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## **The spillover of good crop protection practices for export crops to crops for the domestic market: A case of Kirinyagah district, Kenya**



A farmer carrying out staking exercise on tomato crop

A research project submitted to Van Hall Larenstein University of Applied Sciences  
in partial fulfillment of the requirements for the degree of  
Master of Management of development

**Specialisation International Agriculture**

By  
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To my sister Bernadatte, thanks to you for giving me the opportunity to study by taking care of my daughter throughout the year while I undertook my studies

## **DEDICATION**

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I dedicate this research to my five year old daughter, Precious, my mother and my sister Bernadatte since they always called to encourage me and that motivated me.  
I also dedicate it to all the smallholder farmers of Kirinyagah.

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## ABBREVIATIONS

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AAK	Agrochemical Association of Kenya
CAC	Codex Alimentarius Commission
CCP	Critical Control Point
EU	European Union
Eurepgap	Euro - Retailer Produce Good Agricultural Practices
FPEAK	Fresh Produce Exporters Association of Kenya
GAP	Good Agricultural Practice
GLOBALGAP	Global Good Agricultural Practices
HACCP	Hazard Analysis Critical Control Point
HCDA	Horticultural Crops Development Authority
ICIPE	International Centre for Insect Physiology and Ecology
IPM	Integrated Pest Management
JKIA	Jomo Kenyatta International Airport
KARI	Kenya Agricultural Research Institutes
KEBS	Kenya Bureau of Standards
KEPHIS	Kenya Plant Health Inspectorate Services
KHDP	Kenya Horticulture Development Project
KOAN	Kenya Organic Agriculture Network
KSHS	Kenya Shillings
KEBS	Kenya Bureau Of Standards
MOLFD	Ministry of Livestock & Fisheries Development
MOA.	Ministry of Agriculture
MPH	Ministry of Public Health
MRL's	Maximum Residue levels
NGOs	Non-Governmental Organisations
PCPB	Pest Control Products Board
PPP	Plant Protection Product
SPS	Sanitary and Phytosanitary Standards

## Equivalents

1Euro=108 Kenya shillings (Kshs) (average for the month of August 2009)



## ABSTRACT

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This research carried out in July 2009 looks at the crop protection practices by smallholder vegetable growers which are in the export market production and are used in the crops destined for the domestic market in Kirinyagah district. In recent years more and more attention has been given to food safety. Most of the French beans produced in Kenya are exported to the European market where the European Union regulations and requirements of food safety are stringent such as the Globalgap. In contrast, for tomatoes produced for the domestic market it is not known whether farmers comply with the set regulations except for a few of the market outlets such as Nakumatt supermarket where producers are known to comply with the KENYAGAP which is a local standard benchmarked against the International standard of Globalgap.

It would be interesting to see whether there is a gap between the export production of French beans and the production of tomatoes destined for the domestic market in terms of compliance of the pesticide use regulations. It would also be interesting to find out why farmers use good crop protection practices for an export crop such as French beans and not apply the same practices on a crop destined for the domestic market such as tomato.

The study revealed that there were more crop protection practices carried out by the Globalgap certified farmers as compared to those applied by the non Globalgap certified farmers. There exists very stringent standards in pesticide use for export French beans such as use of approved and less toxic pesticide which was noted that some of the chemical pesticides used in French beans are also used in tomato production which shows that farmers are complying with pesticide regulations for both markets. Other pesticides used for tomatoes were compared with the recommended list and they were found to be complying. The study focused on aspects of farmers health where farmers are using protective clothing, secondly on consumer health where farmers are observing preharvest interval and thirdly environmental health where farmers are ensuring proper disposal by using disposal pits. However, there exist differences in the production of export French beans and the tomatoes destined for the domestic market such as the production period for French beans is shorter (approximately 45 days) whereas for tomatoes is longer (approximately 120 days) this implies that demand for synthetic chemical pesticides is higher in tomatoes as compared to French bean. Despite the length of the production period, the question is, are farmers applying chemical pesticide in the right quantities and correct timing? There have been reports in recent studies showing that there are high levels of pesticide residue in horticultural vegetables produce sampled from the market in Kenya

It was noted that along the chain the actor that applies chemical pesticides is the farmers which becomes the critical control point (CCP) and that is why the study mainly focused on the farmer. In addition the control at the end point in the market was also crucial since when a farmer produces clean tomatoes for the domestic market it is not guaranteed that it will be distinguished at the market thus we interviewed some stakeholders at the end point to check whether the products are checked and lastly, the enforcement of regulation was an important aspect that resulted to interviews with some representatives of the government regulatory organizations. In regards to enforcement, the government parastatals and private sector involved in crop protection

practices were not efficient and working properly whereas none of them is clearly mandated to enforce the maximum residue levels.

The research questions deals with firstly, what are the sources of information farmers use with respect to pesticides use? Secondly, what are the trainings they get with respect to safe handling use of pesticide? Thirdly, are there any remunerations for farmers if they apply pesticide rules? Lastly, what are the enforcement systems with regards to pesticide regulation?

I recommend the government to appoint the National food safety committee to carryout research on the enforcement and regulation of the crop protection practices and later upgrade them to become an authority which enforces and regulates the crop protection practices in the country

## **CHAPTER 1: INTRODUCTION**

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### **1.1 Introduction to the study topic**

The research focused on spillover of crop protection practices from export production to domestic market production for farmers in Kirinyagah. The Globalgap certified farmers are growing French beans for export market where we have very stringent standards that they have to comply with and it is assumed that they are applying good crop protection practices. These farmers also grow crops for the domestic market so it would be interesting to see the food safety in Kenya. It is not well known whether the farmers are applying good crop protection practices for crops destined for the domestic market the same way they apply for the export crops. In addition to that the enforcement for the pesticide rules and regulation is also unclear. It would also be interesting to see whether there are any interactions between the Globalgap certified farmers crop protection practices and those of the non Globalgap certified farmers. Given this, the objective of the study was 'To which extent do farmers use export crop protection practices for crops destined for the domestic market' and for further elaboration of the sub questions the theory of behavior framework was used. To collect information about the crop protection practices two clusters of farmers were selected and interviewed which included a cluster of 15 Globalgap certified farmers and another cluster of 15 non Globalgap certified farmers. In addition to that 11 stakeholders from various organization which are involved in regulation and enforcement of law and standards of pesticide use were interviewed. As noted by Battisti (2009) Globalgap and the national good agricultural practices schemes are bringing improvements for producers in the agricultural sector and the improvements made for export agricultural produce in Kenya is also resulting to improvements in the local food chain.

The research hoped to find answers to the following questions

1. What are the sources of information farmers use with respect to pesticides use?
2. What are the trainings they get with respect to safe handling use of pesticide?
3. Are there any remuneration for farmers if they apply pesticide rules?
4. What are the enforcement systems with regards to pesticide regulation?

### **1.2 Organization of the Thesis**

The rest of the report is organized in this way. Chapter one introduces the topic where an overview of the research study on crop protection practices in Kirinyagah district and the organization of the report is given. Chapter two gives the background information to the topic on the spillover of good crop protection practices for export crops to crops for the domestic market. The third chapter is the research design and set up which includes the introduction to the research problem, justifying, describing the objective, defining the research questions and methodology. This is followed by chapter four which gives the results, findings, discussion of findings analysis and results summary. Lastly, chapter five includes the conclusion and recommendations.

## **CHAPTER 2: BACKGROUND INFORMATION USE OF PESTICIDES IN VEGETABLES PRODUCED IN KIRINYAGAH DISTRICT**

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### **2.1 Tomato production in Kirinyagah district**

Kirinyagah district is one of the seven districts in Central Province of Kenya as shown in (annex 10). It is a high potential area with annual average rainfall ranging 800-2200mm. It has total area of about 112,700 hectares with 95,500ha. (85%) under agriculture. There are two permanent rivers, namely Thiba and Nyamindi, which facilitate the growing of rice and horticultural crops such as tomato on the lower parts of the district. The Kirinyagah district in the north east of central province covers 1478km<sup>2</sup> and is one of the densely populated areas in Kenya with a population density of 317 persons/ Km<sup>2</sup> and a total population of 457,105persons (CBS-1999 census). Tomatoes are the second important cash crop in Kirinyagah after rice in terms of income generating crops. Tomato production in central province is (7,999 Tonnes) ranks second to Nyanza province (10,869 Tonnes) in Kenya. (Humboldt-universitat, 2008). In 2006 tomato production in Kirinyagah was about 1450 hectares with a yield of 15-17 Tonnes per hectare per season. The majority are small and middle scale farmers who own 0.5 to 3 acres with a few posing more than 3 acres.

Majority of the tomato farmers are mainly found in Mwea division which is located on the border to Eastern province and is the poorest division in Kirinyagah with 40% of the population below the poverty line. (Waiganjo , M., Wabule, M., Nyongesa, D., Kibaki, J., Onyango , I., Wephekulu, B and Muthoki, M., 2006). Tomato production is perceived to increase since farmers tend to shift from export crops such as French beans to tomato due to its profitability.

### **2.2. Pesticide use in tomatoes grown in Kirinyagah district**

The study focuses on three aspects mainly farmers health as seen in use of protective clothing, consumer health as seen with farmers when they observe pre harvest interval and environmental health as seen with the farmers using disposal pit to dispose of synthetic pesticide container which are sometimes found to be used for fetching drinking water. We focused on the farmers since they are the people who behave in a certain manner in relation to the pesticide rules whereas consumers were looked at to see what dangers of pesticides they face.

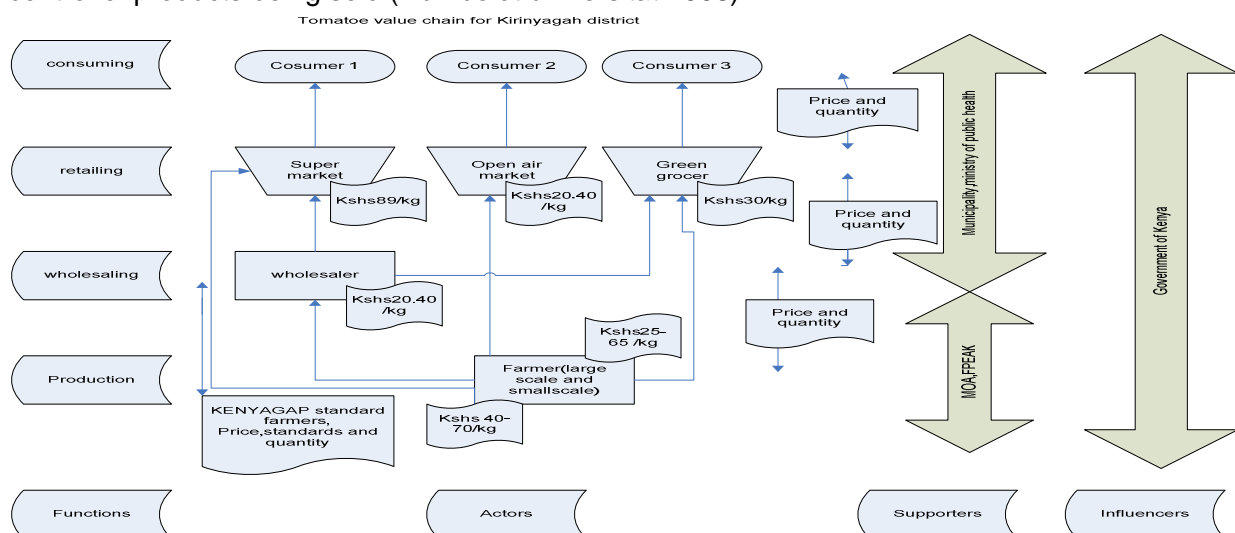
This thesis is about the use of pesticides by farmers producing tomatoes in the Kirinyagah district in Kenya and the residue levels of the tomatoes at the selling points (or outlets) to the consumers. In the past years there were some reports that these levels were in some cases much higher than is allowed. There is documented evidence pertaining to worrying high pesticide residues in some of the vegetables sold on the domestic markets (Esipisu, 2007) noted that high levels of chemicals such as dimethoate, methoym, abamectin diazinon, captan, heptachlor, fenitrothion, desmetryn, chlorothalonil, ethion, parathion and methyl were detected in vegetables sampled from the Wakulima market Nairobi. A study by KOAN (2006) has shown that most of the pesticides were present in high levels beyond what is accepted under the EU MRLs guidelines, meaning that they can have adverse health effects to humans on sustained consumption. In the study wakulima market was chosen to represent the open air markets and an outlet for low

income earners. In addition, KOAN took samples from one of the leading supermarkets within the city centre to represent the middle class and more samples from a green grocer in Hurlingham, Yaya centre to represent the upper class. In the KOAN study, tomatoes from all the three markets outlets were contaminated with one outlet having as high as 0.93Mg/Kg of Diazinon, which is 47 times higher than what is acceptable under EU MRLs guidelines.

As revealed in a study in Kirinyagah by Waiganjo et al., (2006) that among the farmers interviewed, only (44%) of the respondents applied pesticides after scouting, while a few (6%) applied pesticides when they were told by other farmers or extension workers. Majority (77%) of the tomato farmers applied pesticides at regular intervals when they saw pests in their field (59%) or after scouting (36%). As reported by Humboldt universitat (2008) that at production level, extension service providers and farmers producing for the domestic market did not seem to have any information about maximum residue levels. For instance printed copies of the regulations were not available even at the ministry of agriculture but only at Kenya bureau of standards where they are for sale at Ksh1000

### 2.3. The marketing of tomatoes in Kirinyagah district

The tomato produce like other local market vegetables is channeled from farm gate to the wholesale markets either directly or through middlemen/brokers (Waiganjo, et al., 2006). Some produce is channeled directly to the retail markets. The retailers include groceries, supermarkets especially in the urban areas and open air markets in both urban and rural areas. The wakulima market is the Kenya's most important wholesale market with 3000 wholesalers and retailers (Humboldt universitat 2008). This open air market is owned by the Nairobi city council (NCC) and its enforcement is by civil servants who are also in-charge of collecting market fees on a daily basis. Unfortunately, the market authority does not perform any quality assurance or standard control of products being sold (Humboldt universitat 2008).



**Figure I: Tomato value chain in Kenya**

Source: Research study, 2009

At retail or marketing level, the operators are to be differentiated according to their location and or the volumes they trade (Humboldt universitat, 2008). There are sellers in open air market and road side sellers with small wooden kiosks. The latter sell at roadside without a booth, walking around and approaching potential customers. While the first two operate in the formal sector, the hawkers work in the informal one. In addition, supermarkets are part of the formal retail sector but they do not play an important role in the supply of fresh fruits and vegetables (Humboldt universitat, 2008).

As reported by Humboldt universitat (2008) that consumers characterize high quality in terms of medium size, good colour, faultless skin, shape, taste and they look for storable goods (Humboldt universitat, 2008). Only a few consider organic production or pesticide residues.

Thus, there are two aspects to consider as far as standards are concerned (Humboldt universitat 2008) first the legal regulations and standards in particular, do exist but the actors along the chains are not aware of those standards. Second, there is also no demand driven for these standards neither from producers nor from the consumers.

The tomato value chain above (figure 2) shows marketing of tomatoes from the farmer to the consumer and the prices per kilogram. It is noted that although at the farmer levels they are sold in crates of 40-50Kgs depending on size of tomatoes, at wholesale they are sold in kilograms, in open air market and groceries they are sold as bunches of tomato pieces and in the supermarkets in kilograms. The prices for each market differ and as seen in (figure 2) supermarket (Kshs. 89/=) fetch a higher price because the produce delivered by subcontracted farmers is complying with KENYAGAP standard thus the consumer price is also higher. The promotion is being done in Nakumatt by use of the KENYAGAP versus Kenya bureau of standard label as the mark for quality for horticultural vegetables.

The French beans have an organized marketing system where traceability system is very much organized where pesticide residue found in the market can be traced back to the farm itself and even the block in the farm as shown in (annex 11) for tomatoes value chain in Kenya it is not the same case as the seen in the French bean value chain.

Tomato production is constrained by biotic (insect pests, mites and diseases) and abiotic factors (high cost of inputs, poor quality seeds and adverse weather conditions). Other problems include uncoordinated and unorganized marketing, exploitation by middlemen and poor production planning leading to over-supply in some months that leads to very low prices (MoARD, 2001; Waiganjo, et al, 2006).

The marketing mix theory has been used to explain the marketing at the conventional market retailers for tomatoes this includes the product (the kind of product), price (the amount at which it is sold), place (the location with which the product is placed) and promotion (the marketing strategies ) (Wikipedia, 2009) the marketing mix are the variables that marketing managers can control in order to best satisfy consumers in the target market.

## **2.4. Enforcement, regulation, training and information**

In French bean production smallholder farmers form groups with the aim of facilitating joint marketing of their produce to meet basic requirements of economies of scale such as a group grading shed, purchase of pesticides, fertilizers and certification. Some of the farmer groups are Globalgap certified with the support from exporters or other development agencies who fund for the certification and sometimes the farmer groups fund themselves. The certification for groups is recognized as Globalgap certification option 2 for producer organisations. The exporter employs a technical assistant to oversee the groups activities and assist group members with technical



advise. Certification of Globalgap is facilitated by authorized certification bodies in Kenya we have certification bodies such as Africert Kenya limited and Bureau of Veritas.

Currently, enforcement with respect to pesticide regulation varies with the end market of the produce. For the tomatoes that are supplied to supermarkets, the quality standards and KENYAGAP private standard are enforced by the supermarket management, for the French bean for export market, it is the exporters who enforce the International regulations and private standards such as Globalgap where there are stringent standard to be met the exporter facilitates the intensive training and other requirements so as to meet the requirement for a certification. To comply with the standard which is the "stick" as explained by the behavioural conceptual framework since the farmer through information learnt he uses pesticides as recommended to ensure safe produce is delivered to the consumer. On the other hand, Globalgap products found not complying with export standards they are rejected thus the "stick" as described in the behavioural conceptual framework.

For the open air market it is regulated by the Municipal council and for the greengrocers it is the National City council .The municipal council and National City Council are only involved in taking the monthly levies from trader and not enforcing quality or food safety standard in the market.

Fresh Produce Exporters Association of Kenya (FPEAK) in collaboration with Kenya Bureau of Standards has introduced KENYAGAP to Nakumatt supermarket in Kenya where KENYAGAP is a private standard which implies the producers of such vegetables comply with Good Agricultural Practices.

The Kenya Pesticide Control Board is the regulatory body with the mandate to register and deregister all pesticides used in the country. The board maintains a list of the registered pesticides that can be used including those that are banned from use in the country. The regulation is further strengthened by the Kenya Bureau of Standard -KEBS (article no date) KS1758:2003 Code of practice for the horticulture industry where KENYAGAP has been aligned with Globalgap and is compatible with most Good Agricultural Practices (GAP) standards in the world.

As reported by Bayer cropscience (article no date) Farmers are now producing tomatoes confidently as they have seen the advice given to them, through the Green World, working for them. Thanks to the Bayer Tomato Clubs, participating farmers can produce quality tomatoes that conform to the requirements of KENYAGAP. As a result, our consumers will also be safeguarded from the risks of eating tomatoes with pesticide residues.

Public and private extension services are value chain supporters at input level (Humboldt universitat, 2008). However, extension service to horticultural is deficient. The main reason interview partners gave for this is a lack of personnel at the ministries of agriculture. Most farmers stated that for years they had relied on neighbours, friends and relatives for information. There are various organizations in Kenya which are involved in training of integrated pest management in Kirinyagah such as International centre for insect physiology and ecology and exporters.

