Socio-economic contexts on pesticide use in Nepal

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Abstract

Two socio-economic surveys were conducted in Jhiku Khola Watershed (JKW) area in Kabhrepalanchok district of Nepal for understanding the general socio-economics, farming systems and pesticide use in agriculture. An average household owns 0.60 ha of land. Most of the households depend on agriculture for their livelihood and use pesticides for protecting their crops from various pest attacks. Rice, maize, wheat and mustard are treated 1 - 3 times per crop cycle whereas potato, tomato, cabbage, bittergourd and cucumber are treated 2 - 15 times. Farmers have low knowledge on pesticides and their uses, as a result, general precautionary measures are also lacking. The enforcement of pesticide regulation is very poor. The share of pesticides in the cost of production of various crops grown ranges from 0 % (wheat) to 8.41 % (bittergourd). This share being moderate and economically justifiable has stimulated the farmers to use pesticides without thinking their negative impact on human health and the environment. Increasing the awareness of farmers and enforcement of pesticide regulations are needed to improve the situation.

Introduction

Nepal with an area of 147181 square kilometer is a country inhabited by 23.2 million people. Agriculture still plays an important role in its national rural economy with its contribution to Gross Domestic Product going down to 38 percent. The 2001 National Census (CBS, 2001) has put the percentage of population dependent on agriculture and living in the rural area at 76 and 84, respectively. Furthermore, commercialization of agriculture is central to accelerated economic growth and poverty reduction in a country like Nepal, which is an overwhelmingly rural and agrarian economy. However, commercialization entails high input high-value commodities based intensification of agriculture, which often leads to increased use of pesticides. Inappropriate and excess use of chemical pesticides could have hazardous impact
on human being, livestock and environment. Therefore, it is important that effective and ecologically sound crop protection programs that combine various alternative pest control measures, including mechanical, biological and chemical methods, should be implemented to minimize harmful effects of toxic pesticides. Chemical pesticides should be used only as a last resort. This requires promotion of appropriate crop protection technology and pest management strategy, and increased awareness of the farmers.

In this context, a research project entitled "Environmental Risks of Pesticides and Sustainable Development of Integrated Pesticide Management (IPM) for Mountain Areas of Developing Countries considering Socio-economic Conditions and taking Middle Mountains, Central Nepal as an example (DEVELOP IPM NEPAL)" (Herrmann, 1997) was implemented by CEAPRED in collaboration with the Technical University of Braunschweig (TUBS), Germany, in JKW area [Ward No. 4, 5, 6 and 9 of Panchkhal Village Development Committee (VDC)] of Kabhrepalanchok district of Nepal. The objectives of the research project were to understand the general socio-economics, farming systems and use of pesticides in agriculture at the research site. Two socio-economic surveys were conducted in connection (the first during May – September 1999 and the second during 4 – 13 March 2001).

Methodology

Selection of sample site

Since JKW area was chosen as the experimental site, the site for the survey was pre-determined. The collaborating institutions (CEAPRED and TUBS) agreed that a total of 200 households in the JKW area would suffice to generate the required information. Hence a sample size of 200 was fixed. For this purpose, JKW area was divided into Lower Catchment Area (LCA) comprising Ward No. 4, 5 and 6 and Upper Catchment Area (UCA) comprising Ward No. 9 of Panchkhal VDC to account for the ecological/environmental diversity of the area. Since the site selection for the first survey was purposive, this study site may not represent the mid-hills of Nepal. However, it represents the numerous micro-ecological belts with JKW characteristics in the region.
Training of technical staff

The first survey was carried out by the technical staff of District Agriculture Development Office (DADO) Kabhrepalanchok. They were given a four-day training by a Socio-economist of CEAPRED. The second survey was conducted by CEAPRED technical staff. They were also oriented to conduct the survey to solicit quality information.

Selection of sample farmers/households

A total of 200 randomly selected households (10% of the total households based on the voters' list provided by the Panchkhal VDC and Ward Offices) were interviewed during the first survey using pre-tested structured questionnaire. Accordingly, 200 households [(80 in the LCA (3 in Ward No. 4, 20 in Ward No. 5 and 57 in Ward No. 6) and 120 in the UCA (Ward No. 9)] of Panchkhal VDC were interviewed during the first survey. Landless households were not included in the sample.

