

FINAL REPORT

Impact Assessment of National Integrated Pest Management (NIPM) Program in Nepal



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Executive Summary

The Integrated Pest Management program was initiated with the prime objective of training of trainers and conducting farmer field schools which later on extended to be a preliminary process for sustainable management of agricultural and ecological resources in a given locality. The National Integrated Pest Management Phase II in Nepal is a continuation of the earlier phases initiated, which worked towards institutionalization of IPM in Nepal, financially supported by the Norwegian Government and under technical Assistance of FAO. It has been initiated with the strategy to implement participatory IPM programme using the Farmer Field School approach and to scale up the national program covering 75 districts of Nepal giving primary focus on rural poor. National IPM program in Nepal in terms of Consolidation, Up-Scaling and Institutionalization Phase II was intensively launched in 12 districts representing three ecological zones (Tarai, Mid-hills and Mountains) under five development regions with a goal to contribute to sustainable, broad-based poverty reduction and food security, human health and environmental protection.

This NIPM program is recently completed after the implementation of four years period. Thus, realizing the necessity to assess the extent to which the program had fulfilled its goal in terms of its contribution to sustainable, broad-based poverty reduction and food security, human health and environmental protection, Nepal Development Research Institute (NDRI) was awarded to conduct this impact assessment study. This study assessed the impact in terms of household income, pesticide use, fertilizer use, and social aspects related to the behavior and attitude of the farmers and other stakeholders from the sampled districts and households.

Some of the important indicators for the assessment included were farm and household assets, crop income, livestock income, forestry and agro-forestry income, off farm and non-farm income, pesticide use, type of pesticides, health impact of pesticide use, farmers' participation and decision making. To assess the impact of National IPM program five districts, namely, Sarlahi, Bara, Arghakhanchi, Surkhet and Mustang were selected and accordingly data collection and analysis and report writing were carried out from August 2013 to January 2014. The sampling unit of the Impact study was the same households covered during baseline study. However, six households were not found during the field survey. Therefore, altogether 506 sample households constituting of FFS (203), NFFS (151) and Control (152) were considered for the household survey. The data were analyzed using various statistical, economical and indexing methods. In addition environmental impact quotient (EIQ) analysis was done, by adopting the existing methodology designed by the Cornell University USA, to find out the pesticide risk indicators for this study and subsequently results were compared.

While considering the profile of the sampled households, it was found that the number of literate households has increased more in the sampled FFS households. Further, positive change has been seen in the assets owned by both FFS and NFFS households particularly related to owning land, livestock unit, mobile phones and use of roofing materials. A notable increase in in-country migration and decrease in seasonal migration to India of FFS category has been noticeably found while comparing baseline values

with impact values. The farm size of sampled households found increased in intensive program than the regular one. The significant increase was found in the FFS households of Bara district under intensive program. Results complimented with the findings of increased rented in farm size and decreased in rented out farm size of FFS households. Correspondingly increase in farm size under fully irrigation is found in all FFS households in all districts except in Arghakhanchi. The livestock standard unit (LSU) was reported higher mainly in households under intensive program and Mustang. The impact study revealed the increased cropped area and cropping intensity in FFS households under intensive program with maximum increment was found in FFS of Bara district. Higher proportional increase in area under major crops like rice, potato, tomato, cole crops and cucumber was found in FFS households under intensive programs.

It was found that no household of any farm category was using class 1a pesticides in the impact study period which was not the case during baseline study. In totality, it was also found drastic reduction in type and quantity of pesticide use (e.g. class 1b, class II and lower classes and mixed pesticides), particularly in households under FFS category which confirmed that the NIPM Program had immense impact in safer use of pesticides. Therefore, to develop and maintain a sound environment and to supply healthy food products, the IPM program need not only continued, but also expanded or scaled out intensively in all over the country.

In terms of fertilizers use, the impact value indicated the decrease in nitrogen application and increase in use of FYM in rice, vegetables and cole crop in FFS households. The use of improved rice seeds found increased mainly in the FFS type of households in Surkhet followed by Sarlahi and Bara districts. Similar finding was seen in case of use of improved seeds in tomato and potato.

The income analysis showed that the income from the crops increased in both FFS and NFFS households. In terms of environment and health aspects, the findings indicated that farmers' knowledge and awareness on use of pesticide had increased particularly in FFS households. The significant change was found in adopting the appropriate environmental and health protection measures in both FFS and NFFS households compared to control households. Farmers were found using and storing the pesticide safely which resulted into decreased the cases of annual poisoning on human and livestock. The IPM program was also found helpful to farmers in the identification and preservation of beneficial insects. The benefit cost analysis of major crops was also carried out for all districts and farm groups. Results depicted highest BCR in sugarcane in Sarlahi, lentil in Bara and Arghakhanchi, rice and cole crops in Surkhet, and apple in Mustang. Significant increase in the gross margin of rice was found in FFS household of intensive program followed by the FFS of regular program. In case of rice highest increment in benefit cost ratio was found in FFS group Bara, however BC ratio of potato was found increased in majority of districts. Also, the BC ratio of wheat, maize and cole crops showed significant growth in FFS households.

The membership in any social organization was found increased with the higher percentage of membership in IPM related institution followed by agriculture related organizations mainly in FFS households. It was also found that the IPM-FFS participants had gained a reasonable level of confidence and communication skills after the project.

To sum up, the NIPM program had immense impact in reducing type and quantity of pesticide use and creating social awareness among women and poor farmers, increasing knowledge of pesticide use, and generating higher profit by reducing costs. The overall findings indicated that the household assets and income along with safe use of pesticides have been increased more significantly in FFS household types under intensive program. The use of Class Ia pesticides are totally reduced and in all types of households and programs. However, the use of Class Ib type of pesticides was found negligible in FFS households under intensive program and reduced drastically in other household types and programs. The FFS farmers' confidence had been highly increased in IPM and decision making particularly in intensive program type. The key recommendations based on findings can be summarized as to provide easy access to bio or safer pesticides, reduction in the current level of tax on bio and organic pesticides, strengthening of local agro-vests and monitoring of pesticide markets and market provision on IPM products. The further expansion of the IPM FFS is highly recommended. The current districts under intensive program should be declared as IPM districts.

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1. Introduction

1.1 Background of the Study

The National Integrated Pest Management (NIPM) Programme Phase II in Nepal was launched in 2009. Its strategy was to implement participatory Integrated Pest Management (IPM) programme using the Farmer Field School approach and to scale up the national program covering 75 districts of Nepal and giving primary focus on rural poor. The underlying concept was related to the economic benefits, farmer empowerment and mobilization, strengthening farmer groups/organizations, promote better marketing of safer commodities, and safeguard human health and environment in response to government's national commitments to global biodiversity and environment protection and WTO related issues. The Phase II emphasized consolidation, up-scaling and institutionalization of previous achievements. The programme included women and disadvantaged groups and had improved planning and monitoring so as to ensure equitable access to program benefits. In line with its objectives NIPM focused on rice, vegetables, potatoes, tea, apples and citrus crops.

The NIPM program Phase II had two components—*Intensive* and *Regular*. The difference between regular and intensive is primarily based on the nature of support: yearlong FFS with post FFS support (Intensive) and only one season crops support (Regular). Consolidation, up-scaling and institutionalization phase of the Support to NIPM Programme was the FAO Intensive Component responsible for testing and developing the various tools, technologies, and approaches and practices responsible for the achievement of the four outputs of the NIPM Programme in Nepal. The Intensive component (*Consolidation, Up-Scaling and Institutionalization* Phase II (UTF/NEP/059/NEP) was intensively launched in 12 districts of different ecological zones (Tarai, Mid-hills and Mountains) under five development regions with a goal to contribute to sustainable, broad-based poverty reduction and food security, human health and environmental protection. It started field level implementation of programme planning, site selection and training from July 2009 and continued implementation of its programme activities till 2013. The programme adopted an strategies of scaling up of IPM-FFS and strengthening of IPM-FFS groups/network/ /cooperatives to continue with yearlong FFS and post FFS activities leading to the adoption of appropriate IPM technologies, optimization of production procedures and the development of marketing links for safer commodities.

The Plant Protection Directorate (PPD) Component of the NIPM Programme was called regular component. It covered all the remaining 63 districts (regular) that were not included in intensive component. It initially maintained the existing training capacity in the regular districts through FFS training and IPM Training of Facilitators (ToF) to the farmers and facilitators. With the regular support from PPD, one season long IPM FFS were conducted in the regular districts. After one season long FFS, the groups did not receive further support programs in regular component.

The NIPM program Phase II had two main objectives: (1) to contribute to institutionalizing a sustainable NIPM by strengthening the capacity of PPD, collaborating national, regional and district level training

and extension institutions in the governmental and non-governmental sector to integrate IPM training and support program for smallholder farmers; and (2) to empower farmers to increase production and productivity efficiently by linking to market while protecting the environment, conserving the biodiversity and avoiding health hazards for betterment of their livelihood. Thus, the main purpose of the Phase II was to institutionalize and scale up IPM programme for the commercialization as well as sustainable agriculture in the selected districts of Nepal.

At the end of the four years period, It was deemed necessity and considered as an appropriate time to assess the extent to which the Program had fulfilled its goal in terms of its contribution to sustainable, broad-based poverty reduction and food security, human health and environmental protection. Accordingly, an impact assessment study was envisioned, designed and completed. The study assessed the impacts of the NIPM Program in Nepal (*Consolidation, Up-Scaling and Institutionalization* Phase II) in terms of household income, pesticide use, fertilizer use, and social wellbeing and other aspects related to the behavior and attitude of the farmers and other stakeholders from the selected study sites. Some of the important indicators for the assessment included were farm and household assets, crop income, livestock income, off farm and non-farm income, pesticide use, type of pesticides, health impact of pesticide use, and farmers' participation and decision making.

The Nepal Development Research Institute (NDRI) was awarded research fund to conduct this impact assessment study. Accordingly, a Letter of Agreement (LOI) between Food and Agriculture Organization (FAO) of the United Nation under Support to NIPM Program in Nepal: *Consolidation, Up-Scaling and Institutionalization* Phase II (UTF/NEP/059/NEP) and Nepal Development Research Institute(NDRI), Pulchowk, Lalitpur was signed on August 20, 2013.

