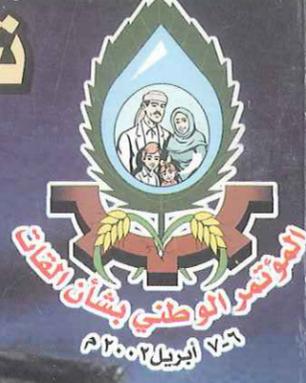


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Under the Auspices of H.E
The President of Yemen
Mr. Ali Abdula Salleh



National Conference on Qat

Conference Discussion Materials

Gatter, Peer, Qahtan Abdul Malik & Khilid Sae'ed (Editors)

Organized by

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and

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National Conference on Qat

CONFERENCE DISCUSSION MATERIALS



Seventh Topic

Qat and its Role in Yemen's Rural Economy

Qat and its Role in Yemen's Rural Economy

An Exemplary Study of Qat Growing and Marketing in the Governorates Of Hajja, Sana'a and Taiz

By

Ali Noman Abdullah, Peer F. Gatter, and Qahtan Yahya Abdul Malik¹

Table of Contents

- I. Introduction
- II. Methodology
 - A. The Questionnaire and its Field Testing
 - B. Selection of Research Areas
 - 1. Hajja Governorate
 - 2. Sana'a Governorate
 - 3. Taiz Governorate
 - C. Collection of Data
 - D. Evaluation of Data
- III. Results
 - A. Hajja Governorate
 - 1. Dawas Region (Najara District)
 - a) Geography and Climate
 - b) Social Characteristics
 - c) Crop Composition
 - d) Characteristics of Qat Farming and Production Inputs
 - e) From the Field to the Market
 - f) Costs and Profits
 - 2. Ar-Rasa'a Region (al-Mahabesha District)
 - B. Sana'a Governorate
 - 1. Bait al-Khardal and al-Muena'a Regions (Khawlan District)
 - C. Taiz Governorate
 - 1. Al-Mesayjid Village (al-Maqatira District)
 - 2. Al-Dhowa Village (al-Shamaytin District, al-Maqarima Sub-District)
- IV. Summary
- V. Literature

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List of Tables

- Table ١: Annual Production Cost of one Hectare of Qat in the Dawas Region
Table ٢: Annual Production Cost of one Hectare of Qat in the Rasa'a Region
Table ٣: Annual Production Cost of one Hectare of Qat in the al-Muena'a Region
Table ٤: Annual Production Cost of one Hectare of Qat in the Bait al-Khardal Region
Table ٥: Annual Production Cost of one Hectare of Qat in the Bait al-Khardal Region
Table ٦: Annual Production Cost of one Hectare of Qat in the al-Dhowa Area
Table ٧: Area Share of different Crops in the Survey Regions
Table ٨: Qat Farming at a Glance
Table ٩: Annual Production Cost of one Hectare of Qat in the Survey Regions
Table ١٠: Annual Production Output, Cost, Tax Payments and Net profits of Qat Farmers in the Survey Regions

I. Introduction

Despite Qat having become a subject of interest in Yemen as well as abroad, very little is known about the production of this crop.

In 2000 a book on Qat, written by respected researchers and notable university lecturers, has been published under the title "*Qat, an Integrated Approach, Issues and Effects*" (Hadrani (ed.) 2000). This piece of work sums up the latest state of research on different qat related issues. In its articles it shows very clearly the knowledge gaps that still dominate our perception of qat. This is especially true for the agricultural and economic sides of crop as the reader can infer from the open questions in this book (Gatter in Hadrani 2000, p. 254-256), such as:

- What is the actual area of Qat cultivation?
- What is the production capacity of a Qat unit area, and Qat production generally?
- What are the costs of production? What are the net returns attained by the farmer from a unit area?
- What is the share of each member of the farming family out of the net Qat returns?
- How much does irrigation cost? And what is the quantity of water consumption in a unit area?
- What kind of workforce is used to produce Qat?
- What methods are used in Qat agriculture in the different producing regions?
- What is the relationship of Qat growing with child and women labor?

These open questions were taken into account during our field survey. The focus of the study is directed to the methods of qat farming, the water consumption of Qat, the returns of Qat farming, the Qat labor force and its share in the total of agricultural work force.

II. Methodology

A. The Questionnaire and its Field Testing

In a first stage, a four page preliminary questionnaire was designed, trying to cover aspects seen as vital in order to gain understanding of the role of qat in the rural economy.

A field testing of the questionnaire was carried out in Sana'a governorate's Bait al-Shami village (Maswar area, Khawlan district). The team was accompanied by a guide chosen for his knowledge of the area and his popularity among the people of this region. This helped the team to gain the recognition and trust of the Qat farmers and guaranteed to some extent the readiness of farmers to participate in the survey and to reply truthfully to questions relating to Qat production and household issues.

Having carried out the field testing it became clear that the questionnaire needed to be divided into separate sections: one for Qat producers, one for Qat merchants or mediators, and a third one on development aspects related to Qat farming (public services such as paving roads, establishing schools, and health centers).

B. Selection of Research Areas

In a second stage the research areas were selected. The survey focused on three Qat growing governorates. These were Hajja, Sana'a, and Taiz. These administrative regions were selected because of their diversity as well as climatic and topographic considerations. On the first account, they belong to the southern, central and northern Qat growing regions of the country and are substantially different in population structure, history and traditional leadership. Therefore, they represent a significant sample.

1. Hajja Governorate

In **al-Mahabesha district** the villages of ar-Rasa'a, Suq al-Makhaidherah, al-Kamah, Bab al-Mohr, and ad-Dahna were visited. In **Najara district** the survey included Dawas village. These two administrative regions were chosen due to the cultivation of two very different Qat types: The first is the *al-Shami* type, which al-Mahabesha is famous for, and which is considered one of the best kinds of Qat in Yemen. The second one is called **Najri**, found in Najara area, and is considered to be of less quality.

2. Sana'a Governorate

In the governorate of Sana'a the district of **Khawlan** was chosen with the villages of Bait al-Khardal and al-Muena'a. While the village of al-Muena'a was chosen for its dependency on irrigation via springs streams, floods and surface wells as well as its average quality qat, Bait al-Khardal was chosen due to its good quality Qat and its dependency on underground wells for Qat irrigation.

3. Taiz Governorate

In the governorate of Taiz the districts of **al-Maqarima** and **al-Maqatira** were chosen. The first area was selected because its medium quality Qat and its dependency on shallow wells (hand-dug wells, less than 10 meters in depth).

Al-Maqatira district with Mesayjid village was chosen because it is dependant on irrigation by rain, springs, wells and water basins. Even though al-Maqatira was made in 1996 a part of Lahej governorate, it can geographically be considered part of Taiz governorate. This area is famous for its Qat, which is considered one of the finest in the southern Qat growing region. Qat from this area is marketed especially in the southern governorates.

C. Collection of Data

In the third stage, data on Qat growing was collected in the field. Experience gained during previous field surveys on Qat proved valuable to the members of the Qat Research Unit team (the objective of these earlier studies was data gathering for the establishment of an information bank that would enable government to draw up development plans and agricultural policies).

The survey team visited eleven Qat growing areas in three governorates during the period of June to August 2000.

Altogether 79 farmers were interviewed (Hajja 21, Sana'a 33, and Taiz 25). Participants were randomly chosen among the Qat farming population. The sample included small, medium and big Qat farmers.

Due to their fear of higher taxes, it proved at times quite difficult to interview Qat farmers on topics such as production costs, profits and taxes. Some of the interviewed are likely to have exaggerated in their statements on actual tax payments and production cost and downplayed real profits. Another problem proved to be the inability of some farmers to give exact information on amounts of fertilizer, pesticides and water use per unit area.

The method of questioning of farmers had thus to be adapted to this reality: The first contact with the farmers was thus made with a guide known in the region - this created some trust. The guide, together with the research team leader, explained to the farmers in a simple words the survey's objectives. Upon this each members of the team sat with one farmer of the respective village and filled out the questionnaire with him. After completion, a meeting would be held with all interviewed farmers, in which results were jointly discussed, and in some cases false data corrected.

Another way of obtaining correct information was by rephrasing questions, asking in indirect ways, or by asking more than one person at one farm. Questions, especially such that were unsatisfactorily answered before, were also repeated in the more informal discussion rounds that were mostly accompanied by a meal and followed by Qat chewing.

A factor that should be taken into account, is also that the time of survey coincided with a period of extreme draught, which forced farmers to irrigate more than in normal years. This could have had an impact on figures of water use. Also water was in this time period more expensive than usual, therefore also irrigation costs reflected in this article may be somewhat above the usual average.

D. Evaluation of Data

After concluding the field surveys, the gathered data was evaluated, in a fourth stage. This proved in part to be a difficult task, since all the locally differing unit measurements (e.g. for land size) used by farmers, had to be converted into comparable parameters (e.g. *habal* and *libna* into hectares). This was quite important to allow comparisons between irrigation, fertilizer use, labor cost, and returns per land unit. In this stage also several verification visits were carried out in the Sana'a area, to check the reliability of results.

