

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Looking back to whole information, concepts discussed and evaluated to draw down and conclude the important points of the study. Agriculture development and sustainability challenged by the following important factors, deterioration of limited natural resources (Land and Water), carelessness of using the right of resources, population growth, migration, illiteracy and improper current agricultural practices.

5.1.1 Deterioration of limited natural resources (land and water)

From the field study in the region it can be seen that the problems are the terraces abandonment (due to male migrant to the cities and to the neighboring oil countries), expansion of Q'at growth and its effect on misused of chemical (pesticide and fertilizers), increasing numbers of wells and disappearance of water right of springs (due to random digging of wells).

5.1.1.1 Migration reasons and effects on natural resources management

a) Reason of migration

Men migrate from rural area to urban area and/or to neighboring oil countries due to several reasons such as increasing number of family (10.3 person/family) Table 4.34, low land production Table 4.35 compared to the effort applied to terraces land Table 4.36, ramose household income Table 4.37, low land holding size Table 4.38 and land holding fragmentation Fig.14. All these reasons encouraged men to migrate to fulfill needs of their families and to improve their family life.

b) Effects of migration on natural resources

Migration of men out of terraces agricultural land effect on production directly and indirectly. Direct effect concluded in shortage of labor force in agricultural, because men migrate and because terraces land, which composed of small terraces suitable to manpower with animal (Table 4.39). Therefore, losses expected if it calculated economically in terraced land with effort applied and input practiced to produce cereal. Due to men migration daily rate increased and farmers do not hire enough labors when it is calculated economically. It is the fact the production of terraces land do not fulfill input cost, especially when amounts of rainfall is small or when amount of rainfall is high but not coincide with plant growing stages (improper distribution during season).

Duty of female increased due to indirect effect of migration because female and children stay at home to work in agriculture land (Table 4.36). Migrants send money to their families to get their food available in markets, in turn it encouraged families year after year to be dependent on imported food rather than do more work in agriculture land to produce food crops. In fact that, the less the effort applied to terraces land the low the production of terraces land. Increasing rented land (Table 4.40) and decreasing social collective among men in agriculture the others effects of men migration from rural area, while collective among women still exist. Also tradition practices in agricultural (crop calendar) and the concept behind them neglected step by step and will disappear with long run because of migrate of active men out of agricultural area (Table 4.41a). Duty of female increased in raising children, working in daily home work, fetching for water and firewood, raising animals and working in agricultural. Women in most of the villages in study area face the problem of shortage of water. The average daily time spends to bring water is 2.6 hours and 3.2 hours during summer and winter time respectively, and the average water used per capita in the study villages is 19 liters and 17 liters in summer and winter respectively (Table 4.43).

5.1.1.2 Q'at expansion reasons and effects

a. Reasons of Q'at expansion

Q'at expanded on other crop land due to many reasons, high and fast income from Q'at and it cleared when profit form Q'at field in Addawm village compared with sorghum field in Al-Ma'amirah Table 4.33. Gradual increasing of demand of Q'at because in Yemen's society Q'at consumed daily among both sexes even young generation in happiness (marriage) celebrations, sadness (death) gathering, working and home entertainment Q'at sessions. Also drought resistance of Q'at plants, low labor need, controlling production (harvesting according to marketing demand), and taxes paid to government are the other reasons of Q'at expansion. However, farmers in study area concluded other reasons for Q'at expansion such as shortage of rainfall, increased of Zakah of other crops during Imam's rule, spread of diseases on vegetables which were growth to exported to Aden (former South Yemen), closed border between what was called South and North Yemen to export local production of vegetables and coffee to Aden in mid of 1960s.

b. Effects of Q'at expansion

1) Effect of using agro-chemicals on Q'at

The common worse or evil in Yemen is random use of agro-chemicals on Q'at without regulation. Effect of this practice not cleared yet because of lack of study in this field in Yemen. Random uses of agro-chemical widely in Q'at without any control will be the disaster if not control right away because residues of poisons with long run will increased in soil layers then with irrigation it will move down to water aquifer. In turn, agro-chemical residues transferred to human body directly by drinking polluted water or through eating contaminated crops and/or by consumed milk and meat of animal grassed on contaminated grass or crop (straw). Q'at farmers used agro-chemicals on Q'at according to their aims to increase Q'at production per unit area to fulfill gradually demand of Q'at in market, not to protect Q'at from pest or diseases. The amounts of agro-chemicals used on Q'at are range from 6-20 times greater than recommended by producers (written on the containers) or by specialist (Table 4.22, 4.23, 4.24 and 4.29). The problem of agro-chemical effect on human body and environment will spread, threat and challenge the government and people of Yemen on near and far future. Spreading of dangerous diseases (cancer) among Q'at chewers and producers is the sign of random uses of agro-chemicals on Q'at.

