



Practices and Challenges of Pesticide Application on Khat Farm, the Case of Kersa Woreda, Jimma Zone, South West Ethiopia

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Abstract: The main objective of this study is to assess the practices and challenges of pesticide application on khat farm, the case of kersa woreda, jimma zone, south west ethiopia. The study was conducted in Kersa woreda located in Jimma zone, from April 2018 to August 2018. A cross sectional study design was conducted to assess the practice and challenges of pesticide application on khat farm by Kersa woreda farmers from April 2018 – August 2018. The source of population was all households found in Wakuddo, kallacha and marawa kebeles, kersa woreda, Jimma Zone. From the total households of the three kebeles means Wakuddo (720 householders), Marawa (1200 householders) and Kallacha (900 householders), 24 householders from Wakuddo, 38 householders from Marawa and 31 householders from Kallacha. Data were collected by using interview for gathering important information used for this assessment. After collected data cleared and checked for their completeness, data were then analyzed using a scientific calculator and results were presented in the form of table and paragraphs. Majority of the respondents were replied that, the level of culture of spraying chemicals on khat farm by the farmers of the study area was very low. The three top known used chemical spraying on khat by kersa woreda were DDT, Malathion and Wuha agar. Of these used chemicals DDT was the most known pesticide used by the local people of the study area. The main reason of using chemical pesticide was to facilitate its growth (to increase khat production). The other purposes of spraying these chemical pesticides on khat were to kill insects and to increase its quality. The season at which chemicals / pesticides application is more effective for the desired objective in the study area was at summer. There was difference between chemical applied and non applied khat in terms of yield. Chemical applied khat can cause headache as reported, gastric disease, eyes burning sensation and heart beat increment.

Keywords: Khat, Pesticide, Chemical Applied, Practices, Spraying

1. Introduction

1.1. Background of the Study

Pesticides are biologically active chemicals designed to kill target organisms for instance insects and rodents, disease organisms and disease vectors in agriculture and public health. Pesticide active ingredients are formulated in different ways, such as liquids, dusts, granules and pellets.[1] The first known pesticide was elemental sulfur used to dust crops in Sumeria approximately 4500 years ago.[2] Around the 15th century, toxic substances like arsenic, lead and mercury were used. By 17th century, nicotine sulphate was extracted from tobacco leaves and was used as an insecticide.[3] The earliest

synthetic pesticide was 1,1,1-trichloro-2,2-bis [4-chlorophenyl] ethane (DDT) synthesized in 19th century, followed in 20th century by other insecticides i.e. organophosphates, carbamates and later pyrethroids [5].

With the increment of Khat production and the use of pesticides over recent years, residual pesticide is a cause of concern for Khat chewers. DDT and other pesticides are being used by spraying on Khat in some parts of Ethiopia for many years [6]. Farmers spray DDT and other unidentified pesticide chemicals on Khat. They do not use any protective devices to keep themselves from the risk. Most of interviewed farmers mix different pesticides together and spray it on Khat [7]. The disposal practices of left-over Khat can lead to contamination of humans as well as animals and

leads to high health problems [8].

Pesticide chemicals are one of the vital inputs in agriculture to prevent loss of production, but if not properly managed, they could create major impact on environment and human health [9]. These impacts could be high particularly for those occupationally exposed [10]. Occupational pesticide exposure can occur directly during mixing and pesticide application and indirectly while performing re-entry tasks in pesticide-treated crops or by take home exposure [11]. Pesticide exposure can occur through the dermal uptake, through respiratory system or inhalation [12] or through the mouth by ingestion and may result in health effects like ocular, dermal, cardiovascular, gastro intestinal, carcinogenic, endocrine disruption, developmental, neurological, and respiratory effects [13].

Khat, (*Catha edulis*), is an evergreen, mild-narcotic, flowering tree consisting of cathinone and mostly grows in East Africa [14]. It was first cultivated in Ethiopia and Yemen. Then after, spread to Kenya, Somalia, Malawi, Uganda, Tanzania, Arabia, Afghanistan, Congo, Zimbabwe, Zambia, South Africa and Madagascar and others [15].