III. Results

A. Hajja Governorate

The governorate of Hajja has an area of 10,195 km² and a population of approximately 1.4 million (CSO 1999).

Cereal crops such as sorghum, millet, oats, barely, maize, as well as, legumes various vegetables and fruits are cultivated in Hajja. However, Qat occupies today a large portion of the agricultural area, estimated to amount to 14,740 hectares (CSO agricultural statistics 1999) or to 25.8 percent of the total agricultural area of the governorate (57,113 ha.).

Rough estimates of the survey team based on a counting of Qat land holdings and their size however suggest that rather 36.850 ha, or about 64.5 percent of the total agricultural area in this governorate are planted to Qat.

The Hajja survey included the Najara district with Dawas village and the Jabal Najara and the al-Mahabesha district with al-Rasa'a and with Jabal Sham. In both regions Qat growing has replaced other crops on the high plateau and the terrace fields. Its cultivation is widespread and dense. Here even the rehabilitation of old and eroded agricultural terraces and the building of new ones for qat planting was observed - the only crop justifying such enormous expenses. In both districts Qat growing was still found at altitudes as low as 600 m above sea level.

Unit Measurements.

Traditional measurement units used to determine the size of land holdings were found to differ in the two research areas. In the Dawas region the *Libna* is used which equals here about 70.6 m² (8.4×8.4 m). One hectare is thus equivalent to 141.7 *Libnas*. (1 In the Rasa'a region the *Habal* (lit. string) represents the traditional measurement. A *Habal* equals in Hajja governorate to about 207.4 m² (14.4 m x 14.4 m). A hectare thus equals about 48.2 *Habal* (it needs however to be noted that *Libna* and *Habal* can differ considerably in size depending on region within Yemen).

1. Dawas Region (Najara District)

a.) Geography and Climate

Dawas village is located 27 km northwest of the governorate capital Hajja at about 1500 m above sea level. It is situated on a rocky mountain top (Jabal Najara), amidst terrace fields (average of 3 meters in dept, decreasing in size towards the pinnacle). In the west of this region the topography is abruptly descending towards the coastal plain of the Tihama. Qat is planted predominatly on terraces fields here.

Mild winters and warm summers characterize the climate of this area. Average annual rainfall is between 400-600 mm. The period of rains is mostly summer and autumn.

b.) Social Characteristics

Random samples taken in this region (n=8) showed that the average family size is 7 persons, of which 3 are male, 4 female. Land generally is privately owned and an average farming family owns approx. 0.8 hectares of arable land.

c.) Crop Composition

Qat occupies a vast area of the terrace terrain starting from about 600 m (mostly however 750 m) to an altitude of 1,800 m above sea level. Qat cultivation accounts in this area for about 36.3 percent (or 0.29 ha.) of the total land possessions of farmers which are on average 0.8 hectare in Hajara district. Another 44 percent are cultivated with cereals and the remaining 18.7 percent are made up of un-arable land. Vegetables (0.5 %) and fruits (0.5 %) are found only on a very negligible area in the immediate vicinity of the farmers' houses and are planted for personal consumption, rather than for sale. Corn and sorghum are planted in rows among Qat trees. In about one third of the Qat terrace fields scattered sorghum and millet plantings were found. However, agricultural land on the slopes of Wadi Khafiya is planted with grains, with rainfall being the main source of irrigation.

d.) Characteristics of Qat Farming and Production Inputs

Growing Pattern

Two growing patterns were observed in this region. Following the old pattern, Qat trees are randomly planted; they can reach heights of over 6 meters and can be over 60 years old. Approximately every 16 trees make up a *Libna* (70.6 m²), i.e. each tree has an area of 4.41 m², which is equivalent to approximately 2,268 trees per hectare.

Following the new pattern, Qat trees are planted in rows. The distance from one planting hole to the next is 0.5 to 0.6 meters. The rows are 1.2 to 2 meters apart. The Qat trees reach about 1.5 to 3 meters in height; the maximum age is around 20 years. Around some older trees younger ones are grown. When planting new fields with Qat, between 8-15 shoots (average 12) are planted per hole. There are approximately 74 holes per *Libna* (about 888 shoots/*Libna*) or holes 10,486 per hectare (about 125,830 shoots/ha.). Only one plant (rarely 2) per hole survives and becomes a tree. Economic production of these new plants begins after 3-4 years. On such new plantations on average 85 trees are found per *Libna* or 12,045 trees per hectare.

The old fields are deeply ploughed 1 to 2 times a year, whereas the new ones 2-3 times.

For Qat fields (old and new) an average of about 36 trees per *Libna* was found in the Dawas region (5,101 per ha.)

Irrigation

Qat cultivation in the Dawas region depends mainly on rainfall, since there are no wells found here. In the dry season (May-June) and during the drier winter months (December/January), however, farmers irrigate qat trees using rain water collected in traditional basins during the previous rainy season (hand dug basins or cisterns with storage capacity range from 100-200 m³).

During especially dry periods additional water has to be bought for YR 1000/m³ and is transported by trucks with tanks carrying 10-18 m³.

To produce qat of high quality, water application needs to be done carefully and is considered a real art. Plants are not irrigated by flooding the fields as observed in some regions, but are watered with 20-litre plastic cans. To keep the water at the tree, little

basins are shoveled around the tree. Each tree is given 20-60 liters per irrigation. If we suppose an average of 40 liters per tree, then 640 liters are needed to irrigate one Libna of old Qat plants (16 x 40 l.) and 3,400 liters to irrigate one Libna of young Qat plants (85 x 40 l.) (see above).

With an average of 3 harvest a year and 3 water applications before each harvest, this would amount per Libna to 5,760 liters for old Qat fields and 26,640 liters for new ones.

Fertilizer and Pesticide Use

Organic fertilizers such as dung are used in Qat cultivation once a year (2-3 sacks, 30 kg each, per *Libna*). Urea is used in differing quantities from between 100-150 grams per plant and year, applied some weeks before each of the year's 3 pickings. Quantities differ according to soil quality.

Chemical and fungi pesticides are used on average 4-5 times per year and are applied some time before picking. Qat is usually harvested 3-6 days after last pesticide application. Products used have names such as "Topaz", "Superacid" and "Perfection".

e.) From the Field to the Market

Harvesting

In the Dawas region, farmers harvest their Qat on average three times a year. A minority picks Qat leaves even up to 5 times annually.

The first picking is carried out during the rainy season (end of March/April). A second one takes place during the dry season (June/July), and a third picking is done during the autumn rains (end of August/September). A fourth harvest may take place in the winter months (December/January), when both, prices and quality of Qat are high, and a fifth picking of Qat leaves may be done for special occasions and religious holidays.

To prepare trees for picking, farmers do not irrigate for a period of 30-45 days. After this they spray pesticides and water the trees 2-3 times in a very short period of time and finally pick the leaves 3-6 days after the last watering.

The productivity of trees grown according to the new agricultural pattern is much higher than of those grown with the old pattern. Trees are more densely planted and allow more harvests.

Production Volume

The branches harvested are 35-45 cm in length. They are usually bound into bundles called *Rubta*. The weight of such a Qat bundle is about 350-400 grams. Per Tree production is between (3-5) bundles (average 4). With an average of 36 trees per *Libna* thus 144 *Rubta* are harvested annually. With 5,101 trees per hectare this amounts to 20,405 bundles.

The price the farmer achieves for a bundle is on average YR 222. Qat produced per hectare and year would thus sell for YR 4,529.910. Numbers are higher for

irrigated agriculture (up to YR 14.69 Mln.) and lower for rain dependent fields (YR 433,000/ha./year).

Transportation and Marketing

There are two ways of harvesting: Qat is either directly marketed after picking by the farmer himself or the whole harvest is sold before picking to merchants and brokers. The latter then come to harvest the leaves with their own workers. Around 35% of farmers market their Qat directly and 75% sell it to merchants and mediators.

Each *Rubta* is sold for an average of YR 222 at the farm level (price depending on quality and climatic conditions like temperatures and the abundance of rain).

f.) Costs and Profits

Cost of Qat Production

The cost of Qat production was found to amount to YR 801,582 (ca. USD 5,010) per hectare and year. This includes labor cost, as well as costs for water, fertilizers and pesticides.

The total cost of irrigation in the Dawas region is about YR 120,730 per hectare and year (i.e. 15.1 percent of the overall production cost) (see table 1). Of this YR 46,530 are paid for water and a further YR 74,200 for irrigation labor (5.8 and 9.3 percent of total cost respectively). In years when surface water is sufficient, than farmers have no cost irrigation other than for irrigation labor, since springs and water reservoirs are owned by the farmers. In the below calculation (table 1) irrigation labor also includes labor cost for fertilizer application, which is carried out by the same laborers.

The high cost of irrigation in the Dawas area can be explained due to the long draughts that this region has experienced during past years. Farmers were thus often forced to buy water that had to be transported over great distances (ca. YR 1000/m³). Under normal climatic conditions irrigation cost per hectare and year was said to amount to just YR 61,335 in the Dawas Region.