The amounts of foreign currency spend outside the country for medication of cancer infected patients is one of disadvantages of high income of Q'at. Also Q'at occupied very good fertile soil and it consumed locally and effect negatively on economic because it does not export to the world to bring foreign currency.

2) Effect of Q'at expansion on natural resources management

Q'at expanded in the last few decades in good agriculture land which was used to grow cereal crops and other cash crop such as coffee. Area occupied by Q'at has been increased 183% between 1972 and 1990 and 130% from 1990 to 2000. Cultivated land distributed among three sectors 83% private land, 3% government land and 15% *Waq'f* land and it called "*Aradhi al-waq'f*". So, Q'at expanded in private land easily because people in private land preferred to grow crop with good demand and income. The consequences of Q'at expansion are **first**; reduction of food production and with increasing of population, demand for food increased the gab between production of food and population every year. **Second**; increasing demand for water to irrigate Q'at fields, encouraged Q'at farmers to dig wells to pump groundwater accumulated for centuries in ground to irrigate Q'at. This practice increased the gab between extraction and recharging of water resources. Q'at occupies 25% of irrigated land and Q'at is an

evergreen plant and it is one of drought resistance plants. **Third;** with high percentage of illiteracy (65%) among population, dealing improperly with resources such as water and land will endangered ecological system. Wrong use of natural resources with aims of profit is a problem because farmers grow Q'at to get fast and high income the consequences of Q'at expansion are increasing of random digging well and expansion of Q'at on good fertile land. So, increasing Q'at cultivated area causing increasing number of wells; i.e number of wells in the villages of study area ranged between 1 well to 74 wells with average of 19 (Table 4.21 and Fig. 4.4). **Fourth;** as it shown in the result of field study in Addawm village in several Q'at field for two years 1997 and 1998 the average daily water consumption 4.7 mm and 6 mm in 1997 and 1998 during the winter period. This amount of water adds to Q'at as supplementary irrigation in winter period when rainfall stopped. So that Q'at's farmers improper used rainfall water because income from Q'at during rainfall time is low due to high production and supply in market so that they keep it (Q'at) un-harvested until demand for Q'at in market increased in winter to get good profit even if the price of water is high to buy it for irrigation. Prices of water and direction of transfer of water in the region is shown in Fig. 4.5.

5.1.2 Carelessness of using the right of natural resources

It can be conclude that the current practices regarding water resources and water right in the study area carried out several problems. Land owners in the study area gained bad habit to evaluate their right of natural resources either land or water. Every one things about his desire and interest neglecting public interest, so that they randomly digging wells in their land according to their desire in which wells dug close to each others seeking for water either for domestic use or for irrigation Q'at Fig. 4.4. The consequence of this practice is natural springs dried out then water rights of cultivated land near the springs suspend and finally canceled. Water right of cultivated land is canceled due to the random of digging wells upstream. The examples is the water right of Wadi Al-Hadyah spring in Al-Ma'amirah village in which the water is used at present for one person dug well close to the outlet of spring to irrigate his Q'at fields.

5.1.3 Improper current agricultural practices

Agricultural practices applied in cultivated land, crop pattern and purpose of crop growing changed nowadays than in four decades ago. In one hand practices applied in cultivated land to grow crops has been changed in recent decades (Table 4.41a). It is best to say that farmers neglect large part of crop calendar of cereal because of migration of male (migration caused

shortage of labor and high labor rate, which encouraged farmers to decrease manpower applied on land and because of economic calculation for low cereal production encouraged farmers also not to hire labors and not to apply more work to farmland. And traditional agricultural collective work among farmers not exists any more). Neglecting of traditional practices applied during the season of cereal crop among recent people will caused disappearance this knowledge, and it will be disaster for agriculture in Yemen in future. In the other hand, farmers in the past for instant, used to produce crops, which were combined from grain, vegetables, legumes, sugarcane, fruits coffee and a little Q'at. Grain produced for double purposes, food and straw for animals feed; the other crops were grown for consumption and selling surplus. Q'at was also grown for consumption and for selling surplus to neighboring villages but it was not main source of income. In the recent decades crops pattern in villages of study area changed to grains (sorghum and millet) and Q'at. Vegetables and fruits are grown only in some villages in a little amount in the valleys close to water. The purpose of growing of sorghum and other crops is for consumption of grain while in most villages where most of area produced Q'at; the purpose of growing sorghum and other grain is for animal feeder.

