ANKARA UNIVERSITY
GRADUATE SCHOOL OF NATURAL
AND APPLIED SCIENCES

MASTER'S THESIS

THE EFFECT OF CLIMATE CHANGE ON VEGETABLE FARMERS IN PEST CONTROL DECISIONS: CASE STUDY IN BOMBALI (SIERRA LEONE) AND BEYPAZARI (ANKARA) DISTRICTS

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ABSTRACT

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THE EFFECT OF CLIMATE CHANGE ON VEGETABLE FARMERS IN PEST CONTROL DECISIONS: CASE STUDY IN BOMBALI (SIERRA LEONE) AND BEYPAZARI (ANKARA) DISTRICTS

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The study was the effect of climate change on vegetable farmers in their pest control decisions (Case study Sierra Leone (Bombali District) and Turkey (Beypazari District). With such the specific objectives were; to identify the new situation caused by climate change in pest control activities, to identify the factors affecting farmer decisions making process on pest control, and also the Perception of vegetable farmers on the causes of climate change in pest control activities. Purposively the communities were selected and the study research design was exploratory, focused on exploring the emergence of themes from respondent data, collected and transcribed via structured interviews. The household head were selected purposively. The study revealed that (65%) of the total targeted population are male and (35%) are female and also of the fifty(50) vegetable farmers interviewed in Sierra Leone(Bombali District) , (35 %) of the population does not receive training on pest management and (45 %) of the total population in Turkey(Beypazari District) received training on pest management from Turkey. The majority of the vegetable farmers have managed vegetable production for six (6) years now. They have also practiced crop rotation and intercropping. Most of the vegetable farmers have heard about climate change and the main source is mass media. (70%) of the farmers interviewed within the two countries believe climate change is due to human activities.

This study recommends that vegetable farmers in Sierra Leone should receive training on pest management. In addition, alternative pest control methods should be made available to vegetable farmers to avoid the negative effects of pesticides. And also collaborative efforts from stakeholders in Turkey and Sierra Leone to create adequate awareness on the use of pesticide.

June 2021, 89 Pages

Key Words: Vegetable crops, climate change, Pest control decisions, temperature, Global warming, fungicides, Pesticides, household, income, crop rotation.

ÖZET

Yüksek Lisans Tezi

İKLIM DEĞIŞIKLIĞININ SEBZE ÜRETICILERININ BITKI KORUMA FAALIYETLERI ÜZERINDEKI ETKISI: BOMBALI (SIERRA LEONE) VE BEYPAZARI (ANKARA) BÖLGELERI ÖRNEĞI.

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Bu çalışma, tarımsal zararlılarla mücadeleye ilişkin karar verme süreçlerinde iklim değişikliğinin sebze çiftçileri üzerindeki etkisini değerlendirmek amacıyla Sierra Leone (Bombali ilçesi) ve Türkiye (Beypazarı ilçesi)'de yürütülmüştür. Araştırmada temel olarak: iklim değişikliğinin neden olduğu yeni durumun tespitini, mücadele faaliyetlerinde çiftçilerin karar alma sürecini etkileyen faktörleri ve çiftçilerin iklim değişikliğinin nedenleri konusundaki algısını belirlemek amaçlanmıştır. Araştırma rastgele seçilen yetişkin sebze üreticileri ile yüz yüze anket şeklinde gerçekleştirilmiştir.

Elde edilen sonuçlara göre, Sierra Leone'den sebze üreticilerinin % 35,5'inin zararlı yönetimi konusunda eğitim almadığını ; Türkiye'de ise üreticilerin % 45,5'inin zararlı yönetimi konusunda eğitim aldığını ve sebze çiftçilerinin büyük çoğunluğunun son beş-altı yıldır sebze üretimini başarıyla gerçekleştirdiğini ortaya koymuştur. Sebze üreticilerinin ayrıca ürün rotasyonu ve karışık ekim sistemi de uyguladıkları; çoğunun İklim değişikliğinden haberdar olduğu (%70); kitle iletişim araçlarının bu konuda başat rol oynadığı ve insan faaliyetlerinin iklim değişikliğine katkıda bulunan başlıca faktör olduğu değerlendirilmiştir.

Araştırma sonuçları, Sierra Leone'deki sebze çiftçilerinin zararlı yönetimi konusunda eğitim almalarını önermektedir. Ayrıca, sentetik pestisitlere alternatif mücadele yöntemlerinin sebze üreticilerinin kullanımıa sunulması sağlanmalıdır. Son olarak, çalışmada, hükümetin, paydaşların ve bağışçı kuruluşların bir araya gelerek iklim değişikliğinin etkisi konusunda farkındalık yaratma konusunda ortaklaşa çalışmasını önermektedir.

Haziran 2021, 89 sayfa

Anahtar Kelimeler: Sebze bitkileri, iklim değişiklilği, Mücadeleye karar verme, sıcaklıkküresel ısınma, fungisit, pestisit, hanehalkı, gelir, rotasyon.

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Patrick KARGBO
June Ankara, 2021

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1. INTRODUCTION

1.1 Background

The world's vegetable crop farmers are challenged with safe, growing, and nutritious food for the rapidly increasing global population in the face of the new change in climate and pest pressures (Bhardwaj, 2012).To enable vegetable farmers to continue to produce highly nutritious crops, they need to have access to appropriate knowledge on pest control, as well as knowledge on climate change.

Climate change in general may be a change in a situation that means various parameters in terms of its climatic appearances (Ayyogari, Sidhya, and Pandit, 2014). Some of these climatic parameters are relativity humidity, temperature, precipitation, and atmospheric gases composition etcetera. It can also be referred to as a change in weather conditions over time depending on the factor. According to Schneider et al (2007), the vulnerability to climate change situation is the degree to which this situation is unable to survive with the radical impacts of climate change. Vegetable crops are a rich source of protein, vitamins, carbohydrates, and salts (Bhardwaj, 2012). The increased health awareness to rural farmers on vegetable crops is now becoming one integral part of the average household's daily meals in Sierra Leone and Turkey. Also, the rapid increase in population growth rate has ignited a high demand for basic dietary for vegetable crops.

The change in climate conditions will pose a negative fell back on vegetable crop production and pest control decisions; consequently which also affect the food supply. The problems of climate change are extreme events that very difficult most time to predict which alter pest control decisions by vegetable farmers. Some of these climate changes that affected vegetable farmer’s decisions are the erratic rainfall patterns and the rapid unpredictable high temperature spells consequently affected crop growth rate and increases the number of pests. Developing countries such as Sierra Leone and Turkey were particularly vulnerable. The shifts in the ecology, land degradation, and agro-economic areas etcetera, makes it difficult to cultivate the traditional way.

Climate change poses significant challenges on pest control decisions and negative impacts upon the present vegetable crop production. There is mounting evidence that vegetable farmers in developing countries are experiencing new situation on climate variability which has affected their pest control decisions some of this climate change variability is extreme temperature and precipitation that is linked to increased greenhouse gas emission.

Notwithstanding, the new situation of climate change regards its physiological and biochemical changes has influenced the pest control decision, pathogen mitigation, the ecology appearance which has led the development of plant diseases(Khan, 2012).

The change in physiological in climate in plants may alter the farmer's pest control decisions regarding climate change perspective, the resistance to any disease may be overcome quickly because of the change in the climate. Fungicide and bactericide efficiency in pests increased moisture and temperature etc. Climate change most time makes vegetable farmers finding it very challenging to decide on pest control and also it ignited the contact fungicides on crops. Sierra Leone, Bombali District is characterized by grassland and open-bush. Rice, sweet potatoes and cassava are the staple food crops while groundnuts, peppers etcetera comprise the main cash/non-staple crops. The land in Bombali district is suitable for livestock rearing. The total number of people food insecure in Bombali District is 132,322(MAFFS) and the percentage of household food insecure (severe and moderate) is 25.5%.and Turkey (Beypazari District) ,the most famous local food in Beypazari district is Kurusu, a traditional long-lasting pastry. The fertile soil of the region makes it produce nearly 60% of Turkey's carrots, as well as lettuce, green onion, and spinach farming.

1.2 Statement of the problem

Sierra Leone and Turkey vegetable farmers have faced a lot of challenges in terms of pest control decisions because of climate change in such countries.

There are very ambitious associated recently in these countries because of inadequate knowledge on the effect of climate change and pest control alternative decisions. The problem facing recently is the higher temperatures from global warming and the increase of sugars in some leaves and lower nitrogen content these has an advanced effect on pest control decision because these can also increase the damage caused by some insects and also help the integration of new pest.

Another possible effect of climate change that needs to be taken into account that affected pest control decision is a warmer temperature which also lowers the effectiveness of some fungicides and pesticides in pest control.

1.3 Aim and Objectives of the research

1.3.1 Aim

The aim of this study is the effect of climate change on vegetable farmers in pest control decisions (Case study Sierra Leone (Bombali district) and Turkey (Beypazarı, Ankara))

1.3.2 Objectives of the study

Objectives of the study are as follows:

(1) Identify new situation caused by climate change in pest control activities.

(2) To identify the factors affecting farmer decisions making process on pest control

(3) Perception of vegetable farmers on the causes of change in climate in pest control activities

1.4 Research Questions of the study

The study researched some of the following questions:

• What are the new situation caused by climate change in pest control activities?
• What are the factors affecting farmer decisions making process on pest control?
• What are the Perception of vegetable farmers on the causes of change in climate in pest control activities?

1.5 Justification

The challenges of climate change on vegetable farmers in pest control decisions is caused due to higher temperatures that hasten the life cycle of many pests, multiplying their birth rate consequently and also increasing the infection pressure. The increase in the number of pathogens due to climate change will eventually lead to unprecedented opportunities for pests which also affected the farmer pest control decision.

1.6 Scope

This research was conducted mainly within Sierra Leone (Bombali district) and Turkey (Ankara province, Beypazari district) because there is a huge number of vegetable farmers in such areas and such districts are famous in terms of vegetable production. According to the study, the following was of a target to identify the new situation caused by climate change in pest control activities, to identify the factors affecting farmer decisions making process on pest control, and perception of vegetable farmers on the causes of change in climate in pest control activities.

1.7 Limitations

The challenges faced in the study are numerous, to name but a few, these will include constraints in terms of finance, time, and logistics, as well as difficulties in accessing information.

There was also be a constraint in transportation from the researcher's residence to the case study area during the research period, there is also a communication problem with

the farmers. However, various measures are being put in place by the researcher to minimize the obstacle that emerged to reach the goal of the project.

Therefore, the researcher's result cannot be taken absolutely. Notwithstanding that, the researcher will of the view that the result will be adequate and useful for the purpose of this study.

2. SUMMARY OF RESOURCES

2.1 Introduction

This section looks at related literature of the study, and it dealt with three subheadings as follow: the new situation caused by climate change in pest controls activities the research area, identify the factors affecting farmer decisions making process on pest control activities, and Perception of vegetable farmers on the causes of change in climate in pest control activities.

2.2 The new situation caused by climate change in pest control activities

The climate change situation circled around environmental changes (Khan et al. 2015). The Climate Change panel of intergovernmental, defined climate change as the change in climatic situation over a period of time, due to human activity or nature.

Daily human activities such as deforestation, mining etcetera have caused negative impacts on our climate systems for our vegetable farmers some this negative impact is general changes in wind and solar radiation, temperature and precipitation, are being seen across the globe (Andrew and Hill, 2017). As it was also indicated by the fifth IPCC annual report that greenhouse gas emission such as carbon dioxide is causing a serious problem for the ocean and air temperatures to rise, also the glaciers to melt and sea levels to rise rapidly (IPCC, 2013).

The change in climate poses a significant threat to farmers in terms of the control of pests. These "pests include invasive weeds and insects etcetera. As the change in climate variables continue new pests may become able to invade in gardens.

The new situation on climatic factors that aid in pest invasions are mostly increase in average temperature related, change in precipitation pattern warmer winter minimum

temperatures and water shortages (Grace et al, 2019). Some major crops such as cowpea, soybeans can also serve as an alternative host for the most pathogen.

The higher the temperature and carbon dioxide elevation may act opposing manner depending on the pest concerned. Most time the result of these change in climate cannot be foreseen until an appearance of a pest to initiate action, is the only remaining option.

Modern Farming practices can also help to minimize the spread pests, and planting strategies such as crop rotation and changing planting times can counter weed growth. As a vegetable farmers you need to adapt the early warning sign and there is also the need to understand that weeds or pest to prioritize.

The climate parameters such as relative humidity precipitation and temperature influence insect's pest control decision both directly and indirectly (Jaworski et al, 2013). The direct influence can sometime be observed through the activity of larvae and the adult insect in the environment. And the indirect is climate influence in the environment where most time new insect appears. The failure of pest control activities on vegetable crops may also because of inadequate production of the protein that is caused by climate change and the effect of the environment on its transgene expression (Sangle et al, 205).

Pest control activities such as the application of bio pesticides or insecticides are highly sensitive to the environmental condition, the rapid increase in radiation and temperature and also a decrease in relative humidity may affect the pest control activities by making them none effective, on the vegetable crop production.

Temperature: The new Climate change situation has to result in a rapidly increased temperature that vegetable pest control populations' activities in several ways. Most recent researcher's works seem to agree that the change in temperatures will increase insect (Satpute, et al, 2015). The increased temperature has greater potential for insect development, behavior, population size, and geographic range.

The temperature change pest physiology and the rapid development of insects through the existence of the physiology. Some of these insect pests complete one life-cycle- in certain habitats because of the moderate temperature. Most insect pests are ‘stop and go’ developing life circle concerning temperature. Most time develops more rapidly during periods when there are high and suitable temperatures.

Precipitation/drought: The change in rainfall also has a major effect on pest control activities. Analysis of data of precipitation in the past years has shown that the amount of precipitation has changed rapidly and also the level of rainfall increased (Das, 2011).

Droughts decrease the vegetable crop yield and also change the composition of the soil. The drought also promote the increase in population of some wireworm which alter pest control activities. (Karuppaiah and Sujiyanad 2012).

2.3 The factors affecting farmer decisions making process on pest control activities

The concept of farmer decisions making process on pest control activates is a strategy for managing pests, has been in existence for a long time in the 21 century (Dara, 2019). Pest control activities are major components of agricultural production because of the reliability for crop protection against insect pests and the assurance of high vegetable crop yields (Damalas and Eleftherohorinos, 2011). In rural areas of developing countries such as Sierra Leone, vegetable farmers suffer annually from insect pests (Miller and Zhang, 2011), because of a lack of knowledge on pest control, incorrect perceptions, education among vegetable farmers, regulation. The pest control activities were conceived as a method of rationalizing insect pests by preventing or delay the resurgence of pest populations (Rezaei et al, 2014).

Today, the approach of pest control activities method seen as a major component of technology, this approach emphasizes pest control activities programs using accurate information on pest life cycles with a better understating and their interaction with the environment will help the vegetable crop farmer to mitigate pest activities. Vegetable

crop production farmers are facing significant challenges in pest control decision due to a constantly changing global environment and some decision in pest control activities demand a thorough analysis of the ecosystem.

Farmer's decision on pest control is their vegetable farm is usually based on the perceived threat of the pest locally and the guidance of commercial advisors (Milne, 2015). The widespread concerns regarding decision making in pest management, is like any other economic problem in the agriculture sector which involves allocating the right resources to meet the required demand . in the process, farmers have to make choices on several inputs such as fungicides, herbicides , insecticides and most time consulting fees for pest infestation and time for treatment. Notwithstanding, farmer decisions on pest management at vegetable farm level may not only be the choice of pest control practices, but it also deal with optimal level of set of particular practices of pest control, this take places in many levels at the vegetable farm on the strategy of pest control in a given region and crop as well as the approaches to implement pest control is as another challenging factors.

The human and economic factors affecting farmer decisions making process on pest control activities are capital, technology, labour government (politics), and market. In the least developing countries, such as Sierra Leone, vegetable farmers used cheap labour instead of hiring machines. While one the other side such as the Netherlands prefer to use machines. Vegetable Farmers sometime are unskilled and also without any knowledge on how to use machines, e.g. tractors, harvesters, and milking machines. Vegetable farmers most time cannot have access to advance technology which provides can help them to determine moisture of the soil and the temperature. No access to the market to buy pesticides and insecticides total affect their pest control activities. The temperature for vegetable crops to cultivate and the adequate rainfall most time determine the types of vegetable crops that can be cultivated, the temperature duration and rainfall affect farmer decision making on pest control activities. The garden site also plays a significant role in making a decision, because it determines soil erosion and inadequate drainage system also affects farmers' decisions in pest control activities

because there will be waterlogging in the vegetable garden which is not advisable to apply any chemical.

2.4 Perception of vegetable farmers on the causes of change in climate in pest control activities

Climate change has posed so many challenges to our communities, in the area of agricultural (Eitzinger et al., 2017). One of the major challenges in the design and implementation of adequate actions that will mitigate this change despite scientific consensus about the risk, possible solutions, and risks to climate change, non-specialists most time underestimate the risk and the cause (Ding, 2011). The new situation of climate change varies across regions, individual, households and farming systems, and so most time farmers have to adapt to the new situation. little is known about the new situation of climate change because it affect differently in terms of rain fed farming livelihood , furthermore the vulnerability to the adverse consequences of change in climate, and the adaptation efforts need to be better understood by the farmers. The change in climatic condition have increased the variability are seen as major threats to vegetable production which have brings lot of challenges on farmers decisions in pest control (Bojang, 2020). The perception of vegetable farmers on the impact of change in climate have effectively utilized their resources for them to cope with the present situation and the kind of adaption strategy to be adopted is of a big concern.

Furthermore, the most satiable actions are undertake by groups or individuals that are supported through government, organization/ institution in most developing counties, the influence of this sector has become a weaker duce to liberalizing economy (Eakin and Lemos, 2006).

Effective mitigating of change in climate requires a better knowledge on the impact that and the causes of change in climate and the within the environment (Niles and Mueller, 2016). Suitable vegetable cultivation activities depend on favorable weather (Porter. 2014). Farmers Perceptions not only shape knowledge but also shapes his / her perceptions about climate change (Ansari and Raghuvanshi, 2018). Enhancing

vegetable farmer's skills and knowledge on how to respond to the change of climate is key in terms of pest control decision. Vegetable farmers must be able to validate and have a better understanding on the new technologies and it approaches adapted to climate change on pest control decisions , such as the new integrate agro ecological approaches it digital-based technologies, and the improve integrated pest management approaches and methodologies.

2.5 Summary and Conclusions

The literature review provided a solid background on the available studies that have been done on the effect of climate change on vegetable farmers in pest control decisions, thereby giving the vegetable farmer more flexibility to meet the challenges they face.

The next page contains details of the research design and methodology used in the study, including the research instruments, sample frame, and sample design, data collection, data capturing and data editing, data analysis.

3. MATERIALS AND THE METHODS

3.1 Introduction

The materials and the methods adopted in this research comprise the research design, the study area, the population, the sample and sample procedure, Data Collection, research instrument, Administration of the Questionnaire and Data Processing

3.2 Description of the study area

(Bombali district, Sierra Leone)

Bombali District is on the Northern Province of Sierra Leone and have its capital call Makeni. Bombali district comprises of the Temne and Limba as the most populated ethnic groups. Their main occupation is farming and trading. This zone is characterized by grassland and open-bush approximately 90% of the cattle in Sierra Leone are found in the Northern Province, predominantly in Bombali and Koinadugu Districts. About 200 000 hectares approximately of savannah woodlands annually. Rice, sweet potatoes and cassava are the staple food crops while groundnuts, peppers etcetera comprise the main cash/non-staple crops. The total number of people food insecure in Bombali is 132,322(MAFFS, 2018) and the percentage of household food insecure (severe and moderate) is 25.5%.

Turkey (Ankara provinces, Beypazari District)

Beypazarı district is a district of Ankara Province of Turkey, with approximately 100 km west of Ankara city. According to the recent census, the population of Beypazari district is 46,493. Beypazari District Turkey has been a settlement since the ancient times and also holds symbols of ancient traditions with rich natural resources and historical, according to UNESCO report. The district has diverse local food, and natural sources.

3.3 Research Design

The study research design was exploratory, focused on exploring the emergence of themes from respondent data, collected and transcribed via structured interviews. The approach to the study was exploratory to gain a deep understanding of climate change on vegetable farmers in pest control decisions (Case study Sierra Leone (Bombali District) and Turkey (Beypazari District)). Leedy and Ormrod (2015) contend that when little is known about a topic and there is inadequate information and unknown variables at play, a qualitative study can assist in the identification of what is important and needs to be studied. The research design used was non-experimental.