## **2.5. National taskforce on Horticulture in Kenya**

A National Maximum Residue Levels (MRL) steering Committee was created by the Ministry of Agriculture to address the challenges faced by Kenyan horticultural producers in the international



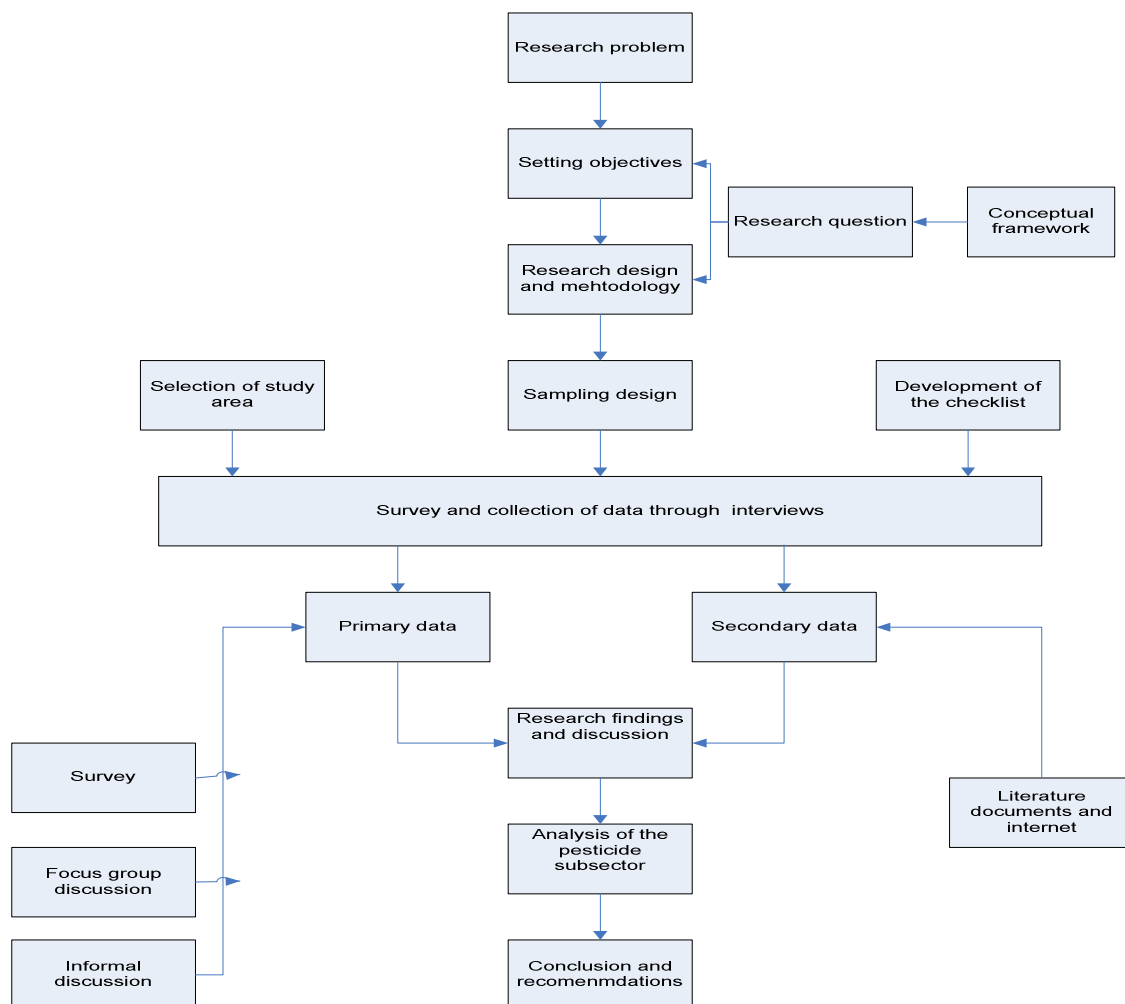
market in 2002. In 2004 it was named the National Task Force on Horticulture to reflect its broadened remit and multi-stakeholder membership (Gichuki, 2006). The National Task Force on Horticulture is an interactive and consensus building forum representing a wide range of stakeholders in the horticulture export subsector. The objectives of the taskforce have evolved over time. Current objectives of the taskforce are meant for both domestic and export market:

- Kenya horticultural produce complies with market requirements and sustains its reputation as a leading grower and exporter of horticultural produce
- Reliable and consistent information channels on issues relating to the horticultural sector in this country are opened between the public and the private sector
- Stakeholders in the horticulture industry are trained and informed on market requirement
- Capacity building on a sustainable basis is undertaken for the horticulture industry to ensure that the sector achieves the international accreditation required

## CHAPTER 3: THE RESEARCH DESIGN

This section elaborates on the research problem, the research objective and the research questions. A description of the behavioural conceptual framework is briefly given which is used to illustrate the behavior of farmers in their crop protection practices. From the research problem an objective was developed .which with the help of the behavioural conceptual framework by Van Woerkum a research question and sub questions were operationalised. The conceptual framework is given in this chapter.

### Overview of complete research setup



**Figure III: Overview of complete research setup**

Source: Research study, 2009

### 3.1 The Research problem

It is important subject to look into the spill over of export crop protection practices to the crops for the domestic market. It is assumed that farmers targeting the export sub-sector to the EU markets have adopted Good Agricultural Practices (GAP) in compliance with current private standards including Globalgap and that they apply similar practices for the vegetables sold on the domestic markets. **However, the problem is it is insufficiently known to which extent the use of pesticide practices for export vegetable is done on tomatoes destined for the domestic market. The export market crop protection rules are well complied with but it is not well known if the domestic crop protection rules are also complied with in the same manner** .There are different sources showing some evidence that non organic fruits and vegetables sold in various types of markets in Nairobi were found to contain dangerously high levels of chemical pesticide residues. In addition, evidence now shows that residents of Nairobi are exposed to high levels of chemical pollutants from both waste material and the foods they eat.(Table 1) The study commissioned by Kenya Organic Agriculture Network (KOAN) claims that most of the fruits and vegetables sold in Nairobi are contaminated with high levels of pesticide residue. (Esipisu-Daily Nation, 2007).

**Table 1: Pesticide contamination and their levels in tomatoes from Kenya**

Product	Source	Pesticide detected	Level (mg/kg)	EU recommended (mg/Kg)
<u>Tomatoes</u>	<u>Green grocer</u>	<u>Dimethoate</u> <u>Methoym</u>	<u>1.07</u> <u>0.08</u>	<u>0.02</u> <u>0.05</u>
Tomatoes	Nairobi supermarket	Abamectin Diazinon	0.13 0.93	0.02 0.02
Tomatoes	Wakulima	Ethion Parathion Methyl Terbutryn	0.30 0.08 0.19	NGG 0.02 NGG

NB: Heptachlor and Parathion Methyl pesticides detected are actually banned in Kenya (annex 6)  
Source: KOAN, 2006

The research was aimed to look at 15 non Globalgap certified farmers and find out whether they have learnt something from the Globalgap certified farmers who are their neighbours and farm next to them. On the other hand, the research was aimed to find out whether crop protection practices on one side of export production are influencing or interacting with the crop practices on the other side of the domestic market production.

The findings of this study can provide useful insights that can be used to give useful recommendations to supermarkets and government for the enhancement of food safety standards for the domestic market in Kenya.

### 3.2. Objective

To which extent do farmers use export crop protection practices for crops destined for the domestic market

### Research questions

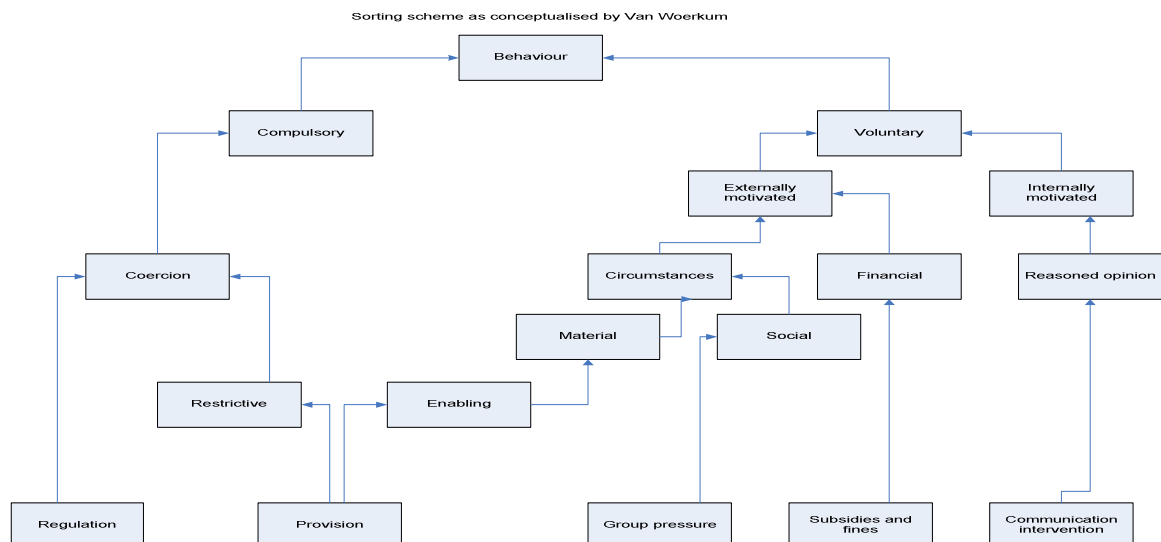
Following the above theoretical grounding of Van Woerkum (Figure II) this study seeks to answer the following main research question

### 3.3 Main research question

- A) What are the crop protection practices applied in crops destined for the domestic market for farmers carrying out export market crop production?

From the main question to the sub questions a kind of a conceptual framework is needed and a starting point is to see practices as behavior and how behavior of human beings is influenced by different factors "carrot", "stick" and "voluntary behaviour change". The "stick" refers to farmers facing punishment for failure to comply with pesticide rules. The three factors inducing behavior change can be much more elaborated and refined as figure II demonstrates. In this thesis not all elements of the model have been used and limit itself to the three main factors of behavioural change ("carrot", "stick" and "voluntary behavior change") which by the way in the model is indicated as coercion, fines ("stick"), subsidies and material ("carrot") and internally motivated (voluntary behavioural change) which is strongly related with effects of training and awareness campaigns.

### 3.4. Conceptual framework



**Figure II: The relationship between communicative intervention and other policy instruments aimed at stimulating behavioural change**

Source: Leeuwis (2006)

### **3.5. Sub questions**

Using the simple conceptual framework of 3.5 the following sub questions have been formulated

1. What are the sources of information farmers use with respect to pesticide use?
2. What are the training they get with respect to safe handling and use of pesticide?
3. Are there any remuneration for farmers if they apply pesticide rules?
4. What are the enforcement systems with regards to pesticide regulation?

### **3.6. Research Strategy**

The research had both quantitative and qualitative approach empirical data, literature and documents. The research strategy used included the desk study and a survey. For the survey, a stratified sample was selected where two clusters were selected, each cluster with 15 smallholder producers' one cluster had smallholder farmers involved in a Globalgap certified group and a second cluster had smallholder producer not involved in any Globalgap certification programmes or groups. All the farmers selected had to be growing French beans and tomatoes. In the survey a checklist was administered through an oral interview with the smallholder vegetable producers who gave an overview of the crop protection practices. A checklist was formulated for the survey where the list was derived from themes which were derived from the research sub questions that were formed from the main question using the behavioural conceptual framework by Van Woerkum. A session of pretesting of the Checklist on 10 farmers was carried out to identify gaps within the checklist and necessary amendments were done before using the final checklist. A focus group discussion which consisted of 15 farmers from Global certified group and another with 15 non Globalgap certified group was carried out for triangulation purpose.

### **3.7 Methods of secondary data collection**

A desk study was carried out for triangulation purposes and information on policies, standards and certification was collected from sources such as NGOs annual reports, Organizations annual reports, exporter's policy document and other publications

Gender distribution within the sample was taken into consideration. This is so because of the importance of gender in Agriculture. However there was the dominance of the male gender in all the groups.

#### **3.7.1. Literature review**

The literature review method was used to collect secondary information related to the research study which was partly done in Netherlands and partly in Kenya. It involved reviewing of annual report, monitoring reports and impact assessment reports of the various stakeholders. The

demographic, production data and economic information was extracted from the district report. Other information was extracted from the internet website of the various organizations.

A focus group discussion was also employed. The various tools were used to get concrete detailed information and for triangulation purposes. For instance a farmer informed that the exporters company allowed them to borrow the groups' protective clothing to use when spraying tomatoes, a fact that was disputed during the focus group discussion. The group categorically informed that the protective clothing was only used for French bean production purpose.

The interviews were carried out individually face to face for 45 to 50 minutes per interviewee. In two cases of the farmer interview translation was required. The interviews involved use of checklist and a lot of probing and verification through field observations.

### **3.8. Methods of primary data collection**

There were two methods used: the semi structured interviews and focus group discussion.

Primary data was collected by conducting open ended interviews to farmers, key informants and focus group discussion with two clusters of farmers those in Globalgap certified groups and those without Globalgap certified groups. The focus group discussion helped in triangulation for the farmer interviews carried out earlier. The questionnaire was pretested with 10 individual farmers and various adjustments were done, such as addition of relevant statements in the farmer survey checklist, new checklist formed included key informants and the final checklist had relevant question which were expected to answer the research questions.

#### **3.8.1. Farmer Interviews**

Field visits were made where the farmers were visited in their respective grading sheds and some in the field. Other stakeholders e.g. office workers, were visited in their respective offices. For the farmers, it allowed for observation of the grading shed and field activities for those visited in their respective farms. For the supermarket I was able to observe how the vegetables are handled, labeled and priced.

The interviews cut across vast sectors including the government bodies formulating standards and enforcing of various regulations, assisting farmer in various capacities and lastly supermarkets where the produce from the farms are marketed. Various actors, supporters and influencers of the tomato value chain were interviewed. It was crucial to interview all of them to get their various roles in either assisting the farmers or enforcing pesticide rules and regulation. The various interviews sort out to find out whether there are any rules and regulations that exist and if they exist which ones and the manner in which the enforcement is done.

### **Sampling**

The study area was Kirinyagah district in Central Province Kenya with a population of 225,117 persons. The study was undertaken from 12<sup>th</sup> July to August 21<sup>st</sup> 2009. The rationale for selection was based on the fact that the Kirinyagah district has the highest potential production for tomatoes and smallholder farmers have been involved in export production for many years. The farmers based in Kirinyagah operate in groups and most of them have been certified under Globalgap certification option 2. The farmers supply the export market with French beans, Okra and sugar snaps on the other hand they also supply the domestic market with vegetables such as

kales, carrots, cabbages and tomatoes. Farmers grow crops for export and domestic market in rotation and/or relay as a strategy to optimize limited land resource and as part of Integrated Pest Management method. Those producing for the export markets are already complying with the Globalgap standard. The situation for those producing for the local market is unclear.

The sampling for the farmer interviews was faced with a lot of challenges which included the initial farmer group sampled began to demand for money for each respondent if they had to be interviewed which resulted to a delay of the research study by five days for re-planning and getting in touch with a new farmer group. Secondly, the farmers were not willing to reveal the price of their tomatoes or income earned for fear that this could lead to calculation of their income tax.

Following the vast work experience I have in the sector I was able to select 30 individual farmers from groups I have previously worked with who grow both French beans and tomatoes and key informants who I have interacted with in different capacities. I planned to get more key informants from suggestion given by the selected informants. Initially there were 6 key informants selected which included (Kenya bureau of standards (KEBS), WONI VEGFRU exporter, Nakumatt supermarket, Horticultural crops authority (HCDA), Pesticide Crops Products Board (PCPB) and International centre of Insect Physiology and Ecology (ICIPE) then after preview of the sampling they totaled up to 11 key informant, the additional key informants included (Uchumi supermarket, Ministry of Agriculture (MOA), Ministry of public health and sanitation (MPH), Kenya Plant Health Inspectorate Services (KEPHIS) and the local authorities)

### **3.8.2. Focus group discussion**

Two focus group discussions were carried out one with farmers from Globalgap certified groups and the other with farmers without Globalgap certified groups. This was carried out to get an overview of the pesticide rules and regulation that exist, to see what the farmers are doing in various aspects of pesticide use and application. The focus group discussion assisted in triangulation of the individual interviews. All the findings were summarized in the next chapter. A focus group discussion included 12-15 members present and it took place in the grading shed for a period of one to one and half hours.

### **Research questions versus the respondent**

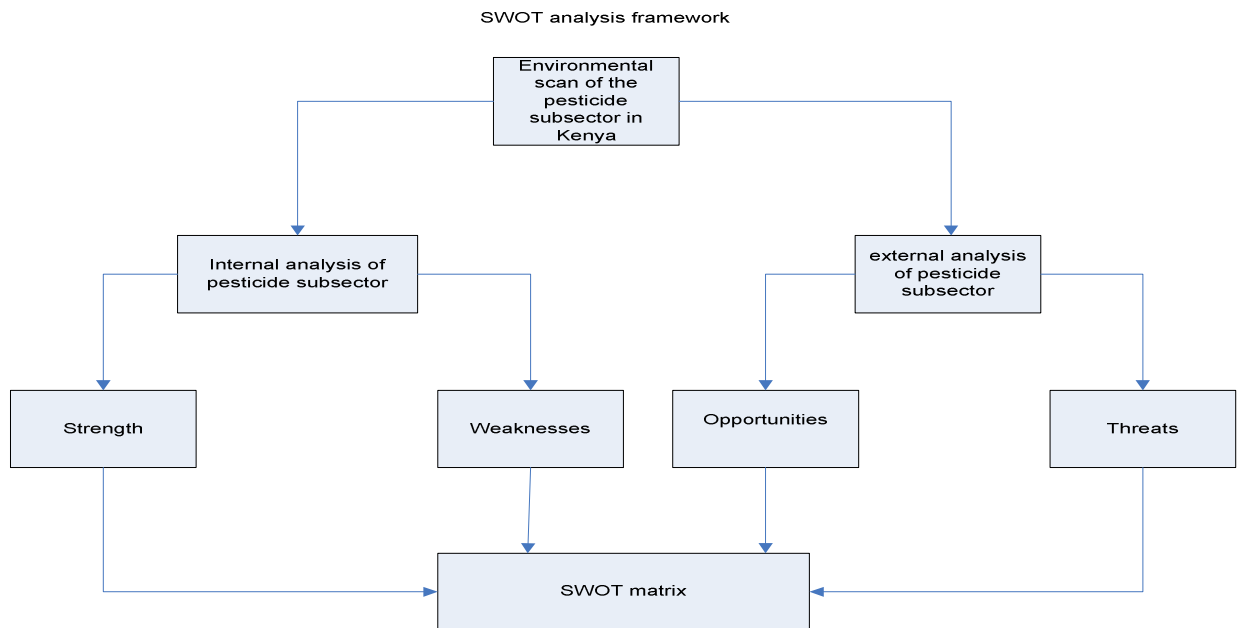
Farmers addressed question 1, 2, 3 and 4, Stakeholders interviews addressed questions 2, 3 and 4 and the focus group discussion addressed questions 1, 2, 3 and 4. See 3.5 for the list of research questions addressed.

### **3.9. Method of processing the collected data**

- The data collected from interviews with key informants, individual interviews with farmers and focus group discussion was summarized according to the various sub-question topics. The data was organized using word program, excel program, Visio program and it resulted to formulation of graphs, charts and tables. Tables were used to compare



between farmers from Globagap certified groups and those without Globagap certified groups.



SWOT/TOWS matrix		
	STRENGTHS	WEAKNESSES
OPPORTUNITIES	S-O strategies	W-O strategies
THREATS	S-T strategies	W-T strategies

**Figure IV: SWOT analysis framework**

Source: [www.quickmba.com/strategy/swot/](http://www.quickmba.com/strategy/swot/)

- The PESTEC analysis tool of the pesticide sector within the vegetable subsector was used to describes the factors which influence or hinder the compliance of food safety standards in internal and external environment of the subsector .The factors included political, economical, social, technical, environmental and cultural. The effect in the internal environment include the aspects that influence farmers crop protection practices such as the kind of stringent standards such as Globalgap which influence the behavior of farmers by complying to crop protection practices. The external

- environment involves the weak crop protection regulation and enforcement in Kenya from the public and private sector which influences farmers and distributors not to comply with crop protection practices for crops destined for the domestic market.
- The SWOT .analysis tool gave a clear overview of the strengths, weaknesses, threats and opportunities of the current pesticide subsector in terms of the standards and policies already developed and the state of crop protection, the roles of different public and private sector organization and how they are influencing the pesticide subsector..
  - A stakeholders analysis was also used to define the roles of the different stakeholders interviewed and their various issues in relation to the pesticide subsector..

## CHAPTER 4: FINDINGS AND RESULTS

This chapter gives a summary of the collected data where it was summarized as per the questionnaire checklist. The chapter also gives the findings, discussion of analysis and results in relation to other information put forward by other authors as referred in literature review. Some of the results are condensed and discussed holistically. This chapter describes the results of the farmer interviews, the focus group discussions of the two clusters one for smallholder farmer in Globalgap certified groups and the other is non Globalgap certified groups. Lastly, the interviews with key informants are also described in brief. The data collected and results are given together with the discussion and analysis. The findings are related to the sub questions of the research which sought answers to the main question; "what are the crop protection practices applied in crops destined for the domestic market "for and the interaction of crop protection practices from the Globalgap certified farmers to Non Globalgap certified farmers as well as spillover in the Globalgap certified group.