Fertilizers (organic and chemical) cost the farmer YR 28,767 per year and hectare, or 3.6 percent of the overall production cost. Labor costs for weeding, Ploughing and trimming account for another 28.1 percent (YR 225,100).

Despite of pesticide application being little labor intensive, labor cost is relatively high. This can be attributed to the fact that there is already a certain sensitization to the dangers of pesticides to health. Many workers carry out this task for not more than 3 hours per day (to limit exposure to these products), but charge the entire day. Cost for the pesticides and for there application is relatively equal and amounts to about YR 91,000 each, or to 11.35 percent (22.7 for both) of total production cost.

Costs for picking and guarding amount to YR 169,200 and YR 75,785 respectively per hectare and year or to 21.1 and 9.4 percent of the total production cost (production cost for the farmer is lower, if the intermediary brings his own laborers to harvest the Qat).

Production cost is thus mostly made up of labor cost (79.3 percent) and amounts to YR 635,285 per hectare and year, and only to a quite small share of costs for water

(5.8 percent), pesticides (11.35 percent) and fertilizers (3.6 percent), amounting together to YR 166,297.

The labor costs making up such a large share in Qat productions illustrates well, why about 81 percent of laborers' income in the Dawas area are from Qat cultivation.

Table 1: Annual Production Cost of one Hectare of Qat in the Dawas Region

Item	Qat production cost/ha. and year	Percentage of total process	Labor cost in Rials/ha. and year	Percentage of total process
Irrigation	120,730	15.1 %	74,200	9.3 %
Weeding/plough./trimm.	225,100	28.1 %	225,100	28.1
Organic fertilizers	21,150	2.6 %	-	-
Chemical fertilizers	7,617	1 %	-	-
Pesticides	182,000	22.7 %	91,000	11.35 %
Picking	169,200	21.1 %	169,200	21.1 %
Guarding	75,785	9.4 %	75,785	9.4 %
Total	801,582	100%	635,285	79.3 %

Profits

Profits of farmers depend on whether they sell their harvest to an intermediary/merchant or whether they sell it themselves at a Qat market. Since it proved too difficult to verify the second possibility, that would include further cost calculations (e.g. gasoline, car maintenance, sales tax, etc.) only profits were calculated for farmers that are selling their harvest at the farm to a merchant or intermediary. Here the average output per hectare and year was YR 4,529,910 (see above).

After the deduction of production cost (YR 801,582) and Zakat (5 percent of net profit = 186,416 YR) the farmer is left with a **net profit of YR 3,541,912**.

This means that the ratio of production cost (YR 801,582) to profits (YR 3.5 million) is 1:4.4 - for Bananas it is just 1:1.

2. Ar-Rasa'a Region (al-Mahabesha District)

a.) Topography and Climate

The mountainous ar-Rasa'a region is situated at the north-western edge of Hajja governorate and about 140 km from Hajja city. The mountain ridges, overlooking the coastal plain of the Tihama, are characterized by steep slopes that are covered with beautiful agricultural terraces having a deep and fertile soil. Qat is planted in considerable quantities on mountain terraces, in all higher wadis up to 2000 meters in altitude, and is even grows in lowland areas of around 600 meters. The climate in this northern highland region is characterized by cold winters and mild summers, with rainfall during summer and autumn (500-600 mm per annum). When descending further towards the Tihama plain, the summers become more humid and the winters milder.

b.) Social Characteristics

Data levied from a sample of 13 randomly chosen farmers of ar-Rasa'a revealed that the average family size is 14 persons, of which 7 are male, 7 female. Private property is the dominant system of land ownership and the average size of land holdings of a family is 0.6 hectare or 29 *Habal* (1 *Habal* = 207.4 m²).

c.) Crop Composition

Qat cultivation occupies about 95 percent of the total cultivable area. Of the agricultural land cultivated by a farming family (average 0.61 ha or 29 *Habal*) thus about 0.58 ha. are planted with Qat.

Sorghum (1.5 % of area) and fodder (1 %) are found only on rare occasions, planted among the Qat trees, and are used to feed animals. For subsistence purposes some fruit trees (1.5 %) are maintained and vegetables are planted (1 %) close to the farmers dwellings.

d.) Characteristics of Qat Farming and Production Inputs

Growing Pattern

In the old pattern, there are 2-3 meter trees with 5-7 high. The average age of Qat trees in such plantations is about 60 years. At times some younger trees are planted in among the old ones.

There were hardly any new plantations with young trees found. However, following this modern pattern observed now and then, Qat trees are in rows that are two meters from each other. Within each row there are 2 meters space between each planting hole (3-5 shoots/hole). After the second year, between each planting hole a new shoot is planted, reducing distance within the rows to one meter. The height of young trees reaches on average 1.5 meters, but some may reach 3 meters in height. Annually the qat trees are trimmed, and every 8 years they are pruned to ground level.

On average (old/new) 80 trees are grown per *Habal* and 3,856 per hectare.

Land is usually ploughed once a year, some farmers however stated to plough only every second year.

Irrigation

During the summer and autumn months Qat plants usually receive sufficient rainfall. During the dry winter months however additional water is needed, which is transported to the fields by truck, mostly from the shallow wells in Wadi Massrouh which runs at the foot of al-Sham mountain.

In the past two years this area has experienced very low rainfall, so that even during summer and autumn it became more and more necessary to used additional irrigation.

Each truck load of water is on average 10 m³. This is sufficient for once irrigating 0.5 *Habal*. To irrigate one hectare of Qat consequently 97 truckloads or 970 m³ of water are needed. Per harvest two irrigations are necessary during the months with

little or no rainfall. This means that 1940 m³ or 194 truckloads are needed per harvest and hectare.

A truck-load of water (10 m³) is sold for 900-1000 YR in this area. High prices have led farmers to use water carefully and avoid its overuse. The low water quantities given to the plants produce a good quality, but expensive qat with a lot of taste and giving high keif (Exiting/enjoyment) - overuse of water generally produces a qat of low quality with little taste and low in keif.

Fertilizer and Pesticide Use

In Qat agriculture organic as well as chemical fertilizers are used. The use of urea (chemical fertilizer) is quite frequent, less common is the use of compound chemicals such as Sinerol. Micro-element fertilizers are also used by spraying to the leaves.

Another method of enriching the fields is by adding fertile soil taken from other areas once a year.

In order to protect the Qat plants from pests, various types of chemical pesticides such as Drobihun, Mtathun, Super, Depretix, Fistax and, Parvoti (French made) are applied.

Also organic pesticides are used in Qat cultivation, among them are Pavestine and Topaz that are applied in order to increase Qat growth and thus output. Random use of pesticides and various kinds of chemical fertilizers without adequate safety measures was frequently found. Sometimes even children (12-15 years old) carry out the spraying. Many farmers also do not respect a safety period and spray pesticides until the harvesting of leaves. Chewers are thus directly exposed to these chemicals.

e.) From the Field to the Market

Harvesting

Qat is picked 4-5 times annually in ar-Rasa'a. The number of harvests is dependent on rainfall and the ability of farmers to afford water transported by truck to the fields. Two pickings (April and September) depend basically on rainfall. Three further pickings depend on additional irrigation (June, December and February).

Production Volume

Production increases during the dry and hot summer months and decreases during the colder months of winter and autumn (but during the latter two producing a better quality).

Qat is picked at varying lengths of between 20-50 cm. The branches are tied in small bundles (500 g) that in turn are tied into larger bundles that weigh 15-20 kg. Per harvest (depending on season) one tree produces about 9 small bundles. With 80 trees per *Habal* (207.4 m²) this amounts to 720 bundles a year and 34,704 per hectare.

The price the farmer achieves for a bundle is on average YR 567. The annual output of one hectare would thus sell for YR 19,677,168.

Transportation and Marketing

After picking, farmers sell some of their Qat in local markets of al-Mahabesha district. Farmers transport their Qat to the market by rented cars. The vehicle owners charge the farmers 10 percent of the sales value of the Qat they transport.

Most Qat is however bought directly by merchants and middlemen at the farm and is from there transported at high speed to the big cities (Hajja, Hudeidah, Sana'a) or the Saudi Arabian border. The transportation cars are hired by the merchants and middlemen. They are usually four-wheel drive and quite new so that transport on the mountain roads is quite fast. Thus these cars do not last long and are soon sold off and replaced by new ones.

f.) Costs and Profits of Qat Production

Production cost for one hectare of Qat was found to average YR 1,114,934 in ar-Rasa'a region. With YR 576,000, irrigation costs accounted for 51.7 percent of the total production costs. The bulk of this was water cost with YR 504,000, labor cost being only YR 72,000 (comprising also cost for fertilizer application) (see table 2).

Fertilizers (organic and chemical) cost the farmer YR 54,564 per year and hectare, or 4.9 percent of the overall production cost. Labor costs for weeding, Ploughing and trimming accounts for another 14.1 percent (YR 156,800). Pesticide cost and cost for spraying account for 16.5 percent of production cost and each amount to about YR 92,160.