3.4 Source of Data

The work was largely based on primary and secondary data. Primary data was sourced from the vegetable farmers. On the other hand, secondary data refers to data which has already been collected and analyzed by someone else.

3.5 The Population, sample Size and Sampling Procedure

3.5.1 Population

This comprises vegetable farmers in Sierra Leone (Bombali District) and Turkey (Beypazari District, Ankara). 134 existing vegetable farmers in Bombali District (MAFFS Bombali District, Sierra Leone registered vegetable farmers 2021) and 1079 producer in Beypazari District (Ministry of Agriculture and Forestry Turkey, farmers registration system 2020 data).

3.5.2 Sample size

The target sample size was 100 farmers in Bombali District and Beypazari District in selected chiefdoms that are engaged in large scale vegetable farming. Of the 134

existing vegetable farmers in Bombali District (MAFFS Bombali District, Sierra Leone registered vegetable farmers 2021) fifty(50) were selected randomly and also out of 1079 producer in Beypazari District (Ministry of Agriculture and forestry turkey , farmers registration system 2020 data) fifty(50) farmers were selected randomly.

3.5.3 Sample procedure

A purposive sampling technique was use to select the vegetable farmers (which is 100 farmers) as a sample for the survey.

3.6 Data Collection Methods

The data was collected using survey, which comprised face-to-face interviews. Interviews were conducted in Krio and Turkish in person. The researcher and his team took shorthand notes of the conversation with each respondent to reconstruct the interview as accurately as possible as fact. 30 minutes were allocated for each questionnaire.

3.7 Research Instruments

A research questionnaire and interview guide were designed to facilitate interviews and the questionnaire was self-administered by the researcher and his three (3) other enumerators to individuals master farmers. The questionnaire used close and open-ended questions. Interview guide was used to guide the researcher and a notebook was used for note-taking. Following the interview including the primary source was gathered, reviewed, and then analyzed.

3.8 Administration of the Questionnaire

Interviews were organized with the vegetable farmers who were randomly selected and then the questionnaire was explained and administered to them since most of them

could not read and understand well. The researcher then interviewed the farmers and conducted individual face-to-face interviews.

3.9 Data Processing

The researcher investigated various data analysis software before settling for Excel a professional software for quantitative, qualitative, and mixed methods of data analysis. A general strategy for organizing and analyzing qualitative data includes the identification of preliminary categories helpful to the coding of the data (Leedy & Ormrod, 2015). The researcher drafted such a preliminary set of data categories and subcategories, listing general themes identified throughout the transcription and data editing process, as pertain to the research objectives. The researcher then used the SPSS software, analysis step to code interview data by respondent and research question, and by each category and subcategory from the preliminary table. Coding increased the efficiency with which the researcher was able to find, access, and reference respondent data.

The statistical analysis is a keyword frequency search tool, to efficiently code categories and subcategories to efficiently establish data-driven themes as Dominant, Semi-Dominant, Important or Inconclusive – memo-coded by respective themes. The researcher presented the data in a tabular format and used charts displaying frequencies, percentages, and means to explain the relevant allocation of response on all the variables. Although it was planned, no statistical analysis could be done due to the lack of enough discrimination in the variables.

3.10 Summary and Conclusions

Chapter 3 outlined the study research design and methodology, including an explanation regarding why an exploratory methodology was the most appropriate and best-suited approach for the research problem. From the data I cannot do any statistical comparison, because of the nature of the questionnaire, but for joint paper, I can do statistical comparison.

4. RESEARCH RESULTS

4.1 Introduction

The research results from the data analysis process outlined in Chapter 3. As detailed in this section, the researcher drafted a preliminary set of data categories and subcategories identified throughout the transcription and data editing process, as they pertain to the research objectives and questions as seen below in 4.2 Presentation of Results, lists the preliminary categories and subcategories. The researcher used Excel Microsoft to code all interview data firstly by the respondent, then by the research question, and thereafter by each identified preliminary categories and subcategories.

Strategy and approaches for analyzing qualitative data are less prescriptive than analysis of quantitative data, and generally involve a greater reliance on inductive reasoning processes. The researcher observes situations, events, or concepts in the data and imposes specific meaning on these via some form of coding with conclusions drawn thereafter. This flexibility and open-mindedness are beneficial, though also increases the difficulty for a researcher to analyze the data with total objectivity. For this reason, a researcher should continuously acknowledge, to self and others that attitudes and beliefs may inevitably creep in, biasing observations and interpretations (Leedy & Ormrod, 2015).

4.2 Presentation of Results

One hundred (100) vegetable farmers were selected from Sierra Leone and Turkey, fifty (50) for each country, who were all considered as master farmers who mostly engage in massive farming within the specific district. The interview lasted for 30 minutes with each master farmer.

The sample was selected according to the calculated quota, being representative of the entire vegetable farmers in Sierra Leone (Bombali district) and Turkey (Beypazari

district). Four research assistants were recruited to conduct this survey regards the time agreed with the vegetable farmer to complete the interview.

The researcher asked questions to gain insight and perspective from the vegetable farmers regarding their perceptions and understanding regarding climate change on vegetable farmers in pest control decisions following by identify the new situation caused by climate change in pest controls activities, identify the factors affecting farmer decisions making process and perception of farmers on the causes of climate change in pest control activities. The following question(s) were asked of vegetable farmers to gain deeper insights into their perceptions.

Demographic characteristics of farmers in Bombali district (Sierra Leone) and Beypazari District (Turkey)

The Demographic characteristics include household head, gender, Age, formal education, and marital status. For these previously compiled factors of demographic, the diagrams show the percentages of participation in the survey among various demographic.

Household head

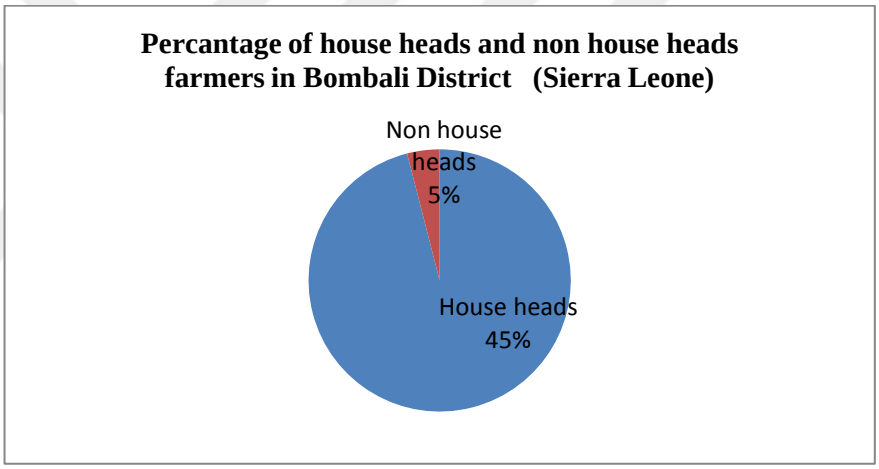
Table 4.1 household head

Country	**House heads**		**Total (%)**
	Yes	**No**	
Sierra Leone	45.0	5.0	50.0
Turkey	48.0	2.0	50.0
Sum total	93	7	100

Table 4.1 shows the household heads for Sierra Leone (Bombali District) and Turkey (Beypazari District), respectively

Figure 4.1 illustrates the percentage of house heads and non-house heads farmers in Bombali district (Sierra Leone) and Beypazari District (Turkey). A total of 100 farmers were interviewed within the two countries (50) vegetable farmers from Sierra Leone (Bombali District) and (50) from Turkey (Beypazari District)) respectively. With respect to the (50) vegetable farmers interviewed in Sierra Leone (Bombali District), (45%) of them are house heads while (5%) are non-house heads. Likewise in Turkey (Beypazari District), out of (50) of farmers interviewed, (48%) are house heads while (2%) are non-house Heads.

From the data, this shows that there are more household head in Beypazari District (Turkey) than Bombali District (Sierra Leone).



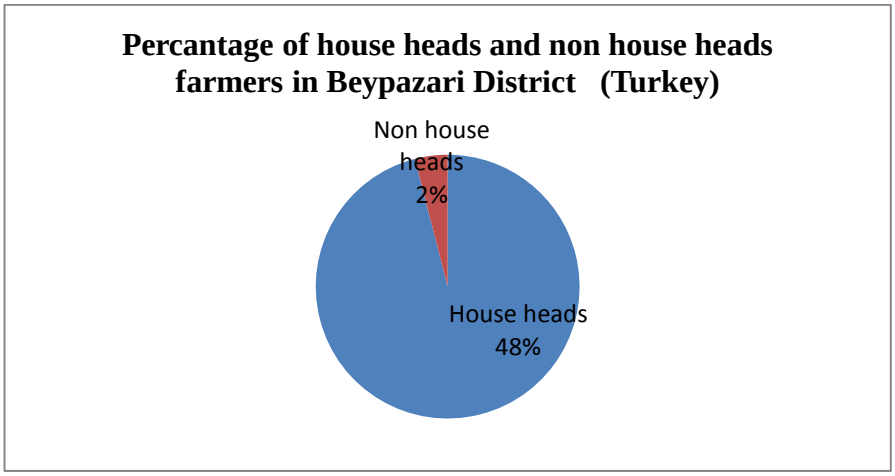


Figure 4.1 above illustrates the percentage of house heads and non-house heads farmers in Bombali District (Sierra Leone) and Beypazari District (Turkey)

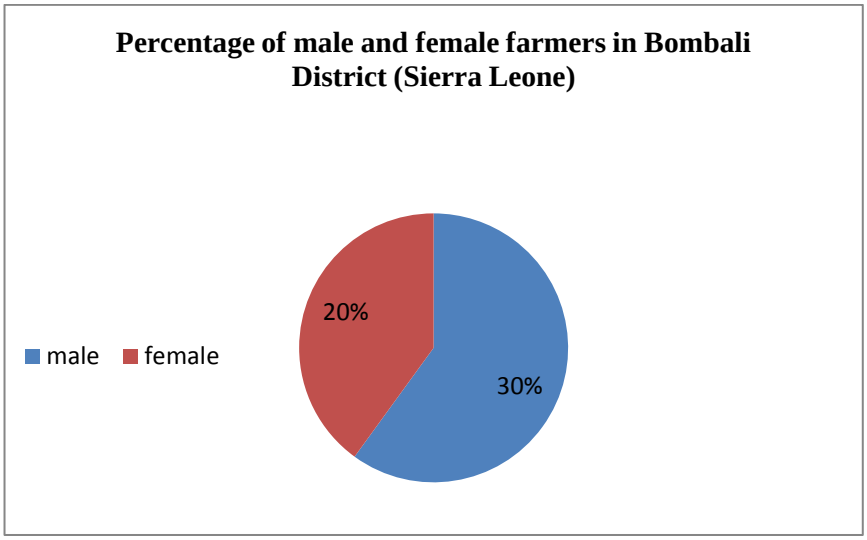
Gender

Table 4.2 Gender

Country	Male	Female	Total (%)
Sierra Leone	30	20	50
Turkey	35	15	50
Sum Total	65	35	100

Figure 4.2 shows the percentage of male and female farmers interviewed in Bombali (Sierra Leone) and Beypazari District (Turkey) respectively. A total of 100 farmers were interviewed, (50) from Sierra Leone (Bombali District) and (50) from Turkey (Beypazari District).with regards to the (50) vegetable farmers interviewed in Bombali District (Sierra Leone), (30%) are male while (20%) are female. Considering the (50) vegetable farmers interviewed in Beypazari District (Turkey), (35%) are male while (15%) are female.

From the analysis , this show that there are more male vegetable farmers in Baypazari District(Turkey) than Bombali District (Sierra Leone) and also there are more female vegetable female farmers in Bombali District (Sierra Leone) than Beypazari District (Turkey).



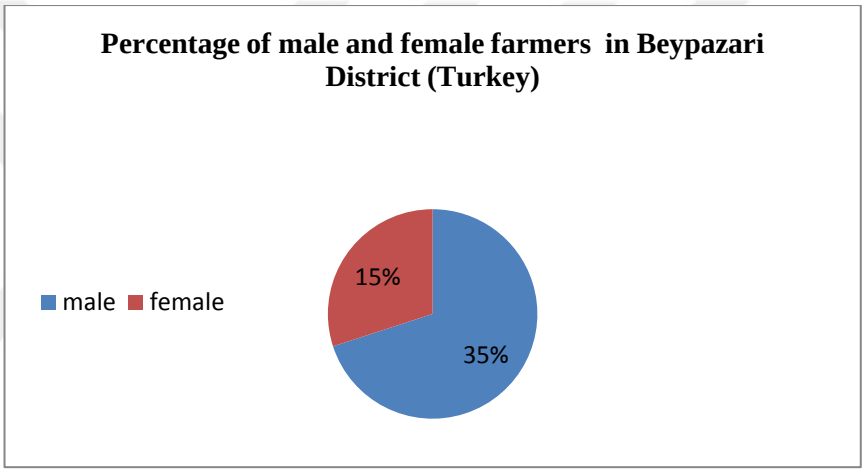


Figure 4.2 above shows the percentage of male and female farmers interviewed in Bombali District (Sierra Leone) and Beypazari District (Turkey)

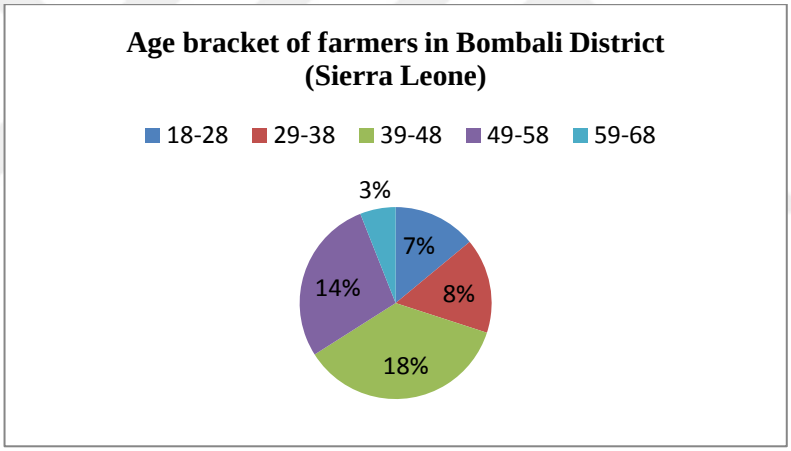
Age

Table 4.3 Age

Country	**Age brackets (years)**					**Total**
	18-28	**29-38**	**39-48**	**49-58**	**59-68**	
Sierra Leone	7	8	18	14	3	50
Turkey	8	7	14	10	11	50
Sum total	15	15	32	24	14	100

Figure 4.3 illustrate age bracket of vegetable farmers interviewed in Bombali District (Sierra Leone) and Beypazari District (Turkey). However, Out of the (50) vegetable farmers interviewed in Sierra Leone (Bombali District), (7%) fall within the age bracket (18-28 years), (8%) fall within the age bracket (29-38years), (18%) fall within the age bracket (39-48 years), and (14%) within (49-58 years) while (3%) are within (59-68 years) respectively. Similarly to Turkey (Beypazari District), out of (50) vegetable farmers interviewed, (8%) are within (18-28 years),(7%) fall within the age bracket (29-38 years) ,(14%) are within the age bracket (39-48 years),(10%) are within (49-58 years) while (11%) fall in the age bracket (59-68 years).

From the analysis there are more youth that engage in vegetable farming in Bombali District (Sierra Leone) than Beypazari District (Turkey)



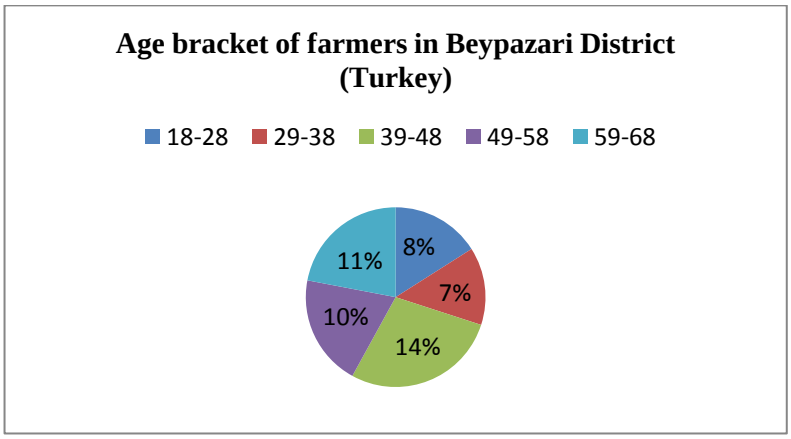


Figure 4.3 above indicates age bracket of farmers interviewed in Bombali District (Sierra Leone) and Beypazari District (Turkey)

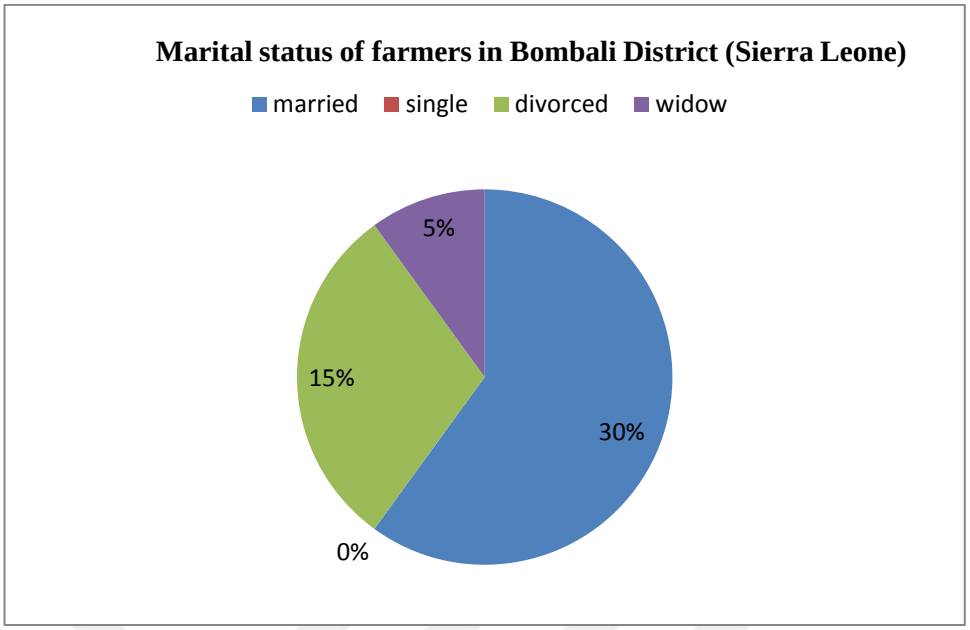
Marital status

Table 4.4 Marital status

Country	**Marriage**	**Single**	**Divorced**	**Window**	**Total for each country**
Sierra Leone	30	0	15	5	50
Turkey	40	0	5	5	50
TOTAL	70	0	20	10	100

Figure 4.4 shows the marital status of famers in Bombali District (Sierra Leone) and Beypazari District (Turkey).considering the marital status of Vegetable farmers. Out of the (50) vegetable farmers interviewed in Sierra Leone (Bombali District), (30%) are married, (15%) have divorced while (5%) are widows. No farmer that is single was interviewed. Similarly for Turkey (Beypazari District), (40%) of the farmers interviewed are married, (5%) have divorced while (5%) are widows. No farmer that is single was interviewed.