There is no any report from Kersa district until this regarding to practice and challenges of pesticide application on khat farm. This shows that, there is no enough knowledge about practice and challenges of pesticide application on khat farm and weather the farmers applying or not. As well as there is no any report weather the people of the study area were affected by the pesticide applied khat or not. But since it is the issue that should be find out and should be studied and reported as any concerned body give the immediate solution. Based on this idea the investigator is interested in order to study the status of practice and challenges of pesticide application on khat farm and the effect of chewing pesticide applied khat on people of kersa district

1.2. Statement of the Problem

Pesticides are the chemicals that can kill or affect targeted organisms but most of the time also it can affect or harm non targeted organisms. The investigations including liver function, immune function, neurologic impairment, and reproductive effects yielded inconclusive results are among the risk associated with the impact of pesticides. An excess mortality from cardiovascular and respiratory diseases was uncovered, are possibly associated to the psychosocial consequences of the accident in addition to the chemical contamination. An excess of diabetes cases were also reported from many countries. Different reports also indicate that cancer incidence and mortality follow-up showed an increased occurrence of cancer of the gastrointestinal sites and of the lymphatic, hematopoietic tissue and other organs. There is no any recent report from around Kersa woreda regarding to practices and challenges of pesticides application on khat farm. This shows that, the level of the challenge and practice of pesticide application around Jimma town well is not known. In order to fill both of these knowledge gap and study site gap, the investigator is interested to make assessment on this title.

Research question:

What type of pesticides people utilized on khat farm?

For what purpose people apply the pesticides on khat?

What is the difference between pesticide applied and non applied khat?

What is the effect of pesticide applied khat after chewing?

1.3. Objective

1.3.1. General Objective

The general objective of this study is to assess the practices and challenges of pesticide application on khat farm, the case of kersa woreda, jimma zone, south west ethiopia

1.3.2. Specific Objectives

To find out the type of pesticides people utilized on khat farm.

To determine the purpose of applying pesticides on khat farm.

To assess the difference between pesticide applied and non applied khat.

To find out the effect of pesticide applied khat after chewing.

1.4. Significance of the Study

Chemical pesticides utilization for different agricultural activities has positive result. But their impact on human beings and the environment also causes larger problems. Thus, this study has used following significances:

It gives detail explanation about the health impact of pesticide applied khat on humans and animals.

This study also give scientifically approved ideas on the impact hazards of pesticides on environment.

It helps to gives information on the disadvantages of chemical pesticides.

It gives awareness, how chemical pesticides can affect human beings and environments.

It helps to recommend the use of biological methods in place of chemical pesticides.

1.5. Scope of the Study

Farmers found in Jimma zone are large in number which is difficult to assess the practice and application of pesticides on khat farm. To overcome this difficulty it is necessary to demarcate the scope of the study. Hence, the work was delimited to be done in three kebeles namely: wakudo, kallacha and marawa kebeles, kersa woreda, Jimma zone, south west Ethiopia, which domains households found in kersa woreda only.

2. Review of Literature

2.1. Pesticides

The term includes: chemical products used in the prevention or control of pests, diseases, and weeds in crops, all chemical products used to protect harvested products against pests and diseases and all chemical products used to

eliminate malarial mosquitoes or to rid cattle of ticks [14]. A pesticide is a substance intended to prevent, destroy, repel or control any animal pest or disease caused by microorganisms and unwanted weeds [17]. It also includes biologically active compounds such as: herbicides, fungicides and insecticides. Pesticides are harmful to animals and microorganisms through direct contact, feeding or other kinds of effective exposure during their stages of growth [18].

Insecticides include: organochlorine, organophosphates, carbamates, synthetic pyrethroids, acylureas and fumigants [16].

2.2. Khat and Pesticides

The report of one work shop on information dissemination on the status of DDT use in the Ethiopia indicates that [19], farmers in Zeway area used DDT to grow their Khat. The result of the workshop did recommend integrated regulation and inspection of the issue is needed which otherwise leads to great human and animal problems in addition environmental pollution in the future [4]. Recent report on the extent of chewing khat indicates very high figure and is estimated that 10 million people worldwide chew Khat daily [20].

The prevalence of chewing Khat in rural Ethiopia is 50%, of which 17.4% chew Khat on daily basis; among which 16.1% of these were male and 3.4% were female [21]. This indicates that as the number of Khat chewers increase, the possible health risks of exposure to DDT and other pesticides.