Costs for picking and guarding amount to YR 115,250 and YR 28,000 respectively per hectare and year or to 10.3 and 2.5 percent of the total production cost (production cost for the farmer is lower, if the intermediary brings his own laborers to harvest the Qat).

In sharp contrast to the Dawas region, in Rasa'a not labor (41.6 %) accounts for the major share of production cost, but water (51.7 %). The total cost of labor amounts to YR 464,210 per year and hectare.

Table 2: Annual Production Cost of one Hectare of Qat in the Rasa'a Region

Item	Qat production cost/ha. and year	Percentage of total process	Labor cost in Rials/ha. and year	Percentage of total process
Irrigation	576.000	51.7 %	72.000	6.4 %
Weeding/Plough./Trimm.	156.800	14.1 %	156.800	14.1 %
Organic fertilizers	12.000	1.1 %	-	-
Chemical fertilizers	42.564	3.8 %	-	-
Pesticides	184.320	16.5 %	92.160	8.3 %
Picking	115.250	10.3 %	115.250	10.3 %
Guarding	28.000	2.5 %	28.000	2.5 %
Total	1,114,934	100%	464,210	41.6 %

Income from Qat farming nearly accounts for 100 percent of farmers' income since other agricultural earnings are insignificant. Per hectare and year plantation output is YR 19,677,168.

After the deduction of production cost (YR 1,114,934) and Zakat (5 percent of net profit = 928,112 YR) the farmer is left with a **net profit of YR 17,634,122**.

This means that the ratio of production cost (YR 1,114,934) to profits (YR 17.6 mio.) is 1 : 15.8.

B. Sana'a Governorate¹

Before the newly created Amran governorate was carved out of parts of Sana'a and other adjacent governorates in 1999 the total area of Sana'a governorate was 38,605 km² (CSO 1996). Total population was estimated to amount to about 1.2 million in 1999 (without the governorate of the capital Sana'a which has a population of another 1.4 million (CSO 1999)). Since the governorate of Sana'a has become smaller due to the recent reform of governorates, the above figures (besides that for the capital) are likely to be lower now. Updated numbers reflecting the new reality are not available yet.

Two areas were surveyed in Sana'a governorate. These were Bait al-Khardal and al-Muena'a village, both in the Khawlan district. Due to great similarities these two regions were treated in one chapter in the following.

Unit Measurements

The traditional land measurement unit found in Sana'a governorate is the "Libna of tens" (*Libna Usharia*) since each *Libna* equals to 10 x 10 *Hadawi* yards (1 yard = 0.7 meter) or 7 x 7 meters. One Sana'a *Libna* thus equals to 49 m² and one hectare to 204.1 *Libnas*.

1. Bait al-Khardal and al-Muena'a Regions (Khawlan District)

a.) Topography and Climate

The two surveyed regions lie 40 kilometers to the east of Sana'a at an altitude of about 2,200-2,300 m above sea level. These regions are characterized by hilly volcanic rock formations that are cut by low altitude valleys and flood paths. Agricultural land is found mainly on the terraced slopes of the hills and mountains, as well as in the beds and on the edges of the valleys. Agricultural plots of a farmer are usually rather small and scattered over this rocky area.

In this region summers are mild and winters cold and dry. Rainfall is on average 250 mm per annum, the rainy seasons being in spring (March/April) and early autumn (August/September), when evaporation is usually high.

b.) Social Characteristics

Data levied from a sample of 6 randomly chosen farmers of the Bait al-Khardal region revealed that the average family size is 11 persons, of which 5 are male, 6 female. Land generally is privately owned and an average farming family owns approximately 1.95 hectares of arable land.

In al-Muena'a region (sample of 7 farmers) average family size is 12 persons, 6 male and 6 female. Also in al-Muena'a land is usually privately owned and average farm size is about 1.42 hectares.

c.) Crop Composition

In both regions of study, cereals are planted, especially millet, which the region is rather famous for, since it is excellent in quality and quite expensive. Different famous kinds of grapes, such as white and *Rezegy*, known also as *al-Masswari*, are grown.

According to the interviewed, Qat cultivation started spreading in both regions only about 50 years ago. Before this time, Qat cultures were very seldom. Nowadays however almost all grape yards have been cleared for Qat growing.

In Bait al-Khardal Qat occupies today about 8 percent or 0.15 hectare of the farming area of a family. The average age of the Qat fields was found to be 25 years. On a further 40 percent of farmland cereals are cultivated, on 15 percent vegetables, on 30 percent fruit, the remaining 7 percent are cultivated with fodder crops.

In al-Muena'a area Qat cultivation accounted for about 30 percent (0.42 ha) of family farmland. Here Qat trees are on average 35 years of age. On a further 45 percent of farmland cereals are planted, on 13 percent vegetables and on the remaining 12 percent fruit. Fodder was planted in very negligible quantities of below one percent of total farming area.

d.) Characteristics of Qat Farming and Production Inputs

Growing Pattern

Growing patterns in Bait al-Khardal and al-Muena'a regions were found to be the same. In the older fields (age ca. 20-35 years) Qat trees are randomly planted in a distance of 2 to 3 meters from each other, with the average number of trees per *Libna* being 8 (1,633 trees/ha.). Tree height is approximately 4-6 meters.

In newly created fields Qat trees are planted in lines that are 1-1.5 m from each other. Distance of Qat plants within each line is about 0.4-0.6 m. An average of 81 trees per *Libna* is found (16,532 tree per hectare) with a high of 1-2 meters.

The overall average of Qat trees (new and old pattern) grown in Bait al-Khardal per *Libna* is 15.99 (3,264/ha.). In al-Muena'a the numbers are slightly higher with 19.24 trees per *Libna* (3,927/ha.).

Qat trees are trimmed down annually by removing dry, strained or exerted branches, which have been harvested too many times over past years. In this region Qat plants are not usually cut down to ground level (unless they were hit by a cold wave), since it would take about three years for the plant to re-grow to harvesting age.

Once or twice a year the land is ploughed by both, using animals and by hand-plough.

Irrigation

Also during rainy season (March/April and August/September) Qat fields need additional irrigating, but it is especially in the drier period of the year that pumping of water from wells and streams is undertaken on a great scale.

In al-Muena'a region farmers use an average of 3.5 m³ per *Libna* (714.4m³/ha.) for each irrigation. Trees are usually irrigated twice per harvest. Two of the 3 harvests

per year two depend on additional irrigation. This means four irrigations a year and thus 18 m^3 per *Libna* or $2,880 \text{ m}^3$ per hectare. Trees are usually watered individually to save water.

In contrast to this, in Bait al-Khardal, fields are flooded since water is more abundant. Here and in most other regions visited in Sana'a governorate, Qat is irrigated from deep wells when rain falls short. Cost for such wells that can be $18-20$ meters in depth is extremely high. Drilling, pump and pipes costs can amount to YR 10 millions (USD $22,000$). Since cost is so high, wells ownership is mostly collective with $5-8$ (and sometimes even more) shareholders.

In Bait al-Kharda trees are watered on average with $3,06 \text{ m}^3/\text{Libna}$ for each irrigation ($222 \text{ m}^3/\text{ha}$). Irrigation is necessary for 2 of the 3 harvests per year (sometimes even for all depending on quantity of rainfall). With irrigations per harvest, this amounts to $6-8$ irrigations and thus to $18,216 \text{ m}^3/\text{Libna}/\text{year}$ or $2,696,160 \text{ m}^3/\text{ha}/\text{year}$. The average that one may take as a basis for further calculations is around $17,8 \text{ m}^3$ per *Libna* and year or $3,622 \text{ m}^3$ per hectare and year.

When asked for what share of water supplementary irrigation accounts in the total amount of water fields receive per annum (including rainfall) farmers stated that this is about 5% percent (the total amount of being around $3,622 \text{ m}^3$ per hectare and year). Such statements have however to be treated with extreme caution, since farmers have no way to measure how much rainfall their fields receive.

Fertilizer and Pesticide Use

Qat production greatly increased in this area with the help of fertilizers and pesticides. Organic fertilizers application is given much attention since it is rare in the Khawlan district due to an underdeveloped animal husbandry. Chemical fertilizers (like Urea and micro-elements) are used moderately (according to the farmers due to a lack of water).

Pesticides are however used in large quantities (insecticides like Daimthoit, Perfection, Super-Acid, and Dipetrix; fungicides like Topaz and Ropigan). Qat plants are sprayed $3-4$ times per before each harvest, which amounts (with 3 harvests) to $9-12$ pesticide applications annually. Amounts used are $1,000 \text{ cm}^3$ per 20 liters of water.

e.) From the Field to the Market

Harvesting

Qat is generally picked 3 times a year. Two pickings (April and September) to some extent on rainfall. A further harvest during dry season (either in June/July or November-January) depends entirely on additional irrigation. However, the picking of small side leaves (*qadar*) is done throughout the year except during periods of extreme draught.