From the data, there are more married vegetable farmers in Turkey (Beypazari District) than Sierra Leone (Bombali District) and also there are more divorced vegetable farmers in Sierra Leone (Bombali District) than Turkey (Beypazari District)



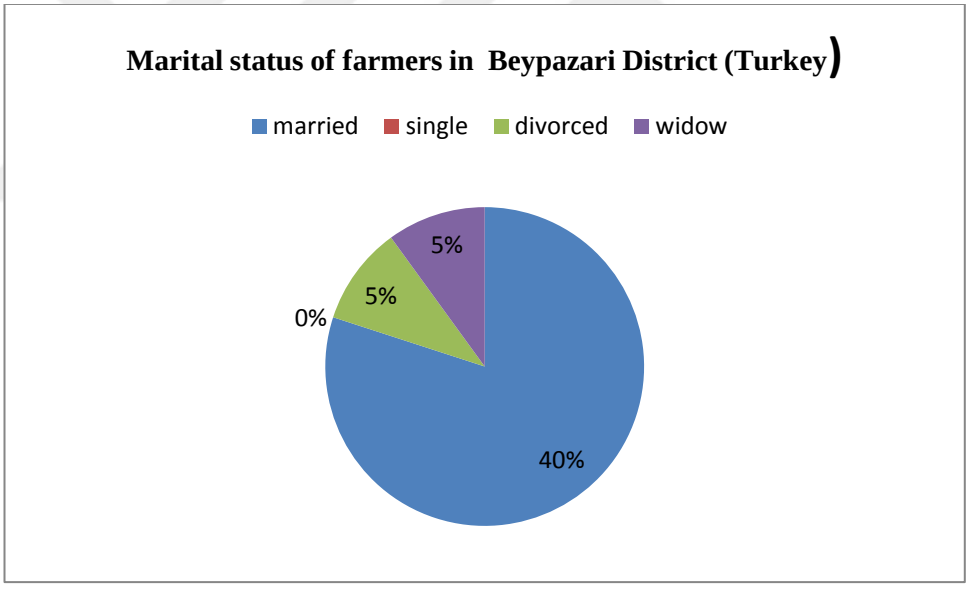


Figure 4.4 above shows the marital status of famers in Bombali District (Sierra Leone) and Beypazari District (Turkey)

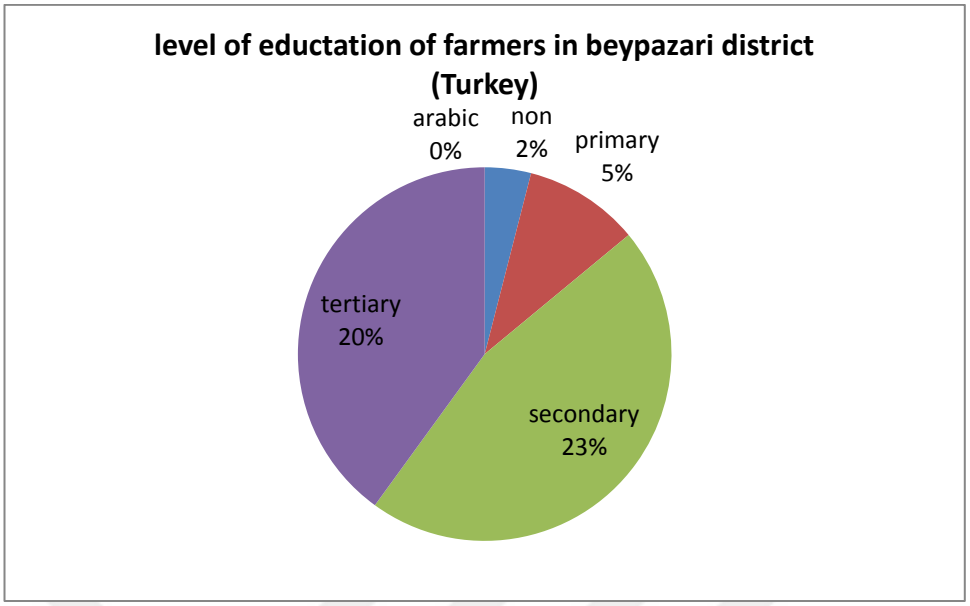
Formal Education level

Table 4.5 formal Education

Country	Formal Education					Total
	None	Primary	Secondary	Tertiary	Arabic	
Sierra Leone	20	15	5	2	8	50
Turkey	2	5	23	20	0	50
Sum TOTAL	22	20	28	22	8	100

Figure 4.5 illustrates various level of education acquired by Vegetable farmers interviewed in Bombali District (Sierra Leone) and Beypazari District (Turkey).with respect to the level of education of vegetable farmers interviewed in Beypazari District (Turkey) out of the (50), (5%) of the vegetable farmers interviewed attained primary school education, (23%) acquired secondary school education, (20%) pursue tertiary education while (2%) acquired non formal education. However, no farmer interviewed in Beypazari District (Turkey) acquired Arabic education. Considering the (50) vegetable farmers interviewed in Bombali District (Sierra Leone), (15%) attained primary school education,(5%) completed secondary school,(2%) attained tertiary education,(8%) acquired Arabic education while (20%) attained no formal education.

From the data, there are more secondary education level vegetable farmers in Beypazari District (Turkey) than Bombali District (Sierra Leone) and there is no Arabic education in Turkey (Beypazari District).



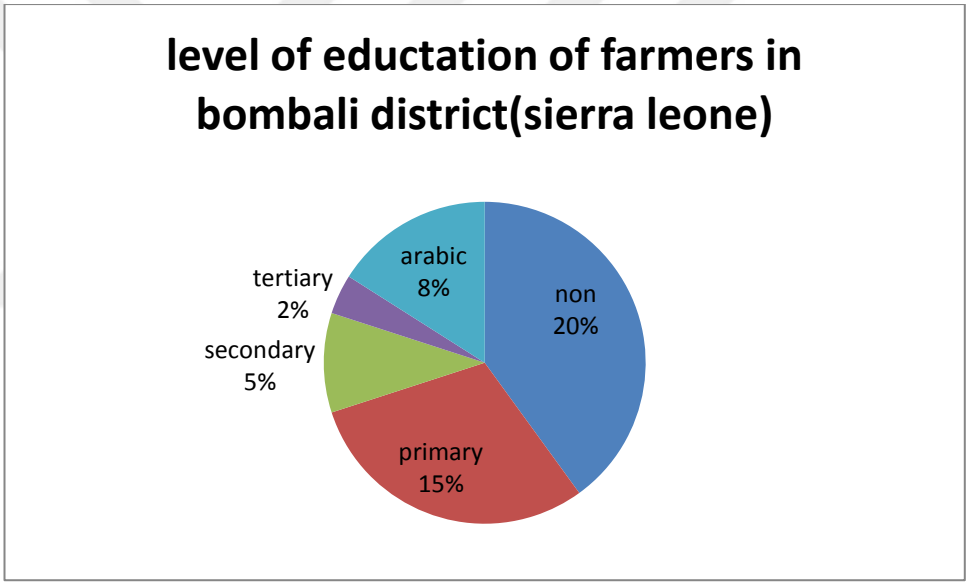


Figure 4.5 above illustrates various level of education acquired by farmers interviewed in Bombali District (Sierra Leone) and Beypazari District (Turkey)

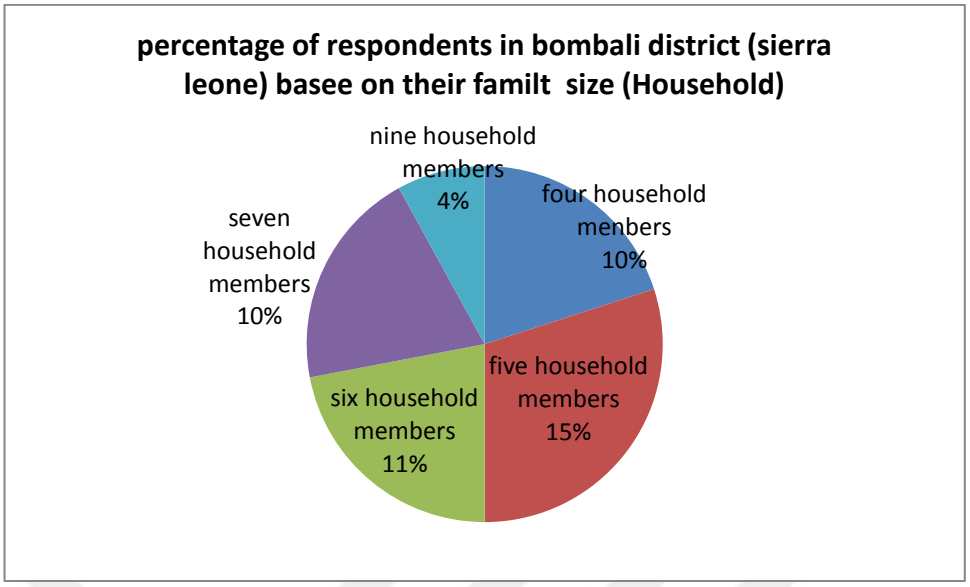
Size of household

Table 4.6 Size of house hold per farmer in Sierra Leone and Turkey

Country	**household members**					**Total**
	Four	**Five**	**Six**	**Seven**	**Nine**	
Sierra Leone	10	15	11	10	4	50
Turkey	0	12	14	13	11	50
Sum TOTAL	10	27	25	23	15	100

Figure 4.6 shows percentage of respondents interviewed both Bombali District (Sierra Leone) and Beypazari District (Turkey). Considering the (50) respondents interviewed in Sierra Leone (Bombali District), (10%) of them have a family size of four (4), (15%) have five (5) family members, (11 %) have a family of six (6), (10%) have seven (7) members while (4%) have a family of nine (9) members. Similarly for Turkey (Beypazari District), out of the 50 of respondents, (14%) of them have a family size of six(6), (13%) have seven(7) members, (11%) have nine(9) family members while (12%) have five(5) family members.

From the data, Turkey (Beypazari District) have more household member of six (6) than Sierra Leone (Bombali District). And there is no Household of four (4) in Turkey (Beypazari District)



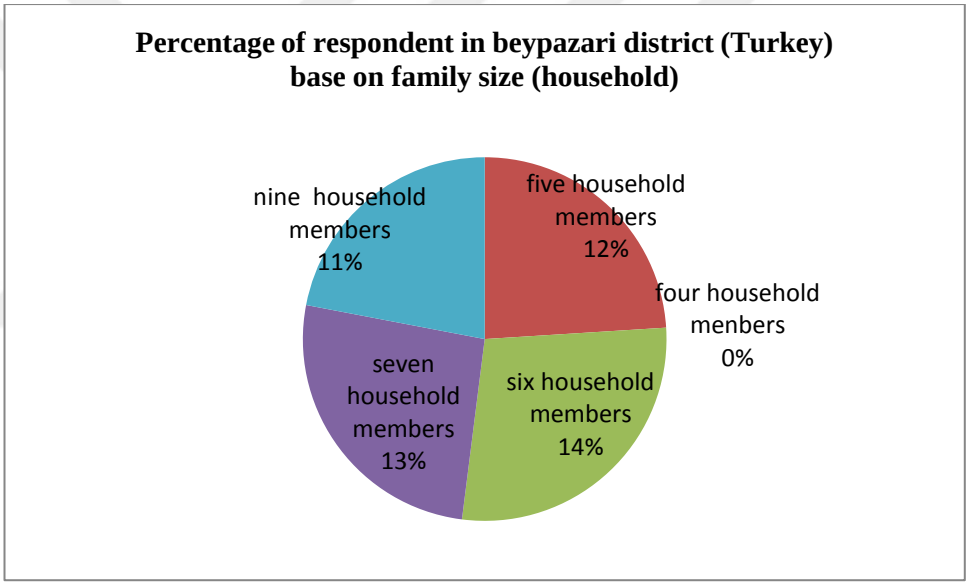


Figure 4.6 above shows percentage of respondents interviewed both Sierra Leone (Bombali District) and Turkey (Beypazari District).

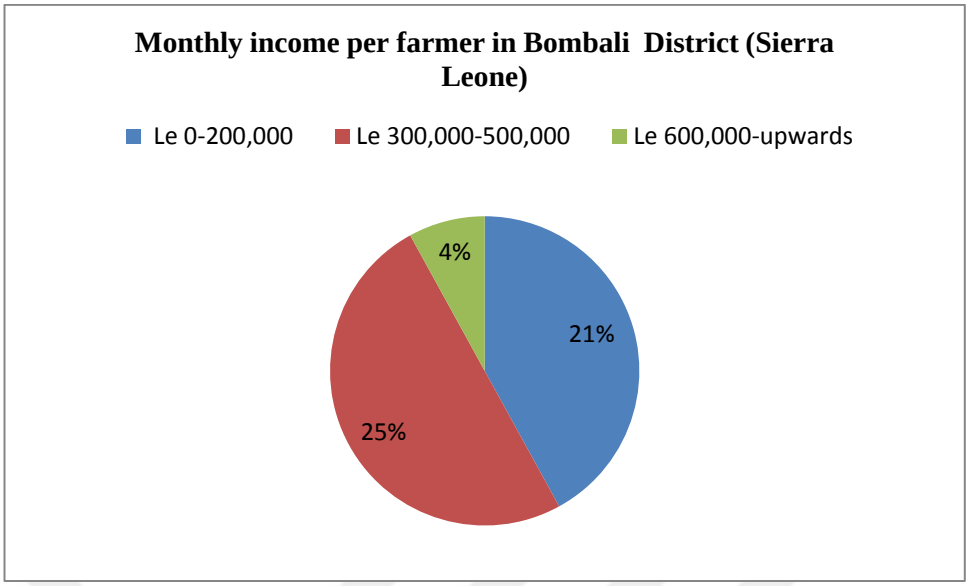
Estimated monthly income from all sources

Table 4.7 Monthly income per farmer in Sierra Leone and Turkey

Country	**Monthly income (TL)**			**Total**
	0-5,000	**5,0001-10,000**	**10,000-20,000**	
Turkey	37	12	1	50
	Monthly income (LE)			**Total**
	0 -200,000	300,000 – 500,000	600,000 upwards	
Sierra Leone	21	25	4	50
Sum total	58	37	5	100

Figure 4.7 illustrates monthly income generated by farmers in Bombali District (Sierra Leone) and Beypazari District (Turkey). With respect to the (50) vegetable farmers interviewed in Sierra Leone(Bombali District) , (21%) generated a total of Le 0-200,000 thousand Leones monthly,(25%) earn Le 300,000-500,000 while (4%) received Le 600,000 thousand Leones upwards. Likewise for Turkey (Beypazari District), (37%) of the farmers interviewed earned an estimated amount of 0-5,000tl per month, (12%) received 5,000-10,000tl while (1%) earned 10,000-20,000tl monthly.

From the data, considering the exchange rate Vegetable farmers in Turkey (Beypazari District) earned more income compare to vegetable farmers in Sierra Leone (Bombali District).



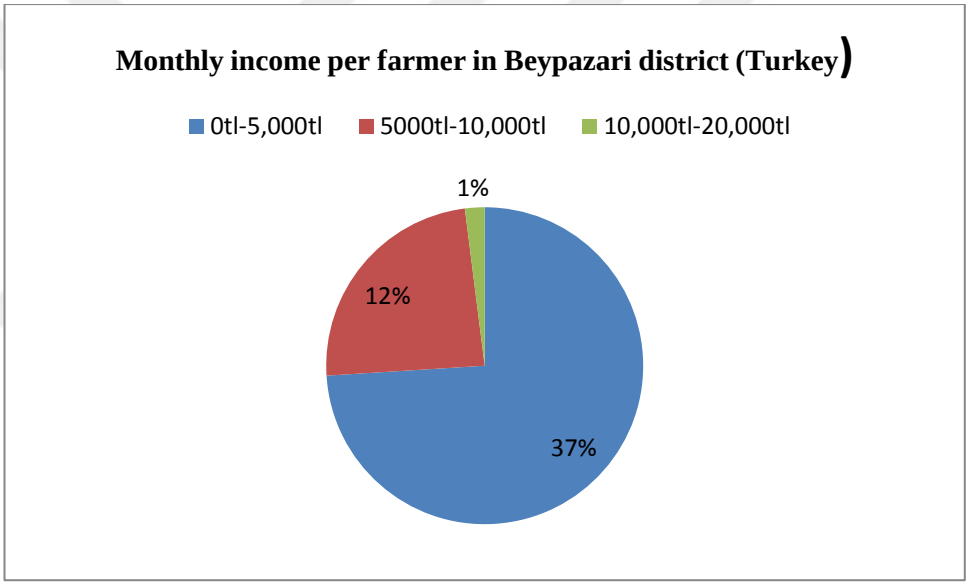


Figure 4.7 above illustrates monthly income generated by farmers in Bombali District (Sierra Leone) and Beypazari District (Turkey)

The new situation caused by climate change in pest controls activities

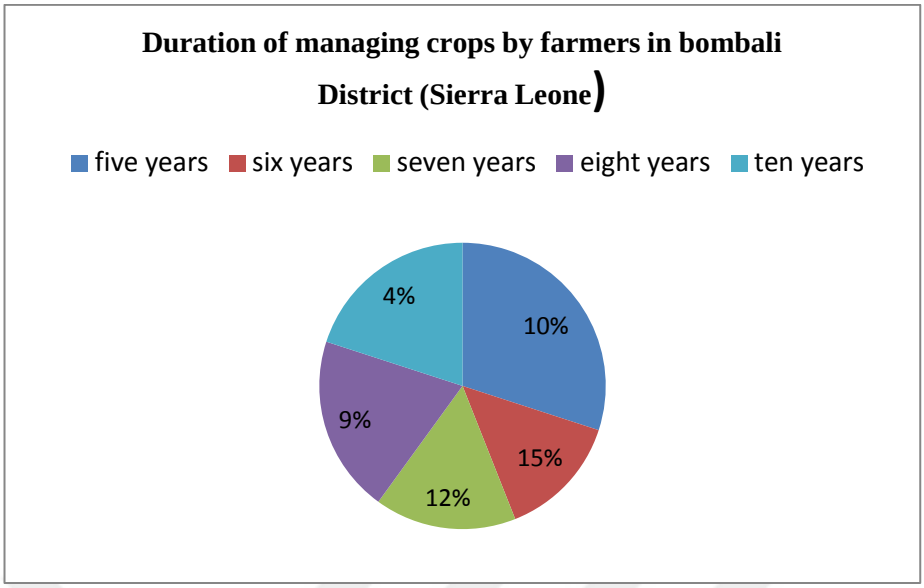
Years managing crops

Table 4.8 Duration of managing crops by farmers in Sierra Leone and Turkey

Country	**Duration of managing crops**					**Total**
	five years	**six years**	**seven years**	**eight years**	**ten years**	
Sierra Leone	10	15	12	9	4	50
Turkey	15	7	8	10	10	50
Sum TOTAL	25	22	20	19	14	100

Figure 4.8 shows the percentage of farmers interviewed both the two countries base on the duration of managing crops. With regards to the duration of crop management by vegetable farmers, out of (50) vegetable farmers in Bombali District (Sierra Leone),(10%) of them have consecutively managed crops almost five(5) years,(15%) have managed for a period of six(6) years,(12%) for a period of seven(7),9% have managed for a period of eight(8) years while 4% have engaged in crop management for a period of ten(10) years. similarly for Turkey(Beypazari District) , out of the (50) vegetable farmers interviewed,(15%) of them have managed crops for a period of five(5) years, (7%,) for six (6) years ,(8%) for seven(7) years ,(10%) for eight(8) years and (10%) for ten(10) years in crop management respectively.