2.3. Health Effects of Pesticide Exposure

Concerns about human health effects of pesticides have increased over the past decades [22]. The health effects from pesticide exposure are dependent upon the nature of the pesticide, route of exposure such as inhalation, ingestion or skin absorption, frequency, duration and intensity of exposure and individual susceptibility. High exposure and uptake either through the skin or by inhalation within a relatively short time span may lead to acute pesticide poisoning (APP) whereas the chronic effects usually occurs following repeated exposures over an extended period of time [23].

2.3.1. Acute Pesticide Poisoning

The World Health Organization (WHO) estimates that 1-5 million cases of pesticide poisoning occur every year, resulting in 20,000 fatalities among agricultural workers [24]. More than 95% of the cases occur in low and middle income countries although less than 40% of the global production of pesticides is used in those countries [25].

2.3.2. Effects on the Nervous System

Pesticide exposure can have profound effects on the nervous system. Most studies of neurotoxicity have documented an increase in symptom prevalence and changes in neurobehavioral performance reflecting cognitive and psychomotor dysfunction [26]. Additional effects of pesticides on the nervous system include neurodegenerative and neurodevelopment effects [27].

2.3.3. Effects on the Respiratory System

A number of studies have identified a higher risk of respiratory symptoms with pesticide exposure: a significant increase in acute respiratory symptoms (e.g. cough, chest tightness, and dyspnea) among pesticide workers and applicators. Acetylcholinesterase inhibiting pesticides have been associated with a higher prevalence of respiratory symptoms (e.g. chest pain, running nose, shortness of breath, and irritation of the throat) [28].

2.4. Health Risks of Using Pesticides on Khat

Spraying pesticides to grow Khat can cause deleterious effect on the environment and human health in particular. Illegal pesticides used in Yemen in the cultivation of Khat, fruits and vegetables causes 16,000-17,000 cancer disease each year [29].

The rampant use of pesticides and toxic chemicals, like DDT, Lindane can cause liver and kidney damages, whereas, methyl-parathion, can affect the central nervous system resulting in dizziness, headache, breathing difficulties, vomiting, diarrhea, tremors, blurred vision, sweating, and possibly death, are used on Khat crops in Yemen [30]. The American EPA has also determined that DDT, DDE, and DDD are probable human carcinogenic chemicals [31].

2.5. Status of DDT and Use in Ethiopia

DDT is the first line insecticide used for Indoor residue spray (IRS) chemical used in the country, because it is the cheapest, relatively safe, and effective under close monitoring and controlling & long residual effect greater than 6 months, compared to all other chemicals as pesticides for public health use [32].

During the last six years ago Ethiopia was the largest consumer of DDT " the Federal Malaria Control Programme imported or purchased 2,701 tonnes of insecticides, and distributed 2,418 tonnes to regions and other institutions of the country. Until recently DDT was purchased and imported from China by the Ministry of Health, in the form of 75% and 100% concentration wettable DDT powder and still purchased distributing [33].

3. Description of the Study Area and Methodology

3.1. Description of the Study Area

The study was conducted in Kersa woreda, Jimma zone, from April - August, 2018. Kersa woreda is found in Jimma Zone, Oromia regional state. Jimma town is the capital of Jimma zone and is located 356 km far from Addis Ababa Ethiopia. It is bordered on the south by Dedo, on the southwest by Seka Chekorsa, on the west by Mana, on the north by Limmu Kosa, on the northeast by Tiro Afeta, and on the southeast by Omo Nada. Towns and cities in Kersa include Jimma, the zone's capital and Serbo. The altitude of

this woreda ranges from 1740 to 2660 meters above sea level. Mountains found in this district includes: Sume, Gora, Kero, Folla and Jiren. This woreda has an estimated total population of 329,629, of whom 162,690 are men and 166,939 are women. About 165,083 or 50.08% of its population are urban dwellers [34].

3.2. Study Design

A cross sectional study design was conducted to assess the practice and challenges of pesticide application on khat farm by Kersa woreda farmers from April, 2018 – August, 2018.

3.3. Populations

3.3.1. Source Population

The source of population was all households found in Wakuddo, kallacha and marawa kebeles, kersa woreda, Jimma Zone, South West Ethiopia.

3.3.2. Study Population

The study population was the number of respondents selected from all Households living in three kebeles of the woreda those have been participated to give information or data for this research.