Production Volume

The branches harvested are $20-30 \text{ cm}$ in length. They are usually bound into bundles containing 100 branches each. The weight of a bundle varies from $200-3000$ grams, with an average 250 grams in Bait al-Khardal where farmers achieve

average sales prices of YR 810. In Bait al-Khardal tree produces about 7 bundles per year with an average of 16 trees per *Libna* and 3,264 per hectare, this means a harvest volume of 112 bundles per *Libna* and 22,848 per hectare. With an average weight of 750 grams per bundle this is equivalent to 84 kg per *Libna* and 17.1 tons per hectare and year. With an average price of YR 810 per bundle, farmers in Bait al-Khardal achieve an average annual sales price of YR 90,720 per *Libna* and YR 18,506,880 per hectare.

In al-Muena'a a tree produces about 4 bundles per year with an average of 19.24 trees per *Libna* and 3,927 per hectare, this means a harvest volume of 77 bundles per *Libna* and 15,708 per hectare. With an average weight of 500 grams per bundle this is equivalent to 38.5 kg per *Libna* and 7.85 tons per hectare and year. With an average price of YR 294 per bundle, farmers in al-Muena'a achieve an average annual sales price of YR 22,638 per *Libna* and YR 4,618,151 per hectare.

Transportation and Marketing

Different ways of Qat marketing were found in Khawlan district, that apply to all survey areas in Sana'a governorate (they are therefore described only once in the following):

- Qat is harvested by the farmer himself, who directly sells part of his harvest to locally consumers. He then takes the remaining Qat to a smaller market in the region, either by his own car or by a rented vehicle. Such markets are usually situated at crossroads that link roads coming from different Qat growing areas. In such places intermediaries or merchants from the bigger cities buy Qat from the farmer, but also consumer may buy it directly from him.
- In other cases the farmer takes his Qat by own or rented transportation to the bigger cities (in this case Sana'a) where he sells all of his Qat to a merchant, who in turn sells it to the consumers. The farmer may however also sell his Qat himself it the bigger cities to consumers (mostly in small quantities per customer).
- The farmer sells the seasonal output of his Qat trees before harvesting it to an intermediary or merchant who has at his disposal laborers specialized in picking Qat. These laborers come to the farm and pick the leaves under supervision of the farmer. The production is then taken to the market by means of transportation belonging to, or rented by the intermediary or merchant.
- The excellent and thus very expensive kinds of Qat, such as Qat from al-Qabil village (see below), has specialized brokers and merchants that buy this Qat before the harvest and arrange for harvesting themselves. This kind of Qat is bound into large bundles of 3 kg with great attention. Such bundles have specific customers (the Yemeni elite) and they are usually delivered to their homes where they and sold for a very high price, starting at YR 3,000. It is difficult to tell what amounts of his Qat are sold in this way, because it is done with much discretion.

It should be noted that all of the above described ways of Qat marketing depend solely on the farmer's considerations and estimates on how to optimize his income. There are no figures available on how much Qat is sold in the above describes ways.

Qat is sold by the farmer at the farm level either in bundles (*rubta*) or as single branches. The price per bundle varies and may range from YR 2,000-3,000s, depending on season, quality, size of bundle and the selling time (higher on holidays and weekends). When taken to the market Qat is also sold in small bags of single leaves (*Qattal*). Weight of these bags may vary from 200-1,000 grams.

f.) Costs and Profits of Qat Production

The Cost for irrigation water is determined by the cost of irrigating labor (see also below), well maintenance, cost of pipes, and maintenance and fuel cost of the water pumps. Taking this into consideration the cost for one cubic meter of water is YR 61.

The amount of water annually given to Qat fields in al-Muena'a region is 14 m³ per *Libna* or 2,857 m³ per hectare (see above). Irrigation cost is thus YR 854 per *Libna* and year or YR 174,277 per hectare.

In Bait al-Khardal cost of irrigation is slightly higher since more water is given to the Qat plants. On average (see above) this is around 17.8 m³ per *Libna* and year or 3,633 m³ per hectare/year. With a price of YR 61 per cubic meter, this would annually amount to YR1,086 per *Libna* and YR 221,163 per hectare.

Labor cost for irrigating the Qat fields was found in both regions to be the same with 28.7 percent of total irrigation cost, amounting to YR 50,000 per hectare and year in al-Muena'a and to YR 63,400 in Bait al-Khardal. Irrigation of one *Libna* (49 m²) needs 30 minutes (102.1 hours/hectare (rounded)). In al-Muena'a Qat is irrigated four times a year, annual irrigation times thus amounts to 2 hours per *Libna* and 408.2 hours (un-rounded) per hectare. With 4-6 irrigations per year in Bait al-Khardal, irrigation time is accordingly higher with up to 3 hours per *Libna* and up to 612.3 per hectare.

Total irrigation cost amounts to 49 percent of annual production cost in al-Muena'a and 39.1 percent in Bait al-Khardal (see table 3).

Irrigation cost per hour (without labor) is thus about YR 304.45, that is for al-Muena'a YR 124,277 annually (408,2 hours) for four irrigations per hectare. With an additional estimated YR 50,000 of irrigation labor cost, this amounts to the total cost of irrigation with YR 174,277 (see table 3).

Labor costs for weeding, Ploughing and trimming are the same in both regions with about YR 35,700 per hectare and year. They account for 10 percent of total production cost in al-Muena'a and 6.3 percent in Bait al-Khardal.

Fertilizer cost was in al-Muena'a YR 20,757 per hectare and annum (5.8 percent of total production cost), quite equally shared by organic fertilizers (YR 10,200) and chemical ones (YR 10,557). In Bait al-Khardal it was double of that of al-Muena'a with a total of YR 41,514 for both kinds of fertilizers (see table 4 for details). This accounts for 7.3 percent of total production cost (Labor cost for fertilizer application is included in irrigation labor cost).

Pesticide and pesticide application cost were YR 53,040 per hectare and annum in al-Muena'a (14.9 % of production cost) and an estimated triple of this amount in Bait al-Khardal (YR 159,120) (28.1 % of total production cost).

Labor cost for pesticide application was below that of Hajja governorate with YR 16,629 for al-Muena'a (4.7 % of production cost) and YR 69,775 for Bait al-Khardal (12.3 %).

Costs for picking and guarding in al-Muena'a around to YR 21,000 and YR 51,000 respectively per hectare and year (5.9 and 14.3 percent of production cost respectively). In Bait al-Khardal they were found to be also YR 21,000 for picking, but much higher for guarding with YR 87,428 (3.7 and 15.4 percent of production cost).

Overall labor cost make up about 49 percent of total production cost in both survey areas. The total cost of labor amounts to YR 174,329 per year and hectare in al-Muena'a and YR 277,303 in Bait al-Khardal.

Production costs for Qat are thus estimated to amount to YR 355,774 per hectare and year in al-Muena'a and to YR 565,925 in Bait al-Khardal.

Table 3: Annual Production Cost of one Hectare of Qat in the al-Muena'a Region

Item	Qat production cost/ha. and year	Percentage of total process	Labor cost in Rials/ha. and year	Percentage of total process
Irrigation	174,277	49 %	50,000	14 %
Weeding/Plough./Trimm.	35,700	10 %	35,700	10 %
Organic fertilizers	10,200	2.9 %	-	-
Chemical fertilizers	10,557	3 %	-	-
Pesticides	53,040	14.9 %	16,629	4.7 %
Picking	21,000	5.9 %	21,000	5.9 %
Guarding	51,000	14.3 %	51,000	14.3 %
Total	355,774	100%	174,329	49 %

In al-Muena'a the annual Qat output of one hectare is sold at the market for YR 4,618,151 per hectare. After deducting production costs of YR 355,774 and *Zakat* which amounts to 5 percent of the profits (about YR 213,119) the farmer is left with a net profit of about YR 4,049,258 (for farmers harvesting their qat with own laborers and selling at the farm level).

Table 4: Annual Production Cost of one Hectare of Qat in the Bait al-Khardal Region

Item	Qat production cost/ha. and year	Percentage of total process	Labor cost in Rials/ha. and year	Percentage of total process
Irrigation	221,163	39.1 %	63,400	11.2 %
Weeding/Plough./Trimm.	35,700	6.3 %	35,700	6.3 %
Organic fertilizers	20,400	3.6 %	-	-
Chemical fertilizers	21,114	3.7 %	-	-
Pesticides	159,120	28.1 %	69,775	12.3 %
Picking	21,000	3.7 %	21,000	3.7 %
Guarding	87,428	15.4 %	87,428	15.4 %
Total	565,925	100%	277,303	49 %

In Bait al-Khardal the annual Qat output of one hectare is sold at the market for YR 18,506,880. After deducting production costs of YR 565,925 and *Zakat* which amounts to 5 percent of the profits (about YR 897,048) the farmer is left with a net profit of about YR 17,043,907 (for farmers harvesting their qat with own laborers and selling at the farm level).

C. Taiz Governorate

The total area of Taiz governorate is 11,242 km² (CSO 1996). Its population was estimated to be about 2.2 million in 1999 (CSO 1999).

Taiz is considered to be the cradle of Qat agriculture in Yemen. Qat is said to have been planted as early as the beginning of 8th century of the Hijra on the Jabel Saber that rises above the city of Taiz. Qat cultivation soon spread from there to the areas of Jabel Habashi and al-Maqatira.