From the data, Turkey (Beypazari District) vegetable farmers have spent up to ten (10) on vegetables farming than Sierra Leone (Bombali District)



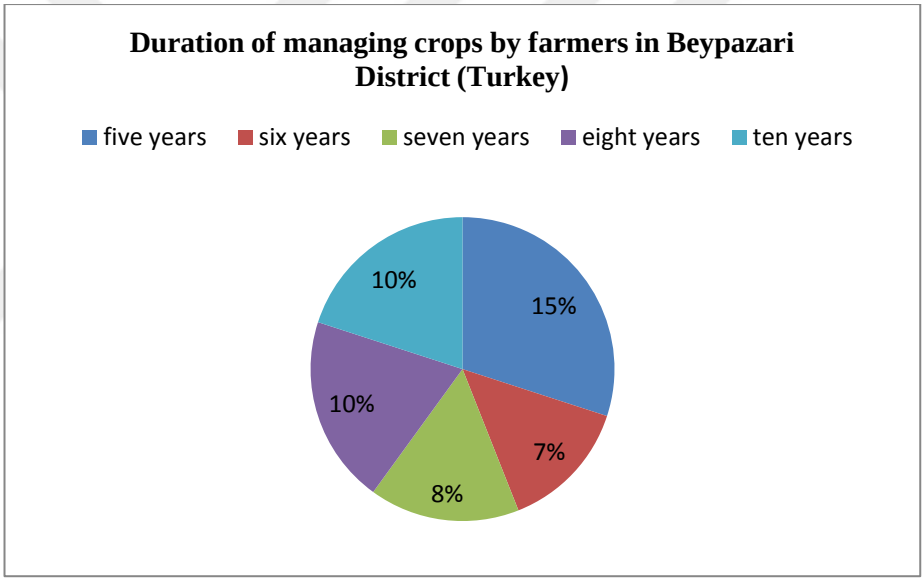


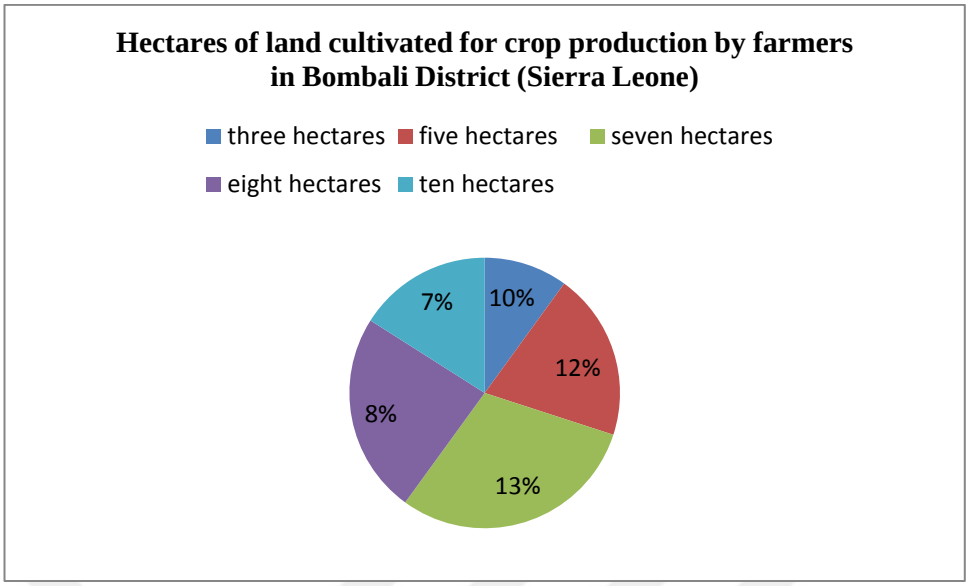
Figure 4.8 above shows the percentage of farmers interviewed both the two countries base on the duration of managing crops

Table 4.9 Hectares of land prepared for crop production by farmers in Sierra Leone and Turkey

Country	**Hectares used for crop production**					**Total**
	three Hectares	**five Hectares**	**seven Hectares**	**eight Hectares**	**ten Hectares**	
Sierra Leone	10	12	13	8	7	50
Turkey	5	10	15	12	8	50
Sum TOTAL	15	22	28	20	15	100

Figure 4.9 illustrates percentage of farmers cultivated various farm size (hectares) for crop production in Bombali District (Sierra Leone) and Beypazari District (Turkey).considering the (50) vegetable famers interviewed in Sierra Leone(Bombali District),(10%) cultivated three(3) hectares,(12%) cultivated five(5) hectares,(13%) cultivated seven(7) hectares,(8%) cultivated eight(8) hectares while seven(7%)cultivated ten(10) hectares for their crop production. Similarly for Turkey(Beypazari District) , out of the (50) respondents interviewed,(5%) of farmed on three (3) hectares of land,(10%) cultivated five(5) hectares,(15%) farmed on seven(7) hectares,(12%) cultivated eight(8) hectares while (8%) of them cultivated almost ten(10) hectares of land for crop production.

From the data, Turkey (Beypazari District) use more hectares of land than Sierra Leone (Bombali District).



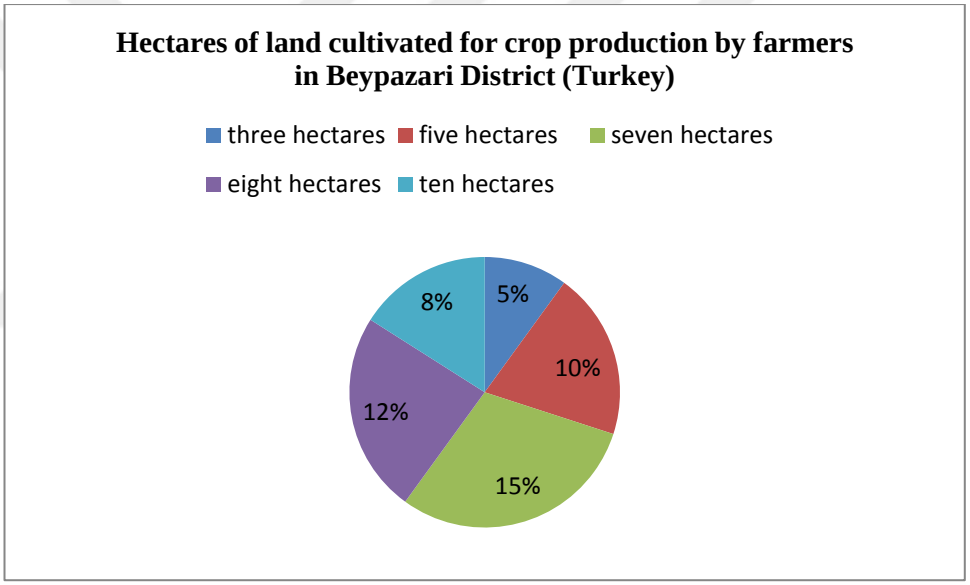


Figure 4.9 above illustrates percentage of farmers cultivated various farm size (hectares) for crop production in Bombali District (Sierra Leone) and Beypazari District (Turkey)

The main vegetable crops

Table 4.10 Type of crop cultivated by farmers in Sierra Leone and Turkey

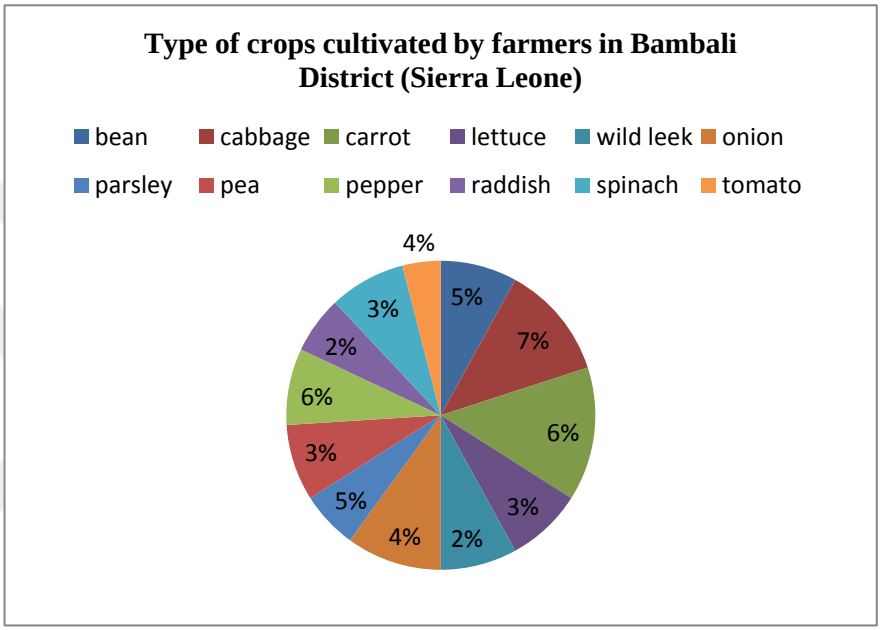
Country	Bean	Cabbage	Carrot	Lettuce	Wild leek	Onion	Parsley	Pea	Pepper	Radis	Spinach	Tomato	Total
Sierra Leone	5	7	6	3	2	4	5	3	6	2	3	4	50
Turkey	4	6	7	4	4	5	3	4	4	3	4	2	50
Sum TOTAL	9	13	13	7	6	9	8	7	10	5	7	6	100

Figure 4.10 illustrates the type of crops cultivated by farmers in Sierra Leone and Turkey. This crops are beans, cabbage, carrot, lettuce, wild leek onion, parsley, tomato, pepper, pea, radish and spinach both farmers within the two countries respectively. In Sierra Leone (Bomabli District), out of the fifty vegetable farmers interviewed five (5) of them mentioned that they grow beans , seven (7) cabbage , six (6)carrot ,three (3) of them mentioned that they grow lettuce, two (2)mentioned that they grow wild leek , four (4) mentioned they grow onion ,five(5) mentioned that they grow parsley, three(3) of the vegetable farmers mentioned that they grow pea, six (6) of them mentioned that they grow pepper , two(2) mentioned that they grow radish , three(3) vegetable farmers mentioned that they grow spinach and four(4) of the vegetable farmers mentioned that they grow tomato.

Likewise for Turkey (Beypazari District), out of the fifty(50) vegetable farmers interviewed four (4) mentioned that they grow beans , six (6) mentioned that they grow cabbage, seven (7) mentioned that they grow carrot , four (4) of the vegetable farmers mentioned that they grow lettuce , four(4) of the vegetable farmers mentioned that they grow wild leek ,five(5) vegetable farmers mentioned that they grow onion, three(3) of the vegetable farmers grow parsley ,four(4) of the vegetable farmers mentioned that they grow pee, four(4) of the vegetable farmers mentioned that they pepper ,three(3)

mentioned that they grow radish ,four (4) vegetable farmers mentioned that they grow spinach and only two (2)mentioned that they grow tomato respectively.

From the data, Sierra Leone (Bombali District) farmers grow more cabbage, pepper and tomato, than Turkey (Beypazari District).



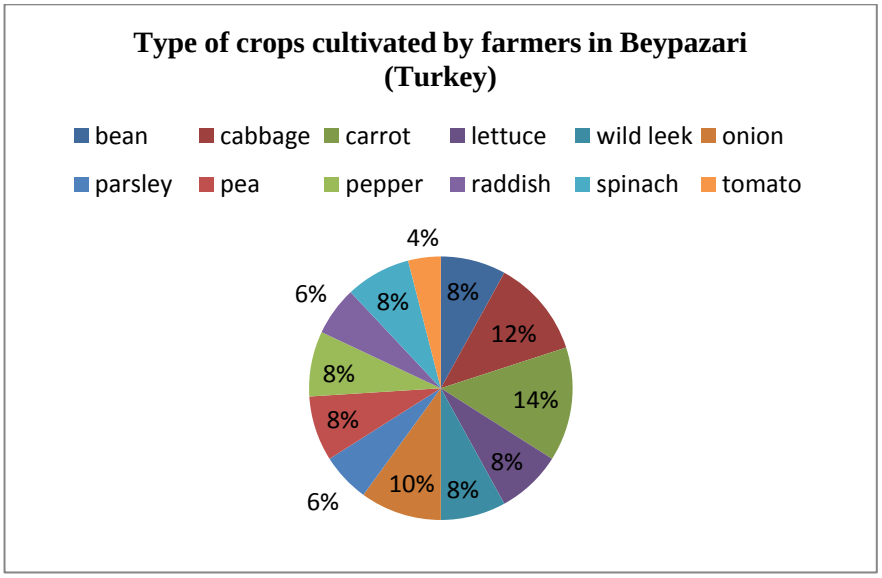


Diagram 4.10 above shows the percentage of farmers engaged in the production of different type of crops in Bombali District (Sierra Leone) and Beypazari District (Turkey)

Identify the factors affecting farmer decisions making process on pest control activities

However with further discussion with the vegetable farmers on pest control activities within the two countries (Sierra Leone and Turkey) , most of them use the following strategy in pest control decisions which is communicating and coordinating management practices between the producer and the agricultural consultant on adopt cultural practices as a first line of defenses such as plan and implantation of new verity selection and accurately identify pest and species composition and quantify population and also develop a scouting technique ,control plans and monitoring the ecology of the insect pest it intercropping relationships in the agricultural field. Notwithstanding, some of the major factors affecting their decision making is the Field Topography and Crop and Variety Selection.

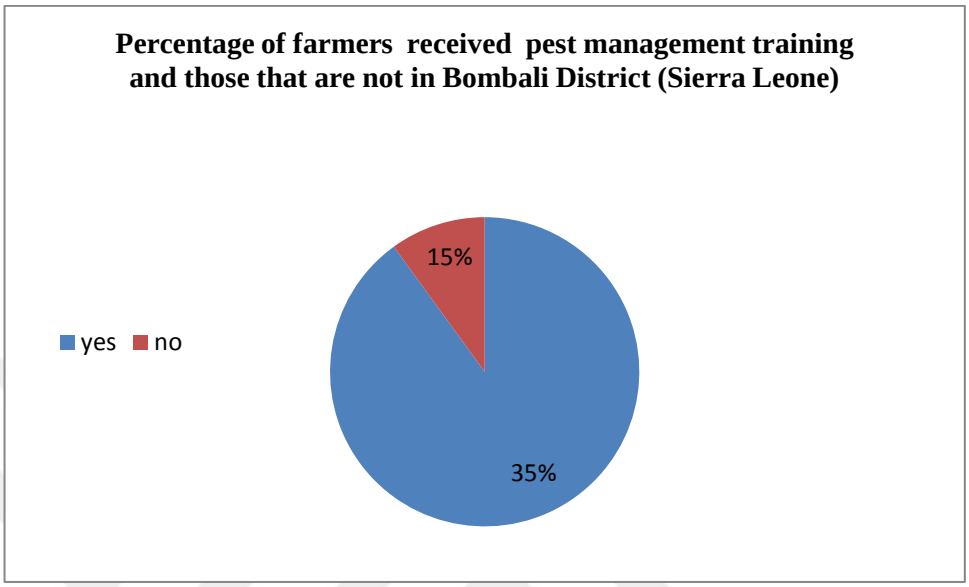
Receiving any training on pest management for your vegetable farm

Table 4.11 vegetable farmers that received training on pest management

Country	**Training received on pest management**		**Total**
	Yes	**No**	
Sierra Leone	15	35	50
Turkey	45	5	50
Sum TOTAL	60	40	100

Figure 4.11 illustrates percentage of farmers who received pest management training and those who do not received any training on pest management in Bombali District (Sierra Leone) and Beypazari District (Turkey).out of the total farmers, (50) that were interviewed in Sierra Leone(Bombali District) , (15%) received training on pest management while (35%) are not. Similarly for Turkey (Beypazari District), (45%) of the interviewed farmers received training on pest management while (5%) received no training.

From the data, there are more vegetable farmers in Turkey (Beypazari District) that received training on pest management compare to Sierra Leone (Bombali district)



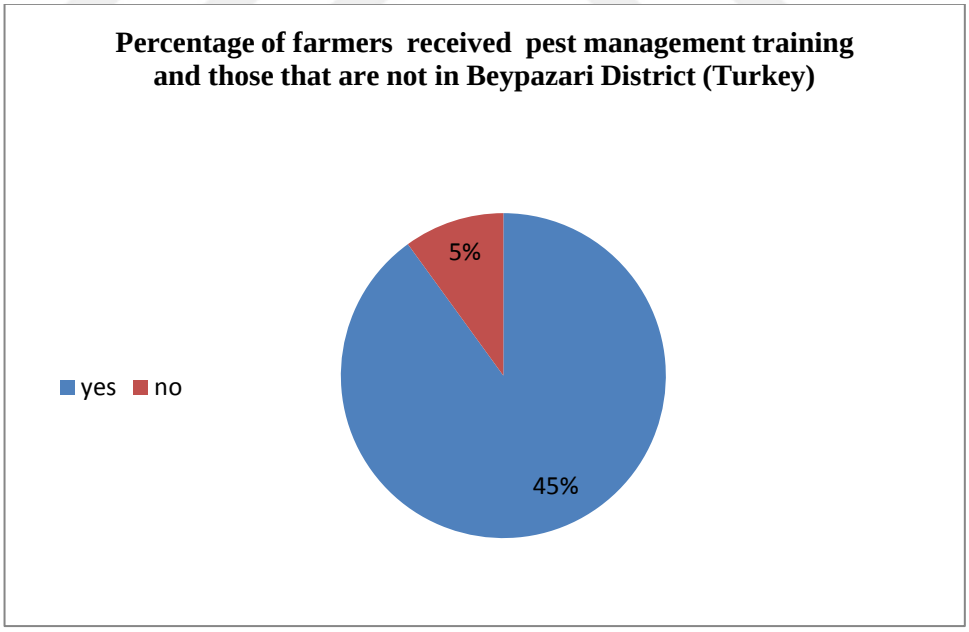


Figure 4.11 above illustrates percentage of farmers who received pest management training and those who do not received any training on pest management in (Sierra Leone) and (Turkey)

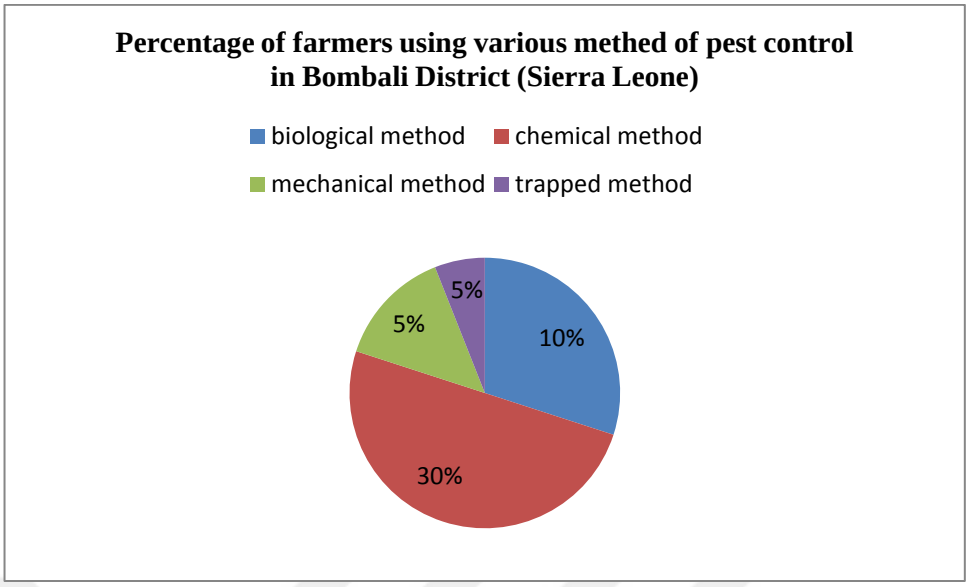
If yes which of the following

Table 4.12 Methods of pest management

Country	Biological	Chemical	Mechanical	Trapped	Total
Sierra Leone	10	30	5	5	50
Turkey	15	25	7	3	50
Sum TOTAL	25	55	12	8	100

Figure 4.12 illustrate various methods of pest management, the vegetable farmers interviewed in Sierra Leone (Bombali District) and Turkey (Beypazari District) used biological, chemical, mechanical, and trapped methods of pest control. In addition, out of the fifty(50) vegetable farmers interviewed ten(10) of them used Biological methods of pest management, thirty (30) of them used chemical methods of pest management , five (5) used mechanical methods and five(5) of them used trapped method. Similarly for Turkey (Beypazari District) fifteen (15) of the vegetable farmers interviewed used Biological method, twenty five (25) adopt the chemical method, seven (7) practiced the mechanical method while three (3) of the farmers chose the trapped method of pest control.

From the data, Turkey (Beypazari District) vegetable use more of chemical in pest management compare to Sierra Leone (Bombali District)



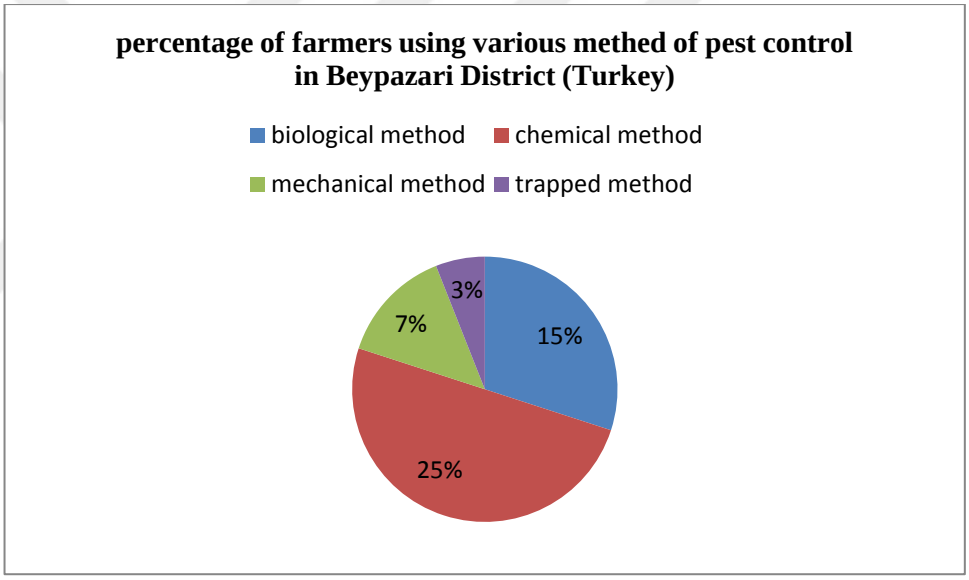


Figure 4.12 above shows the percentage of farmers using various method of pest control in Bombali District (Sierra Leone) and Beypazari District (Turkey)

Practice crop rotation

Table 4.13 Practice crop rotation

Country	Practice crop rotation		Total
	Yes	No	
Sierra Leone	18	32	50
Turkey	35	15	50
Sum TOTAL	53	47	100

Figure 4.13 illustrates percentage of farmer practiced crop rotation and those not practicing such method in Bombali District(Sierra Leone) and Beypazari District(Turkey).in Sierra Leone(Bombali District) , out of the (50) vegetable farmers interviewed (18%) of them practice the system while (32%) are not. Likewise Turkey (Beypazari District), (35%) of the farmers practiced crop rotation while (15%) were not.

