Knowledge and Practices on Pest Management

Case Studies from Jamune VDC and Pokhara Sub-metropolitan

A Dissertation Submitted to the Faculty of Humanities and Social Sciences

in Partial Fulfillment of the Requirements for the Degree of

Master of Arts in Anthropology

By

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Letter of Recommendation

Mr. Indra Prasad Subedi has completed his thesis entitled **"*Knowledge and Practices on Pest Management:* Case Studies from Jamune VDC and Pokhara Sub-metropolitan"** under my supervision. He carried out his research from October 2008 to March 2009. I hereby recommend his thesis to submit for viva voce.

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Approval Letter

This dissertation submitted to Central Department of Sociology/ Anthropology, Tribhuvan University, by Indra Prasad Subedi, entitled ***"Knowledge and Practices on Pest Management:* Case Studies from Jamune VDC and Pokhara Sub-metropolitan"** has been approved by the undersigned members of the Research Committee.

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Introduction

1.1 Background of the Study

Pests attack all crops and livestock. Crop loss due to the pests is continually existing phenomenon. Pests are the serious constraints to the increased crop productivity and diversification. Relation of pests with the human beings is found since very beginning of the civilization. Retention of production needs protection against pests. Biological pests have been posing a mounting challenge to the humankind today. The problem of pest has seriously affected human development. It has not only affected agricultural development but also other major aspects of our socio-economic development.

As protection against pest is must for the retention of production, different methods (natural and chemical) have been employed for the control of pests since the time immemorial. The magnitude of public health risk associated with toxic chemicals is increasing continuously. The pesticides are never applied to the pest population alone except in laboratory, they are applied to the ecosystem. One must realize that the poison for pest is a poison for human beings also.

Before 1950s the people of Nepal were completely relied on traditional techniques for killing insects. Chemical pesticides were first introduced in Nepal in 1955 for malaria control (Baker and Gyawali 1994/ Dahal 1995). In developing countries like Nepal more than 90% of the pesticides used on the crops are wasted and misused. They do not target specific pest, they are not applied on time, in proper doses or according to the proper methods. Farmers of low-income groups face serious consequences with regard to crop protection when applying these chemical pesticides.

They have little knowledge about critical period of application of pesticides when the damage is high but generally, they apply insufficient doses to fulfill the application requirement (Georghiou 1990). The buying of pesticides from multinational companies and selling these chemical pesticides to poor farmers is common practice in Nepal and annual transaction is worth millions of dollars (Gyawali 1993).

The present situation regarding agro-chemical in Nepal is very much chaotic. Increasing numbers of private dealers, suppliers and distributors is uncontrollable. The follow up and monitoring systems regarding use of pesticides is not effective though the pesticide act 2048 and the pesticide regulation 2050 are in force.

The more we use the pesticides, the more we poison ourselves, our children, our environment, and the whole living world. If such unfriendly pesticides are continuously used in the same way, this living earth would be unfit for the coming generations to live in and we will be the responsible generation for such devastation of living organisms. Thus it has been utmost important duty of human beings to search for better alternatives to such unfriendly pesticides. Learning the bitter lessons from the harmful effects of chemicals, even the developed nations have now refocused their attention on the sustainable biological approach of pest control. Host plant resistance, natural plant products, bio-pesticides, natural enemies and agronomic practices offer opportunities for environment friendly, cost effective and gender sensitive pest management.

The use of plants as toxic ingredient or repellent against pests is a common crop pest management practice in traditional agricultural system in developing countries. Locally available and easily extractable plant based pesticides can be supportive to maintain low input agricultural system and improve local food self-sufficiency. If the plant derived pesticides can be produced and obtained easily at low

costs from local plants, both subsistence farming and cash crop farming may benefit from it. Development strategies for the rural people usually emphasize the small scale agricultural development that allows low-income farmers to produce subsistence and cash crop with minimal dependence on external inputs.

The fabulous green wealth, which abounds in the Nepal by virtue of its diversified agri-ecologies, is dotted with a number of plants with pesticidal properties. If thoroughly located and tapped properly, these pesticidal plant resources are sure to replace or reduce the over expensive and faulty use of hazardous chemicals.

Nepali farmers have a long heritage of containment of pests, which have sound scientific ground. The indigenous knowledge has been transmitted as a cultural heritage in Nepalese society from generation to generation. As a result Nepalese farmers have their own traditional skills and practices in pest management. (Thapa 1994)

But not much work has been done on inquiring about the traditional methods used by the farmers and such pest management systems are being invaded and replaced by the use of modern agro-chemicals. It is necessary to build local user groups responsible for maintaining, distributing and using their indigenous resources through sustainable management systems, before these indigenous techniques become extinct. Thus, to stimulate Nepalese farmers with harmful effects of agrochemicals and usefulness of bio-pesticides could be more practicable for the country.

The subsistence pattern of indigenous/ethnic groups reflected in their cultural rules, rituals, festivals and traditional practices are valuable for augmenting the nutritional and food security situation of the population inhabited in relatively isolated areas. Indigenous peoples and their culture are the actual guardians of different crop

types, either domestic or wild, and local landraces. Most of the indigenous peoples have been conserving the different wild and domestic crops according to their socio-cultural needs and importance, embedded in their traditions, customs, myths, histories and experience.

Indigenous farmers do have realistic solutions to manage the environmental problems based on the knowledge evolved through trial and error experiences and often transmitted from the generation to the generations. Indigenous knowledge on agro-biodiversity, crop thriving conditions, and environment is the actual knowledge of the groups of people, which can be regarded as Indigenous Knowledge of crop management. Crop management is a system of numerous activities associated with cultivation, nurturing and production of various crop varieties recognized by a particular community. The overall activities such as seed selection, storage, treatment, sowing method, intercultural practices, irrigation, soil preparation, manure and mulching preparation, harvesting and post harvest practices together constitute crop management system. However, it is not only an exact technical task to preserve and produce the crops, rather overall activities encompassing cultural practices as well.

As Brahmins and Chhetris are the dominant ethnic/indigenous groups of the study area. Chhetri and Brahmins are the major caste/ethnic groups identified by the 2001 census with 15.8% and 12.7% of the total population of Nepal. Both are of the very few Caucasian (indo European Aryan) ethnicities. They have own cultural practices, customs, traditions and valuable indigenous knowledge on the conservation and management of wild and domestic plants. It is obvious that they have used their own knowledge on crop management practices to enhance the nutritional and food security situation. Today, indigenous cultures along with the knowledge systems play a vital role in conserving numerous types of crops for the sustainable livelihoods. This

study seeks to emphasize the roles of culture and local knowledge of local peoples for the conservation and maintenance of different crop types and local landraces.

1.2 Statement of Problem

Ethnic groups have developed their own tradition, methods of adaptation in their surrounding settings and hold precious indigenous knowledge systems. There are many peculiar agro-climatic niches that are mostly suitable for growing crops, which are more liked by certain ethnic groups. However, there are various ethnic groups which have been marginalized (Holmberg, 1989) by the conventional mode of development practices. It is failed to consider their practical knowledge which have been evolved through the methods of adaptation.

Development initiative undertaken in a conventional model, which has the history of only a half-century in Nepal, resulted into interruption of community-based properties such as technology, skills and knowledge. During this period, the usual practice of development planners and scientists has been to borrow improved technology from outside and impose it on farmers without considering the existence of indigenous technical knowledge (Thapa, 1996). Most of the invaluable resources are at the verge of extinction due to many reasons. Lack of awareness of the people, commercial exploitation and indiscriminate provisions to substitute traditional practices, lack of incentives to conserve, utilize and promote available resources have contributed to the disappearance of local knowledge, skills, technologies and biological resources.

Knowledge both 'scientific' and 'local' is socially constructed and the generation and transformation of knowledge is affected by social consideration of power, value system and epistemologies (Tamang, 1996). The 'scientific knowledge'

finds its legitimacy through western universities. However, indigenous knowledge is the basis of 'scientific knowledge' since the scientist engaged in plant or animal breeding observe the indigenous farmers' breeding techniques. Farmers can also be ahead of scientists in breeding techniques. Thus we need to overcome the bias that most of us suffer from, that of acknowledging the research conducted by scientists in white coats working in laboratories of universities as 'science' and dismissing the complex knowledge systems contained in rustic, rural communities as something infinitely less and not worthy of acknowledgement (Shahi, 1998).

