

DOI : <https://doi.org/10.3126/njmr.v2i3.26975>

Increasing Trend of Pesticides' Use in Vegetable Farming and Its Impact for Human Health

(A case study of Bharatpur Metropolitan City, Nepal)

Lila Raj Bhandari

lilaraj_23@yahoo.com

Abstract

This study has analyzed the trend of pesticides' use in vegetable farming in third world country like Nepal, and its impact in public health. This study tries to find out the increasing trend of pesticides' use in vegetable farming and its optimum impact in human health that has also focused for the protection of environmental and human health. Vegetable, a kind of cash crops, is the crops that millions and millions of people use as their meal and it is directly associated with human health, nutrition and daily consumption. Highly use of pesticides in vegetable farming is ultimately the poison for human being because of its maximum uses which is beyond the immunity power of the human beings. This is a sensitive issue that suffers thousands of children and old aged people by bringing acute and chronic diseases. This study moreover tries to juxtapose library and field-based information that directs it in particular way. Both, theory of production and health behavioral theory have been applied in this research because theory of production touches with the producers or farmers and health behavioral theory attaches with consumers. Economic growth model can be attached with the large scale of production. Production approach relates with producers that inspires them to produce large amount of vegetable. This study belongs to not only a field-based research, but it deals with library information, productive concepts and its impact on health too. Applying explorative research design, qualitative and quantitative method with primary and secondary sources of data, this study analyzed significantly statistical information and theoretical concepts. For this study, Bharatpur Metropolitan city (ward number 25 and 27) Nepal was chosen as a research area. In order to study the trend of pesticides use and its health impact, primary data were collected from the vegetable farmers who operate farming at the village area. A purposive sampling method was applied to collect data from 110 farmers who use pesticides in vegetable farming. Sample was drawn in such a way that all kinds of farmers might be included into the sample. Statistical tools such as percentage tables were used to analyze the data, and finding revealed that varieties of pesticides were used by farmers, but awareness associated with pesticides application was not found as we expected among the respondents. Although farmers showed favorable attitudes about the risks of pesticides uses, they did not use protective tools while applying pesticides. Less than half respondents (42.27%) have got primary education whereas only less than one third (30%) respondents have secondary level of education. 77.27% male and rest of the female for this study were selected. This study furthermore deals with the experience of the respondents which begins with 1 year to 30 years while 36.36% respondents have 11 to 15 years experiences in vegetable farming but only 9.09% respondents have 26-30 years experiences. More than two third majority (95.45%) respondents have given their view that pesticides are ultimately harmful for human health although it helps to increase the production. Air pollution, land pollution, and harmful to non-target organisms were also found from the study. Majority of the respondents (vegetable producers 27.27 percent) have opinioned that they were suffering from skin problems but

20.91 % respondents have expressed headache problems whereas 7.27 % had excessive sweating problems. Few of them have reported sneezing, vomiting, muscular difficulties, respiratory difficulties and trembling hands.

In order to study the using trend and practice of pesticides, vegetable farmers were using different types of pesticides based on their decision. No proper advices from stakeholders and extension agent were taken, and no safety tools were used at the time of pesticides' application. Some had taken partial training associated with vegetable farming although strong practical knowledge was not found. Educational awareness, pest control, safe work habits, safety tools, policy, innovative method of farming, and organic farming are recommended for the policy maker from the study.

Keywords: awareness, farming pest control, impact, innovative technique, organic, pesticides, safety measures

Introduction

Pesticides is a kind of chemical substances that are purpose to control and kill pests which is not only a chemical agent that helps to protect vegetables from different virus but it asserts for the large amount of production which also uplifts the economic standard . As *Cambridge Dictionary* explains “a chemical substance used to kill harmful insects, small animals, wild plants, and other unwanted organisms: the pesticides that farmers spray on their crops kill pests, but they can also damage people’s health”, the maximum uses of such chemical directly relates with the public health. Moreover, *Oxford Advanced Learners’ Dictionary* defines the pesticides as “a chemical used for killing pests, especially insects” that totally draw our attention towards the remedies to control and kill the pests in proper way that somehow help to increase the productivity within the limited time and area. Besides, *Encyclopedia Britannica* has clarified the meaning of the insecticide, a kind of pesticides in this way “Insecticide, any toxic substance that is used to kill insects. Such substances are used primarily to control pests that infest cultivated plants or to eliminate disease-carrying insects in specific areas”.

Regarding the pesticides and its impacts on crops production, Sabur and Molla (2001) in their article entitled “ Pesticides Used, Its Impact on Crop Production and Evaluation of IPM Technologies in Bangladesh” mention that majority of farmers believe that pesticides application pollute water and air and they are harmful to farm labor. This article moreover talks about the quantity of pesticides, price of pesticides and IPM (Integrated Pest Management) training. This means it brings negative impacts rather than the positive impact whether we use in vegetable or we applied in other crops.

Similarly, R.G(2012) in his article entitled “ Perceptions of Environmental Effects of Pesticides Use in Vegetable Production by Farmers in Ogbomoso Nigeria” indicates that the intensification of extension services to educate farmers on safe use of pesticides in vegetable production is essentials. This article further insists that the farmers in the study area were quite aware of the risks associated with use of pesticides and its effects on the environment and concluded that the system must be strengthened to increase farmers’ knowledge and understanding ability regarding the effects and its consequences. All pesticides are use in agricultural sectors although it is depend upon the country and areas for example : there are only ten types of pesticides has been registered and used in Nepal . As per the report of ministry of agriculture Nepal, insecticide, Acaricide, fungicides, bactericide, herbicide, Rodenticide, Molluscicide, bio-pesticides, Nematicide and herbal (15th Dec, 2018).