From the data, vegetable farmers in Turkey (Beypazari District) practices crop rotation than vegetable farmers in Sierra Leone (Bombali District).

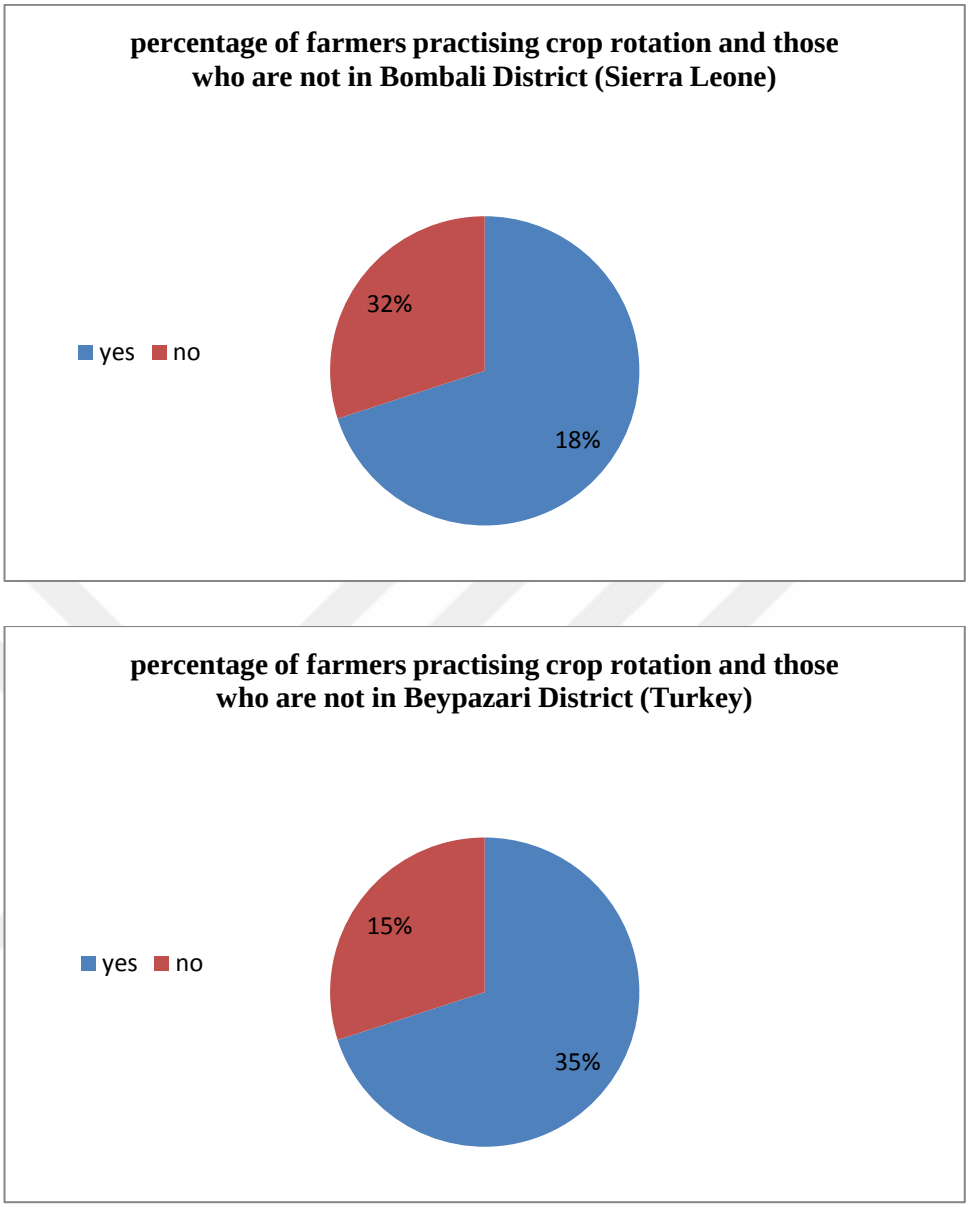


Figure 4.13 above represent illustrates percentage of farmer practiced crop rotation and those not practicing such method in Bombali District (Sierra Leone) and Beypazari District (Turkey)

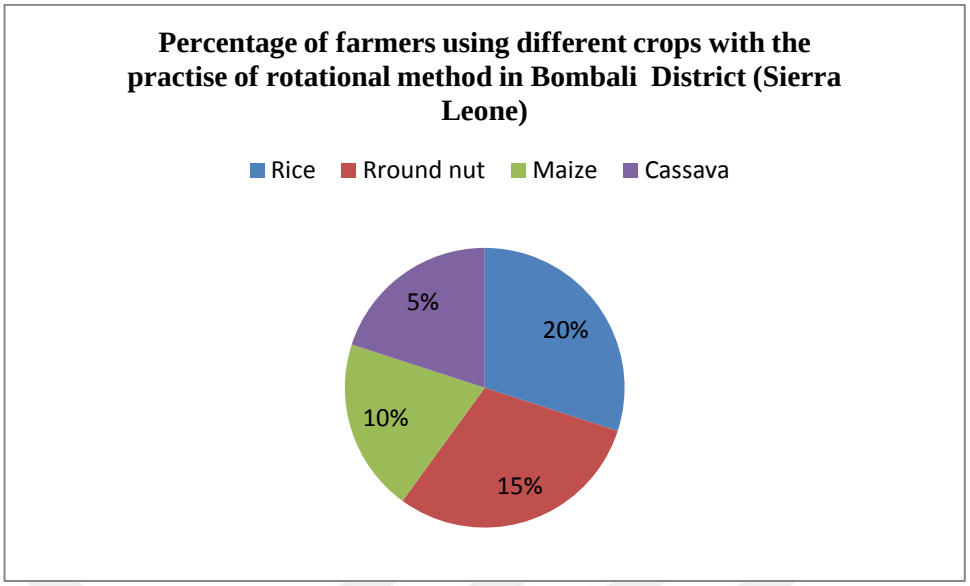
Answer for question number 14 is yes, which crops?

Table 4.14 Practice crop rotation and the type crops

Country	**rice**	**ground nut**	**maize**	**cassava**	**Total**
Sierra Leone	20	15	10	5	50
Turkey	15	15	10	10	50
Sum TOTAL	35	30	20	15	100

Figure 4.14 shows Percentage of respondents base on the use of different crops for crop rotation in Bombali District (Sierra Leone) and Beypazari District (Turkey).with respect to the (50) targeted vegetable farmers in Sierra Leone (Bombali District) regarding crop use for their crop rotation practices, (20%) of them normally use rice for the rotational practice, (15%) chose groundnut, (10%) prefer maize while (5%) selected cassava as a choice for such practices. Similarly, out of the (50) of vegetable farmers interviewed in Beypazari District (Turkey), (15%) of the farmers chose rice for rotational practice, (15%) selected groundnut, (10%) prefer maize while (10%) used cassava for the above purpose.

From the data, vegetable farmers in Bombali District (Sierra Leone) use rice for crop rotation compare to Turkey (Beypazari District).



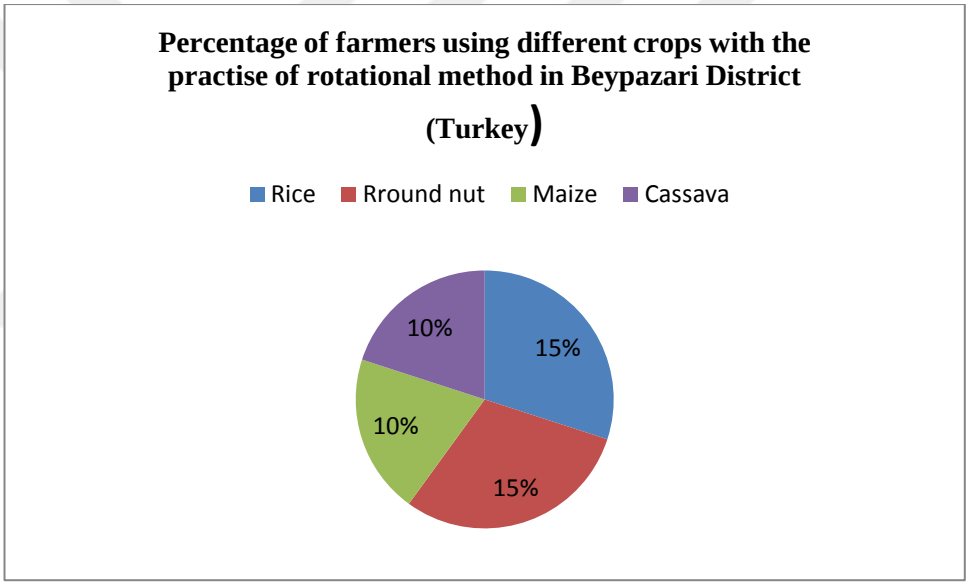


Figure 4.15 above represents Percentage of respondents' base on the use of different crops for crop rotation in Bombali District (Sierra Leone) and Beypazari District (Turkey)

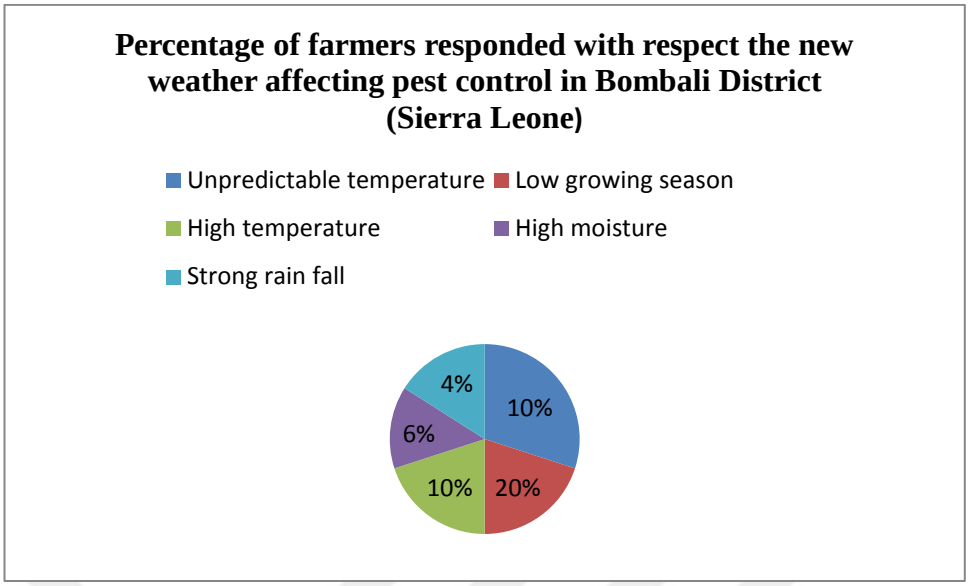
The new climate conditions.

Table 4.15 New weather affecting pest control at current locations

Country	**Unpredictable temperature**	**Low growing season**	**High temperature**	**High moisture**	**Strong rainfall**	**Total**
Sierra Leone	10	20	10	6	4	50
Turkey	15	10	10	7	8	50
Sum TOTAL	25	30	20	13	12	100

Figure 4.15 shows the new weather affecting pest control at the current locations of the farmers. Of the farmers interviewed both in Sierra Leone(Bombali District) and Turkey(Beypazari District) experienced unpredictable temperature, low growing season, high temperature, high moisture content, and strong rain fall in their respective locations. However, out of the fifty (50) vegetable farmers interviewed in Sierra Leone (Bombali District), ten (10) of the vegetable farmers interviewed lamented the unpredictable temperature, twenty (20) mentioned the low growing season, ten (10) elaborated on the high temperature , six (6) mentioned high moisture content while four (4) of them emphasis on the strong rainfall. Similarly for Turkey (Beypazari District), fifteen (15) of the vegetable farmers interviewed emphasize the unpredictable temperature, ten (10) lamented on the low growing season, ten (10) of them elaborated on the high temperature, seven (7) mentioned high moisture while eight (8) of the stressed rain fall.

From the data, Beypazari District (Turkey) experienced unpredictable temperature compared to Bombali District (Sierra Leone). And also in Bombali District (Sierra Leone) experienced low growing season compared to Beypazari District (Turkey)



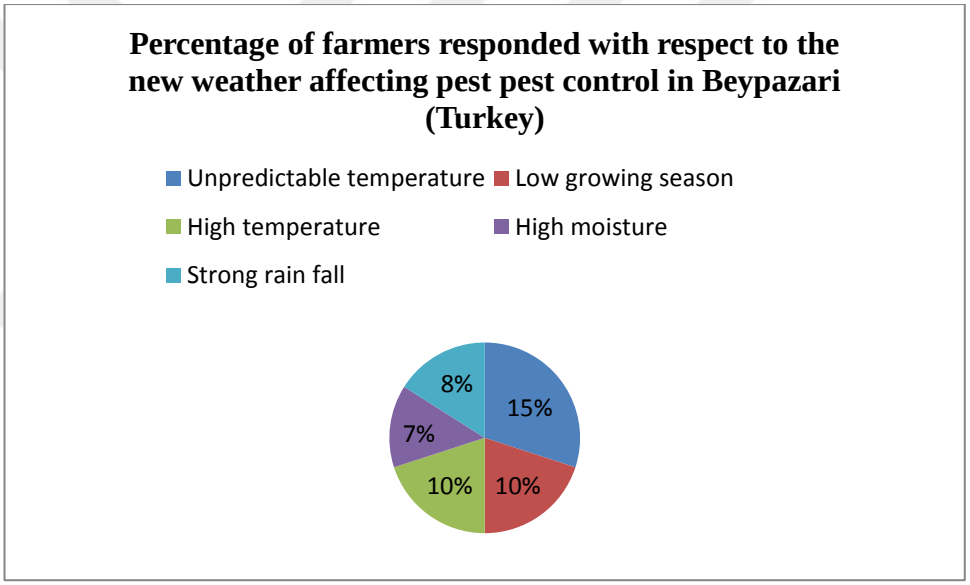


Figure 4.15 above represent Percentage of farmers responded regarding the new weather affecting pest control in Bombali District (Sierra Leone) and Beypazari District (Turkey)

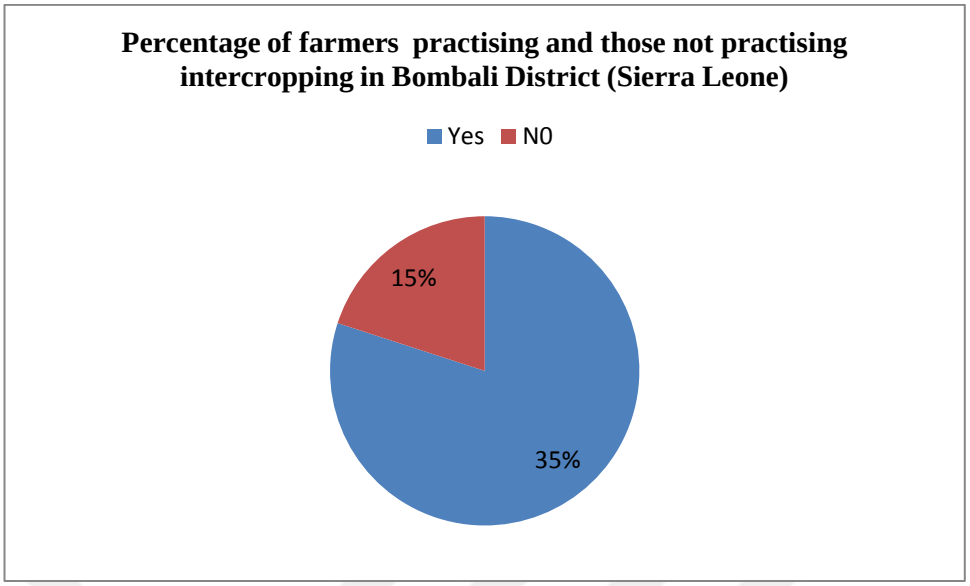
Practice inter-cropping

Table 4.16 Practice of inter- cropping

Country	**Farmers practicing intercropping**		**Total**
	Yes	**No**	
Sierra Leone	35	15	50
Turkey	40	10	50
Sum TOTAL	75	25	100

Figure 4.16 Percentage of farmers practicing intercropping and those not practicing such method in Bombali District (Sierra Leone) and Beypazari District (Turkey).with regards to the target population of farmers (50) interviewed in Bombali District (Sierra Leone), (35%) of them practiced intercropping while (15%) were not. Likewise Turkey (Beypazari District), an estimated percentage of (40%) farmers practiced intercropping while (10%) were not.

From the data, Turkey (Beypazari District) vegetable farmers practice intercropping than vegetable farmers in Sierra Leone (Bombali District)



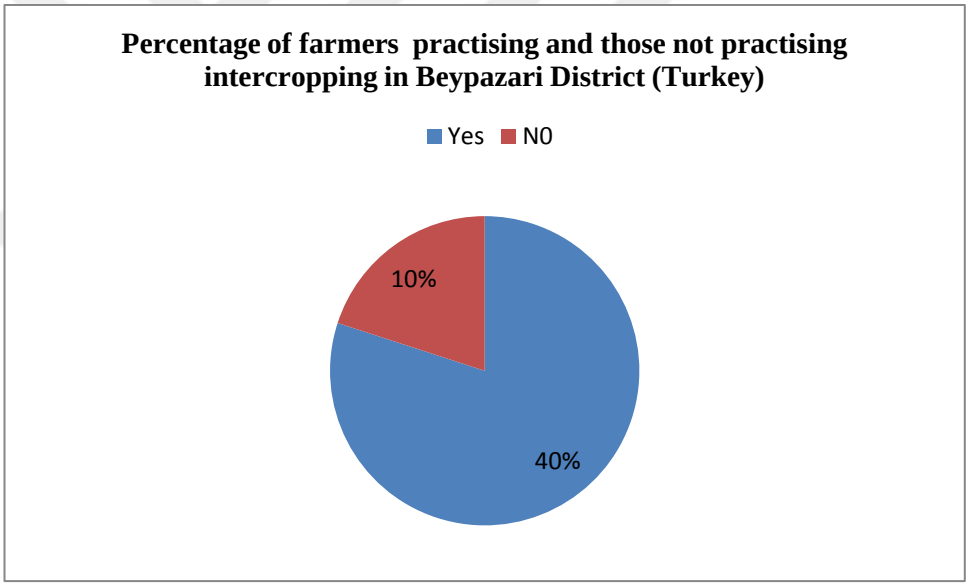


Figure 4.16 above represent Percentage of farmers practicing intercropping and those not practicing such method in Bombali District (Sierra Leone) and Beypazari District (Turkey)

Answer for question number 17 is yes, which crops

Table 4.17 Crops use for intercropping by farmers in Sierra Leone and Turkey

Country	**Crops use for intercropping**					**TOTAL**
	Rice & Maize	**Rice & Pepper**	**Pepper & Tomato**	**Lettuce & Cabbage**	**Spinach & Radish**	
Sierra Leone	20	10	6	7	7	50
Turkey	15	15	10	6	4	50
Sum TOTAL	35	25	16	13	11	100

Considering crop use for intercropping, of the one hundred (100) vegetable farmers interviewed in Sierra Leone (Bombali District) and Turkey (Beypazari District) they intercropped rice and maize, rice and pepper, pepper and tomato, lettuce and cabbage, Spinach and radish respectively. In Sierra Leone (Bombali District), out of the fifty (50) vegetable farmers interviewed, twenty (20) of the farmers intercropped rice and maize together, ten (10) intercropped rice and pepper, six(6) intercropped pepper and tomato, and seven (7) intercropped lettuce and cabbage while seven (7) intercropped spinach and radish together. Similarly for Turkey (Beypazari District), out of fifty (50) vegetable farmers, fifteen (15) of the vegetable farmers interviewed intercropped rice and maize altogether, fifteen (15) of them intercropped both rice and pepper, ten (10) of the farmers intercropped pepper and tomato, six (6) of them intercropped lettuce and cabbage while four (4) of them intercropped spinach and radish altogether.