In agriculture, the period after the 50s was marked by the burgeoning of improved technology such as tractors, threshers, processors, improved seeds and chemical input, which accelerated the productivity of crops in the developing countries (Shiva, 1995). This scenario is popularly known as 'agricultural modernization'. Agricultural modernization schemes have introduced new and uniform crops into farmer's field and destroyed the diversity of local varieties (Shiva, 1995). In view of the growing realization of the limitations and unsustainable nature of certain aspects of the Green Revolution Technology (GRT), more attention is being placed to the sustainable features of indigenous knowledge and technology for advancements in the technological frontier. It is contended that indigenous farming systems are varied, adaptable, nature-friendly, and produce yields, which are not necessarily lower than those of modern agriculture (Mujeri and Wahab, 1994).

Indigenous knowledge, as system of managing agriculture and other natural resources have existed in Nepal for centuries. In the past few decades, however, these systems were largely ignored in the formulation and implementation of natural resources management policies. Therefore there is a critical need to conduct a

comprehensive study on IK on crop pest management practices prior to make all these outcomes.

Indigenous knowledge can be considered as a valuable resource for the country like Nepal. It encourages participatory decision-making and the formulation and effective functioning of local organizations. Familiarity with indigenous knowledge helps change agents understand and communicate with consumers by facilitating participatory approaches to decision making. Indigenous knowledge helps to assure that the end-users of specific development projects are involved in developing technologies appropriate to their needs (Flavier et al., 1995)

Incorporation of indigenous/local knowledge systems is a prerequisite in planning sustainable development programs. Development, through modernization, industrialization, urbanization and acculturation, tended to replace local people's culture. Consequently there is loss of indigenous knowledge, traditional technology and customary of native peoples. Therefore, from an anthropological perspective, it is necessary to document, disseminate and utilize indigenous knowledge systems of local farmers. In consideration to these facts, study aimed at finding the traditional practices of the local people which are being transferred generation to generation and conserving and applying these methods would be highly significant in context of Nepal.

The precious resources are at the verge of extinction due to many reasons. Lack of awareness of the people, commercial exploitation and indiscriminate provisions to substitute traditional practices, lack of incentives to conserve, utilize and promote available resources have contributed to the vanishing of local knowledge, skills, technologies and biological resources.

Considering the above facts, this study has targeted to document the knowledge and practices on pest management in the local community. The study will answer the following research questions:

- What is the perception of local farmers regarding pest management?
- What are the existing pest management practices in the study area?
- What are the major differences in crop management practices in urban and rural areas?
- What were the traditional practices of pest management in the study area?
- What are the major problems of the farmers in agricultural activities?
- What are the perceptions of farmers towards chemical pesticides and traditional methods of pest control?
- What are the factors affecting the Indigenous Knowledge on pest management practices?
- What should be the future research strategies for conserving, utilizing and extending viable indigenous knowledge system of the farmers of the study area?

1.3 Objectives of the Study

The general objective of this study is to explore knowledge of local farmers of ward number 5 and 7 each of Jamune VDC and Pokhara Sub-metropolitan on pest management and their existing practices. The specific objectives of the study are as follows:

- To document the indigenous knowledge and practices of local farmers regarding crop pest management in the study areas.

- To compare the pest management practices between the rural and urban areas.
- To trace out the impacts of agro-chemicals in the local farmers of the study areas.

1.4 Justification of the Study

The present study is a result of the fieldwork conducted by the researcher for the partial fulfillment of the requirement for the degree of Master of Arts in Anthropology. So this anthropological investigation of the local farmers' knowledge and practices on pest management will be of immense importance in understanding their culture, subsistence system and environment. The study is equally significant both in academics and in practice. The study is an effort to explore the relationship between the local culture and the environment based on pest management practices. Moreover the study investigates the impact of intervention of modern technology on indigenous knowledge system and shade light upon the importance of indigenous knowledge in sustainable agricultural development.

Chapter 2

Literature Review

2.1 Theoretical Reviews

The present study is guided by the theoretical perspectives of ecological anthropology and indigenous knowledge systems in relation to development paradigms. It would be more realistic to consider the third world perspective to tackle with the basic issues related to indigenous knowledge systems. Ecological anthropology has long been involved in studying small population and pre-capitalist societies and their survival mechanism. Ecological anthropology since its inception focused on the interrelationship of human population and local environment (Moran, 1992). Adaptive strategy was the major focus for cultural ecologists. Simple communities have been surviving with best adaptive mechanisms based on their knowledge of the local environment even in conditions that look hostile to outsiders (Rai, 1996).

Julian Steward's early writing broke with both determinism and possibilism by rejecting general theory and emphasizing the use of the comparative method to test causal connections between social structure and modes of subsistence (Moran, 1992). Social structure and modes of subsistence such as behavior pattern involved in productive forces were the points of analysis in Steward's ecology. Interaction between living organisms and their environment are subject matter of ecological studies (Moran, 1992).

Cognitive anthropology is a branch of anthropology, which deals with people's understanding of local environment. Ethno-ecology, a well-established branch within ecological anthropology, began to focus on the cognitive aspect of people or culture.

Ethno-ecology gives a method and a meta-theoretical tool for the study of indigenous knowledge systems of local peoples. Ethno ecologist's endeavor is to describe what people know about nature and, second to describe how people use this knowledge to get along in the world (Anderson, 1973).

Indigenous knowledge has traditionally been the subject matter of cognitive anthropology. Cognitive anthropology is virtually as old as anthropology itself, and deals with the study of language and the meaning of symbols (words) in the socio-environmental context and it includes the study of indigenous knowledge (Messerchmidt, 1992). Ethno-ecology is closely related to cognitive anthropology that looks at indigenous knowledge on environment.

The knowledge gained through past experiences is valuable and wealthy; however Westerners treat them as insufficient and unhealthy practices. A decisive contribution of recent anthropologists, geographers, and agronomists investigating "primitive agriculture" has been the exposure of its systematic aspects, including profound practical knowledge of weather, soils, plants, and pests. Communities everywhere in the world have developed knowledge and found ways to derive livelihoods from the rewards of nature's diversity in wild and domestic forms (Shiva, 1995). Westerners have long held distinctly ethnocentric model of agriculture (Netting, 1986).

In the development field, it has emerged over the past decade or two, from two broad approaches: farming systems and participatory development (Sillitoe, 1998). Early anthropologists were basically involved in analyzing interaction of humans with nature and cultural perceptions of their environment. As protected areas have emerged as foundation of great importance, anthropologists of different theoretical backgrounds have started to study them (Orlove and Brush, 1996). Protected areas

that allow the way of life of societies living in harmony with the environment to continue uninterrupted by modern technology are regarded as anthropological reserves. Such reserves whether designed in- or out- side protected areas would preserve intact indigenous knowledge, culture, tradition, customs, beliefs, religion and provide a sound base for the research and eco-tourism development. Serious consideration is needed for designation and management of anthropological reserve in this country representing the tribal people in different ecological zones and develops such areas as open anthropological museums (Chaudhary, 1998). Indigenous knowledge concerning the natural resources management is the entry point of anthropology into biodiversity conservation and development.

Traditional agricultural practices, indigenous knowledge, and local knowledge systems are sometimes associated and are used as synonymous words. Traditional agriculture practices refer to agricultural production where technologies used depend completely on local resources and has over time developed wide range of site-specific technologies embedded in the culture of the people in a certain area. Indigenous knowledge is the actual knowledge of a certain farming population, which reflects the experiences, based on traditions and includes more recent experiences with modern technologies (Haverkort, 1995). Indigenous knowledge also represents the richness of the poor. It is the only major source of the poor who have limited access to basic and essential material resources (Rohana, 1993).

