 20% EC	Buprimate	Dimethal Sulfamate	4000	
2. Saprol 20% EC	Trifurine	Furamide	16000	
3. Rubigan 14% EC	Fenarimol	Berimidine Nethanol	2500	
4. Redomil 5-10% EC	Methlaxyl	Acylanin Compound	669	
5. Topaz	Penconazole	Triazole	2125	28
6. Calixin	Tridemorph	Morpholine	980	
7. Anvil	Hexaconazole		6071	
8. Kumulus-s	Sulphur	Sulphur	6400	14
9. Yeast	Yeast			
10. Shampoo	Shampoo			
C. Fertilizers:				
11. Kostrin (Ferrous Fertilizer)				
D. Others: Sugar	Sugar	Sugar (Insect's trap)		

* Sources: The detailed information compiled from pesticide manual, pesticide handbook and al-Ghashm 1990.

In Yemen the information about residues of pesticides remaining in soil or penetrating to subsurface of soil and to groundwater are not available and no one worked on it till now. So that,

the disaster of poison's effect on environment is not recognized yet but in the future if Allah willing, it will be the biggest challenge to government as well as to people. Danger of chemicals (used on Q'at) on human being increased due to consumption of Q'at as fresh and Q'at harvested before safety time of chemicals finished, also most of chemicals are systematic (the chemicals transfer to plant juice) and never removed by washing of Q'at. Also danger of chemicals is serious because 70% of imported chemicals are used on Q'at (Al-Ghashm et al., 1988).

The effect of chemicals used in Q'at on human being is not clear yet. However, cancer, hepatitis and cirrhosis diseases occurred in large number among people in Yemen in last two decades and the logical reason is the result of consumption of Q'at with chemicals (Dr. Mohamed S. Noa'man, 2001, personal interview). However, Al-Mashwaly, 2002, in his article *"Are the pesticides responsible? The cancer is aggravated in Taiz"*, wrote: "according to the statistic information mentioned by the secretary of medical committee in Al-Thowrah Hospital in Taiz, the sign of increased of harmful cancer among patients entered the hospital has been shown that, for instants, in first four months of 2002 remarked 272 different types of cancer diseases included the harmful type of cancer. This number is much greater than for last four years, which reached 800 cases. The cases concentrated in six areas, Saber has the first number of cancer cases with is 52% followed by Mawiyah area has 40% of the cases then the rest areas such as Al-Q'abitah area, Taiz' city and Thie-asufal area in Ibb Province. Also the report mentioned that the number of cases of cancer presented in front of Medical Committee in Al-Thowrah Hospital during 1997 and 2001 was more than 800 cases. It was 73 in 1997, 161 and 153 in 1998 and 1999 respectively, and it reached 181 in 2000 and finally 248 in 2001. Also the report mentioned that, patients were suffered from blood cancer, lymph glands cancer, and developed to different harmful cancers. The Secretary of Medical Committee in Al-Thawrah Hospital referred that, the reasons of increasing cancers in areas mentioned above is due to these area are famous in Q'at production, sell and using pesticides. Many people affected by this disease due to uses of pesticides in which part of it is forbid to use in this type of agriculture. The Secretary confirms that the continuous of random use of pesticides in Q'at is the main reason of outbreak of cancer diseases in these areas".

Q'at farmers adapted their Q'at trees to chemicals to encourage growth of branches and leaves of Q'at trees and they mixed several pesticides and spraying them as one dose on Q'at. The purpose of mixing of pesticides is not to protect Q'at plant from diseases and pests but to encourage growth of new branches and leaves. With time Q'at farmers believe that without spraying pesticides Q'at does not grow. So that, Dimethoate is mostly used for Q'at with each mixture (Table 4.23) and the reason is that this compound contains Phosphor, which act as

fertilizer to encourage plant growth and it is known by Q'at farmers as “*Morabi Al-Ghos'n*” (branches grower). From field study and discussion with farmers it concludes that several mixtures of chemicals are used in Q'at and they are listed in Table 4.23. The mixture used in Q'at trees may differ from area to another what can be seen in Table 4.24 which shows the mixtures of chemicals used in Sana'a province.

Table 4.23: Pesticides used in mixtures on (*Catha edulas*) trees in the study area

Items	Common Name	Trade Name	Type of Action
Mix. 1	Dimethoate	Dimethoate	Insecticide
	Carbaryl	Seven 85 %	Insecticide
	Penconazole	Topaz	Fungicide
Mix. 2	Methidstion	Supracide	Insecticide
	Trichlorfon	Dipterex	Insecticide
	Dimethoate	Dimethoate	Insecticide
Mix. 3	Methidstion	Supracide	Insecticide
	Penconazole	Topaz	Fungicide
	Dimethoate	Dimethoate	Insecticide
	Sugar	Sugar	Trap for insects
Mix. 4	Trichlorfon	Dipterex	Insecticide
	Penconazole	Topaz	Fungicide
	Lannate	Methomyl	Insecticide
Mix. 5	Dimethoate	Dimethoate	Insecticide
	Talstar 25EC		Insecticide
	Trichlorfon	Dipterex	Insecticide
Mix.6	Perfekthion	Dimethoate	Insecticide
	Penconazole	Topaz	Fungicide
Mix. 7	Dimethoate	Dimethoate	Insecticide
	Fertilizer	Fertilizer	

Source: By the author, 2004.

Table 4.24: Pesticides used in mixtures on (*Catha edulas*) trees in Sana'a governorate

Items	Common Name	Trade Name	Type of Action
Mix. 1	Dimethoate	Perfekthion	Insecticide
	Trichlorfon	Dipterex	Insecticide
	Penconazole	Topaz	Fungicide
Mix. 2	Methidstion	Supracide	Insecticide
	Fenarimol	Rubigan	Fungicide
	D.D.T or Lindane	D.D.T or Lindane	Insecticide
Mix. 3	Methidstion	Supracide	Insecticide
	Penconazole	Topaz	Fungicide
	Fenarimol	Rubigan	Fungicide
	Dust	Dust	Fungicide
	Iron Fertilizer	Iron Fertilizer	Fungicide
Mix. 4	Dimethoate	Perfekthion	Insecticide
	D.D.T	D.D.T	Insecticide
Mix. 5	Trichlorfon	Dipterex	Insecticide
	Penconazole	Topaz	Fungicide

Source: Al-Hadrani, A.; and A.A.M Thabit, 2000.

An example of random using of pesticides and chemicals on Q'at: A farmer in Al-Ma'amirah has a field of 24 Q'asabah (700 m²) planted by about 100 *maghras* of Q'at about 45 years old. The farmer started working in his field hoeing around Q'at for irrigation before Al-Adha feast because of high Q'at demand as people returned from cities to villages to celebrate the feast with their families. So he first irrigated Q'at on 03/01/2003, and then he first sprayed

Perfikthion mixed with 4 oz of seven on 9/1/2003. Then he added 18 kg urea fertilizer (257 kg/ha). Then he sprayed Q'at three times more with Perfikthion alone, the last spray was on 22/01/2003, the total amounts of Perfikthion 2.9 liters (41 l/ha) and he used 80 ml/ 20 liters (4 ml/liter) while the recommendation on bottle is 1.5 ml/l. He irrigated Q'at seven times; the last irrigation was on 07/02/2003 with about 120 liters/ *maghras*/ irrigation. Q'at harvesting started on 04/02/2003; it is 13 days after last spray while the time recommended is 21 days from last spraying. Using of huge amounts of pesticide 41 l/ha and 257 kg/ha urea in this case, no doubt it is a big problem because of chemicals effect on Q'at chewers and residues remaining in plant and soil.

4.2.1.2 Reasons for Q'at production and expansion

The reasons for Q'at production and expansion in the region will be discussed in this section in detail to come to the clear point of the reasons.

a) Economical reasons (home's consumption and low income)

The economical reasons in the Q'at production and expansion are related to that life must stand in the balance of need and consumption. Family needs change with development of social and education of a community in which family is a main stone. To fulfill needs, family members start to look for some reasonable ways to increase their income either by high education and qualified jobs, migration, trading, and growing high productive and valuable crops to sell surplus on the market. Therefore, by mid 1970s men started to migrate to cities and to neighboring oil countries looking for better income to improve their family members' life. In turn, remittances of emigrants flew to the country and this brought positive changes in the balance of government budget which encouraged the government to subsidize imported food. Neglecting effect of subsidy on national agricultural production in long run and that what happened, in other hand effect of subsidy reach to people of rural area, so that farmers found cheaper food available in market such as wheat, flour, rice and so on, only cash was needed; so they started to increase area of Q'at to sell production in markets and get cash to buy their needs. The flow of remittances to hands of emigrant's families encourages them to change their consumption style, in which most of imported commodities consumed and Q'at also became important commodity consumed among people of both sex. Q'at became the dynamo of sadness and happiness gathering of people in rural and urban societies. So that Q'at became the main source of income for many families especially in rural area, where it occupied more than 50% of cultivated land. Income from Q'at covers most and in some villages it covers the whole of family needs. Fig. 4.4 and Table 4.21 are

showing relationship between % of cultivated land occupied by Q'at and % of agricultural production which covers family consumption. Data are collected from 28 villages visited during the field work in Al-Mawasit district (it is divided into three districts in the new arrangement in 2001, they are Al-Ma'afer, Al-Mawasit and Sama' Districts). The villages that Q'at occupied more than 40% of cultivated land are considering it as important part of family income. So that income from Q'at is used to cover the family needs. Therefore, as shown in Fig. 4.5 and Table 4.21, it covers in some villages from 50% to 100% of cost of consumption of the villages. While villages where Q'at occupied less than 25% of cultivated land, agricultural production mainly sorghum and millet becomes part of family consumption as result of production of land and direct used by families. Q'at becomes now one of main source of income for these who produce it and for those who work in harvesting, preparation for market and selling it as a wholesale trader and retail sale traders.

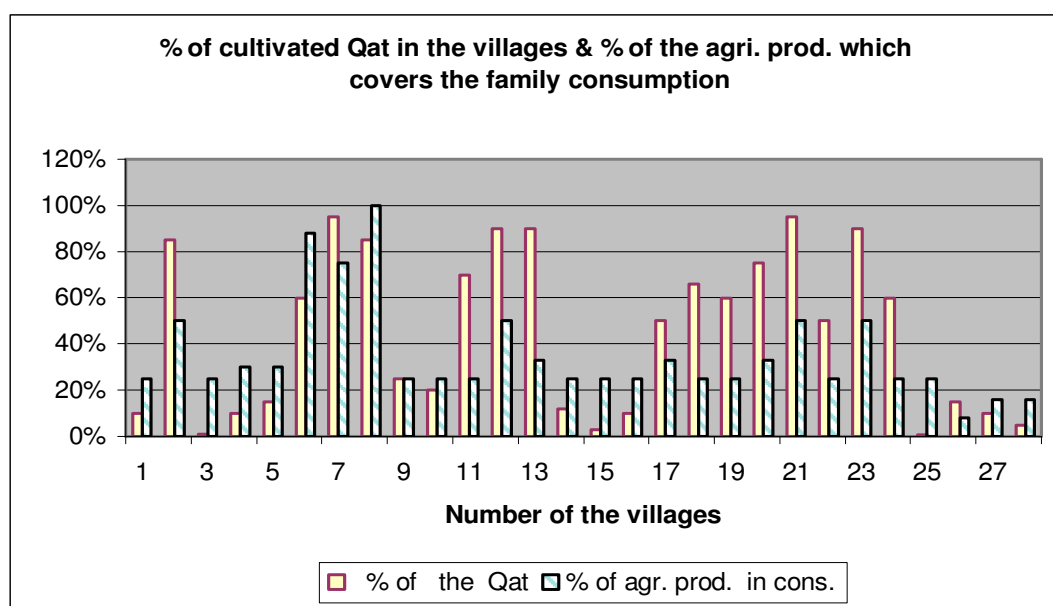


Fig. 4.5: % of cultivated Q'at in villages & % of the agricultural products which covers the family consumption

Therefore, studies and discussions about Q'at in case of replacement of it with other valuable crops and/or uprooting is a very sensitive subject in Yemen nowadays and even in near future. But question still rose why farmer grew Q'at in high mountain area where Q'at now covers more than 75% of cultivated land like in the study area? The answer will be given in next section as reasons of increasing cultivation of Q'at in these areas during former rulers (Imamate time before revolution at 26th of September 1962).

b) Increasing the “zakah” during Imam Time for other product

Legislation of Q’at growing and consuming was normal during Imam’s regime. Also it was one of Islamic scholars who said Q’at is *halal* (unforbidden) and he said poesy about it. During his regime Q’at was entered in the list of crops that *Zakah* was collected from their products (al-Maq’rami, 1987, Thabit, 2000). However, the time of Imam’s regime was the main time of expansion of Q’at especially in areas where Q’at now occupies more than 50% of cultivated land. Because during my field work in the 28 villages and other parts of study area. Old people in Q’at area said that one of the reasons encouraged them to grow Q’at was the injustice of collection of *zakah* from other products such as fruits, vegetables and sugarcane. As they said, during that time, the rulers in the regions used to send someone to the area in the middle of season to check planted area and to estimate production of that season, he was known by *Mokhmn*, (estimator). And according to his estimation collection of *zakah* took place by rules of villages, they called *A’udol* (single is *A’adl*). So in case of sugarcane, crop stayed in the field for two years to have production. But collectors of *zakah* take *zakah* for every year and that cost farmers to pay double for their product. Also for fruit and vegetable collectors of *zakah* collect *zakah* for estimated production but in some cases production could not be sold and may spoil on trees or in the field.

Hint (according to what the scholars agree) that the *zakah* is obligatory to pay from food like agricultural products which can be eaten and stored such as grain and from trees not more than date, and grape (raisins) while nothing from vegetables. Because it was existing during the Prophet Mohammed peace be upon him and during his companions regimes (Caliphs). When Prophet Mohammed peace be upon him sent *Mua’ad Ibn Jabal* and *Abu Musa al-Asha’ari* to Yemen he told them “do not take *zakah* for more than fourth types, wheat, barley, date, and raisins”. But Imam Abu *Hanifa* and *zeft* said it’s obligated to the 10th of the whole of land productions. Amount paid as *zakah* is 10th of product of land that is irrigated by rain, due to *hadith* of Prophet Mohammed peace be upon him said “ whilst that is irrigated by sky (rainfall) is 10th”, whilst that is irrigated from wells by power mean like is ½ of 10th” (Salim, 1995). However, in the *hadith* reported by *Ibn A’umar* in *Al-bukhary* Allah be pleased on them all in section of *Azakah* number (3/347) that Prophet peace be upon him “to order whilst that is irrigated by rainfall, river, spring or it was absorbed water by its deep root or it get water from that passing close to it, is 10th, whilst that is irrigated by power mean like is ½ of 10th “. But *zakah* is not obligatory for non-food agricultural products that can not be stored as food such as row fruit, vegetable and any other products, which sell and used when it is fresh at harvesting. However, in this case farmers are free to pay *zakah* if they want to do in the way of Abu Hanifa otherwise

product sell and *zakah* paid for saving money, which pass on it one year as other money they have (Salim, 1995).

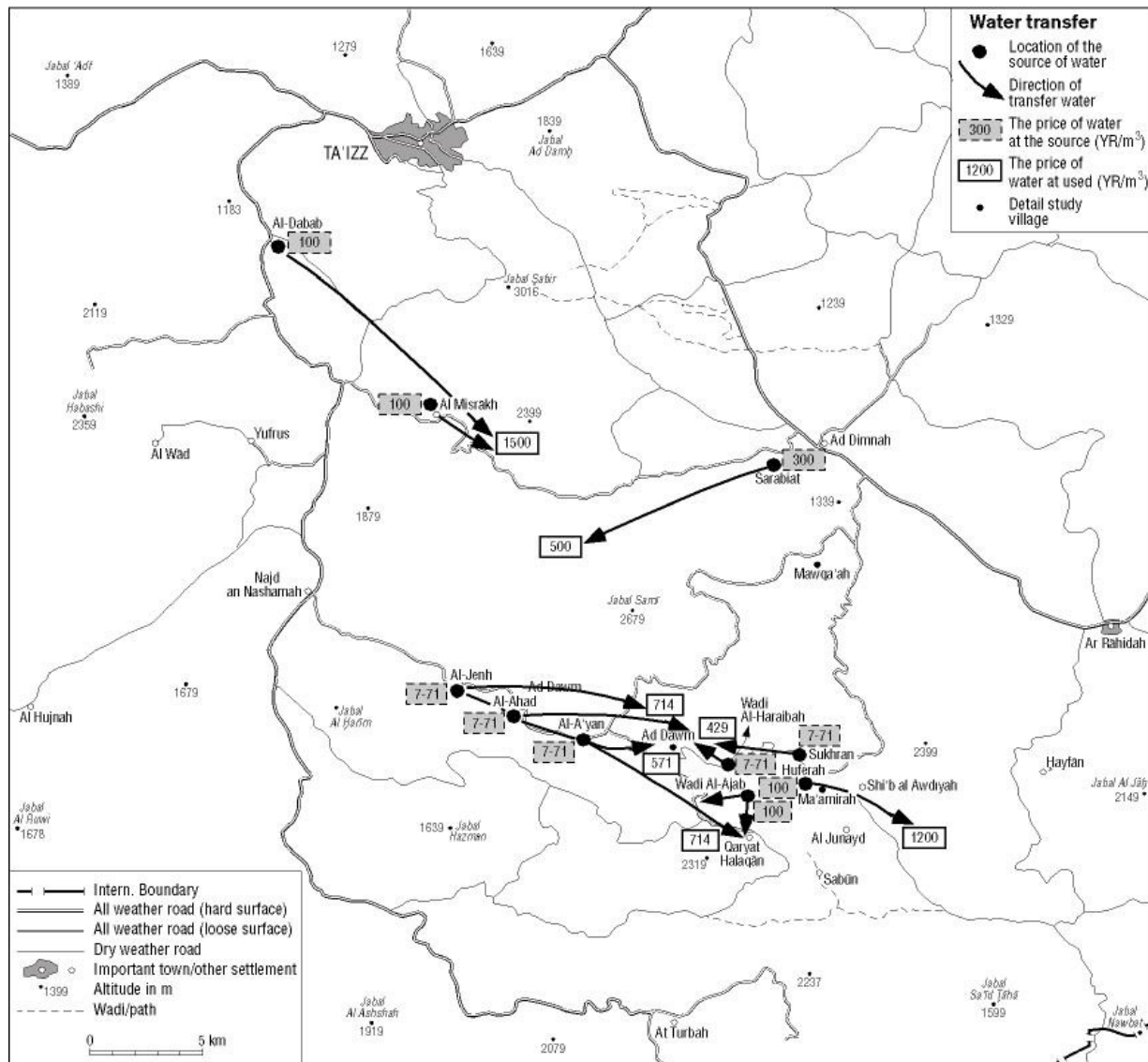
Also during Imam's rule increasing of taxes for coffee, cotton and other products to increase income of government, encouraged farmers to grow Q'at as it well give them high income (al-Maq'rami, 1987). In my opinion when Imam put Q'at in the list of crops that paid *zakah* for them was the main step of legality of Q'at growth and expansion. And that really encouraged farmers to grow Q'at at that time because it was in the beginning of collection of *zakah* from Q'at product. So it was easy for them (farmers) to argue about it and it was one of commodities used to stimulate (bribe) collectors of *zakah*.

In the mid of 1970s when the government raised taxes of Q'at with aim to reduce Q'at consumption. Action of rising taxes acts opposite; instead of reducing consumption and expansion of Q'at, it was encouraging farmers to expand it. Because of the following reasons, 1) Q'at's producers get legislation of Q'at expansion. 2) a big part of these taxes goes to Local Development Associations (LDA), that give Q'at producers push to increased Q'at growing as taxes in turn go back to them indirect as services such as roads, schools and water projects, and 3) import of foodstuff from abroad with subsidy and low prices (al-Maq'rami, 1987). Instability of crop production was during 1970s and early 1980s when income from *zakah* of crop products fluctuated. In which it was equivalent to 8% of government revenue in current prices in 1972 and it decreased to 1% in 1980 and then increased to 3% in 1983. While in the same period taxes from Q'at go opposite, in which the increase of taxes in Q'at cause to the indirect taxes to jump from 6% in 1977 to 8% in 1980 and then to 14% in 1983 of the government revenue in current prices (Chaudhry, 1997).

c) Shortage of rain and its consequence for irrigation water

The effect of shortage of rainfall in the region is one of sensitive topics to discuss and talk about it because information about amount of rainfall was not available due to absence of meteorological stations. Rough and imaginary information about rainfall and draughts during past decades is only to get it from old people in the region. When they talked about the reasons of Q'at expansion over land of others crops, as they said, one of reasons for Q'at expansion was shortage of rainfall in the past decades. For that growing of other crops like vegetable, coffee, and fruits were reduced and a change to Q'at crop occurred. Because Q'at can resist drought during winter even if time of nun rain exceed its range, which in some years reach to 5-6 months. Also Q'at is a valuable cash crop so that wells digging to irrigate it or water bought from other area to irrigate it can covers the cost because income from Q'at is high.