Sample households selected for the first survey and their land holdings formed the basis for the selection of farmers for the second survey. Two hundred farmers interviewed during the first survey were classified into small, medium and large farmers using National Planning Commission norms. The TUBS and CEAPRED agreed to conduct second socio-economic survey of 50 (25%) of 200 farmers. Fifty households were selected using Probability Proportional to Size (PPS) technique to represent VDC Ward as well as different categories of farmers from among the 200 farmers interviewed during the first survey. As in the first survey, farmers interviewed in the LCA and UCA during the second survey constituted 40% and 60% of the total (50). Accordingly, catchment area-wise/Ward-wise and strata-wise number of farmers interviewed during the second survey is given in the Table below.

Results

Households and population

The number of households surveyed during the first survey comprised 1320 persons. This translated into a family size of 6.6 persons per household. At the aggregate level, there are more female than male (97.3 male per 100 female). However, sex ratio is more unbalanced in
LCA (93.4 male for every 100 female).

Caste-ethnicity and population

Brahmin and Chhetri constituted 40 percent of sampled households. Newar was the second dominant group accounting for 23 percent of households surveyed, but is predominant in the UCA. Occupational castes (Kami, Damai and Sarki) constitute the third largest caste-ethnic group in the area. Together they share a little more than 14 percent of the sample population but are confined to the UCA. In the LCA, Danuwar is the second largest caste-ethnic group after Brahmin and Chhetri. Other caste people residing in the area are Tamang and Sanyasi.

Distribution of population by age

The sample populations have been grouped into three classes: less than 15 years, 15 - 59 years and 60 years and above. The percentages of economically active population (15 - 59 years) for the LCA and UCA are 55.9 and 53.4 respectively. Younger age population (less than 15 years) does not vary across the settings but the UCA has slightly higher percentage of female children (40.7 %) than is the case for the LCA (37.3 %). However, the percentage of elderly population (aged 60 and above) is more in the LCA (7.9 %) than in the UCA (5.9 %).

Education

Illiterate population is higher in the UCA (34.6 %) than in the LCA (21.4%). In both LCA and UCA, female illiteracy is significantly higher than the male. Likewise, educational attainment of the population is higher in the LCA than in the UCA. For all categories of educational attainment, male educational attainment is higher than female.

Households and landholdings

In rural Nepal, land continues to be the major source of income and employment. Often, the quality of land (irrigated vs. unirrigated), type of land (lowland vs. upland), and accessibility (road head vs. others) are major determinants of a household’s social and economic status in the community. Based on the distribution of landholdings, farm households have been
categorized into Marginal (< 0.5 ha), Small (0.5 - 1.5 ha), Medium (1.5 - 2.5 ha) and Large (2.5 - 4 ha).

Of the 200 respondents, more than 93.5 (187) % are small and marginal farmers. A little more than half are marginal farmers (103) with an average land holding of 0.26 ha. In the surveyed area, 52 % of households own only 22.5 % of land. In contrast, less than 7 % of households own about 24 % of land indicating rather skewed distribution of productive resource. The average size of landholding for JKW area is 0.60 hectare. The average land holding of a household is 0.78 ha in the LCA while it is 0.49 ha in the UCA.

There is more low land (Khet) in the LCA than in the UCA. Again, the holdings are not in one location, but scattered in a number of small parcels ranging from 3 to 5, which take an average time of 20 - 27 minutes to reach the farthest parcel from the homestead.

**Farming systems**

Some of the characteristics of Nepalese farming systems are as follows: a) Mixed farming consisting of crops and livestock, b) subsistence farming characterized by smallholdings and low productivity, c) agricultural production dominated by cereal crops for food security, d) mostly rain fed farming, e) labour-intensive farming, f) agriculture not providing full time employment to the people thus paving way for seasonal migration in search of employment, g) lack of institutional credit and organized market in the rural areas h) lack of network of roads in the rural areas.