### 4.1. Findings:

#### 4.1.1. Collected data

This section gives a summary of the data collected from the individual farmer interviews, focus group discussion and stakeholders' interviews

**Table 2: Collected data from farmers interviews**

Pesticide use aspect	Globalgap certified farmers N=15	Non - Globalgap certified farmers N=15	Remarks
1. Knowledgeable on pesticide rules and regulation for domestic market	15	15	
2.Groups formed for Marketing of French beans Community service	15 1	0 0	
3.Access to Pesticide equipment Access to a sprayer Borrows a sprayer –neighbour Borrows from exporter store	10 0 5	9 6 0	The exporter provides the sprayer & PPE in the group store a sprayer & protective clothing
4.Synthetic chemical pesticide sources for farmers Agrovet sells Exporter provides	15 9	15 0	Some access chemical pesticides for French beans from exporter whereas for tomatoes from the agrovet
5.Practising crop farming methods Crop rotation	15	12	Some farmers practice both the rotation and

Intercropping	1	6	intercropping
5. Marketing of tomatoes			Some sell direct as well as through the brokers
Direct to retailer	12	6	
Sells through brokers/middlemen	3	9	
6. Markets that farmers sell their tomato produce			Some sell to both markets
Kagio local market-Kirinyagah	10	10	
Wakulima market Nairobi	5	7	
7. Certification done by exporter	15	0	Non Globalgap farmers are not certified
8. Trained on safe use of pesticides for farmers	15	2	Summarised in table 6 next section. Some farmer have been trained in more than one training.
9. High levels of rejects	15	0	The high levels of rejects were only noted in French beans from exporter levels for tomatoes are as little as 10% at farm level. Reason was quality aspect of appearance, (size, shape & pest damage)
10. Pesticide container disposal mode			
Use of disposal pit	15	2	
Buries in the soil		3	
Throw away		6	
Disposes in pit latrines		3	
Burning of the containers		1	
11. Have heard information of reports on pesticide contamination	2	0	They heard from another group that the French beans were found to contain Dimethoate and the farmer responsible was expelled from the group
12. Subject to a traceability system for pesticides	15	1	Traceability exists only for French bean crop
13. Product recall exist where if pesticides found the lot of product can be recollected back			Recall system exists only for French bean
Recall system exists	15	0	
Not aware of such a system	0	5	
Recall system doesn't exist	0	11	
14. Pest control methods used			

Chemical pesticide application	15	15	
Botanical pesticides	4	1	
Integrated pest management	12	3	

Source: Research study, 2009

16. Do you use structure for export produce to handle domestic produce?

15 of the Globalgap certified farmers do not use the grading shed for crops destined for domestic market whereas 15 non Globalgap certified farmer are not in groups which own any grading shed only used for grading export French beans

17. How is handling of tomatoes, the packaging and post harvest handling?

use plastic buckets to harvest, 15 of the Globalgap certified farmers and 12 non Globalgap certified farmers place on manila material on the ground, 2 of non Globalgap certified place on paper carton placed on the ground, All the 30 harvest in plastic buckets then they pack in wooden crates to be transported (30-40kgs wooden crates) to various markets

18. Sources of information for pesticide use

The summary is given in the next section table 4

20. List of chemical pesticides used by farmers in Kirinyagah

**Table 3: List of chemical pesticides used on Frenchbeans and tomatoes by farmers in Kirinyagah**

A represents =Globalgap certified farmers using the chemical

B represents=Non certified Globalgap farmers using the chemical

Tomatoes (domestic market)		French bean (export market)	
Trade name	Active ingredient	Trade name	Active ingredient
Karate 2.5.WG (A,B)	Lambda cyhalothrin	<b>Bestox(A)</b>	Aphacypermethrin
<b>Bestox 20EC (B)</b>	Aphacypermethrin	Alphatox(A,B)	Aphacypermethrin
Mistress(A)	Cymocacylin+Mancozeb	<b>Dithane M45(A)</b>	Mancozeb
Tata Alpha 10 EC(A,B)	Alphacypermethrin	<b>Oshothene(B)</b>	Mancozeb
<b>Dithane M45 (A)</b>	Mancozeb	Fastac 10EC(A)	Alpha cypermethrin
Copsap (B)	Copper oxychloride	Tata Umeme 2.5.EC(A,B)	Lambda cyhalothrin
Milraz WP(A)	Propineb+Cymoxanil	Thiovit(B)	Sulphur
<b>Oshothene(A,B)</b>	Mancozeb	Ortiva SC(B)	Azoxystrobin
Antracol WP 70(B)	Propineb	Decis tab(A)	Deltamethrin
Duduthrin 1.7.EC(A)	Lambda cyhalothrin	<b>Dimeton(A,B)</b>	Dimethoate
Methane(B)	Mancozeb	<b>Thunder(B)</b>	Imidacloprid
Agrinate 90SP(B)	Methonyl	<b>Atom 2.5.EC(B)</b>	Deltamethrin
<b>Dimeton(A,B)</b>	Dimethoate	Alpha guard(B)	Alpha cypermethrin
<b>Atom 2.5.EC(B)</b>	Deltamethrin	Cuppracaffaro	Copper oxychloride

		WP(A)	
Polytrin P 440 EC(B)	Profenofos cypermethrin		
Pencozeb(A)	Mancozeb		
Wet sulf WP(B)	Sulphur		
Ridomil gold MZ 68WG(B)	Metalaxyl+Mancozeb		
Thunder(B)	Imidacloprid		
Dynamec 1.8 EC(A,B)	Abamectin		
Lannate 90SP(B)	Methomyl		

NB: Highlighted are chemical pesticides similar for both French beans and tomatoes.

Source: Research study, 2009

21. Number of sprays for French beans and tomatoes per season  
The summary is given in the next section table 8 in the next section

22. The farmer's compliance level for the good crop protection practices  
The summary is given in the next section table 9 in the next section

#### 4.1.2 Stakeholders interviews

The stakeholders interviewed included Horticultural Crops Development Authority (HCDA), Ministry of Agriculture (MOA), Kenya Plant Health Inspectorate Services (KEPHIS), Kenya Bureau of Standards (KEBS), Ministry of public health (MPH), Pesticide Crops Products Board (PCPB), International Centre for Insect Physiology and Ecology (ICIPE –NGO), WONI exporter, Nakumatt and Uchumi supermarket. The findings are elaborated in annex 13 and a summary of the outcome is given in this section

The study showed that the national food safety system in Kenya is managed by various agencies under different ministries and laws. Each agency operates independently to fulfill the function for which it was established and complements the basic laws for food safety namely the food drugs and substances Act Cap 254 and the Public health Act Cap 242, whose common goal is to safeguard the health of the people (FAO, 2005). The main agencies include KEPHIS, MPH, PCPB, MOA, HCDA and KEBS. Safety and quality control activities are distributed along the food supply chain resulting in a food chain approach. Some of the regulatory agencies without laboratories have collaboration with other institutions to facilitate provision of support services. However, all the activities at each level require integration into a coordinated system. KEPHIS is involved in sampling of horticultural vegetables in the market for the purpose of testing of the pesticide residue levels and thereafter facilitating awareness campaigns and trainings in the country and sensitizing people on the pesticide residue. This was confirmed by FAO (2005) that to complement the inspection and enforcement system, the major agencies namely MPH, KEPHIS, and KEBS have laboratory support services, which carry out analysis for adulteration and quality assurance. They include radiation, mycotoxin, heavy metals, pesticides and drugs, biocides and pathogen. The ultimate aim is promoting public health and protecting the consumer against health hazards, and enhancing economic development.

However, it is also noted that HCDA is currently involved in facilitating trainings on safe use of pesticides and it facilitates information sharing through the press (radio and television), baraza's (district forums) and cooperatives. KEPHIS is involved in withdrawal of Phytosanitary certificates for exporters whose export produce is found to have exceeded maximum residues until they have made an action plan. There is a food safety committee in Kenya which looks into the issues of food safety especially for export crops and some of the stakeholders such as ministry of public health are members of the committee. There exist a national task force for horticulture consisting of public and private sector organization such as MOA, KEPHIS, HCDA, MOLFD and FPEAK among others which are mandated to look into all issues related to the horticulture sector. The PCPB is involved in registration of new products and in ensuring registered chemical pesticides are stocked in agrovet shop. However they complained that most of their laws are outdated.

Some of the supermarket have introduced stringent standards such as Nakumatt which insists that their supplier should be complying to KENYAGAP which is a standard benchmarked against the Globalgap. The supermarkets are working in collaboration with FPEAK in ensuring producers meet the KENYAGAP standard .The FPEAK were involved in initiating the KENYAGAP standard which has evolved from the second edition of FPEAK code of practice which has undergone benchmarking against GLOBALGAP. They are also involved in facilitating training on the KENYAGAP and carrying out internal audits where Africert Kenya limited facilitates the external audits.

The ministry of Agriculture is involved in provision of extension services. They also collaborate with PCPB and Agrochemical Association of Kenya in providing trainings on safe use of pesticides. The exporters are involved in facilitation of trainings on (safe use of pesticide, integrated pest management and crop production practices) , they facilitate construction of grading shed, toilet, pesticide store, protective clothing ,water facilities, building of a group pesticide store, wash room, transport for collection of export produce and payment of certification for Globalgap. Lastly, the non governmental organization ICIPE is involved in training on Integrated Pest Management-IPM, Globalgap standard and they collaborate with exporters as well as ministry of Agriculture to train the technician , farmers and private service providers on IPM and Good Agricultural Practices.

It was noted from the stakeholders that none of the agencies is mandated to enforce pesticide maximum residue level for the domestic market thus when issues arise they tend to shy away and blame one another. Majority of the stakeholders said that the food safety issue should be handled by KEPHIS since they have the facilities for sampling and testing chemical pesticide residue and that they have started already with carrying out sampling of horticultural produce in the market although findings have not been published.

#### **4.1.3 Focus group discussion**

##### **i) Focus group discussion for Globagap certified farmers**

A total of 15 farmers participated in the focus group discussion .The farmers were from various groups the Baricho growers group (8), Kionereria (4) and Kanguka group (3). (Annex 8)  
All the farmers in Globagap certified groups are practising crop rotation and relay planting in addition some are also carrying out intercropping (1).They are practicing crop rotation with tomatoes, maize, French bean, beans kales, cabbage and onion in order of popularity and importance especially for the research area.



All the farmers in the focus group discussion belong to a Globalgap certified groups which has a technical assistants who provides technical information although information on pesticides for tomatoes is sourced from the agrovet attendant and sometimes trainings are carried out by the agrochemical companies such as Orion and Farm chem agrochemical companies. The farmers source synthetic pesticides for French beans from the central chemical store for the group which is organized by the exporter company. The equipment such as protective clothing (13) and sprayers (15) are provided from the central store in the grading shed which is used for application of French beans only. . The disposal pit in the field (15) and seepage pit are used for pesticide containers disposal or chemical remaining for all crops not only French beans. The farmers are familiar with preharvest interval and they observe for both tomatoes and French beans. They also look for less toxic pesticides to be use on their crops

The French beans are packed in plastic washable crates whereas the tomatoes are harvested in plastic buckets and packed in wooden crates. The marketing of French beans is through the exporting company who organizes to collect the French bean whereas for tomatoes the farmers sell in Kagio market or take them to Nairobi Wakulima market.(12) out of the 15 farmers market their tomatoes direct to retailer whereas (3) the market organization is through brokers.

The French beans have an organized traceability system with labels which contain the farmers number, block number group name and date. The produce can be traced back to the farmer who harvested the produce unlike the tomatoes where there is no traceability system.

Farmers (14) keep records for French bean for planting, pesticide spraying, fertilizer and harvesting records this is mandatory for the company whereas for tomatoes farmers only keep pesticide spraying records (type of pesticide, amount used, date of spraying) to show the effective pesticides used and harvesting records (amount harvested, harvesting date) to show the amount of produce for the purpose of calculating profits. Majority of the farmers are using chemical pesticide for control of pesticides.

The farmers said the only negative impacts of the French bean farming is the fact that sometimes the exporter refuses to pick their produce thus they have losses incurred which is translated to the crops meant for the domestic market such as tomatoes which the farmer ends up lacking money for purchasing pesticides or fertilizer for the domestic crops

The farmers have been trained on safe use of pesticides.(15)

The challenges faced in tomato growing is pest (insects pest and diseases), low farm gate prices which are fluctuating whereas for French bean it includes pest(insect pest and diseases ) and sometimes lack of marketing for produce.

**NB:** (x) number of farmers

## **ii) Focus group discussion for farmers without Globalgap certified groups**

A total of 15 farmers participated in the focus group discussion .The farmers were from different regions which included: Kionereria, Kathanji and Kanguka area. All the farmers in the focus group discussion don't have a Globagap certified group or are members of any group.

They are practicing crop rotation with tomatoes, maize, kales, French bean, beans, cabbage and onion listed in order of popularity and importance particularly for the research area.

The farmers source technical information from the agrovet and the trainings (2) facilitated by the agrochemical companies such as Orion agrochemical company. The farmers source synthetic pesticides for French beans and tomatoes from the agrovet shops (15) which are available in the region. The equipment such as protective clothing and sprayers is owned by the farmer although majority of them don't have or use protective clothing they borrow from their fellow farmers. The farmers pesticide containers are disposed off using different modes disposal pit (2) thrown away

(6), burn (1), burying (3) and sometimes disposed off in the pit latrines (3). They lack disposal pit for disposal of pesticide containers and seepage pit for disposing the remaining pesticides. Majority of the farmers are familiar with preharvest interval (7). The French beans are packed in boxes whereas the tomatoes are harvested in plastic bucket and packed in wooden crates. The marketing of French beans is through the brokers (9) or direct to retailers (6) who organize to collect the French bean from farmers field whereas for the tomatoes the farmers sell in Kagio market (10) or the brokers transport them to Nairobi Wakulima market or sometimes the farmers organize to transport them to Nairobi Wakulima (7) market. Farmers (9) the market organization is through brokers and (6) and others direct to retailers.

The French beans don't have an organized traceability system with labels since they are sold through brokers. The produce cannot be traced back to the farmer who harvested the produce this is similar to the tomatoes where there is no traceability system at all.

Farmers keep records for French bean and tomatoes (8) only records for spraying pesticide record (date of spraying, amount sprayed, type of chemical) and harvesting records (date of harvesting, amount) for the purpose of calculating profits and for the pesticide record to refer to the type of pesticides that were effective. Majority of the farmers are using chemical pesticide for control of pesticides (15) and other use botanical pesticides tobacco (1)

The farmers said the only negative impacts of the export French bean farming is the fact that sometimes there is lack of market for French beans.

The challenges faced in tomato growing is pest (insects pest and diseases), low farm gate prices which are fluctuating whereas for French beans pest (insect pest and diseases) and sometimes lack of marketing for produce.

**NB:** (x) number of farmers

## 4.2. Results

### 4.2.1. The sources of information for the export and domestic market production

**Table 4: Farmers general knowledge and source of information on pesticide selection**

Source of information	Farmers with Globagap certified groups n=15	Ranks	Farmers without Globagap certification n=15	Ranks
Agrovet attendant	3	3	10	1
Exporters technical assistant	6	2	0	4
Hired private sprayers	1	4	0	4
Trained-self knowledge	8	1	3	2
Ministry of Agriculture extension officer	0	5	2	3
Fellow Farmer	0	5	3	3

Source: Research study, 2009

The farmers from Globagap certified groups source information on pesticide selection mainly from self knowledge which is as a result of the training given by produce exporters (exporters technical assistants, agrochemical companies and Non governmental organisations) this ranked first (table 4), agrochemical companies such as Orion and Twiga chemicals , the non governmental organizations such as International Centre Of Insect Physiology and Ecology (ICIPE) and Agribusiness and Allied services were reported to have facilitated hands-on trainings on safe use of pesticides. For non Globalgap certified farmers they mainly source information on pesticide selection from the agrovet attendant which ranked first as shown (Table 4). This was confirmed by Bayer cropScience (article no date) that various training have been provided to green world project traders the training provided most of the traders with basic knowledge of the methods of good agricultural practice, correct modern crop protection and safe use of pesticides, which they passed on to their customers with great enthusiasm. The training programmes have also been targeted on farmers themselves through farmers' days and seminars. The focus group discussion also confirmed that the farmers have been trained by various agencies (4.1.3) above.

The second ranked source of information for Globalgap certified farmers is the technical assistants employed by the various export companies such as Kenya Horticultural Exporters (KHE) and value Pak who have subcontracted the interviewed farmers. The farmers also ask technical persons employed by exporters questions regarding tomatoes since most of the synthetic chemical pesticide sprayed in French beans are similar to the ones sprayed in tomatoes as indicated in previous section on table 3. The farmers without Globagap certified groups get their information mainly from the agrovet attendant who sells synthetic pesticide to them. However, some farmers complained that sometimes the agrovet attendant are not always reliable, some don't have sufficient knowledge on the synthetic pesticide they are selling.

For the farmers without Globalgap certified groups the self knowledge through training ranked second where these trainings are facilitated mainly by the agrochemical companies, Non governmental organizations and sometimes farmer to farmer training. This was confirmed by Bayer crop science (article no date) that through the Green World concept Bayer CropScience has introduced a unique concept for farmers growing tomatoes in Central Kenya: The Bayer Tomato Club (BTC). The club is comprised of tomato farmers, each with at least one acre of the crop. The farmers are organised into groups of twenty. Each group has to be registered with the Ministry of Social Services and must have some set of rules and regulations. The club has 45 groups currently made up of 900 farmers. The objective of the club is to give information to farmers on how they can produce tomatoes optimally through observance of good agricultural practices (GAP).

The farmers were reported to also source information from fellow farmers through farmer to farmer information sharing such as the farmers in Globagap certified groups which implies further interaction of good crop protection practices among the two clusters. (Table 2).

**Table 5: Farmers sources of technical information pest identification and on pesticide use**

Sources of information for pesticide use	Globagap certified farmers N=15	Ranks	Non Globagap certified farmers N=15	-	Ranks
Agrovat attendant	3	4	8		2
Exporters technical assistant	10	2	0		5
Trainings	15	1	2		4
Ministry of Agriculture extension	9	3	3		3
Farmer to farmer sharing	0	6	9		1
Agrochemical companies	2	5	0		5

Source: Research study, 2009

The members of Globalgap certified groups get technical information on pest identification and pesticide use for tomato production from mainly the trainings that are facilitated by different agencies which include agrochemical companies, Non governmental organization (Agribusiness and Allied/ICIPE) funded by BSMDP and the horticultural exporters .The farmers from both the farmer interviews and focus group discussion and some stakeholders reported that farmers have been trained on Integrated pest management where they are able to identify pest (insect pest and diseases and the kind of pesticides to use. The government through the Ministry of Agriculture could replicate what the Gueatamelan government has doing as seen in (annex 12) where they have introduced IPM research and developed strategies to reduce pesticide use and residue on snow peas and to enhance product quality. The IPM program has an on-farm research training component and pre-inspection component for pre-harvest handling so that most snow peas are produced and handled in a manner consistent with U.S standards. Snow peas. The IPM systems in Guatemala have also been included in government supported integrated crop management demonstrations and training programs that cover practices such as pest identification and monitoring, trap cropping, soil disinfection, bio-rational pesticide use and variety selection.

For French beans the farmers get information also from trainings as well as the Exporter's technical assistant which ranked second for Globalgap certified farmers. (Table 5). The Globalgap certified farmers were well equipped with information regarding pest identification (insect pest and diseases) 14 out of 15 whereas a few farmers without Globalgap certified groups 5 out of 15 were well equipped with information on pest identification (insect pest and diseases)(Table 9).The high level of knowledge is attributed to the integrated pest management training the Globalgap certified farmer have received as indicated in the (Table 5)

In contrast, farmers without Globalgap certification groups source all there technical information on tomato and French bean from fellow farmers through the farmer to farmer information sharing this was said by one of the farmers, Mr. Wanjohi, *"We get a lot of our information from our fellow farmers who are in Eurepgap certified groups and who have exporters who can train them."*. The second ranking information source for Globalgap certified farmers was the agrovet shops.(Table 5).The agrovet shop is the easiest mode the farmers without Globalgap certification use since they buy the pesticides from the agrovet who stocks only approved chemical pesticides and they have been trained by the agrochemical companies as seen in previous quoted literature. The agrovet attendants are very willing to give information since they are interested in raising their daily pesticides sales. The agrochemical companies are also involved in field days and seminars for farmers to show case their products and as part of marketing strategies to increase their company sales. Despite that, farmers benefit greatly from the agrochemical companies input.

As seen in the (table 5) above the ministry of agriculture ranked third .However, some farmers reported that the Ministry of Agriculture was unreliable and almost inexistent .Similar findings were reported by Nyambo ,et al., (2009) that the government-funded extension services are constrained by a number of factors: (1) an extension worker is assigned a large area and must advise farmer groups who are often sparsely located; (2) extension workers have no reliable transport and so cannot provide good-quality services to all; (3) few extension officers are well versed in the current technical demands of the market, and so are unable to provide relevant information to growers; (4) many extension officers lack business skills and group-management skills, which are basic requirements for managing out-grower farmer groups as viable business enterprises; and (5) services provided through contract farming are unsustainable, particularly when partnerships are severed due to conflicts of interest between and within groups and exporters. When this happens, as it frequently does, growers have to seek new partnerships and services, and the production and/or supply chains crash as a result. In the stakeholders findings it was reported by Ministry of Agriculture that they are involved in facilitating intensive trainings however, other sources such as literature and farmers confirm that the national extension services are unreliable and almost inexistent. The reason for its unreliability could be the lack of motivation for the extension officers and lack of funds for transport to access the farmers and they are assigned a large region thus making their services ineffective.

#### 4.2.2 The training on safe handling use of pesticide

**Table 6: Facilitation of trainings on integrated pest management and safe use of pesticides**

Agencies facilitating the training	Number of farmers trained			
	Globalgap certified farmers	Ranks	Non Globalgap certified farmers	Ranks
Agribusiness and Allied company and ICIPE through BMSDP project	6	1	0	3
Agrochemical companies	2	2	2	1
Horticultural Exporter company	6	1	0	3
Exporters technician	6	1	0	3
Fellow farmer group (Kaka)	0	4	1	2
Demonstration (Miandi)	0	4	1	2

Source: Research study, 2009

Various agencies have been involved in training farmers in the region. The majority of the Globalgap certified farmers have acquired trainings on the subject of integrated pest management and safe use of pesticide from Non governmental organization such as Agribusiness and Allied company and ICIPE which was funded by Business Services Marketing Development Project (BSMDP), the horticultural exporting company also facilitates frequent training to its subcontracted farmers and lastly, the technician employed by the exporter facilitates training when necessary since they are qualified technician with above a diploma certificate thus they are very knowledgeable. (Table 6). The facilitation of the training to farmers was also confirmed by the stakeholder's interviews as seen in (4.1.2) and the focus group discussion (4.1.3) above.

For the non Globalgap certified farmers mainly acquire trainings from the agrochemical companies as reported by farmers which implies that they are aggressive in training because they are business minded people with the aim of ensuring their sells are high. (Table 6) They facilitate training to farmers as they advertise their new products in the market. They also train stockist who are stocking their pesticide products and have been reported to be helpful to farmers in terms of offering advisory information and they are easily accessible in any region of the country. This was confirmed in the focus group discussion where farmers reported to get a lot of information on pest identification and pesticide use from agrovets which ranked second. This was also mentioned by respondents in the focus group discussion and the stakeholders (Table 5).

