

Comparative study was done in Dang and Palpa districts to know the awareness level and practices of pesticide use and Chi-square test was done to find out the significant differences. In some cases farmers of Palpa districts were found to have comparatively more knowledge regarding safe handling of pesticides. Significant difference was noticed in the number of people reading pesticide label in Dang and Palpa districts with higher number in Palpa. Significantly more farmers in Palpa district knew the meaning of pesticide label. Though farmers in Dang district were aware about the adverse effects of pesticides, but they were not practicing safe use of pesticides. Significantly higher number of farmers had received technical training on IPM in Palpa districts and positive correlation was found between technical training obtained and adoption of IPM technology. Significant relationship was found between technical training obtained and adoption of IPM, $\chi^2(1, N=90) 16.982, p < 0.05$.

In order to determine the factors affecting the adoption of IPM technology, a binary logistic regression was performed. The frequency of IPM based trainings obtained and the education level of household head were found to significantly determine the adoption of IPM technology. Farmers receiving the regular IPM based technology were 15.267 times more likely to adopt the IPM technology as compared to those who receive the technician support rarely or never. Similarly, literate household head or household head with minimum up to primary level of education were 5.686 more inclined to adoption of IPM technology than the household with no education level.

Table 5: Binary logistic regression of factors affecting the adoption of IPM Technology

Variables	Coefficient	Significance level	Exp(B)
Technical training obtained	2.656*	0.019	15.267
Gender of household head	0.000	0.331	1.00
Land area	0.43	0.784	1.469
Education level of household head	1.657*	0.014	5.686
Frequency of agricultural technical support	0.019	0.678	0.224
Constant	-2.172	0.084	0.131

3.4 Constraints of adoption of IPM Technology

Index score method was used to rank the constraints on adoption of IPM technology by the commercial vegetable growers. Though many farmers were aware about the negative effects of chemical pesticides, however there were some hindrances in adoption of IPM.

Table 6: Constraints of adoption of IPM Technology

S.N.	Constraints of adoption of IPM Technology	Index Score	Rank
1	Easy availability of chemical pesticides	0.886	I
2	Lack of bio pesticides	0.686	II
3	Lack of technical trainings	0.702	III
4	No separate price for organic vegetables	0.352	IV
5	No block farming	0.338	V

Easy availability of chemical pesticides was ranked the major constraint with an index score of 0.886 which was followed by lack of bio pesticides with index score of 0.686. Lack of technical trainings, no separate price for organic vegetables and no block farming were ranked by the respondents as third, fourth and fifth major constraints in adoption of IPM technology with index score of 0.702, 0.352 and 0.338 respectively. A group researchers also reported the lack of technical trainings and easy availability of chemical pesticides to be the hindrance for adoption of IPM technology (Rijal et al., 2018).

3.5 Human Health and Environmental Effects of Pesticides

Irrational use of pesticides causes several impacts upon human health and environment. The problems of toxicity occur when proper procedures are not followed (Dey, 2010). Residue problems are seen when growers apply the wrong pesticide or apply too much of it too soon before harvest. Excessive and indiscriminate use of pesticides not only increases cost of production but also causes several short term health problems like

headache, skin and eye irritation, dizziness, vomiting etc. and long term health problems like cancer, birth defects, reproductive problems, tumors, damage of liver, kidney and neural organs etc. (Sharma et al., 2012). Effects of pesticide seen on health of farmers in Dang and Palpa districts are shown in Figure 2 and 3 respectively. In Dang, 40% farmers reported skin and eye irritation. In case of Palpa, 46.7% reported headache, 6.7% reported skin and eye irritation when pesticides were used unsafely. Similar results were found (Atreya, 2008).

More than 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target, including non-target species, air, water, bottom, sediments and food. In Dang, only 26.7 % people were aware about the beneficial insects, pests in surrounding. In Palpa 53.3 % knew about the effect of pesticides on pollinator and natural enemies. Serious effect is seen upon the environment due to random spraying of pesticides. Bees which are chief pollinators of different species of crop plants have been severely affected by the pesticides.