The project site can be considered as one of the most privileged sites representing the ideal situation of Nepalese farming systems.

**Land types**

In the hilly regions of Nepal, the agricultural land is broadly classified into two categories, 'Khet' and 'Bari'. 'Khet' refers to land which is usually lowland and suitable for rice cultivation under puddling condition while 'Bari' refers to the upland which is usually not suitable for rice cultivation under puddling condition but suitable for cultivation of several other crops. 'Pakho'
is marginally uncultivated land used for animal grazing and 'Ban' means forest. Some farmers also have forest in their personal land.

**Major crops grown in the project area**

The major crops grown in both UCA and LCA are rice, maize, potato, wheat and tomato. The other crops grown in the area are mustard, cabbage, cucumber, bittergourd, chilli, brinjal and radish. The cropping intensities in Khet land in the LCA and UCA are 250 % and 243 %, respectively whereas in Bari, these figures are 126 % and 134 %, respectively.

**Cropping patterns**

There are three distinct cropping seasons in the project area: Summer or Monsoon (June - October), Winter (November - February) and Spring (March - May). In Khet, the dominant crop during monsoon is rice followed by potato, wheat, vegetables and mustard during winter and summer seasons. In Bari, the dominant crops during monsoon are maize and tomato followed by wheat, mustard, potato and vegetable crops during winter and summer seasons.

**Irrigation**

The major source of irrigation in the UCA Khet is Jhikhu Khola and its tributaries and for the LCA Khet is Jhikhu Khola and groundwater (lifted with either motor pumps or rower pumps). About 96 % of LCA farmers and 76% of UCA farmers irrigate their land from the Jhikhu Khola stream. About 48 % of LCA farmers and only 3 % of UCA farmers also use water pumps to lift groundwater for irrigating their crops. Water tariff is being paid by 55 % of LCA farmers and 23 % of UCA farmers, respectively.

**Livestock holding**

Livestock is an integral part of Nepalese farming system. The major animals raised by the farmers are cattle, buffalo, goat, sheep, pig and poultry. Cattle are raised for milk and draught power, buffaloes for milk and meat and poultry birds for meat and egg.
**Pesticide use**

During the green revolution time (mid 1960s and 1970s) in India, the Nepalese farmers also started the use of improved seed, chemical fertilizer and pesticides to grow more food. All of these inputs except some seed are being imported from other countries.

The use of pesticides in Nepal started in the early 1950s when DDT was extensively used in the Terai and Inner Terai area for eradicating Malaria disease transmitted by mosquitoes (Anopheles spp.). Of course, DDT was not much used in agricultural crops. Parathion was imported in large quantity followed by endirin, BHC, chlordane, aldrin and dieldrin during the 1950s and 1960s. Nepalese farmers have a preference for highly toxic insecticides with broad-spectrum activity, which result in immediate knockdown of pests (Neupane, 1995). All chlorinated hydrocarbons except endosulfan, phosphamidon and parathion among the organophosphates and organomercury chloride have been banned, but methyl parathion is still in use, being one of the most popular insecticides (DOPP, 2001).

A long list of pesticides has been approved by the Directorate of Plant Protection (DOPP) under the Department of Agriculture (DOA) of His Majesty's Government of Nepal for various crops (DOPP, 2001). The Pesticide Act was enacted in 1991 and the Regulations approved in 1993 (DOPP, 2001). Due to lack of enforcement of legislation, there have been several misuses of pesticides. For example, anybody can sell, buy and use toxic chemicals; there is no mechanism for consumer safety (the pesticide residues on marketable crop produce); the expiry dates of pesticides and the quality of imported as well as locally produced chemical is unchecked. There have been some pesticides imported from India, which are of doubtful quality. In the past, the major bulk of pesticides were marketed by the Agricultural Inputs Corporation, but currently it is handled by private dealers. There are many dealers of various pesticides in the country. Since Nepal has an open border with India, it is very difficult to estimate the exact quantity of pesticides imported into the country. However, the DOPP has reported the following pesticide import figures, (in terms of active ingredients), for the year 1997: insecticides - 33356 kg, fungicides/bactericides - 15577 kg, herbicides - 6748 kg and rodenticides - 400 kg (unpublished data). The national average consumption of pesticides is very negligible (142g active ingredient/hectare) (Dahal, 1995).