1.2 Research Questions

The impact study considered the following research questions:

- What changes have come out in terms of household income and expenditure of FFS, Non-FFS, and Control Farm Households at the end of the project period?
- What changes have occurred in terms of land use, cropping pattern, crop productivity and cropping intensity of FFS, Non-FFS, and Control Farm Households at the end of the project period?
- What changes have occurred in terms of types, and extent of pesticides, chemical fertilizers and seeds used by FFS, Non-FFS, and Control Farm Households at the end of the project period?
- What changes have occurred in terms of perception on health and environmental implication of pesticides and chemicals used by FFS, Non-FFS, and Control Farm Households at the end of the project period?
- What changes have occurred in terms of level of participation and decision making on farm and community activities by FFS, Non-FFS, and Control Farm Households at the end of the project period?

- What changes have occurred in terms of level of self-confidence of using sustainable farming technologies among FFS, Non-FFS, and Control Farm Households at the end of the project period?
- What changes have occurred in terms of level of satisfaction among FFS, Non-FFS, and Control Farm Households with the level of crop yields at the end of the project period?

1.3 Objectives

The overall objective of this study was to assess the impacts of the NIPM Program (*Consolidation, Up-Scaling and Institutionalization* Phase II) in Nepal. The specific objectives were:

1. To assess the household income and expenditures,
2. To assess the type of pesticides used by source, types (name of the product, formulation/composition/AI), quantity, frequency & timing, and cost by each crop,
3. To assess the awareness and protection measures undertaken for the safe use of pesticides and poisoning cases,
4. To assess types and amount of fertilizers and seeds used from the perspective of national integrated pest management,
5. To assess the level of participation and decision making, self-confidence, working in the group and the satisfaction level with the induced services of Integrated Pest Management Project.

1.4 Organization of the Report

This report contains fourteen chapters. The first chapter briefly introduces the NIPM Program and discusses on the context, research questions and objective of the impact study. The second chapter deals with the methodology. It mainly discusses on the research design, conceptual and sampling frameworks, various tools and techniques used for collecting and analyzing primary data. The third chapter is about the brief profile of the study districts. It mainly discusses on demography, land use patterns, development indicators, crop and livestock production and productivity. The fourth chapter mainly deals with the socioeconomic characteristics of the sampled households and comparing before and after project scenario. Chapter five gives the brief overview of farm and household assets of the sampled households such as landholding size, livestock herd size, type of house, and household stuff or materials. Chapter six explains about the land use and crop productivity. Pesticide use in major crops and their hazardness are presented in chapter seven. Chapter eight and nine are on fertilizer and seed use in different crops by program and household type. Environmental and health aspects of pesticide application are given in chapter ten. Chapter eleven presents the household income and expenditure. Chapter twelve presents cost benefit analysis of major crops. Social capital, participation and decision making by program and household type are given in chapter thirteen. Finally, Conclusion and recommendations are given in chapter fourteen.

2. Methodology

The research methodology included the two major aspects: conceptual framework and the entire study process. The conceptual framework depicts the type and level of research, survey organization, followed by data processing and outputs (Figure 2.1). The entire study process included different activities performed in terms of survey organization, data collection, data analysis, and report writing.

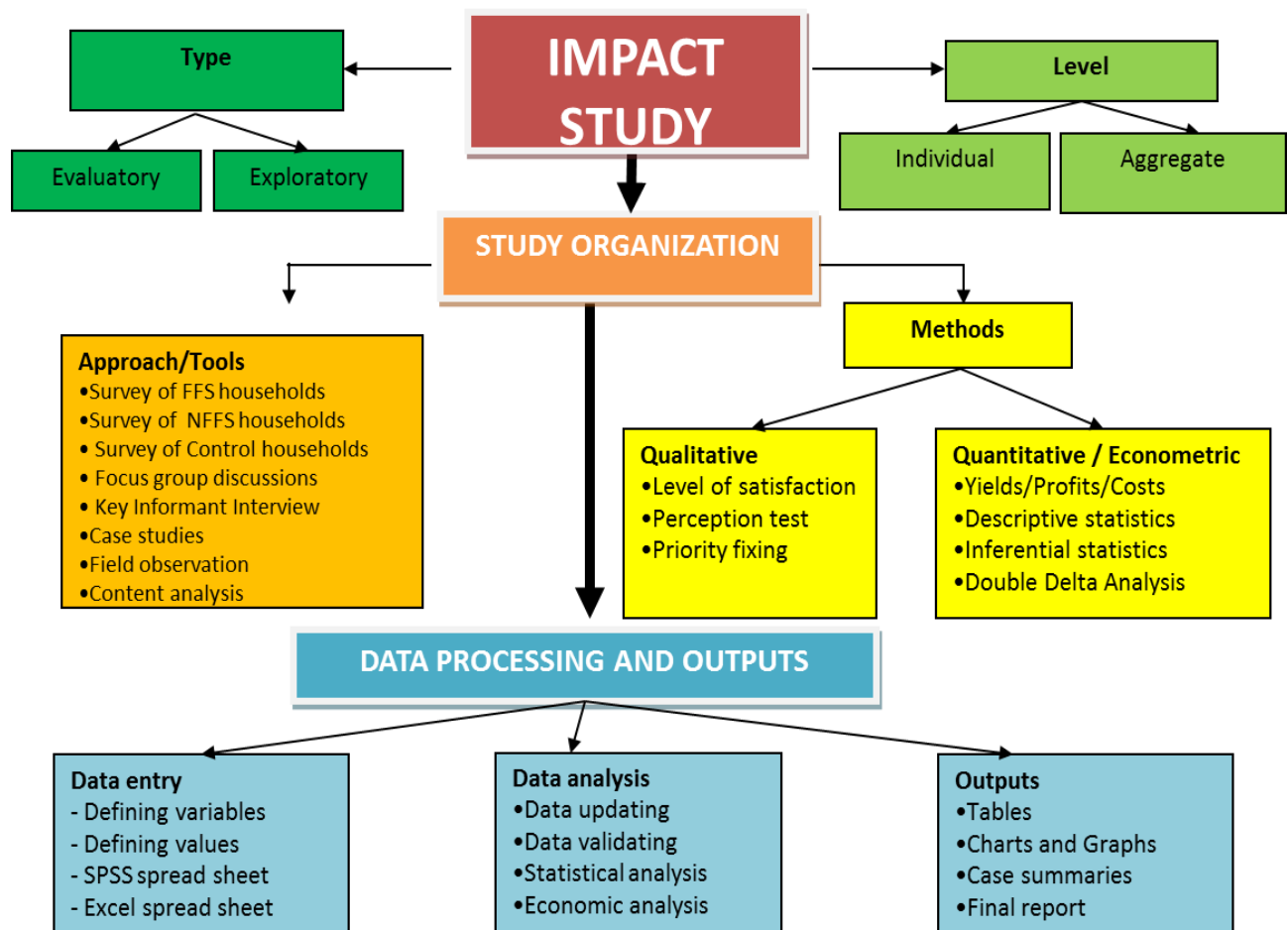


Figure 2.1: Schematic Diagram of Conceptual Framework

2.1 Survey Organization

The survey organization included activities related to developing study indicators, questionnaires and interview checklists, hiring and training of enumerators, pre-testing and finalization of questionnaire, and data collection and analysis techniques.

The impact indicators are the both baseline and impact values in terms of household income, pesticide use, seed and fertilizer use, and social and health aspects as identified. The baseline values are based on the baseline study 2010 (**Appendix 2. 1**) while the impact values are calculated based on this impact assessment.

The basis of developing questionnaire was the baseline and impact indicators. The complex and simple variables were developed from each indicator of different project themes. A semi-structured questionnaire developed for the household survey. The trained enumerators took the interview of the sampled household heads/respondents. The quality of data heavily depends upon the quality of questionnaire and the enumerators. The basic qualification of the enumerators was bachelor completed or ongoing in related subjects, such as agriculture, environment, economics/commerce, rural development, and sociology and anthropology. The study team adopted suitable procedures to select the best enumerators. Two-day of orientation training to the enumerators was provided which ensured the thorough understanding of the given set of questionnaires and field survey techniques. The household survey data were supplemented or complemented by the data and information received from focus group discussions, key informant interviews, interaction meetings, workshops, and field observations. The impact study, 2013 considered to cover the same sampled households of the project baseline study in 2010.

The intensive component of the NIPM program covered 12 pilot districts representing from all three agro-ecological areas: high hill, hill and Tarai. They were 2 high hill districts (Mustang and Jumla), 5 Hills (Ilam, Kavre, Syangja, Surkhet, Dadeldhura) and 5 Tarai (Jhapa Bara, Kapilvastu, Banke, Kailali). Similarly, high value crops: seasonal and off seasonal vegetables, ginger, tea, citrus and apple are the main crops included in the FFS training and education. Yearlong FFS and post FFS support programs were implemented in the 10 pilot districts of hills and Tarai through DADOs in 2009 and 2010; whereas two hill districts (Jumla and Mustang) had FFS in apple starting lately in 2011 onwards. As a result these districts received only one year post FFS support programs, whereas the remaining intensive pilot districts in hills and Tarai received more than two consecutive post FFS support programs from winter season 2010/11. It was mainly due to lack of technical IPM facilitators to plan, manage and conduct the

planned IPM FFS in Jumla and Mustang districts. Thus, though the two high hill districts (Jumla and Mustang) are also intensive pilot districts but beneficiary farmers and groups received less support as compared to other intensive pilot districts. Considering these facts, Mustang has been separated from the Intensive Program while analyzing and assessing impact against baseline study.

Thus program districts which received continuous support to run the IPM program from NIPM program throughout the four consecutive years were considered as intensive program districts. Thus, Bara and Surkhet districts represented intensive component whereas Sarlahi and Arghakhanchi districts which were supported through PPD (department of agriculture) and received support for only one season of FFS considered as regular program district. As mentioned earlier, Mustang district was separated from the intensive program as it received less support from the project. Thus it has been grouped separately though it was grouped as intensive districts during baseline study. It means all programs along with a cross cutting theme called as institutionalization was taken into account while selecting the study sites and sample size. The selected sites and samples had also representation from three different agro-ecological zones of the country. The five districts, namely, Sarlahi, Bara, Arghakhanchi, Surkhet and Mustang used for baseline study were used for the impact study as well (Figure 2.2). The Sarlahi and Bara are Tarai districts, Arghakhanchi and Surkhet are in Hills and Mustang is the Mountain district of Nepal. There were altogether 506 sample households (**Table 2.1**) constituted by FFS (203), NFFS (151), and Control (152) categories were surveyed in this impact study as against 512 households in the baseline study. The size of the sample households was reduced by six due to permanent migration of the farmers from Surkhet (2 households) and Arghakhanchi (4 households).