In contrast to areas where Qat cultivation is a new phenomenon, in Taiz governorate farmers were found to have a profound knowledge, handed down from generation to generation, on how to best plant and maintain Qat trees. Farmers are able to stimulate the Qat trees to grow fresh leaves at times they set (even without the use of chemical pesticides used in other areas as growth enhancers). This enables them to achieve greater harvest volumes.

Probably due to the long history of Qat cultivation in this area also many more types of Qat were found to be cultivated here than in other research areas. On Jabel Saber, for example, there were more than six different types of Qat found, that all have different names according to their special features.

Two areas were included in the survey, al-Mesayjid village in al-Maqatira district, and al-Dhowa village in al-Shamaytain district (al-Maqarima sub-district).

Unit Measurement

The traditional land unit of measurement used in Taiz governorate is the *Habal* or *Qassabah*. The Taiz *Habal* equals to 29 m² (ca. 5.39 x 5.39 meters). One hectare is thus equivalent to 344.83 *Habal/Qassabah*.

1. Al-Mesayjid Village (al-Maqatira District)

a.) Topography and Climate

The village of al-Mesayjid located in al-Maqatira district (al-Aqahila sub-district) which is since 1996 part of Lahej governorate. It is located 12 kilometers to the east of at-Turba town and its surroundings lie at an altitude of about 1,400 meters above sea level. The village is situated at the foot of a near vertical mountain-cliff. This area is accessible by a road by passing through the Sharjab region and the "Heijat al-Abid" slope, which is very rough and dangerous to travel on.

The region is characterized by an all year mild climate with rainfall during March/April and August/September. In some years however also during December/January rainfall can appear as a result of heavy fog and cloud gathering carried by westerly winds from the Arabian Sea. The average annual rainfall in this region is 500-600 mm.

b.) Social Characteristics

Data levied from a sample of 10 randomly chosen farmers of al-Mesayjid village revealed that the average family size is 14 persons, of which 7 are male, 7 female.

Land generally is privately owned and an average farming family owns approximately 0.16 hectares (55 Habal) of arable land.

c.) Crop Composition

The fairly small mountain terraces nearby the village are predominantly planted with Qat. The average area of Qat cultivation is about 81 percent of the agricultural area owned by a farming family (0.13 hectare or 44.6 *Habal*). Qat agriculture has a long history in this region, and the age of Qat trees in some cases well exceeds 100 years.

There are also some fruit trees dispersed randomly such as peach, pomegranate guava, and lemon. They however account for only about 2 percent of the agricultural area. Size of agricultural plots in the wadi bed is larger than on its slopes. Different types cereals like fine sorghum, millet and cow pea, grow here (16 % of land area). Also vegetables like fenugreek (*Helbah*), squash and carrot grow here, mostly for home consumption (1 % of land area).

d.) Characteristics of Qat Farming and Production Inputs

Growing Pattern

Despite the long history of Qat cultivation in this area, it is the new growing pattern that is dominant. Qat shoots are grown in a distance of 1.5 m × 2.0 m. The trees begin producing harvestable leaves 3-4 years after planting.

The soil in the Qat fields is plowed once a year. The height of Qat trees varies between 2-4 meters. Per *Habal* (29 m²) 7-13 Qat trees (average 12) were found in al-Mesayjid area. This is an average of 4,138 trees per hectare.

Irrigation

Rainfall is the main source of irrigation in this area, but farmers during drier periods of the year also depend on water from springs and streams. Here water levels depend on rainfall. Wells were not found in this area.

Qat is usually harvested twice and given 2 irrigations before each picking of leaves. A hectare receives about 4,000 m³ rainwater per year, another 1,863 m³ are added.

Fertilizer and Pesticide Use

For soil amelioration mostly manures are used according to their availability. Chemical fertilizers (like Urea) are added with much attention and in small quantities (90 grams/tree/year). After fertilizer application irrigation becomes necessary.

Pesticides are used three times before each harvest. They are mainly used to combat pests, such as leaf-worms, and partly also to stimulate and increase growth. The farmers in this region were found to not over-use the pesticides and stay within the limits of what is necessary to keep the trees healthy. They use an average of 1 cm³

of a pesticide product per liter of water. 20 liters of the solution is enough for 4-5 *HaballQassabah* per sprinkle.

e.) From the Field to Market

Harvesting and Production Volume

There are on average two pickings per year. One is the "leaf" picking or "sticks" picking in October, the other the *Mubrih* picking in November. *Each tree produces about 160 branches per year (80 per picking), this is bound into 4 bundles with 40 branches each.* The branches have a length of 20-30 cm. A bundle weighs about 500 grams, which means a tree output of 2 kilos per year.

With an average of 12 trees per *Habal* this amounts to an output of 48 bundles harvested per year with a total weight of 24 kilos. With 4,138 trees per hectare (see above) this amounts to an output of 16,552 bundles and 8,276 kilos per year.

The price the farmer achieves for a bundle is on average YR 232. Qat produced per hectare and year would thus achieve a sales price of YR 3,840,064.

Transportation and Marketing

The Qat is taken to at-Turba town where from where it is sold on commission by merchants that claim 10 percent of the profits. The remaining 90 percent go to the farmer.

f.) Costs and Profits of Qat Production

Qat irrigation costs amounts to YR 162,081 per hectare and year (most being labor - the exact share could however no be determined). Per *Habal* and year this amounts to YR 470. It accounts for 56.8 percent of total production cost (see table 5).

Organic fertilizers make up 2.4 percent of production cost and amount to YR 6,900 per hectare and year. Chemical fertilizer cost is YR 3,450 or 1.3 percent of production cost. Pesticides and cost for their spraying are YR 53,040/ha./year (8.6 % of production cost), of which about 9,600 is labor cost.

Costs for weeding, Ploughing and trimming are YR 16,215 (5.7 % of production cost), for picking an additional YR 9,000 (3.1 %) and for guarding YR 34,500 (12.1 %). The share of labor cost in the total production cost is not known, since there are no figures for irrigation labor available (see table 5).

Table 5: Annual Production Cost of one Hectare of Qat in the Bait al-Khardal Region

Item	Qat production cost/ha. and year	Percentage of total process	Labor cost in Rials/ha. and year	Percentage of total process
Irrigation	162.081	56.8 %	?	?
Weeding/Plough./Trimm.	16.215	5.7 %	16.215	5.7 %
Organic fertilizers	6.900	2.4 %	-	-
Chemical fertilizers	3.450	1.3 %	-	-
Pesticides	53.040	18.6 %	9.600	3.4 %

Picking	9,000	3.1 %	9,000	3.1 %
Guarding	34,500	12.1 %	34,500	12.1 %
Total	285,186	100%	<i>69,315 plus irrigation labor</i>	<i>24.3 % plus irrigation labor</i>

The annual Qat output of one hectare is sold at the market for YR 3,840,064. After deducting production costs of YR 285,186 and the merchants commission of 10 percent of the sales price (384,006.4) the farmer has a profit of YR 3,170,872 per hectare and year.

After deducting Zakat which amounts to 5 percent of the profits (about YR 158,544) the farmer is left with a net profit of about YR 3,012,328.

2. Al-Dhowa Village (al-Shamaytein District, al-Maqarima Sub-District)

a.) Topography and Climate

Al-Dhowa village is located in al-Shamaytain district (al-Maqarima sub-district) 20 km west of at-Turba town from which it can be reached by a rocky dirt-road. The village lies at an altitude of about 1,400 meters above sea level. Qat is grown in a small water-bed. The area is surrounded by mountains with a water runoff to the west. In the rainy seasons (May-July and August-October) frequently floods occur. Water availability is thus fairly good and rainwater accumulates well in this basin area. The region is marked by a mild climate throughout the year, with an rainfall average of 400 mm/year.

b.) Social Characteristics

Data levied from a sample of 5 randomly chosen farmers of al-Dhowa village revealed that the average family size is 6 persons, of which 3 are male, 3 female. Land generally is privately owned and an average farming family owns approximately 0.13 hectares (44.9 *Habal*) of arable land.

c.) Crop Composition

Qat cultivation is fairly young in al-Dhowa and started only around 1984. Despite this fact today about 31 percent (0.04 hectares per farmer) of the farmland are occupied with Qat.

Besides Qat, also cereals are planted such as different varieties of sorghum (yellow and ghareb), millet, cowpea (vigna), wheat and barely (55 % of area). There are also different types of dispersed fruit trees (14 % of area) like mango, guava and palm trees, which in an intercropping pattern are planted between Qat trees. Fruit production is despite the relative high area share mostly limited to family consumption. Vegetables and fodder where not found in this area.

d.) Characteristics of Qat Farming and Production Inputs

Growing Pattern

In the older fields where Qat was planted in the second half of the 1980s, the distance between trees is about 2×2 m and each *Habal* (29m²) holds on average 7 trees with a height of 2-4 meters (2,414 trees/ha.). In new Qat fields, trees are planted closer to each other (distance of 1×2 m). Each *Habal* holds about 14 plants of 2-4 meters in height. A hectare holds 4,828 trees. The average number of trees in the region (old and new pattern) is about 10 per *Habal*.