In the context of the pesticides in Nepal, it has no long history. According to “ Use of Pesticides in Nepal –and Impacts on Human Health and Environment”, the history of pesticides in Nepal is not so old . The use of chemical pesticides for the first time introduced in Nepal was in 1952 in the course of malaria control program. Pesticides are used for the control and to kill the pest and disease while bio-pesticide can be used to control vector-borne disease such as malaria, dengue-fever, whereas fungicides is used to control the disease related fungus and rodenticide is used for controlling pests and diseases.

Rodenticides are pesticides that kill rodents. Rodents include not only rats and mice, but also squirrels, woodchucks, chipmunks, porcupines, nutria, and beavers. Although rodents play important roles in nature, they may sometimes require control. with the modernization of agricultural production, the use of innovative farming techniques and applying various chemical fertilizers in place of organic fertilizers, hybrids seeds instead of local are using for mass production. Similarly, almost all farmers use pesticides after seeing pests and diseases in all crops to control pests and diseases as well as to get more productivity from the crop yields to meet the demand of present escalating population.

Pesticides are substances that are used in agriculture or in public health in order to protect plants from pests and diseases, and humans to protect them from vector-borne diseases like, dengue fever and malaria. Insecticides, fungicides, herbicides, acaricides, rodenticides, molluscicides are the examples of pesticides. Comparatively maximum pesticides are applied for vegetable crops rather than food crops farming.

Objectives

The general objective of the study is to identify the use and practice of pesticides among vegetable farmers in Bharatpur, Nepal, and make them aware to be healthier.

The specific objectives are:

To identify the pesticides' use and its increasing trend.

To analyse its impact in human life.

To recommend for the protection of environment and human health.

The producers are inspiring towards the use of current technology, and use Pesticides as well as chemical fertilizers for mass production because traditional method of vegetable farming cannot fulfill the present food demand of increasing population.

Literature Reviews

Many studies have been conducted associated with the use of pesticides in the past few decades. Health is a great thing for every creature. It has shown that pesticides are harmful for human health so, this title is chosen for the study. As (Henrik, Damian, and Nicolas, March 14, France) in their article argue that it is now better understood that pesticides have significant chronic health effects, including cancer, neurological effects, diabetes, respiratory diseases, fetal diseases, and genetic disorders.

These health defects are different depending on the degree, and the type of exposure. It is saying that, prevention is better than care. In the context of Nepal, human health treatment is highly expensive, and government of our country has not taken full responsibility, so it is better to concern earlier. All individuals like to live his or her full phase of life. Pesticides have contributed substantially to the controlling of pest and increasing crop yield in meeting the demand of escalating population and control vector-borne diseases.

Exposure to pesticides is one of the most important occupational risks among farmer in developing countries (R.G, 2012).In order to study the use and practice of pesticides, vegetable farmers were using different types of pesticides based on their decision. No advices from extension agent was taken, and no safety tools were used at the time of pesticides' application, some had taken partial training associated with vegetable farming, but strong practical knowledge was not found.

Most pesticides do not distinguish between pest and other similar incidental life form. They are potentially harmful to human, animals, another living organism and the environment if used incorrectly. Human beings are the highest leveled animals in terms of intelligence, so before the application of pesticides to protect human health safety measures, awareness associated with different kinds of pesticides can be applied.

Pesticides are used widely to increase the productivity of crop yield, from the economic point of view by producing more amount of agriculture products producers can get profit, but some previous studies have shown that farmers who have been occupationally applying agriculture profession they are suffering either from acute or chronic types of health problems. The effect of a short duration can be delayed but there is a possibility of cumulative effects. So that, this study has given emphasize to be aware and use protective tools meaningfully before or after applying pesticides. Vegetable farmers as well as farmers belonging with agriculture are using pesticides to control pests, diseases, and that may be for controlling weeds, but they are not directed only towards targeted organisms. In the process of application, pesticides are affecting in or on the body of exposures directly or indirectly if using incorrectly it impacts for the human health.

Atreya, and et.al (2012).have published an article entitled "Health and Environmental Costs of Pesticide Use in Vegetable Farming in Nepal." and claim that there is a growing concern of pesticide risks to human health, natural environment and ecosystems. Many previous economic valuations have accounted health aspects or environmental components, but rarely combined; thus, overall risk assessment is partially distorted. Their study close to the capital of Nepal, addressed the health effects of pesticides on small-scale farmers and evaluated the monetary risks of pesticide use on human health and environmental resources. Their paper adopts cost of illness, defensive expenditure and contingent valuation willingness to pay approach. The study concluded that the methods used for valuing pesticide risks to human and environmental health are theoretically consistent. The exposed individuals are likely to bear significant economic costs of exposures depending on geographical location, pesticide use magnitudes and frequency. Individuals are willing to pay between 53 and 79% more than the existing pesticide price to protect their health and environment. The integrated pest management training is less likely to reduce health costs of pesticide exposure, although it leads to higher investment in safety measures.

Bhrtyal, and et.al. (2016) has published an article about pesticides entitled " Knowledge, Practice and use of Pesticides Among Commercial Vegetable Growers of Kaski District Nepal." They claim that the increasing use of pesticides, deteriorating ecosystem health has advocated the need to change traditional and external input use agriculture towards safe and sustainable production. A descriptive cross sectional study was conducted to evaluate knowledge, practice and use of pesticides among commercial vegetable growers of Kaski district of Nepal. Around 80.0 % (77.1%) of the vegetable growers were using pesticides for more than ten years. All the vegetable growers were using highly hazardous (Ib) pesticides. Almost 80.0% of the vegetable growers spray pesticides more than six times in a year. Less

than half (44.3%) of the vegetable growers know the adverse effect of pesticides and more than half (62.9%) of the vegetable growers experienced symptoms of health hazards. Waiting period for picking vegetable is less than four days for nearly two-third (61.9%) of the vegetable growers.