Table 2.1: Sample Size by different Categories

Program	District	VDCs	Household Type			Total
			FFS	NFFS	Control	
Regular	Sarlahi	Haripur	45	30	0	75
		Sasapur	0	0	30	30
	Arghakhanchi	Argha	15	9	0	24
		Khanchikot	14	8	0	22
		Kimdanda	15	11	0	26
		Pali	0	0	30	30
	Sub-total		89	58	60	207
Intensive	Bara	Bhalui Bhunwalia	0	0	30	30
		Babuyeen	45	30	0	75
	Surkhet	Sahare	38	33	0	71
		Pokharikanda	0	0	33	33
	Sub-total		83	63	63	209
Mustang	Mustang	Tukuche	30	30	0	60
		Kagbeni	0	0	30	30
	Sub-total		30	30	30	90
Grand Total			203	151	152	506

2.2 Data Collection

Required data were collected through both primary and secondary sources. The primary data were collected through household survey (FFS member households and non-member households and as control households), focus group discussions, case studies, and key informant interview. The secondary data were collected from the related project documents, previous studies and governmental and non-governmental organization. A semi structured interview schedules developed and administered to the sampled FFS households, non-FFS households (NFFS) of the FFS villages, and control households to get in-depth responses about socioeconomic data, data related to agricultural practices, pesticide use, IPM production, and information related to FFS and knowledge, practice and attitude towards IPM technologies. The household survey was carried out with the help of carefully selected and trained 21 enumerators lead by two Research Associates (RAs). The field survey was carried out in five districts, namely; Bara, Sarlahi, Surkhet, Arghakanchi and Mustang (Figure 2.2).

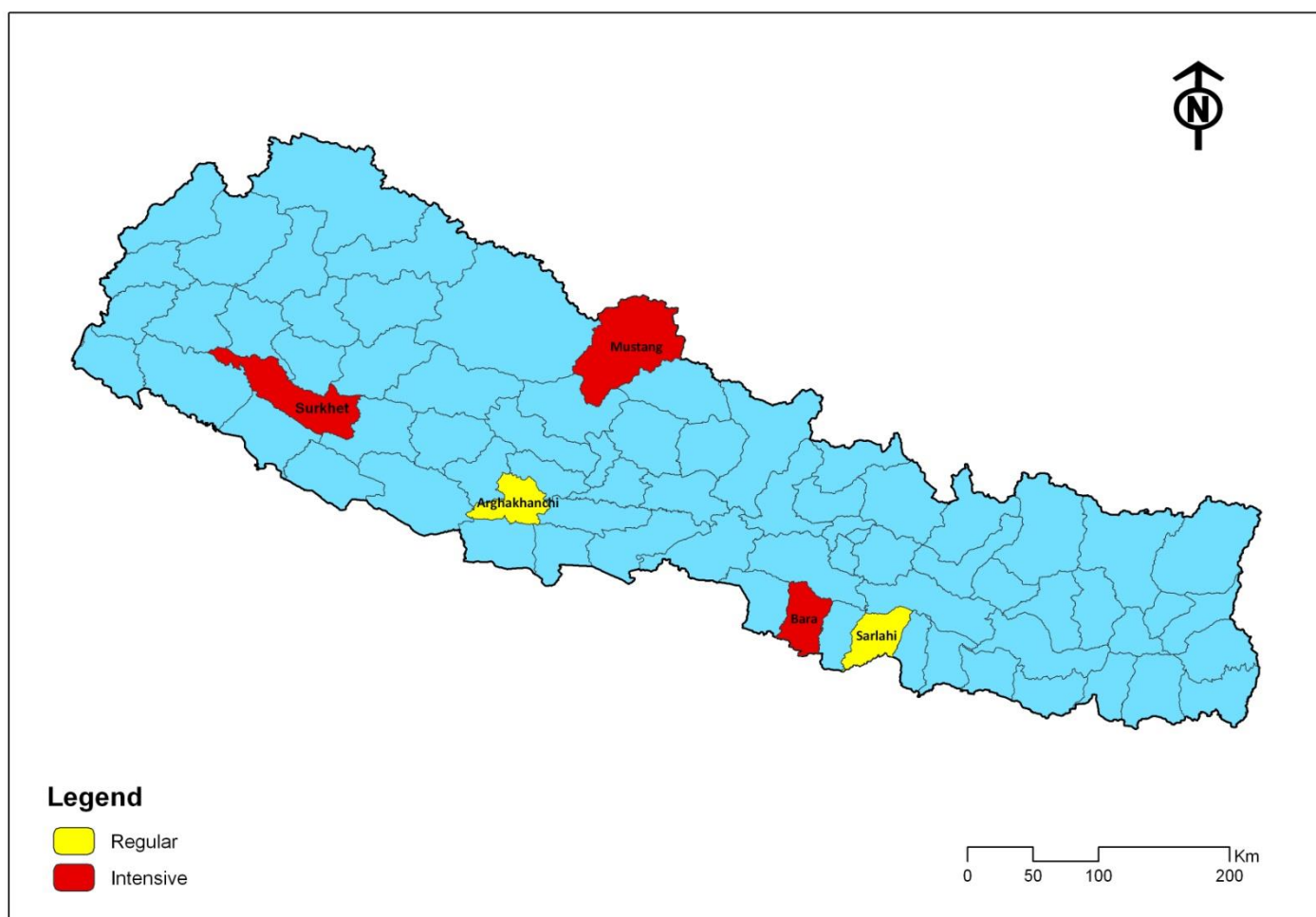


Figure 2.2: Map of Nepal Showing Districts under Study by NIPM Program

The field work for four districts (Sarlahi, Bara, Surkhet and Arghakhanchi) was completed in the first week of September 2013 and whereas in Mustang it was completed in October (Appendix 2.2). At least one FGD in each study VDC was conducted with the FFS, NFFS and Control participants to identify the impact of the IPM-FFS. In these, 8 to 12 carefully selected participants freely discussed issues, ideas, and experiences among themselves. A moderator (research associates) introduced the subject, kept the discussion going, and tried to prevent domination of the discussion by a few participants. Focus groups were homogeneous with participants of similar backgrounds and as much as possible. However, some mixed FGD were conducted as per the local socioeconomic milieu. FGD enabled to identify the existing status of the project interventions, success story, failure cases and suggestions and comments for improvement in future. Checklist was prepared to orient and conduct the FGDs. The Key Informant Interviews were done focusing on knowledge and experience in IPM-FFS related issues. The interviews was guided by a checklist of topics/issues or open-ended questions. Information was related to status and progress on IPM policy and standard formulation, pesticide use policy formulation, and effectiveness of FFS.

An informal discussion with local stakeholders and people of different backgrounds and social identities was conducted to identify key actors and agents of the project and to explore the underlying socioeconomic, cultural and political situation that have shaped the life circumstances of the men and women of the communities of the project areas. The research team observed and recorded what they saw and heard at a research sites. The information was related to physical surroundings or about ongoing activities, processes, or discussions about project activities. Some illustrative case studies were carried out related to the pesticide poisoning cases, treatment cost of poisoning cases, and protection measures. The team briefed the findings in different meetings organized by NIPM Project and FAO in the presence of FAO Nepal representatives at different time periods and even in the Wrap Up meeting of the NIPM Project on 28 January 2014, Kathmandu Nepal. The comments and suggestions gathered during such different meetings and workshops are incorporated in this final report.

In the beginning the thorough review of the project documents was made provided by FAO, PPD and NIPM Project office. The secondary sources were used to collect data and information such as the number of FFSs currently in place in different districts, VDCs and wards; number of IPM training conducted; number of Government Officers, JT/JTAs, and farmer facilitators who received IPM training; number of farmers participated /benefited from National IPM Project; number of farmer's associations; the curricula/content of the training documents; IPM curricula being included by different institutions; the content of the constitution of FFSs; the status and progress of IPM National Standard Development; status and progress of IPM Ecological guide Development; and technical and financial norms currently adopted to run FFS by GOs/NGOs.

2.3 Data Analysis

The commonly used Statistical Package for Social Science (SPSS version 17) and Excel used to enter and analyze data. Before venturing into the data analysis, data updating and validating was done. As per requirements, some intervening variables were developed for cross-tabulations. The statistical and economic analyses were made. The cost benefit analysis was done for the selected crops for different seasons by the FFS households versus non-FFS and Control households. There are certain agricultural inputs which are not marketed and always difficulty in estimating their costs. For instance, farmers use farm yard manure in a significant amount but the cost per unit manure is not fixed. For such items, per unit cost was estimated based on local transactions in the corresponding villages, after verifying through discussions with farmers and key informants. The calculation of both return and cost makes sense without which it is always difficult to identify which crop or enterprise is more beneficial or profitable. The popularly known benefit-cost (BC) ratio was estimated in order to know whether crops grown by the FFS households are economically viable or not. Minimum BC ratios of 1.25 for the industrial sector and 1.5 for the agricultural sector have been fixed for any enterprise or crop to be economically viable. According to this standard any agricultural crop must maintain a 1.5 ratio to be economically sustainable (Bhandari, 1993:230).

The linear regression model was used assuming that there is a linear, or "straight line," relationship between the dependent variable and each predictor or independent variable. This relationship was described by using the following formula:

$$y_i = b_0 + b_j x_{ij} + \dots + b_p x_{ip} + e_i$$

Where,

- y_i is the value of the i th case of the dependent scale variable
- p is the number of predictors
- b_j is the value of the j th coefficient, $j=0, \dots, p$
- x_{ij} is the value of the i th case of the j th predictor
- e_i is the error in the observed value for the i th case

The model is linear because increasing the value of the j th predictor by 1 unit increases the value of the dependent by b_j units. In this regression model, b_0 is the intercept, in which the value of every predictor is equal to 0. The regression analysis is useful to see the level of contribution of different factors in crop yields, farm and household incomes of the FFS households versus non-FFS or Control households.

The double delta analysis was made to see the effect of NIPM considering FFS village and control village and before and after situations. Through this approach, different impacts related to economic, environmental, and social was assessed. The basic idea of the double delta method is to model the effect of FFS training by estimating the difference between before and after the training for both for FFS

participants and non-participants (both non FFS of the FFS village and control Village) and the comparing the difference between these different groups (Figure 2.3).