With expansion of Q'at, increasing of population and shortage of rainfall a new system in the study area was developed to provide water for domestic use and to irrigate Q'at. To increase production of Q'at, it needs water at specific time that farmer has experienced with it to secure time of demand of market. So this water nowadays is transferred by truck and Toyota cars from several locations in the region to Q'at production area. Fig. 4.6 shows direction of water transferred by trucks and Toyota cars to irrigate Q'at and prices of water at well and at irrigation area (Q'at area). Water is transferred especially during winter time and it is continued to beginning of spring when monsoon rainfall started. This water is not only used to irrigate Q'at but it is also used for domestic purposes in the area where water shortage in the dry periods of the year not only in winter occur. These areas are in the mountains where shortage of water is caused by type of mountain that is composed of volcanic rock and does not hold water for long period such as Addawm and neighboring villages. However, people now do not aware and realize the problem of extraction of water from these sources, because they get benefit from it at source as dealers and at Q'at area as consumers. But effect of extraction of water from these sources in the region in long run will be the problem. Because groundwater will be depleted and reach to dangerous stage or dry out in that places. So this matter must be studied and discussed in a way that it can help to avoid misuse of groundwater to produce non-food product. Also in a way that groundwater can recharge either by constructing dams or other ways of effective use of rainfall water by building private reservoirs; it is known as a "*Syq'aya*".



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

Design: Al-Ghory; Cartography: D. Engel

Fig. 4.6. Water transfer in the region

d) Agricultural diseases and closing the border of export to Aden in the end of 1960s

In early 20th century Yemen was producing its own food and export surplus of vegetables, coffee and cotton to the world. In the study area vegetables and coffee were exported through Aden seaport during colonization of Britain to Aden, since 1839 up to 1967. Bulb of propagation of potatoes and other crops were produced locally and distributed to the areas to produce, i.e., As-Salu district used to produce bulbs of potatoes and sold them to neighboring villages such as Mawq'a'ah and Q'adas for production. In turn production was transferred to closer markets in the region such as Al-Musallah and Ar-Rahida to transfer it to Aden to export it to the world. After withdrawal of Britain from Aden in the late 1960s production of potatoes and coffee stopped to transfer to Aden. Moving men from villages to cities to defend revolution was also another reason of reduction of exported commodities (potatoes and coffee). However, farmers

believed that the reduction of production of potatoes and other crops was because of introduced of disease after potatoes bulbs imported or gave to Yemen as aids and that might be right when aid came to revolution during the war against oppositions and it might be contained infected commodities and introduced diseases. The indirect effect of closing export of production to Aden was encouraging men to migrate to the cities and to neighboring oil countries looking for better income. And that reduced labor forces in agricultural land and in consequence starting of decreasing land production, which helped with other reasons expansion of Q'at growing in the region. Farmers grew Q'at instead of grain and in some areas they uprooted coffee trees and replaced them by Q'at plants because of income from Q'at is higher than that from grain and even from coffee.

Another reason of Q'at expansion was due to its high profitability than other crops even coffee, profit from Q'at not only encouraged Q'at farmers but also helped merchant to work, government constituted a source of income from taxes of Q'at too. Income from Q'at was compared to remittances from migration in Gulf State, Saudi Arabia or America by Kennedy, 1987.

4.2.1.3 Effect of Q'at expansion in study area

As it was mentioned earlier the problem is not the Q'at itself as a plant growing and consumed by people. But in this section will focus on the problems that are related to Q'at expansion and its effect on resources.

a) Increase in the number of wells

Expansion of Q'at on cultivated area and its requirement to water to optimize production of Q'at fields is the main aim for Q'at farmers. Expansion of Q'at is a disaster because Q'at cultivators are encouraged by increase of daily Q'at chewers demand. Because it is consumed daily by most of population in all levels and sexes male and female. The problem concentrates mainly in addition of Q'at cultivators on water used in Q'at and how much effort they pay to get water either in way of digging wells or buying it from other areas. Because of high profit from Q'at and fast income compared with other crops this happened without awareness of losses of water resources in country like Yemen which is one of the poorest countries in water resources. So that Q'at farmers are misusing their land and misunderstanding their right to use their land due to their desire; and with absence of law and control of government to dig wells. Farmers dig wells in their fields in small terraced mountain land. So that wells spread in fields of the villages and it is common to find two wells in a terrace or separated from each other by one or two

terraces. Of course these wells are surface, hand digging and not all of them have water all the time of the year, and some of them have no water from the beginning. But the question I was asking farmers, why did you dig the wells? The answer was “seeking for water”. Farmers dig wells everywhere in their land, the priority where they expect to find water is mostly upstream of Wadi(s) or springs. Random digging of wells cause another problem, resulting of decreasing water in public spring in the beginning and then disappeared. Therefore, water right of land that irrigates from spring has to be stopped or suspended because of dryness of spring due to wrong practices of digging wells not because natural dryness. While, water of spring was distributed between nearby lands and the water rights that were known between the owners either by written documents or by continence use of water.

Many examples can be taken to prove this problem, for instant in Wadi al-Masha’ar, which is located east of Najd An-Nashamah; it is around 1.5 to 2 kilometers in long and it is a continual of Wadi Al-Kathyah, where water was running all over the year. So, in this section of Wadi al-Masha’ar there are 36 wells, distances between wells is in some cases not more than 30 meters. In each of these wells 4 inches water-pump with 25-28 horsepower engine are pumping water to irrigate new Q’at, vegetables and other crops. The problem is not only extraction of the groundwater for non-food crops, but also polluting of air, land and perhaps groundwater. The smoke from diesel engine spread over the area, misuse of diesel and engine’s oil spread on land surface nearby and it might be mixed with water and spread on agricultural land and that is a problem of deteriorating the land.

Number of wells in the villages in study area is also evidence of random digging wells in which increased due to needs to water for Q’at and for domestic use. Number of wells is vary from 1 well as minimum in one village to a maximum of 74 wells in another village; while the average area of a village will not exceed 3 kilometers square (Fig. 4.3 and Table 4.21). Normally, digging wells is done manually by hand using local made tools, so that a lot of efforts applied from labors to find water especially in strong rocky ground, people dig wells where they expect to find water. Digging a well is easier in a place where ground consists of soil without hard rock than the other one of hard rock ground, where dig need more work, time and cost. Determination of location to a new well in the terraced land is not the easy step, so that it is usually done by an expert in the area or sometime the farmer brings him from another region and then pays him for his effort to locate the new well. Some experts put their guarantee to the owner of land to find water and keep their payment in the end when water comes out from well. When water is occurred even if it is in small amount happiness of worker and owner of well will be great. In some cases when water did not come out the owner of well will move workers from a

location to another to dig another well seeking for water and that is the reason of a number of dry wells available in the villages. These practices are the main issues among people that put a lot of their effort, time and money to dig wells to have water to use it for growing evil tree “Q’at”. But income from Q’at might cover effort, time and cost and that is the explanation of this situation.

Nowadays, people in Q’at area invest money to construct water reservoirs known as “*Syq’ayat singular is Syq’aya in Arabic*” or small dams. Constructing of water reservoirs is costly so that it is only common among Q’at farmers especially those who had high income or other sources of income from migrants or from their trading in the cities or other private works. The *Syq’aya* (reservoir) used to hold water during rainfall season and in some areas where water of wells occurs in rainfall season, water is pumped from well to *syq’aya* and is kept for dry time. In wintertime water in *syq’aya* is used for domestic purposes and to irrigate Q’at. But in some cases reservoirs are built to hold water for Q’at only and water for houses is the responsibility of women to look for it from neighboring wells or springs.

b) Increased use of groundwater

The amount of water used in irrigation of Q’at as crop water requirement is not known because lack of studies in this field due to ignorance from researchers to this plant. However, Q’at (estimated by World Bank) occupied 80,000 ha which are equal to 25% of irrigated land and it covers 33% of national holding capacity and it consumes about 800 million cubic meters per year which equal to 30% of water used in agriculture. Water requirement for Q’at is estimated to be 6000 CM/year also it provides employment for 500,000 (16 % of labor force) of population (World Bank 1996:4.1/5). Regarding the estimation of World Bank to the water requirement of Q’at, in my opinion this amount is under estimated because Q’at farmers use extra irrigation between rainfall and in winter to produce Q’at; therefore, the amount of water used by Q’at is the rainfall and supplementary irrigation and that will exceed 6000 CM/year.

Income from Q’at encouraged farmers to grow it and to introduce new practices for Q’at such as irrigation and uses of pesticides and fertilizer to increase Q’at production to meet demand in market. Water use for Q’at does not differ from one region to another but it differs within the same region due to differences in type of soil and uses of agro-chemicals which effect in differences of water use on Q’at. Because Q’at farmers irrigate Q’at after each spray of agro-chemicals and their explanation is that the poison is harming Q’at plant if not irrigated and irrigation will minimize effect of poison on plants.

It is common that the expansion of Q’at in Wadi lands had increased experiences and knowledge of Q’at farmers about Q’at behaviors and its demand for water and chemicals.

Because the time of spraying chemicals and the time of irrigating Q'at are important to Q'at farmers to maintain optimal Q'at production. From experiences of Q'at farmers, is that they understand that, the factor of Q'at production is age of Q'at plants. Production of Q'at is high for young trees as it can be possible to harvest it 3-4 times per year. Because roots of Q'at plants in this stage are in upper layers of soil and it is good for Q'at to reach to materials in this layer. Also in this stage root zone of Q'at trees is small and it can full dry when rainfall or irrigation intervals are large, and it can be wet fast with rainfall or irrigation. So, when Q'at is under water stress it is good for farmers because Q'at trees are tolerated to drought and they respond faster to irrigation. So, that when production of this field is needed then field will be irrigated and respond of trees will be fast to grow new branches and leaves to harvest after few days for marketing.

When Q'at plants become old, roots will grow deeper to reach to moisture in deep layers of soil and then Q'at plants stay green. So, if trees are green all the time new leaves and branches will not grow as needed. In this case and in the case of expansion of Q'at in fertile soil in Wadi lands that have high water holding capacity plants become subject to infection by diseases like powdery mildew and other diseases. Therefore, the chance of harvesting of old plants is only once a year during winter time so that production will decrease and in this case farmers use chemicals to enhance growing of new leaves and branches before irrigation. Their explanation for using of chemicals: that the chemicals are worming up Q'at trees to enhance growth of new buds. In the past farmers used to grow Q'at in the upper terraces where soil layer depth is small and soil mostly is sandy loam or gravelly to avoid wetness on root zone to reduce infection of diseases. Even nowadays, in mountain areas farmers prefer soil that has gravel for Q'at and they called it "*torbah hager*" gravelly soil.

Nowadays expansion of Q'at take place in Wadi lands where it is planted in rows and in hills close to each other, so that number plants per hectare is much more than those of old style in mountain areas. Also Q'at farmers do not allow plants to grow more than few meters as in mountain area where Q'at tree reach more than 5 meters, so, farmers in Wadis cut the Q'at trees frequently to keep them young to harvest them several times a year.

From new experiences of Q'at farmers, they irrigate fields of Q'at to stop growing of new leaves and branches. And they do that when the price in market is low and on the other hand they are afraid that if growing of leaves is continued then the quality of Q'at will decrease because Q'at with small leaves is more popular in market. For that farmers understand that the growth of new leaves "*the bedl*" is reduced if temperature of plant's roots is cooling down, so that they irrigate the field to saturate plant's root zone, to cool down the ground to stop leave

growth. Farmers actually in this practice misuse water because plants are not in need for it, but they act only according to their hypothesis to keep production of field to next season when the prices in market are good. Whatever, when demand in market is high even if water is rear they start to spray Q'at by chemicals to enhance growth of leave and branches and provide water from any place even with high price to irrigate Q'at to gain high price in market.

4.2.1.4 Q'at market

Before the spread out of Q'at production in recent times, Q'at used to be marketed by the lowest social strata in Yemen (Sherif et. al., 2002). Q'at farmers used to refrain from selling their Q'at themselves to consumers, as this would affect there social status in there local community. Today, values changed to allow anybody to deal with Q'at markets. Q'at marketing does not require special skills or large investment, or even owning or renting special stores. Except for Q'at consumption tax, there are no law or trade conditions that regulate Q'at marketing. All what is needed to deal in Q'at trade is to contact farmers or wholesalers to get Q'at to be marketed. Q'at trade became more profitable and the number of people working in Q'at trade increased significantly during recent decades. Presently, their number was estimated at about 300 thousands, or about double number of Q'at farmers. However, most Q'at dealers trade in a relatively small amount of Q'at to avoid any possible high losses. Hence, they do not tend to monopolize the market or utilize any means of market concentration, which is another positive aspect of Q'at marketing (Sherif, et.al, 2002).

Q'at crop is one of several important economical crops in the ROY, it has expanded very fast during the last three decades in which is increased from 8000 ha in 1972 to 103000 ha by 2000 (Sherif, et. al, 2002). Because its demand increased year after year with increased population and increasing number of chewers from both sex. It is consumed daily and fresh that means harvesting and preparing for market has to be before noon in market to be available in hand of consumers. Harvested Q'at which could sold in the same day, its price then will decrease and in many cases it will not be accepted by high level's regular consumers, so it is sold with low price to people who has low income and pay little money. Therefore, the Q'at consumption and the demand force the producers and the dealers to find out the system to market it.

a) Q'at Marketing Systems:

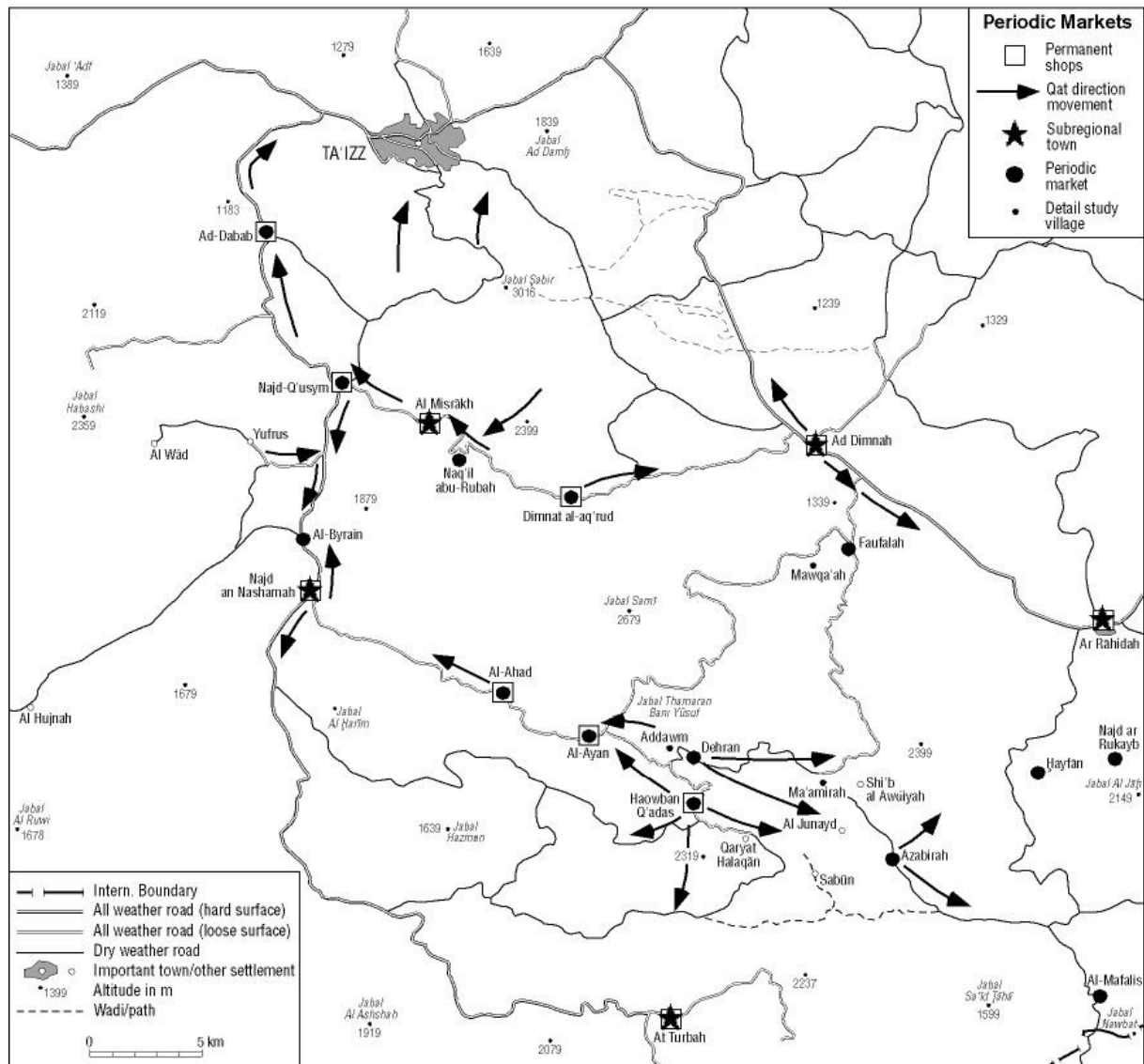
Q'at marketing becomes industry, as it is hired labor to fulfill the continuation of its availability in hand of consumer anytime anywhere. Q'at is marketed through three marketing systems, direct marketing (direct sell to the consumers), wholesale marketing and retail sale

marketing and each one has its dealers and manpower. The direct marketing system has low manpower because consumers go to farms to get fresh Q'at or farmers go to closer market to sell their Q'at to consumers or to dealers. While the wholesale marketing system consists of large dealers who buy Q'at in large quantities either from fields (farm gate) or at market gate and then sell it to retail dealers. Also the retail marketing system consists of medium to small dealers who also buy Q'at from wholesale dealers in market and/or from farm and then sell it to consumers.

i) Direct Marketing System

In this system the Q'at product is directly sold to consumers either at farm gate (consumers go by themselves to the fields and buy their Q'at) or farmers or their sons go to closer periodic market and sell Q'at direct to consumers. Farmers go to market to sell Q'at directly to consumers to save losses, which normally go to pockets of mediator (whole and retail traders). Farmers also use to go to closer periodic market to sell their Q'at to retail traders and these transport it to the other markets to sell it to consumers (Fig. 4.7). Sherif et al., 2002 estimate 3-4% of Q'at is sold by this process. Fig. 4.7 shows direction of Q'at movement from production areas to nearest markets and to other markets in the region either to sell to consumers or to whole and retail dealers. Q'at move from Saber Mountain to Taiz city for sell in one direction and in other direction it move to Naq'il Aburubah, then to Al-Misrahk, Najd-Q'usym (Q'at comes also from Yafrus to Najd-Q'usym), Ad-Dabab markit north and/or to Al-Byrain market and Najd- an-Nashamah south to sell. The other direction movement of Q'at is from Saber Mountain to the local market (Dimnat al-Aq'rud) then it is distributed to the area nearby and to the east to Ad-Dimnah market. There it is sold directly to consumers or to dealers in turn transport to other populated areas in the region. On the other hand Q'at which reached to Dehran market (Q'at market close to Q'at production areas such as Addawm and neighboring villages) and Howban Q'adas Market is moved to Al-A'yn and Al-Ahad market west to sell directly to consumers or to dealers to transport it to An-Nashamah and other markets in the region and to At-Turbah. Also Q'at moves from Dehran market and Hawban Q'adas market by dealers to Al-Markazi market and Al-Musalah market east to sell it or to transport it to closer areas by these markets.

The perishability of Q'at means that it must be marketed very quickly, and this has been much of the stimulus behind the expansion of the system of roads in North Yemen. Hundreds of small villages have built feeder roads with only hand tools in order to connect their areas with the main roads and highways, so that the local farmers and merchants could move their Q'at to the larger markets of cities and towns (Kennedy, 1987 and Kopp, 1981).



Source: Joint Operations Graphic-Map 1: 250,000 TA'IZZ. 1984; own investigations.

Design: Al-Ghory; Cartography: D. Engel

Fig. 4.7: Q'at Movement in Periodic Market in the region

ii) Wholesale marketing system

The wholesale marketing system consists of large Q'at traders, they available in the main market in the region and in the cities. Farmer sell Q'at to them in the market or wholesale dealers buy the harvest of a Q'at field as a whole and pay for all costs such as harvesting and preparing Q'at for marketing. They then sell Q'at to retail traders to transport it to other markets in the region or to cities; Sherif, et al, 2002, found that the average of 41% of total Q'at is sold by this process.

iii) Retail marketing system

The retail marketing system consists of great numbers of small dealers and they spread in all local, regional and central markets. Through this system Q'at is delivered to consumers; Sherif, et. al, 2002 estimate that 92% of Q'at is sold to consumers by this process

b) Q'at marketing channels

Marketing channels represent the path along which the commodity moves in its way from producers to consumers. This path might be short when the commodity moves directly from producer to consumer. However, it might be long enough to allow all middlemen to add different types of values to the commodity until it reaches its final consumer (see Fig. 4.7). The most efficient marketing channels are those through which commodities move from producers to final consumers in the time and place required at the lowest possible marketing cost. Q'at marketing channels are as follows:

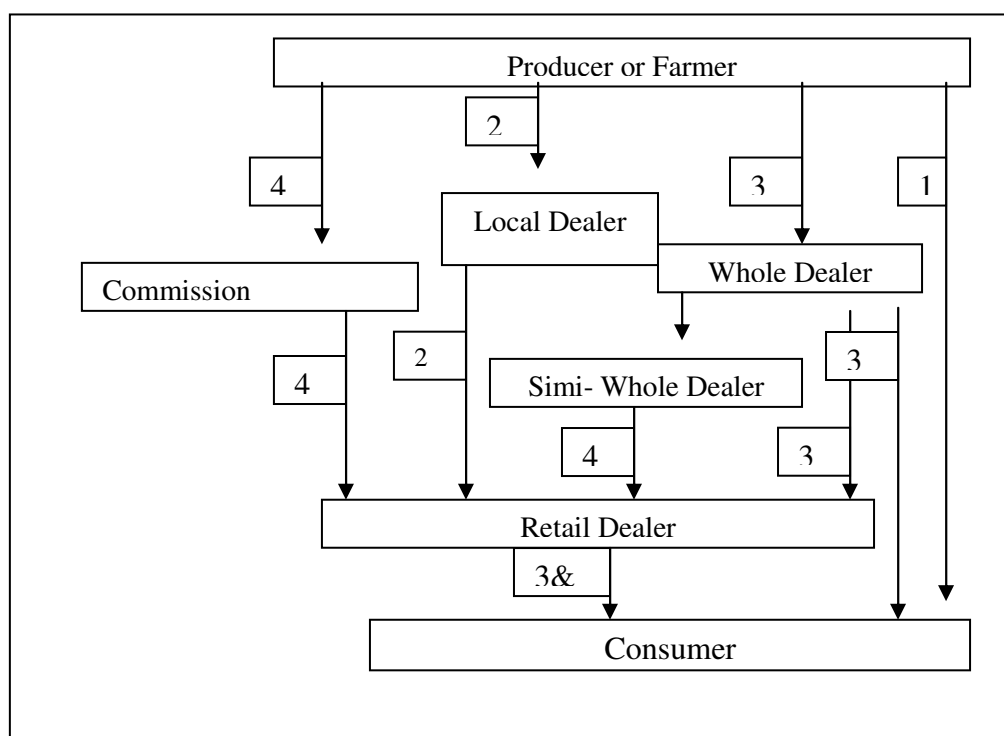


Fig. 4.8: Q'at marketing system channels

Source: (Sherif, et. al, 2002), National Conference on Q'at "Towards the Formulation of a Comprehensive Q'at Policy in the Republic of Yemen". Technical Field Study 6-7 April 2002.