Although increasing consideration is given to traditional knowledge, the conventional scientific disciplines continue to dominate the overall approach (Escobar, 1998). A discrete hierarchy between different knowledge systems is thus created, and 'planned' interventions in training and educating the farmers (because

they are 'backward' and rely on 'crude, primitive' technology not conducive to general capitalistic growth) are undertaken (K.C. and Pradhan, 1996).

It is now recognized that research in less-developed countries is not just a question of coming up with technological fixes to other problems passing along with the scientifically validated information for them to adopt. It is increasingly acknowledged beyond anthropology that other people have their own effective 'science' and resource use practices and that to assist them to understand something about their knowledge and management systems (Atte, 1992; Barrow 1992; Morrison and Crow 1994; cited in Sillitoe, 1998).

2.2 Review of Previous Studies

Gurung and Vaidya (1998) highlighted the culture, caste, and ethnicity-based variations in food habits and the importance attached to different crop and animal species. Budathoki et al. (1996) studied the indigenous knowledge and technology of Western Hill Farmers of Nepal on vegetable crops and concluded that the farmers have identified and gained various skills and knowledge, which have been proved to be useful in managing their crops with the use of locally available resources. Pandey (1996) studied the indigenous practices of vegetable production by Jyapu Farmers of Kathmandu Valley and concluded that the techniques of vegetable production adopted by Jyapu are not the result of a year or decades but that of many generations.

Men employed different methods of pest control even before they learnt to write. Even in Neolithic times (about 1200 B.C.), Chinese used chalk and wood ash for the control of insect pests in enclosed spaces and botanical insecticides for seed treatment (Anonymous, 1994). The Roman author Pling the Elder described hand picking of insects and spraying against insects. Homer refereed the burning of sulphur

for fumigation used at homes in about 1000 B.C. (Ware, 1978). Gips (1987) reported that the increase in cancer rates has been linked in part to pesticide use. Fifty five cancer causing pesticides have been identified as those leaving residue on food. Giri (1998) indicated the existence of many complex problems pertaining to the awareness among the farmers of Kathmandu valley. He further reported that 28% vegetable crops were found to be contained excessive residue than permissible dose. Neupane (1999) reported 311 species of pesticidal plants in Nepal. Gyawali (1993) reported that more than 50 species of plants and indigenous techniques are used in Nepal to protect field crops and stored grains. Thapa (1994) reviewed the indigenous knowledge of pest management in Nepal. Several workers reported the effectiveness of indigenous pest management system such as wood ash, cow dung slurry, diluted urine of cow, plant extracts and local cultivars of crop plants. Kautilya, Varahimihira, Surapala , Someshwor Dev reported the properties of cow dung (mixture of dung and urine in ratio of 3:1) and recommended for managing seed health (Nene, 1999). Subedi (2000) reported that the plant extracts (neem and marati extracts) and animal urine (cow and buffalo urine) are effective in controlling the insect pests.

Indigenous knowledge system of managing agriculture and other natural resources have existed in Nepal for centuries. In the past few decades, however, these systems were largely ignored in the formulation and implementation of natural resource management policies (Hagen, 2000). The existing literatures on indigenous knowledge systems in Nepal suggest for the need to incorporate indigenous knowledge for the development of different communities.

Chapter 3

Methodology

3.1 Study Area/ Rationale of Site Selection

The study was conducted in two wards each of Kaski and Tanahun districts of the Western Development region. Ward numbers five and seven each of Jamune VDC of Tanahun district and Pokhara Sub-metropolitan of Kaski district were selected for the study. These wards were selected mainly because these are the major wards where many people are involved in agricultural activities. Jamune VDC lies ten kilometers west from district headquarter Damauli of Tanahun district. Though study sites lie near to highway, the low access to the various facilities to the people made it a rural area. On the other hand, the residents of Pokhara Sub-metropolitan have easy access to the facilities so it indicates the urban areas. As the study sites include the rural and urban areas, it can reflect the similarities and differences in the existing pest management practices in the rural and urban communities of the country. Moreover, the differences in terms of access to modern techniques of agricultural practices between these two study sites could be significant in comparing the knowledge and practices between the farmers of the study areas. The study areas are inhabited by the various caste/ethnic groups like Brahmins, Chhetri, Magar, Gurung, Bishowkarma, Nepali so these could reflect knowledge systems of different caste/ethnic groups. Considering these facts, the study sites were selected for the study.

3.2 Research Design

The research design of the present study was basically descriptive and exploratory. The detail investigation and recording of existing practices of pest

management had been made in the study. The research primarily aimed at documenting the existing practices of pest management and also finding indigenous knowledge of local farmers regarding the pest management. Thus, the study was largely a descriptive one. Records of numerous concepts of knowledge system could not be generalized, neither be calculated in mathematical term nor be simplified. It was exploratory in the sense that this study was an attempt to explore new facts about local farming practices and the long held indigenous knowledge of the farming community.

3.3 Nature and Sources of Data

Both primary and secondary primary data have been used in this study. The secondary data were collected from the published studies, reports, journals and other relevant sources so as to supplement the finding. The conclusions of the previous studies on indigenous knowledge systems, natural resource management, ethno botany and ethno-zoology have been used to elucidate the argument that need to be clarified.

Depending upon the nature of the study the data collected from the secondary sources only can't be sufficient. So the conclusions have been made mainly based on the primary source which is the essence for validating the objectives of the study. The primary data was collected during the field study held in the months of October in Jamune VDC and Pokhara Sub-metropolitan applying the various data collection tools such as sample survey (interviewing the respondents using semi structured interview schedule), key informant interview, group discussion, and direct observation by the researcher. The final writing of the report constituted both qualitative and quantitative

assessment of the data. Since the data used in the study are dominantly qualitative, the study is purely anthropological one.

3.4 Sampling of Study Population

A purposive sampling technique was applied in order to get the desired data. Ward numbers five and seven each of Jamune VDC of Tanahun District and Pokhara Sub-metropolitan of Kaski district were purposively selected as the study sites. The study sites could represent knowledge systems of the rural areas and urban areas. Moreover the diversified ethnic/caste composition of the study areas was significant for the indication of varieties of cultural practices regarding pest management. A total of 90 respondents among the farmers involved in different agricultural activities were selected for the study. Moreover representations of both sexes, different age groups and caste/ethnic groups have been made so that the information collected could be more informative, effective and reliable in anthropological perspective.

3.5 Data Collection Techniques

Different tools and techniques used in the study are discussed below:

3.5.1 Personal Interview

A socio-economic outline of the respondents, information on indigenous knowledge regarding common farming practices, level of awareness and adoption of modern agricultural technologies by the respondents' were collected using semi-structured interview schedule. Semi-structured interview schedule was developed, and was modified based on pre-test prior to the actual interview with the respondents.

3.5.2 Key Informants Interview

Some elder people and trained farmers were asked the additional questions regarding the local pest management practices, indigenous knowledge and other techniques on crop farming. This key informant interview helped in getting in depth knowledge about the cultural practices and traditional skills. In addition to this, case study was also done with the experienced farmers.

3.5.3 Group Discussion

In order to cross-examine the information collected through above methods group discussions with various stakeholders were performed. The group discussions were performed in four groups, one in each ward of the study areas. Each discussion group comprised of five to six members of the society which included the representatives of different sex, age and castes/ethnic groups. The members of discussion teams are given in the annex 2. The group discussions have been proved as the opportunities to share ideas with participants, clarify the doubts and refine the information collected from other sources.

3.5.4 Observation

It was not possible to get all necessary information only from the above methods and a great deal of qualitative information could be obtained through direct observation by the researcher. The researcher observed the on-going agricultural activities, in and around villages while interviewing the respondents without intervening them and recorded their observational remarks on the particular issues relevant to the objective of the study. Researcher collected information on settlement patterns, village resources, land use systems and cropping patterns and other

information while passing through the village and made some qualitative assessment of existing condition of the village. However the main focus of the researcher during observation was on getting the knowledge on existing crop management practices and their view regarding the use of bio-friendly organic pesticides.