Compendium, and et.al. (2014) in their article “Compendium on Pesticide Use in Vegetables”, they said that pesticides are the most essential agricultural inputs for protecting crop plants and increasing agricultural production. In India, 241 pesticides and 41 combination products are registered as on date for use in agriculture. Out of these 62 insecticides, 40 fungicides and 7 plant growth promoters have been registered for use only in vegetable crops. The average pesticide consumption in India is around 0.381 kg a.i./ha as compared to world average of 0.5 kg a.i./ha. Around 13-14 per cent of pesticides are used in the country are applied on vegetables, maximum use is in chilli (5.13%) followed by brinjal (4.6%).

Dey, (2010) in her article “Use of Pesticides in Vegetable Farms and its Impact on Health of Farmers and Environment.”, claims that the irrational use of pesticides is increasingly threatening our ecosystem, health and environment. This study investigated the use of pesticides in vegetable farms and its impact on health and environment. Three contrasting sites under three sub-districts where vegetable production were common were considered for this study. From each sub-district 60 farmers who had been using pesticides application for growing vegetables were selected randomly. Findings reveal that the use of pesticides in vegetable farms was higher and frequent. Higher doses of pesticides were used in the high cropping intensity areas and doses of application were positively increasing for all three categories of cropping intensities. Yearly increase of pesticides use was around 1-2% among the study sites. Most of the farmers knew the importance of taking protective measure during pesticides application. However, 85-90% of farmers were not accustomed to take any protection during pesticide application as well as preservation and transportation. People aged 21-40 years were relatively highly exposed to pesticide poisoning. This study found that selection of pesticide, dosage and mode of application were based on agro-chemicals dealers’ suggestion. During pesticide use, farmers felt burning sensation of skin, breathing problem, itching, and dizziness and burning in their eyes. Around 27% perceived that fish had been reducing and water pollution occurred due to wash-out of agrochemicals from agricultural farms. Intensive awareness training of farmers on safety measures regarding application of pesticides and its rational use is necessary to avoid potential health and environmental hazards.

Diwaka and et. al. (2008) in their article "Study on Major Pesticides and Fertilizers Used in Nepal " explain the government data shows that nine major pesticides groups with seven subgroups of Insecticides were imported from the year 1997 to 2003. The pesticide use amounts to 142 g/ha which is low compared to other counties. The highest pesticides quantity imported & quantity consumed from the 2056/57 (1999) to 2060/061(2003) were fungicides, bactericides, acaricides & seed treatment. group. For the year 2056/57 (1999) & 2057/58(2000), no import & consumption of biopesticides were done but from the year 2058/59(2001) to 2060/061(2003) no import & consumption of plant regulators was done. The various types of pesticides with 306 trade names and 71 technical names are registered / enlisted and used in Nepal which includes Insecticides, Fungicides, Herbicides, Rodenticides, Acaricides and Others. Moreover, twelve types of pesticides are band in Nepal for its import and use. Similarly, the demand of fertilizers were increased from 1997/98 to 2001/02 and then decreased dramatically with high amount from 2001/02 to 2002/03 and since then again

it again increased up to 204/05. This trend is same for Urea and Diammonium Phosphate whereas Murate of Potash is increasing from 1997/98 to 2004/04. Seven types of fertilizers are being used in Nepal viz. Urea, Diammonium Phosphate (DAP), Murate of Potash (MOP), Ammonium Sulphate (AS), Single Super Phosphate (SSP), Ammonium Phosphate Sulphate (APS) and NPK. These are imported by Public institution like Agricultural Input Corporation (AIC) , Private Institutions and also donated/granted by the Government of Japan called as 2KR (Two Kenny Round). The import of fertilizers shows irregular trend. The import of fertilizers was highest in 1998/99 which amounted to 219038 metric ton and since then it decreased although there showed fluctuations. The distribution of fertilizers was increase from 1997/98 and reached highest in the year 2002/03 and since then it started decreasing. Similarly, the fertilizer consumption was highest in the year 1994/95 which was 30.4kg/ha which declined since then and showed fluctuation. The fertilizer consumption is regularly decreasing in the recent years from the year 2002/03. Key words: Agriculture; Fertilizer; Insecticide; Pest and pesticide. DOI: 10.3126/sw.v6i6.2638 Scientific World, Vol. 6, No. 6, July 2008 76-80.

Jeyanthi and Kombairaju (2005) in their article entitled “Pesticide Use in Vegetable Crops: Frequency, Intensity and Determinant Factors”, examined pest management practices in four important vegetable crops, viz. chilies, cauliflower, brinjal and okra using farm level cross-sectional data. Average pesticide usage has been estimated at 5.13, 2.77, 4.64 and 3.71 kg active ingredient per hectare on chilies, cauliflower, brinjal and okra crops, respectively. On an average, cauliflower and brinjal are each given 15 applications, chilies is given 13 and okra is given 12 applications. The study has suggested that for reducing pesticide-use, farmers need to be educated about different nonchemical control methods and should be encouraged to adopt integrated pest management (IPM) practices.

Jha and Regmi (2009) in their article “Productivity of Pesticides in Vegetable Farming in Nepal”, examines the effectiveness of damage control mechanisms to reduce crop losses from agricultural pests. It uses data from a sample of Cole crop (Cauliflower and Cabbage) growing households in the Bhaktapur district of Nepal to study the impact of pesticides on agriculture production. The results suggest that the marginal productivity of pesticides is close to zero for the average farmer, indicating an excessive use of pesticides. While the study estimates the optimal amount of pesticide per hectare of Cole crop to be 680 grams of active ingredients, the average farmer in Bhaktapur uses 3.9 times as much pesticide as this optimal amount. Over 70% of the farmers in the sample use pesticides above the optimal level despite very small increases in yield attributable to pesticide applications. Our results suggest that the time has come to re-examine the current strategy of the National Integrated Pest Management program and the curriculum of the Farmers’ Field School to ensure more efficient use of pesticides in vegetable farming.