The pesticide application equipment, mostly sprayers (hand compression and knapsack type) are also imported from India by many of the pesticide dealers.
Vegetable production has become very popular in many parts of Nepal, especially near the highway corridors. Farmers have started treating high value vegetable crops with pesticides very frequently. In many places farmers apply pesticides in a routine manner, without considering the waiting period, residue on the treated stuff, human health and the environment as a whole. Panchkhal VDC is very popular pocket for growing different vegetable crops, which are sold at high prices in Kathmandu and other nearby towns. Many people who are concerned about the abuse of pesticides, are frightened to consume the crops (especially vegetables) grown in Panchkhal area. Since there is very limited facility for pesticide residue analysis in the country, it is difficult to judge the amount of pesticide residue present in the plants, soil and water around the treated area. In this context the present collaborative research has aimed at studying pesticide management aspects in the Hindu-Kush Mountain Region, taking Nepal as a representative site.

**Pesticides used in the project area**

The following pesticides are used by the farmers of the project area for controlling various pests on different crops: Insecticides (aluminum phosphide, chlorpyrifos, dichlorvos, dimethoate, fenvalerate, malathion and methyl parathion), Fungicides (carbendazim, edifenphos, mancozeb and metalaxyl).

**Broad use of pesticides in agriculture**

In the research site, farmers use pesticides mostly on standing crops in the field. All LCA farmers and 97 % of UCA farmers have been found using pesticides on their crops. Cereals and grain legumes are stored for several months. The grains are used both as seed and food. About 20 % of LCA farmers have been found treating the seed with pesticide and none of the UCA farmers did so. In both the areas, farmers treated the grains meant for human and animal consumption.

**Priority crops for pesticide use**

In the study area, farmers use pesticides mainly on the following crops for controlling various insect pests (Neupane, 2002) and diseases (Shrestha, 1996): potato, tomato, rice, cauliflower, brinjal (eggplant), chilli, beans, gourds, wheat and mustard. In UCA and LCA, potato, tomato
and rice are the important crops followed by different vegetable crops in terms of pesticide use.

Use of pesticides in stored commodities

The major stored commodities in the research site are cereal grains (rice and wheat), which are kept for 3 - 6 months. Very few farmers (6 %) applied following insecticides on cereal grains: aluminium phosphide (Celphos tablets), malathion (dust) and dichlorvos (Nuvan EC). The latter two insecticides are not recommended by DOPP for direct use in grains in the storage.

Use of pesticides in field crops

Crop-wise use of pesticides and their frequencies of application/ (FA) on a crop for one season have been presented below.

*Lower catchment area*

**Rice** (i) Insecticides: dichlorvos, dimethoate, fenvalerate and methyl parathion. These are used against chewing and sucking insects. Dichlorvos is very low persistent insecticide and not desirable to be used on rice. FA: 2 - 3 times. (ii) Fungicides: carbendazim and edifenphos. These are used against fungal diseases such as rice blast and brown spot. FA: 1 - 2 times.

**Maize** (i) Insecticide: chlorpyrifos. It is used against soil and foliage insects. FA: 1 time.

**Potato** (i) Insecticides: dichlorvos, dimethoate, fenvalerate and methyl parathion. Here again, dichlorvos is not a proper choice. FA: 8 - 12 times. (ii) Fungicides: mancozeb and a mixture of metalaxyl and mancozeb (Krilaxyl). These are used mainly against the late blight of potato. FA: 9 times.

**Tomato** (i) Insecticides: dichlorvos, dimethoate, fenvalerate and methyl parathion. FA: 7 - 15 times. (ii) Fungicides: carbendazim, mancozeb and Krilaxyl. These are used against the late blight. FA: 4 - 11 times.
Cabbage and Cauliflower  (i) Insecticides: dichlorvos and fenvalerate. FA: 2 - 4 times. (ii) Fungicide: mancozeb. FA: 7 times.