3.5.5 Reliability and Validity of the Data

The researcher is conscious about the significance of the data collection. Maximum effort was made to minimize the possible sources of errors during the pre and post data collection phases of study. The researcher has widely reviewed the similar types of studies conducted by other researchers and the types of data collection methods and instruments used. The variables used in the present study have been selected very carefully and appropriate instruments are developed and pre tested prior to the field study. Various methods and tools were blended to ensure the reliability and validity of the data collected from different sources.

3.6 Data Processing and Analysis

All completed interview schedule were edited, coded and kept in appropriate formats. For the quantitative data, frequency and percentage were calculated for categorical variables. The appropriate standard statistical tools were used to analyze the data and the interpretation of the result was made. The qualitative data were interpreted on the basis of study and were presented in the suitable formats.

3.7 Limitation of the Study

Despite the importance of the research title, the study is failed to include some of the variables because of the limitation of resources. As the study is performed for the partial fulfillment of the requirement of Master's Degree, there are obviously the limitations of resources and time so the study may not be free of shortcomings.

- The study is localized in only two wards each of Jamune VDC and Pokhara Sub-metropolitan which may not represent all farming communities across the districts.
- Due to limited sample size and locations, the findings of the study may not be generalized to the wider area.
- The study documented the limited aspects of prevailing pest management practices of the study area; hence, the findings are limited to the specific context.

Chapter 4

The Study Population

The study population included 90 respondents selected purposively among the farmers from two wards each of Jamune VDC and Pokhara Sub-metropolitan. Among them 48 respondents were from ward number 5 and 7 of Jamune VDC and 42 respondents were from ward number 5 and 7 of Pokhara Sub-metropolitan. The results based on the interview performed using semi-structured questionnaire schedule (Annex 1), key informant interview, group discussions, case studies and direct observation are presented below. The data obtained from the respondents of rural and urban areas are presented comparatively in the tables so that the comparison can be made in the different variables within the particular study areas and also between the different trends in rural and urban areas. The data from Jamune VDC can reflect the conditions of the rural areas while that from Pokhara indicate the realities of the urban areas.

4.1 Socio-demographic Characteristics of Study Population

The composition of the study population in terms of age, caste/ethnicity and family size socio-demographic characteristics is presented below in table 1. The study population comprises of 53.3% of male and 46.7% of the female respondents. 43.3% of the respondents' age was up to 40 years while rests of them were above 40. The people of old generation were found mainly in favor of indigenous pest control measures and they were found worried by the intervention of local measures by the conventional methods. The educated people were found more aware of the harmful effects of pesticides. The people of old generation and educated people need to play an important role in disseminating the ideas regarding the importance of traditional

practices. Brahmin and Chhetri were the dominant castes in the study area. Brahmin respondents were dominant with about 60% of the total respondents and Chhetri was second with 30% respondents. Respondents from other castes (Bishowkarma, Nepali, Gurung, Magar etc) constituted only 10% of the study population. The family size of about 53.3% of the respondents was up to four while that of the rest (46.7%) was more than four.

Table 1. Socio-demographic characteristics of study population

Socio-demographic characteristics	Number of respondents		
	Male	Female	Total
Age			
Below 40	12(13.3)	27(30)	39(43.3)
Above 40	36(40)	15(16.7)	51(56.7)
Caste/ethnicity			
Brahmin	30(33.3)	24(26.7)	54(60)
Chhetri	13(14.4)	14(15.6)	27(30)
Other castes	5(5.6)	4(4.4)	9(10)
Family size			
Up to 4			48(53.3)
Above 5			42(46.7)

Source: Field study, 2008

Note: Figures in the parentheses represent percentage of respective categories

4.2 Educational Status

The educational status of the majority (60%) of the respondents was under SLC which was followed by the respondents having education up to intermediate level with 31.1%. None of the respondents were found illiterate. The study showed

that the male respondents were educated than female respondents. Table 2 shows the comparative chart educational status of the respondents.

Table 2. Educational status of respondents

Educational status	Number of respondents		
	Male	Female	Total
Under SLC	21(23.3)	33(36.7)	54(60)
Undergraduate	22(24.4)	6(6.7)	28(31.1)
Graduate/ Postgraduate	5(5.6)	3(3.3)	8(8.9)

Source: Field study, 2008

Note: Figures in the parentheses represent percentage of respective categories

4.3 Occupation

The occupation of the majority (76.7%) of respondents was agriculture. Rests of the respondents were found to be involved in government service, teaching, carpentry. There was no significant difference in the occupation between male and female. Table 3 shows the occupation of the respondents.

Table 3. Occupation of the respondents

Occupation	Number of respondents		
	Male	Female	Total
Agriculture	34(37.8)	35(38.9)	69(76.7)
Government service	6(6.7)	2(2.2)	8(8.9)
Teacher	4(4.4)	5(5.6)	9(10)
Others	4(4.4)	-	4(4.4)

Source: Field study, 2008

Note: Figures in the parentheses represent percentage of respective categories

4.4 Land Holding Size and Land Ownership

The distribution of respondents by the land holding size and land ownership is shown in table 2. The land in the study site included the *Khet* (land used for the cultivation of rice as major crop), *Pakho Bari* (land basically used for the cultivation of vegetable plants). The average cultivated landholdings of the respondents ranged from one to nineteen ropanies. The land holding size among the inhabitant of Jamune VDC was found larger than that in the inhabitant of Pokhara Sub-metropolitan. The study sites in the Jamune VDC were with low population density in comparison to the study sites of Pokhara Sub-metropolitan. This was the reason for the difference in land holding size between the resident of Jamune and Pokhara. All of the respondents were found to cultivate plants in their own land. Insignificant number of respondents was recorded to work in the land of others besides their own land. They were found to pay certain amount annually to the land owner and such land was found to be used particularly for the cultivation of vegetable crops. The khet was found to be taken in *adiya* (fifty percent of the production goes each to the land owner and farmer) and such land was found to be used particularly for growing rice, maize, wheat etc. About 50% of the respondents from Pokhara were recorded to have less than 3 ropanies of land while majority (81.25%) of the respondents from Jamune was found to possess more than three ropanies of land.

Table 4. Land holding size

Area	Pokhara	Jamune	Total
Up to 3 ropani	21(23.3)	9(10)	30(33.3)
3- 10 ropani	17(18.9)	24(26.7)	41(45.6)
Above 10 ropani	4(4.4)	15(16.7)	19(21.1)

Source: Field study, 2008

Note: Figures in the parentheses represent percentage of respective categories

4.5 Average Annual Income

Majority of respondents (88.9%) were found to produce the crops for the commercial purpose also. The average annual income from the agricultural products was found more in Pokhara than in Jamune. The farmers of Jamune were found to produce more cereal crops in comparison to the vegetable and cash crops. On the other hand, the condition was different in Pokhara. In majority of farmers the average annual income meet there general household expenditure. A significant number of farmers are earning a very good sum of money from the agricultural products and it is contributing in increasing the life standard. Table 3 shows the comparative chart of average annual income of the respondents from two different study areas.

Table 5. Average annual income

Average income per annum	Pokhara	Jamune	Total
Upto 25000	7(7.8)	21(23.3)	28(31.1)
Above 25000	30(33.3)	22(24.4)	52(57.8)
Not for commercial purpose	5(5.6)	7(7.8)	12(13.3)

Source: Field study, 2008

Note: Figures in the parentheses represent percentage of respective categories

4.6 Major Crops and Self Sufficiency of Food

The major crops in the study area include cereals like paddy, maize, millet, wheat; pulses like soyabean, black gram black gram; vegetables like cauliflower, cabbage, potato, brinjal, tomato, lady's finger, radish, carrot, coriander etc fruits like papaya, orange, guava etc and other leafy vegetables. The paddy, maize, wheat etc are the major crops cultivated in the khet land while cauliflower, cabbage, radish etc are the major vegetables cultivated in the bari land. The trend of planting improved

varieties of cereal and vegetable crops is increasing which is one of the contributing factors for increasing productivity. The annual agricultural production of about 61.1% of respondents was found to meet their annual food demand. However for 38.9% of the respondents, the annual food production is not sufficient for their own consumption and they have to buy food for few months of the year. Table 6 shows the comparative chart regarding food self sufficiency between Pokhara and Jamune. Rice is the major food they need to buy for their consumption. In Jamune, majority responded that they won't need to buy rice for their own consumption but in Pokhara, comparatively higher proportion of people were not found in the condition of self sufficiency of cereal crops. Regarding vegetable crops, almost all the respondents were found in the condition of self sufficiency. They need to buy the vegetables from the market only if they wanted to taste the other vegetables other than they can grow in their own field. The trend of buying the vegetable crops from the market was found prominent in the urban area than in the rural area. The farmers of the rural area are mainly reliant upon their own production. Moreover tendency of borrowing the vegetables or other food items from the neighbors was also a common feature in the rural area.