Sharma and et.al. (2012) in their article “Use of Pesticides in Nepal and Impacts on Human Health and Environment”, concluded *that the* majority of the farmers were unaware of pesticide types, level of poisoning, safety precautions and potential hazards on health and environment. According to the latest estimate, the annual import of pesticides in Nepal is about 211t a.i. with 29.19% insecticides, 61.38% fungicides, 7.43% herbicides and 2% others. The gross sale value accounts US \$ 3.05 million per year. Average pesticides use in Nepal is 142 g a.i./ha, which is very low as compared to other Asian counties. The focus of this paper is to analyze the use and application status of pesticides in Nepal to aware the society about adverse effects of chemical pesticides in the environment . Pesticidal misuse was being a serious concern mainly in the commercial pocket areas of agricultural

production, where farmers are suffering from environmental pollution. Incidence of poisoning is also increasing because of intentional, incidental and occupational exposure. Toxic and environmentally persistent chemicals are being used as pesticides. Many studies showed that the chemical pollution of the environment has long-term effects on human life. It is therefore essential that manufacture, use, storage, transport and disposal of chemical pesticides be strictly regulated.

Subur and Molla(2001) in their article “Pesticide Use, Its Impact on Crops Production and Evaluation of IPM Technologies in Bangladesh,” talk about pesticides these are generally sold at a price lower than MRP, but in some cases during peak period they are sold higher than MRP. More than one-half of farmers use recommended quantity of pesticides. Almost all farmers use pesticides after seeing pest/disease in the field. Majority of them cover their face during pesticide application. Among all crops, comparatively more pesticides are applied for vegetables crops. Majority of farmers believe that pesticide application pollute water & air and they are harmful to farm labour. The study shows that farmers use excess pesticides for all crops except Banana (sagar) and Mango. Non-IPM farmers apply much higher amount of pesticides than IPM farmers. Only IPM trained farmers know and use IPM technologies. Apart from pesticide application, majority of trained farmers are aware and use crop rotation and control by hand methods. In contrast, a few of them use cultural and biological methods. Although they are interested to use pest resistance seeds, they cannot use those because of non-availability of seeds. In case of using recommended doses of pesticides, IPM and nonIPM farmers differ significantly. Comparatively more IPM farmers express their view that pesticide application pollutes air as well as crop. Finally, this study reveals that training on IPM encouraged farmers to adopt non-traditional pest control methods.

Sushma (2015) in her article “A Review on Status of Pesticides Use in Nepal”, claims that pesticides are used for increasing the agricultural productivity and safeguarding the public health. This paper analyses the trend of pesticide import, formulation and consumption in Nepal. Moreover, quantity of pesticide used per hectare of agriculture field in Nepal has been compared with other countries of the world and banned pesticides in Nepal have been reported along with their hazard level. Results show an increasing trend of pesticide consumption for agricultural purposes. Fungicides are the major form of pesticide used in the country. Since 1950s, pesticides have been used for increasing the agricultural productivity and safeguarding the public health in Nepal. Every year the consumption of pesticide for agriculture purpose is increasing but the quantity of consumption per hectare in agricultural field is very low comparing with other countries of the globe. Trend of pesticide import, formulation and consumption in Nepal have been analyzed. The results showed an increasing trend of pesticide consumption for agricultural purposes but quantity of pesticide used for public health purposed has been decreased. Among various forms of pesticides, fungicides are the main pesticide used in the country.

This pesticide can be fatal if inhaled, swallowed, and absorbed through the skin, even though, the effects of contacts or inhalation may be delayed due to its formulation. Farmers should careful from the pesticides' effects along with agriculture farming. None of the earlier studies provided. This study is expected to fill this information gap concerning pesticides in Nepal.

Methodology

Methodology is direct attached with the framework and settings that mingles the different points or components in one place in a systematic manner. In this study I have applied explorative research design because I have analyzed statistical tools as well as I have applied

two specific theories. Similarly this research is relates with the qualitative and quantitative research method because it juxtaposes the number, percentages, and tables attaching with the components of qualitative analysis. The study area is located in the center of western Nepal and it lies about 150 kilometers from the Kathmandu, the capital city of Nepal. For this study, Bharatpur Metropolitan city ward number 25 and 27 were chosen. Purposive sampling method was applied where one hundred and ten vegetable farmers were selected in such a way that all kinds of respondent might be included into the sample. In the study area, we could not find any vegetable farmer who had never sprayed pesticides. They have been using pesticides like, insecticides, herbicides, fungicides, and a few of them were using rodenticides for fifteen years. Comparatively maximum insecticide and fungicides were used. Secondly, herbicides and less use of rodenticide was found. Mainly, six leading vegetables were taken for the study they are: Long Bean, Bottle guard ,Bitter gourd, Tomato, Okra, ladies' finger, and Chilly.

Not only these above mentioned vegetables are analyzed but numbers of vegetables are also cultivated in Nepal like: Brinjal, Bell pepper, Beans, Snake gourd, Sponge gourd, and so on. Above selected six are the leading vegetables which are maximum use in our daily food. From the economic point of view, time duration, and for detail study, these six leading vegetables were selected. In the context of data collection, I have used both primary and secondary sources of data in which I collected secondary data through library and online based portals while I have collected primary date from selected respondents with the help of interview and observation as well as field visit I took formal and informal both interview with vegetable farmers or pesticides users. Data was collected from April to July, 2019 and developed the final questions on the basis of this survey within study area. Structured and semi-structured types of questionnaire were constructed. Some of data were collected through repeated visits on a weekly basis from the vegetable farmers.

During this research and its coding, decoding, tabulation, classification, explanation and application, I have used maximum statistical tools such as table, chart After presentation of the information, I have analyzed two selected theories and apply them in my research showing figures, facts and knowledge.

Results and Discussion

The following table shows sex of the respondents.

Table 1: Sex of the respondents

S.N.	Sex of the respondents	No. of respondents	Percentage %
A	Male	85	77.27
B	Female	25	22.73
	Total	110	100

This study has regarded in the 110 respondents among them 77.27 were male and 22.73 % respondents were female. Out of one hundred and ten, only less than quarter of 22.73% women are involving in this sector that clearly indicates that more than two third respondents were male.