1) Direct sells: In this channel Q'at is sold by producers to consumers and it exists in rural areas quite close to production fields in which consumers go to buy their requirements directly from the fields, or farmers transport their Q'at to closer market to sell it by themselves to consumers (Fig. 4.7). Q'at marketed through this channel represents 6% of total marketed Q'at (Sherif, et. al, 2002).

2) The second channel is selling Q'at through local dealers and retailers. In this channel farmers go to the closer local market and sell their Q'at to local dealer, who in turn sells it in the same markets or transports part of it to retailers in other markets (Fig. 4.8); Q'at sold through this channel is 3-5% of total marketed Q'at (Sherif, et. al, 2002).

3) The third channel is selling Q'at through wholesalers and retailers, in which wholesalers and retailers buy Q'at directly from farmers such as whole field (called *Gabr* in Arabic) and transport it to markets in the region and cities to sell it to consumers (Fig. 4.7). They (traders) normally have modern Toyota cars to transport the Q'at which enables them to reach markets in shortest time possible to fulfill desire of consumer to find Q'at fresh and at a time. The amount of Q'at sold through these channels is estimated by 74% of total marketed Q'at (Sherif, et. al, 2002).

4) The fourth channel is selling of Q'at through commission dealers, semi-wholesalers, and retailers, in which commission dealers sell Q'at on behalf of farmers against 10% as a commission of marketed Q'at, without any risk. While the semi-wholesalers buy Q'at from wholesalers. Then commission dealers and semi-wholesalers sell their Q'at to retailers, who sell it to consumers (Fig. 4.8). The amount of Q'at marketed through this channel is 15-17% of total marketed Q'at (Sherif, et. al, 2002).

c) The share of farmers from marketed Q'at

Following the Q'at marketing process to find the net profit shared by farmer from his field of Q'at is shown in Table 4.25 as result of a study done by the FAO experts Sherif et al., 2002; the average net profit from retail price of Q'at marketed is 67.2, 62.5, 61.4, 55.7 and 55.0 for Sana'a city, Taiz, Sana'a rural, Aden and Hudeidah respectively compared to the average of traders net profit shared from retail price of Q'at is 45.0, 44.3, 38.4, 37.5 and 32.8 for Hudeidah, Aden, Sana'a rural, Taiz and Sana'a city respectively. This indicates that farmers of Q'at shared by 60% of net profit from retail Q'at price and traders shared by 40%, which is high for farmers while it is might be other way of share.

Table 4.25: Estimate of the farmer's share of the Q'at sold in July-August 2001

Daily Q'at Sales (1000 YR)	Farmers share's from retail price in percentage									
	Sana'a city		Sana'a rural		Taiz		Hudeidah		Aden	
	Farmer	Trader	Farmer	Trader	Farmer	Trader	Farmer	Trader	Farmer	Trader
Sale<20	61.7	38.3	66.5	33.5	56.2	43.8	62.4	37.6	57.2	42.8
20< s<40	65.4	34.6	60.2	39.8	63.1	36.9	59.7	40.3	42.2	57.8
40< s < 60	67.4	32.6	59.6	40.4	58.1	41.9	56.7	43.3	53.7	46.3
Sale > 60	72.3	27.7	63.1	66.9	67.7	32.3	52.6	47.4	47.8	52.2
Average	67.2	32.8	61.4	38.4	62.5	37.5	55.0	45.0	55.7	44.3

Source: (Sherif, et. al, 2002), National Conference on Q'at "Towards the Formulation of a Comprehensive Q'at Policy in the Republic of Yemen". Technical Field Study 6-7 April 2002.

4.2.2 Migration

4.2.2.1 General

Internal and external migration in Yemen is a common movement of people to find best income to provide best life for their families and to stabilize ecological resources. People moved from rural area to urban area to fulfill their desire for better life and find jobs to cover needs of daily life of their families in rural area. Migration of men from rural areas to the cities produce two systems a) unstable ecological system in urban area; b) stable ecological system in rural area. In case of unstable ecological system, migration of men from rural area to cities caused instability of resources per capita in cities due to high population growth. Increasing of population in cities increased stress on natural resources so that people in urban area are suffering from shortage of water and land and also from increasing of diseases due to pollution in cities. While in released area (rural area) the effect is positive on stability of ecological system in which resources are enough for remaining people in rural area. Effect of migration of men from rural area can be seen from other angle that rural area is suffering from shortage of labor force and in turn reduction of agricultural production due to abundant and un-maintained terraced land.

Migration of men do not stop in cities but it reaches to neighboring oil countries in Gulf States and Saudi Arabia to look for better jobs to improve standard of life of their families. Flow of remittances to families of migrants direct or through official's transfer canals (banks) increased the dependency on imported commodities. Families that received remittances from their migrants encouraged them to increase their consumption of imported commodities such as foodstuff, luxuries commodities and Q'at. On the other hand the government encouraged by flow of remittances and foreign aid from mid of 1975 to increase imported and subsidized food and other commodities to fulfill demand of people. During that period, compromise between two poles of economy actors in Yemen, traders and agricultural producers, took place. Traders imported food, grain, rice, sugar, milk and other products to fulfill demand in market, while agricultural producers changed their production from food crops to cash crops production in which Q'at became an important cash crops.

The honeymoon of flow of remittances did not continue in the same rate for long time. But it declined in mid of 1980s to 60% due to dropping of oil prices in oil countries in Gulf States and Saudi Arabia Table 4.26 and Fig. 4.9. Chaudhry 1997 wrote "Saudi Arabia's oil revenue declined from a high of \$120 billion in 1981 to \$17 billion in 1985. Yemen labor remittances is dropped by about 60%, and development aid, which had covered the entire current budget of the Yemeni government, dropped to only 1% of the state budget. Both countries experienced severe fiscal crises that prompted in wide-ranging economic reforms in 1986-87 designed to cut

government outlays of the foreign exchange, increase domestic taxation, and regulate what had been two of the most open economies in the world. Reform efforts produced different outcomes in the two countries. The Yemeni government's thoroughgoing package included heavy, retroactive taxation, foreign trade reforms, and a host of economic regulations that restricted the activities of its powerful private sector. In contrast, private elites in Saudi Arabia forced the Saudi government to withdraw most reforms within days of their enactment.”

Migration phenomenon in Yemen is not new but it is a unique character of people in this area of the Arabian Peninsula. But it has become visible in the last 3 decades when people migrated in large number to outside of country to Saudi Arabia and other petroleum Gulf States seeking for better job and income.

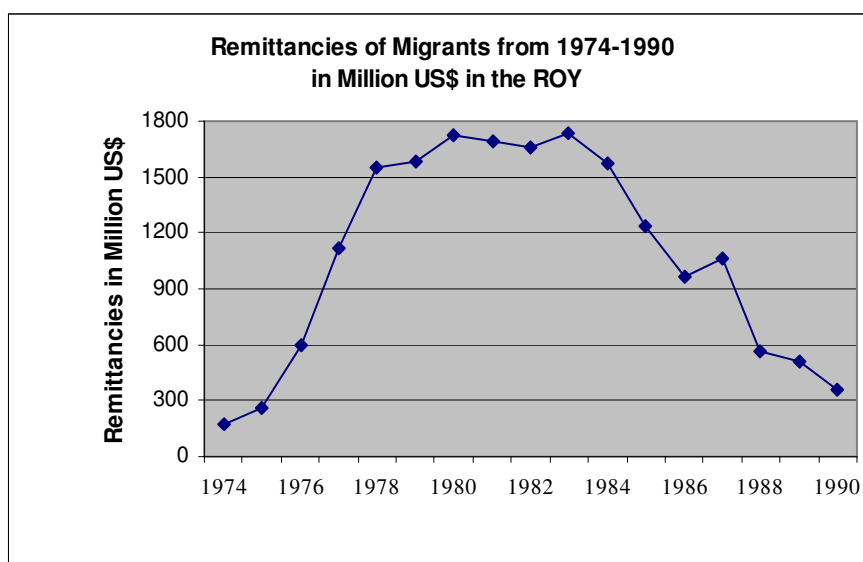


Fig. 4.9: Remittances of migrants from 1974 to 1990 in million US\$ in the ROY
Source: The First National Population policy Conference in Sana'a 26-29 October 1991 (Page, 209)
(Referring to World Bank 1990)

Table 4.26: Remittances of migrants during 1974-1990 in millions US\$

Year	YAR	PDRY	Total
1974	130	43	173
1975	222	42	264
1976	518	79	597
1977	1000	119	1119
1978	1393	155	1548
1979	1404	183	1587
1980	1410	310	1720
1981	1340	350	1690
1982	1191	471	1662
1983	1245	488	1733
1984	1067	501	1568
1985	809	426	1235
1986	669	293	962
1987	762	304	1066
1988	343	224	567
1989	344	161	505
1990	200	155	355

4.2.2.2 Migration Trends in the Study Area

In the three detail study villages and in the other villages in the region which are surveyed in this study the migration of people to the cities in the country and to the Gulf States and Saudi Arabia were clear especially among the young men. Looking to Table 4.27a, Table 4.27b and Fig. 4.10, migration to cities increased after 1990 when migrants flow back from Saudi Arabia and Gulf State after the second Gulf war against Iraq. Return migrants did not go back to their villages where agriculture activities need them but they stayed in cities seeking for jobs to support their families. As it is shown in Table 4.27a and Fig. 4.10, percentage of men who migrate to cities during the study period in 1998 ranged between 2% and 73% with average of 16% where it was pre 1990 between 0% and 62% with average of 12%. While the whole family migrates to cities ranged from 2% to 38% with average of 13% in 1998 where it ranged from 0% to 33% with average of 9% pre 1990. Migration of men to outside the country in 1998 was ranged from 0% to 6% with average of 2%, where it ranged from 0% to 42% with average of 9% of men in the villages' pre 1990. While the whole family migrated to outside the country in 1998 was ranged from 0% to 9% with average of 2% where it ranged from 0% to 38% with average of 5% pre 1990.

Table 4.27a: Percentage of migrants (persons and families) in Yemen's cities and out of Yemen; at present and before 1990 in the study area (*by the author, 2004*)

No.	Villages name	Migrant in Yemen now		Migrant in Yemen pre 1990		Migrant out Yemen now		Migrant out Yemen pre 1990		% Of Q'at cultivation
		Person	Family	P	F	P	F	P	F	
1	Al-Ma'amirah	14	34	13	20	3	2	4	3	10
2	Addawm	4	2	4	2	1	1	4	1	85
3	Mawq'a'ah	3	9	1	9	3	0	1	2	3
4	Al-A'akyshah	13	8	9	5	6	1	19	1	10
5	Jawhan	14	8	10	10	3	2	10	3	15
6	Al-Oudayrh'	32	38	19	27	6	2	32	38	60
7	Al-Monakh	3	15	1	14	0	1	1	2	95
8	Hugarah	2	7	3	2	1	0	4	1	85
9	Al-Q'utayn	25	17	5	14	5	5	30	10	25
10	Al-Hugar	7	16	1	10	1	3	4	10	20
11	Wadi Al-A'gab	11	21	7	16	1	7	2	7	70
12	Jurynat	35	10	26	7	1	0	9	0	90
13	Sharar	5	15	4	11	0	0	3	1	90
14	Al-Q'abilah	35	17	24	14	3	3	6	4	12
15	Al-Ashaa'er	12	13	12	10	0	1	0	1	3
16	Al-Haq'eeb	7	33	5	33	3	11	7	11	10
17	Hawrah	29	18	19	9	0	1	9	1	50
18	Boukryan	3	6	2	4	0	0	6	2	66
19	Bany-Aba'as	11	5	5	2	0	0	3	8	60
20	Ouq'f	5	10	3	13	1	2	3	2	75
21	Halaq'an	24	19	19	14	1	4	4	5	95
22	Mataran	30	10	23	8	1	1	11	2	50
23	Dhagomal	14	15	12	15	0	1	2	2	90
24	Al-Huq'ab	4	3	2	3	0	0	1	1	60
25	Al-Buheem	73	5	62	4	6	2	17	15	1
26	Al-Anbough	6	5	0	0	6	8	13	11	15
27	Al-Misha'ar	40	8	40	0	0	0	3	0	10
28	A'aniyah	14	5	5	0	0	0	42	0	5
	Average	17	15	12	11	2	3	9	5	42

Table 4.27b: Migrants (persons and families) in Yemen's cities and out of Yemen, at present and before 1990 in the study area (*by the author, 2004*)

No.	Villages name	Migrant in Yemen now		Migrant in Yemen pre 1990		Migrant out Yemen now		Migrant out Yemen pre 1990		% Of the Q'at in the villages
		Person	Family	P	F	P	F	P	F	
1	Al-Ma'amirah	98	36	91	21	22	2	27	3	10
2	Addawm	100	10	100	10	20	3	100	6	85
3	Mawq'a'ah	19	10	10	10	2	0	8	2	3
4	Al-A'akyshah	300	30	200	20	150	5	450	5	10
5	Jawhan	200	15	150	20	50	3	150	5	15
6	Al-Oudayrh'	500	100	300	70	100	5	500	100	60
7	Al-Monakh	20	18	10	17	1	1	5	2	95
8	Hugarah	25	14	30	3	9	0	50	2	85
9	Al-Q'utayn	250	25	50	20	50	8	300	15	25
10	Al-Hugar	80	25	15	15	10	5	50	15	20
11	Wadi Al-A'gab	150	40	100	30	7	13	27	13	70
12	Jurynat	200	40	150	30	6	2	50	1	90
13	Sharar	100	48	80	35	4	1	60	2	90
14	Al-Q'abilah	600	50	400	40	46	8	100	11	12
15	Al-Ashaa'er	250	40	250	30	3	4	5	4	3
16	Al-Haq'eeb	20	12	15	12	10	4	20	4	10
17	Hawrah	1400	128	900	60	17	7	450	10	50
18	Boukryan	70	18	50	10	6	0	120	6	66
19	Bany-Aba'as	400	30	200	10	16	3	100	50	60
20	Ouq'f	75	24	53	32	9	5	44	4	75
21	Halaq'an	500	50	400	37	14	12	87	13	95
22	Mataran	581	30	445	25	20	3	210	7	50
23	Dhagomal	134	20	110	20	3	1	18	3	90
24	Al-Huq'ab	100	14	60	13	2	1	25	3	60
25	Al-Buheem	650	9	550	7	57	4	150	25	1
26	Al-Anbough	50	7	0	0	46	11	105	15	15
27	Al-Misha'ar	150	5	150	0	0	0	10	0	10
28	A'aniyah	200	12	70	0	1	0	600	0	5
	Average	258	31	176	21	24	5	136	12	42

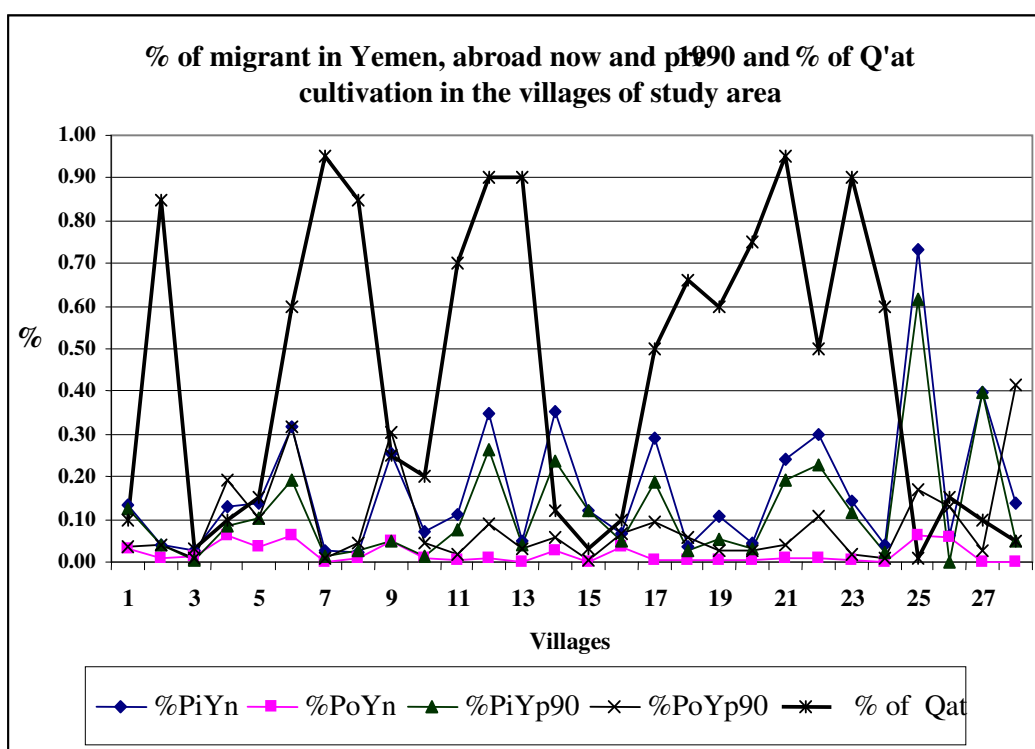


Fig. 4.10: % of migration in Yemen, abroad, at present and before 1990 and % of Q'at cultivation in the villages of study area

4.2.2.3 Migration and Q'at

Q'at expansion in the villages consumed free hand labor as it need people to work in different stages of production such as cultivation of land, pruning, spraying chemicals, harvesting and marketing. In Table 4.27a and Fig. 4.9 villages with high percentage of Q'at cultivation have low percentage of migrants such as villages 2, 7, 8, 11, 12, 13, 18, 20, 21 and 23, where the villages with low percentage of Q'at cultivation have high percentage of migrants such as villages 1, 3, 4, 5, 9, 14, 15, 16, 17, 22, 25, 26, 27 and 28. The advantage of expansion of Q'at is holding men to work in Q'at which is consumed locally. Also the good advantage of Q'at expansion is it's growing in terraces in top mountain hills and helping maintaining terraces due to its high income. While its disadvantage is the negative effect on economy because it is consumed locally and is not exported to provide the government budget by foreign currency but Q'at grower's families depend on imported food. In the other side migrant of men in low Q'at production area reduced labor force in agriculture area and in turn food production pre unit area decreased.

4.3 Sub-Sub-Regional

4.3.1 Water uses in Q'at fields in Addawm

Q'at farmers in Addawm's village, one of the three detail study villages, expressed their experience of change in water use for Q'at 40 years ago and at present. They said, 40 years ago and before chemicals used for Q'at, the amount of water used to enhance growth of leaves and branches during a season was less than that used at present. For example, the large "*maghras*" of Q'at (a bunch of several plants in a bund) was irrigated 3-4 times about 100 liters each (300- 400 l/*maghras*), (farmers in the past used a small container (~15 liter) made from mud called "Garrah" to carry water from springs to irrigate Q'at trees). Whereas, at present a truck of 8 cubic meters irrigates about 20-30 *maghras*, 3-4 times, (960-1280 l/*maghras*). So, at present the quantity of water add to each large *maghras* each time equals triple of that of 40 years ago. An other example, the small *maghras* irrigated with 40 liters 3-4 times (120-160 l/*maghras*) at 40 years ago; compared to present, when a truck of 8 cubic meters irrigate 50-60 small *maghras* 3-4 times, (436-582 l/*maghras*). At present the quantity of water add to each small *maghras* equals 3.5 times of 40 years ago. As farmers said, Q'at plants at present got used to chemicals, which in turn increased the demand of water. In my opinion, at present rainfall occurred frequently and drought period increased compared to the past decades because in the past decades and during winter time weather was humid, foggy rainfall and it continued for 2-3 days, therefore, irrigation water was less in winter period (Q'at's farmers sell their Q'at in winter because of good demand and high prices).

To determine the amount of water uses for Q'at, several fields in Addawm village had been chosen to collect information about the amount of irrigation water used extra to rainfall, agro-chemical and labor, in 1997 and 1998. The information documented by the farmers themselves for each field. Rainfall did not record due to lack of rainfall gauge the result is summarized in Table 4.28.

From the information in Table 4.28, the area per *maghras* of Q'at is varied from one to another depends on size of *maghras* of Q'at. The area per *maghras*, ranged from 2 m² to 5 m² with an average of 3.7 m²/*maghras*. The number of *maghras* of Q'at per hectare ranged from 2000 to 5000 *maghras* with average of 2703 *maghras* per hectare.