Irrigation

Due to al-Dhowa's favorable location in a basin, the area has plentiful of water and can already be found in a depth of 4-6 meters. It is pumped from hand-dug wells by small transportable petrol driven engines. From there water is distributed to the fields by plastic hoses (diameter 2 inches). If the field is too far from the water source or too high up, sometimes up to three pumping engines are lined up and attached to a hose.

Each farmer possesses 1-3 pumps, well ownership is however collective, usually 15-20 farmers possess a well. Fields are irrigated 6 times per year (3 per picking).

One *Habal* consumes 12 m³ per annum (2 m³ per irrigation) that is 4,138 m³ per hectare annually.

Fertilizer and Pesticide Use

Organic fertilizers are used on a small scale according to availability. Chemical fertilizers like Urea are applied to the trees with each irrigation (average of 100-150 grams/tree/annum). "Iron Shailat" is used once per harvest (twice 3 grams per tree and year). Liquid micro-element fertilizers are mixed with water and sprayed with other chemical pesticides. Qat is sprayed 5-6 times per picking. 20 liters of water mixed with 80-100 mm of pesticide are sufficient to spray 4-6 *Habal* (=116-174 m²).

e.) From the Field to the Market

Harvesting and Production Volume

Qat is picked from twice a year. The farmer, helped by family members or laborers from the village, leads himself the process of picking the leaves. One harvest is in November-January when trees are deprived of all their leaves in order to obtain later in the year the second harvest (time depending on rains and irrigation) of fresh young shoots (*al-Mubrih* picking) which are of high quality and sold at a very high price.

The branches harvested are 15-30 cm in length (shoots are smaller). They are usually bound into bundles containing 40 branches. The weight of a Qat bundle is about 500 grams. Each tree produces on average 6 bundles (240 branches) per year. With an average of 10 trees per *Habal* this is an output of 60 bundles per year. For one hectare (= 344.83 *Habal*) this would amount to 20,690 bundles (*Rubta*).

Sales price for one *Rubta* is YR 100-400, depending on season and the quality of the Qat (average YR 270 per bundle). Qat produced per hectare and year would thus achieve a sales price of YR 5,586,300.

Transportation and Marketing

The farmer himself carries out the harvesting of Qat branches with the help of some of his family members and additional labors from village. Qat is transported to the market (at-Turba and neighboring areas) by farmers where it is handed to a retailer who claims a sales commission of 10 percent of the retail value (see below).

f.) Costs and Profits of Qat Production

Qat irrigation costs amounts to YR 168,967 per hectare and year (of which YR 17,000 is labor). Per *Habal* and year this amounts to YR 490. It accounts for 46.2 percent of total production cost (see table 6).

Organic fertilizers make up 1,9 percent of production cost and amount to YR 6,900 per hectare and year. Chemical fertilizer cost is with about YR 6,900 the same. Pesticides and cost for their spraying are YR 106,080/ha./year (29 % of production cost), of which about 42,000 is labor cost.

Costs for weeding, Ploughing and trimming are YR 16,215 (4.4 % of production cost), for picking an additional YR 9,000 (2.5 %) and for guarding YR 51,750 (14.1 %). The share of labor cost in the total production cost is 37.1 percent (see table 6).

Table 6: Annual Production Cost of one Hectare of Qat in the al-Dhowa Area

Item	Qat production cost/ha. and year	Percentage of total process	Labor cost in Rials/ha. and year	Percentage of total process
Irrigation	168.967	46.2 %	17.000	4.6 %
Weeding/Plough./Trimm.	16.215	4.4 %	16.215	4.4 %
Organic fertilizers	6.900	1.9 %	-	-
Chemical fertilizers	6.900	1.9 %	-	-
Pesticides	106.080	29 %	42.000	11.5 %
Picking	9.000	2.5 %	9.000	2.5 %
Guarding	51.750	14.1 %	51.750	14.1 %
Total	365,812	100%	135,965	37.1 %

The annual Qat output of one hectare is sold at the market for YR 5,586,300 (see above). After deducting production costs of YR 365,812 and the merchants commission of 10 percent of the sales price (YR 558,630) the farmer has a profit of YR 4,661,858 per hectare and year.

After deducting Zakat, which amounts to 5 percent of the profits (about YR 233,093) the farmer is left with a **net profit of about YR 4,428,765.**

IV. Summary

The survey focused on three Qat growing governorates, Hajja, Sana'a, and Taiz. Altogether 79 randomly chosen farmers were interviewed (Hajja 21, Sana'a 33, and Taiz 25), including small, medium and big Qat farmers.

In Hajja Governorate two areas were chosen, that of al-Mahabesha district, a focus was set on ar-Rasa'a village and the Najara district with Dawas village. Al-

Mahabesha is famous for the *al-Shami* qat, one of the best and most expensive in Yemen. *Najri* qat from Najara area is of less quality.

In Sana'a Governorate the district of Khawlan was chosen with the villages Bait al-Khardal and al-Muena'a. While the village of al-Muena'a was chosen for its dependency on irrigation via springs streams, floods and surface wells as well as its average quality qat, Bait al-Khardal was chosen due to its good quality Qat and its dependency on deep wells for Qat irrigation.

In Taiz Governorate the al-Maqarima area was selected because of its medium quality Qat and its dependency on hand-dug shallow wells. Al-Maqatira region was chosen because it grows one of the finest Qat in the southern part of Yemen, dependent on irrigation by rain, springs, wells and water basins.

Results

Land ownership was found to be private in all survey areas, the farmers cultivating the ground were found to be its proprietors.

Average farm size was found to be 0.84 hectares. It was considerable lower than the average in al-Dhowa with only 0.13 hectares, and much higher in Bait al-Khardal with 1.95 hectares (see table 8).

Crop Composition

Qat cultivation was found to occupy 54.6 percent of a farmer's arable land in the survey areas. It was extremely high in Rasa'a with 95 percent, and quite low in al-Muena'a and al-Dhowa with 30 and 31 percent respectively.

Second to Qat cultivation were cereals with an average of 32.3 percent of land share, followed by fruit (6%), vegetables (2.9%) and fodder with only 0.3 percent.

Fruit trees were found in a quite considerable number in al-Muena'a and al-Dhowa with 12 and 14 percent of land share respectively.

In the Dawas region a large share of un-arable land was found accounting for 19 percent of farmers properties, this is most likely due to rural urban migration. Farming families are not able anymore to cultivate all their land due to labor shortages (see table 7).

Table 7: Area Share of different Crops in the Survey Regions (in Percent).

Region	Qat (in %)	Fruit	Cereals	Vegetables	Fodder	Unarable Land	Total
Dawas	36 %	0.5 %	44 %	0.5 %	0.5 %	19 %	100 %
Rasa'a	95 %	1.5 %	1.5 %	1 %	1 %	0 %	100 %
al-Muena'a	30 %	12 %	45 %	12 %	0 %	0 %	100 %
Mesayjid	81 %	2 %	16 %	1 %	0 %	0 %	100 %
al-Dhowa	31 %	14 %	55 %	0 %	0 %	0 %	100 %
Average	54.6 %	6 %	32.3 %	2.9 %	0.3 %	3.8 %	100 %

It must be said that the figures in the above table are not representative for the entire surveyed governorates; figures on Qat are thus no governorate average. This is since only regions were chosen that grow Qat. Others without Qat or only small scale Qat agriculture were for this study of minor interest

Growing Pattern

Qat is grown in different patterns, old ones usually leave the trees more space, there are thus less trees per unit area. Also trees are often not planted in a determined pattern in older fields. In younger fields they are usually planted in rows, and the space between trees is uniform.

The average number of trees (for old and new pattern) found per hectare is 3,956. Numbers were lowest in Bait al-Khardal with 3,264 trees/ha. And higher up to 5,101 trees/ha in Dawas (see table 8).

Irrigation

Qat fields are in most regions not irrigated all year round, since during the summer and autumn months rain is abundant, and mostly sufficient. During the rest of the year additional irrigation is however necessary. Fields are irrigated several times before the harvest (average of 3 times), to stimulate leaf growth.

Irrigation water is either pumped from machine drills deep wells, from shallow hand dug wells, from cisterns, or from streams. In case there is not sufficient water in the area additional water has to be bought, which is brought by truck from the valleys. A truck usually transports 10 m³, which is sold an average of YR 900-1000.

High prices have led farmers to use water carefully and avoid its overuse. Too much water is not good for qat plants and produces low quality qat leaves that lack taste.

Fertilizer and Pesticide Use

Farmers use both organic and chemical fertilizers. Amounts vary greatly from one farm to the other. Fertilizer is usually applied just before irrigation so that it can reach the trees' root fast and to avoid that it is carried away by the wind.

Another method of enriching the fields is by adding fertile soil taken from other areas once a year.

In order to protect the Qat plants from pests, various types of chemical pesticides such as Drobihun, Mitathun, Super, Depretix, Fistax and, Parvtoti are applied.