Table 6. Self sufficiency of food

Self sufficiency	Pokhara	Jamune	Total
Sufficient	24(26.7)	31(34.4)	55(61.1)
Insufficient	18(20)	17(18.9)	35(38.9)

Source: Field study, 2008

Note: Figures in the parentheses represent percentage of respective categories

Chapter 5

Pest Problem and Management Practices

The crop loss due to the pests is the continuously existing phenomenon. The pest problem is one of the most serious problems for the retention of the production. Different control measures are being practiced by the local farmers for the containment of pests. Before 1950s Nepal was totally dependent upon the traditional techniques for the plant protection. With the introduction of chemical pesticides in Nepal, the rate of their application has been increasing day by day. Now it has become major means for the control of the pests. The application of natural pest control techniques is being reduced day by day despite of their eco-friendly nature. The members of old generation are in favor of natural pest control techniques however the knowledge still to be disseminated properly to the young generation. This chapter discusses the extent of pest problem, common pest control practices of local farmers and their effectiveness, appropriateness of pest control measures in context of Nepal and the preference of pest control methods by the farmers.

5.1 Degree of Pest Problem

The problem of pest was found more serious in the urban area than in the rural area. Majority of the respondents of the urban area (57.1%) considered the pest problem as the severe problem while majority of the respondents of rural area (79.2%) rated the pest problem as the mild problem. This difference in the pest status may be due to the severe intervention of traditional farming techniques by the conventional methods in the urban area. The intervention might have disturbed the adaptability of the plants which ultimately led to the low resistivity of the plants to the disease and insects. Moreover the optimum use of pesticides created the unbalance in the natural

population of predators. As a result the problem of pest became more serious. The assessment and rating of pest problem by the residents of rural and urban areas are given comparatively in table 7.

Table 7. Degree of pest problem

Pest problem	Pokhara	Jamune	Total
Severe	24(26.7)	4(4.4)	28(31.1)
Mild	12(13.3)	38(42.2)	50(55.6)
Minor	6(6.7)	6(6.7)	12(13.3)

Source: Field study, 2008

Note: Figures in the parentheses represent percentage of respective categories

5.2 Crop Damage by Pests

The loss of crops as estimated by the farmers themselves showed that about 15-30% of their annual production is being lost due to the pests. Majority of respondents (51.1%) responded that their annual crop loss due to the pests is about 15-30%. The data showed that the loss of crops in the rural area seems to be higher than that in the urban area. This might be due to the availability of the desired control measures in the urban area. The people of urban area are in the condition of easy access to the desired control measures. In the rural area the pesticides and other methods which can give quick knock down effect are not easily available and also because of lack of knowledge about the proper timing for the use, these are not being applied at right time. Table 8 shows the comparative data of damage caused by the pests as per the assessment of the farmers themselves which do not reflect the damage calculated applying any standard tools.

Table 8. Crop damage by pests

Damage percentage	Pokhara	Jamune	Total
Up to 15%	21(23.3)	16(17.8)	37(41.1)
15-30%	21(23.3)	25(27.8)	46(51.1)
Above 30%	-	7(7.8)	7(7.8)

Source: Field study, 2008

Note: Figures in the parentheses represent percentage of respective categories

5.3 Prevailing Pest Control Methods

The common pest control methods in the study areas are the use of chemical pesticides and natural pesticides. Majority of the farmers (82.2%) were found to be dependent mainly upon the chemical pesticides. About 48.9% of the respondents mentioned that they apply at least some natural pest control methods but very few farmers were found to dependent completely upon indigenous methods of pest control. A significant number of respondents (41.1%) were found to use both of the methods for the pest control. The indigenous methods of pest control include the use of various plant and animal based products. Different plant extracts were found to be used for the control of different diseases and insect control. The plants extracts are generally prepared in aqueous solution. These can be prepared easily in the home by the farmers themselves and can be applied in the field either by using sprayer or simply by using the home made simple equipments. The cattle urine was the prevalent pest control measure in the study area. It can be used for the treatment of several diseases and insects. The farmers mentioned that the natural ways of pest control are time consuming and if they are applied in time (before the outbreak of the problem) they will give desired effect. Table 9 shows the common pest control measures in the study areas.

Table 9. Common practices of pest control

Pest control measures	Pokhara	Jamune	Total
Chemical control	33(36.7)	41(45.6)	74(82.2)
Local resources	17(18.9)	27(30)	44(48.9)
Integration of both	13(14.4)	24(26.7)	37(41.1)

Source: Field study, 2008

Note: Figures in the parentheses represent percentage of respective categories

5.4 Effectiveness of Pest Control Methods

The effectiveness of prevalent methods of pest control in the study area has been assessed by the respondents on the basis of their experience. Majority of respondents (57.8%) considered chemical methods as highly effective control measure while rest of the respondents found them moderately effective. None of the respondents found them ineffective in controlling the pests. On the other hand majority of respondents (54.4%) found local measures moderately effective in controlling the pests. Some of the experienced farmers believe that the local measures of pest control proved as the effective method of pest control in long run. The chemical pesticides show the quick knock down effects but in long run they could be ineffective in controlling the pests. They shared their experience of requiring higher doses in getting the similar results year after year. The chemicals kill the useful insects as well so these are contributing for intensifying the pest problem by disturbing the natural population of the useful insects. Moreover minor pest may get the status of major pest because of the absence of natural agents which are playing role for maintaining the population of these pests within the limit. Table 10 shows the comparative chart of effectiveness of different pest control measures in particular study area.

Table 10. Effectiveness of prevalent pest control methods

Effectiveness	Chemical control		Total	Local measures		Total
	Pokhara	Jamune		Pokhara	Jamune	
Highly effective	36(40)	16(17.8)	52(57.8)	8(8.9)	17(18.9)	25(27.8)
Moderately effective	6(6.7)	32(35.6)	38(42.3)	27(30)	22(24.4)	49(54.4)
Ineffective	-	-	-	7(7.8)	9(10)	16(17.8)

Source: Field study, 2008

Note: Figures in the parentheses represent percentage of respective categories

5.5 Appropriateness of Pest Control Methods

Majority of respondents (53.3%) considered that the integration of both chemical and local control measures of pest would be the most appropriate method in combating with the pests. About 31.1% of the respondents mentioned that the local control measures would be the suitable method of pest control in our context. Only 15.6% respondents were in favor of chemical control methods. Based on the study we can conclude that we should minimize the use of chemical pesticides and the use of natural methods of pest control should be enhanced. The application of local control measures would definitely contribute for the high yield with low investment in agriculture. It will increase the self dependence of the country and also prevent the loss of money which is going outside the country every year for the import of chemicals. In addition it could be the important measures for protecting our natural environment by minimizing the faulty and haphazard use of unfriendly pesticides. Table 11 shows the appropriateness of pest control methods in our context.