The trainings which have been facilitated have had positive impact this is seen from the information gathered from interview and focus group discussion where apart from the use of



synthetic chemical pesticides farmers are using other methods such as botanical where as seen in table 2 in previous section that 4 out of 15 farmers in Globalgap certified group and 1 out 15 farmers in non Globalgap certified are using botanical pesticides such as ashes. The farmer from Non Globalgap certified was using tobacco which is forbidden in production of export crops and when asked why she is using, she said, *"I use tobacco since it is easily available and it is very effective."* When asked why she was using it when it is banned she said she was not aware it was banned and harmful.

The outcome of the interview and focus discussion confirmed that the trainings on Integrated pest management have been effective since 15 farmers (Table 2) have reported to have knowledge and to be practicing Integrated pest management practices. In addition as seen on (table 10) below farmers are fully complying to various Good crop practices such as cultural practices was practiced by Globalgap certified farmers 13 out of the 15 whereas non Globalgap certified 4 out of the 15 .For the use of physical pest control methods the farmers who fully complied were 13 out the 15 Global certified farmers and 4 out of 15 non Global certified farmers. This show that the training carried out by the exporter and non governmental organizations are more intense and effective than other agencies facilitating trainings for the non Globalgap certified farmers as shown on (table 6 )above. The exporter has to be effective in the trainings since the importer pressurizes them to comply with all the standards otherwise they loose the market .As for the non governmental organization they are donor funded and their project have to show impact to the donors and they recruit staff who are qualified and are up to date with the current required information. The Non governmental organization is involved in intense capacity building for their employed staff in relevant trainings. As reported in the stakeholders interviews ICIPE has facilitated the training of their staff in food safety, Integrated Pest Management training , Globalgap, safe use and handling of pesticides and Hazard analysis critical Control Point (HACCP) training which is what was necessary to enable them facilitate training to the farmers. This training for Integrated Pest Management (IPM) was confirmed by an article in the Pesticide news (2006) that the Kenya-based International Centre for Insect Physiology and Ecology (ICIPE) has been working for over a decade on Integrated Pest Management (IPM) systems suitable for smallholder production in export and domestic market crops.

Farmers are also practicing Good Agricultural Practices such as crop rotation 27 out of 30 respondents and intercropping is practiced by 7 out of the 30 respondents. The practices are attributed to farmers own knowledge and also the fact that or the Globalgap certified farmers it is mandatory to intergrate crop rotation in their export crops planting programme.

The training on safe use of pesticides has also been effective since farmers are able to identify the kind of synthetic pesticide they use in their fields (table 3).It proved to be more effective for Globalgap certified farmers as seen on (table 2 number 10) where 15 of Globalgap certified farmers use proper means of disposing chemical pesticide container unlike only 2 of the non Globalgap certified farmers that are using disposal pit .Other improper methods were used by non Globalgap certified farmers which included: burning (20%), throwing away (40%), disposing in pit latrines (20%) and burying (7%). The proper disposal is to ensure the pesticide containers are not used for drinking water or to pollute the environment. This was confirmed by a study done by Waiganjo et al., (2006) where it was revealed that empty containers were disposed off in the waste pits/latrine (76%), or were burnt (36%). A small percent (9%) either left the empty containers in the farm or sold them to the scrap metal dealers





**Plate 2: Picture showing a disposal pit in the farm**

Source: Research study, 2009

As seen in (table 2) for the Globalgap certified farmers their French bean is highly rejected and the reason was not pesticide residue but quality in terms of appearance (shape, size and pest damage) except for one case in 2004 in a different group in Kirinyagah where Dimethoate was found in produce and because of the good traceability system the farmer was traced and expelled from the group and because of the well developed recall system in the export market the products lot was recalled back. As reported by farmers on (table 2 number 12 and 13) the traceability and recall is well developed for farmers in Globalgap certified groups this is was only done in export horticultural produce and not tomatoes for the domestic market which is a gap.

**Table 7: Farmers rate of use of protective clothing**

<b>Pesticide use equipment</b>	<b>Farmers in Globalgap certified groups n=15</b>	<b>Ranks</b>	<b>Farmers without Globalgap certified groups n=15</b>	<b>Ranks</b>
Use of all the Protective clothing(mask, gumboots, cap, overall and goggles)	13	2	1	3
Access to sprayers (Owned/group/borrowed)	15	1	15	1
Only gumboots	0	3	3	2
Use of nylon paper as gloves	0	3	1	3

Source: Research study, 2009



**Plate 3: A farmer spraying without protective clothing**

Source: Research study, 2009

As reported by farmers in (table 7 ) above it shows that the Globalgap certified farmers 13 out of 15 are using all the protective clothing which include the gumboots, mask, overall, cap and proper sprayers whereas only 1 out of 15 of the non certified Globalgap farmer are using all the protective clothing. The Globalgap certified farmers high level of compliance is attributed to the intensive and effective trainings facilitated by the exporter, Agribusiness and Allied company and ICIPE funded by BSMDP as well as the fact that the exporter provides the protective clothing at the store for the farmer group so the protective clothing is easily accessible to the Globalgap certified farmers. The exporter is scrutinized by their buyer who organise to make un pronounced visits to farms at the exporter level to check whether farmers welfare is adhered to in terms of farmers health by provision of protective clothing, secondly the buyer and consumers checks on the environmental health such as the use of disposal pit and farmers avoiding contamination of the water sources and lastly consumer health where pre harvest interval is observed and this is monitored through the critical scrutiny of record they keep for pesticide use.

The trainings and information farmers get makes the farmers behave in a positive way by voluntarily complying with the pesticide rules and regulation this was explained by the behavioural conceptual framework discussed and shown in (Figure II) where there is self motivation of the farmers which is resulting from the trainings and information access.

**Table 8: Number of sprays per season for French beans and tomatoes**

Number of sprays	Farmers in Globalgap certified groups n=15			Ranks	Farmers without Globalgap certification groups n=15			Ranks
	Tomato	French beans	total		Tomato	French beans	total	
1-5	2	12	14	1	0	5	5	3
6-10	7	4	11	2	5	10	15	1
11-15	7	0	7	3	8	0	8	2
16-20	0	0	0	4	0	0	0	5
21-25	0	0	0	4	2	0	.2	4

As shown in (table 8) above farmers from Globalgap certified groups majority of them apply fewer sprays (less than 5 times per season) compared to the farmers from groups without Globalgap certification where we have spraying more than 6 times. In some cases the non Globagap certified farmers group sprayed more as many times as 21 times per season this is attributed to lack of sufficient knowledge on safe use of pesticides. As indicated earlier fewer farmers have been trained 2 out of 15 (table 2). The fewer times of spraying by farmers in Globalgap certified groups is attributed to the fact that they have undergone intense training on safe use of pesticide and integrated pest management. As confirmed by a study carried out in Kirinyagah by Waiganjo, et al.,(2006) which revealed that among the farmers who had been trained, the following: disease identification(49.2%), tomato quality aspects (43.3%) pesticide safety (40.8%) and insect identification (35.8%) pesticide usage (27.5%) were the most common topics while integrated pest management -IPM (20.8%) was the least commonly taught.

The farmers reported that they always get high percentages of rejects for their French bean which is not the same case for tomatoes. The reason they get rejects is because of poor quality



and they said farmers from other groups have reported that their French beans were ones rejected because Dimethoate pesticide residue was found in high levels. A farmer Mrs. Wanjiku added by saying, *"Sometimes we see the farmers not in our certified group spraying dimethoate on tomatoes when they are ripened and almost ready for harvest but we normally advise them accordingly since dimethoate has a preharvest interval of 17 days and it is harmful."*

#### **4.2.3 Remuneration for farmers if they apply pesticide rules**

The farmers could get a remuneration as seen in the behavioural conceptual frameworks in this case it means if farmers are complying with standards then their farm gate price is higher compared to the farmers not complying to the standards. In the study it was found out that the sub contracted farmers in Nakumatt are complying to the KENYAGAP standard which is a standard in Kenya that is benchmarked against the international Globalgap standard. A total of 200 active farmers subcontracted by Nakumatt have been trained through their supplier 'Fresh and Juici' by Fresh Produce Exporters Association of Kenya (FPEAK) organization and are in the process to be certified by the end of 2009. The trainings were confirmed by FPEAK director (Annex 13) who said that 300 farmers are certified with KENYAGAP and many other farmers have been trained on KENYAGAP standard. The farmers get a better farm gate price for complying unlike the farmers not complying with KENYAGAP they even dictate the price which also depend with the supply and demand as shown in the tomato value chain (Figure 1). This was confirmed by Nakumatt supermarket vegetable manager in the stakeholders interview as seen in (4.1.2) above.

Majority of the Globalgap certified farmers from Kirinyagah 12 out of the 15 (table 2) are selling directly to the market and 3 others through middlemen/brokers whereas the non Globalgap certified farmers majority 9 out of 15 are selling through brokers/middlemen. The high number of Globalgap certified farmers selling direct is as a result of the Globalgap training which they have through the exporter that makes them attractive to direct buyers such as Nakumatt who are currently subcontracting farmers who have KENYAGAP training which was confirmed by the Nakumatt in the stakeholders interviews (4.1.2) above. The Globalgap training farmers have undertaken makes it easier for them to comply with KENYAGAP and the buyers target such farmers since they know they are able to comply with necessary standards such as KENYAGAP or quality standards. As reported by FPEAK (2009) that in recognition of the need to meet these standards of environmental management, products food safety, quality, traceability and occupational health and safety of workers, FPEAK launched the code of practice that has so far changed its name into KENYAGAP) in 1996 as a certification measure for producers and exporters to achieve. KENYAGAP can be utilized by individual companies or farmers as production and a marketing tool upon certification. As reported in the stakeholders interviews summary (annex 13) FPEAK is involved in training of farmers on KENYAGAP standard and has 300 farmers registered with KENYAGAP standard. FPEAK confirmed that they facilitate internal audits which are followed by external audits undertaken by Africert Kenya Limited

*"The national KENYAGAP standard was benchmarked against the Globalgap standard (an international private standard) and it is therefore a private standard owned by FPEAK. Currently it is being used by the conventional markets for horticulture produce as the KEBS standardization mark"* (Dr. S. Mbithi, August 2009, personal communication).

The WONI-VEGFRU exporter director (Annex 13) Mr. Mutiso said, " *We are training our export produce subcontracted farmers on safe use of pesticide where the good practices learnt by farmers are spilling over to the produce destined for the domestic markets.*" Similar findings are reported by Battisti, et al, (2009) that they observed further that the majority of African growers supply the domestic market in their own countries and although private voluntary food safety standards directly affect export chains, they also indirectly influence the produce destined for domestic markets. Battisti, et al (2009) where Steve Horner commented " *public legislation cannot keep up with fast moving consumer concerns so private standards fill in the gap.*"

Apart from Nakumatt supermarket we have other outlet in Kenya supplying clean and safe products. This is confirmed by literature (Kreuzer, 2009) where Madam Su Kahumbu was first known through the organic shop and supplying supermarkets with her product segment Green Dreams. The Green Dream range is also sold on its own special shelves in seven supermarkets belonging to three different chains. As reported by Su Kahumbu (2008) she said, " *I started my company Green Dreams Ltd Kenya in 2000 on a farm producing organic products which we sold on the local market. I have developed the company to being one of the biggest names in organic agriculture in East Africa. To do this I have had to develop a supply chain from scratch in Kenya. This has meant having to develop an out growers scheme from the basics of organic fundamentals. Teaching the farmers the code of organic as well as the methods of production*"

However, organized marketing system to separate the vegetables grown by use of good agricultural practices and those not grown without good agricultural practices is lacking except for a few outlets which have developed their own chains as mentioned above. This is confirmed by IIRR (2008) that by farmers selling to a supermarket, they cut out the traders and sell a graded product directly to the retailer.

**Table 9: The farmer's compliance level for the good crop protection practices**

Particulars	Farmers without Globalgap certified groups						Farmers in Globalgap certified groups					
	French beans n=15			Tomatoes n=15			French bean n=15			Tomatoes N=15		
Score	1	2	3	1	2	3	1	2	3	1	2	3
Use of registered pesticide	5	3	7	5	3	7	14	1	0	13	2	0
Observing pre-harvest interval	7	0	8	6	0	9	11	2	2	11	2	2
Use of Integrated pest management practices	3	6	6	3	6	6	12	1	2	11	0	4
Use of botanical pesticides	3	0	12	1	1	13	11	1	3	10	2	3
Use of tolerant varieties	5	0	10	5	0	10	13	2	0	13	2	0
Proper pest identification	5	3	7	5	3	7	14	0	1	14	0	1
Use of protective clothing	1	1	13	1	1	13	14	1	0	12	3	0
Keeping records on pesticide use	0	8	7	0	8	7	14	1	0	9	1	0
Reading and making use of information of label on pesticide containers	8	0	7	8	0	7	14	1	0	14	1	0
Use of less toxic chemical pesticide	2	4	9	2	4	9	12	2	1	13	1	1
Use of cultural methods	4	2	9	4	2	9	13	2	0	13	2	0
Use of physical methods	4	2	9	4	2	9	13	2	0	12	2	0
<b>Total</b>	<b>47</b>	<b>29</b>	<b>104</b>	<b>44</b>	<b>30</b>	<b>112</b>	<b>145</b>	<b>16</b>	<b>19</b>	<b>144</b>	<b>18</b>	<b>18</b>
<b>%</b>	<b>26</b>	<b>16</b>	<b>58</b>	<b>24</b>	<b>16</b>	<b>60</b>	<b>80</b>	<b>9</b>	<b>11</b>	<b>80</b>	<b>11</b>	<b>11</b>
<b>Ranks</b>	<b>II</b>	<b>III</b>	<b>I</b>	<b>II</b>	<b>III</b>	<b>I</b>	<b>I</b>	<b>III</b>	<b>II</b>	<b>I</b>	<b>II</b>	<b>II</b>

**Notes: 1 full compliance**

**2 partial compliance**

**3 no compliance**

Source: Research study, 2009

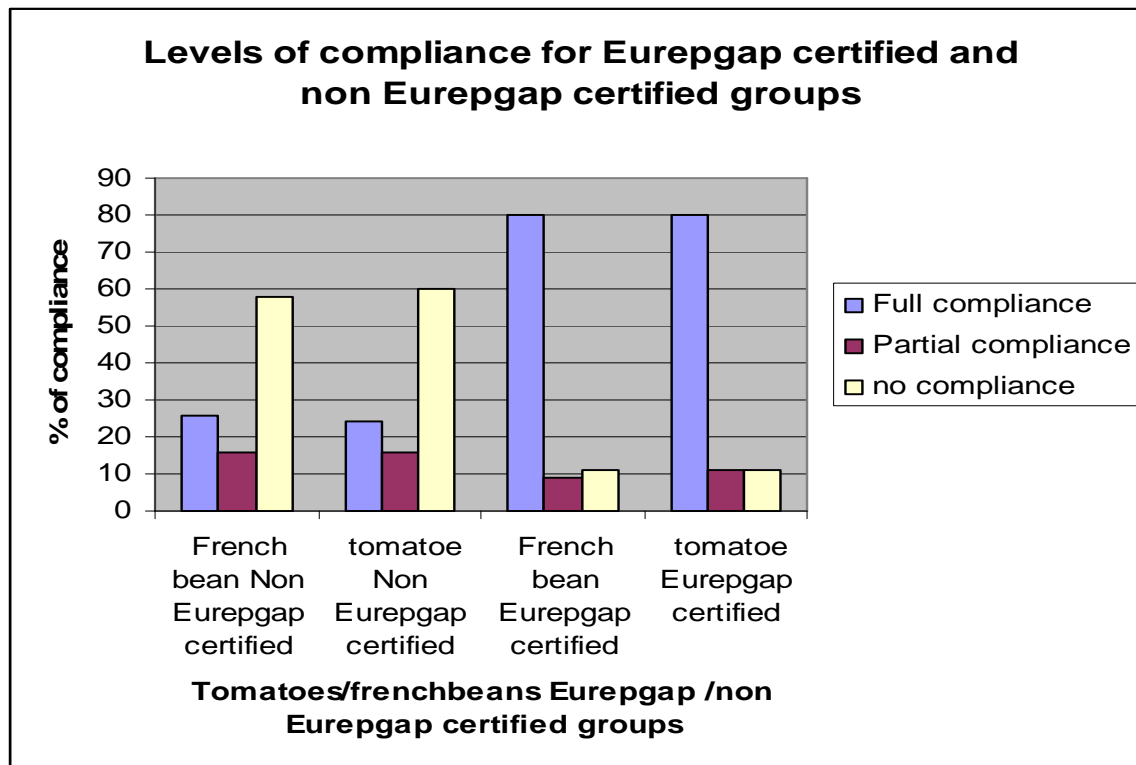
Practices such as observing pre-harvest interval was mostly complied with by farmers who were Globalgap certified 11 out of 15 whereas for the farmers without Globalgap certification only 7 out of 15 complied with the practice. The Globalgap certified farmers comply since they are trained by the exporter on safe use and in French bean the record they keep on pesticide use are critically scrutinized whereas the farmers without Globalgap certification are trained by other agencies such as agrochemical companies. This was confirmed by ICIPE (2003) where reports of training of farmers' groups in Integrated Pest Management (IPM) and hygiene standards for French beans production was held between March and July 2003 for 15 farmers' groups. Ten trainers out of the 15 graduates from ToT courses were involved in the group training of almost 350 farmers. The groups were drawn from Kathiani, Kerio Valley, Kirinyaga, Kiserian, Kitale, Maragua, Meru, Mitunguu, Mwea, Nyeri and Subukia in Kenya. This was also confirmed by ICIPE in the stakeholders interviews in (4.1.2) and by the farmers in the focus group discussion (4.3.1.) above.

In table above (Table 10) indicates the well organized record keeping for export French beans (14 out of 15 farmers fully complying with record keeping for the French bean production). The records kept include fertilizer application, chemical pesticide application, and harvesting which are mandatory for Globalgap compliance. From this study, there is evidence that there is spill-over of practices from the Globalgap requirement practices on to vegetable destined for the domestic market. The training on proper record keeping which is a part of the training in safe use of pesticides has spilled over to the practices used in tomatoes destined for the domestic market (9 out of 15 Globalgap certified fully comply and 8 out of 15 Non Globalgap certified partially comply for the tomato production) as indicated above (table 9). This where farmers keep record for spraying for the purpose of future reference on the effective pesticides used whereas the harvesting and sales records are kept for the purpose of calculating profits or losses incurred. For the export market the behavior of proper record keeping is as a result of the intense training in Globalgap standard and the fact that it is mandatory to keep records. For the non Globalgap certified farmers none of them keeps all the record they only keep the spraying and harvest record 8 out of 15 (farmers table 9) which is the same reason as for the Globalgap certified farmer that they would refer to the effective chemicals used and to calculate profits or losses incurred. As mentioned earlier the record keeping for crops destined for the domestic market is very minimal and not for the use in terms of proper pesticide use such as how much was sprayed, the date of application, the amounts as done in French bean export. In the export market they have intense proper record keeping where the technical assistant is able to follow-up on the pesticide usage in the farm thus tracing back on synthetic chemical pesticide is possible. This was confirmed in the focus group discussion (number 4.1.3)



**Plate 4: Record keeping at Kionereria grading shed for export crops such as French beans**  
Source: Research study, 2009





**Figure V: Compliance of pesticide related aspects level graph for French bean and tomato (farmers with Eurepgap (Globagap) certified and those without Eurepgap (Globagap) certified groups) based on the interview and the table 7**

Source: Research study, 2009

As shown in (Figure V) above 80% of the Globalgap certified farmers comply fully with the above listed good crop protection practices for both French beans and tomatoes whereas 24% for tomatoes and 26% for French bean the farmers without Globalgap certification comply fully with the above listed good crop protection practices (Figure 6). The high number of full compliance for Globalgap certified farmers is as a result of the intense training they undergo on Globalgap standard , the audits that are carried out and strict enforcement by exporter. The farmers tend to monitor each other especially in complying for the export market standards which are very stringent. The good crop protection practices for the export French bean are reported to spillover to the tomato destined for the domestic market. The differences in compliance were also confirmed by the focus group discussions of the Globalgap certified farmers and non Globalgap certified farmers. Differences noted between the two clusters included the Globalgap certified groups possess disposal pit and pesticide seepage pit, more farmers observe preharvest interval, they keep more types of records, they are using less toxic pesticides and using protective clothing whereas Non Globalgap certified farmers don't have disposal pit or pesticide seepage pit,

they are not keeping proper records, not using protective clothing, using more toxic chemicals i.e. Polytrin (see table 3 above).

One of the farmers named Mr. Kinyua said, *the training on Globalgap has helped me learn a lot in terms of safe use of pesticide which am applying on other crops in my farm such as tomatoes*". The impact of export market pesticide use practices on domestic market is a positive one since a lot of practices learnt from the Globalgap have spilled over to the crops destined for the domestic market such as tomato; such practices include the observing of preharvest interval, use of disposal pit, reading of the label of synthetic pesticides, use of seepage pit, ensuring pesticide does not get to water bodies and use of personal protective clothing. The frequent use of crop protection practices by Global certified farmers is attributed to the frequent Globalgap training they have undertaken and the few practices adopted by the non Globalgap certified groups are attributed to the farmer to farmer sharing with the Globalgap certified farmers.