Farmers usually make bund around the *maghras* of Q'at during supplementary irrigation to reduce the losses of water in the field, and to increase water distribution efficiency. The amount of water per *maghras* per irrigation varies according to the size of *maghras*, the growth stage of Q'at and the amount of rainfall, so that it changes from one year to another in the same field.

In 1997, the amount of water added was 533.3 liters per *maghras* (area 3.4 m²) as maximum for farmer 2 and 60 liters per *maghras* (area 2 m²) as minimum for farmer 5. The amount of water added to each *maghras* was 296 liters (area 5m²) and 100 liters (area 4.5m²) for farmer 6 and 1 respectively and 267 liters was the average amount of water per *maghras* (area 5m²) for farmer 3 (Table 4.28). The reason for the variation of water used on Q'at, farmer 5 brought water by his car and he used it efficiently to increase the profit from Q'at, while, farmer 6, used water from his small private reservoir, and he used it very efficiently to save water. Whereas, farmer 2 has paid for the whole truck, so he used all water in his field. Farmer 4, because his field located in top of terraced slope and it was difficult for him to provide water by another sources, so he harvested his Q'at and sold it during rainfall period in both years 1997 and 1998. The depth of water used during one Q'at sell in 1997 ranged from 7 mm/day for farmer 2 to 2.3 mm/day for farmer 6, with average of 4.7 mm/day (Table 4.28)

Table 4.28: Amount of irrigation water used for the Q'at in Addawm in 1997 and 1998

Year	Items	Farmer 1	Farmer 2	Farmer 3	Farmer 3	Farmer 4	Farmer 5	Farmer 6
1997	Area m ² / <i>maghras</i>	4.5	3.4	5	5	2	2	5
	No. Of <i>maghras</i>	27	15	4	6	40	40	20
	Total Area m ²	121.5	51	20	30	80	80	100
	No. Of irrigation	2	2	4	3	Rain	5	4
	Volume of added water/ total area (m3)	16	16	5	4		12	8
	Depth of added water (mm)	132	314	250	133	0	150	80
	L/ <i>maghras</i> /Irrigation	296	533	312	222		60	100
	Water Source	Tanker	Tanker	Private well	Tanker + Private well	Rain	Tanker	Small Reservoir
	Period of new growth of Q'at leaves and branch to sell	10/11-2/12/97=22 days	16/11-30/12/97 = 44days	13/12/97-8/2/98 =57 days	25/2 - 31/3/98 =34 days	20/11 - 15/12/97 =25 days	17/11 - 21/12/97 =34 days	25/10 - 29/11/97 =35 days
	Depth of Water /day (mm)	6	7	4.4	4		4.4	2.3
1998	No. Of <i>maghras</i>	27	15	10		40	40	20
	Total Area m ²	121.5	51	50		80	80	100
	No. Of irrigation	1	Rain	8		Rain	Rain	2
	Volume of added water/ total area (m3)	2		16.4				14.4
	Depth of added water (mm)	16.5		328				144
	L / <i>maghras</i> /Irrigation	74		205				360
	Source of water	Tanker	Rain	Private well+ tanker		Rain	Rain	Public Well
	Period of new growth of Q'at leaves and branch to sell	17/9-4/10 /98=17days	23/9 - 4/ 10 /98=11days	22/10-27/ 11/98 = 36 days		5/8-26/8/ 1998 =21 days	9/09- 8/10/98 =29 days	6/9-23/9/ 98=17 days
	Depth of water /day (mm)	1		9				8

Sources: By the author, 2004.

In 1998, Table 4.28, the amount of water added to the Q'at's fields was low in general because rainfall was good in that season and three of farmers (2, 4 and 5) sold their Q'at without any supplementary irrigation. The amount of water used in other three farmers fields was varied accordingly, i.e., the amount of water added to each *maghras* was 360 liters, 205 liters and 74 liters for farmer 6, 3 and 1 respectively (Table 4.28). The reason for the variation of water used,

farmer 1 added 2m³ of water in one irrigation only to complete growing of Q'at branches till harvesting (17 days). Farmer 3 irrigated his field 8 times in 36 days (22/10-27/11/98). Farmer 6, pumped water from public well and he did not take care for extra water add to the field. Therefore, depth of water used during one Q'at sell in 1998 was 9 mm/day, 8 mm/day and 1 mm/day for farmer 3, 6 and 1 respectively, with average of 6 mm/day (Table 4.28) .

Only supplementary water recorded and takes into the calculation of water used in Q'at fields. Rainfall was not included in the calculation due to lack of data. Rainfall was part of the amount of water consumed by Q'at field, and it can say the amount of water used for Q'at fields, rainfall and supplementary irrigation added in winter, or when the rainfall interval was large.

Period of new growth of Q'at leaves and branches can concluded from Table 4.28, it shows the time that farmers start to work on their fields of Q'at until harvesting, making bund around *magharis* (plural of *maghras*) of Q'at, spraying insecticide and irrigation. Starting of work in fields varied from one field to other according to the stage of Q'at and its approach to harvest. Farmers of Q'at are market oriented, and they use to make their own calculations and estimations about market price of Q'at. Therefore, they do not harvest the Q'at even if it is ready during the rainy season when market price is low, they keep it till the demand of Q'at is high, then they start to irrigate it even if water is expensive to get the highest price in the market. Otherwise, they harvest their Q'at and sell it even if the price in the market is low when they are in need for cash to procure urgent family needs.

4.3.2 Agro-chemicals use in Q'at field in Addawm

Agro-chemicals are normally used in Q'at fields to enhance growth of new leaves and branches, to fulfill demand of Q'at in the daily market. In Addawm Q'at fields, farmers used agro-chemical on Q'at and they added it in mixture such as (Dimethoate+ Seven), (Dimethoate + Deptrix) and (Perfikthion+ Seven), see Table 4.22 for more detail about agro-chemicals. Q'at farmers used mixtures to enhance and to worm up Q'at to grow new leaves and branches and do not use them to protect Q'at from pests or diseases.

The amount of chemicals added to Q'at fields varied from farmer to another. In 1997, it was 100 ml of Dimethoate or Perfikthion (insecticide chemicals) for all farmers' fields and 255 gm Seven or Deptrix (insecticide chemicals). Farmers used 255 gm Seven and/or Deptrix in maximum and 57 gm in minimum with average of 157.8 gm and mixed it with 100 ml Dimethoate or Perfikthion for farmer 3, 2 and 6 respectively. The number of sprays varied from 1 for farmer 1, 2 and 6, to 2 for farmers 3 and 5, with average of 1.2 sprays. Farmers harvested

Q'at after 3 days in minimum and 52 days in maximum from last spray, with average of 30 days (Table 4.29).

In 1998, the amount of Dimethoate or Perfikthion used in Q'at fields was 300 ml for farmer 1 and 200 ml for all other farmers, with average of 217 ml. The amount of Deptrix or Seven ranged from 28.35 gm for farmer 1 to 284 gm for farmer 3, with average of 128 gm. The number of sprays varied from 1 spray for farmer 1, 4 and 6 to 2 times for farmer 2, 3 and 5 with average of 1.5 sprays. Farmers harvested Q'at after 5 days to 20 days from last spray with average of 11 days (Table 4.29 for more detail see Table 4, Appendix 3.).

Table 4.29: Agro-chemicals use in Q'at field at Addawm village

Year	Items	Farmer 1	Farmer 2	Farmer 3	Farmer 4	Farmer 5	Farmer 6	Average
1997	Area of field (m ²)	121.5	51	50	80	80	100	80.4
	Number of spray	1	1	2	--	2	1	1.2
	Time (from last spraying) to harvesting (days)	52	45	3	--	21	30	30
	Total added (ml)	100	--	100	--	100	100	100
	Total added (gm)	250	57	255	--	170	57	157.8
	Total of urea added (kg)	--	--	2	--	--	--	--
	Total added (l/ha)	8	--	20	--	13	10	12
	Total added (kg/ha)	21	11	51	--	28	6	16
1998	Total of urea added (kg/ha)	--	--	400	--	--	--	--
	Growth period (days)	22	44	90	25	34	35	--
	Number of spray	1	2	2	1	2	1	1.5
	Time from last spray (days)	20	5	12	7	7	17	11
	Total added (ml)	300	200	200	200	200	200	217
	Total added (gm)	28.35	85.35	284	85	170	113	128
	Total of fertilizer added (kg)	--	--	4	--	--	--	--
	Total added (l/ha)	25	39	40	25	25	20	27
1998	Total added (kg/ha)	2	17	57	11	22	11	16
	Total urea added (kg/ha)	--	--	800	--	--	--	--
	Growth period (days)	17	11	36	21	29	17	--

Sources: By the author, 2004.

The explain increases amount of chemicals used in 1998 than 1997 because Q'at Farmers used Dimethoate and Perfikthion (insecticide chemicals) and mix it with either Seven or Deptrix (insecticide chemicals) to enhance growth of Q'at and to encourage the Q'at buds to grow new leaves, not to kill the insects or protect Q'at from pests. Q'at farmer nor uses the recommendation written in pesticide packing, neither follows the extension recommendation. i.e., Seven and Deptrix recommended by manufacture, 1.2 kg/ ha and recommended by research study, 2g/l and 2 kg/ha (Al-A'ali, 1980 and Al-Ghashm, 1990). Whereas, Dimethoate and Perfikthion recommended by manufacture, 2.0 l /ha and by research study, 2 ml/l (Al-Ghashm, 1990). But, if it compared the amount used by Q'at farmers in Addawm with recommended, i.e., farmers used 16 kg/ha of Seven or Deptrix, in both years 1997 and 1998, which is greater 8 times than recommended. Farmers used 12 l/ha and 27 l/ha of Dimethoate or Perfikthion, in 1997 and 1998, respectively, which is higher 6 and 13 times than the recommended in 1997 and 1998,

respectively. In the average, farmers harvested Q'at after 30 days and 11 days from last spray in 1997 and 1998, respectively. In 1997, 83% of farmers harvested Q'at after safety period and 17% of farmers harvested Q'at after three days from last spray. In 1998, 17% of farmers harvested Q'at after 5 days from last spray, 33% harvested after 7 days, 17% harvested after 12 days and 33% harvested after 17 days from last spray. It is recognizable that only one farmer used urea fertilizer in both years, because fertilizer used also to increase flora growth of plant and it has negative affect on the quality of Q'at as increased the moisture of Q'at leaves, reduced its use in other farmer's fields.

It can be conclude that the random used of agro-chemicals in Q'at has effect in two dimensions; the direct effect of consumed of poisoned Q'at on human health and the indirect effect because pesticide residues remaining in plant and soil, which in turn will transfer to groundwater or to other cropped to pollute the environment. In general, random and uncontrolled uses of agro-chemical in Q'at fields are the most challenge to government and people in Yemen at present and in future for its effect on human health and environment.

4.3.3 Economic Considerations Aspects

4.3.3.1 Economics of Q'at cultivation in Addawm

The cultivation of Q'at in Addawm existed for many centuries. The old people identify that Q'at entered to Addawm's village in several hundred years ago. Their evidences are the old documents to transfer land between inheritors mentioned the Q'at before 200 years ago (see Fig. 6a and 6b in appendix 3).

So men in Addawm or in any Q'at production area spent their time in the Q'at field hoeing, removing weak branches, adding fertilizer, spraying pesticide, guarding at night at critical time before harvesting, harvesting Q'at and preparing it for the market, and finally marketing it. Women also do some work in Q'at field as part of their duties such as hoeing during the season of sowing intercropped grain with Q'at and sharing men in harvesting Q'at. Also, women shared men in picking off leaves of Q'at trees a process called "birah al-Q'at" and the product then is called "Q'at *mobarh*". This process takes place every 3-4 years for each field that needs to renew growth of branches to increase its production. It is common for family members to exert extra effort and time in Q'at fields, yet farmers do not count it in the input cost of Q'at. Whereas, only the cost of hired labor counted into input cost of Q'at. Family labors varied from one farmer to another and from year to another for the same field (Fig. 4.11a) also see Table 5, in appendix 3. Table 4.30a, showed the total cost of production, return and net profit for each of the six farmers in 1997 and 1998. In 1997, when family labors was not added to cost of production, the net

profit ranged from 250,000 YR/ha (farmer 4) to 3,834,000 YR/ha (farmer 3), with an average of 1,150,000 YR/ha. The relative profit ranged from 84% (farmer 2) to 2223% (farmer 6), with an average of 763%. Whereas, when the family labors was included in the calculation, the net profit ranged from (-1,326,000 YR/ha) (farmer 3) to 569,000 YR/ha (farmer 6), with an average of -173,000 YR/ha, and the relative profit ranged from -51% (farmer 5) to 377% (farmer 6), with an average of 70%.

In 1998, when the family labors was not added to the cost of production, the net profit varied from 675,000 YR/ha (farmer 1) to 2,031,000 YR/ha (farmer 4) with an average of 1,193,000 YR/ha. The relative profit ranged from 53% (farmer 3) to 1400% (farmer 5), with an average of 602%. Whereas, when the family labors was included in the calculation, the net profit ranged from -750,000 YR/ha (farmer 3) to 2,038,000 YR/ha (farmer 5), with an average of 782,000 YR/ha, and the relative profit ranged from -27% (farmer 3) to 959% (farmer 5), with an average of 300%. In 1997, the highest cost of production was for water (because of inadequate distribution of rainfall), followed by hired labor, then the cost of pesticide and fertilizer. In 1998, the highest cost was hired labor followed by water and the cost of pesticide and fertilizer (Fig. 4.11b).

To check the differences in net profit without family labor for farmers in 1997 and 1998; statistical analysis conducted. The result tabulated in Table 4.30b, confirmed no significant differences among each farmer in both years, while, it is significant among farmers in both years at 8% and 3% in 1997 and 1998, respectively. The differences occurred due to the deference in the input cost such as water, labor and pesticides; and also due to the chance of the price in market because it changes in one day according to the flow of Q'at to the markets from the region.

Table 4.30a: The cost of production, return and net profit of Q'at field at Addawm in 1997 and 1998

	Items	Farmer 1	Farmer 2	Farmer 3	Farmer 4	Farmer 5	Farmer 6
1997	Area (m ²)	121.5	51	50	80	80	100
	Total cost of production with family labor (YR)	8200	8100	27430	1600	20280	1510
	Total cost of production without family labor (YR)	7600	5500	1630	0	5080	310
	Return (YR)	15000	10100	20800	2000	10000	7200
	Net profit with family labor cost (YR)	6800	2000	-6630	400	-10280	5690
	Net profit without family labor cost (YR)	7400	4600	19170	2000	4920	6890
	% of net profit from return with family labor	83	25	-24	11	-51	377
	% of net profit from return without family labor	97	84	1176	900	97	2223
	Profit with family labor cost/ha (1000YR)	560	392	-1326	50	-1285	569
	Profit without family labor cost/ha (1000 YR)	609	902	3834	250	615	689
1998	Area (m ²)	121.5	51	50	80	80	100
	Total cost of production with family labor (YR)	9800	1350	13750	4150	1700	3000
	Total cost of production without family labor (YR)	3800	550	6550	2950	1200	1400
	Return (YR)	12000	5500	10000	19200	18000	8300
	Net profit with family labor cost (YR)	2200	4150	-3750	15050	16300	5300
	Net profit without family labor cost (YR)	8200	4950	3450	16250	16800	6900
	% of net profit from return with family labor	22	307	-27	363	959	177
	% of net profit from return without family labor	216	900	53	551	1400	493
	Profit with family labor cost/ha (1000 YR)	181	814	-750	1881	2038	530
	Profit without family labor cost/ha (1000 YR)	675	971	690	2031	2100	690

Sources: By the author, 2004.

Table 4.30b: Statistic analysis result, for Q'at farmers in 1997 and 1998 in Addawm

	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Farmer 1	156.5	84.2	59.5	2.60	1	.231
Farmer 2	492.0	577.0	408.0	1.21	1	.441
Farmer 3	614.5	794.1	561.5	1.09	1	.471
Farmer 4	725.5	246.8	174.5	4.16	1	.150
Farmer 5	748.5	921.4	651.5	1.15	1	.456
Farmer 6	1358.0	1223.3	865.0	1.57	1	.361
NP97PER	762.8	856.6	349.7	2.181	5	.081*
NP98PER	602.2	488.0	199.2	3.023	5	.029*

Sources: By the author, 2004.

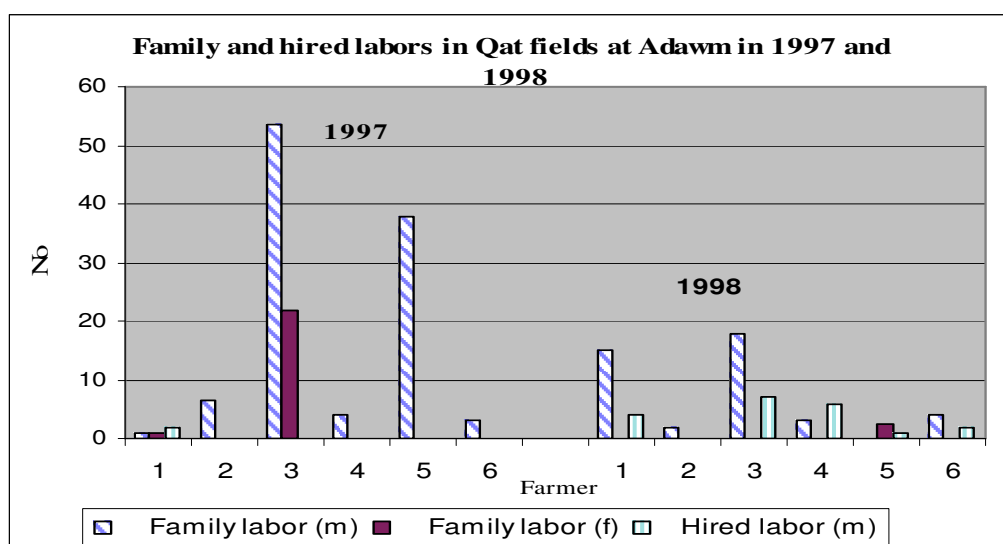


Fig. 4.11a: Family and hired labors in Q'at fields at Addawm in 1997 and 1998
Sources: By the author, 2004.

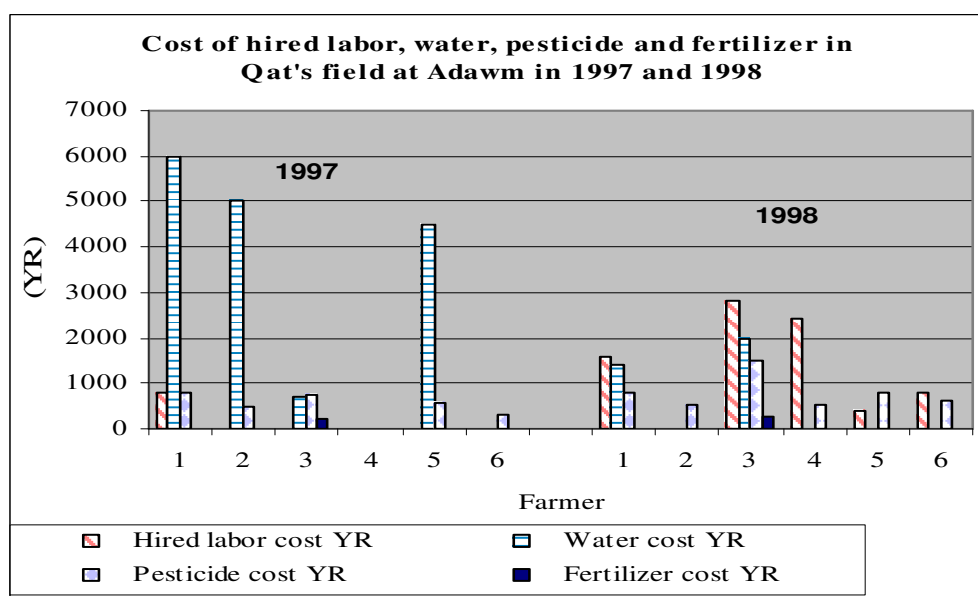


Fig. 4.11b: Cost of hired labor, water, pesticide and fertilizer in Q'at's field at Addawm in 1997 and 1998. Sources: By the author, 2004.

a) Q'at production stages

The production of Q'at normally affected by some factors such as weather, rainfall (water), location of field in the terraces and input. Input started at hoeing land, pruning of Q'at plants, spraying agro-chemical materials and finally harvesting and selling the product in the market. In the rainy season, Q'at trees naturally start to produce new branches and leaves with the beginning of rainfall after long draught period (winter). The first product called "*Gaddah*", and the production from a peace of land is normally high, this stage is known as "*Saif al-Q'at*", literally "summer of Q'at". In this stage, Q'at commonly free from any pesticides, price is low and quality depends on the field where Q'at come from and the amount of moisture in the

harvested leaves. The lower the moisture in the leaves of Q'at the more the Q'at will be acceptable by consumers; and vice-versa. Farmers in Q'at's production areas usually give passing by people free Q'at as a gift. Q'at's farmers at this stage also cleaned off (picked off) the extra leaves and branches to encourage the top head to grow for second stage. Q'at of second stage normally a good quality and has high prices, it called "*Pazgha*" literally "top of Q'at branches". In Addawm and in similar old Q'at production areas, Q'at at this stage is harvested only according to economic situation of farmers (if he in need for cash) and if the prices of Q'at in the market is good.