The following Table 2 shows education status of respondents.

Table 2: Educational Status of the respondents

Education Status	No. of respondents	Percentage %
Higher Education	12	10.91
Secondary Level Education	33	30
Primary Education	52	47.27
Adult Education	13	11.82
Total	110	100

Regarding the educational status of respondents, 10.91 % respondents have got higher education, 30 % have secondary education and 47.27% respondents have primary education but adult education holders are only 11.82 % that shows only fewer respondents have achieved higher education. . Farmers who have completed secondary level of education are thirty percent, and only twelve percent respondents have completed higher education.

Table 3: Working experience of the respondents

Year	No. of respondents	Percentage %
1 to 5 years	9	8.18
6-10 years	20	18.18
11-15 years	40	36.36
16-20 years	16	14.55
21-25 years	15	13.64
26-30 years	10	9.09
Total	110	100

In the context of working experience of the respondents, only 9.09% have more than 26 years of experience while slightly less (8.18%) respondents have only 5 years working experiences. Moreover, those respondents who have experiences of 6 to 10 years, 11 to 15 years, 16 to 20 years and 21 to 25 years are 18.18%, 36.36%, 14.55% and 13.64% respectively. The topic of the study is related to human health, so symptoms of pesticides' effects may vary on the basis of duration or time period so that above framework will be helpful to figure out the reality of

the study. Acute health characteristics are seen within short period of time, but for chronic effect it takes long time. To collect all kinds of information associated with pesticides this data will be meaningful.

1- Production and Its Consumption

According to the Central Bureau of Statistics (2009-10) & Ministry of Agriculture and Cooperatives (MoAC), vegetable crops are cultivated in only 7.3 percent of the total cultivable land in Nepal. Total worth of vegetables (excluding potatoes) produced during 2009/10 was around Rs 105 billion, which is 8.8 percent of the country's GDP. Per capita vegetable consumption has increased to 105 kg from 60 kg over last two decades due to massive rise in agriculture and production area. There are 3,243,521 vegetable holdings reported in Nepal. Vegetables crops are cultivated in 232,295 hectares of cultivable land. The total production of the vegetables was 2,820,527 metric tons. Among the total production, household consumption contributed 1,100,710 metric tons (39 percent) and total sale contributed 1,719,818 metric tons (61 percent).

Table 4: Production and Consumption of Vegetable Farming

S.N	Vegetable Farming	Production(MT)	Hector	Consumption(MT)
A	Long Bean	4.5 MT/H	26	All
B	Ladies Finger	12-16 MT/H	20	All
C	Chilly	25-30 MT/H	13	All
D	Bitter Guard	20-25MT/H	10	All
E	Bottle Guard	25-30Mt/H	24	All
F	Tomato	15 MT/H	19	All

Source : Field Survey, 2019.

This table explores the trends of vegetable production and consumption of vegetable farming that relates to the selected respondents and selected areas. Only 4.5 Mt /hector Long bean has been produced in and all production has been consumed in local market while 25-30 Mt/ hector chilly has been produced and has been consumed in same time. In the context of tomato farming , the production of tomato is slightly more than bottle guards in which bottle 25 to 30 Mt/Hector produces in one times which all has been consumed. As a whole, bottle guard and chilly are same in the context of production which are 5 times more than long bean.

2. Amount of pesticides

There are mainly ten types in practice in Nepal which are : Fungicide, Herbicides, Insecticide, bactericides, Rodenticides, bio-pesticide, scaricide, mollouscides, nematicide and Herbal. The amount of the pesticides using is on the basic vegetables. The amount of the pesticides use has been given in this table.

Table 5: Amount and Frequency of Pesticides

S.N.	Pesticides	Amount	Frequency
A	Fungicide	142 G/H	Per 12-15 Days
B	Herbicides	142 G/H	Per 2 months
C	Insecticide	142 G/H	Per 12 to 15 Days
D	Bactericide	142 G/H	Null
E	Rotencicide	142 G/H	Null
F	Bio-pesticide		Rarely

G	Scaricide	142 G/H	Nil
H	Molluscicide	142 G/H	Nil
I	Nematicide	142 G/H	Before plantation
J	Herbal	142 G/H	Rarely
	Total		

Source : Field Survey, 2019

Above table no 5 shows that the trend of the pesticides used in amount and using frequency. All pesticides use 142 gram per hector where the frequency of the fungicides' use is indicates in 12 to 15 day which is same as insecticide. The use amount of herbicides is equal to other but the frequency of this pesticides is regards with the per 12 to 15 days .

3- Techniques of Pesticides Used

The methodology or tools to use in the spray of pesticides uses may refers the techniques of pesticide used . System is everything that shapes the all matter in particular direction. There are mainly two kinds of tool are used in the vegetable farming such as traditional techniques and modern techniques. The techniques used by respondents in vegetable farming have been given in this table.

Table 6: Techniques of Pesticides Used

S.N.	Techniques of Pesticides	Number of Respondents	Percentage (%)
A	Using Mask	90	81.81
B	Safety Tools	20	18.18
C	Necked Hand	80	72.72
D	Boot	70	63.63
E	Hand Wash before and After	110	100
F	Use Clothes at the time of Spray	90	81.81
G	Using leaking equipment to spray pesticides	30	27.27
	Total		

Source : Field Survey, 2019

This table shows that majority of the farmers (81.82 percent) cover their face with cloth during pesticides' application. Among them 72.73 percent respondents are not aware with pesticides' use. Only 4.55 percent vegetable farmers had reported that they were using glass, hat, shoes, and mask as a form of safety tools at the time of pesticides' application. This indicates that maximum vegetable farmers were away from the security measures. Above table indicates that only a few numbers of vegetable farmers have applied safety tools at the time of pesticides' application.