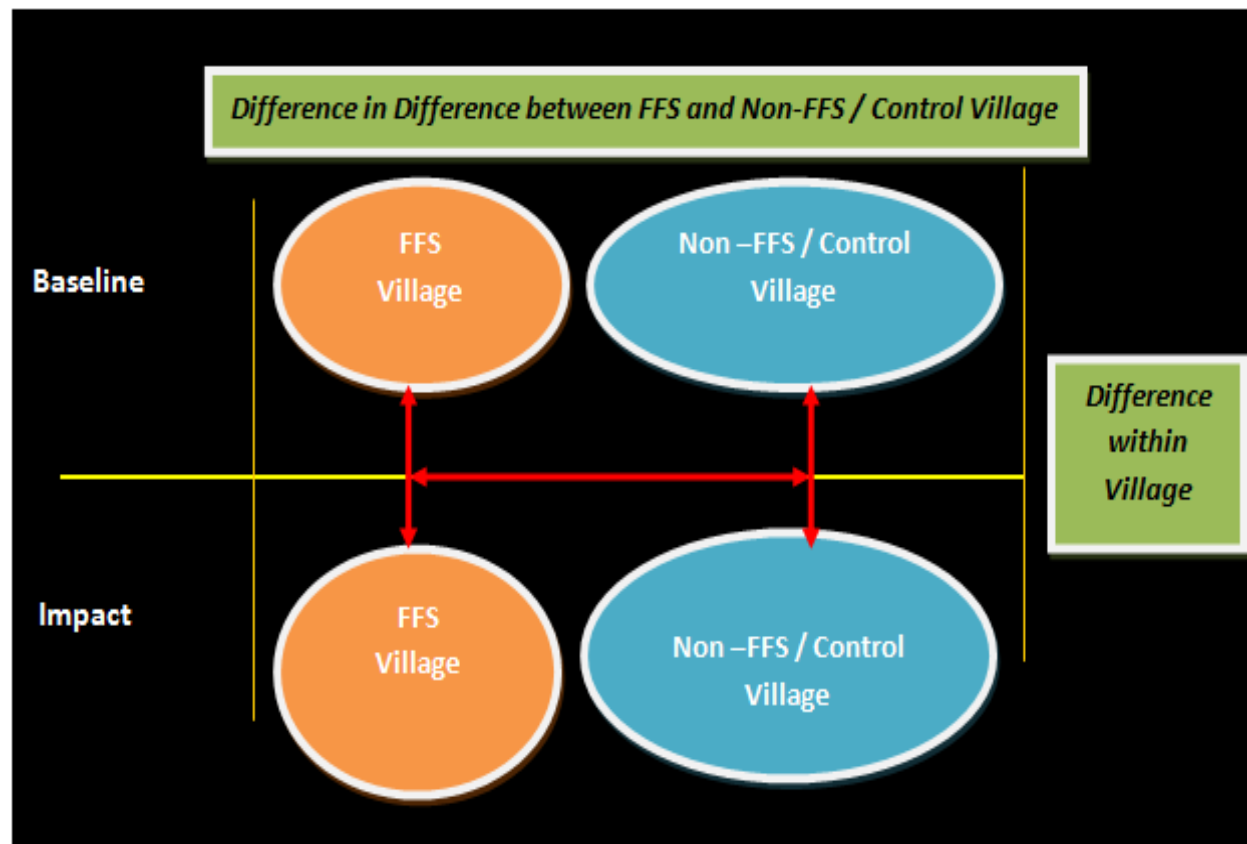


Figure 2.3: Approach of Double Delta Method

Scaling technique was used which describes the procedures of assigning numerals to various degrees of opinion, attitude and other qualitative types of responses. Scaling can be done in two ways viz., (i) making a judgment about some characteristic of an individual and then placing him/her directly on a scale that has been defined in terms of those characteristics and (ii) constructing questionnaires in such a way that the score of individual's responses assigns him/her a place on a scale. Numbers for measuring the distinctions of degree in the attitudes/opinions are, thus, assigned to individuals corresponding to their scale-positions. The weighted index value was calculated after the data or information gathered through scaling techniques. The index value calculated by using following formula:

$$I = \frac{\sum s_i f_i}{N}$$

Where, I = index for agreement such that $-2 \leq I \leq +2$

s_i = scale value at ith agreement

f_i = frequency of ith agreement

$N = \text{total no. of observations} = \sum f_i$

The environmental impact quotient (EIQ) analysis was done by adopting the existing methodology designed by the Cornell University USA to find out the pesticide risk indicators. This is a basically 3 level of scaling technique in which 1 denotes as little effect, 3 denotes moderate effect and 5 denotes high to very high effect. The main variables considered for the EIQ analysis are Long-term health effects (symbol/denoted by: C), Dermal toxicity (Rat LD₅₀, symbol: DT), Bird toxicity (8 day LC₅₀, symbol: D), Bee toxicity (symbol: Z), Beneficial arthropod toxicity (symbol: B), Fish toxicity (96 h LC₅₀, symbol: F), Plant surface half-live (symbol: P), Soil residue half-live (Tl/2, symbol: S), Mode of action (symbol: SY), Leaching potential (symbol: L) and Surface runoff potential (symbol: R). The EIQ values of all the pesticides applied to study areas were calculated as below:

$$\text{EIQ} = (\text{EI Farm worker} + \text{EI Consumer} + \text{EI Ecology})/3$$

where EI Farm Worker = EI Sprayer + EI Picker

where EI Sprayer/Applicator = $C \times (DT \times 5)$ and EI Picker = $C \times (DT \times P)$

EI Consumer = EI Consumer + EI Ground Water

Where EI Consumer = $C \times ((S + P)/2) \times SY$ and EI Ground Water = L (leaching potential) and

EI Ecology = EI Fish + EI Bird + EI Honey Bee + EI Natural Enemies,

where EI Fish = $F \times R$, EI Bird = $D \times ((S + P)/2) \times 3$, EI Honey Bee = $Z \times P \times 3$ and EI Natural Enemies = $B \times P \times 5$.

The values for all the pesticide risk indicator variables were obtained from documented materials, such as pesticide use instruction leaflets, research papers, books, internet, etc.

Field EIQ of the applied pesticides was calculated as follows:

Field use EIQ = Hazard (EIQ value) $\times$ % active ingredient in formulation $\times$ Rate (pints or pounds/acre) $\times$ Number of applications.

Amount of each pesticide formulation used per unit area and total number of applications per crop per season was obtained from the respective farmers. Other pesticide use indicators, such as pesticide sales statistics, total area treated by each farmer/household, and cost per hectare were obtained from the users/farmers, local pesticide dealers and extension workers.

Eco-friendly and sustainable pesticides were acquired from botanical and / or biological sources which could be good alternatives to the commonly used chemical pesticides in the area. This enhances the number of species and population levels of the natural enemies of epiphytotic/important plant diseases/pathogens and insect-pests in the major crops.

3. District Profile

The five sampled districts, namely, Sarlahi, Bara, Arghakhanchi, Surkhet and Mustang are located within the range of 26° 45' to 28° 30' north latitude and 80° 45' to 85 ° 20' degree east longitudes. Sarlahi and Bara represent Tarai region, Arghakhanchi and Surkhet stand for hill region and Mustang belongs to high mountain region of Nepal. Southern borders of Sarlahi and Bara districts adjoin with the Bihar state of India whereas the northern border of Mustang district connects with Tibet. Physical location and political boundary of the each sample district are given in **Appendix 3. 1**.

3.1 Demography

Of the five districts, Sarlahi has highest population while Mustang has lowest population according to the census data of 2001 and 2011. The variations in location and topography are not evenly matched by variations in demography. Despite marked variations in population density across districts, variations in terms of household size and sex structure of the population are minimal (**Appendix 3.2**).

Sarlahi district in the Tarai, which is relatively small in size, is densely inhabited (more than 500 persons per sq km) whereas Mustang district in the Mountain, which is relatively bigger in size, is less inhabited (only 4 persons per sq km). However, literacy rate varies by district which ranges from a lowest of 46 percent in Sarlahi to maximum of 73 percent in Surkhet as per the 2011 census of the literacy rate.

3.2 Female Headed Households

The 2001 census defined household headship as the person who usually managed the household affairs. Among the sampled districts and as per 2011 census, the largest proportion of female headed households is concentrated in Arghakhanchi district (42.5%) followed by 29.91% in Surkhet, 23.76% in Mustang, 11.09% in Sarlahi and the lowest percentage is in (7.6%) in Bara district. Ecologically also, the largest proportion of female headed households are concentrated in hill, followed by Tarai and mountains (CBS, 2012).

3.3 Development Indicators

The composite index of development ranges from 1 to 75 since Nepal has 75 districts. The development index 1 indicates the most developed district and the 75 denotes the least developed district. Of the five sampled districts, Sarlahi is ranked as 61 whereas Mustang is ranked as 19 in terms of overall composite development index. Percentage of irrigated area defined as a percentage of operational agricultural land is highest in Mustang district (82.62%) with lowest percentage (10.66) of irrigated area in Arghakhanchi

area. In terms of women empowerment index, Mustang has a ranking of 17th while Bara belonged to 67th position among the 75 districts of the country. Bara has the highest per capita food production followed by the lowest per capita food production by Mustang district. Farm size among the sampled districts varies from 0.47 hectare in Mustang to 1.03 hectares in Sarlahi. Similarly, marginalized farm households (farm size < 0.5ha) is the highest (53.91%) in Arghakhanchi and the lowest marginal farm households (21%) are in Sarlahi district. The details are presented in the **Appendix 3. 3**.

3.4 Land Use Patterns

Land use pattern varies drastically among the survey district. Nearly 63% of the land is cultivated in Sarlahi district which is the highest in the sample district with the lowest cultivated area in Surkhet district (i.e.17%). About 70% of the total land is occupied by forest in Surkhet and only 17% of the land is for cultivation purpose. Similarly for Mustang, Arghakhanchi and Bara most of the land is under cultivation (**Appendix 3.4**).

3.5 Crop Productivity

The sampled districts provide a diversity of geographical conditions, making it possible to cultivate major cereal crops such as paddy, maize, wheat, millet, and barley. Productivity of major cereals in the sampled district is presented in the following **Table 3. 1**.

Table 3. 1: Productivity (Mt/ ha) of Major Cereals in Sampled Districts

Program	District	Rice	Maize	Millet	Wheat	Barley
Regular	Sarlahi	3.65	4.10	1.00	2.40	1.50
	Arghakhanchi	3.20	2.49	1.20	1.70	0.89
	Total	3.57	3.10	1.07	2.25	1.38
Intensive	Bara	4.20	4.10	1.28	3.20	1.20
	Surkhet	3.72	2.84	1.34	3.05	1.32
	Total	4.10	3.24	1.33	3.14	1.28
Mustang			1.54		1.80	1.85
Nepal		3.31	2.50	1.13	2.41	1.25

Source: MOAD, 2011/12.