3.4. Sample Size & Sampling Technique

3.4.1. Sample Size

From the total households of the three kebeles means Wakuddo (720 householders), Marawa (1200 householders) and Kallacha (900 householders) by using the following formula 93 of which 78 male and 15 female from the following three kebeles namely Wakuddo, Marawa and Kallacha

$$n = \frac{Z^2 pqN}{d^2 (N-1) + Z^2 pq}$$

Where n=Sample size

q=1-p=1-0.5=0.5,

N=Total number of population,

Z=Level of confidence with 95% \approx 1.96,

d=Margin of error,

P=proportion of population (50%) for maximum sample size.

3.4.2. Sampling Techniques

In order to get enough information from farmers that cultivate khat in three kebeles, Purposive sampling technique was used. By asking the people those cultivate khat more and those get high income from khat, the investigator purposively asked 93 households of which 78 were male and 25 of them were females from three kebeles namely: Wakuddo, Marawa and Kallacha.

3.5. Data Collection Instrument

Data were collected by using interview for gathering important information. The investigator was gathered data from 93 households by making interview with each

respondents of the study area.

3.6. Method of Data Analysis

After collected data cleared and checked for their completeness, data were then analyzed using a Microsoft Excel 2007. After data were analyzed, the results of this study were presented in the form of table and paragraphs.

4. Result and Discussion

4.1. Demographic Characteristics of the Respondents

The table shows demographic characteristics of respondents which contains age, sex and educational status of the respondents. Majority of the respondents participated to give data for this investigation were males 78 (83.87%) and 15 (16.12%) females. Whereas most of them were found between the age interval from 20-40 years 47 (50.5%) of them and 46 (49.5%) of the respondents were found in the age group of > 40 years old. Regarding to the educational status of the respondents, 73 (84.49%) of them were illiterate and 13 (13.97%) of the respondents were primary education completed 7 (7.5%) of them were secondary school completed (Table 1).

Table 1. Demographic characteristic of the respondents of the study area, June 2018.

No	Item	Respondents	
		Number	Percentage
1	Age:-		
	20-40	47	50.5
	>40	46	49.5
2	Total	93	100
	Sex:-		
	Male	78	83.87
	Female	15	16.12
	Total	93	100
3	Education status:-		
	Illiterate	73	78.49
	Primary school	13	13.97
	Secondary school	7	7.5
	College diploma	-	-
	Total	93	100

4.2. Factors Decrease the Khat Production and Mechanisms Used to Overcome the Problem

The most factors those decrease the khat production were different types of worms 21 (22.58%), selection of unfavorable site 7 (7.5%), lack of protection from livestock 4 (4.3%) and absence of fertilizer 61 (65.59%). Whereas the solutions to overcome those problems were: spraying chemicals, selecting favorable site, making protection and applying fertilizer by the same number of respondents with that of factors respectively (Table 2). Pesticides are one of the vital inputs in agriculture to prevent loss of production. Insects decrease the production of khat and people use different types of insecticides to overcome the problem. But if not properly handled and/or managed they could create major environmental and human health risks [9].

Table 2. Things decrease the khat production and mechanisms used as a solution to overcome the problem by local people of the study area, June 2018.

Factors	Solution	Respondents			
		Male	Female	Total	%
Different types of worms	Spraying chemicals	17	4	21	22.58
Selecting unfavorable site	Selecting favorable site	5	2	7	7.5
Lack of protection from livestock	Making protection	3	1	4	4.3
Absence of fertilizer	Applying fertilizer	53	8	61	65.59

4.3. The Level of Culture of Spraying Chemicals on Khat Farm

Majority of the respondents 84 (90.3%) were replied that, the level of culture of spraying chemicals on khat farm by the farmers of the study area was very low. Unlikely about 9 (9.67%) of the respondents replied that there was some what the culture of spraying chemicals on khat in the society at medium level for some purpose like to get high yield (Table 3). The prevalence of chewing Khat in rural Ethiopia is 50%, of which 17.4% chew Khat on daily basis: among which 16.1% of these were male and 3.4% were female [21]. This indicates that as the number of Khat chewers increase, the possible health risks of exposure to DDT and other pesticides.

Table 3. The level of culture of spraying chemicals on khat farm by respondents of the study area, June 2018.