#### **4.2.4 The enforcement systems for pesticide regulation**

It was assumed that the behaviour of farmers would probably also be influenced by the "stick" which is the enforcement (which could imply fines) if non compliance of the pesticides regulations. To get a clear picture of this in the case of tomatoes destined for the domestic market, 11 stakeholders of the regulation and enforcement sector were interviewed. The 11 stakeholders included representatives from HCDA, MOA, KEPHIS, KEBS, MPH, PCPB, ICIPE – NGO, WONI-VEGFRU exporter, Nakumatt and Uchumi supermarket. (Annex 13) The results were as follows.

The stakeholder interview outcome showed that the national food safety system in Kenya is managed by various agencies under different ministries and laws. Each agency operates independently to fulfill the function for which it was established as seen in (Annex 13 ) and complements the basic laws for food safety namely the food drugs and substances Act Cap 254 and the Public health Act Cap 242, whose common goal is to safeguard the health of the people. The main agencies include KEPHIS, MPH, PCPB, MOLFD, HCDA and KEBS. Safety and quality control activities are distributed along the food supply chain resulting in a food chain approach. Some of the regulatory agencies mandated to carry out pesticide residue such as KEPHIS collaborates with other institutions to facilitate provision of support services. However, all the activities at each level require integration into a coordinated system. To complement the inspection and enforcement system, the major agencies namely MPH, KEPHIS, and KEBS have laboratory support services, which carry out analysis for adulteration and quality assurance. They include radiation, mycotoxin, heavy metals, pesticides and drugs, biocides and pathogen.(FAO,2005) The ultimate aim is promoting public health and protecting the consumer against health hazards and enhancing economic development. It is observed that none of the agencies is mandated to enforce pesticide maximum residue level for the domestic market. However, it is also noted that KEPHIS is currently involved in carrying out sampling from all municipal markets and supermarket to ascertain the maximum residue levels in various vegetables in the market. KEPHIS is currently, in the initial stages of consumer awareness creation and training on maximum residue levels. KEPHIS is also involved in withdrawal of Phytosanitary certificates for exporters whose export produce is found to have exceeded maximum residue levels.(Annex 13) On the other hand there is a food safety national task force

which consists of various government and private sector organization which looks into the issues of food safety for export crops in the country (2.5) above.

The PCPB is involved in registration of new pesticide products and ensuring registered chemical pesticides are stocked in agrovet shops. In case of non-compliance the culprit are fined heavily or even a case filed against them this is explained by the behavioural conceptual framework where the coercion is seen in fines or court cases for culprit who don't comply with regulations.

The fact that there is no government body which is clearly mandated to look into food safety issues it becomes difficult to pinpoint who is responsible in case of a national issue on pesticide residue. The organizations in the public sector are said to blame each other when there is issues on pesticide residue. This is because their roles also tend to overlap for different government agency. As seen in the previous sections the private bodies are on meantime aggressive in ensuring standards are met thus overcoming the issues on pesticide residue as seen with FPEAK and Nakumatt supermarket (annex 13) who are ensuring private voluntary standards such as KENYAGAP standards are met. However, some of the government bodies such as Kenya Bureau Of Standards (KEBS) is collaborating with FPEAK on use of KENYAGAP as the quality standard mark for horticultural crops in the formal market (Annex 13)

#### **4.3. Discussion of findings analysis (SWOT, PESTEC & Stakeholders analysis)**

This section gives the summary of the information in the PEST and SWOT analysis tool for the pesticide subsector in Kenya (Annex 14). The section ends with the stakeholder's analysis of the various key informants interviewed who are representatives of both private and public sector (annex 15). The analysis is based on the findings in the previous sections. The SWOT analysis tool gives a clear overview of the strengths, weaknesses, threats and opportunities of the pesticide subsector of vegetable in Kenya whereas the PEST gives the overview of the external and internal environment

A scan of the internal and external environment is an important part of the strategic planning process. Environmental factors internal to the pesticide subsector can be classified as strengths (S) or weaknesses (W), and those external to the subsector can be classified as opportunities (O) or threats (T). Such an analysis of the strategic environment is referred to as SWOT analysis (QuickMBA, article no date). The SWOT /TOWS (Figure IV)

The strengths with which the sector can use to handle the opportunities include the national task force for horticulture which is a strength since they are a collaboration of various public sector organizations which have a role to play in the pesticide sector. The national task force for Horticulture has come up with a food safety committee consisting of various public sector bodies which can be utilized to ensure the issues of pesticide residues are addressed to attract the new competitive market that are coming up with the stringent standards. On the other hand, it could be used as a strong point to overcome the weaknesses in the sector for example when the public sector blames each other when confronted with pesticide residue issue the national task force for horticulture could be used to effectively address such matters.

The pesticide subsector is a sensitive subsector since it deals with sensitive aspect of pesticide residues it is threatened by the new market for consumers who are demanding safe products and and also the anticipated shift of consumers to organic products. In regards to that the pesticide

subsector with the strength it has of aggressive marketing by some of the stakeholders such as the agrochemical companies they could utilize the same aggressiveness to address the pesticide residue issue in the sector such training and awareness campaigns.

The main strength in Kenya is that it has a National task force for Horticulture which is addressing the issues on food safety. The task force is a positive start towards the coming up with an organization that is wholly mandated to address issues of food safety and enforcement of the regulation in the country. The main weakness is that the extension service is very weak and staff are not well equipped with current information to be able to address the issues arising in food safety and the subject of maximum residue levels is also very complex for them to understand they could collaborate with the non governmental organization in the subsector who are effective and have the capacity to address the issues. The main opportunity is that with the new campaigns by KEPHIS on maximum residue levels there are available facilities to address the issue of pesticide residue in the sector and lead to opening of new markets for the country . Lastly, the main threats include when the sector openly reports regarding the high levels of pesticide residue in our produce destined for domestic market it threatens our export market since this crops are grown in relay and rotation with the export crops. The internal environment in the pesticide subsector Kenya is moving at a slow pace thus not being updated or keeping pace with the current fast changing external environment such as the high demands from consumers for access to safe quality products.

The stakeholders analysis main issue is that the government sector tends to blame each other when their issues of food safety and the problem ends up not being addressed and none of them is clearly mandated to look into issues of food safety such as pesticide residue. This shows that there is no collaboration among the public sector and that they are not ready to take up challenges. The issue with the exporters is that they have not realized the opportunity in the domestic market they are only focusing on the export market this was seen where Nakumatt a supermarket dealing with domestic market produce has began to access clean produce from farmers complying with KENYAGAP which is a positive aspect in regards to the pesticide sector.

#### **4.4. Results summarized**

With the above discussion of the findings the following answers can be given to the research questions. This implies that the main question can be answered as follows:

1. What are the sources of information farmers get with respect to pesticides use?
  - Trainings facilitated by various agencies
  - Technical people employed by the exporter.
  - Ministry of Agriculture
  - Agrovets shop attendants
  - Agrochemical companies such as Orion, Farm chem. companies
  - Farmer to farmer sharing
  - Agrochemical companies
2. What are the trainings they get with respect to safe handling use of pesticide?
  - Safe use and handling of pesticide
  - Integrated pest management

The trainings are facilitated by

- Non governmental organization such as International centre for insect Physiology and Ecology (ICIPE) which collaborates with Agribusiness and Allied company and exporter
- Exporting company
- Technician employed by the exporter
- Fellow farmers
- Demonstration sites (Miandi group)

3. Are there any remunerations for farmers if they apply pesticide rules?

Some supermarkets which have sub contracted farmers who are complying with KENYAGAP standard or organic farmers give them a better price than the other farmer supplying other outlets .It was reported they even dictate the price.) farm gate price for their tomatoes lowest price is Kshs. 50 per kilogram whereas in other outlet where farmers are not KENYAGAP certified they give the lowest price at Kshs. 35 per Kilogram. The price for tomatoes is always varying depending on the demand and supply but the fact remains farmers complying with KENYAGAP standard always receive a higher farm gate price.

4. What are the enforcement systems with regards to pesticide regulation?

- The Pesticide Crops Products board is involved in registering of approved pesticides and they carryout inspections in the market to ensure approved pesticides are stocked
- The Kenya bureau of standards ensure conventional outlets stock quality products in this case horticultural produce that has the FPEAK-KENYAGAP versus Kenya bureau of standards standardisation mark of quality which means Good Agricultural Practices have been used in its production
- Fresh Produce Exporter Association of Kenya developed a private standard of KENYAGAP which is benchmarked against the Globalgap international standard
- Horticultural Crops Development Authority is involved in training producers on safe use of pesticides
- Local authority ensure the open air market are clean and ensuring there are no dangers of any chemical pesticides in the market
- Some supermarket have demanded for KENYAGAP standard compliant produce from their subcontracted suppliers whereas others demand for organic certified produce
- Ministry of Agriculture are collaborating with Pesticide Crop Products Board (PCPB) and are involved in training of safe use pesticide and monitoring the pesticides being used in the field if they are unapproved they report to PCPB for necessary action to be taken
- Kenya Plant Health Inspectorate Board is involved in giving the phytosanitary certificates to exporters if they have high levels of pesticide the certificate is withdrawn. They are also involved in sampling of the horticultural vegetable so as to check for levels of pesticide residue and inform necessary bodies so as the issues coming up are addressed

- A national task force for Horticulture has been formed in Kenya to address the issues coming up in the horticulture sector such as pesticide residue where a food safety committee was formed.
- Exporters such WONIVEGFRU have the Globalgap standard which has to be complied with by the subcontracted producers
- The non governmental organizations work in collaboration with government bodies involved in enforcement and standards which they intergrate the pesticide regulation or standards in their projects.



## CHAPTER 5.0 CONCLUSION AND RECOMMENDATION

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### 5.1. Conclusion

The thesis result showed that tomato is a major crop in Kirinyagah .In this research, the objective was to find out ‘to what extent farmers use export crop protection practices for crops destined for the domestic market. The results showed that the objective was met .The study revealed that all interviewed Globalgap certified farmers applied the good pesticide use practices used in the export market on their tomatoes destined for the domestic market. The good pesticide practices included observing pre-harvest intervals ,use of registered approved pesticides, proper pesticide application, use of protective clothing ,reading of product labels and proper pesticide record keeping .Most of the interviewed farmers from non certified Globalgap farmers however did not meet the good crop protection practices .

The study revealed that the trainings facilitated by the exporter and non governmental organizations were more effective than the others facilitated to non Globalgap certified farmers thus some lessons could be drawn and replicated by other agencies who facilitate trainings as a tool to motivate farmers to behave positively in terms of compliance of regulations. The method used by exporter to provide protective clothing and sprayer at a central point in addition to training on how to use then was effective to make farmers use protective clothing. In terms of factors that make farmers behave in a manner to comply with pesticide regulation the ‘stick’ that is punishment was effective for farmers whose crops are destined for export market whereas the ‘carrot’ which is remuneration was more effective for farmers with crops destined for the domestic market. The study also revealed that farmers receive reliable information from various sources such as the exporter and trainings facilitated by Non governmental organisations NGO however a gap remain especially for farmers who are not in Globalgap certified groups who lack reliable sources.

One of the supermarket is subcontracting farmers who are complying KENYAGAP which is a positive outcome towards compliance of the pesticide regulation. On the other hand, the Globalgap, an international standard is being implemented by few farmers targeting the export markets. The French bean farmers interviewed in Kirinyagah district were found to be able to comply with the stringent standards and are certified. There have been spillovers of good crop protection practices from the French bean production to tomatoes destined for domestic market as seen in the study.

A number of public sector organizations are involved in aspects of pesticide use and regulations. The MOA is involved in training farmers on safe use of pesticides, PCPB is involved in ensuring proper registration of pesticides and stocking of registered pesticides in agrovet shops, KEBS is involved in ensuring products such as horticultural produce have a standardization mark for quality which currently they are using the KENYAGAP/KEBS standard mark, KEPHIS is involved in carrying out sampling countrywide for the purpose of testing for residues and carrying out awareness creation session on maximum residue levels, MPH is involved in carrying out inspection of food or agricultural products to ensure they are free from hazardous materials that can cause harm to the health of the public. However none of these public sector organizations is mandated to enforce food safety issues which include pesticide residue. Currently a National committee for food safety was formed with various representatives from the public sector organizations which is meant to address issues of food safety in agricultural products in the country.



The good agricultural practices GAP and food safety being promoted in Globagap standard are also very relevant in the production of fruits and vegetables for the domestic market. As most export farmers also produce for the domestic market (due to the need to practice crop rotation and to minimize risk), the adoption of GAP and food safety as prescribed by Globagap standard for export crops has been seen to be constructive and as revealed in the study KENYAGAP which is benchmarked against Globalgap has begun to bear fruits in the country.

My main research questions “What are the crop protection practices applied in crops destined for the domestic market for farmers carrying out export market crop production?” was answered by the study.

## **5.2. Recommendation**

Based on the findings of the research and conclusion drawn in the previous section I recommend the government to appoint the National food safety committee to carryout research on the enforcement and regulation of the crop protection practices and later upgrade them to become an authority which enforces and regulates the crop protection practices in the country. There should also be collaboration among the different public sector organization in the pesticide subsector since they all play a role in ensuring the pesticide rules and regulations are complied with.

In the study, there are indications that there are spillovers of good agricultural practices from the export sub-sector to the domestic market as well as some cases of non compliance. Therefore, there is a need for more massive awareness creation and intense trainings to enlighten farmers on safe use of pesticides and sensitise consumers on issues of food safety.

The system adopted by Nakumatt supermarket should be replicated by other retailers where the KENYAGAP standard should be made mandatory for any of the suppliers of the supermarkets and open air markets so that safe produce is provided to consumers. The supermarkets and open air market in the country should be aggressive in the enforcement of food safety standards on pesticide use and introduce private voluntary standards which producers can adhere to. In addition, as the stringent standards are introduced to suppliers and producers intensive trainings should be facilitated in all regions of the country which should cover various food safety topics since the training carried out previously have not been sufficient. The trainees should include the smallholder producers, suppliers, extension officers, agrovet attendants, middlemen and retailers. The subsector stakeholders who are involved in different capacities should collaborate so that information given to farmers is consistent.

The methods used by exporters to provide protective clothing and a sprayer at a central point should be replicated by the national extension department to ensure farmers use protective clothing and have access to sprayers. They should also draw lessons from approaches used by the exporter and non governmental organization in facilitating training and then intergrate them in the national extension service.

## **ISSUES FOR FURTHER RESEARCH**

- Investigate the adaptation and compliance of the KENYAGAP standard at national level.
- Investigate on the levels of pesticide residue on vegetable in Kenyan market

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## ANNEXES

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### Annex 1: Survey questionnaire for smallholder producers

**Farmer name:**

**Group name**

**Gender :**

**Date:**

1. Knowledgeable on pesticide rules and regulation
2. Access to Pesticide equipment (sprayer)
3. Synthetic chemical pesticide sources for farmers
4. Crop farming methods used
5. Marketing of tomatoes for farmers in Kirinyagah
6. Markets that farmers from Kirinyagah sell their tomato produce
7. Certification facilitation
8. Agency facilitating safe use of pesticides training
9. Levels of rejects in crops
10. Pesticide container disposal mode
11. Pest control methods used
12. Subject to a traceability system for pesticides
13. Product recall exist where if pesticides found the lot of product can be recollected back
14. Attendance of training on safe use of pesticides
15. Pesticide application methods used
16. Do you use structure for export produce to handle domestic produce?
17. How is handling of tomatoes, the packaging and post harvest handling?
18. Sources of information for pesticide use
19. List of chemical pesticides used by farmers in Kirinyagah
20. Number of sprays for French beans and tomatoes per season
21. . Number of sprays for French beans and tomatoes per season
22. Rate the Score of compliance for the following crop protection practices  
**1 full compliance    2 Partial compliance    3 non compliance**  
 Use of registered pesticide  
 Observing PHI  
 Use of IPM methods  
 Use of botanical pesticides  
 Use of tolerant varieties  
 Proper pest identification  
 Use of protective clothing  
 Keeping of records  
 Reading of label on pesticide containers  
 Use of less toxic chemicals pesticide  
 Use of cultural methods  
 Use of physical methods

**Annex 2: Checklist for the interviews for the key informants (supermarkets, exporter, NGO and parastatals)**

**Open questions: Informant Kenya Bureau of Standard (KEBS)**

**Department:**

**Date:**

Pesticide rules and regulation present  
Enforcement of rules and regulation  
Measures taken for violation of rule regulation  
Produce sampling and testing  
Role of KEBS

**Open questions: Informant fresh vegetable produce exporter**

**Department:**

**Date:**

Target market  
Pesticide rules and regulations  
Out growers requirement  
Role of Globalgap and KENYAGAP compliance  
Produce rejects levels and reason  
Recommendations on compliance of the pesticide rules and regulations

**Open questions: Informant Fresh Produce Exporter Association of Kenya (FPEAK)**

**Department:**

**Date:**

Pesticide rules and regulations  
Enforcement of the pesticide rules and regulations  
Facilitation of smallholder producer  
Role of FPEAK in enhancing compliance

**Open question: Informant Horticultural Crops Development Authority**

**Department:**

**Date**

Pesticide rules and regulation  
Enforcement of pesticide rules and regulation  
Facilitation of smallholder producers  
Enforcement by retailers and wholesalers  
Role of HCDA in enhancing compliance

**Open questions: Informant Nakumatt/ Uchumi Supermarket**

**Department:**



**Date:**

Knowledge on pesticide rules and requirement  
Requirement on pesticides to be complied  
Usefulness of the pesticide rules and regulation  
Constraints faced in relation to pesticide rules and regulations  
The persons to enforce the rules and regulation  
Marketing of produce  
Quality management system  
Quality standards for tomatoes they receive  
Produce payment modalities  
Tonnage of tomatoes in the supermarket  
4P's –Marketing mix (Price, Product, Promotion and Place)

**Open questions: Informant non governmental organization**

**Department:**

**Date:**

Knowledge on pesticide rules and regulation  
Rules and regulations recommended  
Constraints in compliance of pesticide rules and regulation  
Role of NGO in enhancing compliance  
Recommendation to minimize the non compliance  
Trainings facilitated and information shared

**Open questions: KEBS**

**Department:**

**Date:**

The pesticide rules and regulation  
The enforcement  
What is the role of KEBS  
The standards for horticulture sector  
Whose mandate is it to enforce pesticides rules and regulation

**Open questions: PCPB**

**Department:**

**Date:**

List of approved chemicals for French beans and for tomatoes  
The pesticide rules and regulation  
The enforcement  
The aspects on Minimum Residue Level  
The role of PCPB  
Whose mandate is it to enforce

**Open questions: KEPHIS**

**Department:**

**Date:**

Pesticide rules and regulation  
The enforcement of pesticide rules and regulation

The aspect of Minimum Residue Level  
How they facilitate farmers  
The role of KEPHIS in the industry  
Whose mandate is it to enforce

**Open questions: MPH**

**Department:**

**Date:**

Pesticide rules and regulation  
The aspects of Minimum residue level  
Whose mandate is it  
The role of MPH  
The enforcement of pesticide rules and regulation  
The food safety committee and its roles

**Open questions: MOA**

**Department:**

**Date:**

The pesticide rules and regulation  
The enforcement for the above  
How are farmers facilitated  
Trainings and information shared to producers  
What is the role of MOA  
The standard for horticulture sector  
Whose mandate is it to enforce the pesticide rule and regulation

**Open questions: Local Authority**

**Department:**

**Date:**

Are you aware of the pesticide rules and regulation  
What is the role of the local authority  
What enforcement do you have in the markets in Kenya  
Their role in enhancing food safety in the market

**Annex 3: List of participants for the case study interview**  
**Interviews from 20<sup>th</sup> July to 19<sup>th</sup> September 2009**

<b>Interviewee</b>	<b>Department</b>	<b>Place</b>	<b>Location</b>	<b>Time of interview</b>
Grace Chalo	Production	HCDA	JKIA Airport	10.00AM
Virginia Mwai	Horticulture	MOA	Kilimo House	8.00AM
Stephen Mbithi	FPEAK-Director	FPEAK	New Rehema house	10.00AM
Jonathan Ndunda	Vegetable department	Uchumi supermarket	Agakhan walk	11.00AM
Charles Maina	Vegetable department	Nakumatt supermarket	Nakumatt Uhuru highway	10.00AM
Peter Opiyo	Standards	PCPB	PCPB Waiyaki way	2.00PM
Kilinda Kilei	Food safety	MPH	Ardhi house	4.00PM
Joseph Kigamwa	National task force for Horticulture	KEPHIS	KEPHIS-head quarters	11.00AM
Dr. Brigitte Nyambo.	Technology Transfer Unit	ICIPE	Kasarani complex	2.00PM
John Gakuo	Town clerk Nairobi city council	Local Authority	Nairobi city	8.00PM
Margret Aleke	Food and agriculture	KEBS	KEBS South C	2.00PM
Joackim Gacheru (M) Sarafina Warui (F) Benedict Njunguna (M) Anne Wangui (F) Florence Wanjiru (F) Rahab Mururia (F) Kathuri Kabothe (M) Peter Munene (M)	Baricho farmer group	Value pak exporters contracted farmers	Kirinyagah	8.00AM and 2.00PM
Benson Gatimu (M) Josephat Gituka (M) Hillary Kamotho (M) Betty Wanjiku (F)	Kionereria farmer group	Kenya Horticultural exporters	Kirinyagah	8.00AM and 2.00PM
Petersson Mureithi (M) David Manegene (M) Geofrey Munyiri (M)	Kanguka farmer group	Kenya Horticultural exporters	Kirinyagah	8.00AM and 2.00PM
Cecily Kariuki (F) Mary Wambui (F) Kamaru Jmaleck (M) Daniel Wanjohi (M) James Mwangi (M)	Non group members	Own farming	Kirinyagah	8.00AM and 2.00PM

Josephine Wanjiku				
Elijah Maina (M)				
Stephem Nyama (M)				
Ndungu Kage the (M)				
Geoffrey Maina (M)				
Lucy Wanja (F)				
Peter Chombe (M)				
Gerald Kamau (M)				
Julius Wanjohi (M)				
Francis Rwenu(M)				

(M)-Male (F)-Female

#### **Annex 4: Further explanation of terms used in the thesis**

**Small holder grower:** A farmer with 0.1 Ha to 1 Ha of land

**Food safety management system:** A system put in place to ensure that food products are safe and that they do not cause adverse human health effects

**Quality:** as defined by Juran (1990) defined as 'product performance that results in customer satisfaction and freedom from deficiencies which avoids customer dissatisfaction', in short 'fitness for use'

**Small scale** a farmer who owns 0.25-1 acres of land

**Middle scale** a farmer who owns 1-3 acres of land

**Large scale** a farmers who owns >3 acres of land

**Standards** Documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines or definitions, to ensure that materials, products, processes and services are fit for their purpose. Standards include environmental standards; organic standards; labour standards; social standards; and normative standards

**Preharvest Interval (PHI)** The minimum number of days that must pass between the last application of a pesticide and the start of harvesting

**Protection product:** a pesticide in the form in which it is packaged and sold ,it usually contains an active ingredient and must be diluted before use

**Residue:** any specified substances remaining on or in food, agricultural commodities or animal feed. The term includes any derivatives of a pesticide, such as conversion products, metabolites, reaction products and impurities considered to be of toxicological significance. The term "**pesticide residue**" includes residues from unknown or unavoidable sources (e.g. environmental) as well as known uses of the chemical

**Pesticide:** Any substance or mixture intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport or marketing of food

**Minimum residue levels:** The maximum concentration of a residue that are legally permitted or recognized as acceptable in or on a food, agricultural commodity or animal feedstuff

**Critical control point:** A point step or procedure at which control can be applied and safety hazard can be eliminated or reduced to acceptable levels

**Audit:** Systematic and functionally independent examination to determine whether the quality and food safety activities result comply with planned procedures and whether the procedures are implemented effectively and are suitable to meet objectives

**Active ingredient:** The biologically active portion of a pesticide present in a formulation

**Globalgap :** Globalgap was initially called Eurepgap meaning Euro-Retailer Produce Working Group (EUREP) and Good Agricultural Practices (GAP). It is a global scheme and a reference for Good Agricultural Practice (GAP) which is managed by GLOBALGAP secretariat

**Certification** A procedure by which a third party gives written assurance that a product, process or service is in conformity with certain standards.