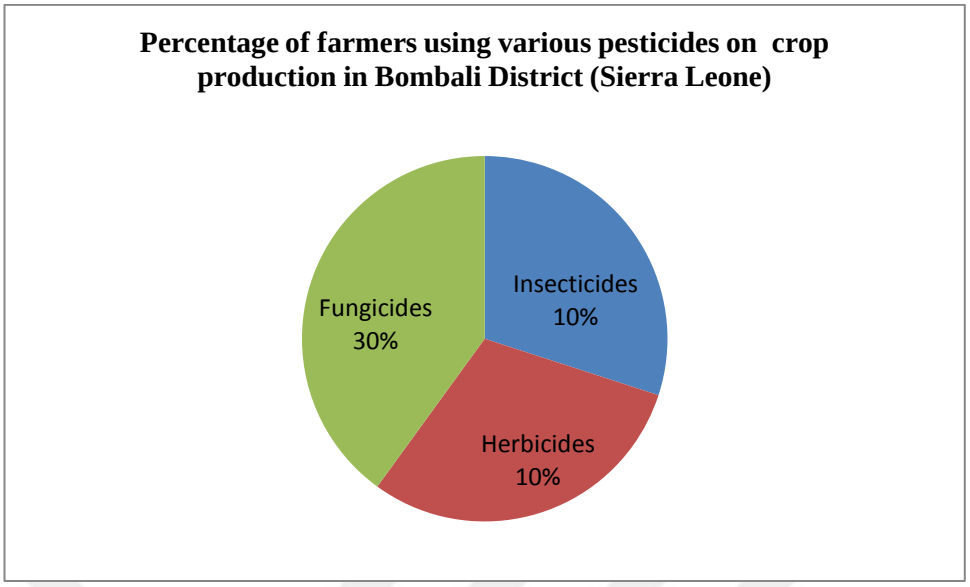
Use any pesticides in your vegetable garden, If yes, which of the following do you use

Table 4.18 illustrates the various pesticides used

Country	**insecticides**	**herbicides**	**fungicides**	**Total**
Sierra Leone	20	20	10	50
Turkey	15	15	20	50
Sum TOTAL	35	35	30	100

Figure 4.17 Percentage of farmers using various pesticides on their crop production in Bombali district (Sierra Leone) and Beypazari District(Turkey).considering the percentage of targeted farmers, out of the (50) in Bombali District (Sierra Leone),(20%) of the farmers applied insecticides for pest control,(20%) used herbicides while (10%) applied fungicides. With regards to farmers interviewed in Beypazari District (Turkey), (15%) of the farmers interviewed used insecticides, (15%) applied herbicides while (20%) applied fungicides.

From the data, vegetable farmers in Bombali District (Sierra Leone) used more insecticides than Beypazari District (Turkey), while Beypazari District (Turkey) used more fungicide than Sierra Leone (Bombali District).



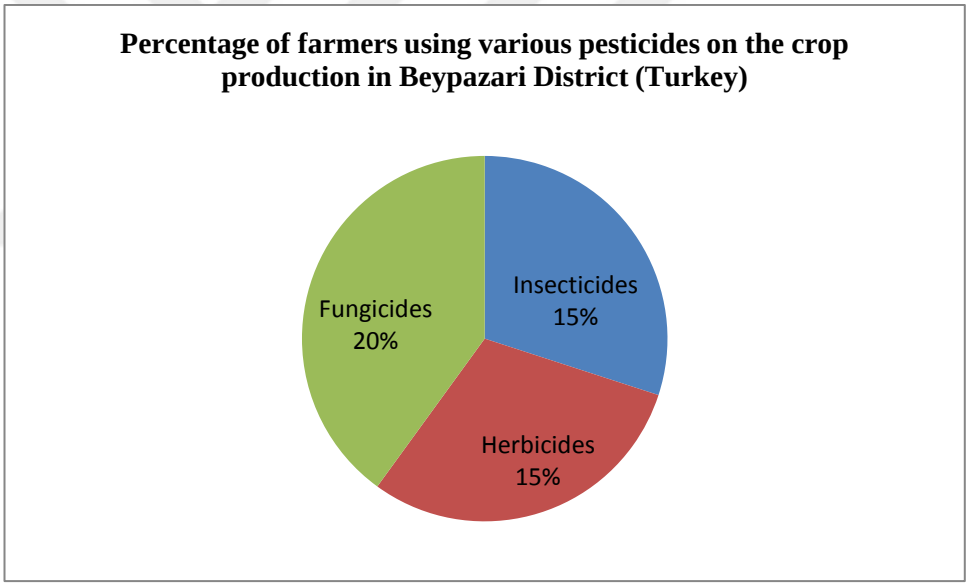


Figure 4. 17 above represent Percentage of farmers using various pesticides on their crop production in Bombali District (Sierra Leone) and Beypazari District (Turkey)

Frequency of using Pesticides

Table 4.19 the period of applying such pesticides by farmers in Sierra Leone and Turkey

Country	Daily	Weekly	Monthly	Yearly	Total
Sierra Leone	0	5	45	0	50
Turkey	3	12	35	0	50
Sum TOTAL	3	17	80	0	100

Figure 4.18 percentage of respondents applying various pesticides at different period in Bombali District (Sierra Leone) and Beypazari District (Turkey). However, out of the total percentage of farmers (50) interviewed in Bombali District (Sierra Leone),(0%) applied pesticides daily,(5%) applied weekly while (45%) applied monthly. however, no farmer interviewed in Sierra Leone(Bombali District) applied pesticides yearly. Similarly for Turkey (Beypazari District), (3%) of the farmers applied pesticides daily, (12%) applied weekly while (35%) applied monthly. No farmer interviewed in Beypazari District (Turkey) applied pesticides year.

From the data, vegetable farmers in Sierra Leone (Bombali District) applied pesticides monthly than Beypazari District (Turkey).

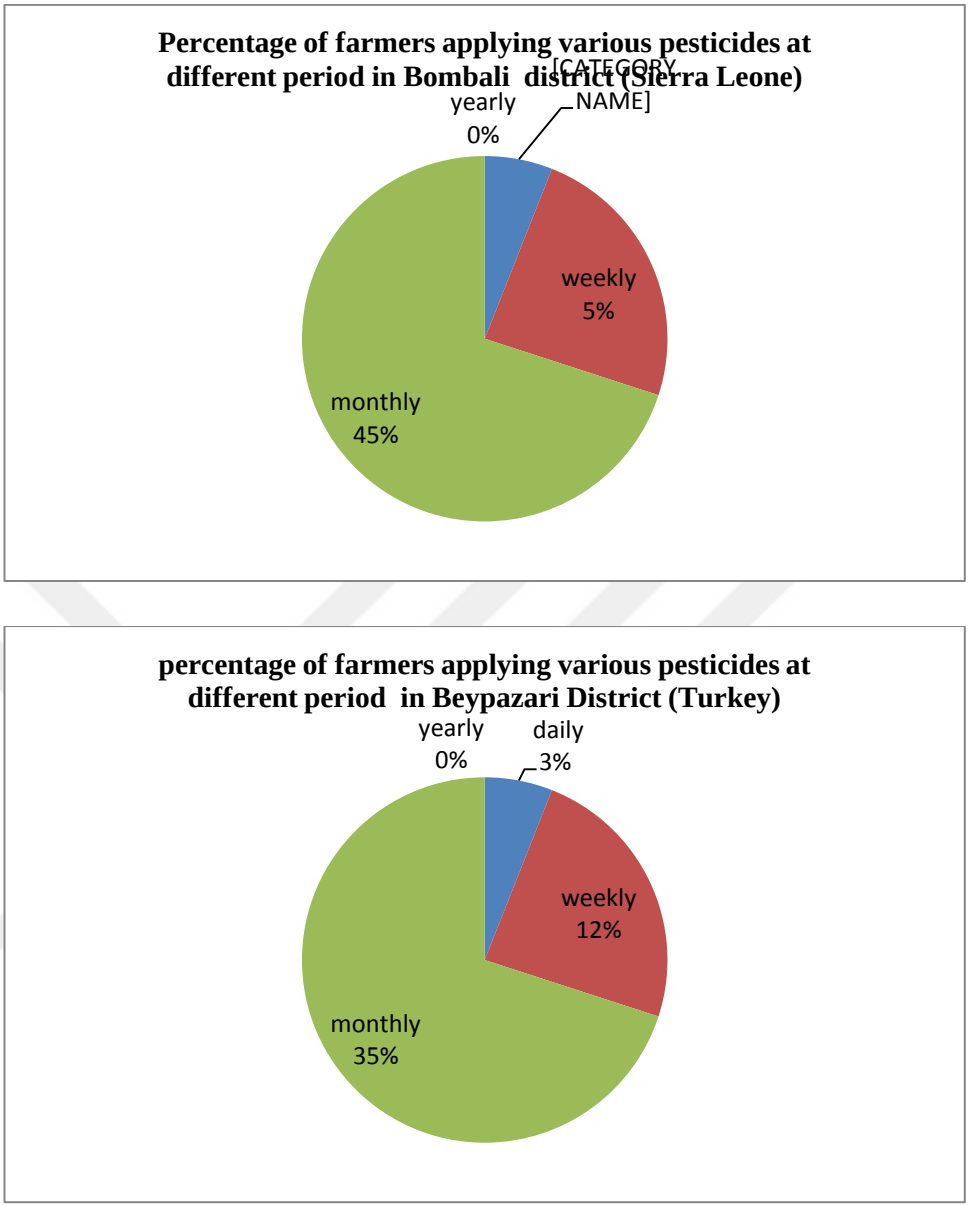


Figure 4.18 above represent percentage of respondents applying various pesticides at different period in Bombali District (Sierra Leone) and Beypazari District (Turkey)

Level of agreement regarding the effect of pesticides on the following categories.

Table 4.20 Various negative impacts of using pesticides encountered by farmers in Sierra Leone and Turkey

Country	**Affect humans health**	**Affect livestock**	**Affect marine resources**	**Affect crops**	**Total**
Sierra Leone	20	10	9	11	50
Turkey	25	10	5	10	50
Sum TOTAL	45	20	14	21	100

Figure 4.19 shows the various negative effects of pesticides encountered by farmers in Sierra Leone (Bombali District) and Turkey (Beypazari District). Out of the fifty (50) vegetable farmers interviewed in Sierra Leone (Bombali District), twenty (20) of the farmers interviewed responded on the human health effect, ten (10) of them responded on the effect of livestock, nine (9) on the effect of marine resources, while eleven (11) of the responded on the effect it has on crop production. Similarly for Turkey (Beypazari District), out of the fifty (50) vegetable farmers interviewed, twenty five (25) of the vegetable farmers elaborated on the human health effect, fifteen (15) on the effect of livestock, thirteen (13) lamented on the effect of marine resources while twelve (12) of the farmers mentioned the effect it has on crop production respectively.

From the data, vegetable farmers in Beypazari District(Turkey) agreed more that pesticides have negative affect human health compare to Sierra Leone (Bombali district) .

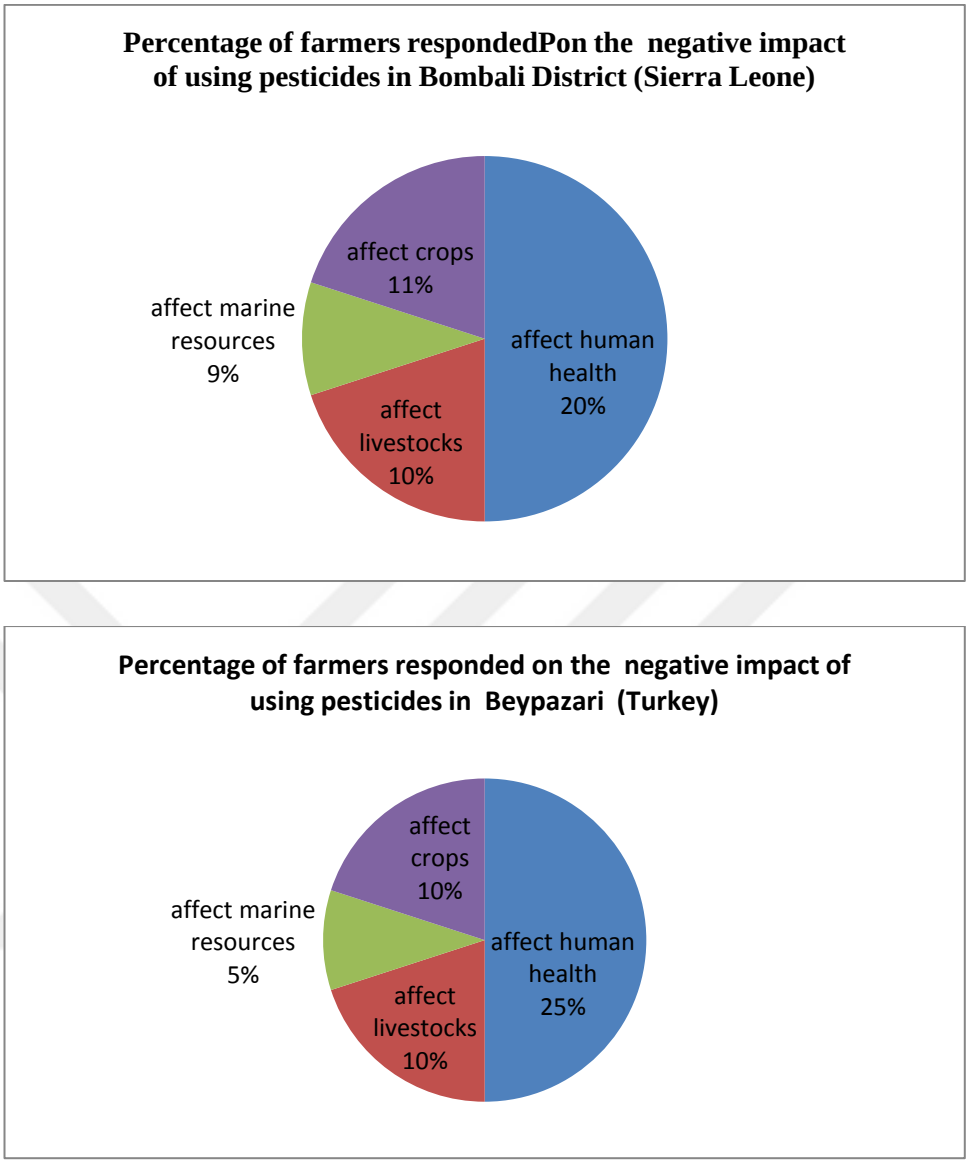


Figure 4.19 above represent Percentage of respondents' responded base on the negative impact of using pesticides in Bombali District (Sierra Leone) and Beypazari District (Turkey)

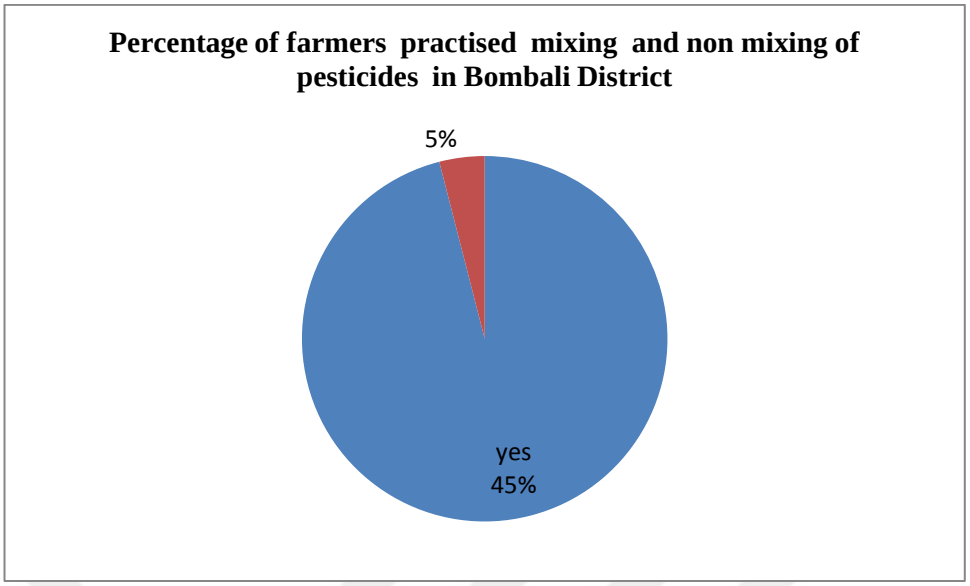
Farmers' practices on pesticides.

Table 4.21 Farm practice on pesticides

Country	**Mixing Pesticides**		**Use Personal Protective**		**Read Pesticides Manual**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Sierra Leone	45	5	45	5	20	30
Turkey	48	2	40	10	47	3
Sum TOTAL	93	7	85	15	67	33

Figure 4.20 Percentage of farmers practiced mixing and non-mixing of pesticides in Bombali District (Sierra Leone) and Beypazari District (Turkey). However, out of the percentage of the targeted farmers, (50) in Bombali District, (45%) of the farmers practiced mixing of pesticides while (5%) were not. Likewise Turkey (Beypazari District), (48%) of the farmers interviewed yes for the mixing of pesticides while (2%) say no to it.

From the data, vegetable farmers in Turkey (Beypazari District) practiced more mixing pesticides than Vegetable farmers in Sierra Leone (Bombali District).



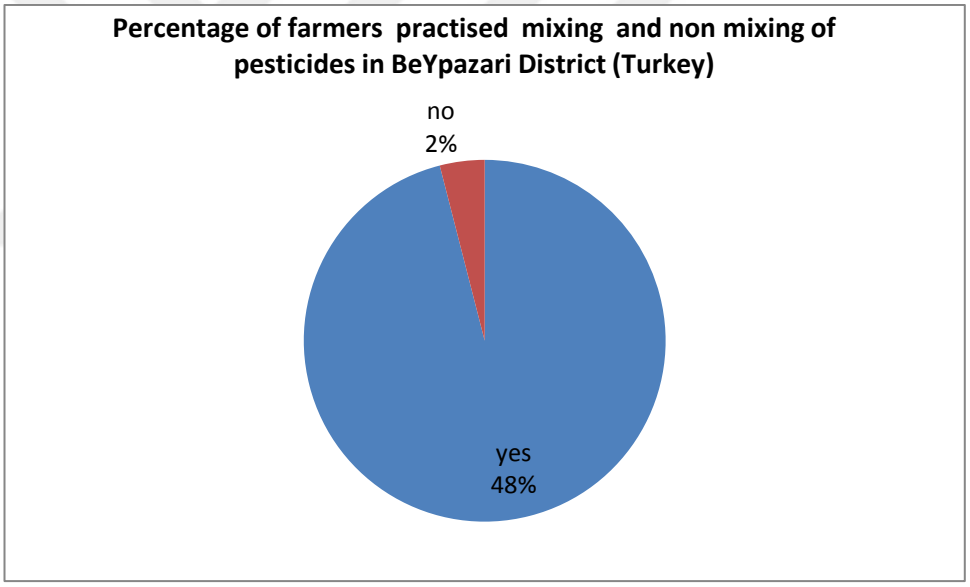


Figure 4.20 above represent Percentage of farmers practiced mixing and non-mixing of pesticides in Bombali District (Sierra Leone) and Beypazari District (Turkey)

Figure 4.21 Percentage of farmers that read pesticides manual and those who were not in Bombali District (Sierra Leone) and Beypazari District (Turkey). In Sierra Leone (Bombali District), out of the (50) farmers interviewed, (20%) normally read pesticides manual while (30%) are not. Similarly for Turkey (Beypazari District), (47%) of the interviewed farmers usually read pesticides manual while (3%) of them are not.

From the data, vegetable farmers in Turkey (Beypazari District) read pesticides manual than vegetable farmers in Sierra Leone (Bombali District).