Q'at becomes the main source of income for Q'at growers in areas where it occupied most of the cultivated land. Q'at has been spread over most of 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 occupied 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 does not exceed 5% of cultivated land such as Al-Aa'lum in Al-Mawasit district (Fig. 4.2).

5.2 Recommendations

Q'at growth and its consequences are not new as it grown for centuries in Yemen. Therefore, expansion of Q'at will ring the alarm of the danger on the near and far future, due to its effect on natural resources, environment and human health. Because Q'at expand on the good fertile soil, consumed 25% of irrigate land and its requirement of random and aggressive (large quantity) used of agro-chemicals such as pesticides and fertilizers to enhance Q'at growth. Random and aggressive used of agro-chemicals on Q'at directly and indirectly effect on human health and environment. If its advantage (high income, reducing unemployment, improving rural life, growing in terraces in top mountainous hills, helping maintaining terraces and supporting the government budget by taxes) and disadvantage (occurrence of dangerous diseases due to aggressive uses of agro-chemicals and its needs for large quantity of foreign currency for medications in foreign countries) compared, might be palm side of disadvantage will win. Therefore, problem of Q'at expansion need wisdom decision to recover its amazing influences in daily socio-economic life in rural and urban areas equally, due to its reward to producers in rural area and reward to Q'at employments in urban area. Also due to advantage of Q'at on maintaining of terraces because in high Q'at producing villages in study area, it grows in all land even in small terraces in top mountainous hills due to its high income compared to low Q'at producing villages where abandoned terraces are common. Also Q'at consumers in all level of social and educational level gave themselves excuses to chew Q'at such as when they said in hot summer, Q'at is good to cool our worm legs and in cold winter they said Q'at is good to worm our cold legs. Labors of construction and other hand works said Q'at is active them on work. While these labors work in Saudi Arabia without Q'at and they were active in their work without Q'at because Q'at was far from their eyes.

Q'at has multi problems effect on health, resources and environment. To recover it many steps need to be taken.

- 1) To avoid inapplicable decision to stop Q'at chew and produce; wisdom studies by local experts are needed to reduces opposition feedback that increased the problems instead of solving them like what happened in mid of 1970 when Q'at growth and consumption increased, because Q'at production and consumption connect to socio-economical situation in Yemen.

- 2) To solve Q'at problems it needs strong and wisdom decision regarding law to regulate import and use of agro-chemical especially the worldwide forbidden to reduce health and environment effects.

3) To develop educational situation of people especially of young generation about negative effects of Q'at on health, economic and resources to increase anti-Q'at voice among them to stop using it voluntarily.

4) To regulate and control agro-chemical residues on Q'at enter market and increased education of young generation about agro-chemicals uses in Q'at and their effects through lectures in schools and universities and through daily newspaper, radio and television.

5) To develop educational situation of people about negative effects of plastic bags used for Q'at marketing on health and environment to stop using them in marketing of Q'at and to stop completely manufacturing plastic bags.

6) To encourage stop manufacture of plastic bottles used in water factory and replace them by reused bottles.

7) To stop Q'at expansion in new land and keep the situation as it is in mountainous area and even encourage it, where income of other crop is low compared to Q'at's income to maintain terraces in top mountainous hills to reduce loses of land resources.

8) To encourage local researcher to find competitive crops, acceptable to Q'at farmers to replace Q'at, and government must encouraged Q'at farmers to replace Q'at by new productive crops and to guaranty marketing production.

9) To stop random wells digging and regulate improper using of groundwater to irrigate Q'at which is a stimulant plant, also encouraging conducting research to determine water requirement for Q'at to compare it to replaceable crops.

10) To establish infrastructure system in rural area to encourage people to dwell in rural areas to reduce stresses on resources in urban area and to support people to cultivate agricultural land to produce at least their own food crops.

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