4- Impact of Pesticides

Table 7: Impact of Pesticides

S.N.	Impact of Pesticides	Number of Respondents	Percentage (%)
A	Skin problems	30	27.27

B	Trembling hands	5	4.54
C	Respiratory difficulties	8	7.27
D	Muscular weakness	9	8.18
E	Nausea or vomiting	10	9.09
F	Sneezing	7	6.36
G	Headache	23	20.90
H	Dizziness	10	9.09
I	Excessive sweating	8	7.27
	Total	110	100

Source : Field Survey, 2019

Above Table 7 shows that majority of the vegetable producers (27.27 percent) have opinioned that they are suffered from skin problems. Out of one hundred and ten respondents, 20.91 percent have headache problems, and 7.27 percent had viewed excessive sweating problems. Few of them have reported sneezing, vomiting, muscular difficulties, respiratory difficulties and trembling hands.

5- Stakeholder's Cooperation

Stakeholders of the vegetable farming are agricultural office, farmers, consumers, pesticides whole seller, re-tailers, training office and others. The need of cooperation among the stakeholders is essential for effective farming and consumptions. The cooperation among the stakeholder has been given in this table.

Table 8: Stakeholder's Cooperation

S.N.	Stakeholder's Cooperation	Number of Respondents	Percentage (%)
A	Yes	10	9.09
B	No	90	81.81
C	Sometimes	10	9.09
	Total	110	100

Source: Field Survey, 2019

According to results mentioned in above table, more than two third respondents have said that they do not have any cooperation among the stakeholders in vegetable farming although 9.09% respondents support to the cooperation among the stakeholder. This shows that the sole attempt of farmers relates with the farming and consumers do not attach with the farmers.

6- Pesticides Use Training

Pesticide safety training program is required for training employees who handle pesticides and fieldworkers who enter treated fields. If we are not able to take any training, we will be unable to use anything properly. That means the notion of skill should be adopted whether we work in agriculture or other sectors. The training skills of respondents have been presented in this table.

Table 9: Pesticides Use Training

S.N.	Training	Number of Respondents	Percentage (%)
A	Partial Training	20	18.18
B	Yes(Full Training)	5	4.54
C	No	85	72.72
	Total	110	100

Source : Field Survey, 2019.

This table explores the notion of training of the respondents where only 18.18% respondents have got partial training and 4.54% respondents got full training although more than two third majority respondents have got no training regarding the vegetable farming. This table moreover indicates that there is no training of pesticides use and farmers believe on own knowledge.

7- Trends of Pesticides

Trend is a line that may fluctuate as per the circumstances. The trend of pesticides use in Nepal has been increasing dramatically replacing the organic production or farming. The following table indicates that the increasing trend of pesticides on the basis of respondents' view.

Table 10: Trends of Pesticides

	Trends of pesticides	Number of Respondents	Percentage (%)
A	Increasing	105	95.45
B	As Usual	4	3.63
C	Decreasing	1	0.90
	Total	110	100

Source : Field Survey, 2019

Two third majority(95.45) respondents in this table said that the trend of pesticides has been increasing although 3.63% respondents only said that they feel as usual and less than one & respondents claim that the trend of respondents has been decreasing . Overall, the table shows the increasing trend of pesticides in Nepal.

8- Government Policy

A plan or course of action, as of a government, political party, or business, intended to influence and determine decisions, actions, and other matters. The government is a planned policy to conduct the acts according to their interest that shows the nature of the government towards the developments. This table here talks the effectiveness of the government policy.

Table 11: Government Policy

	Government Policy	Number of Respondents	Percentage (%)
	Effective	5	4.54
	Ineffective	100	90.90
	Just as Registration	5	4.54
	Total	110	100

Source : Field Survey, 2019

90.90% respondents said that the government policy is in-effective for them or the effectiveness of the government belongs to the 4.54% only which indicates that the government policy for the grass root level is meaningless. 4.54 % respondents said that the government policy is only for registration and tax collection and it did not help to the real farmers.

9- Monitoring Body

Monitoring body is an authorized unity that monitors in own areas. Regarding the monitory body of pesticides use, we should remember the department of agriculture and related laws and other local government and non –government bodies. The monitoring body in the context of vegetable farming and pesticides use in this area has been illustrated in this table.

Table 12: Monitoring Body

S.N.	Monitory Body	Number of Respondents	Percentage (%)
A	Yes	108	98.19
B	No	2	1.81
	Total	110	100

Source : Field Survey, 2019

Almost cent percent (98.19%) respondents said that there is a monitoring body in the sector of pesticides use in vegetable farming although 1.81% respondents rejects the notion about monitoring body. It means, the local, province level and central bodies are active in the sector of monitoring.

10- Producer and Consumer’s Perception

Perception is a notion or understanding about the issues that shows the attitudes of perspectives of the people over the issues. Perception is a kind of ideology that may reflect the notion of people which is relates on the foreknowledge, situation and context. Definitely, the notion of respondents in the context of producer’s perception has been illustrated in this table.

Table 13: Producer’s Perception

	Producer’s Perception	Number of Respondents	Percentage (%)
A	Optimistic in Production	110	100
B	Pessimistic in Pesticides	75	68.18
C	Pessimistic with the monitoring	105	95.45
	Total		

Source : Field Survey, 2019

This table shows that the perception of producers where all respondents are satisfied with the production although they are not optimistic towards the use of pesticides. Few numbers of the respondents are not satisfied with the monitoring agencies. This table ultimately explores the notion of producer where respondents are happy with production and unhappy with the pesticides uses.