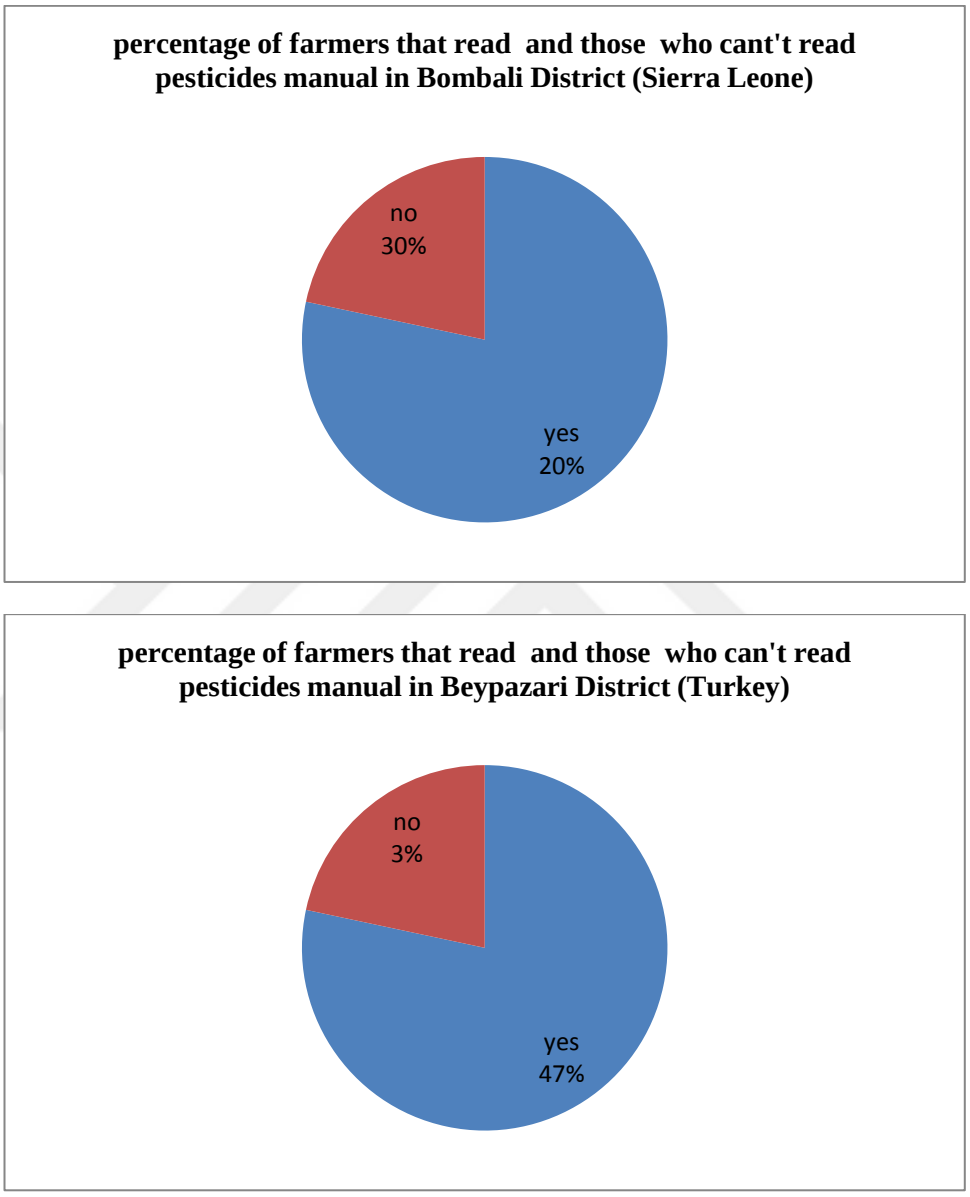


Figure 4.21 above Percentage of farmers that read pesticides manual and those who were not in Bombali District (Sierra Leone) and Beypazari District (Turkey)

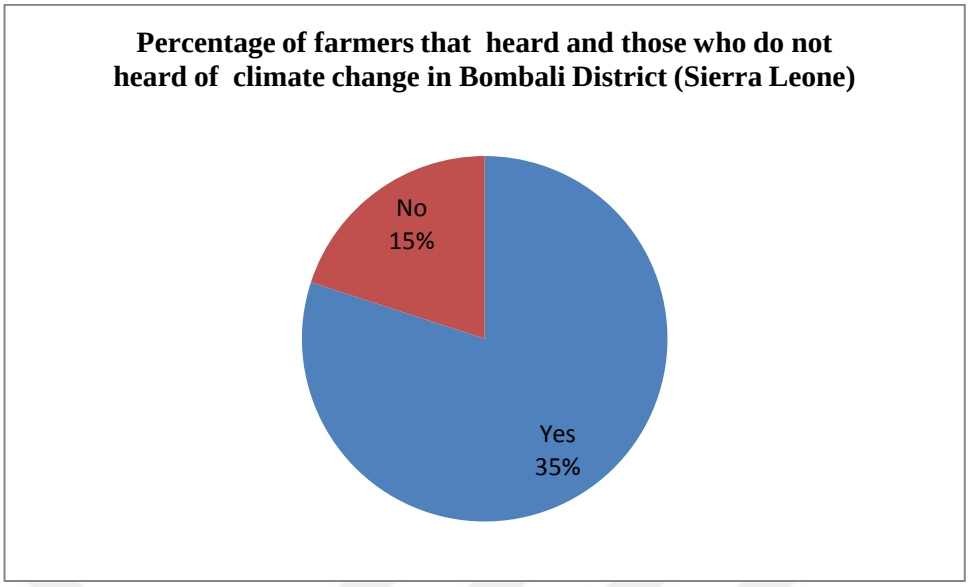
The Perception of farmers on the causes of change in climate in pest control activities

Heard about the expression climate change

Table 4. 22 Hearing about the expression of climate change

Country	Have you ever heard about the expression climate	
	Yes	No
Sierra Leone	35.0	15.0
Turkey	40.0	10.0
Sum total	75	25

Figure 4.22 Percentage of farmers that heard about climate change and those who are not in Bombali District (Sierra Leone) and Beypazari District (Turkey). In Sierra Leone (Bombali District), out of the targeted (50) farmers that were interviewed, (35%) have previously heard about climate while (15%) have never heard about that. Likewise Turkey (Beypazari District), (40%) of the farmers interviewed had heard about climate change while (10%) are not.



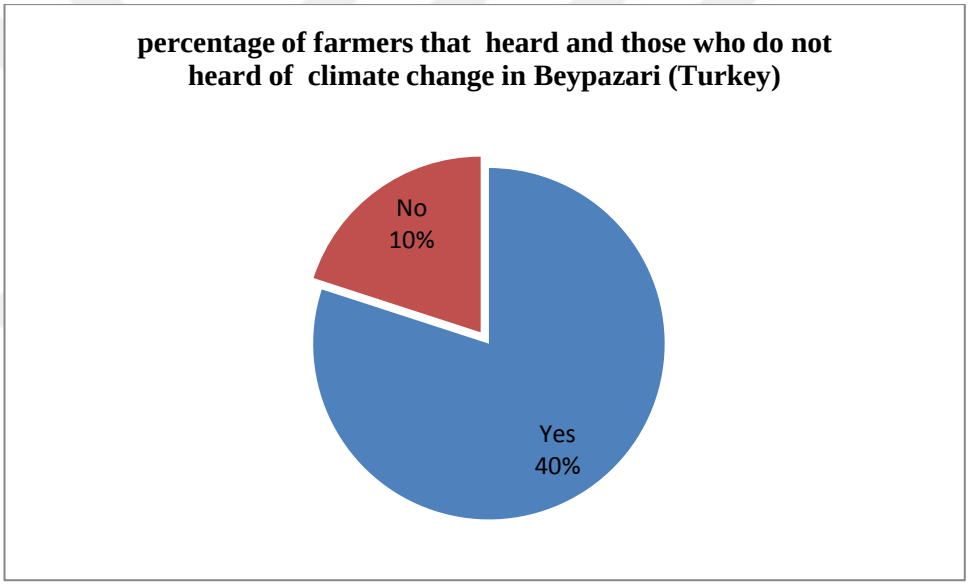


Figure 4.22 above represent Percentage of farmers that heard about climate change and those who are not in Bombali District (Sierra Leone) and Beypazari District (Turkey)

Information about climate change

Table 4.23 shows the sources of enquiring information for climate change and the belief in climate change as a problem.

Believe that climate change is a problem

Out of the one hundred(100) vegetable farmers interviewed , fifty(50) of the vegetable farmers in Sierra Leone(Bombali District) believed that climate change is a problem and also fifty(50) in Turkey(Beypazari District) believed that climate change is a problem

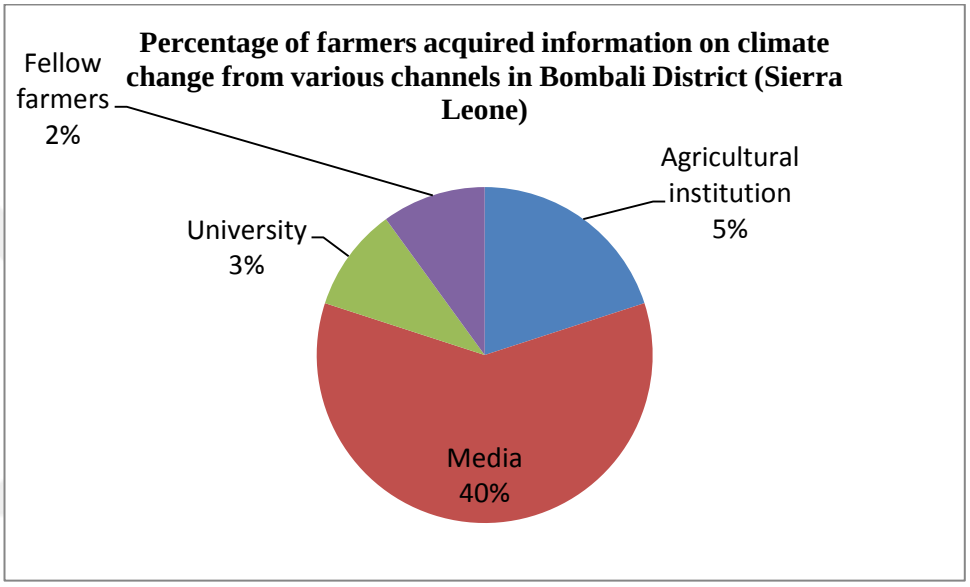
Table 4.23 Sources of enquiring information for climate change and believes in climate change as a problem

Country	Source of enquiring information for climate change				Believe in climate change as a problem		
	Agriculture institution	Mass media	University	Lead farmer	Yes	No	Don't know
Sierra Leone	5	40	3	2	50	0.0	0.0
Turkey	10	30	5	5	50	0.0	0.0
Total	15	70	8	7	100	0.0	0.0

Figure 4.23 Percentage of farmers acquired information on climate from various channels in Bombali District (Sierra Leone) and Beypazari District (Turkey).In Sierra Leone (Bombali District), out of the targeted population of farmers of (50), (5%) of them sourced information about climate change through agricultural institution, (40%) acquired information through media, (3%) and (2%) extracted information on climate change through university and fellow farmers respectively. Similarly for Turkey (Beypazari District), out of the 50 vegetable farmers in interviewed, (10%) of them

access information about climate change through agricultural institution, (30%) acquired information through media, (5%) of them through university while (5%) access information through fellow farmers.

From the data, vegetable farmers in Sierra Leone (Bombali District) acquired more information from media compared to Turkey (Beypazari District).



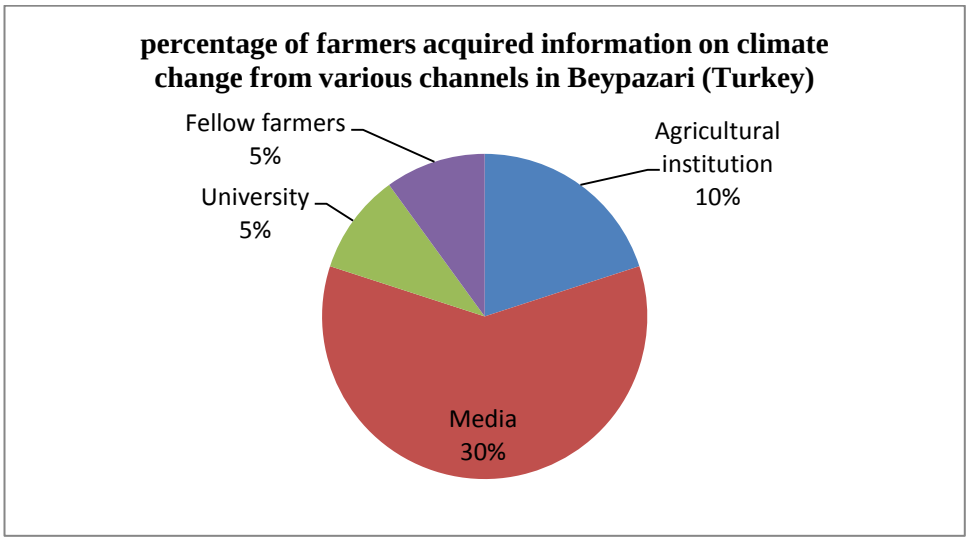


Figure 4.23 above represent Percentage of farmers acquired information on climate from various channels in Bombali District and Beypazari District (Turkey)

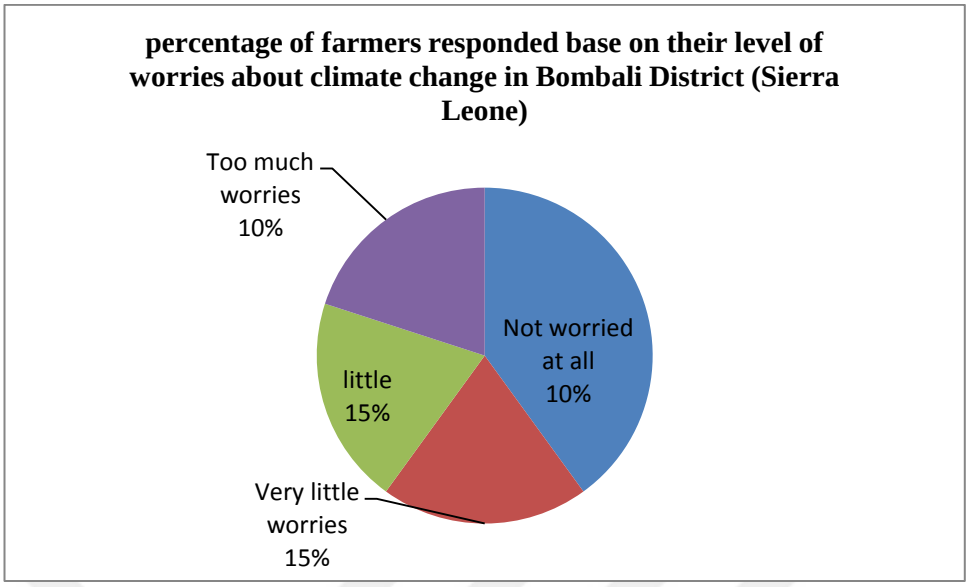
Worry about climate change

Table 4.24 How much do you worry about climate change

Country	Not at all	Very little	Kind off	Too much	Total
Sierra Leone	10	15	15	10	50
Turkey	20	10	10	10	50
Sum TOTAL	30	25	25	20	100

Figure 4.24 Percentage of farmers responded with regards their level of worries about climate change in Bombali District (Sierra Leone) and Beypazari district (Turkey). In Sierra Leone(Bombali District) , out of the targeted (50) farmers interviewed,(10%) of the farmers were not worried at all about climate change,(15%) worried very little,(15%) have kind off worried while (10%) have too much worried about climate change. Likewise Turkey (Beypazari District), (20%) of the farmers interviewed were not at all worried about climate change, (10%) are very little worried, (10%) are kind off worried while (10%) have too much worried about climate change.

From the data, vegetable farmers in Sierra Leone (Bombali District) are more very little or kind of worried about climate change compared to Turkey (Beypazari District).



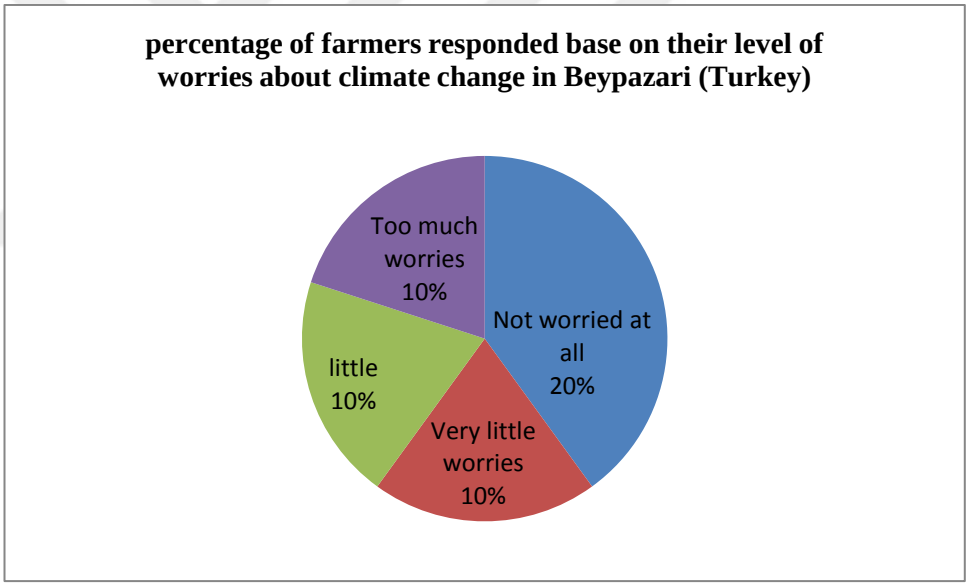


Figure 4.24 above represent Percentage of farmers responded with regards their level of worries about climate change in Bombali District (Sierra Leone) and Beypazari District (Turkey)

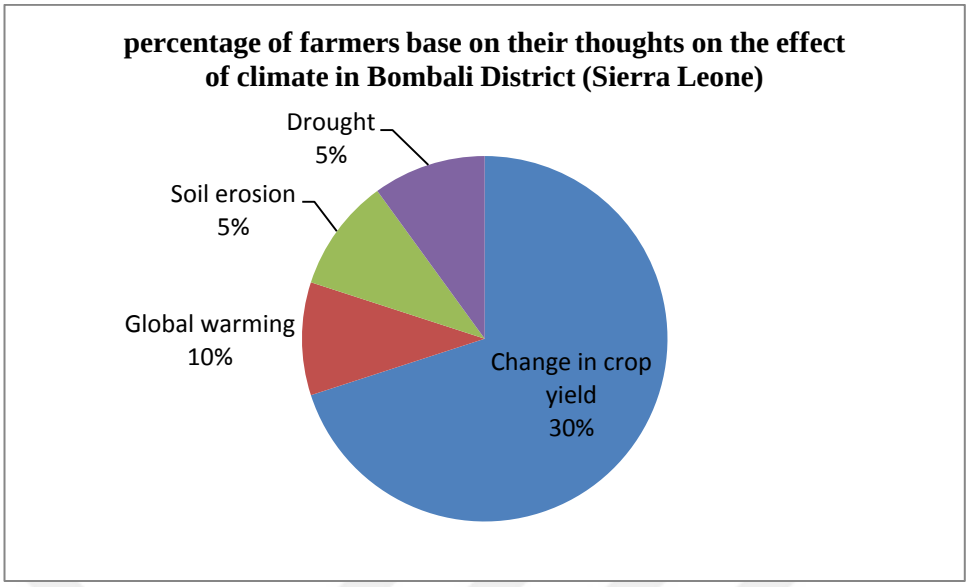
Thinking about in relation with the climate change

Table 4.25 Thinking about in relation with the climate change

Country	Change in crop yield	Global warming	Soil erosion	Drought	Total
Sierra Leone	30	10	5	5	50
Turkey	35	5	5	5	50
Sum TOTAL	65	15	10	10	100

Figure 4.25 Percentage of farmers base on their thoughts about climate change in Bombali District (Sierra Leone) and Beypazari District (Turkey).out of (50) farmers interviewed in Sierra Leone, (30%) of them have the feeling of thoughts that climate change may cause change in crop yield, (10%) deliberated on the causes of global warming, (5%) lamented on the causes of soil erosion while (5%) mentioned that climate change may cause drought. Similarly for Turkey (Beypazari District), an estimated percentage of (35%) of farmers interviewed deliberated on change of crop yield as a result of climate change, (5%) emphasized on global warming due climate change, (5%) lamented on soil erosion while (5%) deliberated on drought as a result of climate change.