Responses	Respondents			
	Male	Female	Total	%
Low	72	12	84	90.3
Medium	6	3	9	9.67
High	-	-	-	-
Unknown	-	-	-	-

4.4. Chemicals Frequently Sprayed on Khat by the Local People of the Study Area

The three top known used chemical by spraying on khat by kersa woreda were DDT, Malathion and Wuha agar. Of these used chemicals DDT was the most known pesticide used by the local people of the study area as 58 (62.36%) respondents replied followed by Malathion as about 24 (25.8%) of the respondents reported (Table 4). The report of one work shop on information dissemination on the status of DDT use in the Ethiopia indicates that [19], farmers in Zeway area used DDT to grow their Khat. The result of the workshop did recommend integrated regulation and inspection of the issue

is needed which otherwise leads to great human and animal problems in addition environmental pollution in the future [4]. Recent report on the extent of chewing khat indicates very high figure and is estimated that 10 million people worldwide chew Khat daily [20]

Table 4. Chemicals frequently sprayed on khat by the local people of the study area, June 2018.

Responses	Respondents			
	Male	Female	Total	%
DDT	48	10	58	62.36
Malathion	21	3	24	25.8
Wuha agar	9	2	11	11.82

4.5. The purpose of Applying Chemicals on Khat

Of all purposes of spraying chemicals on khat, the main reason was to facilitate its growth (to increase khat production) as reported by 58 (62.36%) respondents. The other purposes of spraying these chemical pesticides on khat were to kill insects and to increase its quality. There was no any farmer who sprayed these chemicals as the khat stimulates the khat chewers (Table 5). Pesticide chemicals are one of the vital inputs in agriculture to prevent loss of production, but if not properly managed, they could create major impact on environment and human health [9]. These impacts could be high particularly for those occupationally exposed [10] Occupational pesticide exposure can occur directly during mixing and pesticide application and indirectly while performing re-entry tasks in pesticide-treated crops or by take home exposure [11]. Pesticide exposure can occur through the dermal uptake, through respiratory system or inhalation [12] or through the mouth by ingestion and may result in health effects like ocular, dermal, cardiovascular, gastro intestinal, carcinogenic, endocrine disruption, developmental, neurological, and respiratory effects [13].

Table 5. The purpose of applied chemicals on khat by local people of the study area, June 2018.

Purposes	Respondents			
	Male	Female	Total	%
To kill insects	18	4	22	23.65
To facilitate its growth (to increase production)	49	9	58	62.36
To increase its quality	11	2	13	13.97
To stimulate the mind and give satisfaction after chewing	-	-	-	-

4.6. The Season at Which Chemicals / Pesticides Application Is More Effective for the Desired Objective

The season at which chemicals / pesticides application

is more effective for the desired objective in the study area was at summer when the atmosphere was very wet. About 87 (93.54%) of the respondents replied that these chemicals were used during the summer season. While only 6 (6.45%) of the respondents replied also sprayed

during spring season when atmosphere is partially wet (Table 6).

Table 6. The season at which chemicals / pesticides application is more effective for the desired objective in the study area, June 2018.

Favorable season	Respondents			
	Male	Female	Total	%
Summer	74	13	87	93.54
Spring	4	2	6	6.45
Autumn	-	-	-	-
Winter	-	-	-	-

4.7. Perception of the Society Toward Spraying Chemicals on Khat Farm

All the local people of the study area know the health effect of chemical applied khat. So 93 (100%) of the respondents hate chewing the chemical applied khat (Table 7). During the last six years ago Ethiopia was the largest consumer of DDT " the Federal Malaria Control Programme imported or purchased 2,701 tonnes of insecticides, and distributed 2,418 tonnes to regions and other institutions of the country. Until recently DDT was purchased and imported from China by the Ministry of Health, in the form of 75% and 100% concentration wettable DDT powder and still purchased distributing [33].

Table 7. Perception of the society toward spraying chemicals on khat farm, June 2018.

Society's feeling toward application of chemicals on khat	Respondents		
	Male	Female	Total
Happy	-	-	-
Hate	78	15	93
No idea	-	-	-

4.8. The Difference Between Pesticide Applied and Non Applied Khat

More than half percent 52 (55.9%) of the respondents reported that there was difference between chemical applied and non-applied khat in terms of yield. About 34 (36.55%) of the respondents were replied that there was difference between chemical applied and non-applied khat in terms of fast growth (Table 8).

Table 8. The difference between pesticide applied and non-applied khat of

Table 10. The mechanisms used by khat chewers and traders to know chemical applied khat on farm land, June 2018.