Table 14: Trend of Pesticides Used (2013-2018)

S. No.	Pesticides	2013/14				2014/15				2015/16				2016/2017				2017/2018			
		Importer		Formulator		Importer		Formulator		Importer		formulator		Importer		Formulator		Importer		Formulator	
		Qty(Kg)	a.i(Kg.)	Qty(kg)	a.i(Kg.)	Qty(kg)		Qty(kg)	a.i(Kg.)	Qty(kg)	a.i(Kg.)	Qty(kg)	a.i(Kg.)	Qty(kg)	a.i(Kg.)	Qty(kg)	a.i(Kg.)	Qty(kg)	a.i(Kg.)	Qty(kg)	a.i(Kg.)
A	Fungicide	223797.50	155622.63	53162	36581	296585.9	206067.3	65950	44740.5	303053	210304.52	55555	37170.7	422525.95	301262.22	708045	46445	350433.80	242145.49	34980	24889.50
B	Herbicides	169266.60	78643.99	23434	11483	254112.4	117923.4	31000	15934	248102	113846.37	45110	20386	179619.60	92075.44	32540	13370.0	312868.50	126351.70	31650.00	15791
C	Insecticide	1042039.40	136428.03	96773.50	25897.97	1019357.5	138146.7	44713	17895.2	916242.25	165999.59	39223	15271.28	1053023.80	151836.89	53582.50	17523.1	1455498.28	194873.06	45054.50	21018.85
D	Bactericide	312.50	31.25	-	-	58.8	5.88	200	20	129.60	11.36	-	-	67.00	6.70	-	-	376.60	37.66	-	-
E	Rotenocide	14536.50	9836.36	-	-	19105	9180.382	-	-	24479.00	11007.74	-	-	25357.50	12077.31	-	-	23950.50	6171.21	-	-
F	Bio-pesticide	6277.50	71.74	-	-	7287.5	51.778	-	-	8424	63.33	-	-	20448.25	1125.25	-	-	11865.00	866.56	-	-
G	Molluscicide	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4000.00	240	-	-
H	Herbal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1057.00	34.35	-	-
	Total	1456230	380634.01	173369.50	73961.97	1596507.14	471375.49	141863	78589.7	1500429.85	501232.91	139888	72828.03	1701042.10	558383.82	156922.50	77338.1	2160049.68	570720.03	111684.50	61699.35

Source : Ministry of Agriculture

According to official data, only 8 types pesticides are in practice although the government itself listed 10 types of pesticides. The more and heavy use of pesticides during the period of half decade are insecticides, fungicides, herbicides, bio-pesticides and rodenticides rather than others. During the five years period, above mentioned 8 types of pesticides have been used in practice. But, according to the field survey, only three types of pesticides such as : insecticides ,fungicides and less amount of herbicides were used in the vegetable farming.

Discussion

Theory of production attaches with the production that creates or add value or utility. It is the process in which the inputs are converted into the outputs. Input according to this theory contents means of production such as capital, land, labor and organization but the output is the final products which relates with the consumers. Theory of production always keeps the relationship between input and outputs. There are mainly two kinds of inputs in the theory of production that explores fixed cost and variable cost. Its talks about the short run production and long run production. It also explores the total production , average product and marginal product.

Theory of production, in economics, an effort to explain the principles by which a business firm decides how much of each commodity that it sells (its “outputs” or “products”) it will produce, and how much of each kind of labor, raw material, fixed capital good, etc., that it employs (its “inputs” or “factors of production”) it will use. The theory involves some of the

most fundamental principles of economics. These include the relationship between the prices of commodities and the prices (or wages or rents) of the productive factors used to produce them and also the relationships between the prices of commodities and productive factors, on the one hand, and the quantities of these commodities and productive factors that are produced or used, on the other.

The various decisions a business enterprise makes about its productive activities can be classified into three layers of increasing complexity. The first layer includes decisions about methods of producing a given quantity of the output in a plant of given size and equipment. It involves the problem of what is called short-run cost minimization. The second layer, including the determination of the most profitable quantities of products to produce in any given plant, deals with what is called short-run profit maximization. The third layer, concerning the determination of the most profitable size and equipment of plant, relates to what is called long-run profit maximization.

Health Behavior: Theory, Research and Practice provides a thorough introduction to understanding and changing health behavior, core tenets of the public health role. Covering theory, applications, and research, this comprehensive book has become the gold standard of health behavior texts. This new fifth edition has been updated to reflect the most recent changes in the public health field with a focus on health behavior, including coverage of the intersection of health and community, culture, and communication, with detailed explanations of both established and emerging theories. Offering perspective applicable at the individual, interpersonal, group, and community levels, this essential guide provides the most complete coverage of the field to give public health students and practitioners an authoritative reference for both the theoretical and practical aspects of health behavior. A deep understanding of human behaviors is essential for effective public health and health care management. This guide provides the most complete, up-to-date information in the field, to give a real-world understanding and the background knowledge to apply it successfully.

- Learn how e-health and social media factor into health communication
- Explore the link between culture and health, and the importance of community
- Get up to date on emerging theories of health behavior and their applications
- Examine the push toward evidence-based interventions, and global applications

Written and edited by the leading health and social behavior theorists and researchers, *Health Behavior: Theory, Research and Practice* provides the information and real-world perspective that builds a solid understanding of how to analyze and improve health behaviors and health.

Findings

The findings of this study are as follows:

- Out of 110 respondents, only 27.27 % respondents were female that shows the maximum participation of the male in farming although Nepal is male dominant society whereas only 9.09 % respondents have higher education and maximum respondents had school level education.
- only 9.09% have more than 26 years of experience while slightly less (8.18%) respondents have only 5 years working experiences. Moreover, those respondents who have experiences of 6 to 10 years, 11 to 15 years, 16 to 20 years and 21 to 25 years are 18.18%, 36.36%, 14.55% and 13.64% respectively. This is the clear indication that almost all respondents have well experiences .

- . 27.27 percent) have opined that they are suffered from skin problems. Out of one hundred and ten respondents, 20.91 percent have headache problems, and 7.27 percent had viewed excessive sweating problems this ultimately explores the sensitive consequences of the pesticides.