Table 11. Appropriateness of pest control methods in Nepal

Chemical control	Local control measures	Integration of both
14(15.6)	28(31.1)	48(53.3)

Source: Field study, 2008

Note: Figures in the parentheses represent percentage of respective categories

5.6 Preference of Pest Control Methods

Most of the respondents (92.2%) were found to have knowledge regarding the hazards of pesticides. However they are compelled to use the chemical pesticides as these pesticides give quick knock down effect. The preparation of natural pesticide is time consuming, many of them are not all aware of the methods of preparation of natural pesticides and these may not be give quick results. Most of the respondents (62.2%) preferred to use natural pesticides for the subsistence farming while majority (92.2%) preferred to use chemicals in the food producing for commercial purpose. Although majority preferred natural pesticides for subsistence farming, majority of the respondents (65.6%) were found to use chemicals in the food cultivated for their own consumption. Only 34.4% of the respondents are not using any chemical pesticides in the food which is being produced for their own consumption. The majority of the respondents might have preferred chemicals for the commercial production because of the quick results of the chemical pesticides. However several farmers are now found to be attracted towards natural crop protection techniques. They were of the opinion that they would use the natural crop protection techniques if majority of farmers in their localities apply these techniques. It might be due to the fact that the effectiveness of the local measures would be guided by the adoption of these methods in the society. The preference of the respondents regarding different crop protection methods is given in table 12.

Table 12. Preference of pest control methods

Preference of pest control methods			
Subsistence farming		Commercial farming	
Chemical pesticides	Local control measures	Chemical pesticides	Local control measures
36(40)	56(62.2)	83(92.2)	7(7.8)

Source: Field study, 2008

Note: Figures in the parentheses represent percentage of respective categories

Chapter 6

Agro-chemicals and Their Impacts

Agro-chemicals include the chemicals, which are used for the control of pests like pesticides and for the increment of production like chemical fertilizer. In early days, the farmers in our country are totally dependent upon the local resources in agricultural practices. However, in the recent days the application of conventional methods of pest control and other agricultural practices are dominant among the local farmers. Number of dealers, suppliers and distributors of agro-chemicals are increasing day by day and the situation in the country regarding agro-chemicals is very much chaotic. In one side, enormous amount of capital is being lost to import agro-chemicals every year. On the other hand, the use of pesticides is hazardous in several aspects of human life. The control of the faulty use of these agro-chemicals should be controlled in time. This chapter discusses the frequency of pesticides use and annual expenditure for buying the pesticides in the study area. Moreover, the impact of pesticides is discussed in this chapter.

6.1 Frequency of Pesticides Use and Annual Expenditure

A significant proportion of respondents (48.9%) were found to use the chemical pesticides once or twice a week. The frequency of use of pesticides by the farmers of urban area was found higher than that by the farmers of rural area. The annual expenditure in the pesticides is more than 10% of their annual income from the agriculture (compare Table 5 and 13). However the frequency of application of the pesticides is also dependent upon the condition pest attack. Insufficient knowledge regarding the proper timing and dose of pesticide need to use the desired effect also contribute for its misuse. Table 13 shows the frequency of use of pesticides and

annual expenditure in chemical pesticides. As we need to buy the pesticides from the international market, a huge amount of money is being lost annually. The frequency of use of chemical was found higher in the vegetable crops than in cereal crops. In cereal crops the farmers were reported to use pesticides once or twice in a season depending upon the condition of pest attack. The use of chemical fertilizer is very common in all types of crop farming.

Table 13. Frequency of pesticides use and annual expenditure in chemicals

Frequency of pesticide use		
Once or twice a week	Once in two week	Sometimes
44(48.9)	29(32.2)	19(21.1)
Annual expenditure in pesticides		
Upto Rs. 2500	Rs. 2500-10000	Above 10000
31(34.4)	42(46.7)	17(18.9)

Source: Field study, 2008

Note: Figures in the parentheses represent percentage of respective categories

6.2 Problems of Farmers in Agricultural Activities

The farmers were found to have several problems regarding agricultural works. The major problems entailed with the agricultural works as of the respondents were availability of fertilizer, chemical pesticides, labors, market for selling the products, pest problems etc. Particularly in Jamune the chemicals, seeds, fertilizers and irrigation facilities were the major problems. They were facing the problems for selling their product in the market. They were not getting the proper price of their agricultural products. They were compelled to sell the products in cheap price. All these problems in Jamune could be the comparative access of the area to the good market. Few farmers mentioned that they do not have the easy access to the credit

facility which is one of the important constraints to expand the agricultural activities. Access to the modern agricultural technology and quality seeds were other constraints. In Pokhara pest problems, shortage of labors, compost fertilizer, and knowledge regarding diseases were mentioned as major problems of the farmers. Overall, there are several problems associated with the agricultural activities. These problems could be solved by the combined effort of farmers' community and the government agencies as of the respondents.

6.3 Demerits of Chemical Pesticides

Chemical pesticides since their invention and use have been playing a significant role in the agriculture all around the world. Though their immediate results seem to be beneficial, their long-term effects are hazardous to our environment, to us and also to other organisms. The pesticides are toxic. They do not differentiate between target and non-target species and hence when applied kills not only the harmful organisms but also the useful ones. The indiscriminate use of chemical pesticides has resulted in several problems. The harmful effects of chemical pesticides as per the response of respondents and published resources (Pedigo 2002, Dahal 1995) are listed below:

6.3.1 Acute poisoning: Acute poisoning causes illness or death from a single dose or exposure. This type of poisoning is of particular concern to person involved directly in the manufacture and application of pesticides because they are at greatest risk.

6.3.2 Chronic poisoning: Chronic poisoning occurs from long time exposure to low levels of toxicant. This type of poisoning is often revealed only after several weeks of exposure and is of special concern to the general public. The main worry is that food

will contain residues capable of causing sickness or death after repeated consumption over time. Some of the most insidious effects are cancer, genetic damage to future generations and birth defects in offspring of exposed pregnant females.

6.3.3 Environmental pollution: Pesticides persist in the environment causing several types of damage. Pesticides released in the environment tend to build up in the fat tissues of living organisms causing severe harm to the health of species and a potential loss of bio-diversity. The pesticides contaminate the surface soil as well as ground water.

6.3.4 Financial Loss and other impacts: The expenditure of farmers in the pesticides is becoming a financial burden to them. The regular use of pesticides causes the development of resistance by the insects. The pesticides kill the predators and other useful organisms also that may cause the outbreak of diseases in the crops.

6.4 Comparison of Agro-chemicals with Natural Pest Control Measures

The use of natural pest control techniques results in better harvest and decreased use of pesticides, thus leading to increased productivity. It leads to increased farmer empowerment and enhanced farmers' ability to confront pest problems without the need of chemicals. It also results in contributions to the invention and development of natural control strategies attractive to smallholder farmers and promotes a new and highly participatory approach to learning with farmers. The natural control techniques are cheaper than chemical pesticides. These techniques have no side effects and give protection of plants for long run. Natural pesticides sometimes serve as fertilizer too. The organic vegetables produced using natural control techniques are healthy, tasty and these can be sold with high price in the market. Moreover, it is very easy to sell organic vegetables in the market. On the

other hand, these methods still have some demerits. Preparation of natural pesticides is time-consuming and labor-intensive. These may not give quick effects. Therefore, these methods may not be highly effective at the time of pest outbreak.

Case Study: 1
Bishnu Prasad Nepal, 41 years old farmer from Malepatan-5, Pokhara is involved in agricultural works since last 25 years. He is also a job holder in the agricultural office at Pokhara. He mentioned that the most of the farmers in his area apply chemical pesticides for the control of pests. In his view, the chemical control is not the proper method of pest control in our context in long run. He had the experience of loss of effectiveness of the pesticides year after year. And they compelled to invest a large sum of money in pesticides. Mean time, he got a chance to join the training program regarding natural crop protection technique. Later on he started using these methods for pest control and now he is satisfied with the results of these local methods. He mentioned that he is earning more form the organic vegetables produced by him as these can be sold easily in high prices.

Case Study: 2
P. R. Koirala, 84 years old man from Jamune-5 was involved in agricultural works since his childhood. He mentioned that in early days they do not have any idea regarding chemical pesticides. They used to protect their crops by the local methods and these were effective methods in controlling the pests. The pest problem was not much serious at that time. The quality and taste of vegetables and other crops was superb in the early days. But with the intervention of chemical pesticides, the pest problem became much serious. Moreover the quality and taste of the food is being degraded in these days. Now a day, he is trying to disseminate his knowledge regarding crop pest management as per his opinion this is the sustainable method for the crop pest management in our context. He further mentioned that he never uses chemical in his vegetables for the control of pests.