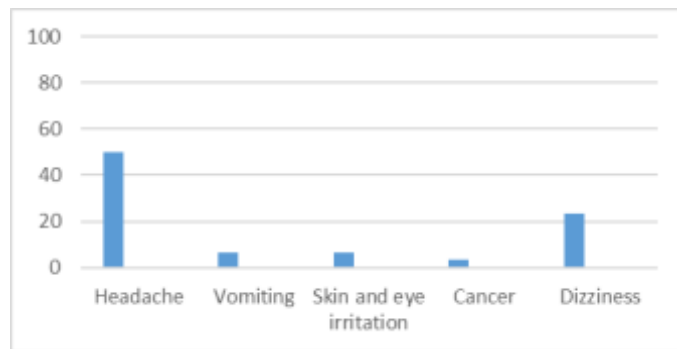


Figure 2: Effects of pesticides seen at Dang

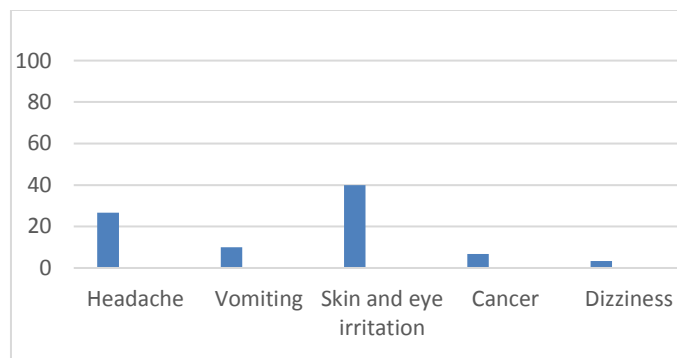


Figure 3: Effects of pesticides seen at Palpa

3.6 Role of Agrovets and IPM Adoption

Agrovets played a significant role in providing agricultural inputs like seeds, pesticides etc. to the farmers. There was more influence of agrovets among farmers than government bodies. A researcher also reported more dependence of farmers upon agrochemical dealers for suggestions (Dey, 2010). In Dang, 66.7 % farmers took technical advice from agrovets before spraying pesticides. Only 20% obtained technical advices from DADO (District Agriculture Development Office) / Service Centre. In case of Palpa, 76.7 % farmers were dependent upon agrovets for technical advices and other agricultural inputs while only 6.7 % farmers were associated with DADO for technical advices. This data depicts very poor presence of government authorities among farmers. There is high chance of pesticide misuse and overuse if pesticide resellers do not have technical knowledge about the safe use of pesticide.

IPM not only minimizes pesticide use but also generates high yields and high net returns and reduces health, environmental and social costs of pesticide pollution. Rate of adoption of IPM was found low in both districts. Use of IPM materials like Pheromone trap, Sticky traps were found lower. Most of the people hadn't heard about IPM. Even those who had taken trainings on IPM weren't practicing it. Most farmers found IPM methods to be costly. Crops raised through IPM practices have comparatively shorter post-harvest life in relation to those of pesticides sprayed. Adoption of IPM practice in a small area by a single farmer was found ineffective as such areas were easily influenced by the neighboring farms using pesticides. Hence IPM need to be practiced in a large block of land for its effectiveness. 40 % farmers in Dang and 56.7% in Palpa had obtained technical trainings on IPM through different organization like

LiBird, DADO etc. (Table 4), however, rate of adoption was low. Only 13.3% farmers were found to adopt IPM in Dang district and 66.7 % in Palpa, also reported only 20% IPM trained individuals in the research. Only 10% farmers had separate organic plot for home consumption in Dang whereas in Palpa 20% farmers had separate organic plot (Atreya, 2005). There was growing interest of people in practicing IPM. High willingness for IPM program indicates that farmers are aware of negative effects of pesticides on human health and ecology. Hence focusing on IPM based technical trainings helps in IPM adoption among farmers. IPM uses locally available resources which are effective and cheaper. Increased adoption of IPM will help reduce pesticide use without adverse consequence on agriculture (Dey, 2010).

4. CONCLUSION

The knowledge level of farmers regarding safe use and handling of pesticides was found to be very poor. Main reason behind this is the lack of education and sufficient technical trainings about the safe use of pesticides. Unsafe handling of pesticides resulted in several health hazards of the farmers and the consumers. Pesticides use was found much greater in Dang district, a Terai district in comparison to Palpa, Hill district. Main reason behind this is the easy availability of pesticides in Terai region due to open border with India. Pesticides enter Nepal easily without any legal procedures. Porous border, easy availability of pesticides, sales of banned pesticides, lack of strict regulation and monitoring system, poor technical knowledge of agroveterinarians, less priority programs to IPM are the other reasons for overuse of pesticides. Pests attack is also found more severe in Terai region. IPM based technical trainings need to be run from the government levels and other organizations to aware farmers about the importance of organic farming. Easy availability of chemical pesticides, lack of government policies in favor of farmers such as subsidies in case of crop failure, labelling system and market price for IPM products, strict regulation of the pesticide industry are the major hindrances in adoption of IPM. IPM practiced by single farmer in small area is found ineffective due to effect of neighboring farms using chemical pesticides. Hence IPM needs to be practiced in the entire block of the community. Long-term implications of pesticide use on human health and environment need to be studied for sustainable agriculture, safety to human health and the environment as a whole.

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