Chilli and Capsicum  (i) Insecticides: dichlorvos, dimethoate and fenvalerate. FA: 5 - 11 times. (ii) Fungicide: mancozeb. FA: 8 times.

Cucumber  (i) Insecticides: dichlorvos, dimethoate and fenvalerate. FA: 2 - 9 times. (ii) Fungicides: mancozeb and Krilaxyl. FA: 12 times.

Brinjal (i) Insecticides: dichlorvos, fenvalerate and methyl parathion. FA: 2 - 9 times. (ii) Fungicides: mancozeb and Krilaxyl. FA: 2 - 4 times.

Beans  (i) Insecticides: dimethoate. FA: 5 times. (ii) Fungicide: mancozeb. FA: 5 times.

Upper catchment area

Rice  (i) Insecticides: dichlorvos, fenvalerate, malathion, dimethoate and methyl parathion. FA: 2 - 4 times.
(ii) Fungicide: edifenphos. FA: 2 times

Wheat  (i) Insecticide: malathion. It is used for controlling the pests of stored wheat grains. FA: 1 time.

Potato  (i) Insecticide: dichlorvos, dimethoate, fenvalerate and methyl parathion. FA: 6 - 8 times. (ii) Fungicides: mancozeb and Krilaxyl. FA: 8 times.

Tomato  (i) Insecticides: dichlorvos, dimethoate and fenvalerate. FA: 10 times. (ii) Fungicides: mancozeb and Krilaxyl. FA: 10 times.

Bittergourd  (i) Insecticides: dichlorvos and fenvalerate. FA: 6-7 times. (ii) Fungicide: mancozeb. FA: 8 times.
**Chilli and Capsicum** (i) Insecticides: dichlorvos and fenvalerate. FA: 7 times. (ii) Fungicide: mancozeb. FA: 8 times.


**Mustard** (i) Insecticide: fenvalerate. FA: 2 times. (ii) Fungicide: mancozeb. FA: 1 time.

The rate of pesticides per application used on various crops in LCA and UCA has been found to be normal when compared with the rate of application used in United States of America (Thomson, 1998, 2000).

Criteria for pesticide application

For the application of pesticides on the crops, farmers usually take presence of pests or their damage symptoms or both into consideration. Some farmers also use pesticides even without noticing the above criteria. In case of rice 31.2 % of the households considered the presence of pests and 36.2 % considered the damaged symptoms while 2.5 % considered both in the LCA. While in the UCA, only 4.1 % of the households considered pests and 23.3 % considered damage symptoms. In case of potato 87.5 % of the households considered damaged symptoms. This is particularly true because of potato late blight caused by a fungus (Phytophthora infestans), which cannot be seen by naked eyes. Hence, farmers have to rely on damage symptoms. In most of the crops farmers rely on at least two criteria listed above.

Waiting period

Waiting period can be defined as the period between the last application of pesticide on a crop and the date of its harvest. Generally, during this period the pesticide residue on or in the treated stuff / plants is dissipated and such stuff is usually harmless to human and animal consumption. Now the problem in developing countries including Nepal is that farmers usually do not maintain the recommended waiting period prescribed for different pesticides. This has compelled people to consume agricultural products containing illegal amount of pesticide residues and suffer from various ailments.
The research site is important vegetable growing pocket and a lot of vegetables are sold in Kathmandu and other surrounding areas. The vegetable growers of this area also have not maintained the recommended waiting periods for various pesticides. The waiting periods of mancozeb, fenvalerate, matalaxyl + mancozeb (Krilaxyl), dimethoate and methyl parathion are too short in both UCA and LCA. It means that vegetables grown in these areas are not safe for human consumption.

Use of right dosage of pesticides

About 24% of respondents took the advice of agricultural technicians (Agricultural Officers, Junior Technicians, Junior Technical Assistants of DADO, Kabhrepalanchok and technical staff of CEAPRED), 11% decided on their own and 65% either decided on their own or took the advice of the agricultural technicians in the LCA whereas in the UCA 89% took the advice of the technicians.