Chapter 7

Indigenous Knowledge on Crop Pest Management

Nepalese farmers have own traditional knowledge regarding crop pest management which has been transmitted as a cultural heritage from generation to generation. The farmers of different caste/ethnic groups have their own traditional skills and practices in pest management. These indigenous methods of pest control can be supportive to maintain low-input agricultural system and improve food self-sufficiency. These systems if searched and expanded properly, would definitely help in the sustainable development of the country. The indigenous knowledge system and practices are the realistic solutions to manage the problem of pests and to manage environmental problems. The bio-friendly local natural crop protection techniques can replace the faulty and hazardous use of agro-chemicals. The resources for natural crop protection techniques are available in our environment and can be prepared to useable conditions with minimum investment. These methods are thus cost effective, easily available and bio-friendly however, the techniques may be more labor intensive. This chapter outlines some of the important natural techniques of the protection of crop adapted by the local farmers.

7.1 Local Measures of Pest Control

The use of plant products or animal products as toxic ingredient or repellent against pest is a common crop protection practice in the countries like Nepal. Locally available and easily extractable plant and animal based crop protection measures can be supportive to maintain low input agriculture system and improve local food self-sufficiency. Nepal is rich in biodiversity and possesses a large number of plants with pesticide properties. Various locally available natural pest management methods

based on field study and published resources (Baker and Gyawali 1994) are given below:

7.1.1 Ash

Ash from wood, rice husk, straw, maize, cow dung cakes play significant role in managing sucking pests. It can reduce cowpea, aphids, cabbage, and other stored grain pests. It is also significant in controlling the ants in potato. Moreover the ash help in making the soil porous.

7.1.2 Cow Dung Slurry

Cow dung is mixed with water to make slurry, which is then applied to standing crops such as rice, wheat, garlic, cabbage etc to protect from insects. Seeds are covered with cow dung slurry to protect them from insect pests. It is reported that cow dung acts as an anti-feedant and provides physical protection against insect pests.

7.1.3 Kerosene

Some farmers treat their seeds with kerosene to deter ants from carrying it away. Quantities used vary from 10 to 16 drops of kerosene stirred well into 12 kg of maize seeds. The kerosene is mixed with the seed immediately before sowing.

7.1.4 Cattle Urine

Animal urine (cow urine and buffalo urine) can be applied on cereal crops as well as on vegetable crops to prevent from pest and disease. The urine should be diluted to desired concentration before use.

7.1.5 Kusauro

It is the name given to fine hairy dust like particles, which are left from legume plants after the threshing of the crops. Kusauro with black gram seed protect the seeds from pest.

7.1.6 Turmeric Powder

Its powder mixed with oil or itself applied on top of stored legumes then they can be prevented from insect pests. Its powder can be used to store the seeds for long time.

7.1.7 Tobacco

It is used for the pest control in vegetable crops. Farmers in rural areas use hukka in which tobacco leaves are ignited and then the smoke is drawn through water. This water is poisonous for some sucking insect pest (aphids, hoppers, mites, larvae etc). Also the dried tobacco leaves and stem after dipped in water for 5-6 days and mixed with water (1:4) and sprayed can manage the pests.

7.1.8 Titepati

Its liquid is mixed with water to make slurry (1:3), which is applied to crops to prevent it from the pests of the soil. It can be used to control caterpillar, aphids, etc. Its dried leaves can be used to protect potatoes against tuber moths.

7.1.9 Bojho

Mixture of dry rhizome powder and water can be used with emulsifier like liquid soap can be used against number of common field pests.

7.1.10 Sisno

The stem and leaves of sisno are firstly rotten for 7 days and mixed with water (1:4). This when sprayed controls ants, caterpillars, aphids, etc. Besides, sisno has medicinal value for the control of different diseases.

7.1.11 Tomato

Tomato leaves and stem are boiled and then sprayed so as to control caterpillars. Also when its leaves are rubbed in hot water for 5 hours and sprayed in cabbage and potato then it can control the pest of cabbage (cabbage gabaro) and potato (potato butterfly).

7.1.12 Neem

Neem products prevent bacterial, fungal and viral growth and are excellent agents to prevent soil nitrification and control of root nematodes. Neem is known to affect more than 200 species of insects. It inhibits the feeding in different insects. The neem seeds and leaves are particularly used for the crop protection purpose.

7.1.13 Bakaino

The dried fruits, stem, bark and leaves of bakaino are excellent repellent against pests in stored cereals, pulses, and tuber crops. The leaf extract, kernel extract, seed cake extract and seed oil spray are significant for the control of common insect pests.

7.1.14 Timur

The seeds of timur can be used to protect cereal seed and legume grains from stored grain pests.

7.1.15 Asuro

The aqueous extract of asuro can be used to control different vegetable and cereal crop pests. Dried leaves of asuro when applied on top of the stored grains protect them from infestation. The fresh leaves extract can effectively control mites.

7.1.16 Black Pepper

It mainly helps to protect the stored grains and potatoes by minimizing the population of pest. The leaf extract of black pepper is effective for the control of aphid in vegetables.

7.1.17 Bojho

In stored grains small pieces (7-10 per sack) of bojho can be used to protect from the pests. The aqueous extract of bojho can be used to control different crop pests.

7.1.18 Khichhadi Jhar

The stem and leaves of garlic, onion, chilly, pudina, when rotted and sprayed can protect the infestation of the pests. To ensure the proper spraying the soapy water can be sprayed along it.

7.1.19 Tip Cutting in Rice Paddy

Before the plantation of the rice, tips of the seedlings are removed so as to suppress the outbreak of rice insect pest as rice stem borers leaf hoppers and several other pests.

7.1.20 Hand Picking

Larger pests can be collected by picking with the hands and these can be killed collectively by any suitable methods.

7.1.21 Compost Pits

It is mainly used due to the outbreaks of white grubs. In order to minimize the multiplication of these and other soil insects farm yard waste and leaves are placed into a compost pit. Lime is mixed in during the turning of the compost, thus causing the temperature to increase inside the heap. The eggs, larvae, and pupae of white grub as well as other soil born insects are killed due to increase in temperature.

7.1.22 Intercropping Method

Number of evidences suggested that pest populations and problems are greater in monoculture than those grown in polyculture (i.e. with intercropping). Increasing the diversity of plant species is one practical measure for reducing the impact of pests. Intercropping is the best way of organic farming. As such in this method varieties of crops are planted side by side, for example we can grow coriander, salad around cauliflower. The strong smell of coriander repels pest. Moreover the pest that attacks the cauliflower may not be the pest that attacks coriander and this intensely protects the crop from pests.

7.1.23 Crop Rotation and Diversification

Crop rotation is also one of the major ways to manage the pest. Every year same plant must not be planted. If one variety of crops is planted in a year then another variety can be planted in the forthcoming year. This to great extent retains the fertility of the soil and prevents from pest attack.

7.1.24 Field Sanitation

Field hygiene is a measure aimed at interrupting the life cycle of pests. This includes the removal and destruction of infested harvest residues or prematurely fallen fruit, which might be infested with larvae or pupae. Preventing further development of pests in this way reduces future populations.

7.2 Social Aspects of Plant Protection

Plant protection also has a social aspect. An individual farmer cannot take effective measures against pests which range over a large territory. Here it is worthwhile to consider joint action with neighbors or in some cases larger scale action that requires government intervention to assist coordination. At individual level, it is important that alternative techniques consider the potentials and limitations of smallholders. General limitations of smallholders are capital, labor and knowledge. Farmers often reject cost-effective but labor-intensive practices because of the discomfort, lack of labor, or because hiring workers are too expensive. Another important social issue is the role of women. The women can make decision themselves regarding the application of pest control measures. This decision making is very important in order to assist in effectively launching different pest control measures, their extension and to provide relevant training.