**Certification body** An organization performing certification. Sometimes it is referred to as the certifier or the certification agency. The certification body may use an existing standard or may set its own standard, perhaps based on an international and/or normative standard.

**Annex 5: The category of interviewees, number, expected information and research tool used.**

	Category of interviewees	Number of respondent	Type of expected information provided	Research tool
a	Farmer group (Baricho, Kionereria and Kanguka-15 and 15 non grouped members)	30	<ul style="list-style-type: none"> <li>-Knowledge about pesticide rules and regulation</li> <li>-Pesticide use and application by farmers</li> <li>-Trainings attended</li> <li>-Information sources</li> <li>-Standards complied with</li> <li>-Challenges in the sector</li> <li>-The roles of public and private sector -</li> <li>-Organizations in facilitating farmers</li> <li>-Tomato production and farm gate prices</li> <li>-Crop protection practices used and level of compliance</li> </ul>	<ul style="list-style-type: none"> <li>-Farmer interview and</li> <li>-Focus group discussion</li> <li>Observation</li> <li>-Literature review</li> </ul>
b	Nakumatt/ Uchumi supermarkets	2	<ul style="list-style-type: none"> <li>Control of tomatoes in the shop</li> <li>The 4 P's (price, product, place and promotion)</li> <li>Tonnage of tomatoes</li> <li>Standards complied with</li> <li>Farmers they outsource from</li> </ul>	Interviews
c	KEBS	1	<ul style="list-style-type: none"> <li>-Standards by manufacturer</li> <li>-Standardisation mark for quality KENYAGAP</li> <li>-Enforcement of standards</li> </ul>	Interview
d	KEPHIS	1	<ul style="list-style-type: none"> <li>-Testing and sampling</li> <li>-Enforcement of compliance of maximum residue levels</li> <li>-Trainings facilitated</li> </ul>	Interview
e	MPH	1	<ul style="list-style-type: none"> <li>-Compliance of food Act</li> <li>-Enforcement of chemical pesticide regulation</li> <li>-Food safety committee role</li> </ul>	Interview
f	Exporter-WONI VEGFRU	1	<ul style="list-style-type: none"> <li>-Crop protection practices</li> <li>-Private voluntary standards</li> <li>-Role of exporter in assisting the farmer to meet the pesticide rules and regulation</li> </ul>	Interview

g	HCDA	1	<ul style="list-style-type: none"> <li>-Role of HCDA in assisting the farmer to meet the pesticide rules and regulation</li> <li>-The trainings they facilitate</li> <li>-The marketing of horticultural produce</li> </ul>	Interview
h	MOA	1	<ul style="list-style-type: none"> <li>-Role of MOA in assisting the farmer to meet the pesticide rules and regulation</li> <li>-The trainings and extension service offered to farmers</li> <li>-The collaborators they are involved in</li> <li>-The challenges they face</li> </ul>	Interview Literature review
i	FPEAK	1	<ul style="list-style-type: none"> <li>-Role of FPEAK in assisting the farmer to meet the pesticide rules and regulation</li> <li>-Information of KENYAGAP</li> <li>-Standards they comply with</li> <li>-Collaborators in the sector dealing with standard</li> </ul>	Interview Literature review
j	PCPB	2	<ul style="list-style-type: none"> <li>-Pesticide rules and regulations</li> <li>-Pesticide use standards /code of practice</li> <li>-Enforcement of pesticide rules and regulation</li> <li>-The trainings they facilitate and information shared</li> </ul>	Interview Literature review
j	ICIPE-NGO-(ICIPE)	1	<ul style="list-style-type: none"> <li>-Role of ICIPE in assisting the farmer to meet the pesticide rules and regulation</li> <li>-The trainings they facilitate and information shared</li> </ul>	Interview Literature review



## Annex 6: Kenya list of banned and /or restricted pesticides

List of Products Banned or Restricted by the Pest Control Products Board-PCPB  
(Updated March 2004)

Common Name	Use	Banned or Restricted	Date
1. Dibromochloropropane	Soil fumigant	Banned	1986
2. Ethylene Dibromide	Soil fumigant	Banned	1986
3. 2,4,5, T: (2,4,5,- Trichloro phenoxy butyric acid)	Herbicide	Banned	1986
4. Chlordimeform	Insecticide	Banned	1986
5. 5 Isomers of hexachlorocyclohexane (HCH)	Fungicide	Banned	1986
6. Lindane- pure gamma-BHC	Insecticide	Insecticide, Restricted use seed dressing only	
7. Chlordane	Insecticide	Banned	1986
8. Heptachlor	Insecticide	Banned	1986
9. Endrin	Insecticide	Banned	1986
10. Aldrin	Insecticide	Banned	2004
11. Dieldrin	Insecticide	Banned	2004
12. Toxaphene (Campechlor)	Insecticide	Banned	1986
13. DDT( Dichlorodiphenyl Trichloroethane)	Insecticide	Insecticide, Restricted use to public health for control of mosquito breeding grounds by Ministry of Agriculture. Banned for agricultural use	1986
14. Captafol	Fungicide	Banned	1989
15. Ethyl Parathion	Insecticide	All formulations banned except for capsule suspensions.	1988
16. Methyl Parathion	Insecticide	Restricted use, All formulations banned except for capsule suspensions.	1988
17. Monocrotophs	Insecticide/ Acaricide	Restricted Use, Soluble liquid formulations of the substance that exceeds 600g active ingredient/L	2004
18. Pentachlorophenol	Herbicide	Banned	2004
19. Phosphamidon	Insecticide	Restricted use, Soluble liquid formulations of the substance that is below 1000g active ingredient/ L	2004
20. Benomyl, Cabofuran, Thiram combinations		Restricted use, Dustable poeder formulations containing a combination of Benomyl below 7%, Carbofuran below 10 % and Thiram below 15%	2004

21. Binapacryl	Miticide/Fumigant	Banned	2004
22. Clorobenzilate	Miticide	Banned	2004
23. Dinoseb and Dinoseb Salts	Herbicide	Banned	2004
24. DNOC and its salts (such as Ammonium salt, Potassium Salt and Sodium salt)	Insecticide, Fungicide, Herbicide	Banned	2004
25. Ethylene Dichloride	Fumigant	Banned	2004
26. Ethylene Oxide	Fumigant	Banned	2004
27. Fluoroacetamide	Rodenticide	Banned	2004
28. Hexachlorobenzene (HCB)	Fungicide	Banned	2004
29. Mercury Compounds	Fungicides, Seed treatment	Banned	2004

**NB:** Highlighted are pesticides which have reported to be in tomatoes sampled from Kenyan markets by a study carried out by KOAN in 2006

Source: Available at- <http://www.pcpb.co.ke> accessed on 20/08/09

## Annex 7: EEC list of banned and /or restricted pesticide

Product	Status	Comment
Alkoxyallyl and any mercury compound	Banned	
Mercuric oxide	Banned	
Mercurous chloride	Banned	
Other Inorganic mercury compound	Banned	
Alkyl mercury compounds	Banned	
Hexachlorobenzene	banned	
Ethylene oxide	banned	
Nitrophenol	banned	
1,2 dibromomethane	banned	
1,2 dichloroethane	banned	
Dinoseb	banned	
Binapacryl	banned	
Dicofol	banned	Containing less than 78% of PP-DICOFOL or more than 1g/kg DDT and DDT related compounds
Maleic hydroxide and its salts other than its chloride, potassium salts	banned	
Chlorine, potassium and sodium salts of maleic hydroxide	banned	Containing more than 1mg/kg free Hydroxine expressed on the basis of the acid equivalent
Quintozine	banned	Containing more than 1g/kg HCO or more than 10g/kg Pentachlorobenzene

Source: Available at [http://www.foe.co.uk/resource/briefings/endocrine\\_european\\_list.pdf](http://www.foe.co.uk/resource/briefings/endocrine_european_list.pdf),  
 Accessed on 20/08/09

**Annex 8: Baricho Farmers preparing for interviews for the survey**

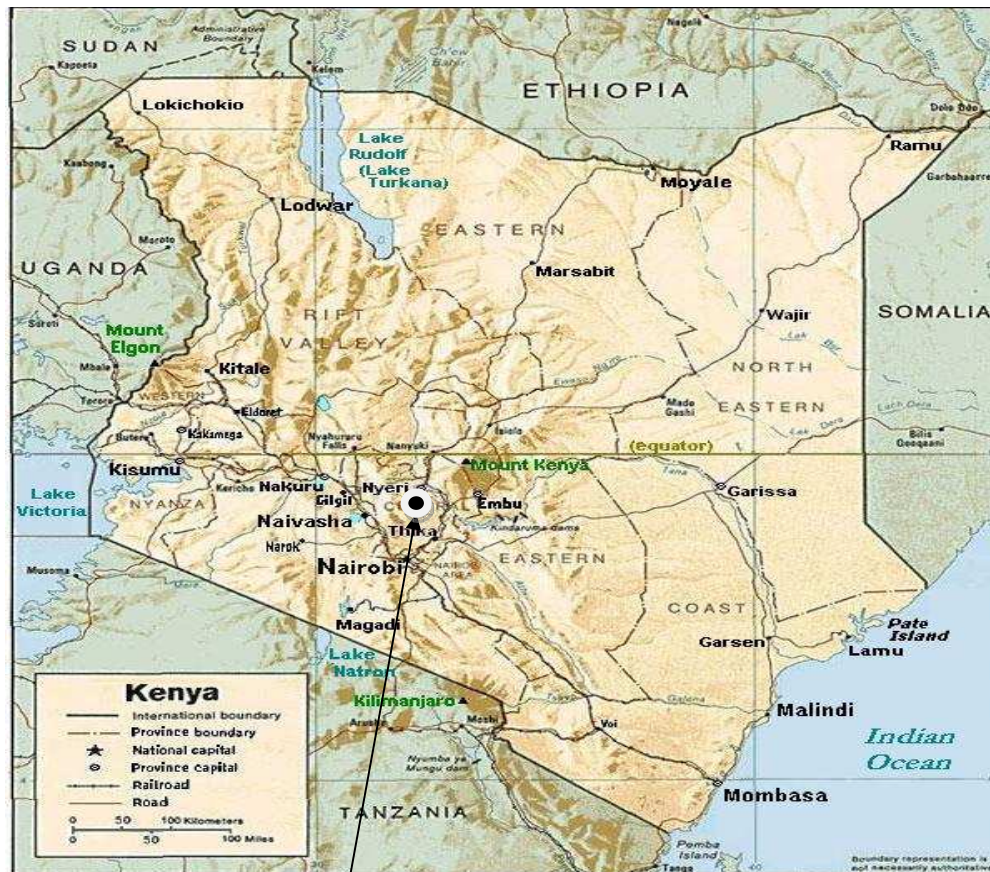




## Annex 9 :Farmers interviews



## Annex 10: Map of Kenya and research area-Kirinyagah

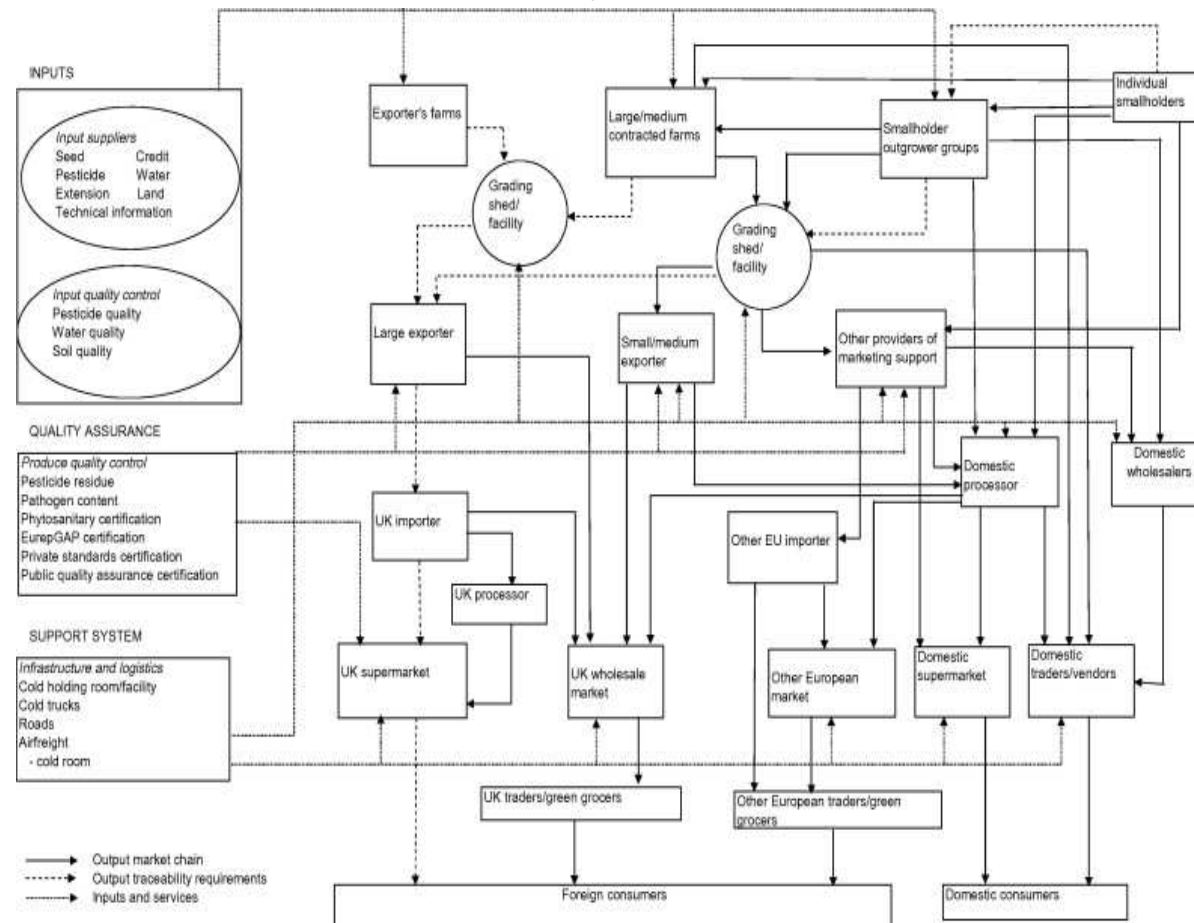


Kirinyagah-Research area

Source: Available at [http://www.absoluteastronomy.com/topics/Central\\_Province\\_\(Kenya\)](http://www.absoluteastronomy.com/topics/Central_Province_(Kenya)) Accessed on 5/09/09



## Annex 11: French bean value chain in Kenya



Source: Narrod ,et al, 2009

## **Annex 12: Experiences from other countries: A case of Snow peas in Guatemala**

In Guatemala (Norton, G., Sanchez, G., Clarke-Harris, D. and Traore, H.(2003)) reported that since the early 1990's horticultural exports have been plagued by detections and rejections at U.S. ports because of presence of pesticide residues or pest themselves. Snow peas (*Pisum sativum*) , a primarily Guatemalan vegetable export, have been under automatic detention by the US food and drug administration (FDA) since 1992 first because of pesticide contamination and recently because the postharvest handling program did not meet FDA requirement for pre-inspection protocols. The result has been reduced competitiveness for Guatemalan snow peas exports since 1992 this resulting to losses of \$35million per year during the ban from 1995 to 1997. In response to this situation, the government of Guatemala undertook **IPM research and developed strategies to reduce pesticide use and residue on snow peas and to enhance product quality. The IPM program has an on-farm research training component and pre-inspection component for pre-harvest handling**, so that most snow peas are produced and handled in a manner consistent with U.S standards. **Snow peas IPM systems in Guatemala have been included in government supported integrated crop management demonstrations and training programs that cover practices such as pest identification and monitoring, trap cropping, soil disinfection, bio-rational pesticide use and variety selection.** About half the snow peas produced in Guatemala come from one of the three systems: farms which both grow and ship, cooperatives that market through many producers or growers who produce under contract to export firms. All of these supply channels **have good pre-inspection protocols**. Independent producers supply the other 50 percent of snow peas in open market areas. Many of these producers have not adopted pre-inspection protocols, which is why Guatemalan snow peas are automatically inspected in US. ports even though the U.S has lifted the ban.(Norton, et al.,2003)

The study from Guatemalan snow peas for export and interventions taken could be adopted for the tomatoes or generally all vegetables in the domestic market as well as the export market

### Annex 13: Stakeholder interview summary

Stakeholder	Mandate	Role in pesticide subsector
<b>Horticultural Crops Development Authority (HCDA)</b>	<p>The Horticultural Crops Development Authority (HCDA) is a parastatal established under the Agriculture Act, CAP 318 by an order in 1967. The order has been amended several times, the latest being 1995 (L.N. No. 230) with the aim of revitalizing the horticultural industry.</p> <p>HCDA is run by a board of directors drawn from both the public and private sectors and derives its main revenue from levies and fees charged on produce. HCDA offers vital services including facilitating increased production of top quality horticultural produce for export and local market. Its activities related to this research include:</p> <ol style="list-style-type: none"> <li>Licensing horticultural exporters.</li> <li>Promoting the provision of cold stores and pre-cooling facilities at major collection centres.</li> <li>Monitoring and disseminating prices in the local and export markets to enable farmers and exporters plan effectively.</li> <li>Availing market information and market statistics to investors, exporters and producers for planning purposes,</li> <li>Assist the growers to identify local and export market outlets for their produce.</li> <li>In collaboration with key players formulate and implement a National Code of practice for the industry.</li> <li>Design, introduce and implement standards for locally marketed produce.</li> </ol> <p>The HCDA in collaboration with other government and private institutions, both local and international agencies assist in training, research promotion and creating awareness among producers and exporters in understanding and adhering to international regulations and quality requirements, packaging and environmental regulations.</p>	<ul style="list-style-type: none"> <li>-They facilitate farmer trainings on proper pesticide use</li> <li>-They provide educational materials to farmers</li> <li>-They are members of the National task force for Horticulture which is responsible to discuss issues on food safety in horticulture sector</li> <li>-Facilitates information sharing through the press(radio/Television),barazas (districts forums),cooperatives and individual level on aspects of maximum residue levels</li> </ul>
<b>Pesticide Control</b>	A Parastatal established under the Pest Control Products Act (Cap 346). Its functions are to regulate the importation, exportation, manufacture, distribution and use of	-The PCPB has provided the public with a list of the approved and recommended pesticides in