Similarly the productivity of the major cash crops (oil seed, potato and sugarcane) and vegetables (cauliflower, cabbage, radish, tomato, cucumber etc.) is presented in the Table 3.2.

Table 3. 2: Productivity (Mt./ha) of Major Cash Crops and Vegetables in Sampled Districts

Program	District	Oilseed	Potato	Sugarcane	Vegetables
Regular	Sarlahi	0.76	14.80	45.00	13.22
	Arghakhanchi	0.90	12.09	20.00	12.75
	Total	0.79	13.81	44.99	13.15
Intensive	Bara	1.09	17.07	42.00	19.40
	Surkhet	0.83	19.12	20.71	15.90
	Total	0.93	17.29	41.66	18.92
Mustang		0.83	12.80	0.00	13.37
Nepal		0.83	13.58	45.45	13.46

Source: MOAD, 2011/12.

3.6 Animal Husbandry

Livestock is an important component of agriculture and contributes to a larger extent in the household economy of the sampled districts. Cattles, buffaloes, poultries, goats and pigs are the major livestock reared in the sampled districts. All types of livestock population in Sarlahi district constituted the largest size. Sheep are mainly domesticated in Surkhet and Mustang districts. The following Table 3.3 shows the livestock distribution in the sampled districts in terms of number (head counts).

Table 3. 3: Livestock Population and their Distribution in Survey Districts

Program	District	Cattle	Buffalo	Sheep	Goat	Pigs	Fowl	Duck
Regular	Sarlahi	114987	69383	1905	170719	6548	341254	9071
	Arghakhanchi	49102	96015	1143	85994	2932	277812	121
	Total	164089	165398	3048	256713	9480	619066	9192
Intensive	Bara	112785	75979	245	144999	18344	274753	17602
	Surkhet	141935	56300	10162	214684	12339	754876	7551
	Total	254720	132279	10407	359683	30683	1029629	25153
Mustang		7695	88	5345	19992	3	16311	5
Nepal		7244944	5133139	807267	9512958	1137489	45171185	376916

Source: MOAD, 2011/12.

4. Sample Household Profile

This chapter demonstrates the information on different types of households surveyed their caste and ethnicity, number of female-headed households, household illiteracy, household size, average farm size, remittances, and non-farm income.

4.1 Household Types

As mentioned earlier sections, this study was to collect the impact data in order to compare with baseline value so that the purpose of impact assessment can be met. For this, the survey households were designed into three categories namely, FFS, NFFS, and Control. In some places of Bara and Surkhet districts the IPM program were started even before the baseline survey. However, in Mustang district there was no formation of FFS and was formed during the course of baseline data collection. **Table 2.1** provides the detail information on sample household types by VDCs and districts done during the impact study. The total number of households in the impact was slightly less compared to the baseline study (i.e. decreased from 512 household size to 506) due to out-migration of six households from Surkhet and Arghakhanchi districts.

4.2 Household Head

The designation head of household, is applied to one whose authority to exercise family control and to support the dependent members is founded upon a moral or legal obligation or duty. In Nepal, household head takes all the crucial decision in terms of farm as well as household activities. Thus, the characteristics of household head in terms of gender, age, education, and occupation matter a lot in making rational decisions. While conducting the impact survey majority (more than 50%) of the household head appeared as respondents. Among the total household heads nearly 90% of the household heads are male and merely 10% were female. The district wise statistics indicated that the highest proportion (i.e. 100%) of male household heads was found in FFS group of Bara and Mustang district followed by 97 percent of NFFS group in Surkhet. Overall 89 percent of the household heads were males (**Table 4.1**). This data also corresponds with the baseline data conducted in the same district.

Table 4. 1: Percent Household Head by Districts and Gender

Program	District	Gender	Baseline				Impact			
			FFS	NFFS	Control	Total	FFS	NFFS	Control	Total
Regular	Sarlahi	Male	93.3	86.7	100	93.3	93.3	96.7	100.0	96.2
		Female	6.7	13.3	0	6.7	6.7	3.3	0.0	3.8
	Arghakhanchi	Male	82.2	86.7	80	82.9	86.4	89.3	86.7	87.3
		Female	17.8	13.3	20	17.1	13.6	10.7	13.3	12.7
Intensive	Bara	Male	97.8	93.5	96.7	96.3	100.0	93.3	96.7	97.1
		Female	2.2	6.5	3.3	3.7	0.0	6.7	3.3	2.9
	Surkhet	Male	84.2	97.2	90.3	90.5	84.6	97.0	87.5	89.4
		Female	15.8	2.8	9.7	9.5	15.4	3.0	12.5	10.6
Mustang		Male	90	70	86.7	82.2	100.0	80.0	85.7	88.6
		Female	10	30	13.3	17.8	0.0	20.0	14.3	11.4

Source: Baseline Survey 2010 and Impact Study 2013.

4.3 Average Age of Sample Household Head

Table 4.2 presents the average age of the household head in both baseline and impact study. The minimum and maximum age of FFS household head (**Appendix 4. 1**) for Sarlahi district was found 32 and 78, respectively. Similarly, 26 and 80 for Bara, 27 and 83 for Arghakhanchi 25 and 80 for Surkhet, and 30 and 83 for Mustang were reported minimum and maximum age of the household head, respectively.

Table 4. 2: Average Age of Sampled Household Head (Years)

Program	Household type	Baseline	Impact
Regular	FFS	50.06	53.05
	NFFS	52.03	55.03
	Control	51.48	54.48
Intensive	FFS	48.16	51.14
	NFFS	48.53	51.53
	Control	47.69	50.67
Mustang	FFS	53.73	56.13
	NFFS	51.33	54.30
	Control	50.33	53.50

Source: Baseline Survey 2010 and Impact Study 2013.

4.4 Education Level of Household Heads

It was found that there was not much change in education level of household head. The percent of illiterate in FFS type of household had decreased in all districts compared to the baseline value. Similarly, the percentage of illiterate had somewhat decreased in NFFS type of household except for

minimal increase in Bara district. The impact values showed that majority of the household head in FFS were literate (more than 50%) with most of them having Secondary level education. **Appendix 4.2** presents the education level of the household head in both baseline and impact study.

4.5 Household Heads by Main Occupation, District and Household Type

The impact study showed that majority of household head of FFS type households' i.e. 78% were involved in agricultural activities, which is close to baseline value 77 percent (Figure 4.1). Apart from agricultural activities, few household heads in FFS type were also found involved in service (i.e. nearly 7%). Similarly, majority of the household head in all NFFS and control type was involved in agricultural activities. **Appendix 4. 3** presents the occupation of the household head in both baseline and impact study by district and household types.

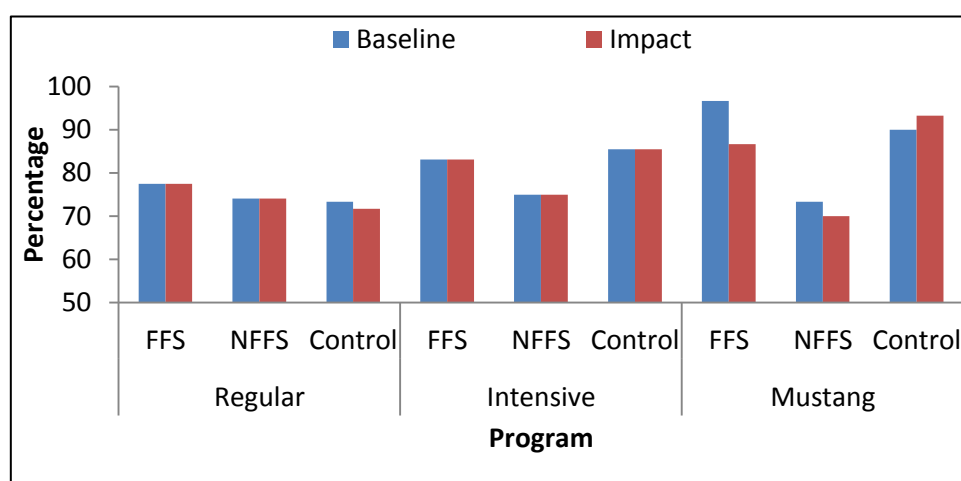


Figure 4. 1: Household Heads with Agriculture as Major Occupation by Program and Household Type

4.6 Family Characteristics

The family characteristics such as gender composition, household size, education, occupation, household assets and migration status highly affect the overall income of the household. Therefore, these family characteristics were considered most important features of the study. In comparison to baseline values, Figure 4.2 and Appendix 4. 4 indicate total population by district and household type. The total population is found slightly decreased in Sarlahi, Bara, and Surkhet in comparison to baseline values.

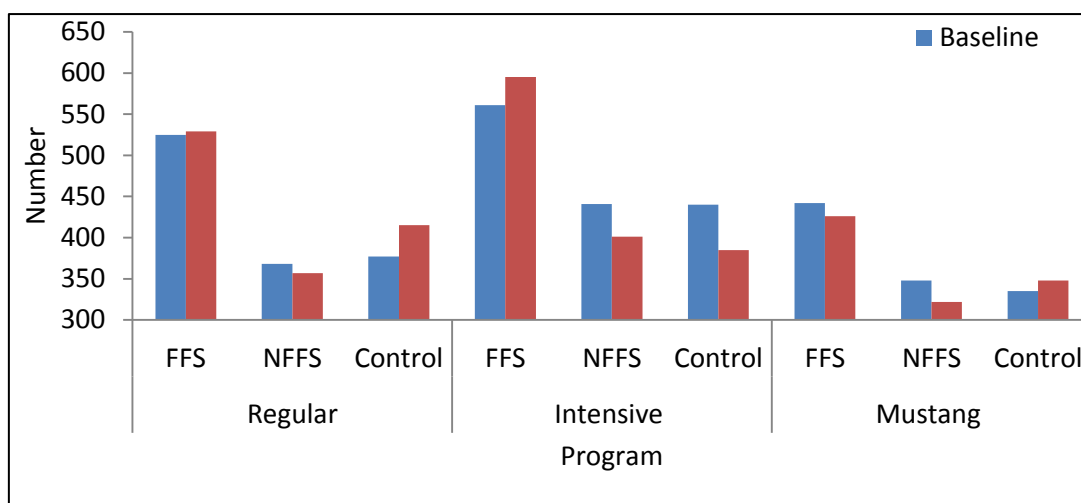


Figure 4. 2: Total Population by Program and Household Type

The total population was found increased in FFS type except in Arghakhanchi and Surkhet districts, where the percentage change was found as -10% and -0.8%, respectively. Similarly, looking at the overall average household size and comparing with the baseline values showed that except for the Sarlahi and Mustang district, the average household size was decreased. Regarding the household size of the FFS type of household, increase in average household size was found for all the sampled districts except for Arghakhanchi and Surkhet. Corresponding to increase in total population in Sarlahi the household size was also increased. In terms of gender composition in the households, the entire sampled districts had the highest population of male than the female population. The gender composition of the FFS type of household also showed higher population of male than the female in the total surveyed household which is in consistent with the baseline survey data.