From the data, vegetable farmers in Turkey (Beypazari District) thinks that change in crop yield in relation to climate change more compare to Sierra Leone (Bombali District)



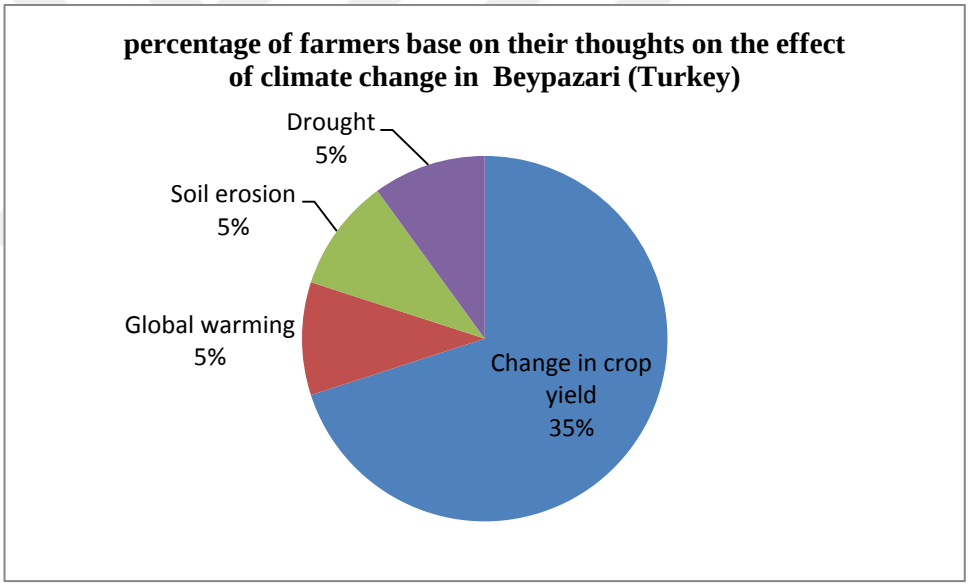


Figure 4.25 above represent Percentage of farmers' base on their thoughts about climate change in Bombali District (Sierra Leone) and Beypazari District (Turkey)

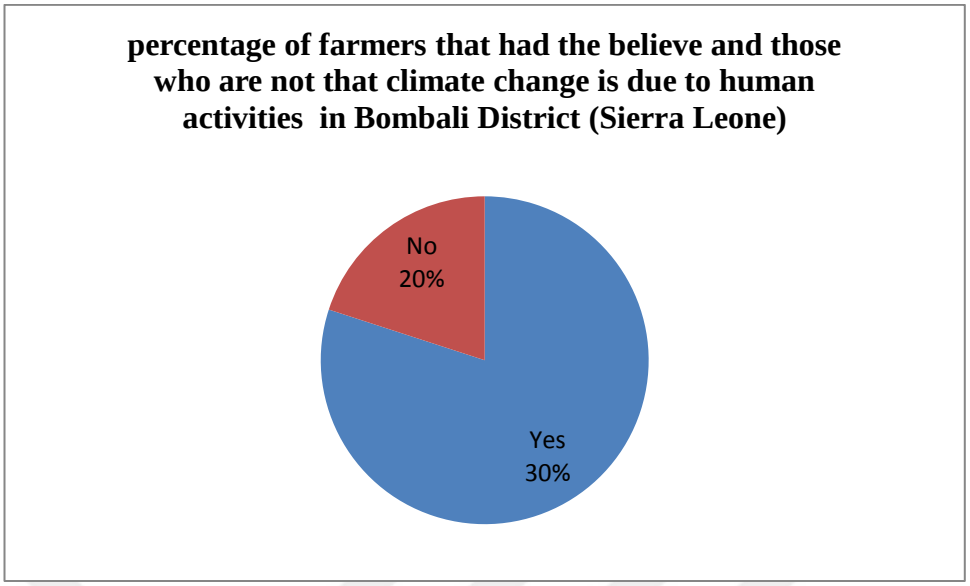
Believe that climate change is due to human activities

Table 4.26 Believe that climate change is due to human activities

Country	**Yes**	**No**	**Total**
Sierra Leone	30	20	50
Turkey	40	10	50
Sum TOTAL	70	30	100

Figure 4.26. Percentage of farmers had the believe and those who are not that climate change is due to human activities in Bombali District (Sierra Leone) and Beypazari District (Turkey).In Sierra Leone (Bombali District), out of the (50) farmers interviewed in Sierra Leone (Bombali District), (30%) of the farmers believe that climate change is cause by human activities while (20%) are not. Similarly for Turkey (Beypazari District), out of the (50) farmers targeted, (40%) of them believe that climate change is cause by numerous human activities while (10%) are not.

From the data, vegetable farmers in Turkey (Beypazari District) believe more that climate change is cause by the numerous human activities compared to Sierra Leone (Bombali District).



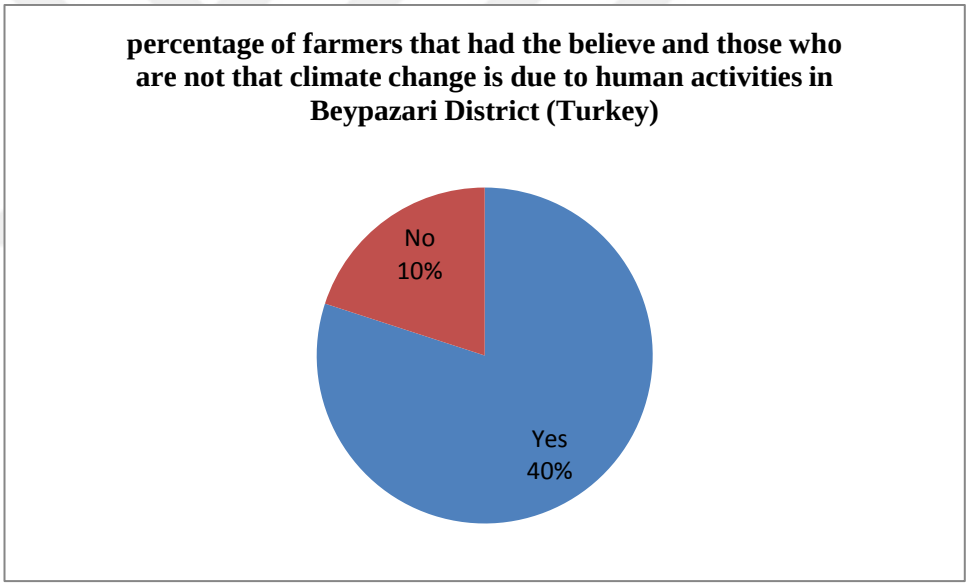


Figure 4.26 above represent Percentage of farmers had the believe and those who are, not that climate change is due to human activities in Bombali District (Sierra Leone) and Beypaqzari District (Turkey)

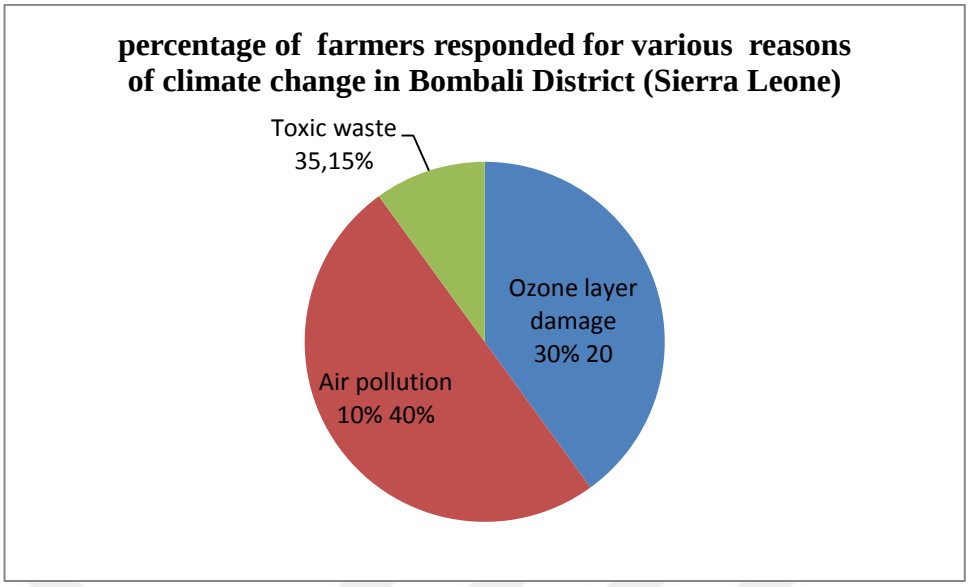
Reasons for climate change

Table 4.27 reasons for the climate change

Country	**Reasons for the climate change**					
	Ozone Layer Damage		**Air Pollution**		**Toxic Waste**	
	Yes	No	Yes	No	Yes	No
Sierra Leone	20.0	30.0	40.0	10.0	35	15
Turkey	30.0	20.0	45.0	5.0	40	10
Total	50	50.0	85	15	75	25

Figure 4.27 Percentage of farmers respondents base on the various reason for climate change in Bombali District(Sierra Leone) and Beypazari District (Turkey).considering the percentage of targeted farmers in Sierra Leone(Bombali District) out of the (50) ,(30%) of the farmers says yes ozone layer damage as a main cause of climate change and (20%) says no ,(40%) says yes on air pollution as a cause while (10%) says no, on toxic waste (35%) says yes and (15%) says no .similarly for Turkey(Beypazari District) , out of the (50) farmers interviewed, (30%) says yes on ozone layer damage as a cause of climate change and (20%) says no ,(45%) says yes on air pollution while (5%) says no and on toxic waste (40%) says yes and (10%) says no.

From the data, majority of the vegetable farmers in Turkey (Beypazari District) mentioned ozone layer damage and air pollution are the main reason to climate change compare to Sierra Leone (Bombali District).



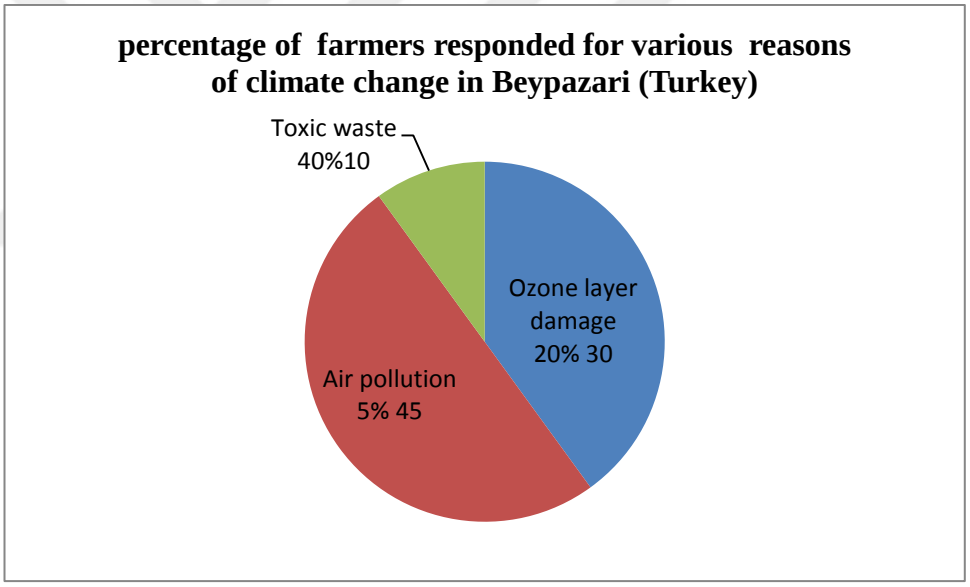


Figure 4.27 above represents Percentage of farmers' responded base on the various reasons for climate change in Bombali District (Sierra Leone) and Beypazari District (Turkey)

5. DISCUSSION AND CONCLUSIONS.

Overall objective of this study was the effect of climate change on vegetable farmers in pest control decisions (Case study Sierra Leone (Bombali district) and Turkey (Beypazari district)) with specific objectives such as, to identify the new situation caused by climate change in pest controls activities, to identify the factors affecting farmer decisions making process on pest control and the Perception of vegetable farmers on the causes of change in climate in pest control activities. The study was limited to Bombali district, Sierra Leone, and Beypazari district, Turkey. Data collection mainly targeted household heads.

A survey research design was adopted based on which a verified questionnaire was developed. The population for this study are both male and female household heads in these chiefdoms. The size of the sample for this study was determined by purposive sampling. The sampling technique used to carry out the selection of the respondents is two stages. Stage one was a purposive selection of the project areas (areas mostly vegetable production). Stage two was respondent selection. Purposive sample technique was used in the selection of household heads for the study. The information was collected by using a survey, the questionnaire was administered by the researcher himself and three (3) enumerator to the vegetable farmers.

The data collected was entered and analyzed by simple descriptive analysis by using SPSS.

From the findings of this study include. There are more Male household head than female household, from the data, this shows that there are more household head in Beypazari District (Turkey) than Bombali District (Sierra Leone).

an majority of the vegetable farmers are within the age brackets of (39-48) years this presents the active farmers in vegetable production, seventy (70%) of the respondents were married, from the data, there are more married vegetable farmers in Turkey

(Beypazari District) than Sierra Leone (Bombali District) and also there are more divorced vegetable farmers in Sierra Leone (Bombali District) than Turkey (Beypazari District) an average of twenty two (22%) of the respondents do not attended school, also (93%) of them were household heads, the household size for majority of the vegetable farmers is between six(6) people, from the findings the household heads income for Turkey(Beypazari District) is between 5000tl-10000tl and for Sierra Leone(Bombali District) is between le300,000-le500,000

From the finding of the study, a large number of the respondent in Turkey(Beypazari District) have received pest management training and only few Sierra Leone(Bombali District) vegetable farmer have received pest management training, and the majority received training on the chemical method of pest control.

From the finding, the majority of the vegetable farmers practice crop rotation, and in Sierra Leone (Bombali District) is rice and groundnut and for Turkey (Beypazari District) is rice and maize.

According to the study low growing season is the new weather conditions that have affected farmers pest control activates the most at their current location and most of the farmers practice inter cropping and rice and maize are the major crops they use for inter cropping.

The study revealed majority of the farmers use pesticides and these pesticides are herbicides and insecticides and they only use such chemicals monthly.

According to the studies, pesticides affected human health

The study revealed the farm practices of vegetable farmers are mixing pesticides, use Personal Protective and Read Pesticides Manual

According to the findings from the study, major of the vegetable farmers in Turkey (Beypazari District) and Sierra Leone (Bombali District) have heard about climate change from mass media and they believe in climate change as a problem

From the finding, the majority of the farmers not at all worried about climate change, and the first thing they think relation to change in climate is change in crop yield.

The study revealed the farmers' believed that climate change is due to human activities and the reason is air pollution

The following conclusions were drawn from the study:

Male household heads are more than female household head.

Most of the household head were within the age bracket of (39-49) years, this shows that there are more youth engaged in vegetable production. since most of them were married and tend to adopt adequate knowledge on the effect of climate change in their environment and how to control pest activities in their vegetable farms. None educated household head were very few among. The household size is six (6) people which adopt adequate knowledge on the effect of change in climate on vegetable farmers in pest control decisions. From the study the respondent main income is vegetable farming.

From the data, the household head preference is adequate knowledge on the effect of climate change in their environment.

5.2 Recommendations

The following recommendations were drawn from the study;

1 vegetable farmers in Sierra Leone should receive training on pest management. In addition, other alternatives for the method of pest control should be made available to rural households to avoid the effect of the use of chemicals.

2. The study recommends that support is needed to promote higher production of crops.
3. According to what the study revealed, low growing season affected farmers most due to climate change, collaborative efforts from stakeholders in Turkey and Sierra Leone to create adequate awareness on the use of pesticide.

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APPENDICES

Questionnaire

The effect of climate change on vegetable farmers in pest control decisions

(Case study Sierra Leone (Bombali district) and Turkey (Beypazari District)

Name:

Village:

Date :

INFORMED CONSENT

I am Patrick Kargbo, an MSc student at Ankara University, Turkey I am conducting my research study regarding the effect of climate change on vegetable farmers in pest control decisions in Turkey and sierra Leone.

The research survey will include detailed questions regarding identify the new situation caused by climate change in pest controls activities, to identify the factors affecting farmer decisions making process and perception of farmers on the causes of climate change in pest control activities.

The interview will last for about 30 minutes. All answers will be kept highly confidential. Participation is voluntary and we will not force you to answer any question. If you wish to end the interview at any time, you may do so.

Demographic questions

(1) . Are you a household head? 1. Yes 2.No

(2) If no what is your position ……

(3) Gender

(A) male

(B) Female

(3) What is your age …….

(4) Marital status 1. Married 2. Single 3. Divorced
4.widowed

.

(5) Formal Education level

A. None

B. Primary

C. Secondary

D. Tertiary

F. Arabic

(6) Size of household …….

(7). Estimate your monthly income from all sources…….

New situation caused by climate change in pest controls activities

1. Approximately how many years have you been managing crops?.....

2. Approximately how many average acres of crop production at your current location have you managed? ……

3. Please select the main vegetable crop that you have managed at your current location. (Select the one that apply).

A Beans, E lettuce I Pepper

B Cabbage F Onion J Radish

C Carrot G Parsley K spinach

D leek H Pea L tomato

M if other…….

Identify the factors affecting farmer decisions making process on pest control activities

(1) Please select the NEW weather conditions that have affected your pest control activates the most at your current location and indicate whether the effect has been positive, negative, or both.

A. Unpredictability in temperature: Positive effect Negative effect

B. Low temperatures: Positive effect Negative effect

C. High temperatures: Positive effect Negative effect

D. Unpredictability in precipitation: Positive effect Negative effect

E. Low moisture: Positive effect Negative effect

F. High moisture: Positive effect Negative effect

G. Strong rainfall events: Positive effect Negative effect

H . Long growing season: Positive effect Negative effect

I. Short growing season: Positive effect Negative effect

J. Other: _____ Positive effect Negative effect

K. Other: _____ Positive effect Negative effect

2. Do you receive any training on pest management for your vegetable farm?

Yes . No

If yes which of the following

A Biological Method B Poisoned Bait Method C Chemical Method

D Mechanical Method E Trap Cropping F Other …….

3 Do you practice crop rotation? 1. Yes. No

4. If your answer for question number 3 is yes, which crops?

.....
.....

5. Do you practice inter-cropping? 1. Yes. No

6. If your answer for question number 7 is yes, which crops?

1. _____ with _____

2. _____ with _____

3. _____ with _____

4. _____ with _____

5. _____ with _____

7 Do you use any pesticides in your vegetable garden?

Yes

No

If yes, which of the following do you use?

A herbicides, B fungicides C Insecticides D……..if any

8. How frequently do you use Pesticides?

A daily

B weekly

C monthly D yearly

9 .We would like to establish your level of agreement regarding the effect of pesticides on the following categories. Kindly use the following level of agreement

scale, where 1 = definitely agree, 2 agree, 3 = neither agree nor disagree, 4 = disagree, and 5 = definitely disagree.

Effect of pesticides 1 2 3 4 5

Pesticides affect human health

Pesticides affect livestock

Pesticides affect the environment

(Fish)

Pesticides affect crop

10. Below are some of the Farmers' practices on use, storage, and disposal of pesticides.

(Kindly select the one that is applicable to you)

Farmer practices

Store of pesticides

1. Open shed just for pesticides

2. Locked chemical store

3. Living house

4. Animal house

Mixing pesticides/dose according

to the recommendation

A yes

B No

Place of pesticide mixing

(1) Near a river/lake water sources

(2) In the field 92 21.75

(3) In home

Recommended frequency of

Spraying

(1) Yes (2)No

Use personal protective during

Spray

(1) Yes (2)No

What do you do with the unused?

Leftover (mixed, diluted)

Pesticides?

(1) Dispose of in the field

(2) Dispose into

(3) Apply on crops reputably

What do you do with old?

Pesticides stocks?

(1) Return to retailer

(2) Apply on crops

(3) In the field

(4) Buy the only amount needed

Empty pesticide containers

(1) Discard on-farm

(2) Incinerate/bury on-farm

(3) Reuse for other purposes

Read pesticides labels

(1) Yes (2)No

Have been taken formal training

On pesticides

(1) Yes (2)No

Informed about the proper use of

Pesticides

(1) Informed

(2) Non informed

Source of information*

(1) Pesticides sellers

(2) Local DA experts

(3) Health care providers

Perception of farmers on the causes of climate change in pest control activities

1. Yes 2.No

3. From where do you get info about climate change?

A Agricultural institutions E Mass media (TV, radio, internet)

B Leader farmers F if other (specify)…….

C University

D journals, newspapers

4 Do you believe in that climate change is a problem?

A yes b no c don't know

5 How much do you worry about climate change?

A Not at all B Very little C Little D Too much

6 What is your opinion about climate change in the future? …….....

……
…….

7 What is the first thing you think about in relation with the climate change?

A change in crop yield E global warming I soil erosion

B heavy rains F Unpredicted heavy rains J water deficit

C drought G seasonal changes K melting polar ice

D floods H Ozone layer damage L…….(other)

8. What is the main reason for climate change? ……..

……
……
……

10 Which ones of the following are the reason for climate change?

	YES	NO	DONT KNOW
An Ozone layer damage			
B deforestation			
C (Petrol, coal) Fossil fuels			
D population increase			
E air pollution			
F use of nitrogenous fertilizers			
G Animal husbandry and animal wastes			
H toxic wastes (chemical, nuclear)			
I Agricultural practices			

J other:_____

THANKS