In the third stage Q'at has two phases: 1st "*mathna*", it is the second product of Q'at after "*Pazgha*", and then the 2nd "*mathna*", is the fourth product after *Gaddah*, *Pazgha* and 1st *Mathna*. Finally the last stage called "*A'awaridh*", the small branches collected from remaining branches. "*A'awaridh* Q'at can be collected after "*Pazgha*" stage, as happened in Saber mountain, the highest mountain south Taiz city.

In the dry season and in case of fields, where farmers kept the Q'at product un-harvested, due to low prices, the Q'at irrigated at winter when the prices in market is good. Production divided into two main types, the first one is called "*Mutla'*", which is known as "*Pazgha*" in summer. The field of "*Mutla'*" harvested, then it kept to the next rainy season to grow new heads; i.e., "*Pazgha*". The second type called "*Q'at Mubrah*", where all of old leaves removed, and then plants irrigated and sprayed by pesticide to encourage growing of new leaves and branches. Of this "*Mubrah*", any next harvest after irrigation or rainfall called "*Mathna*". The third product in next rainy season in summer called "*thaleel*", then fourth product called "*Mathna*" and then fifth product called "*Tusrur*" and it kept on trees un-harvest to the next season and then farmers harvest it in winter to encourage plants to grow new head called "*Pazgha*".

b) Q'at in household expenditure

The family income spent on daily needs, that, the expenditure of the family income disbursed to cover foods, clothes, health care, school, Q'at and others. Some families spend large part of their income for Q'at and neglect composition of meal to fulfill daily-required calories, on the other words they do not provide their families with food contain protein, carbohydrate and other sources, because of their poor knowledge on daily-required calories and because of high prices of the products. To understand the situation of household expenditure in rural area, the quantitative questionnaire, include section with bulk of questions for household in the three detail study villages. All households in the villages asked and then the data collated and elaborated in Table 4.31.

Table 4.31 shows that Q'at consumed in average of 19% of total household expenditure; wheat and flour together consumed 12% of total households expenditure; while sorghum and medicine consumed in average of 10% each of household expenditure. The household, in average spends 2% for red meat and 6% for white meat. Whereas, the low household expenditure was for water, electricity, Tax and/or *Zakah* which in average of 1% each.

Table 4.31: The relative monthly expenditure of the household*

Monthly Purchases of commodities and services	Al-Ma'amirah	Addawm	Mawq'a'ah	All villages
	Avg. %	Avg. %	Avg. %	Avg. %
Sorghum (1600 YR/Q'adah) (34kg)	8.3	5.1	16.2	10
Wheat and flour (1000YR/wheat, 1200YR/flour)	10.4	15.2	10.1	12
Meat (300-500YR/kg)	5.5	0.5	0.0	2
Chicken meat (250YR/ chicken)	0.7	8.4	8.0	6
Sugar (3000YR/50 kg)	6.4	5.2	7.5	6
Rice (3000 YR/50kg)	6.1	3.1	1.6	4
Ghee and/ cooking oil (1950YR/large can)	6.0	5.8	4.5	5
Powder tea (300 –550YR/kg)	1.7	1.5	1.4	2
Vegetables	4.2	3.8	2.8	4
Powder milk (1450 YR/2.5kg can)	2.0	2.0	1.6	2
Q'at	19.1	19.6	19.0	19
Medicine	8.8	8.4	13.1	10
Clothes	10.5	7.4	8.3	9
School	5.4	5.4	4.9	5
Electricity	1.5	0.6	0.0	1
Water	0.8	5.6	0.2	2
Government (Tax and Zakah)	0.8	1.0	0.7	1
Cooking Gas	1.9	1.6	0.2	1
Total	100.0	100.0	100.0	100

Sources: By the author, 2004. * Market prices of commodities and services in 1998.

According to survey in 1981 and 1987, Q'at was consumed 23% and 22.5% of rural family and 19.7% and 23.1% of urban family expenditure in 1981 and 1987 respectively. Compared to meat, fish and chicken were consumed 20% and 17.7% of rural family and 22.5% and 21.5% of urban family expenditure in 1981 and 1987 respectively (CPO 1981, 1987 and Thabit, 1994). If it is compared expenditure in rural area according to the information in Table 4.31 with 1987, Q'at still the first and it decreased from 22.5% in 1987 to 19% in 1998 study, while meat and chicken decreased from 17.7% in 1987 to 8% in 1998 study, due to the life expenses, inflation and low family income (poverty). Food consumption has been change according to food supply in the market. Households in study area, i.e., where Q'at production, most of them consumed imported wheat all the year around and sorghum and/or millet consumed in Ramadan as “Lahowh”. Increasing wheat consumption increased cooking oil accordingly. In 40 years ago, local wheat was seldom cooked as old people said and its smelling was spread on whole village if a family was cooked it with local cow ghee. Also sorghum and millet were the main grains consumed; even the people in Q'at area exchanged it with grain.

With high illiteracy among rural community and low education about the meal balance, the household takes large part of family income for Q'at. I had small story happened during my field

study, I asked a farmer to comment about his spend on Q'at more than other commodity, he said, I (farmer) bought several sacks of wheat, cans of ghee, dry paper, fenugreek and so on, so the family has its food. I told him but you have to buy meat, vegetables and fruit frequently in stead of Q'at; he said all these are luxury if there is no cash. However, the calories consumed daily in Yemen in average are 1700 kcal (Hashim 1998), in which this calculated according to survey in the cities and rural area closed to the center of the large cities. So that the daily calories consumed in rural area, such as villages in study area lower than the daily need, because Q'at consumed fifth of family income, life expenses, infilation and poverty.

4.3.3.2 Sorghum Field in Al-Ma'amirah Village

Sorghum crop is one of the main and important crops grow in most of cultivated land for two purposes, grain for food and straw for fodder. It is grown separately and/or intercropping with millet, which is grown in small amount. A Q'at field could be intercropped with sorghum as source of grain or straw for livestock. In the study area cereals are cultivated under rainfed farming system. Economic study is needed to evaluate cereal farming system and to compare it with cash crop such as Q'at, which mostly expand over cereal cultivated area. The data collected from two fields for two years (1997 and 1998) in Al-Ma'amirah village.

Data sheet has been designed to collect data about type of activities practices 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. Result of cost-benefit analysis for field 1 and field 2 in 1997 and 1998 are summarized in Table 4.32 (detailed data are figure in Table 6a and 6b in Appendix 3).

In 1997, the average profit of the two fields was -42097 YR/ha (-26%) and -4121 YR/ha (-3%) when family labor cost counted and not counted, respectively. In 1998, the average profit of two fields was -29319 YR/ha (-13%) and 52332 YR/ha (38%) when, family labor counted and not counted, respectively. Average production of grain was 1 ton/ha and 2 ton/ha in 1997 and 1998, respectively and average of straw production was 3 ton/ha and 5 ton/ha in 1997 and 1998 respectively.

The reasons of variation in grain and straw production in 1997 and 1998 are related mostly to distribution of rainfall and for animal manure added in 1998 to the fields (animal manure usually add to the fields in turn every two or three years). Period of sorghum growth started in 1st of May, to the 1st week of Nov, which almost, 190 days. So, in the long season crops the distribution of rainfall within the season is more important than total amounts to fulfill crop water requirement to reach optimal production. The amount of rainfall was 778 mm and 800 mm in

1997 and 1998, respectively. Whereas, in 1998 distribution of rainfall was good during crop growing stages in which the total amount of rainfall was greater by 22 mm than in 1997. In 1997 rainfall was concentrated in the early period of the season and in the mid of season in mid of August and before head formation, then rainfall stopped till the late period of the season when it rained again in mid of October Fig. 4.12. Consequently, water stress on head formation growth stage effect negatively on production crops. Therefore, the production from the same land was lower in 1997 than in 1998 by 50% in grain and 40% in straw. Anyhow, the production in 1998, 2 t/ha and 5 t/ha for grain and straw, respectively was reasonable compared to the production of sorghum in Taiz-Ibb region under rainfed farming system in 1998, 2.2 t/ha and 5.9 t/ha for grain and straw, respectively (Al-Mogahed et. al., 1998). The yield of Tagarb variety was 5.1 t/ha and 6.4 t/ha and yield of Monsala Khomasey variety was 4.4 t/ha and 11.1 t/ha for grain and straw in 1993 under water harvest irrigation 1:1 planted area (Ghalib, 2001).

Table 4.32: Calculation of cost of input and output of Sorghum's fields in Al-Ma'amirah in 1997 and 1998

Items	1997			1998		
	Field 1	Field 2	Average	Field 1	Field 2	Average
Area of the field m²	1166	875	1021	1166	875	1021
Family labor (day)	15	9	12	34	21	28
Rental labor (day)	29	28	28	33	23	28
Cost of family labor (YR)	4859	2892	3876	10087	6578	8333
Cost of rental labor (YR)	7670	7187	7429	9159	5665	7412
Cost of draught animals	4750	4000	4375	3600	3300	3450
Cost of animal manure (YR)	0	0	0	2880	1920	2400
Cost of fertilizer (YR)	240	200	220	320	200	260
Cost of seed (YR)	750	750	750	750	500	625
Total production cost including family labor (YR)	18269	15029	16649	26796	18163	22480
Total production cost excluding family labor (YR)	13410	12137	12774	16709	11585	14147
Production of Grain (t/ha)	1.01	0.95	1	1.96	2.07	2
Production of straw (t/ha)	3.17	3.33	3	4.49	4.94	5
Total output value (YR)	14588	10118	12353	22319	16656	19488
Profit include family labor cost (YR)	-3681	-4911	-4296	-4477	-1507	-2992
Profit exclude family labor cost (YR)	1178	-2019	-421	5610	5071	5341
Profit include family labor cost(YR/ha)	-31569	-56126	-42097	-38396	-17223	-29319
Profit exclude family labor cost(YR/ha)	10103	-23074	-4121	48113	57954	52332
Profit include family labor %	-20	-33	-26	-17	-8	-13
Profit exclude family labor %	9	-17	-3	34	44	38

Sources: By the author, 2004.

Labor work is very important in terraces land due to difficulty of using mechanization. In 1997, the average labor was 12 days and 28 days for family and hired labor respectively, while in 1998 it was 28 days for each of family and hired labor. The average cost of total labor (family and hired labor) was valued 68% (23% family labor and 45% hired labor) and 70% (37% family

labor and 33% hired labor) of total production cost in 1997 and 1998, respectively. Increased of labor forces in 1998 than in 1997 was due to labor work used to removed the sediment accumulated in the field after each flood and hoe between plant in mid of the season it called (Mihwad), in 1997 oxen used to plow between plants rows; it called “Galab”. The average cost of draught animal was valued 26% and 15% of total production cost in 1997 and 1998, respectively; the average cost of animal manure and chemical fertilizer was valued 1% and 12% of total production cost in 1997 and 1998, respectively. The average cost of seed was valued 5% and 3% of total production cost in 1997 and 1998, respectively.

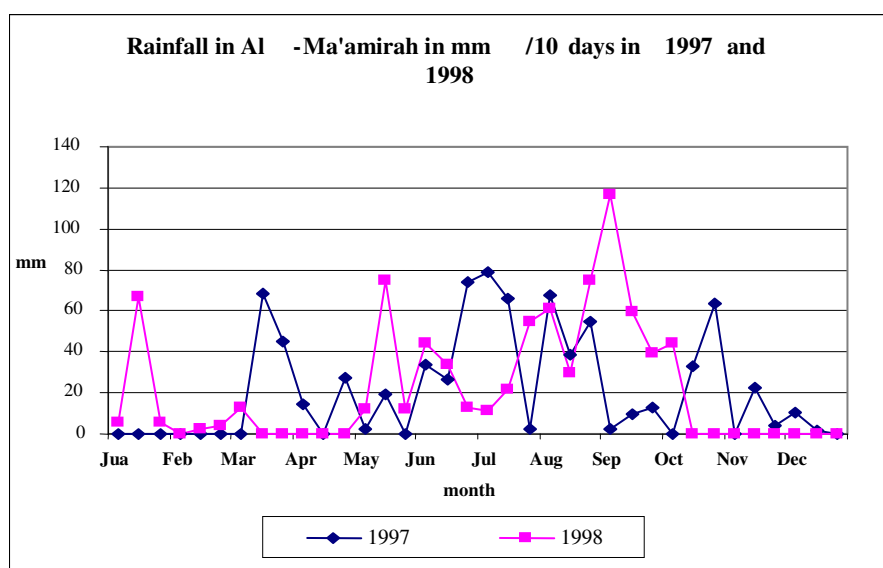


Fig. 4.12: Rainfall in Al-Ma' amirah in mm/10 days in 1997 and 1998
Sources: By the author, 2004.

To understand the economic reason of Q'at expansion on grain area, comparison between the two economic evaluations of sorghum and Q'at crops is needed. Table 4.33, represent clear view of the variation of return per hectare, in which Q'at exceed sorghum by 13 and 8 times in 1997 and 1998, respectively, while, both crop equal in using family and hired labor, but Q'at use family labor more than sorghum. Due to land fragmentation the risk of net profit is higher in sorghum than in Q'at because sorghum grows during specific time of the year, correlated with rainfall, while Q'at can irrigate any time and harvested according to the market demand and prices. Therefore, Q'at farmers gain 250% to 300% of their production cost in 1997 and 1998, while sorghum farmers gain -3% and 38% of production cost in 1997 and 1998 respectively. The high income of Q'at is one of the reasons of Q'at expansion in grain land. In general, farmers do not count the losses because they cultivate land to produce their own food security.

Table 4.33: Cost of production, return; comparison between Sorghum and Q'at

Items	Sorghum		Q'at	
	1997	1998	1997	1998
Cost of Production including family labor cost (1000 YR)/ha	163	220	1773	809
Cost of Production excluding family labor cost (1000 YR)/ha	125	139	449	398
Return (1000 YR)/ha	121	191	1599	1591
Net profit including family labor cost (1000 YR)/ha	-42	-29	-173	782
Gain or Loss including family labor (%)	-26	-13	-10	97
Net profit excluding family labor cost (1000 YR)/ha	-4	52	1150	1193
Gain or Loss excluding family labor (%)	-3	38	256	300
Total cost of family labor %	23	37	65	47
Total cost of rental labor %	45	33	2	24
Cost of water %	0	0	27	5
Cost of pesticide %	0	0	7	23
Cost of Fertilizer %	1	12	0	0
Cost of draught animal %	26	15	0	0
Cost of Seed %	5	3	0	0

Sources: By the author, 2004.

4.3.4 Reasons of migration

a) Household social structure

A rural family in villages consists of husband, wife and children. Husband is the head of the family and he is responsible to provide food, clothes, school, and medicament for all members of the family. Wife duties such as raising children and organizing house economy. Her duty in agriculture is important; providing work in the farm, raising animals and fetching for fire wood and water. It is recognizable in the three study villages the average family number is 9.1, 10.3 and 11.2 persons in Al-Ma'amirah, Addawm and Mawq'a'ah villages, respectively, with average of 10.3 persons per family, compared to 6.2 persons per family in Taiz province. Children below 15 years of age comprise 46.3%, 42.5% and 58.2% in Al-Ma'amirah, Addawm and Mawq'a'ah, respectively. The people from 16-49 years are 41.6%, 44.4% and 31.8% for Al-Ma'amirah, Addawm and Mawq'a'ah, respectively. The people with age >50 Years is 12.1%, 13.1% and 10% for Al-Ma'amirah, Addawm and Mawq'a'ah, respectively Table 4.34. Increase number of persons per family in the rural areas increased stress on natural resource, in which agricultural terraces-land distributed among descendent inheritors to small pieces generation after generation. It is not suitable for mechanization and it cultivated under rainfall, production per unit area is low as discussed earlier. All these reasons encouraged people in rural areas to migrate to cities and to neighboring oil countries, looking for better job and income to provide better life to fulfill daily families' needs. Addawm (Q'at area) had the lowest migration percentage while, Al-Ma'amirah had the highest migration percentage. Because in Addawm Q'at production used labor and income from Q'at is high enough to hold the people in the area, it is opposite in grain production

area where the income from farm is not enough and it exiled people out the area to find alternative job to support their families (Table 4.34).

Table 4.34: Population status and the family structure in the three study villages

Villages	Population status							Migration	
	1-15 years		16-49 years		>50 Years		Person/ Family	Migrants	
	Male	Female	Male	Female	Male	Female		Person	Family
Al-Ma'amirah: No %	193	190	177	167	47	53	9.1	827	120
	23.3	23.0	21.4	20.2	5.7	6.4		100	38
Addawm : No %	134	133	142	137	37	45	10.3	628	120
	21.3	21.2	22.6	21.8	5.9	7.2		100	13
Mawq'a'ah : No %	61	56	30	34	11	9	11.2	201	29
	30.3	27.9	14.9	16.9	5.5	4.5		100	20
Average %	25.0	24.0	19.7	19.6	5.7	6.0	10.2	100	19

Sources: By the author, 2004.

b) Household economy and food production

Small size of farmland per family and the low farmland production are reasons of male migration out of rural agricultural land. To understand this problem, evaluation of farmland production is needed, in which production of cultivated land still important source of income because of effort apply of family members. Farmers cultivate their land to produce grain animal fodder, Q'at trees and/or fruit trees such as Guava and Mango to sell them to get cash to buy their needs. Result of study in the three detail study villages is summarized in Table 4.35. In average, farmer grow cereal crops in 71%, 26% and 71% of farmland in Al-Ma'amirah, Addawm and Mawq'a'ah, respectively. Whereas, Q'at crop is cultivated in average of 29% and 74% in Al-Ma'amirah and Addawm, respectively, while fruit crop is grow in 29% of farmer farmland in Mawq'a'ah village only. Due to different cropping pattern system in three study villages, the income of farmland will be differed accordingly. The average net profit of farmland system is valued 34727 YR/year, 66242 YR/year and 22291 YR/year in Al-Ma'amirah, Addawm and Mawq'a'ah, respectively. Average net profit was from cereal and Q'at in Al-Ma'amirah and Addawm villages, while it was from cereal and fruit in Mawq'a'ah village. Q'at is the main indicator for high land profit (Addawm) compared to other two villages. Income from sorghum in general never circulates as cash money because grains consumed within the family and straw used as animal's fodder compared to income from cash crops either Q'at or fruit as they sold in the market and provide cash for family.

Recent cropping pattern and its low income are the reasons to men and some families to expel out of agricultural area, in case of the three detail study villages 17%, 5% and 4% of men migrated out village in Al-Ma'amirah, Addawm and Mawq'a'ah, respectively. While, 36%, 3% and 18% of families migrated out of Al-Ma'amirah, Addawm and Mawq'a'ah, respectively. This indicate that, Q'at cultivation area has less expellant of men than other agriculture areas, so it is

common to see Addawm village has less percentage of migration and Al-Ma'amirah has high percentage of migration.

The change happened to cropping pattern become unbelievable in such cases where you can see cereal crop become a minimum as 5% of cultivated land and remaining of 95% occupied by Q'at as in Addawm and other Q'at area. The funny thing is that in some area where some farmers, who used to grow coffee, they keep some trees in the field as a sign of their tradition activity to keep them with a hope, where in some other cases you can find coffee and Q'at shared one field as intercropping. The disaster where Q'at (a stimulant plant) expanded in very good fertile soil in some valleys and in large terraces, where grain and other food crops used to produce. Q'at was grown in small and separate locations in the villages, while it covered nowadays between 25% up to 95% of cultivated land of the villages. It was consumed among old people, Q'at farmers used to exchange it with grain in the neighboring villages, while it is nowadays the main source of income for most of Q'at farmers.

Table 4.35: Average area and profit/ farmer from agriculture product in the three study villages

Items	Al-Ma'amirah		Addawm		Mawq'a'ah	
	Area	%	Area	%	Area	%
a. Average Area						
Grain (Q'asabh)*	49	71	20	26	99	71
Q'at (Q'asabh)	20	29	57	74	0	0
Fruit (Q'asabh)	0	0	0	0	41	29
Total cultivated area (Q'asabh)	69	100	77	100	140	100
b. Average Profit (YR)						
Cost of input for Grain crops	13732		11818		16542	
Output of Grain crops	32926		10620		23157	
Cost of input of Q'at	7877		24083		-	
Output of Q'at	23410		91523		-	
Net profit from Grain crops	19194		-1198		6615	
Net profit from Q'at	15533		67440		-	
Net profit from fruits	-		-		15676	
Total Profit	34727		66242		22291	
Migrants: person and Family	17% and 36%		5% and 3%		4% and 18%	

Sources: By the author, 2004. * Q'asabh = 20.25 m²

Rural agricultural area hold about 70% of population and it employed 50% of labor forces. However, income from cereal cultivated land under rainfall is not profitable to hold men to work in the villages because of the risk of shortage of rain which in turn causes low production. Men then, preferred to migrate to cities or neighboring countries to look for better chance to improve their life and to provide needs for their families. Old people in study villages said, farmers in the past used to grow several crops such as cereal, vegetable, coffee, fruit and a little Q'at, crop rotation was applied. Production per unit area was high due to availability of labor, population was small and rainfall was good. But nowadays, sorghum, Q'at and a little fruit are growing in the villages in the study area, and sorghum cultivated yearly in the same area, which cause low

production per unit area. Dependency of farmers on imported food caused more in low effort applied to cultivated land, which in turn effect negatively on production per unit area.