Change in pesticide types

Little changes have been seen on pesticide types in the research site. In the LCA, 27% of the respondents have switched over to other types of pesticides from the regularly used ones. In the UCA, only 8% of the respondents did so. The reasons for the changes were agricultural technicians’ advice, unavailability of the regularly used pesticides and pesticide dealers’ advice.

Know-how about pesticides use

Know-how about pesticides (such as their types, method of dilution and application, residue problems, expiry dates, precautionary measurers etc.) was low among the farmers. In LCA, only 41% of the male and 23% of the female had knowledge on the above areas while it was so only with 32% of male and 8% of female in UCA.

Other pest control practices

Only 12 farmers have reported using the following means than synthetic insecticides for controlling pests on vegetable crops such as tomato, potato, cauliflower, pea, bean, mustard, gourds and other vegetables:

Botanicals: Azadirachta indica (Neem), Artemisia vulgaris (Mug-wort), Capsicum frutescens (Chilli), Allium sativum (Garlic), Nicotiana spp. (Tobacco) and wood ash.
Miscellaneous: Cow urine, Soap and Light-trap.

Cow urine alone (diluted with water) or in combination with crude water extracts of the above botanicals (especially their leaves, fruits and bulbs) are applied on the plant foliage. Farmers believe that this treatment protects the crops from the damage from various insects and diseases. But published data that confirm farmers' believes are lacking.

**Pesticide appliances**
In Nepal, pesticides are applied using very simple manual appliances such as sprayers and dusters. The hand compression (usually 9-litre capacity) and the knapsack sprayer (16-litre capacity) are very commonly used. In the absence of a sprayer, locally made brooms are used. Similarly, in the absence of a duster, pesticide dust is spread over plants and soil surface by hand.

Both men and women are involved in pesticide application. In rare cases, even children are involved. About 45.6 % male and 24.7 % female are engaged in pesticide application in the LCA. Similarly, 36.5 % of male and 14.4 % of the female are engaged in pesticide application in the UCA.

About 91 % and 57 % of LCA and UCA households own sprayers. Farmers, who do not own sprayers, borrow from their neighbors by paying Rs. 40/day (LCA) and Rs. 23/day (UCA), respectively.

**Marketing of pesticides**
In the LCA, farmers buy pesticides from the following retailers in order of priority: agro-vet shop, local agro-shop, Agricultural Input Corporation (AIC) dealers and farmers’ cooperatives. Similarly, in the UCA, farmers buy pesticides from local agro-shop, agro-vet shop and AIC dealers.

**Pesticidal hazards to human being and environment**
**Hazards to users:**
In the LCA, 94 % of the users did not feel any side effect of pesticides whereas 6 % felt some effects. Similarly, in the UCA, 33.6 % of the respondents did not respond to the side effects of
pesticides. About 38% of the respondents did not experience any side effect whereas 28.3% of the respondents did experience side effects.

Hazards to general public and environment:
Pesticides applied on the field also have some side effect on general public and the environment. About 85% and 67% of the respondents in LCA and UCA, respectively, were aware of pesticide hazards to general public health and the environment.

Use of protective measures
LCA:
A majority of users (85%) washed their hands with soap, very few (5%) used gloves; boot; mouth and nose cover; about 19% used gloves and mouth and nose cover.

UCA:
A majority of users (90%) washed their hands with soap and 5% used mouth and nose cover.

Farmers' training on pesticide management
Training of farmers on pesticide management is very important. But it is being neglected by the concerned agencies. Only two LCA male farmers have received a very short training on IPM.

Availability of pesticides
Around 90% of the households of UCA and LCA stated that pesticides were available in the market whenever they needed. Very few (7%) commented that they were not available when they required them.

Storage of pesticides by farmers
Generally, farmers buy pesticides before they use while others buy them when needed. In the first case, farmers have to store the pesticides at their residences for some time. In the LCA, 40% and in the UCA 25% of the households stored pesticides.