<b>Products Board (PCPB)</b>	<p>products used for the control of pests and of the organic functions of plants and animals.</p> <p>Pests and diseases are one of the most important factors in the production and exports fruits and vegetables and often account for significant losses in the field as well as during post harvest handling.</p> <p>All the legislation of pesticide management in Kenya is under the mandate of the Pest Control Products Board.</p> <ul style="list-style-type: none"> <li>-The introductions of pesticides to Kenya: All pesticides introduced from outside the country have to be approved of the Board.</li> <li>-To get an approval from the Board, the applicant has to bring in experimental samples, and to submit data supporting efficacy, toxicological and environmental data on the product. The procedure may take up to 2 years.</li> <li>-Immediately after approval comes a testing phase, which is obligatory and carried out at the agricultural centers of the Kenya Agricultural Research Institutes. However, there is a more open and practical approach to these issues and private companies as well as consultants can carry out the tests and provide results to KARI.</li> <li>-Generally, the procedure takes 6-12 months</li> <li>-Registration to trade the product</li> </ul>	<p>the country at a fee of Kshs.1000 through their office and website</p> <ul style="list-style-type: none"> <li>-Incase one is found in possession of adulterated or banned pesticides they are fined heavily or a case filed in court.</li> <li>-PCPB works in collaboration with MOA to ensure approved products are used by farmers and in facilitating trainings on safe used and handling of pesticides</li> </ul> <p><b>Challenges faced:</b></p> <ul style="list-style-type: none"> <li>-Lack finances for capacity building for PCPB staff</li> <li>-Some of the PCPB laws and regulation are outdated and not in line with current situation</li> </ul>
<b>Kenya Bureau of standards (KEBS)</b>	<p>It is a parastatal established under the Standards Act (Cap 496). Its primary function is to promote standardization in commerce and industry through development of standards, quality control, certification and meteorology. It has the mandate of establishing and enforcing quality standards of all products on the Kenyan Market, both locally produced and imported.</p>	<ul style="list-style-type: none"> <li>-They facilitate standardisation of products and processes</li> <li>-The KS1758 National Horticultural code of practice purpose was to have a national baseline that would enable all producers have a</li> </ul>

		<p>guide on the basic principles of Good Agricultural Practices (GAP), worker health and safety.</p> <p>KEBS is involved in setting National standards ,advisory services, regulating and the enforcement of the standards .If non compliance of the quality standards one could be fined heavily or a case filed in court</p> <p>-Collaborating with FPEAK on the KENYAGAP standard to be used as the quality standardisation mark</p>
<b>Kenya Plant Health Inspectorate Services (KEPHIS)</b>	<p>KEPHIS was established by the Kenya Plant Health Inspectorate Service Order, 1996 under the State Corporations Act (Cap 446). It is mandated to: co-ordinate all matters related to pests and disease control; monitor the quality and levels of toxic residue in plants, their soils and products; administer Plant Breeder Rights; undertake inspection, testing, certification, quarantine control, variety testing and description of seeds and planting materials; establish the machinery for educating public on safe-use of agro-chemicals; approve import application for seeds, plants and appropriate phytosanitary requirements and importation of such material; and be responsible for inspection of produce for export and import.</p>	<p>-KEPHIS is involved in sampling of horticultural vegetables in the country to test for the rate of compliance of maximum residue levels (MRL's)</p> <p>-They are involved in awareness campaigns and training of farmer and staff of supermarkets on issues of pesticide residues.</p> <p>-In the case of CAP 319 which provides that commodities with exceeding levels of residues could be stopped thus KEPHIS is responsible to ensure products leaving the country have recommended rates of residue if an exporters produce is found to have exceeding levels of residues the phytosanitary certificate is withdrawn until a plan of action is drawn by the exporter.</p> <p>-They ensure compliance of EU 91/414 for minimum residue</p>
<b>Local Authorities</b>	<p>The local authorities (City Council, Municipal, Town, Urban and County Councils) develop markets and market infrastructure for agricultural produce among others. They are also responsible for collection and disposal of garbage, provision of sanitary facilities and land allocation for marketing facilities</p>	<p>-They are involved in collection of monthly levies</p> <p>-Involved in ensuring high standards of hygiene in the market</p> <p>-Maintenance of the market structures</p>
<b>Non</b>	<p>The organisation is non profit making non governmental organisation dealing with</p>	<p>-They facilitate integrated pest management</p>

<b>governmental organization- International Centre for Insect Physiology and Ecology (ICIPE)</b>	research in insects. The organisation has various departments dealing with Plant health, Animal health, Human health and Environmental health. The plant health division for horticulture has a unit of Technology Transfer Unit which facilitates farmer training such as Globalgap, Integrated Pest Management for tomatoes, brassicas, okra, French beans, Mango.	training, safe use of pesticides trainings, Globalgap trainings -Training and development of private sector service providers -Facilitates training of their staff in highly recognized organisations on aspects of Integrated Pest Management- IPM, food safety, Hazard Analysis Critical Control Point HACCP, Globalgap, safe use of pesticides
<b>Nakumatt supermarket</b>	It is aimed at providing a wide variety of products which include fresh quality vegetables which are KENYAGAP certified in addition to other consumer products.	-They are knowledgeable on recommended pesticides rules and regulation -They receive supplies of vegetables from KENYAGAP certified farmers where the certification is facilitated by FPEAK to be carried out by Africert. Nakumatt carries out sampling from their producers where samples are tested for pesticide residue levels if levels are high they discontinue the supplier -Subcontracted farmers are given a better price for the commodities i.e. tomatoes compared to other outlet due to the KENYAGAP compliance -Nakumatt uses the KENYAGAP/KEBS standard mark as a tool for promotion for their vegetables -Nakumatt staff are trained on KENYAGAP and their horticultural products have the standardisation mark for KENYAGAP and KBS They outsource through their supplier Fresh and Juici 'who outsources from 200 active farmers complying with KENAYGAP -Takes 3-10Tonnes of tomatoes every week -Farm gate of farmers range from Kshs. 60-70 and sell at -Consumer price ranges from Kshs. 89 -150

		per Kg <b>NB:</b> The price depends on the season
<b>Uchumi supermarket</b>	Uchumi is a public limited company incorporated in 1975 under the Companies Act (Cap 486 of the Laws of Kenya). Its main objective is to have an enterprise for equitable distribution of essential commodities, affordable prices whilst creating an outlet for the local manufacturers and producers. It provides a wide variety of products which include horticultural vegetables	<p>-The supermarket requests KEPHIS to carry out sampling where they carry out testing for the levels of pesticide residues. It was reported that sampled produce from the shop meets the recommended standards</p> <p>-Mr. Ndunda the vegetables manager of Uchumi said, 'one time tomatoes were delivered to the shop with residue on the surface then they were rejected.'</p> <p>-Takes 7 Tonnes per week from 4 main suppliers who outsource from farmers</p> <p>-Farm gate price ranges from Kshs. 35-70 per Kilogram</p> <p>-Consumer price ranges Kshs. 35-89 per kilogram</p> <p><b>NB:</b> The price depends on the season</p>
<b>Fresh produce Exporters Association of Kenya (FPEAK)</b>	The fresh produce exporters Association of Kenya (FPEAK) is premier trade association for growers, exporter and service providers involved in the horticultural fresh produce export industry (flowers, vegetables and fruits). They aim to represent and improve the business environment of the horticultural industry. Some of the benefits of FPEAK membership include compliance with standards such as KENYAGAP. FPEAK members are also required to adhere to international standards on food safety, social and environmental responsibility	<p>-FPEAK works with both the domestic markets and the export market producers</p> <p>-KENYAGAP was initiated by FPEAK and it has evolved from the second edition of FPEAK code of practice. It has undergone benchmarking against the Globalgap</p> <p>-Has 300 farmers registered with KENYAGAP standard</p> <p>-FPEAK is involved in capacity building for farmers, supermarket staff on aspects of KENYAGAP</p> <p>-FPEAK is involved in talks with the city council to adopt and introduce the KENYAGAP to the open air market.</p> <p>-FPEAK is involved in undertaking internal</p>



		audits for KENYAGAP standard whereas Africert Kenya Limited is involved in carrying out the external audits.
<b>Ministry of Agriculture (MOA)</b>	The mandate of the Ministry of Agriculture is to promote and facilitate production of food and agricultural raw materials for food security and incomes; advance agro-based industries and agricultural exports; and enhance sustainable use of land resources as a basis for agricultural enterprises. They are involved in providing extension services to farmers	<ul style="list-style-type: none"> <li>-They provide national extension services to farmers</li> <li>-MOA in collaboration with Agrochemical Association of Kenya (AAK) and Pesticide Crops Product Board (PCPB) facilitate training on safe use and handling of pesticides, Globalgap and HACCP for farmers and agrovets attendants</li> <li>-They monitor the pesticides used by farmers in the field if there are any adulterated pesticides or unapproved pesticide in use they report to PCPB</li> </ul>
<b>Exporter-WONI –VEGFRU exporter</b>	The exporter WONI is situated near the airport and is involved in growing vegetable such as French beans, sugar snaps, runner beans, mangoes. They are also receiving produce from subcontracted farmers from various regions in Kenya and exporting to Europe	<ul style="list-style-type: none"> <li>-The exporter has employed technical people to oversee the production at the subcontracted out growers level</li> <li>-The exporter supplies both export and domestic market and the produce go through similar proper handling and proper crop protection practices</li> <li>-Exporter provides construction of grading shed, pesticide store, wash room, cleaning containers, market and transport, protective clothing and sprayer</li> <li>-Exporter facilitates training on safe use of pesticide, IPM, Globalgap, HACCP and crop production</li> <li>-Mr. Mutiso the WONI managing director said, <i>"One time I visited the farms and found a farmer spraying his tomatoes which were already ripe and when asked why he was not observing preharvest interval."</i> he answered,</li> </ul>

		<i>"the produce is not for export."</i> The exporter
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**Annex 14: PEST VERSUS SWOT analysis of the pesticide subsector in Kenya**

	<b>STRENGTHS</b>	<b>WEAKNESSES</b>	<b>OPPORTUNITIES</b>	<b>THREATS</b>
<b>POLITICAL</b>	<ul style="list-style-type: none"> <li>-The national task force for horticulture and the national food safety committee are good indication of the way forward in tackling the issues on pesticide residue in the country</li> <li>-The ministry in collaboration with Agrochemical Association of Kenya is involved in training on safe use of pesticide and other trainings such as HACCP and Globalgap</li> </ul>	<ul style="list-style-type: none"> <li>-The mandate for enforcement of pesticide rules and regulation is not clear as to which parastatal organization is responsible</li> <li>-Lack of staff on the ground for KEPHIS to facilitate pesticide safe use training.</li> <li>-Official government channels for communication are not effective partly due to inadequate field extension capacity</li> <li>-The government organizations refusing to acknowledge that domestic vegetable produce have high levels of pesticide residues</li> </ul>	<ul style="list-style-type: none"> <li>With the new campaigns by KEPHIS on sensitisation of maximum residue levels new markets from neighbouring and other countries will develop</li> <li>-The ministry of Agriculture is training farmers on Globalgap so as to get certification for them to access the European market</li> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>-With reports in the media of pesticide residue in vegetables for the domestic market it poses loss of the country's export market.</li> <li>-The government lacking the expertise for Globalgap regulation</li> <li>-Because of high levels pesticide residue reported the produce destined for the domestic market could cause serious health effect for consumers in the country</li> </ul>
<b>ECONOMICAL</b>	<ul style="list-style-type: none"> <li>-The spillover of Good Agriculture Practices (GAP) from export market produce to the domestic market by farmers is a positive aspect in the subsector</li> <li>-The Globalgap standard complied grown vegetables</li> </ul>	<ul style="list-style-type: none"> <li>-The parastatal-(KEPHIS) lacks funds for capacity building for their staff on issues of proper pesticide use and maximum residue level (MRL's)</li> </ul>	<ul style="list-style-type: none"> <li>-As a result of the government ensuring the maximum residue are not exceeded or making an effort to addresses the pesticide issues it opens up for new markets in the region</li> </ul>	<ul style="list-style-type: none"> <li>-The exceeding of the maximum residue for domestic market produce is a threat to export crops since they are grown together in relay or rotation</li> <li>-If reports on residue are revealed openly it threatens the export or domestic market for the</li> </ul>

	<p>create confidence to the consumers</p> <ul style="list-style-type: none"> <li>-The KENYAGAP certified produce sold in the Nakumatt gives confidence to it domestic consumers</li> <li>-Aggressive advertisement and promotion of pesticide by agrochemical companies</li> </ul>		<ul style="list-style-type: none"> <li>-Funding from donors such as Pesticide Initiative Programs for pesticide residue related projects in the country</li> <li>-New target of consumer for the supermarket for the produce that is safe and free from pesticide residues</li> </ul>	<p>country</p> <ul style="list-style-type: none"> <li>-New food safety regulation on pesticide use</li> <li>--Introduction of Globagap could lead to farmers being locked out of the market</li> </ul>
<b>SOCIAL</b>	<ul style="list-style-type: none"> <li>-Shift by consumer to buy indigineous vegetable and organic which are not sprayed with any chemical pesticides</li> </ul>	<p>Customers are not aware about food safety threats associated with inadequate pesticide use.</p>	<p>Invest in raising public awareness about food safety and show it is linked to farmer practices on pesticide use</p>	<ul style="list-style-type: none"> <li>-Consumers not demanding safe produce</li> <li>-Following the food insecurity in the country consumers have no choice but to purchase what is available</li> </ul>
<b>TECHNOLOGICAL</b>	<ul style="list-style-type: none"> <li>-Undertaking of training and awareness creation session by KEPHIS to farmers, supermarket produce handlers on the issue of pesticide residue</li> <li>-Availability of highly equipped laboratories for testing of pesticide residue in KEPHIS</li> <li>-Agrochemical companies organize technical trainings on pesticide safe use for</li> </ul>	<ul style="list-style-type: none"> <li>-The various parastatal mandated to carry out laboratory analysis for pesticide residue lack the equipment for analysis thus they have to take the samples to other laboratories.</li> <li>-Aggressive advertisement and promotion of chemical pesticide could lead to overuse of chemical pesticides by farmers</li> <li>-The Maximum Residue Levels issue is too complex for the national extension officers to</li> </ul>	<p>The new knowledge on food safety opens new opportunities for experts in that field to get employment for training or analysis of residue samples</p>	<p>Lack of knowledge on how to test and identify produce with exceeding pesticide residue by mandated organizations i.e. KEPHIS</p> <ul style="list-style-type: none"> <li>-Farmers lack of knowledge on pesticide rules and regulation</li> </ul>

	<p>farmers and agrovet attendants</p> <ul style="list-style-type: none"> <li>-Research by KARI has come up with disease and insect pest tolerant varieties which require little or no pesticide use</li> <li>-Exporter and Non governmental organisation involved in intensive trainings for farmers on various subjects</li> <li>-Ministry of Agriculture and exporters involved in extension services whereas NGO's develop private service providers</li> </ul>	<p>understand and explain effectively</p> <ul style="list-style-type: none"> <li>-Farmers depend on diverse sources of information which has tended to provide inaccurate and inconsistent information</li> <li>-Non governmental organization are donor funded thus for a short period and only work in very few region not national projects thus little impact in the country as a whole</li> </ul>		
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### Annex 15. Stakeholders analysis

Stakeholder	Role	Issues
Government Parastatals (KEPHIS HCDA, MPH, KEBS, PCPB, MOA) National task force for horticulture and National food safety committee	To serve the public in their various capacities, as indicated in chapter 5.	<ul style="list-style-type: none"> <li>-The pesticide rules and regulation mandate is not clearly defined as to which of the listed parastatal should enforce it.</li> <li>-When there is an issue of food safety the parastatals begin to blame each other</li> <li>-The parastatals are involved in capacity building on food safety and safe use and handling of pesticides aspects in a few pilot areas thus little impact in the country as a whole</li> <li>-Lack of staff with technical knowhow on food safety regarding pesticide use and application</li> </ul>
Exporters- WONI exporter	To assist contracted farmers ensure they produce export vegetables which are safe and complying with the expected maximum residue levels	-They are only focused on the proper pesticide use for vegetables for export and little emphasis on produce destined for domestic .market
Supermarket Uchumi/ Nakumatt	To provide services and good to the public Provide fresh vegetables to consumers	They do not have strong enforcement from the supplier side in regards to compliance with food safety aspects such as pesticide residue.
ICIPE-non governmental organisation	Involved in projects to assist the farmers in terms of capacity building on food safety aspects such as safe use of pesticide trainings	The NGO-ICIPE are only in a few pilot project areas and their projects are undertaken over a short period of time thus little impact on food safety (i.e. safe use of pesticide) in the country as a whole sometimes funding end before projects impact is felt





## **Annex 16: Research Proposal**



**University of Applied Science**

# **The spill over of good crop protection practices for export crops to crops for the domestic market A case of Kirinyagah district, Kenya**

**A Research proposal submitted to the Vanhall Larenstein University of Applied Sciences  
in partial fulfillment of the requirement of Masters Degree in Management of  
Development specialization International Agriculture**

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## CHAPTER 1: INTRODUCTION

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### 1.1 Introduction to the study topic

The research focused on spillover of crop protection practices from export production to domestic market production for farmers in Kirinyagah. The Globalgap certified farmers are growing French beans for export market where we have very stringent standards that farmers have to comply with and it is assumed that they are applying good crop protection practices. These farmers also grow crops for the domestic market so it would be interesting to see the food safety in Kenya. It is not well known whether the farmers are applying good crop protection practices for crops destined for the domestic market the same way they apply for the export crops. In addition to that the enforcement for the pesticide rules and regulation is also unclear. It would also be interesting to see whether there are any interactions between the Globalgap certified farmers crop protection practices and those of the non Globalgap certified farmer. Given this, the objective of the study is 'To which extent do farmers use export crop protection practices for crops destined for the domestic market' and for further elaboration of the sub questions the theory of behavior framework has been used. To collect information about the crop protection practices two clusters of farmers will be selected and interviewed which include a cluster of 15 Globalgap certified farmers and another cluster of 15 non Globalgap certified farmers. In addition to that 11 stakeholders from various organization which are involved in regulation and enforcement of law and standards of pesticide use will be interviewed. As noted by Battisti (2009) Globalgap and the national good agricultural practices schemes are bringing improvements for producers in the agricultural sector and the improvements made for export agricultural produce in Kenya is also resulting to improvements in the local food chain. The research hopes to find answers to the following questions

1. What are the sources of information farmers get with respect to pesticides use?
2. What are the trainings they get with respect to safe handling use of pesticide?
3. Are there any remuneration for farmers if they apply pesticide rules?
4. What are the enforcement systems with regards to pesticide regulation?

## **CHAPTER 2: BACKGROUND**

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### **Information use of pesticides in vegetables produced in Kirinyagah district**

#### **2.1 Tomato production in Kirinyagah district**

Kirinyagah district is one of the seven districts in Central Province of Kenya as shown in (annex 10). It is a high potential area with annual average rainfall ranging 800-2200mm. It has total area of about 112,700ha. with 95,500ha. (85%) under agriculture. There are two permanent rivers, namely Thiba and Nyamindi, which facilitate the growing of rice and horticultural crops such as tomato on the lower parts of the district. The Kirinyagah district in the north east of central province covers 1478km<sup>2</sup> and is one of the densely populated areas in Kenya with a population density of 317 persons/ Km<sup>2</sup> and a total population of 457,105persons (CBS-1999 census). Tomatoes are the second important cash crop in Kirinyagah after rice in terms of income generating crops. Tomato production in central province (7,999 Tonnes) ranks second to Nyanza province (10,869 Tonnes) in Kenya. (Humboldt-universitat, 2008). In 2006 tomato production in Kirinyagah was about 1450 hectares with a yield of 15-17 Tonnes per hectare per season. The majority are small and middle scale farmers who own 0.5 to 3 acres with a few posing more than 3 acres.

Majority of the tomato farmers are mainly found in Mwea division which is located on the border to Eastern province and is the poorest division in Kirinyagah with 40% of the population below the poverty line. (Waiganjo, et al, 2006). Tomato production is perceived to increase since farmers tend to shift from export crops such as French beans to tomato due to its profitability.

#### **2.2. Pesticide use in tomatoes grown in Kirinyagah district**

The study focuses on three aspects mainly farmers health as seen in use of protective clothing, consumer health as seen in farmers observing pre harvest interval and environmental health as seen with the farmers using disposal pit to dispose of synthetic pesticide container which are sometimes found known to be used for fetching drinking water. We will focus on the farmer since they are the people who behave in a certain manner in relation to the pesticide rules whereas consumers will be looked at to see what dangers of pesticides they currently face.

This thesis is about the use of pesticides by farmers producing tomatoes in the Kirinyagah district in Kenya and the residue levels of the tomatoes at the selling points (or outlets) to the consumers. In the past years there have been some reports that these levels were in some cases much higher than is allowed. There is documented evidence pertaining to worrying high pesticide residues in some of the vegetables sold on the domestic markets (Esipisu, 2007) noted that high levels of chemicals such as dimethoate, methoym, abamectin Diazinon, Captan, Heptachlor, Fenitrothion, Desmetryn, Chlorothalonil, Ethion, Parathion and Methyl were detected in vegetables sampled from the Wakulima market Nairobi. A study by KOAN (2006) has shown that most of the pesticides were present in high levels beyond what is accepted under the EU MRL's guidelines, meaning that they can have adverse health effects to humans on sustained consumption. In the study Wakulima market was chosen to represent the open air markets and an outlet for low income earners. In addition, KOAN took samples from one of the leading supermarkets within the city centre to represent the middle class and more samples

from a green grocer in Hurlingham, Yaya centre to represent the upper class. In the KOAN study, tomatoes from all the three markets outlets were contaminated with one outlet having as high as 0.93Mg/Kg of Diazinon, which is 47 times higher than what is acceptable under EU MRL;s guidelines.