Families in rural agricultural production used to apply effort in cultivated land to fulfill the practices need during the season. The duty of family members distributed according to the effort need, the duty can be seen in the Table 4.36. In general, the farmland activity cover by family members' effort, however, some families cannot do the activity by themselves alone, so they hired labor according to the type of activities during the season. For instant, plowing, hoeing, sowing (Zageed), Naq'wa, Mihwad, harvesting, threshing and pulling sorghum residual are the most work farmers hire labor to fulfill it, so that, these works have the high ranks in Table 4.36. Other activities with low ranks showed in Table 4.36 done by family members. However, in the study area; rural society and females duties become important and essential to sustain the agricultural production. Because of their works from the beginning of season, when they breaks down the clods in first plowing, provides food and water for labors and oxen. Then they distribute animal manure to fields and helps in sowing. They do thinning, collecting feed for animals, then collective with other women to collect leaves of plants before harvesting which is called "*Suor*" and transfers it to store as feed for animals in winter. Females also help in harvesting, transferring straw to store as animal fodder in winter, selecting seed for next season, help in/or threshing, if male is migrate, storing grain in containers, and collecting "*Q'ushah*" residues of sorghum stems stored as firewood. While, duties of male if he is present or he can hire labor to plow farmland, sow, hoe between rows of plants after 1.5 month from sowing, it called "*Naq'wah*", the latest is not exist in most families farmland nowadays, because women are hoeing around the plant during thinning. Then hoe or plow between rows of plants after 15th of July, it called "*Mehwad* or *Galab*" (also nowadays, it does not exist in some of families land). Then male harvest, thresh and pull out the residues of sorghum stems after harvesting "*Q'ushah*", and store straw on trees "*migam*". Family with few numbers of female will suffer form shortage of family labor working in agriculture, in which will increased pressure on household to hire labor to work in field (able families), which in turn will increased the cost of production, or most of farmland activities will be neglected, and that, will affect negatively in production per unit area.

c) Sources of household income

The household economy in rural agricultural area is a complex process, in which part of it direct income and other is from indirect source of income. The direct sources of family income from marketable product such as Q'at, fruit, raising animals, wages of work in agricultural and nun agricultural in the village, also form migrants and/or income from private job such as shop,

car, workshop and etc. The indirect sources of income are the production of farmland, which consumed within family and family labor work in agricultural farmland otherwise hiring labor will be need.

Table 4.36: Family hiring labor in agriculture during the season

No	The type Activities the families hired labor for	Al-Ma'amirah %	Addawm %	Mawq'a'ah %
1	Maintain terraces wall (M)	2	7	11
2	First Plowing (M&F)	72	23	78
3	2 nd plowing (M&F)	8	0	6
4	Break the clods after plowing (F)	5	3	0
5	Distribute animal manure to the fields (F)	4	2	0
6	Sowing (M & F)	64	5	78
7	Zageed "sowing seed by hand tools" (M)	16	36	50
8	Hoeing ends of fields (M)	7	0	11
9	Hoeing land for Q'at and /or other crop (M)	17	39	78
10	Thinning (F)	0	0	0
11	Hoeing between plant (Naq'wah) (M)	8	8	28
12	Hoeing between plant (Mihwad) (M)	49	18	72
13	Galab (M&F)	4	0	17
14	Collecting dry leaves from plants (<i>Suor</i>) (F)	7	2	6
15	Hold the plant before harvesting (M)	1	0	0
16	Harvesting (M & F)	27	15	33
17	Threshing (M & F)	34	2	0
18	Storage of straw make it in tent (M)	5	0	0
19	Transfer the straw (F)	0	0	0
20	Pulling out the plant residues (Q'ushah) (M)	29	2	17
21	Collecting and transfer (Q'ushah) (F)	0	0	0
22	Removing the "Solalah" in Q'at field (M)	0	3	0
23	Remove the Q'at leaves "Berah Al-Qat" (M & F)	0	2	0
24	Protect the fields by needle trees "Zerrab" (M)	0	0	6

Sources: By the author, 2004.

Table 4.37, summarized the sources of income of household from non-agricultural production in the three study villages. Due to the low income from farmland, household's head works in another non-agricultural works in the village or migrate to support his family, and leaved responsibility of farmland to his family. Therefore, income of family come from different sources, i.e., in Al-Ma'amirah, the source of income from migration, daily non-agricultural work, employment with government/ private, private work, raising animals and other sources (*zakah*). Where in Addawm, the sources of income from employment with government/private, selling of Q'at, other sources (*zakah*), migration, trading and raising animals. Where in Mawq'a'ah, the sources of income from raising animals, migration, private work, non-agricultural work and trading.

d) Land holding size

In the study area, land holding size per capita varied among farmers according to the size of cultivated area in the village, wealth families (purchased) and size of the families (inheritor). Increased of family member due to newborns (descendants) decreased land holding size of

cultivated land per capita (the average family member is 9.2, 10.3 and 11.2 for Al-Ma'amirah, Addawm and Mawq'a'ah, respectively). Table 4.38, shows land holding size in the detail study villages, in which the average cultivated land per family is 71, 68 and 140 Q'asabah for Al-Ma'amirah, Addawm and Mawq'a'ah respectively, which equal to 7.8, 6.6 and 12.6 Q'asabah per capita in Al-Ma'amirah, Addawm and Mawq'a'ah, respectively. Therefore, the production of small size of cultivated land per family will not be enough for living in rural villages, which can be conclude that, the small the cultivated land per family in rural area, the more the men migrate to look for another source of income.

Table 4.37: Household source of income from nun agricultural product

The sources of nun Agricultural Income	Al-Ma'amirah %	Addawm %	Mawq'a'ah %
Employment with government or private	18	36	0
Nun agriculture daily work	28	18	22
Migrants in Yemen	30	5	33
Migrants out Yemen	12	8	0
Trading	5	8	22
Taxi or other machine	3	5	6
Hand craft work	1	0	0
Private work	14	0	28
Rising animals	13	7	89
Sell of Q'at	1	23	0
Other sources	13	20	6

Sources: By the author, 2004.

Table 4.38: The land holding size of owned and cultivated land per family and per capita

Items	Al-Ma'amirah		Addawm		Mawq'a'ah	
	Owned	Cult.	Owned	Cult.	Owned	Cult.
Max. / Family Q'asabh (ha)	470 (0.94)	450 (0.9)	540 (1.08)	462 (0.92)	340 (0.68)	330 (0.66)
Max. / capita Q'asabh (ha)	52 (0.1)	50 (0.09)	52 (0.11)	45 (0.09)	30 (0.06)	30 (0.059)
Min. /Family Q'asabah (ha)	1 (0.002)	1 (0.002)	4 (0.008)	4 (0.008)	4 (0.008)	40 (0.08)
Avg. / Family Q'asabh (ha)	62 (0.124)	71 (0.147)	81 (0.16)	68 (0.14)	90 (0.18)	141 (0.28)
Avg. / Capita Q'asabh (ha)	6.8 (0.014)	7.8 (0.016)	7.8 (0.016)	6.6 (0.013)	8 (0.016)	12.6 (0.026)

Sources: By the author, 2004, Q'asabah = 20.25 m²

e) Land holding fragmentation

Cultivated land in the study area consist of small terraces built in the slope of mountainous land to conserve soil and to hold rainfall water and to increase soil water holding efficiency to fulfill crop water requirement. Terraces land distributed in all mountainous slope and down in valleys. Terraces land owned by old people and then it transferred to their descendant generation after generation. Terraces land transferred among people in the area through inheriting and/or by process of sell and purchase. So that cultivated land per each family consist of small terraces distributed in several location in the slope of mountain; i.e. a field (terrace) can be shared by many owners. An example of distribution of cultivated land of a family in the area can be seen in Fig. 4.13 for Addawm villages. The size and distribution of cultivated land of a family is one

of the problems that can prevent family to cultivate all land and/or reduced effort applied to far land, in turn production per unit area will be low. Therefore, the complex of problems of size of land and distribution of it in many locations cause low production per unit area and that was one of the reasons of migration out of agricultural land to seek for job with high income in cities or in neighboring oil countries.

4.3.5 Effect of migration on

a) Shortage of labor and change of social collective in agriculture

Men migrate from rural agricultural area to cities and to neighbouring countries because of landholding size, low production and low income of agricultural in rural area. Phenomenon of moving people out agricultural land is common in rural agricultural area in which men migrate to look for better job to improve their life and to provide their family by their needs. The result of study in the three villages in the area can be seen in the Table 4.39 which shows total men migrate to the cities in Yemen and out Yemen, it was 120, 120 and 29 men for Al-Ma'amirah, Addawm and Mawq'a'ah, respectively. It was in average of 1.3, 0.7 and 1.2 person per family, which is greater than a person in two villages, Al-Ma'amirah and Mawq'a'ah and less than a person in Addawm. The reason of low migration in Addawm because in Q'at production area labor work in Q'at production system and Addawm village has more than 75% of the cultivated land occupied by Q'at. Migration of manpower from agricultural area will reduced the number of labor forces, which in turn, increased the daily rate due to the gap between manpower supply and demand.

However, increased of daily wages in agricultural area effect on activities need in farmland in which, farmers will not hired labor even if they in-need, because output of cereal farmland system is low compared to output of cash crop such as Q'at or fruit. Daily rate varied in the three study villages, it ranged from 400-500 YR plus lunch and Q'at in Al-Ma'amirah, while, it ranged from 300-500 YR plus lunch and Q'at in Addawm (Q'at area), and it ranged from 300-400 YR plus lunch and Q'at in Mawq'a'ah.

Migration of men out agriculture area caused shortage of labor and in turn it effects on collective among farmers. People in the study area said, after migration of men, collective among farmers decreased step by step and nowadays there is no collective in agriculture activity among farmers. Men staying in the villages after migration, tried to get their chances to increase their income from wages of work with another farmers. So that, the collective among farmers (men activities) does not exists any more in all villages in the study area.

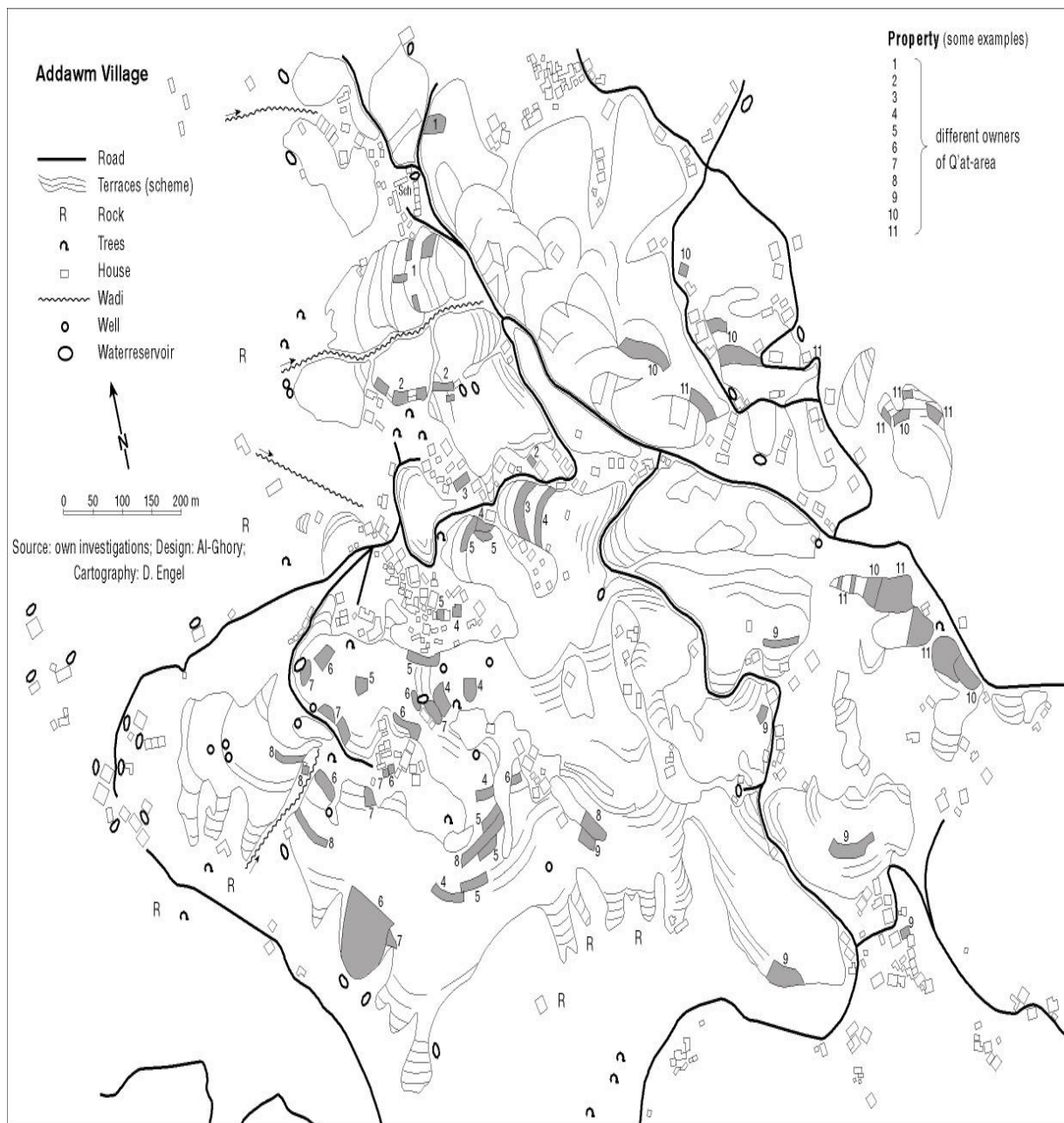


Fig. 4.13: Property pattern in Addawm Village.

Table 4.39: Total of migrants in Yemen, out Yemen, Max/family, Min /family, Avg. / family and daily labor rate in the three study villages

Villages	Migrant in Person	Total	Max / family	Min / Family	Avg. / Family	Rate /day YR
Al-Ma'amirah	Migrant in Yemen : No %	98 14	5	1	1.1	400-500+ Q'at & lunch
	Migrant out Yemen : No %	22 3	4	1	0.2	
Addawm	Migrant in Yemen : No %	100 4	3	1	0.6	300-500+ Q'at & lunch
	Migrant out Yemen : No %	20 1	2	1	0.1	
Mawq'a'ah	Migrant in Yemen : No %	19 3	4	1	1.1	300-400+ Q'at & lunch
	Migrant out Yemen : No %	10 1	1	1	0.1	

Sources: By the author, 2004.

Collective still exist among women in agricultural activities such as, transferring animal manure to fields, thinning, collecting leaves of crops before harvesting (*suor*), carrying straw from fields after harvesting to the storage places and collecting and carrying plant residues to the storage places "*Q'ushah*". Also women collective in different activities outs of agriculture, such as conveying firewood or any other women related duties.

b) Increase of women's agricultural activities

Result of migration of men from agricultural land effect directly and indirectly on the production of farmland and also on female duty in agricultural farmland. The direct effect, effort need in agricultural land decreased and production per unit area will decreased consequently. The rule of thumb, in terraces land the more the effort applied in farmland, the more the production of land. The indirect effect of the flow of remittances to the families increased dependency on imported food and reduced the effort applied to the agricultural land because of high input cost (labor rate) reduced hiring labor, in the another hand women effort not enough when men overseas. So that female reduced their concern on farmland, which in turn, reduced production per unit area. With absence of men from cultivated land, female duty expand from work in the house, where here main duty as a housewife (raising children, prepare food, fetching for water, care for animals if they have and organizing the house) to daily work in the fields. So, duty of females increased especially for those of low incomes and can not hired labor to do the work in the fields such as plowing, hoeing, maintaining terraces walls, Mihwad (hoeing between plant rows after three months of sowing), and/or harvesting. The other activities women can do them instead of men or never done if these activities are much and cash is not enough to hire labor.

c) Rental land

Land is a part of wealth of people and owning of it arose from inheriting and/or selling / purchasing processes. Cultivation of a farmland is the effort applied in the farmland starting with the idea of choosing type of crop to be cultivated till harvesting of production to fulfill the desired need for food and/or other purpose. So that, cooperation (collective) among farmers was coincide with relation between them and according to their interests. The interests between farmers built according to their need and ability to do the work. Therefore, interests among farmers developed in which, riches farmers hired poor laborer farmers to do the work they need, and can not do it by themselves, from this phenomenon, interests increased to reach sharing between owning wealth (land) and the owning the effort. One of the interests was rental of land in which riches rent their land to these who can cultivate it instead of left it uncultivated. The

relation between owner and rental has to be organized and continue without losses of the benefit of each side. So that rental land has several rules, the common one, owner of land get $\frac{1}{2}$ of production (grain of sorghum and/or $\frac{1}{2}$ of net profit of Q'at) and tenant get the another $\frac{1}{2}$ of sorghum's grain plus straw and/or $\frac{1}{2}$ of net profit of Q'at. The another rule, owner request a specific amount of production or money from tenant as rent of his farmland, so that he get his share from tenant even if the land does not cultivated or the production of land does not covered the input, due to shortage of rainfall or due to another natural disaster. In the other hand might the production was high, but the owner never get more than that in the contract (this rule found only in land that cultivated by grain and not by cash crop such as Q'at).

Rental land is common among farmers in the study area. Fig. 4.14 and Table 4.40 depict percentage of land cultivated under tenant, percentage of Q'at cultivated area and percentage of migrants. Rental land varied among the villages, such as 64% in Mawq'a'ah and zero% in Al-Monakh village with average of 22%. Several reasons caused rental land, **first**, location of land from farmer's houses, the far the land from house the more the time needs to go and back, so land rent to farmer near to it. **Second**, shortage of household members, so part of land rented and family work concentrated on remaining part efficiently. **Third**, migration of men of some families and the whole family of some others to cities or to abroad, and they rent their land to their relatives as first choice and/or to farmers who can cultivate the land and maintain it.

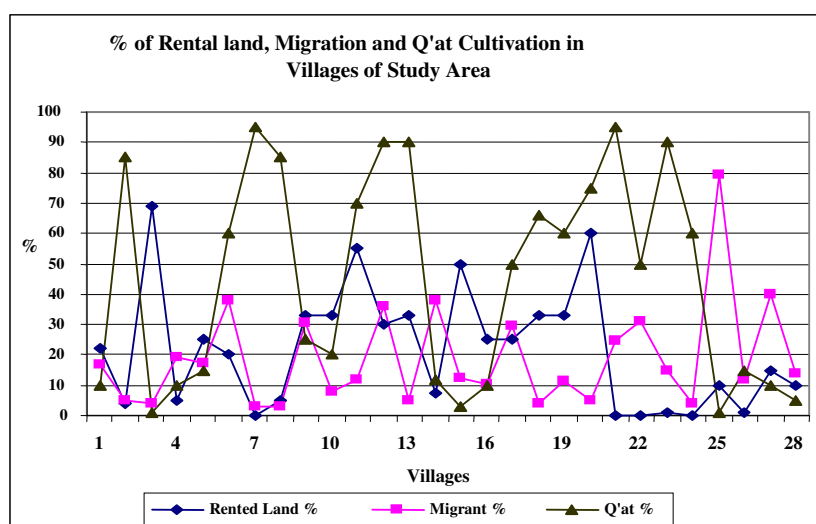


Fig. 4.14: % of rented land, migrants and Q'at cultivation in the villages of study areas: Sources: By the author, 2004.

The common habit among farmers, they rent out their land, to farmers who can work in it and they preferred first their relatives. In Table 4.40, it can be seen the relationship between % of Q'at cultivation, migration and rental land which is reversing relationship, the more the Q'at cultivated the less the migrant and the less the rental land and visa –versa. For instant, in

Mawq'a'ah, 3% of land cultivated by Q'at, 4% of people are migrated and 64% of farmland is under tenants. Whereas, in Addawm 85% of farmland occupied by Q'at crop, 9% of people migrated and 9% of farmland under tenants. Compared to 10% of farmland occupied by Q'at, 17% of people migrated and 25% of farmland under tenants in Al-Ma'amirah villages.

Table 4.40: % of rented land, Q'at and migrants in the villages in the study area

Village Name	Rented land %	Q'at%	Migrant %	Village Name	Rented land %	Q'at %	Migrant %
1. Al-Ma'amirah	25	10	17	15. Al-Ashaa'er	50	3	12
2. Addawm	9	85	5	16. Al-Haq'eeb	25	10	10
3. Mawq'a'ah	64	3	4	17. Hawrah	25	50	30
4. Al-A'akyshah	5	10	19	18. Boukyan	33	66	4
5. Jawhan	25	15	17	19. Bany-A'ba'as	33	60	11
6. Al-Oudayra'	20	60	38	20. A'uu'f	60	75	5
7. Al-Monakh	0	95	3	21. Halag'an	0	95	25
8. Hugarah	5	85	3	22. Mataran	0	50	31
9. Al-Q'utayn	33	25	30	23. Dhalgomal	1	90	15
10. Al-Hugar	33	20	8	24. Al-Huq'ab	0	60	4
11. Wadi Al-A'gab	55	70	12	25. Al-Buheem	10	0.8	79
12. Jurynat	30	90	36	26. Al-Anboush	1	15	12
13. Sharar	33	90	5	27. Al-Misha'ar	15	10	40
14. Al-Q'abilah	8	12	38	28. A'aniyah	10	5	14
Average					22	47	19

Sources: By the author, 2004.

d) Changes in traditional agricultural practices

Migration effects negatively on agriculture production directly and indirectly. The direct effect of men migration decreases of availability of labor force in agricultural land, consequence increases of daily labor wages and decreases of hiring enough labor to work in farmland, when it is calculated economically especially where cultivated lands built in mountainous terraces and manpower with animal only suitable for it. Effort applied or input to terrace lands to produce cereal crops economically more costly than production expected from terrace land. This phenomenon is a fact especially when amount of rainfall is small or when its distribution does not coincide with plant growing stages even though when total amount of rainfall is large.