Also organic pesticides are used in Qat cultivation, among them are Pavestine and Topaz that are applied in order to increase Qat growth and thus output. Random use of pesticides and various kinds of chemical fertilizers without adequate safety measures was frequently found. Sometimes even children (12-15 years old) carry out the spraying. Many farmers also do not respect a safety period and spray pesticides until the harvesting of leaves. Chewers are thus directly exposed to these chemicals. Times and frequency of pesticide application vary greatly from one farmer to the other.

Harvesting

Qat is picked on average 2.9 times per year. In Rasa'a it was higher with up to 5 times annually, in al-Mesayjid and al-Dhowa it was lower with 2 harvests per year. The number of harvests is dependent on rainfall and the ability of farmers to afford water transported by truck to the fields. Pickings in March/April and August/September depend mostly on rainfall. During other times of the year additional irrigation is needed (see table 8).

Production Volume

Production increases during the dry and hot summer months and decreases during the colder months of winter and autumn (but during the latter two producing a better quality).

Qat is picked at varying lengths of between 15-50 cm. The branches are tied in small bundles with a weight of 376-750 grams (average 521 g).

Per year a Qat tree produces between 4 and 9 bundles (average 6.3). In Rasa'a it was found highest with an average of 9 bundles, in Dawas and al-Muena'a with 4 bundles.

With an average of 3,956 trees per hectare with each producing an average of 6.3 bundles, this amounts to 24,923 bundles per year and hectare. Numbers of bundle output were greatest in Rasa'a with 34,704 per hectare and year, and lowest in al-Mesayjid with 16,552.

The price the farmer achieves for a bundle of Qat also greatly varies by region and is principally dependent on climate and quality. The average bundle price was found to be YR 399, but was higher in Bait a-Khardal with YR 810 and lower in Dawas with YR 222.

When multiplying the sales price with the number of bundles produced by a hectare, plantation output amounts on average to YR 9,459,746/ha./year. Also here considerable differences were found from one region to the next. In Rasa'a where the well known and expensive *Shami* Qat is produced it was highest with YR 19,677,168, and with one fifth of the latter lowest in al-Mesayjid with YR 3,840,064 (see table 8).

Table 8: Qat Farming at a Glance

Item	Hajja		Sana'a		Taiz		Average
	Dawas	Rasa'a	Al-Muena'a	Bait al-Khardal	al-Mesayjid	al-Dhowa	
Farmland per family (in ha.)	0.8 ha	0.6	1.42	1.95	0.16	0.13	0.84 ha
No of harvest/year	3	4-5	3	3	2	2	2.9
No. of trees/ha.	5,101	3,856	3,927	3,264	4,138	3,448	3,956
Bundles/tree/year	4	9	4	7	8	6	6.3
Bundles/ha/year	20,405	34,704	22,638	22,828	16,552	20,690	22,970
Bundle weight	376 g	500 g	500 g	750 g	500 g	500 g	521
Bundle price	222 YR	567 YR	294 YR	810 YR	232 YR	270 YR	399
Production output/ha/year	4,529,910	19,677,168	4,618,151	5,06,880	3,840,064	5,586,300	9,459,746

Costs and Profits of Qat Production

Plantation output is however not what the farmer earns. His profit is determined by the height of production cost, Zakat tax and in some cases by commissions taken by merchants.

Production cost for one hectare of Qat was found to average YR 581,526. It was found highest in Rasa'a (YR 1,114,934) and lowest in al-Mesayjid (YR 285,186).

In most areas water makes up the highest share of production cost (40.8 %). It averages YR 237,203 and was found highest again is Rasa'a (YR 576,000) and lowest in Dawas (YR 120,730) (see table 9). A great share of this (one third to one half) is labor cost, the rest being cost for pumping (gasoline), pump maintenance, and water. Irrigation labor cost includes labor for fertilizer application since this is done simultaneously.

Fertilizers (organic and chemical) cost the farmer on average YR 28,292 per hectare (4.8 percent of production cost). It is highest in Rasa'a with YR 64,564 and lowest in al-Mesayjid with 10,350 Rials per hectare and year.

Labor costs for weeding, Ploughing and trimming accounts for another 13.9 percent of the production process and amounts on average to YR 80,955 per hectare and year. It was found to be highest in Hajja governorate and lowest in Taiz (see table 9).

Pesticide cost and cost for spraying account for 21.1 percent of production cost and amounts to about YR 122,933/ha./year. In Rasa'a the highest pesticide expenditure was found with YR 184,320. In al-Mesayjid and al-Muena'a it was lowest with YR 53040 each.

Costs for picking and guarding amount to YR 57408 and YR 54,744 respectively per hectare and year or to 9.9 and 9.5 percent of the total production cost. Costs for picking were found to be exceptionally high with up to 18 times the Taiz labor costs. This could hint to wrong statements by farmers in the Hajja area (see table 9).

Table 9: Annual Production Cost of one Hectare of Qat in the Survey Regions

Item	Hajja		Sana'a		Taiz		Average	Percent
	Dawas	Rasa'a	al-Muena'a	Bait al-Khardal	al-Mesayjid	al-Dhowa		
Irrigation	120.730	576.000	174.277	221.163	162.081	168.967	237,203	40.8 %
Weed./Plough /Trim:	225.100	156,800	35.700	35.700	16.215	16,215	80,955	13.9 %
Organ. fertiliz.	21.150	12.000	10.200	20.400	6.900	6.900	12,925	2.2 %
Chem. Fertiliz.	7.617	42.564	10.557	21.114	3.450	6,900	15,367	2.6 %
Pesticides	182.000	184.320	53.040	159.120	53.040	106.080	122,933	21.1 %
Picking	169.200	115.250	21.000	21.000	9.000	9.000	57,408	9.9 %
Guarding	75.785	28.000	51.000	87.428	34.500	51,750	54,744	9.4 %
Total	801,582	1,114,934	355,774	565,925	285,186	365,812	581,526	100 %
Governorate Average	958,258		460,850		325,499		581,526	

Per hectare and year plantation output is on average YR 9,459,746 (see table 10). After the deduction of production cost (YR 581,526) and Zakat the farmer is left with a net profit of about YR 8,285,049 per hectare and year. This means that the ratio of production cost (YR 581,526) to profits (YR 8,878,220.) is 1 : 15.3 - for Bananas it is 1:1, sometimes 1:2.

Table 10: Annual Production Output, Cost, Tax Payments and Net profits of Qat Farmers in the Survey Regions (per Hectare)

Item	Hajja		Sana'a		Taiz		Average
	Dawas	Rasa'a	al-Muena'a	Bait al-Khardal	al-Mesayjid	al-Dhowa	
Production output/ha/year	4,529,910	19,677,168	4,618,151	18,506,880	3,840,064	5,586,300	9,459,746
Production Cost (YR)	801,529	1,114,934	355,774	565,925	285,186	365,812	581,526
Zakat (YR)	186,416	928,112	213,119	897,048	158,544	233,093	436,055
Net profits (YR)	3,541,912	17,634,122	4,049,258	17,043,907	3,012,328	4,428,765	8,285,049

Average net profits per hectare are YR 8,285,049. However, land possessions of farmers are much smaller than a hectare. On an average for all survey regions they are 0.84 hectares (see table 8). Of this area only 55.6 percent (without Bait al-Khardal (see table 4) are planted with Qat. Thus, a Qat farmer cultivates on average on only 0.47 hectares Qat. The annual net profit produced by this area would be YR 3,893,973.

Recommendations

Qat demand is likely to increase over coming years due to population growth and an ever-increasing share of the population that embraces this habit. Thus, in coming years the Qat issue must be given adequate attention by the government by:

- Strengthening and developing the Qat Research Unit in order to enable it to conduct its tasks (study of Qat cultivation, trade and consumption, and impacts thereof on environment, natural resources and the society) and help it to become the National Center for Qat Research.
- Determining the actual area of Qat cultivation by aerial photography, remote sensing, and ground surveys and by using the experience of the Qat Research Unit in this field
- Determining the number of farmers involved in the overall Qat production.
- Making the issue of Qat a permanent focus of future agricultural censuses.
- Raising awareness among farmers on water depletion and preservation.
- Developing and introducing new irrigation techniques (e.g. spot sprinkler irrigation) in order to save water and making these techniques available to farmers for affordable prices.

- Conducting awareness campaigns on the harmfulness of pesticides to human health and the environment, as well as on the proper and timely use of fertilizers.
- Developing and introducing new (natural) pesticides that are less harmful and could replace the highly toxic pesticides used by farmers currently.
- Enforcing laws on the import of pesticides in order to limit the use of harmful substances by farmers.
- Introducing new crops into the farming process as an alternative for Qat in the various environments in which it is grown (such alternatives should be chosen according to marketing possibilities).
- Creating new jobs and opportunities in the countryside to keep the population from migrating to the cities, once Qat agriculture is abandoned or reduced.
- Revising the current Qat taxation system since until now Qat taxation is only carried out unsatisfactorily with great revenue losses for the state.
- Conducting pharmacological studies on Qat in order to find ways how to use Qat ingredients in pharmaceutical products.

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