As revealed in a study in Kirinyagah by Waiganjo et al.,(2006) that among the farmers interviewed, only (44%) of the respondents applied pesticides after scouting, while a few (6%) applied pesticides when they were told by other farmers or extension workers. Majority (77%) of the tomato farmers applied pesticides at regular intervals when they saw pests in their field (59%) or after scouting (36%). As reported by Humboldt universitat (2008) that at production level, extension service providers and farmers producing for the domestic market did not seem to have any information about maximum residue levels. For instance printed copies of the regulations were not available even at the ministry of agriculture but only at Kenya bureau of standards where they are for sale at Ksh1000

### **2.3. The marketing of tomatoes in Kirinyagah district**

The tomato produce like other local market vegetables is channeled from farm gate to the wholesale markets either directly or through middlemen/brokers (Waiganjo, et al.,2006) .Some produce is channeled directly to the retail markets. The retailers include groceries, supermarkets especially in the urban areas and open air markets in both urban and rural areas. The Wakulima market is the Kenya's most important wholesale market with 3000 wholesalers and retailers (Humboldt universitat 2008). This open air market is owned by the Nairobi city council (NCC) and its enforcement is by civil servants who are also in-charge of collecting market fees on a daily basis. Unfortunately, the market authority does not perform any quality assurance or standard control of products being sold (Humboldt universitat 2008).

At retail or marketing level, the operators are to be differentiated according to their location and or the volumes they trade (Humboldt universitat, 2008). There are sellers in open air market and road side sellers with small wooden kiosks. The latter sell at roadside without a booth, walking around and approaching potential customers. While the first two operate in the formal sector, the hawkers work in the informal one. In addition, supermarkets are part of the formal retail sector but they do not play an important major role in the supply of fresh fruits and vegetables (Humboldt universitat, 2008).

As reported by Humboldt universitat (2008) that consumers characterize high quality in terms of medium size, good colour, faultless skin, shape, taste and they look for storable goods (Humboldt universitat , 2008). Only a few consider organic production or pesticide residues.

Thus, there are two aspects to consider as far as standards are concerned (Humboldt universitat 2008): first the legal regulations and standards in particular, do exist but the actors along the chains are not aware of those standards. Second, there is also no demand driven for these standards neither from producers nor from the consumers.

The tomato value chain includes marketing of tomatoes from the farmer to the consumer and the prices per kilogram. It is noted that although at the farmer levels they are sold in crates of 40-50Kgs depending on size of tomatoes, at wholesale they are sold in kilograms, in open air market and groceries they are sold bunches of tomato pieces ranging from 4 to 6 and in the supermarkets in kilograms. The prices for each market differ.

Tomato production is constrained by biotic (insect pests, mites and diseases) and abiotic factors (high cost of inputs, poor quality seeds and adverse weather conditions). Other problems include uncoordinated and unorganized marketing, exploitation by middlemen and poor production planning leading to over-supply in some months that leads to very low prices (MoARD, 2001; Waiganjo, et al, 2006).

## **2.4. Enforcement, regulation, training and information**

In French bean production smallholder farmers form groups to facilitate joint marketing of their produce to meet basic requirements of economies of scale such as a group grading shed, purchase of pesticides, fertilizers and certification. Some of the farmer groups are Globalgap (Globagap) certified with the support from exporters or other development agencies who fund for the certification and sometimes the farmer groups fund themselves. This is certification for groups that is recognized as Globalgap certification option 2. The exporter employs a technical assistant to oversee the groups activities and assist group members with technical advice. Certification of Globalgap is facilitated by authorized certification bodies in Kenya such as Africert Kenya limited and Bureau of Veritas.

Currently, enforcement with respect to pesticide regulation varies with the end market of the produce. For the tomatoes that are supplied to supermarkets, the quality standards and KENYAGAP private standard are enforced by the supermarket management, for the French bean export market it is the exporters who enforces the International regulations and private standards such as Globalgap where there are stringent standard to be met the exporter facilitates the intensive training so as to meet the requirement for a certification. To comply with the standard which is the "conviction" as explained by the behavioural conceptual framework since the farmer through information learnt he uses pesticides as recommended to ensure safe produce is delivered to the consumer. On the other hand, there is strict control where if standards set are not met for the Globalgap products found not complying will be refused for export and sometimes even rejected thus the "stick" in the behavioural conceptual framework. (Figure 2)

For the open air market it is regulated by the Municipal council and for the greengrocers it is the National City council. The municipal council and National City Council are only involved in taking the monthly levies from trader and not enforcing quality or food safety standard in the market.

Fresh Produce Exporters Association of Kenya (FPEAK) in collaboration with Kenya Bureau of Standards has introduced KENYAGAP to supermarket in Kenya where KENYAGAP is a private standard which implies the producers of such vegetables comply with Good Agricultural Practices.

The Kenya Pesticide Control Board is the regulatory body with the mandate to register and deregister all pesticides used in the country. The board maintains a list of the registered pesticides that can be used including those that are banned from use in the country. The regulation is further strengthened by the Kenya Bureau of Standard -KEBS (article no date) KS1758:2003 Code of practice for the horticulture industry where KENYAGAP has been aligned with Globalgap and is compatible with most Good Agricultural Practices (GAP) standards in the world.

As reported by Bayer cropScience (article no date) Farmers are now producing tomatoes confidently as they have seen the advice given to them, through the Green World, working for



them. Thanks to the Bayer Tomato Clubs, participating farmers can produce quality tomatoes that conform to the requirements of KENYAGAP. As a result, our consumers will also be safeguarded from the risks of eating tomatoes with pesticide residues.

Public and private extension services are value chain supporters at input level (Humboldt universitat, 2008). However, extension service to horticultural is deficient. Most farmers state that for years they have relied on neighbours, friends and relatives for information. There are various organizations in Kenya which are involved in training of integrated pest management in Kirinyagah such as International centre for insect physiology and ecology.

## **2.5 National taskforce on Horticulture in Kenya**

A National Maximum Residue Levels (MRL) steering Committee was created by the Ministry of Agriculture to address the challenges faced by Kenyan horticultural producers in the international market in 2002. In 2004 it was named the National Task Force on Horticulture to reflect its broadened remit and multi-stakeholder membership (Gichuki, 2006). The National Task Force on Horticulture is an interactive and consensus building forum representing a wide range of stakeholders in the horticulture export subsector. The objectives of the taskforce have evolved over time. Current objectives of the taskforce are meant for both domestic and export market:

- Kenya horticultural produce complies with market requirements and sustains its reputation as a leading grower and exporter of horticultural produce
- Reliable and consistent information channels on issues relating to the horticultural sector in this country are opened between the public and the private sector
- Stakeholders in the horticulture industry are trained and informed on market requirement
- Capacity building on a sustainable basis is undertaken for the horticulture industry to ensure that the sector achieves the international accreditation required

According to Mithoefer ,et al. (2006) the export of fresh fruits and vegetables from Kenya targets almost exclusively the European market stricter regulations, e.g. export standards introduced by the food industry, like EurepGAP, present a challenge for Kenyan horticulture. These standards have become more important in Europe and influence producer decisions in a developing country like Kenya.

There is growing international concern related to a perceived emergence of increase in food borne diseases. Consumers around the world are seeking ever greater assurances about the safety and quality of food they eat. There has been need for countries to develop there own standards based on international standards . Several resolutions adopted by World Health Assembly recognized the need to highlight health considerations in international food trade and acknowledged the importance of the Codex Alimentarius Commission (CAC)for ensuring the highest levels of consumer health protection. On the other hand the fundamental mandate of CAC is to develop international standards, guidelines and other recommendations for protecting the health of consumers and ensuring fair practices in the food trade and Kenya has adopted through benchmarking KENYAGAP on international standards such as GLOBALGAP. ( WHO/FAO ,2007)

## CHAPTER 3: THE RESEARCH DESIGN

This section elaborates on the research problem, the research objective and the research question. A description of the behavioural conceptual framework is briefly given which is used to illustrate the behavior of farmers in their crop protection practices. From the research problem an objective was developed which with the help of the behavioural conceptual framework by Van Woerkum a research question and sub questions were operationalised. Theoretical framework is given in this chapter.

### 3.1 The Research problem

It is important subject to look into the spill over of export crop protection practices to the domestic market practices. It is assumed that farmers targeting the export sub-sector to the EU markets have adopted Good Agricultural Practices (GAP) in compliance with current private standards including Globalgap and that they apply similar practices for the vegetables sold on the domestic markets. **However, the problem is it is insufficiently known to which extent the use of pesticide practices for export vegetable is done on tomatoes destined for the domestic market. The export market crop protection rules are well complied with but it is not well known if the domestic crop protection rules are also complied with in the same manner**. There are different sources showing some evidence that non organic fruits and vegetables sold in various types of markets in Nairobi were found to contain dangerously high levels of chemical pesticide residues. In addition, evidence now shows that residents of Nairobi are exposed to high levels of chemical pollutants from both waste material and the foods they eat. (Table 1) The study commissioned by Kenya Organic Agriculture Network (KOAN) claims that most of the fruits and vegetables sold in Nairobi are contaminated with high levels of pesticide residue. (Esipisu-Daily Nation, 2007).

**Table 1: Pesticide contamination and their levels in tomatoes from Kenya**

Product	Source	Pesticide detected	Level (mg/kg)	EU recommended (mg/Kg)
Tomatoes	Green grocer	Dimethoate Methoym	1.07 0.08	0.02 0.05
Tomatoes	Nairobi supermarket	Abamectin Diazinon	0.13 0.93	0.02 0.02
Tomatoes	Wakulima	Ethion Parathion Methyl Terbutryn	0.30 0.08 0.19	NGG 0.02 NGG

NB: Heptachlor and Parathion Methyl pesticides detected are actually banned in Kenya

**Source: KOAN, 2006**

The research was aimed to look at 15 non Globalgap certified farmers and find out whether they have learnt something from the Globalgap certified farmers who are their neighbours and

farm next to them and are assumed to have access to a lot of knowledge. On the other hand, the research was aimed to find out whether crop protection practices on one side of export production are influencing the crop practices on the other side of the domestic market production within the same farm.

The findings of this study can provide useful insights that can be used to give useful recommendations to retailers and government for the enhancement of food safety standards for the domestic market in Kenya.

### **3.2. Objective**

To which extent do farmers use export crop protection practices for crops destined for the domestic market

### **3.3 Research questions**

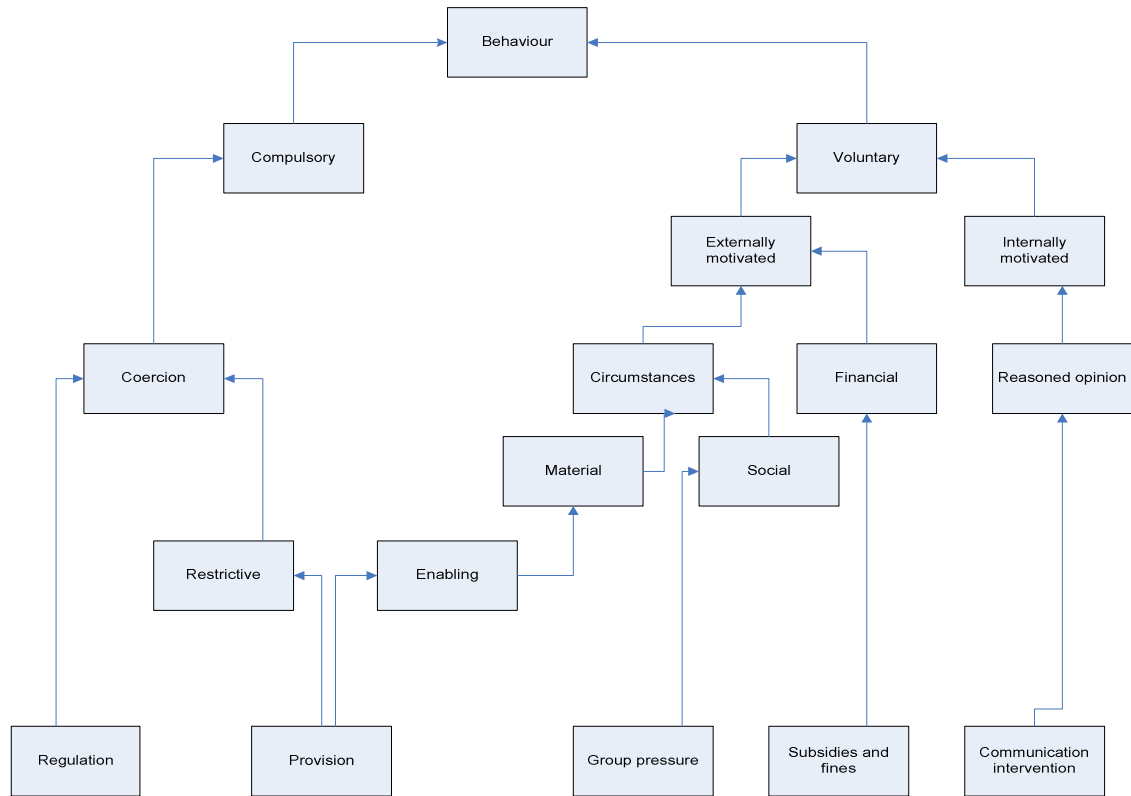
Following the above theoretical grounding of Van Woerkum (figure 2) this study seeks to answer the following main research question

### **3.4 Main question**

A) What are the crop protection practices applied in crops destined for the domestic market for farmers carrying out export market crop production?

From the main question to the sub questions a kind of a conceptual framework is needed and a starting point is to see practices as behavior and how behavior of human beings is influenced by different factors "carrot", "stick" and voluntary behaviour change. The "stick" refers to farmers facing punishment for failure to comply with pesticide rules and self motivation through the training and awareness campaigns done.

Sorting scheme as conceptualised by Van Woerkum



**Figure2: The relationship between communicative intervention and other policy instruments aimed at stimulating behavioural change**  
**Source: Leeuwis (2006)**

Following the use of the behavioural conceptual framework the sub questions were derived and later the interview checklist developed.

### 3.5 Sub questions

1. What are the sources of information farmers get with respect to pesticides use?
2. What are the training they get with respect to safe handling use of pesticide?
3. Are there any remuneration for farmers if they apply pesticide rules?
4. What are the enforcement systems with regards to pesticide regulation?

## **CHAPTER 4.0: RESEARCH METHODOLOGY**

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### **4.1 Study area**

The study area will be Kirinyagah district in central province Kenya. This area is selected because of its many smallholder vegetable producers who are growing vegetables for the domestic and export markets and the tomatoes is a major crop for the farmers. The farmers of Kirinyagah operate in groups and some have been certified for Global GAP. These farmers have benefited from various trainings facilitated by local and international Non governmental organizations such as the International Centre of Insect Physiology and Ecology (ICIPE) and Ministry of Agriculture (MOA) on a number of production aspect including Global Gap. These farmers supply the domestic market with vegetables such as kales, carrots, cabbages and mainly tomatoes for the local market. They also produce baby corn, okra and French beans for the export market. Farmers grow crops in rotation and/or relay as a strategy to optimize limited land resource. Those producing for the export markets are already complying with the Global GAP standard. The situation for those producing for the local market is unclear.

### **4.2 Methodology**

The research will have both quantitative and qualitative approach empirical data, literature and documents. The research strategy used includes the desk study and survey. In the survey semi structured questionnaires will be administered through an oral interview to the smallholder producers who will give an overview of the food safety aspects. A survey where open question interviews with key informants in the pesticide sub sector will also be carried out to get in-depth information and their various roles in regards to food safety.

### **4.3. Primary data collection**

A survey will be carried out which will include various interview discussions using open questions 11 key informants who are selected strategically through the experience I have in the sector. The interviews will be carried out in the informant's respective office of work where documents will be reviewed for triangulation purpose so as to gain an overall in-depth view of the food safety aspects in the sector. The selection criteria will be based on their position they have in relation to working with farmers in the selected district of study.

A total of 30 farmers will be selected where 15 will be from Globalgap certified groups and 15 will be from non Globalgap certified groups.

The interviews will be carried out where key informants and farmers will be interviewed and facilitation of a focus group discussion with 15 randomly selected smallholder farmers of the two clusters of one with farmers who are involved in Globalgap certified groups another with farmers without Globalgap certified groups. The focus group discussion and individual interviews will provide information on current farmer practices on pesticide use and application in vegetable production destined for the domestic and export markets. The factors that enhance and/or hinder compliance with recommended food safety standards for domestic and export market will be discussed in details.

The officer in charge of standards at Kenya Bureau of Standards (KEBS) will provide information on the overview of the various standards that exist on food safety in pesticide use and application and the internal mechanism which have been put into place to ensure compliance and the ways for enforcing the regulation to the actors in the tomato value chain. They will also give a overview of the role of the Kenya Bureau of standard in the vegetable subsector.

The fresh vegetable produce exporter manager of WONI company will provide information on how the exporters are involved with the farmers they sub contract : for instance they train farmer groups on how to comply with the private standards on food safety, at the same time give backstopping in pesticide use and application and assist in the construction of produce collection centers and compliance with the international standards. The exporters will therefore provide an overview of the factors in the sector which enhance and / or hinder the compliance to the standards in aspects to do with pesticide use.

The Fresh Produce Exporter Association of Kenya (FPEAK) an association of exporters which has been the lead organization in the development of KENYAGAP the local standard benchmarked against EUREPGAP. This manager of FPEAK will give an overview of the domestic and export food safety standards on pesticide use in addition to factors which enhance and/or hinder The Horticultural Crops Development Authority (HCDA) which is an organization that is a government parastatal body involved with the farmers in giving advisory services as well as market linkages for both domestic and export markets. The program officer will give an overview of how the smallholder is complying with the standard for domestic and export market. In addition they will describe their role of HCDA in the roadmap for enforcing national food safety standards on pesticide use and requirement for domestic & export markets

The Nakumatt and Uchumi supermarket which are local supermarkets that source produce from smallholders for the domestic market. The managers will give an overview of the domestic market standards and requirement for supply in addition to how they facilitate wide use of standards

The Non governmental organization is involved in developmental work. They assist farmers through training on how to comply with the export private food safety standards as well as linking farmer groups to exporters and assisting them to acquire necessary required structures for Globalgap in addition to training on safe use of pesticide. The non governmental organization Insect Centre for Insect Physiology and Ecology ICIPE's head of technology transfer unit will give an overview of the factors hindering and/or enhancing compliance with both domestic and export food safety standards in the aspects of pesticide use and application.

The survey will be carried out in Kirinyagah district. The research population is 291,431 persons (CBS-1999 census) and a total of 30 small holder producers will be strategically selected from the research population. A selection criterion will be employed where 2 clustered will be identified where one includes smallholder producers who have been certified through Globalgap and the other cluster with farmers who are not Globalgap certified. Each cluster will consist of 15 smallholder producers. The total sample size will be 30 which is the smallest representative number given that the survey is to be carried out within a short period of 6 weeks. The smallholder producers selected should be involved in both export production for French beans and at the same time producing tomatoes for the domestic market.

The survey will be carried out through administering a checklist through semi structured interviews for 1hour to each of the selected 30 small holder export/ domestic producers. The survey will give an overview of the current food safety practices in place, the aspects on



pesticide use in their farms and the factors which enhance or hinder the compliance of pesticide use and application requirement for both domestic and export standards.

A checklist will be developed where the questions will be derived from themes which will be derived from the research sub questions that were formed from the main question. A session of pretesting of the questionnaire will be carried out to identify gaps within the questionnaire for amendments before the administering of the questionnaires

#### **4.3.1 Research questions versus the respondent**

Farmers addressed question 1, 2, 3 and 4, Stakeholders interviews addressed questions 2,3 and 4 and the focus group discussion addressed questions 1,2,3 and 4. See 3.5 for the list of research questions addressed

#### **4.4 Secondary data collection**

A desk study will be carried out where partly it will be done in Netherlands and partly in Kenya for triangulation purposes. This will include information on policies, standards, and certification from sources such as NGOs annual reports, Organizations annual reports, exporter's policy document and other publications. Various sources will be used such as the internet, library and various official reports

## 5.0 DATA PROCESSING

- The PESTEC analysis tool of the pesticide sector within the vegetable subsector will describe the factors which influence or hinder the compliance of the food safety standard in the internal and external environment of the subsector. The factors will include the political, economical, social, technical, environmental and cultural.
- The data collected will be summarized as well as analyzed using the excel and Visio tool since it gives a presentable and easy to understand overview of collected data
- The SWOT analysis tool will give a clear overview of the strengths, weaknesses, threats and opportunities of the pesticide subsector of vegetable sector in terms of the standards and policies developed. It also involves identifying internal and external factors that are favorable and unfavorable to achieve the food safety standards.
- Stakeholders analysis will be carried out after the field survey interview and it will give the analysis of the roles they have played in ensuring standards are complied with in the subsector and issues arising from the stakeholders

### 4.5 Definition of concept

**Small holder grower:** A farmer with 0.1 Ha to 1 Ha of land

**Food safety management system:** Systems put in place to ensure that food products are safe and do not cause adverse human health effects

**Quality:** as defined by Juran (1990) defined as 'product performance that results in customer satisfaction and freedom from deficiencies which avoids customer dissatisfaction', in short 'fitness for use'

### 4.6 Expected out

It is expected that this research will provide highlights on how the food safety standards can be enforced to ensure compliance and filling the gap that exist in compliance between domestic and export standards.

## 6.0 Planning

Tasks	in weeks												
	26	27	28	29	30	31	32	33	34	35	36	37	38
Proposal writing & literature review													
Literature Review & desk study													
Pretesting ,Data collection (survey & case study) & field work													
Data Analysis													



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