4.7 Household Illiteracy

Figure 4.3 shows the literate and illiterate status of different household types. The illiteracy level decreased in all types of household when compared impact values with baseline values. However, the highest percentage change in terms of decrease in illiteracy was observed in FFS type of household. The percentage of literate population was found increased significantly by nearly three times in FFS type of household compared to the baseline Value.

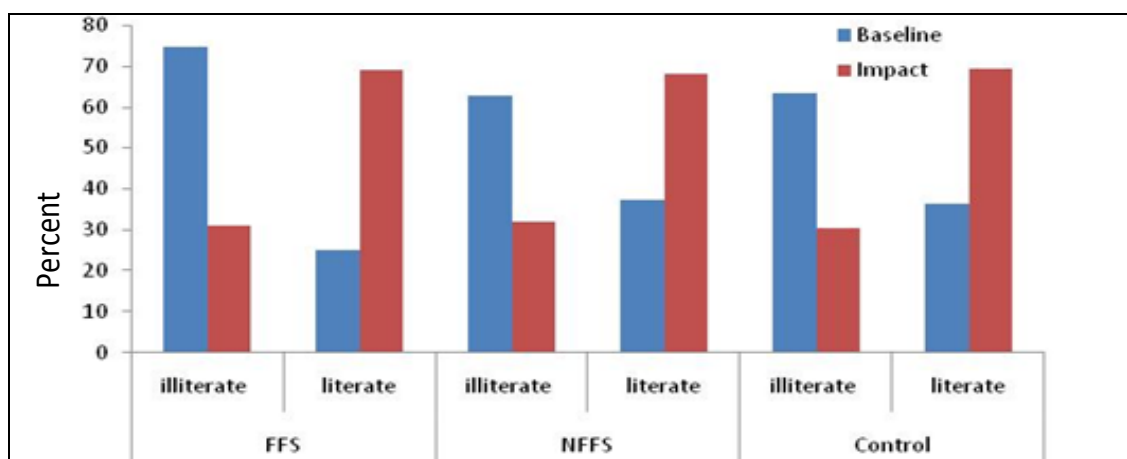


Figure 4. 3: Percent of Literate and Illiterate People by Household Type

4.8 Remittances

Remittance in the form of cash or in kind has always been one of the major sources of household income in Nepal. In the sampled districts also, remittances coming from different sources such as within the country, from India, and from foreign countries were found major part of household income. Average amount of remittance received by household was found decreased in FFS household of regular, intensive and Mustang. However, somewhat increment in average annual remittance received by household resulted in control households. Some variation was observed for NFFS household depending on types of program, which means, it was found decreased average annual remittance per household in NFFS under regular and Mustang while it was increased under intensive program (Table 4.3).

Table 4. 3: Average Cash Income (NRs.) of Sampled Households from Remittance

Program	Household Type	Baseline			Impact		
		N	Mean	SD	N	Mean	SD
Regular	FFS	32	529756	179528	24	213042	181434
	NFFS	25	354550	151392	23	207510	173832
	Control	26	344263	13250	24	187182	178042
Intensive	FFS	24	261716	129457	16	230875	253194
	NFFS	18	194353	109022	14	195571	176806
	Control	12	30108	21645	16	98035	77131
Mustang	FFS	4	185000	67577	12	87,560	23450
	NFFS	7	230000	175973	1	70000	
	Control	4	162500	103078	2	200000	91924

SD=Standard Deviation

4.9 Migration Status

The figure 4.4 below shows the migration status of the sample population based on the household types. The in-country migration of FFS in was found increased by 30% compared to the baseline value. In contrast to that, the seasonal migration to India had decreased slightly and the migration to other countries than India has increased by nearly 30% in FFS category. Similarly, at NFFS the in-country migration had increased but the seasonal migration to India and the migration to other countries had decreased. Likewise, in control household type, the in-country migration had decreased slightly whereas the seasonal migration to India and the migration to countries other than India found the same.

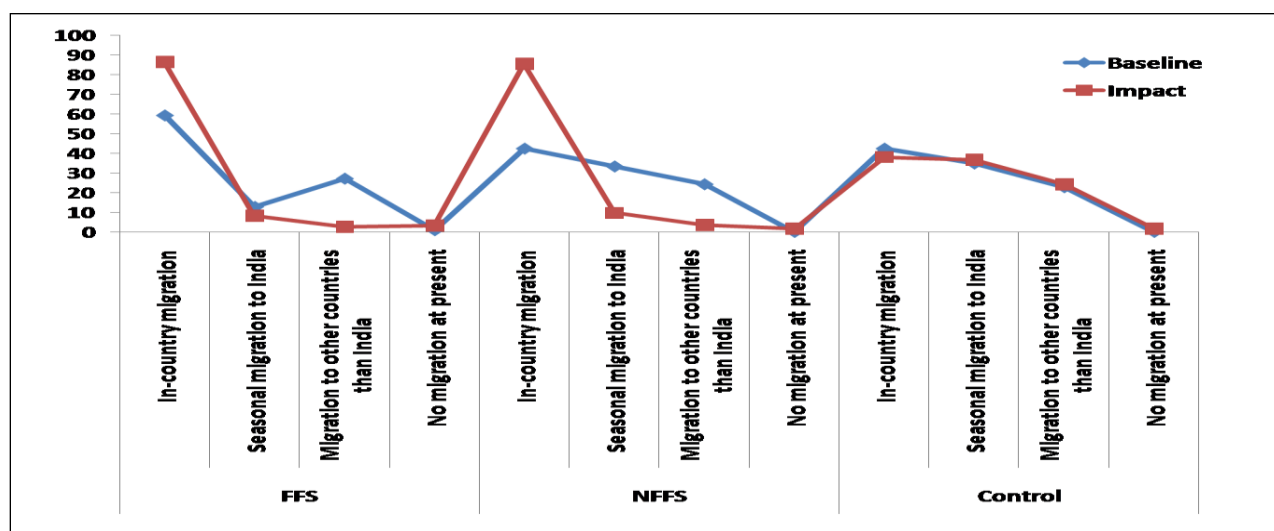


Figure 4. 4: Comparative Status of Migration by Household Type

5. Farm and Household Assets

This chapter highlights on landholding size, livestock herd size, type of house, and household stuff or materials of the sampled households and districts. Details by considering household types such as FFS, NFFS, and Control categories and program types, namely, regular, intensive, and Mustang are given here under.

5.1 Farm Land

Overall increase in the farm land was found in all regular, intensive and Mustang as compared impact value with baseline value. However, remarkable increase in the farm land was found in Mustang district. This might be due to the change in pasture and uncultivated land into cultivable land and initiating farming practices at the previously fallow land. The test statistics revealed that such increase in the farming land at the impact level was not significantly different (Paired t value- 0.66, P=0.50) while comparing with baseline values (Table 5.1).

Table 5. 1: Average Farm Size (ha) by Program and Household Type

Program	Household Type	Baseline		Impact	
		Mean	SD.	Mean	SD.
Regular	FFS	0.88	1.08	1.05	1.13
	NFFS	1.02	0.64	1.04	0.68
	Control	0.76	0.85	0.82	0.97
	Total	0.88	0.91	0.99	0.97
Intensive	FFS	1.12	0.73	1.22	0.90
	NFFS	0.98	0.96	1.07	0.83
	Control	1.01	0.91	0.97	0.93
	Total	1.05	0.86	1.10	0.89
Mustang	FFS	0.55	0.48	0.68	0.86
	NFFS	0.40	0.36	0.72	0.56
	Control	0.55	0.29	0.57	0.28
	Total	0.50	0.39	0.67	0.32

SD=Standard Deviation

Except in FFS type, overall slight decrease in rented in farm size was reported in all districts in comparison to baseline value (Appendix 5. 1). In comparison to baseline value, rented in farm size was found higher in FFS type households in all sampled districts during impact study while vice-versa in NFFS

household types. Observation on total rented out land shows overall decrease in area except for Bara and Mustang districts. In case of FFS household type, rented out area was found decreased in all sample districts compared to baseline values.

The farm land of sampled households was assessed considering variables like area under fully irrigated, area under partially irrigated and unirrigated area. Appendix 5. 2 reveals the average size of land owned by the sampled households, determined in baseline and impact study with mean by irrigated, partially irrigated, and unirrigated types. Farm size under fully irrigation was found higher in all districts in comparison to the farm size under partially irrigation and semi-irrigation land types in all except for Arghakhanchi district while comparing impact values against baseline values. Except in Arghakhanchi, the area under fully irrigation was found higher in case of FFS, followed by NFFS sampled households and control household type.

An inquiry was made to know the number of households renting in different types of farming land such as irrigated, partially irrigated and unirrigated. Appendix 5. 2 gives the irrigation characteristics of sampled households by district. Results from impact analysis showed that majority of the sample households under FFS type in all districts renting the irrigated type of land except in Sarlahi district (Appendix 5. 3). In comparison to impact values with baseline, it was found decreased in rented-in irrigated area of sampled households under NFFS and control groups in all districts except in Sarlahi district. Both baseline and impact analyses showed that very few sampled households rented out irrigated type of farm land. Appendix 5.4 gives the number of sample households renting out irrigated, partially irrigated and unirrigated farming land. While comparing the baseline and impact study, it was found decrease in rented- out irrigated area in all household type of all districts except FFS group of Mustang district, where it was found more or less constant during baseline and impact study.

5.2 Livestock Farming

Livestock is one of the integral components of Nepalese farming system. Cattles, buffaloes, *chauries*, poultries, goats and pigs are the major livestock reared by the sampled households. The total livestock head counts were converted into Livestock Standard Unit (LSU) and presented in Table 5.2. The highest LSU was found in Control sample households because of *chauries* reared by the Control type under Mustang district. Increased LSU was observed in regular, intensive and Mustang as compared to baseline with impact values. Meanwhile, decreased LSU was noticed in the control household of Mustang district. The increased in the LSU was higher in the FFS household under all programs compared to corresponding NFFS and Control. However, Livestock Standard Unit at impact was not significantly increased (Paired t- value= 1.05, P=0.29) compared to baseline study.