Chapter 8

Findings and Conclusion

In view of the fact that many invaluable indigenous knowledge and traditional techniques of the native people regarding the crop pest management are vanishing day by day and they are in the verge of extinction, present study was conducted to document the current status of the indigenous knowledge and practices on crop pest management of the farmers of Jamune VDC and Pokhara Sub-metropolitan. Jamune VDC and Pokhara Sub-metropolitan were purposively chosen for the study as these areas allow the comparison of existing practices regarding crop pest management in rural and urban areas. Moreover the caste/ethnic diversity and cultural diversity in the study area also help in making the idea more inclusive. The study outlined exploration of knowledge of local farmers on pest management and their existing practices as major objective. Moreover, the documentation of indigenous knowledge of local farmers regarding crop pest management, examining the current pest management practices of local farmers related to different caste/ethnic groups, analyzing the limitations of the local farmers concerning current pest management practices, comparing the pest management practices between the rural and urban areas and tracing the impacts of conventional pest control methods in the local farmers of the study areas are considered as specific objectives.

Ninty respondents were purposively selected from two wards each of Jamune VDC and Pokhara Sub-metropolitan. A semi structured questionnaire schedule was developed and used to obtain their socio economic profile, cultural tradition, indigenous knowledge and traditional practices regarding crop pest management. Besides, key informants interview, direct observation and group discussion were

performed to gather information. The data collected from primary source was analyzed applying the appropriate methods and tabulated in frequency tables where deemed necessary. Secondary data were collected during the investigation survey and from different published and unpublished materials.

Significant proportion (46.7%) of female respondents were included in the study, assuming that women are mainly responsible for carrying out the major farming activities at the household level and perform domestic works (such as, collecting fuel-woods, feeding cattle, selecting and processing seeds and storing them) and possesses varieties of indigenous knowledge. The respondents included the farmers of different age groups and caste/ethnic groups which gave the idea of different categories of people. The people of old generation were found mainly in favor of indigenous pest control measures and they were found worried by the intervention of local measures by the conventional methods. The educated people were found more aware of the harmful effects of pesticides. The people of old generation and educated people need to play an important role in disseminating the ideas regarding the importance of traditional practices.

The land holding size showed variability ranging from one to nineteen ropanies. All of the respondents were not found in the condition of food self sufficiency. The respondents were found to adopt various conventional methods of pest control. However, most of the farmers are still using the traditional methods of pest control in addition to the conventional methods.

The use of improved varieties of seeds, chemical fertilizers and pesticides was found prominent in the study area. However in the recent days, several farmers are attracted towards the natural crop protection techniques. Most of the farmers are found aware about the risks associated with the use of chemical pesticides. Most of

the farmers believe that the quality of seed contribute for good yield. Indigenous Knowledge of seed selection, storage and pesticides was very rich among the farmers of old generation. Farmers have been cultivating local land races of major crops since generations and farmers have still observed traditional criteria for seed selection, processing and storage.

Majority of the farmers have been maintaining their subsistence system through traditional farming practices. Many farmers have been conserving local land races of major cereal crops. Socio-cultural backings have played a crucial role in the conservation of these land races. Different belief systems, rituals and festivals were found important for the conservation of agro-biodiversity. Brahmin and Chhetri farmers were conserving the local land races of basically of cereal crops like paddy, maize, millet etc.

The local farmers are facing the pest problem as one of the serious threat to the production system. More than 15% of their annual production is being lost every year due to the pests. The chemical control and natural pest control techniques were prevailing pest management methods in the study area. A significant number of farmers were found to adopt the integration of both of these methods for pest control. Majority of farmers responded chemical method as the effective method of pest control. However, they have suggested that the chemical control is not appropriate method of pest control in long run. The natural crop protection techniques of the local farmers are the sustainable methods of pest management in context of Nepal. The plant based and animal based products prepared by traditional methods are the best alternatives to the hazardous chemical pesticides. Thus, the application of traditional methods of crop protection is the realistic solution to manage the problem of pest. These methods have sound scientific backing as these methods are evolved through

trial and error experiences and transmitted from the generations to generations. The crop protection techniques could be most effective and adaptable methods in long run.

Based on the present study following recommendations have been made to the farmers, concerned authority and other stakeholders:

- The existing indigenous knowledge regarding crop pest management is invaluable wealth of the country which are being invaded and replaced by the use of agro-chemicals. It is necessary to conserve these resources in local peoples' participation and these conservation activities should be supported by the concerned authority.
- The faulty use of harmful pesticides should be minimized by conducting the awareness campaigns concerning hazards of pesticides. Moreover the people should be made aware about the usefulness of bio-friendly indigenous methods of pest control.
- More research works should be conducted responding the need of documentation of the indigenous knowledge and practices of the local people.

Since the researcher failed to investigate numerous other activities related with crop management practices. The future researchers are suggested to focus on livestock rearing, compost preparation methods, irrigation management and other crop management practices considering different caste/ethnic groups.

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Annex 1

INTERVIEW SCHEDULE

Name (optional):	Occupation:
Gender:	Age/Age group:
Address:	Academic qualification:
Family size: Male( ) Female( )	

1. Please mention total area of your cultivated land.

2. Is the land, which you work in, your own property?

   □ Yes □ No

3. Please mention the major crops you cultivate.

4. What is your average annual income from agriculture? (mention if you farm for commercial purpose)

5. Is the annual production of your land sufficient for the subsistence of your family?

   □ Yes □ No

6. List the problems which you are facing in agricultural works.

7. Rate the problem of pests in your crops.

   □ Severe □ Mild □ Minor

8. Give a rough estimation of the damage caused by the crop pests annually. (You may mention it in terms of percentage or amount)

9. List the control measures you are adopting yet to get rid of or reduce pest problems?

10. Are you using any chemical pesticides for the control of crop pests?

    □ Yes □ No

11. How frequently you use the chemical pesticides in your crops?

12. Assess the effectiveness of chemicals in controlling crop pests.

    □ Highly effective □ Moderately effective □ Ineffective

13. What is your average annual expenditure in the chemical pesticides?

14. Is the application of chemical pesticides in crops hazardous?

    □ Yes □ No

15. Are you applying any alternative methods of pest control?

    □ Yes □ No

16. Do you have any idea about indigenous pest control methods?

    □ Yes □ No

17. If you are applying the indigenous methods of pest control, please list the methods you apply.

18. Please rate the effectiveness of indigenous methods of pest control.

    □ Highly effective □ Moderately effective □ Ineffective

19. As a means of indigenous methods of pest control, which one would you frequently use?

□ Plant products □ Animal products

20. Based on your knowledge, please mention the merits and demerits of natural and chemical pesticides.

21. Which one would you prefer for subsistence farming?

□ Chemical pesticides □ Natural pesticides

22. Which one would you prefer for commercial farming?

□ Chemical pesticides □ Natural pesticides

23. Which one is more suitable method of pest control in the context of Nepal?

□ Chemical pesticides □ Natural pesticides □ Integration of both

24. Whether do you apply chemicals for the cultivation of the agricultural products for your family's consumption?

□ Yes □ No

25. Please list the traditional methods of pest control which you know.

Comments (if any):

Date:

Annex 2

Group Discussion Teams

Group 1 (Jamune)

1. Ms. Kamala K.C. (23)
2. Mr. K. B. Adhikari (43)
3. Ms. G. Pandit (54)
4. Mr. K. Bishowkarma (53)
5. Mr. R. Thapa (29)

Group 2 (Jamune)

1. Ms. G. Pandit (29)
2. Mr. M. Pandit (55)
3. Ms. R. Nepali (41)
4. Mr. M. B. Adhikari (70)
5. Ms. P. K.C. (32)
6. Mr. A. Pandit (18)

Group 3 (Pokhara)

1. Ms. N. Subedi (55)
2. Mr. K. L. Adhikari (49)
3. Ms. P. Paudel (22)
4. Mr. S.R. Koirala (44)
5. Mr. H. Thapa (66)
6. Ms.P. Koirala (67)

Group 4 (Pokhara)

1. Ms. P. K.C. (42)
2. Mr. P.R. Koirala (84)
3. Ms. G. Sharma (51)
4. Mr. T.P. Nepali (63)
5. Mr. R. Thapa (29)