Annual expenditure
Farmers' annual expenditure is grouped into seven categories, namely, foodstuff, education, health, livestock raising, transportation, fuel, festivals and clothing. Average annual
expenditure of UCA farmers (Rs. 53809) is less than that of LCA farmers (Rs. 63077). (Table 5).

**Income and Expenditure**

Income of farmers in the project area is categorized into two: farm income (Value of Production minus Cost of Production) and Income (Farm Income plus Off-farm Income). Table 6 shows that average farm income of UCA farmers (Rs. 66621) is much less than that of LCA farmers (Rs. 145603). This is so because they apply more purchased inputs and produce more in terms of quantity than that of UCA farmers. Similarly, average income of UCA farmers is less (Rs. 108253) than that of LCA farmers (Rs. 190093). Average expenditure (value of home consumption plus annual expenditure) of UCA farmers, which stands at Rs. 103324, is less than that of LCA farmers (Rs. 137573). Thus there is a big difference between the average income of UCA and LCA farmers. Average surplus (excess of income over expenditure) per UCA farmer/household (Rs. 4928) is very low as compared to the same of LCA farmer/household (Rs. 52520).

**Table 1 Value of production (NRS)**

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**Table 2 Cost of production (NRS)**

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### Table 3 Off-farm Income (NRS)

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### Table 4 Value of home consumption (NRS)

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<th>LCA</th>
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### Table 5 Annual expenditure (NRS)

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<th>UCA</th>
<th>LCA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 Small Farmers</td>
<td>8 Medium Farmers</td>
</tr>
<tr>
<td>Annual</td>
<td>879887</td>
<td>478792</td>
</tr>
<tr>
<td>Expenditure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>43994</td>
<td>59849</td>
</tr>
</tbody>
</table>
Table 6 Income and expenditure of UCA and LCA farmers (NRS)

<table>
<thead>
<tr>
<th></th>
<th>UCA</th>
<th>LCA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 Small Farmers</td>
<td>8 Medium Farmers</td>
</tr>
<tr>
<td>Income</td>
<td>1771272</td>
<td>1001075</td>
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<tr>
<td>Value of Production</td>
<td>983022</td>
<td>668766</td>
</tr>
<tr>
<td>Minus Cost of Production</td>
<td>68696</td>
<td>39891</td>
</tr>
<tr>
<td>Farm Income</td>
<td>914326</td>
<td>628875</td>
</tr>
<tr>
<td>Plus Off-farm Income</td>
<td>856946</td>
<td>372200</td>
</tr>
<tr>
<td>Expenditure</td>
<td>1765880</td>
<td>915959</td>
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<tr>
<td>Value of Home Consumption</td>
<td>885993</td>
<td>437167</td>
</tr>
<tr>
<td>Plus Annual Expenditure</td>
<td>879887</td>
<td>478792</td>
</tr>
<tr>
<td>Surplus (Income - Expenditure)</td>
<td>5392</td>
<td>85116</td>
</tr>
<tr>
<td>Surplus/Household</td>
<td>270</td>
<td>10640</td>
</tr>
</tbody>
</table>
Conclusion

Farmers in the research site have started growing high value crops such as vegetables in place of traditionally grown cereals. They do not like to take any kind of risk such as pest damage in these crops. Hence they have started using pesticides lavishly. The other reasons for high use of pesticides are their cheapness and very low share in the total cost of production of the crops. The farmers have very low knowledge on pesticides and the pesticide regulations have not been enforced properly. For improving this situation, the awareness of the farmers needs to be raised towards pesticides, their alternatives and IPM and enforcing the regulation by the government as well as several developmental agencies.

Acknowledgement

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References

Herrmann, A. (1997) Environmental Risks of Pesticides and Sustainable Development of IPM (Integrated Pesticide Management) for Mountain Areas of Developing Countries Considering Socio-Economic Conditions and Taking Middle Mountains, Central Nepal as an Example (DEVELOP IPM NEPAL). Project Proposal, Institute for Geography and Geocology, Department for Physical Geography and Hydrology, Technical University of Braunschweig, Germany