Table 5. 2: Livestock Standard Units by Program and Household Type

Program	Household Type	Baseline		Impact	
		Average	SD.	Average	SD.
Regular	FFS	6.72	10.5	7.74	2.28
	NFFS	5.97	9.94	5.77	3.08
	Control	3.85	2.88	4.35	1.95
	Total	5.68	8.85	6.21	2.50
Intensive	FFS	5.68	7.5	6.76	2.67
	NFFS	4.44	4.06	5.30	2.42
	Control	6.46	5.42	6.47	4.91
	Total	5.53	6.03	6.23	3.55
Mustang	FFS	4.81	4.7	5.90	17.26
	NFFS	9.37	17.06	10.14	11.86
	Control	21.93	28.36	18.27	3.48
	Total	12.04	20.42	11.44	12.67

Note: the basis of calculating LSU = 1.5 (number of buffalo) + 1 (number of cow/bull) + 0.6 (number of swine/pig) + 0.4 (number of sheep/goat) + 0.2 (number of poultry). The more or less same size was found when the livestock herd size in terms of LSU was assessed by considering mean herd size of Regular, Intensive and Mustang district.

5.3 Roofing Material

Roofing material of household in Nepal somewhat resembles the economic status of that particular household. It means household with high income built house using concrete as raw material for roof while mud, thatch/slate types raw materials are mainly used by low income households. Different type of roofing materials such as mud, mud and slate, thatched/bamboo, slate/local tiles, corrugated galvanized iron (CGI) sheet, concrete, and asbestos sheet as used by sampled households are presented in **Appendix 5. 5**. In Sarlahi district (Tarai region), Surkhet (Inner Tarai and Hills) and Arghakhanchi (Hilly region), a large majority of the sampled households irrespective of household types were found using slate or local tiles. Majority of households are found using CGI sheet as roofing material in Bara districts (Tarai region). In case of Mustang district, mud and mud and slate are used by large majority of sampled households.

Comparative analysis of sampled households using roofing materials during baseline and impact study revealed that there was shift from mud, and thatched/bamboo to CGI sheet, slate/local tiles, concrete and asbestos sheet except for Mustang district. In Mustang, still large number of households were found using mud as roofing materials, however, some households have shifted from mud to concrete and mud and slate materials. Figure 5.11 reveals the roofing condition of sampled households by household type and district, analyzed during baseline and impact study. Majority of sampled households of under FFS category of all studied districts reported the good condition of their roofing materials.

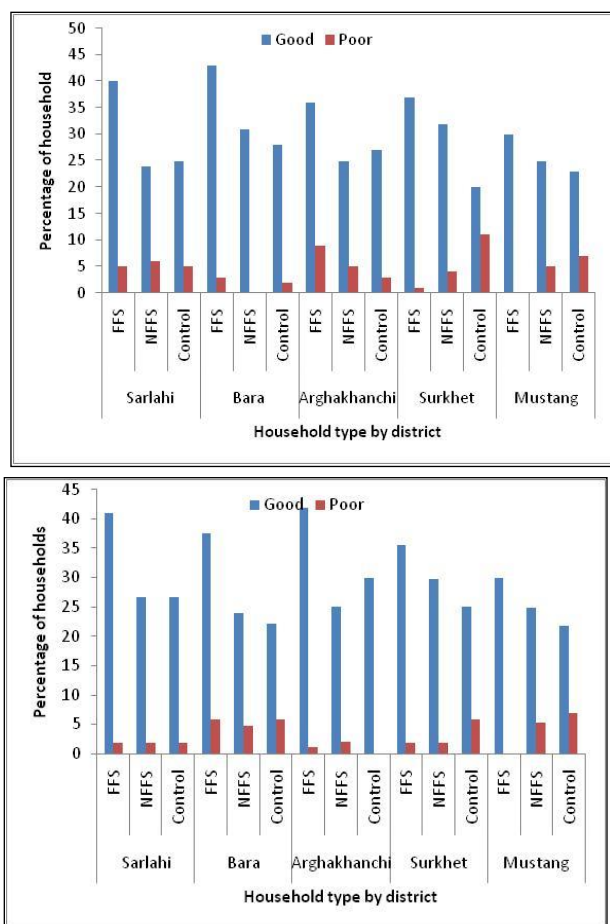


Figure 5. 1: Households Indicating Condition of Roofing Materials by District and Household Type
(Baseline in Left side and Impact in Right side)

5.4 Household Electronic Goods and Bicycle

Figure 5.2 shows the percentage change in the household electronic goods and bicycle by program and household type (FFS, NFFS and Control households). It was found that there has been slight increase in these goods owned by both FFS and NFFS households. The highest change is found in case of mobile phones.

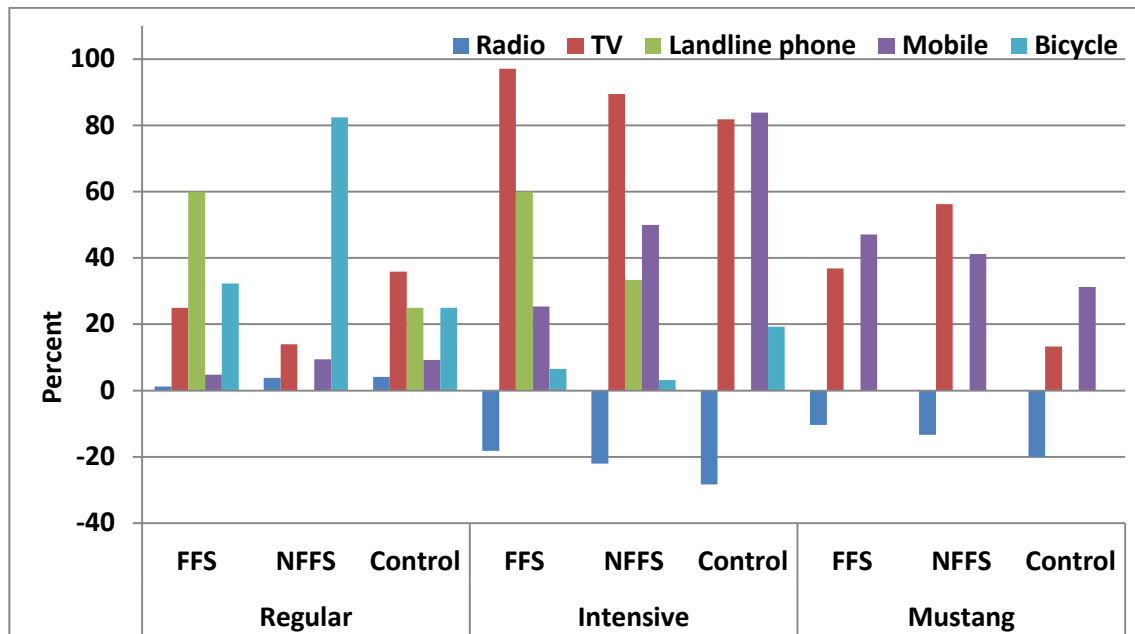


Figure 5. 2: Change in Electronic Goods and Bicycle by Program and Household Type

6. Land Use and Crop Productivity

This chapter mainly concentrates on the cropped area, cropping intensity of key crops grown in the sampled districts. Rice is a major staple crop and found most prevalent all sampled districts except in Mustang. From the cash income point of view, vegetable farming including potato is found in all five sampled districts. Moreover, the apple farming is the most important source of cash income in Mustang district.

6.1 Cropped Area and Cropping Intensity

The total cropped area in both baseline and impact survey period by sampled district and household type such as FFS, NFFS and Control are presented in Table 6.1. The cropped area by the three main seasons, namely, summer, winter, and spring are summed and divided by the corresponding sample households. The cropped area in terms of number of sample households with their average farm land and standard deviation are also calculated. Table 6.1 reveals an increase in cropped area in all FFS sampled households under both regular and intensive program. The highest cropped area is in intensive program compared to the regular program. Among the three sampled household type, the highest increment was found in FFS category followed by NFFS under both programs. The maximum increase in cropped area was found in the NFFS category of Mustang.

Table 6. 1: Total Cropped Area (Ha) by Program and Household Type

Program	Household Type	Baseline		Impact		Percent Difference
		N	Mean	N	Mean	
Regular	FFS	90	1.07	89	1.20	12.1
	NFFS	60	1.09	58	1.10	0.9
	Control	60	1.02	60	1.08	5.9
	Total average	210	1.06	207	1.20	13.2
Intensive	FFS	114	1.48	113	1.50	1.4
	NFFS	97	1.15	93	1.10	-4.3
	Control	91	1.25	93	1.01	-19.2
	Total average	302	1.29	299	1.20	-7.0
Mustang	FFS	30	1.21	30	1.30	7.4
	NFFS	30	0.71	30	0.90	26.8
	Control	30	1.23	30	1.10	-10.6
	Total average	90	1.05	90	1.00	-4.8

Among the sampled districts there is highest increase in total cropped area in Bara district with least increased in Arghakhanchi district. However, on the basis of household type, the FFS group had highest percentage of cropped area in all districts with maximum increase being observed in Bara district. In comparison to seasonal crops i.e. cereals/legumes; there is maximum increase in cropped area during the spring season in all districts with highest increase in Bara district. Moreover, it is also found an increasing percentage of total cropped area under NFFS category in all districts except in Arghakhanchi district. A significant increase in fruit farming was found in Sarlahi and Surkhet district under FFS category. There is also a considerable growth in summer and spring vegetable growing area in sampled districts. **Appendix 6. 1** presents total cropped area by sample household and districts on the basis of seasonal crops especially cereals/legumes, vegetable and fruits. In comparison to surveyed district, the analyses revealed the highest increase in cropping intensity in Bara district and a least increase in Mustang district (**Appendix 6. 2**). However, decreased cropping intensity was found in the NFFS and control households of Mustang district. And the least change was reported in Arghakhanchi district (3.50%). Furthermore, the Figure 6.1 shows an increment in cropping intensity in all household type and district except in NFFS and control group of Arghakhanchi district.