The peasants in rural area used actually and not keep effort to apply to terraces land started from plowing, breaking clods of soil with wooden hammer, leveling, adding manure, sowing. Then after sowing, is thinning, hoeing between crops to increase water holding capacity (*Naq'wah*), and/or plowing between plants rows (*Galab*) after 2.5 month of sowing to increase soil surface reservoir to hold more water for crop. Then after grain are formed the activities started from picking up leaves of plant (*Suor*), holding tall crops together before harvesting, and harvesting, and bundling straw and store it in cages on trees or suitable places. Then threshing, removing crop residues, repairing destructed walls of terraces are take place. These are some of

the major operations, which are carried out by farmers by hand, using only simple tools and domestic animals. These activities conducted by men and/or women. i.e., women activities such as, breaking clods of soil during plowing, carrying animal manure to fields, thinning, picking up leaves of crops (*Suor*), sharing in harvesting, bundling straw and transfer it from fields into stores. Female has activities also such as raising animals; collecting animals fodder from fields and also take care of animals stable.

Indirect effect of migration on agriculture production when men migrate; women and children stayed at home to work in agriculture. Whereas, men send cash money to their families to help them getting their needs such as food and others needs available in the markets. Flow of cash to families year after year encouraged them to depend on imported food rather than working in agriculture land to produce their food. Migration of active men out of agricultural area will neglected tradition practices in agriculture such as crop rotation and cropping schedule (timetable) with the concepts behind it step by step and then might be disappeared.

To know the size of change in tradition practices in agricultural production area nowadays from what it was in few decades ago. Sorghum crop will be taking to consideration, as it is the main grain crop growing in terrace lands. Farmers used to follow the agricultural timetable (cropping schedule) for each crop during the year, Table 4.41a depicts sorghum crop schedule. Farmers or their families nowadays do what ever they can do in any time without care about the timetable as it showed in Table 4.41a. For instant preparation of land for seedbed by tillage is important. Plowing (tillage) scheduled in (*Kanu'n al-awwal and Kanu'n al-thani*) (1st kanu'n and 2nd kanu'n) December 14 to February 13, Table 4.41b. But nowadays most of farmers do it any time before sowing. In same cases, plowing and sowing done once, because of limiting of cash money on farmers hands to hire Oxen and/or sometime due to shortage of number of oxen in the village/area. For instant, and from my experience in Al-Ma'amirah village there are 7 oxen at present belongs to seven families, compare to 16 oxen for 13 families in 10-15 years ago, three families were have pair oxen. During plowing, soil's clods need to be broken down by family women or hired women using wooden hammer. The 2nd operation, known as (*thinyah*), 2nd plowing, it was important in the past during old farmers because plowing soil for second time will increase the soil pore space and plowing with opposite direction will level the field. This process scheduled to be after adding animal manure to farmland, and its time is (*Adhar*), it scheduled on March 14 to April, 13. However, most of farmers nowadays do not do this practice (*thinyah*), unless those who have their own oxen or those who have money to hire oxen. The next practice is sowing, this process is scheduled to be in (*Naysan*), and it scheduled on April, 14 to May, 13, which all farmers do it either by oxen or by men using hand tools called (*Zageed*).

Thinning is the next practice and it started two weeks after planting if season is wet, if it dry thinning delay until crop grow around 15-20 cm. Thinning practice is the duty of women, and it done in three times through three month and collected to feed animals. Women are cooperated for thinning in addition to their cooperation in carrying animal manure to the fields.

The next practice is *Nakwah or Kaheif*, which means, hoeing between rows and around plants to break down the top hard layer of soil to increase soil porosity and to reduce evaporation and increase percolation of water to increase soil's water holding capacity in the deep root zone of plants. It scheduled on May14 to June, 13, it called (*Mabkar*). However, this process nowadays is seldom practiced in farmland of old farmers who still working by themselves. Other wise, hoeing by women during thinning cover this purpose. The next activity is known as (*Glab*) or (*Mihwad*), which means plowing by oxen (*Glab*) or hoeing by men using hand tools (*Mihwad*), between rows to make basin to hold roots of plants and to increase soil surface reservoir to hold more rainfall water for plants. This process nowadays is applied only in some farmer's land and some other families do not care about the time when it must be done. It scheduled to take the remaining six days of *Huzairan* and beginning of six days of *Tammuz*, it located between July, 8 and July, 20 and this period is called (*al-a'lib*).

Traditionally farmers recite proverbs related to cropping schedule. For instant, they said (*Saqu hab or galab*) it means irrigate it (crop) when it is seed (at sowing) or during *Glab*. The last one (*Glab*) is the time when they plow by oxen between plants rows in *Tammuz*. This proverb explains two important information; the first one sowing must be done even if it is dry due to delaying of rainfall (first monsoon in March and April). And second one express of importance of (*Glab*) activity on its time before the second monsoon which started in July until September. The other proverb related to the time of (*al-glab*) is (*hawel be-al-a'lib shirib ow-lazad shirib*) it means that do the *Glab* activity, and it drink (irrigate) or it never drink (irrigate) in the other words *Glab* activity is important on its time even it is dry. The activities of women are continued in the field collecting up-normal plants and grass from walls of fields and around plants in ground to feed animals.

The next activity called (*Suor*), it means collecting leaves of sorghum plans. *Suor* activity is scheduled on (*Ailul*), September, 14 to October, 13, mostly it better to be in the second star (September, 24 to October, 3) which called the fifth star (*al-Khamis*) in Arabic. (*Ailul*) is divided into three parts each part is 10 days according to the stars in the sky and they called, fourth star, fifth star and sixth star. This division is the continuation of (*Aab*), which scheduled from August 14 to September 13. It divided into three parts, called first star (9 days), second star (10 days) and third star (12 days). *Suor* activity a women duty and they do it by hand, cooperation among

women is still common to do agricultural works. Every day women and young ladies work together with one family farmland in the village. Family with large farmland hires some women to do this activity to fulfill the shortage of cooperation days with other families. In this activity, all leaves of each plant picked up except last three leaves kept at the top of plants, during this work women replay some tradition songs related to this activity of the season. In the recent years this process done sometime earlier especially for families who has small farmland, they do not care on time of this activity. It common in some years this activity start earlier in case the crop infected by Aphids pest, it called (*a'usaal*). The proverb related to (*Ailul*) is (*Ar-rabia' shamsu-wala mataro*) it means, in the fourth star the sunny days better than the rainy days, because in this time grains need sun to ripe. The proverb for the fifth star is (*low ga al-khamis wa-hawlak mabush la-hames t'era-lak t'arat namis*). It means if the fifth star occurred (24 September to 3 October) and you do not find grain in crop's head in your field then you have to run like mosquito to find food from somewhere else. This proverb stated that in some years shortage of rainfall is common and production is none. The common thing in this stage is that grain of sorghum and millet reach to medium ripe, and farmers preferred to picked heads and fried them on fire and eat then fresh it called (*gahish*).

Holding and tying plants (*Tarbit almahagen*) is the following activity before harvesting, it means several plants from two rows hold together and tied by leaves of plants to stand plants to facilitate work of harvesting, this work done by men. The next activity is harvesting, it scheduled after 20 of (*Tishrin al-awal*), started in first week of November and there is a proverb related to the time of harvesting, (*a'ishrin bi-tishrin serab bitamken*), it means at 20 of *Tishrin* harvesting will be better. However, in recent years some farmers and families of migrants do not take this time to their account, only they think about how fast they can finished collecting their grain and straw before other to relax then. The evidence of that is what had happened in season of 1997, when farmers started harvesting in the beginning of October because rainfall was delayed from time it used to be. But after they harvested the heads of crop and spread them on roof to dry out by sunlight and stored straw in cages, rainfall started again and it continued for several days. The problem was the heads on the roof and the straw in cages get wet in the first day, and with continuation of rainfall the heads and straw infected by insects and fungus and heads become black and straw decayed. It was a lesson for those who did not listen to the advices of old experiences people. Harvesting activity is a duty of both men and women and even children work with parents. Men cut plant's stems by hand tool (scythe) and lay them done in rows and women and/or ladies and young boys cut heads and collect them in sacks to transfer to the place where they drying and threshing. Bundling of straw is the work of men and women and it

happened in next days when straw still fresh to be easy to tie in bundles. Transfer of straw from fields to store place is the women duty and storing it in cages is the men duty and only specialist people do it. All this activities need family members' effort and hiring labors either men and/or women to do them.

Table 4.41a: Crop calendar of Sorghum

Agricultural Practice	Jan	Feb	Mar	April	Mai	June	July	Aug	Sep	Oct	Nov	Dec
	Kanun.-2 kanun-1	Shubat	Adhar	Naysan	Mabkar	Huzairan	Tammuz	Aab	Ailul	Tishrin-1	Tishrin-2	
1 st Plowing	===											=====
2 nd Plowing + manure		=====										
Sowing				=====								
Thinning					=====							
Naq' wah					=====							
Mihwad / Galab							=====					
Collecting leaves 'Suor'									=====			
Harvesting											===	
Uprooting residuals											=====	

Sources: By the author, 2004.

Table 4.41b: Agriculture's months coincided with calendar months

1. Tishrin al-awwal=14 October – 13 November	2. Tishrin al-thanie=14 November – 13 December
3. Kanun al-awwal=14 December – 12 January	4. Kanun al-thanie = 13 January – 13 February
5. Shubat =14 February – 13 March	6. Adhar =14 March – 13 April
7. Naysan = 14 April – 13 May	8. Aiyar (Mabkar)= 14 May – 13 June
9. Huzairan =14 June – 14 July	10. Tammuz =15 July – 13 August
11. Aab =14 August – 13 September	12. Ailul =14 September – 13 October

Sources: By the author, 2004.

The next activity is threshing of heads by hitting them by stick to separate grains from heads. This activity is mostly a men activity unless for small landholder and when men in migration women do this work, also in Q'at area where sorghum grows intercropping with Q'at and the production is small, so women do the threshing work.

The last activity is uprooting plant residues to use as cooking firewood. It is a men activity and farmland owners do it by themselves, and the families who have few members or they cultivate large area hiring labor or young students. Collection and transferring dry residues after uprooting to store place is women duty. Either it do by cooperation among women or in some cases women come to collect residues and they get part of the residues as a reward for the work.

“Necessity is the mother of invention” in Arabic (*al-hajaa um al ikhtiraa*). This proverb was suitable for people in mountainous area where soil and water were limiting. Traditionally farmer built the terraces land to conserve soil and increase soil surface reservoir to increase the

production per unit area. Because of dependency on the farmland to produce the food crop, farmers in the mountainous area applied intensive effort in agriculture land to obtain optimal production of the small terraces land. Farmers used to concentrate on farmland all the season period to increase their experiences on agriculture production area and they transfer their experiences from generation to generation to survive. Disappearance of agricultural traditional practices and information among young descending is the dangerous challenge in the future. Traditional practices and information about cropping schedule (crop timetable) that old people known by practicing with their father and grandfather has meaning for them and they knew reasons and traditions proverbs related to each incident in the season. This information is not easy to transfer to young people, if they are far from agricultural land. Because young men moved out villages to cities or abroad looking for better life and job. Young generation heard and/or watched traditional agricultural practices during their vacations or (A'ids) when they visit their families, but they do not knew the explanation of that practices. Even for these who are cultivated the land they do not understand deep meanings of these practices they applied in farmland. Agricultural traditional information and practices will disappeared if there is no care and collection for it and re-teach it in agricultural high school and even in collages of agriculture to evaluate and to develop.

It can be conclude that Yemen has unique traditional agricultural practices from ancient centuries. Phenomenon of cleverly designed, building and forming terraces land all over mountain slopes areas by the oldest generation people to conserve the soil and to maintain water requirement for crops to reach; if not the optimal, is the good production. The people in rural area in Yemen in the past used to survive from their farmland production in which, the efforts they applied to farmland were highly and consequently in all the season period. The activity during the season divided and named due to the experiences they were built-up for centuries. The gap of the traditional practices and what the farmers practicing nowadays is the consequences of migration of men, and the information that the old people knew about the traditional practices and its consequences will be a history in next generation if the old experiences people dead.

e) Terraces land maintenance

Migration of men and flow of cash to their families increased dependency on imported food products. In turn, caused careless on terraces farmland especially in top of mountain slops, where production of these terraces is low compared to the effort applied to the terraces. Most of these terraces collapsed and did not maintain any more, the terraces structure built by old people in top of mountains to protect cultivated land from sediments. Collapse of terraces and structures

cause problem of soil erosion and sediments flashed down to good land during rainfall. With continuous flashing the sediments to good farmland and shortage of labor to maintain collapsed walls and terraces, un-wisdom decision had been chosen to solve this problem, channel opened in the middle of good cultivated land to facilitate passing of runoff with sediments out the land. For instant, in Al-Ma'amirah village, in the end of 1960s channel was opened in the middle of cultivated land with width of 1 meter and 1 meter deep. Then a lot of good soil was cutting every runoff every year. Dimensions of the channel increased with cutting of sides of the channel each runoff, with long run dimensions of channel reach 3-4 meters in width and 5-6 meters in depth. Maintaining and rebuilding the channel become more difficult and costly to farmer. Using of runoff water to irrigate field where the channel was opened become difficult due to increase the depth of the channel.

In the past before the channel was opened, cultivated land used to receive whole rainfall water. It was enter the terraces from the top and pass down from one terrace to another until the end of terraces slope. Water was hold on surface of terraces and it percolated in the soil profile to saturate the soil and to recharge the ground water aquifer in which discharge of spring down stream was increasing. The extra water was move out the area of the village to the valley of Warazan.

Nowadays, and because of short and intensive rainfall take place runoff is formed very fast and it goes fast in the channel out of farmland in the village. Therefore, the amounts of water enter terraces is low to saturate the soil pores and production is low especially if distributions of rainfall dose not coincide with crop growing stages. It was obvious in Q'at cultivation area; terraces in all locations are maintained and renewed because of high income of Q'at.

f) Change of cropping pattern

According to the information from old people in the study area they said during the past up to 1960s and early 1970s there were many crops growing up also crop rotation was practiced. The main crops were grain (sorghum; millet, corn, and wheat), vegetable (potatoes, sweet potatoes, onion, garlic) and others. Potatoes were one of the cash crops for most farmers and were cultivated in the middle of summer and harvested in fall to export to Aden, which was colonized by the British since 1839 up to 1967. Wheat was usually cultivating during winter time also sorghum and millet grew during summer and fall time. Coffee trees were grown in mountainous and valley land and it was the main exported product of the country to the world. Fruit trees were grown in valley's lands where water was available in most time during the year; fruits were banana, papaya, mango, guava, pomegranate, peach and fig. Sugarcane was also common product in valleys land where water was running during whole the year, nowadays they

become dry unless on rainfall time. Sweet roles were made from sugarcane and covered by sesame and were the best sweet. Q'at was grown in specific locations in the study area; it was grown in small separated terraces in the villages. Nowadays it occupied between 25% up to more than 70% of cultivated area of the villages. It was consumed among old people and Q'at farmers used to exchange it with grain in neighboring villages. Nowadays Q'at became the main source of income for most of Q'at farmers.

The recent change on cropping pattern is because of migration of men from agricultural areas. The change became unbelievable in such cases where you can see the cereal crop occupied 5% of cultivated land and 95% occupied by Q'at (Table 4.40) and Fig. 4.15 as example of changing of Q'at occupation between 1990 and 1998 in Addawm village. The interesting thing where you find farmers kept some coffee trees in the field as a sign of their tradition activity to keep them with hope and where some other have coffee and Q'at trees shared the same field as intercropping. The disaster can be seen where the expansion of Q'at takes place in very good soil of the valleys, where it was used to produce grain and other food crops. It is also good in some valleys where you can see new varieties of mango trees are grownup, such as in valley of *al-Barakany* (Al-Ma'afer district) and *Mawqa'ah* (Samia' district). Also it is obvious that local mango trees are still available in valley of *Mawqa'ah* (Samia' district) down stream of catchment (basin) of the study area and they are old and in low production stage.

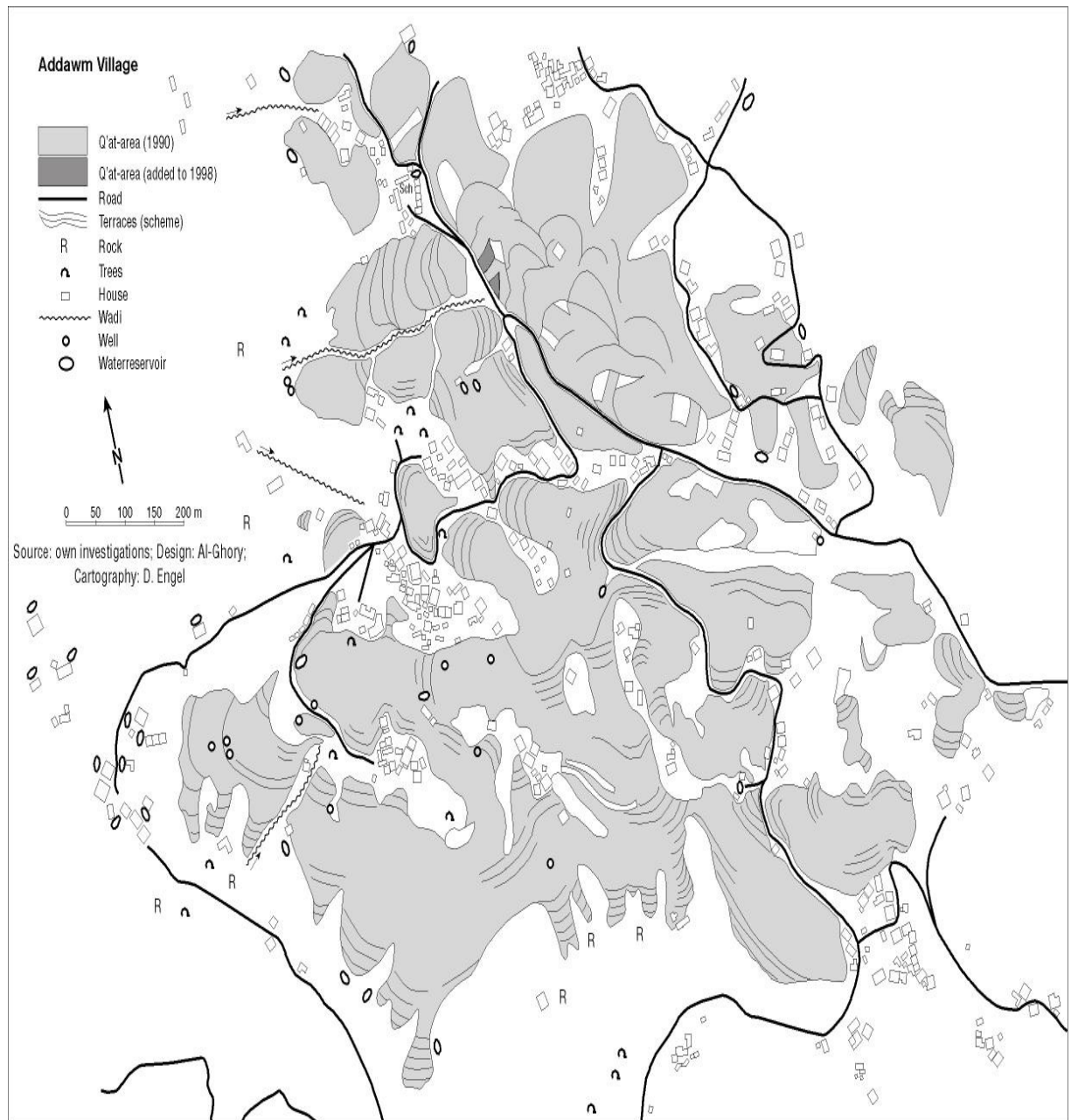


Fig. 4.15: Q'at grown in Addawm village in 1990 and changed in 1998

4.3.6 Water demand

4.3.6.1 Water rights

a) *The Islamic rules of water rights/Background*

Water is a very important substance for whole live organs as Allah said in the Holy Quran ((وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ حَيٍّ)) "We made from water every living thing". Also in the Hadith recite in "*Sunan Ibn Magah*" Prophet Muhammad peace be upon him said "Three not to prevent water, pasture and fire".

حَدَّثَنَا مُحَمَّدُ بْنُ عَبْدِ اللَّهِ بْنِ يَزِيدَ حَدَّثَنَا سُفْيَانُ عَنْ أَبِي الزُّنَادِ عَنْ الْأَعْرَجِ عَنْ أَبِي هُرَيْرَةَ أَنَّ رَسُولَ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ قَالَ ثَلَاثٌ لَا يُمْنَعَنَّ الْمَاءُ وَالْكَلَاءُ وَالنَّارُ

Therefore, water considered in most Islam jurists is a "*mubah*" (permitted) commodity, not owned by any one, unless it is in the private container, tank or other private reservoir. The *Shafia'i* scholars cleared two categories of the water, first is "*mubah*" i.e. *res nullius* or ownerless and the second one is "*Ghyr mubah*", not *mubah* (Maktari, 1971). However, *mubah* water is free for all of mankind according to the statement of the Prophet Muhammad peace be upon him above. Therefore, water not prevents from any thirsty person and it is free of charge in this case. Also when the Prophet asked Muslims who can buy well of *Rawmah* in the *Medina* and made it free for whole people and Allah will reward him a house in the Heaven, then "*Uthman b. A'ffan, Allah be pleased with him*", did it (Maktari, 1971).

Flood was distributed among land's holder as it organized during the Prophet Mohamed peace be upon him by rule of "*ala-a'la fla-a'la*", if whole land cultivated. It is means that water starts in upper field then the next field until the end of land or to where water end according to its amounts. But if the cultivated fields in a season are varied, then the most dangerous field takes first turn and so on. Distribution of flood water among farmers land was control and did not allow it freely used due to farmer's desires. The Prophet Mohamed peace be upon him determined amounts of water enter to the field until it reach "*Alka'bin*" singular "*Alka'b*" (the heel) and that the amount of water is covered trunk of crop or palm trees (Salem, 1995).