In conclusion, the trends of pesticides' used have been drastically changing including health impact. This research on the basis of field and library information only focuses about the trends of pesticides and its health impact that is also limited in selected six vegetables crops in the period of 3 months. This study has concluded that the lack of awareness, proper use of pesticides, using of safety tools , proper training are essential while farming vegetables whether it covers large area or small units. Moreover, this research brought the consequences of pesticides that attaches with the human health bringing acute and chronic diseases.

Recommendations

The recommendations of this study have been classified into following three levels:

1- Recommendation for the Policy maker's Level

After conducting this research, the lack of proper policy, government aid and substance, awareness training, vegetable farmers are suffering from health problem and traditional pattern of farming. The government should operate training school and its easy access to the vegetable farmers.

The government should establish suitable lab test center to test the chemical before importing and after formulating. And the government should provide proper human resources for soil testing, and proper guidance in the context of pesticides' uses.

The government of the stakeholder should prioritize to the farmers for proper market, production , promotion and storage. And government should conduct the awareness program in grass root level in practical way so that the consumer will be able to protect from possible diseases.

2- Recommendation for the Researcher Level

In the context of research level, the researcher should be aware with the past events and should explores more reliable knowledge to the public so that they can understand the issue. Research should go in depth study before conducting the research that may help to guide the stakeholders.

3- Recommendation for Practical (Applied) Level

The producer should be responsible towards the consumer and their production. They have to be watchful about their health during the farming applying the safety tools. As much as they should be accountable towards the public health and other issues that brings by the farming. The consumer should be aware about the production and its trends before the consumption. Children, women, old people should be thought about the effects of pesticides.

Acknowledgements

This research " Increasing Trend of Pesticides' Use in Vegetable Farming and Its Impact for Human Health(A case study of Bharatpur Metropolitan City, Nepal)" would not be completed until my real attempt during the period of three month field survey.

I hereby declare that to the best of my knowledge this research is original; no part of it was earlier submitted in any institution. I have used citations of all information which I took as literature reviews. This is an inspiration of chandrakal. Her proper help and inspired me a

lot for this research. I would like to express my gratitude to the editor Mr. _____ and Mr. _____ of _____ journal. I would like to thank to my friends K. B. and N.B. Thapa My wife Mrs. Chandra Kala Bhandari, Daughter Dr. Shanti, daughter Miss. Chunu and son Vijaya Bhandari, Rehan and Rehana.

At last but not least, I would like to thank those respondents of selected areas especially Dear farmers, Mr. Amar Subedi and Mr. Gridhari Mahato, Manoj Chapagain and thanks to all stakeholders, Institutions and writers/ authors of reference articles which I studied and used in my research.

References

- Atreya, Kishor and et.al (2012). "Health and Environmental Costs of Pesticide Use in Vegetable Farming in Nepal." *Environ Dev Sustain* (2012) 14:477–493 DOI 10.1007/s10668-011-9334-4.
- Bhrtyal, Yadav Bandu and et.al. (2016) " Knowledge, Practice and Use of Pesticides Among Commercial Vegetable Growers of Kaski District Nepal." *IJSTE - International Journal of Science Technology & Engineering | Volume 3 | Issue 03 | September*.
- Compendium, M.H. and et.al. (2014) "Compendium on Pesticide Use in Vegetables" " Indian Institute of Vegetable Research Varanasi - 221 305 (Uttar Pradesh), Extension Bulletin No. 50.
- CBS(2009) *Annual Report*. Central Bureau of Statistics, Thapathali, Kathmandu , Nepal
- Dey, Nepal C. (2010) "Use of Pesticides in Vegetable Farms and its Impact on Health of Farmers and Environment." *Environmental Science & Technology (II)*, Dhaka, Bangladesh.
- Diwaka, Jasmine, et. al. (2008) "Study on Major Pesticides and Fertilizers Used in Nepal " *Scientific World*, Vol. 6, No. 6, July 2008.
- Encyclopedia Britannica online (2019) *Encyclopedia Britannica ' Pesticides'* October.
- Hornby , G.S.(2010) *Oxford English Dictionary*. Oxford University Press, London, U.K.
- Jeyanthi, H. and S. Kombairaju (2005) "Pesticide Use in Vegetable Crops: Frequency, Intensity and Determinant Factors. " *Agricultural Economics Research Review* Vol. 18 July-December 2005 pp 209-221, SRF, Department of Agricultural Economics, 2 Dean, School of Post Graduate Studies, Tamil Nadu Agricultural University, Coimbatore.
- Jha, Ratna Kumar and Adhrit Prasad Regmi (2009) "Productivity of Pesticides in Vegetable Farming in Nepal". South Asian Network for Development and Environmental Economics (SANDEE) PO Box 8975, EPC 1056 Kathmandu, Nepal
- Ministry of Agriculture (2016) *Vegetable Farming Techniques Manual*. Government of Nepal Ministry of Agriculture Development sector, Sindhupalchok, Nepal.
- Nepal Health Research Council (2014) "Health Effects of Pesticide among Vegetable Farmers and the Adaptation Level of Integrated Pest Management Program in Nepal, 2014," Government of Nepal, Ramsaha Path Kathmandu, Nepal.
- Sharma, D.R, et.al.(2012) "Use of Pesticides in Nepal and Impacts on Human Health and Environment". *The Journal of Agriculture and Environment*. Vol. 13, June ,2012.
- Subur, S.A . And A.R. Molla(2001) "Pesticide Use, Its Impact on Crops Production and Evaluation of IPM Technologies in Bangladesh." *Bangladesh J. Agric. Econ.* XXIV, 1 & 2(2001) 21-38.
- Sushma, Dhital (2015) "A Review on Status of Pesticides Use in Nepal." *Research Journal of Agriculture and Forestry Sciences*. ISSN 2320- 6063 Vol. 3(3), 26-29, March
- www.cambridge.org (2019) *Cambridge Dictionary*. October 2.