Mechanisms	Respondents			
	Male	Female	Total	%
Its leave is very beautiful and attractive to chew	28	5	33	35.4
There is white, fiber like structure in its stem after cutting	23	6	29	31
It replaces itself in a short period of time after cut	27	4	31	33.33

According to the below table all respondents of the study area preferred non chemical applied khat. As the data collected from the respondents showed, this could be due to

the study area, June 2018.

Difference	Respondents			
	Male	Female	Total	%
In terms yield	45	7	52	55.9
In terms quality	4	3	7	7.5
In terms fast growth	29	5	34	36.55

4.9. The Effect of Pesticide Applied Khat on Human Body or Health After Chewing

Chemical applied khat can cause headache as reported by 35 (37.6%) respondents of the study area. About 28 (30%) of the respondents were replied chemical applied khat causes gastric disease and eyes burning sensation. Whereas 30 (32.25%) replied that chemical applied khat causes heart beat increment (Table 9). Concerns about human health effects of pesticides have increased over the past decades [22]. The health effects from pesticide exposure are dependent upon the nature of the pesticide, route of exposure such as inhalation, ingestion or skin absorption, frequency, duration and intensity of exposure and individual susceptibility. High exposure and uptake either through the skin or by inhalation within a relatively short time span may lead to acute pesticide poisoning (APP) whereas the chronic effects usually occurs following repeated exposures over an extended period of time [23].

Table 9. The effect of pesticide applied khat on human body or health after chewing.

Effect	Respondents			
	Male	Female	Total	%
Headache	29	6	35	37.6
Gastric and eyes burning sensation	24	4	28	30
Heart beat increment	25	5	30	32.25

4.10. The Mechanisms Used by Khat Chewers or Traders and Their Experiences to Know Chemical Sprayed and Non-sprayed Khat

Majority of the respondents 33 (35.4%) could know chemical applied khat on farm land by khat's leave as it is very beautiful and attractiveness to chew followed by 31 (33.33%) of respondents those could to know chemical applied khat as it replaces itself in a short period of time after cut. About 29 (31%) of the respondents replied that as they knew chemical applied khat by seeing the white, fiber like structure in its stem after cutting which is not found in nonchemical applied khat (Table 10).

people's awareness towards the health effect of chemical applied khat on human body (Table 11).

Table 11. Khat users and traders preference towards chemical applied and non applied khat, June 2108.

Type of khat	Respondents		
	Male	Female	Total
Non chemical applied khat	78	15	93
Chemical applied khat	-	-	-

5. Conclusion and Recommendation

5.1. Conclusion

The most factors those decrease the khat production were different types of worms, selection of unfavorable site, lack of protection from livestock and absence of fertilizer. Majority of the respondents were replied that, the level of culture of spraying chemicals on khat farm by the farmers of the study area was very low. The three top known used chemical spraying on khat by kersa woreda were DDT, Malathion and Wuha agar. Of these used chemicals DDT was the most known pesticide used by the local people of the study area. The main reason of using chemical pesticide was to facilitate its growth (to increase khat production). The other purposes of spraying these chemical pesticides on khat were to kill insects and to increase its quality. The season at which chemicals / pesticides application is more effective for the desired objective in the study area was at summer. There was difference between chemical applied and non applied khat in terms of yield. Chemical applied khat can cause headache as reported, gastric disease, eyes burning sensation and heart beat increment. The local people knew chemical applied khat on farm land by khat's leave as it is very beautiful and attractiveness; it replaces itself in a short period of time after cut and by seeing the white, fiber like structure in its stem after cutting which is not found in nonchemical applied khat. There were no any people who want to chew and trade the chemical applied khat since they well knew its negative health effect.

5.2. Recommendation

Based on the results obtained from this study, the following recommendations were offered by the investigator:

The result gained from the study area indicated that majority of the farmers apply the chemical pesticides in order to get high yield. Even if they apply chemical on khat to get high production, the chemical applied khat had great health effect on human being. So, the farmers those were applying chemical pesticides on khat in order to get high productivity should save themselves from this practice.

Other than using chemical pesticide to get high productivity, the society should apply fertilizer that increase the yield and make fast its growth.

The mechanisms used to identify chemical applied khat from non-applied one for example like seeing white thread like structure in khat stem after cut should be known by all khat chewers and traders in order to decrease the health impact of chemical applied khat on human body.

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