According to Islamic law and because Yemen is one of the Islamic community, constitution took to its consideration the Islamic fundamentals to apply to all laws in water and other daily live situations. So that in constitution, Islam is the state religion and Islamic Law constitutes basic of all legislation. Regarding to water ownership " both flowing water on surface and underground as well as water occurring on *Waqf* land, is considered as *Res Nullius* or *res communis* (*Musha'a* in Arabic), the use of it is to benefit whole Muslim community" (Mullick, 1987).

Private appropriate water is the water contained in containers, tanks, well that is developed by a man on his land, rainfall water that is remained in the private land, and small irrigation water's channel and spring water developed by a man on his land (Mullick, 1987).

Also in the constitution, whatever, water flowing in small natural streams, irrigation channels, and from wells or springs developed jointly, is subject to joint ownership and its use is subjected governed by provisions of Shari'ah Law /Islamic Law (Mullick, 1987).

Water subjects to private ownership may be acquired by donation, transfer, sell or inheritance. It is to be noted in this connection that water being traditionally attached to the land on which it occurs, only water contained in receptacles or tanks may be transferred separately from the land. The following will to clarify further what is stipulated in the above-mentioned Constitutional By-Laws.

- a) The owner of land does not own water in a well. If he transfers water from the well to a tank or pipe, then water in tank or in pipe belongs to owner and he can do anything he likes with water.
- b) The owner of land can do what he likes with land e.g. he can dig wells. He can, however, be prevented from drilling more wells than he needs.
- c) The State claims the ownership of all water resources both above and below ground that will be used in best interest of all of community (Mullick, 1987).

b) The tradition rules of the water rights

The tradition rules of water right ownership nowadays are basically taking from Islamic rules but due to weakness of faith of people and they do not fairing Allah. The corruption's in Islamic rules taking place and then it becomes the tradition rules in daily basis applying. For example, in case of water in digging well, it (water) is freed for any thirsty either human or animal because water is a gift from Allah. And according to the Hadith of Prophet Mohammed peace be upon him, said "who prevent water from his brother; Allah will prevent him from his graciousness" (Salem, 1995). However, owner of well has the right to prevent using and taking water by any one if water transfer in pipe or it is already in container. Although people need water for their houses to drink and to cock and they have to get it free from any well. But owner of the well act differently such as he excuses preventing people from drawing water from well due to damage may happen to well. Or he excuses saying, water is not enough, or people well damage crop if well in farmland, or land around well will be compacted and it will not be cultivated easily and so on of these excuses.

Other case of tradition rules, people digging wells every one in his land even though damage would be on land and inequitable extraction of ground water. In the past, there were in each villages one or two public wells or spring for whole community in the village and each family used to draw her needs of water without any selfishness against others. Water was taken from these sources in basis of "the first come the first take". However, influences of urbanization, introduced the style of multi clothes and new food consumption. This is not a bad habit as the statement here, but it means here, after opening to the world in beginning of 1970th and due to imported of clothes and food stuff, family's member change to new life style and they become consumers for products they do not made and for food they do not produce. So that demand of family's members increased each one has several suits and consequently need for water increased. Therefore, the amount of water in public well became not enough any more and people started to look for another way to get water by digging wells in their land to provide necessary amount of water for their need.

Water right of flood or spring also follow the Islamic rules but people changed these rules to tradition rules after they fulfill their desired. For instant water of flood is going by gravity from upstream to down stream and the rule "water irrigate the upper field and then below one and so on". But what had happened in the villages of study area with influences of some elite water organized to be right for some fields only. In *Al-Ma'amirah* village for instant there were 4 fields had right of water from the catchment. And water collected from sub-catchment named by that fields such as *Saq'yat Hawl Asha'b* (channel of Hawl Asha'b), *Saq'yat Al-A'uzabi* (channel of Al-A'uzabi), *Saq'yat Hawl Ashia'bah* (channel of Hawl Ashia'bah) and *Saq'yat Al-A'q'mah* (channel of Al-A'q'mah). And in Addawm village there was one field had right for rainfall water form catchment this field called *Al-Harwr* and the channel called *Saq'yat Al-Harwr* (channel of Al-Harwr). The owners of these fields were responsible for maintenance of the channel and for sediment the flood brought it to the fields, so the amounts of sediments used to move to the end of the fields every year and it available until now as evidence. Water right of these fields does not exist any more in some cases at present, because owners of other fields in upper part of catchment started to take water from the channel to irrigate their fields when water pass in the channel closed to their fields. Therefore, water right of *Al-A'uzabi* and *Hawl Ashia'bah* canceled, while water right of "*Saq'yat Hawl Asha'b*" and "*Saq'yat Al-A'q'mah*" still exist as a tradition right but part of the water upstream taken to upper fields and remained goes to these fields.

From my experiences in Tihama region, where lands irrigated from flood's water traditionally farmers built up wall of fields from soil to high of 1-2 meters to keep water in the fields. The amounts of water entered the field and fill it up, so the field looked like a pool and

water kept for 24 hours when gage opened to allow water run out to next field. The idea behind entering more water for 24 hours to allow deposit the alluvial into the fields to increase soil fertility. Therefore, water right does not change but acting of farmers to take huge amount of water changed and it became a tradition practice in Wadi's lands.

Regarding of natural springs and according to information from old people in the study area the amount of water running is a right for all lands in vacancy of spring and it distributed among them according to the amount of water and location of land from the channel. Whereas, the artificial spring found by some people, the right of water will be for land of founders of spring, and they share it according to their shares in the investment. Water allocation among them will establish according to the location of their land from the source and also due to the quantity of water and the rule of "*ala-a'la fla-a'la*". Also the same right will be applied to the founders of a channel of water that made to convey water from main Wadi to irrigate lands far from Wadi's channel.

4.3.6.2 Water allocation rules

a) Islamic rules of water allocation

In general the rule of free moving water on surface and below surface is free for all of community. So, no one can claim owning of free moving water either from flood or from spring because it is a gift from Allah. Therefore, the right of allocation of water is guaranteed for all farmland in basis of "*ala-a'la fla-a'la*" from flood water and spring according to amounts of water and location of farmland from sources of water. Water allocated among owners of land in vacancy of water stream during the Prophet Mohammed peace be upon him to the heel, in which it is enough to cover the trunk of crop, to save water from loss and to control human being desired.

In case of well's water found by co-owners, it also applicable to same rules of surface water in addition, water will allocated in amount related to amount of sharing in investment and to distance of land from well. Losses of conveyance system of closer fields will be small, while it is large for land located far from the well and it has to be considered in water allocation.

Allocation of water right control by several systems according to type and amount of water running in the channel or accumulate in the pool (small spring). For example, if the amount of water is not enough to distribute to several fields in the same time so it needs to accumulate in a pool before distribution. The turn or "*nawbah*" means, each field has a turn to get its water and this turn determined according to the area of the field. The turns specify by a time length and it known among farmers by stars at night or by movement of sun during daytime but at present the

ordinary watch is used. The longer turn called "A'ssr" and it equivalent to 12 hours, either at night or at day. On another words, the amounts of water accumulated in the pool during 12 night's hours used to irrigate land that has night's turn or 'A'ssr'. While the amounts of water accumulated during 12 daytime's hours used to irrigate land that has right of day's turn or 'A'ssr'.

1) Examples of water allocation rules in the region

i. Spring of Wadi Al-Hadya in Al-Ma'amirah

Allocation of water from spring of wadi *Al-Hadya* in *Al-Ma'amirah* village applied according to the document written before 100 years ago at 1315 AH (1898 AD) to determine allocation of water among farmers. Farmers had conflict about water running in the channel and they asked a respective *Q'adi* to resolve the conflict and to regulate allocation of water among the owners of land that had water right from Wadi Al-Hadya spring. *Q'adi* used informal people according to their experiences and knowledge to clarify the water right of spring to the land owners; he measured the cultivated lands to determine the area of each field. From document, the total area covered by spring was 43 *Alf* (an *Alf* = 10 *Qasab* (singular *Qasabah*) = 10 *Hebal* (singular *Habl*), each *Habl* = 12x12 arms or 10x10 arms, one arms is equal to 45 cm). The area of one *Qasabah* or *Habl* is 29.16 m² for 12x12 arms or 20.25 m² for 10x10 arms. So the area of one *Alf* (ten *Qasab*) is 291.6 m² for 12x12 arms or 202.5 m² for 10x10 arms. The amount of water for ten *Qasab* determined for *A'ssr*; (12 hours either during day or night time). Therefore, the whole turns were 43 *A'ssr* (21.5 days and nights), allocation among 30 farmers according to their cultivated area. Water allocated among farmers according to the right of land not to farmers, while in some cases tenant cultivated the land. The higher allocation time was 37.5 hours (2.75 *A'ssr*) and the lower allocation time was 3 hours (1/4 *A'ssr*) (see Fig. 1 and Table 1, appendix, 3). Water accumulated in the pool closed to spring outlet for 12 hours; then pool opened to increase the speed of water in the channel to reach the field faster. Water for one *A'ssr* is accumulated in the pool during the day from 6 am to use in the end of the day before 6 pm. And the water accumulated in the pool during the night from 6 pm to use in the next early morning before 6 am.

Unfortunately, the system of allocation of water from *Al-Hadya* spring had been stopped some 20 years ago due to reduction of water in the spring. It result from missused of right of people in their land as each one dug well in his land upstream of spring and due to shortage of rainfall in the last 2 decades as old people said. Nowadays one person uses the remained of water of spring because he dug well near by the spring's outlet. He pumps water using

centrifugal pump powered by 23 horsepower machine to irrigate his land in the wadi and in the top hill which cultivated by Q'at.

ii. Water allocation rules in other villages in the region

1) Turn or "A'ssr", is the time of water irrigates a cultivated area, it differed from place to another depend on amount of discharge of spring. As it mentioned in *Al-Ma'amirah* village "A'ssr" (12 hours) irrigated 10 *Qassabah* (202.5 m² (10x10 arms) or 291.6 m² (12x12 arms)). However, in 1383 AH (1964 AD) water of *Ghayl Al-Kusar* (spring of *Al-Kusar*) in *Al-Anbou* village in *Ash-Showbah* in wadi *Adanah* was allocated to 43 "A'ssr". Each "A'ssr" covered 100 *Qasabah* (2025 m² (10x10 arms) or 2916 m² (12x12 arms)), the system still exist at present (Fig. 2, appendix, 3).

2) In *Hugarah* village, a village in *Bani-Yousif* near *Addawm* village, and according to document written in 1310 AH (1892 AD) the water from "*Birkat Hijat Al-Janah*" (pool of *Hijat* of paradise), it located in the top of the mountain north of the village, divided into 20 "A'ssr". Water allocated among 6 families, the lowest right was 1.25 "A'ssr" and the highest right was 6 "A'ussor" plural of "A'ssr". It still exists at present; the area covered by each "A'ssr" was not mentioned in the document (Fig. 3, appendix 3). For instant the amount of water per "A'ssr" during day time is the amounts of water accumulated in the pool during day time until the end of the day irrigates area has right of day's "A'ssr". While the amounts of water accumulated in the pool during night time until end of the night irrigates area has right of night's "A'ssr".

3) The another example of water allocation in "*Wadi Al-A'jab*" village in *Qadas* (Fig. 4, appendix, 3). In the document dated 1372 AH (1971 AD), it was referred to old document dated 1287 AH (1870 AD) showed resolution of the conflict between farmers regarding their right of the water from *Wadi Al-A'jab* spring. Water was allocated among farmers according to the rule of "*ala-a'la fla-a'la*". The amount of water allocated for land determined by amount of water in the pool nearby the spring. The turn called 1.5 "*Ndh*", it means, the pool will fell by water and opened to irrigate land and then the pool fill again to 1/2 of it and opened again to irrigate the same land to cover 1.5 "*Ndh*". The another right determined by "*A'shwiya*", it means the time from rest of labor in middle of after noon to sun set which approximately 3 hours (labors worked from 8-12 and rest for lunch, then they worked from 14-16 and get rest for tee/coffee and worked to sunset, the last part called "A'shwiya"). This system does not applied all the times at present; it applied only when water running in the spring during rainfall season. Water of spring reduced and in dry winter it dried out due to many wells opened upstream of spring outlet. Farmers at present used galvanized metal pipes and rubber pipes to transfer water to their land from spring

to reduce loss of water in ground channels. Water sold in this Wadi to neighbor areas and villages to irrigate Q'at and for domestic uses. Also several reservoirs were under construction during the field work belong to affluent families in the village these reservoirs planed to serve Q'at fields of investors. The area of Q'at in this village covered more than 70% of cultivated land.

4) The another example of water allocation in the region is Al-Hujmah spring in Q'adas which still exists at present and its water allocated among farmers in Wadi Al-Ahjum in A'zlat Q'adas and Wadi Al-Ashaa'r in A'zlat Al-Ahkum. Water divided into two parts one part take water during day time from 5 am to 5 pm, the land of this part located upstream in Ahjum Q'adas and it allocated for 19 days. While water during night time allocated for 19 nights, it irrigated land downstream in Al-Ashaa'r Ahkum, and it started at 5 pm to 5 am. The main document was difficult to find, but I got the 19 names that have right in upstream in Q'adas from "A'dl" of Al-Ahjum and I dictated it from him direct. The downstream section I found the note with "A'dl" of Al-Ashaa'r and I write it down to my notebook (Table 4.42).

Table 4.42: Water right of people in Al-Ahjum Qadas and Al-Ashaa'ir Ahkum from Al-Hujma Spring

The turn's	<i>Al-Ahjum in Qadas (daily w. right)</i>	<i>Asha'ir Ahkum (night w. right)</i>
Day or night	Name of the owner of the water right	Name of the owner of the water right
1	Hamud Noa'ma Mulhi & his brothers	A. Naji, Muqbil Gh. A. A'uthman, Msa'od's son & Sa'id Qaid's son
2	Ahmed Salih	Son of Salih Mua'mar
3	Muhhammad Abdu Muhsen	Abdul Ali Mua'mar
4	Abdullah S. Ali	Salam Moqbil
5	Ahmed Qaid Noman	Son of A'alwan Muhammad
6	M. Ahmed Mahub	Son of Noman Muqbil & Son of Sa'id Sa'd
7	Son of Ashykh A. Ali Al-Hakimi	Son of Noa'man Muqbil & Son of Sa'id Sa'd
8	Thabit Salam	Ahmed Abdullah Haidar
9	Abullah Ali Al-Haj	Abdullah Saleh A'umar
10	Abdu Q. A'uthman & his companions	Son of Soufyan Moqbil
11	Qasem Faria' & his companions	Son of Noa'man Moqbil
12	Ahmed Salih & his companions	Son of Sa'id Ahmed & his brother, and Son of Qasem Muhammad
13	M. Abdu Muhsen	Abdu Ali A'umar & Son of Salh Mua'mar
14	Ahmed Sa'id Hashim	Moqbil Ghalib Mua'mar
15	Ali A. Hajeb	Salam Ghalib & his brothers, Abdu Al-Malik A. Moqbil
16	Raweh Shmsan Salam	Son of M. Abdulah & the "Alf al-Jorol" of M. Ghalib Mua'mar
17	Qaid M. A'umar & his companions	Salam N. Hamadi, Mansur S. Ali, Semaa'il M. Salim
18	Abudlwali Sa'id Ali	Son of Yousif Qaid & Son of Hasan Ali
19	Semaa'il M. Ghalib Noman	Son of Moqbil & Ali Muhammad Thabit

Sources: By the author, 2004, dictated from A'dl of Al-Ahjum and A'dl of Al-Ashaa'ir villages

Discharge of water covered 180 Q'asaba during one "Sirb"/ turn/"Assr" (12 hours) either in daytime in upstream section in Q'adas or during night time in downstream section in Al-Ahkum. The time required to irrigate 10 Q'asabah (40 minutes). However, "A'dl" of Al-Ahjum

said water in the past was enough to irrigate 180 *Q'assabah* per day but at present it only enough for 50 *Q'asabah* per day. Because water of spring reduced due to drilling wells upstream to provide *Halaqan* and *Al-Kadarah* villages by domestic water.

From information in the documents I found in the region regarding the right of allocation of water. The references of allocation of water was the Islamic rule, in which it considered the right of water of land due to continuous uses (custom) "*a'adah*". It means water right of land considered as legal right and accepted by Islamic law by continuous uses "*a'adah*".

b) Traditional rules of water allocation

Islamic rules are the main source of water right allocations either from rainfall (flood) and spring. But with absences of rules application and illiteracy among people, water right allocation changes according to desire of the powerful leaders in the area (in each village). Therefore water right allocated in some areas, become a serious problem, it is allocated according to desire of people and strong person get water easier than the other person. In my opinion allocation of water change to certain situation because of the ability of some elite's to protect there rights when they able to do so. With running of time it become a custom and right to the land of theses elite's. Digging of wells in land or in terraces without any study and control threaten water resource and aquifers in the region.

4.3.6.3 Competition for water

a) Water for domestic uses

According to Islamic Law, flow water does not subject to ownership, because it is a gift of Allah, and water cannot be sold unless it in receptacles tanks or others containers.

In large cities and towns water distributed against a nominal customary fee; water for domestic and municipal uses distributed through public utility networks is metered and sold as per established tariffs. Whereas, in the villages women daily searching and collecting waters for house and animals. Women fetch for water either from public or private wells or from spring. The time required to gather water from source varied within a village and between families, due to the location of houses in the villages and the distances between houses and the source of water. Referring to Table 4.43, the average amounts of water consumed per a family in summer and winter in Al-Ma'amirah 140 liters and 136 liters respectively, with average of 19 liters and 18 liters per capita in summer and winter respectively. Comparing to village of Addawm (*Q'at area*) the average amounts of water consumed per a family in summer and winter 166 liter and 113 liter respectively with average of 18 liters and 12 liters per capita in summer and winter

respectively. While in Mawq'a'ah the average amounts of water consumed per a family in summer and winter 211 liters with average of 21 liter per capita in both summer and winter.

In Al-Ma'amirah village the average numbers of time need per a family in summer and winter to collect water was 6 times and 7 times respectively. And the time per one turn 35 minutes and 44 minutes in summer and winter respectively; in which it carries out average total time per day per a family 195 minutes and 292 minutes in summer and winter respectively. Where in Addawm village average numbers of time need per a family in summer and winter to collect water 6 times and 2 times respectively. And the time per one turn 24 minutes and 12 minutes in summer and winter respectively; it carries out average total time per day per a family 178 minutes and 82 minutes in summer and winter respectively. The explanation of this differences because in Addawm during winter most of the families bought water from trucks because of shortage of water in the village. In Mawq'a'ah village average numbers of time need per a family in summer and winter to collect water 4 times and 7 times respectively. And the time per one turn 11 minutes and 22 minutes in summer and winter respectively; it carries out average total time per day per a family 102 minutes and 203 minutes in summer and winter respectively.

Table 4.43: Water for domestic uses in the three villages Al-Ma'amirah, Addawm and Mawq'a'ah

Items	Al-Ma'amirah			A d a w m			Mawq'a'ah		
	Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.
Total amount of water used/ day / family in Summer "l"	500	20	140	400	70	166	300	120	211
Total amount of water used/ day / family in Winter "l"	500	20	136	280	60	113	300	120	211
Amounts of water used by animals 'l'	80	0	21	40	0	17	50	20	38
Total Family Member	25	1	9	29	4	10	26	5	11
Amount of water used / a family member in Summer "l"	83	6	19	36	7	18	50	9	21
Amount of water used / a family member in Winter "l"	83	5	18	32	5	12	50	9	21
Time needed for a women to bring water in Summer "min"	60	10	35	75	0	24	45	0	11
Time needed for a women to bring water in Winter "min"	75	15	44	120	0	12	60	0	22
Number of times a women go to bring water in Summer	13	2	6	20	0	6	12	0	4
Number of times a women go to bring water in Winter	20	2	7	12	0	2	14	0	7
Total time in minute to bring water in summer	715	30	195	675	0	178	540	0	102
Total time in minute to bring water in winter	740	30	292	750	0	82	720	0	203

Sources: By the author, 2004.

b) Daily water use per capita

The amount of daily water used per capita in rural area depend on availability of water in wells or container where people can use it with confidence of availability of water. For example, the amount of water consumed per capita in the villages (rural area) was 83 liters, 34 liters and 50 liters in maximum in Al-Ma'amirah, Addawm and Mawq'a'ah respectively. It is in minimum

5.5 liters, 6 liters and 9 liters in the same villages, with average of 18.5 liters, 15 liters and 21 liters for the same villages. Therefore, the average maximum water used per capita per day in the study villages 56 liters; and the average minimum daily water used per capita 7 liters with average of 18 liters (Table 4.43). So that, the daily amount of water use per capita in rural area incredible compared to average amounts of water used per capita in urban area in Yemen (64 liters/day) and in the world the amount of water used per capita according to estimation of World Health Organization is 30-150 liter/day in urban area and 60 –80 liters/day in rural area (United Nation 1993).

If we talk about the share of water resource per capita in general, where the renewable of water resource estimated to reach 2.1 billion cubic meters a year in Yemen and the per capita of availability of water resource will not exceed 133 cubic meters a year. Compared to per capita in the Middle East and North Africa is 1250 cubic meters and for the world is 7500 cubic meters. However, agriculture consumed 90% of water resource with low conveying, application, and distribution efficiencies the water per capita used in municipal will be low and the consequences of that will be effect negatively on live standard and diseases diffusion (World Bank 1997).