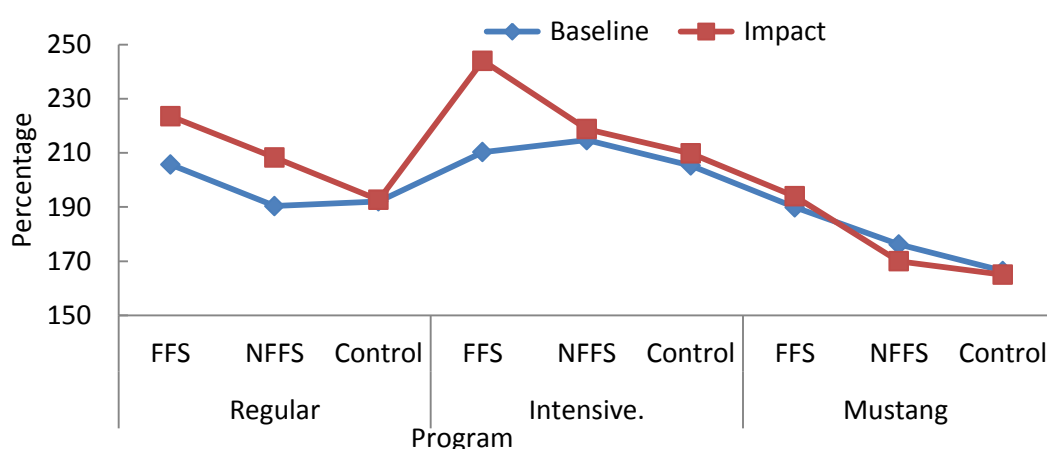


Figure 6.1: Total Cropping Intensity by Program and Household Type

Figure 6.1 shows total cropping intensity comparing baseline with impact study by program and household type. It can be inferred that cropping intensity of FFS farmers had increased in all districts. Moreover, remarkably increased cropping intensity was found in the FFS household under intensive program.

6.2 Area Under Key Crops

The area under major crops like rice, potato, tomato, cole crops and cucumber was found increased in FFS type of households under regular and intensive programs. However, higher increment was reported in the intensive program as compared to regular program. Area under rice, potato, tomato, cole crops

and cucumber cultivation increased from 0.37 to 0.5, 0.02 to 0.08, 0.01 to 0.03, 0.06 to 0.08 and 0.01 to 0.1 ha, respectively, under intensive program. Similarly, nearly six times increased in the area under potato cultivation in intensive program was observed after implementing the IPM-FFS program. In case of Mustang, area under apple cultivation was increased by two folds after implementing the program in IPM FFS group. Similar but small increase in the area under apple was reported in NFFS and control group of mustang district. The area under cereals, vegetables; fruit was increased while area under non timber forest products was decreased. This may be due to farmers' awareness about the conversion of pasture and non-timber forest land in to cultivable land so that farmers could practice agricultural practices on their fallow and previously uncultivable land. The area under different major crops in the study area by the programs and household types are given in **Appendix 6. 3**.

6.3 Area Under Vegetable Farming

Figure 6.2 depicts area under vegetable farming by program and household type. It was found increased area under vegetables in all types of household (FFS, NFFS and control) and program (regular, intensive, and Mustang). There was remarkable increase in the area under vegetable (50%) in the FFS household under intensive program. Only small area was found increased on the control group of household compared to FFS and NFFS. In baseline survey, the highest vegetable growing area was found in Surkhet (0.50 ha) followed by Arghakhanchi district (0.41 ha) under the category of FFS. However, largest area under vegetable farming in impact study was found in Arghakhanchi (0.54 ha) followed by Bara (0.51 ha) and Surkhet (0.51 ha) under FFS Household (**Appendix 6. 4**). When the percentage change analysis was done, it was found that a significant increase in vegetable growing area in Bara district (264%) under FFS category followed NFFS (214%) and control (175%). A considerable rise in area also found in Sarlahi district under FFS (75%), NFFS (60%) and control (37%). Meanwhile, area under vegetable was found decreased in NFFS and control households of Surkhet district by 17.5 and 2.5%, respectively. Details are given in Appendix 6.4.

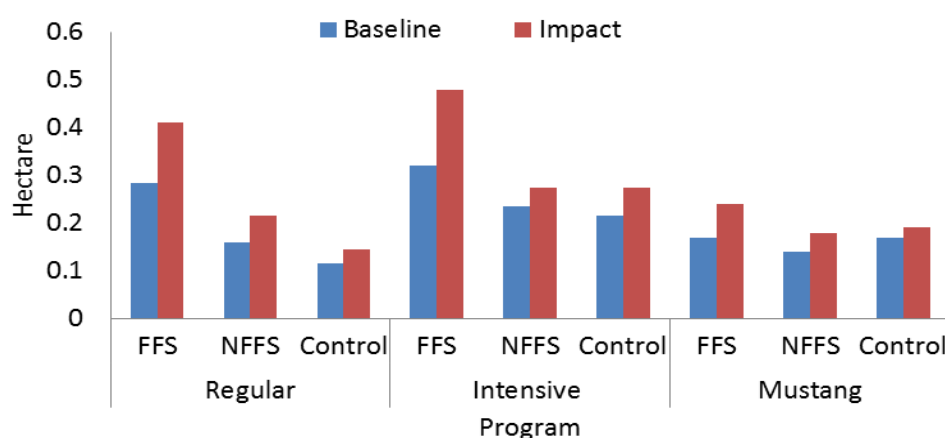


Figure 6.2: Area under Vegetable by Program and Household Type

7. Use of Pesticide

Pesticides are substances used to control plant pathogens (bacteria, fungi, nematodes, viruses, mollicutes, and viroids), insect-pests, weeds, rodents and other harmful entities during pre-sowing or post-planting period, standing crops or on post-harvest products. They can also be used for seed and seedling treatment, disinfection of warehouses and packaging materials. Pesticides may be organic, or inorganic, synthetic chemical products, plant extracts/products (botanical pesticides) or of microbial origin (biological pesticides). In recent years, farmers are using fermented or non-fermented herbal plant extracts (known as *Jholmal* in Nepalese local language) to control especially soft bodied insects, some diseases and sources of plant nutrients as well. An attempt was also made to assess the use of micronutrients and other non-pesticides as well. Because of commercialization of some agricultural crops and high market price of good looking products, many farmers tend to apply chemical pesticides in an uncontrolled manner to fetch more benefit without taking much care on health and environment. Such practices have adverse effects on soil, water and biodiversity. Therefore, IPM program has tremendous scope for the safer use of pesticides and developing sustainable environment for both human beings and entire nature. This chapter provides the overview of types and extent of pesticides used in major crops by program types and farm categories.

Out of 25 crops selected for study, the major crops taken as key crops, during both baseline and impact studies, under both regular and intensive programs, are presented in Table 7.1. Among the 3 intensive districts, implementation of IPM program in Mustang was quite less than the other 2 districts. Therefore, data from Mustang district were analyzed and explained separately.

Table 7.1: Key Crop Selected for Baseline and Impact study

Program	District	Key Crop
Regular	Sarlahi	Rice, Tomato, Cole crops, Potato, Cucurbits
	Arghakhanchi	Rice, Tomato, Cole crops, Potato, Cucurbits
Intensive	Bara	Rice, Tomato, Cole crops, Potato, Cucurbits
	Surkhet	Rice, Tomato, Cole crops, Potato, Cucurbits
Mustang*		Apple and Potato

*IPM Program was implemented in a limited scale.

7.1 Sources, Time, and Frequency of Pesticide Application

Local agro-vets were major sources for both regular (83.75% and 96.58%) and intensive (94.10% and 91.56%) programs during baseline and impact studies, respectively (**Figure 7. 1**). However, in Mustang, INGO/NGO/DADO field workers (66.38%) were major suppliers in baseline and local agro-vets (84.49%) in impact study period. There may be dew and dilution of pesticides during morning and the bright sun is harmful to the applicator during midday time. For the safe and high efficiency, pesticides should be sprayed during evening hours provided that there is no wind and rain. The impact value against baseline value indicated that there was no considerable difference in the time of pesticide application by program and household types (Appendix 7.1).

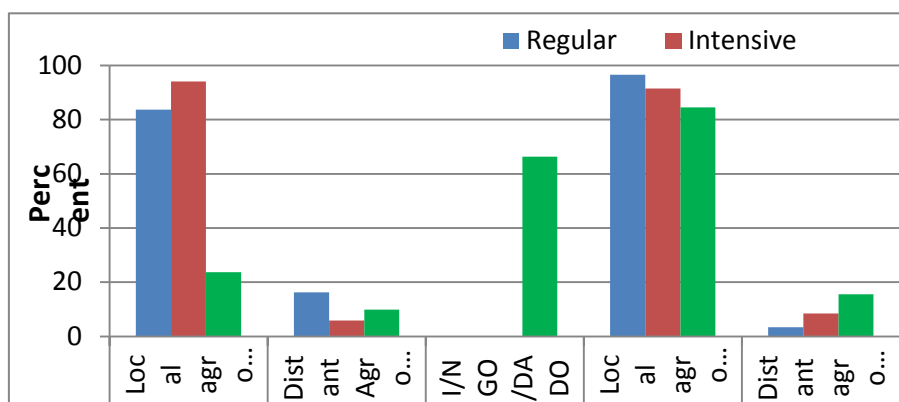


Figure 7. 1: Major Sources of Pesticides by Program

Frequency of application of pesticides in sampled districts ranged from 1 to 40 and 1 to 7 in baseline and impact studies, respectively (Appendix 7. 2). The frequency of 40 was reported in the use of cypermethrin on cucurbit by a control farmer from Sarlahi. Mean frequency of application was reduced more in impact study period than baseline, especially with FFS and NFFS farmers. Maximum reduction in frequency was found with FFS (-77.24%) and NFFS (-51.93%) farmers under intensive program, followed by FFS (-36.86%) and NFFS (-29.26%) under regular program (Figure 7. 2). In Mustang, reduction was lower than in other programs. The result revealed that FFS and NFFS farmers were convinced to reduce the amount of pesticides by reducing the frequencies.

The analyses revealed that out of 25 crops, only 9 crops (chilli, cole crop, cucurbit, maize, mango, potato, rice, tomato and wheat) were used with pesticides in impact study as compared to 13 crops (banana, bean, brinjal, chilli, cole crop, cucurbit, maize, mango, orange, potato, rice, tomato and wheat) in baseline under regular program, and 12 crops in impact bean, brinjal, chilli, colecrop, cucurbit, lentil, maize, potato, radish, rice, tomato and wheat) as against 16 crops (bean, brinjal, broad bean, capsicum, chilli, cole crop, cucurbit, lentil, maize, mango, okra, potato, radish, rice, tomato and wheat) in baseline under intensive program. In Mustang, 5 crops, namely, apple, bean, colecrop, maize and potato in baseline, and 3 crops, namely, apple, maize and potato in impact assessment were used with pesticide.

The same farmer was applying, in many cases, same or different pesticide, on one or more crops, and in one or more times.

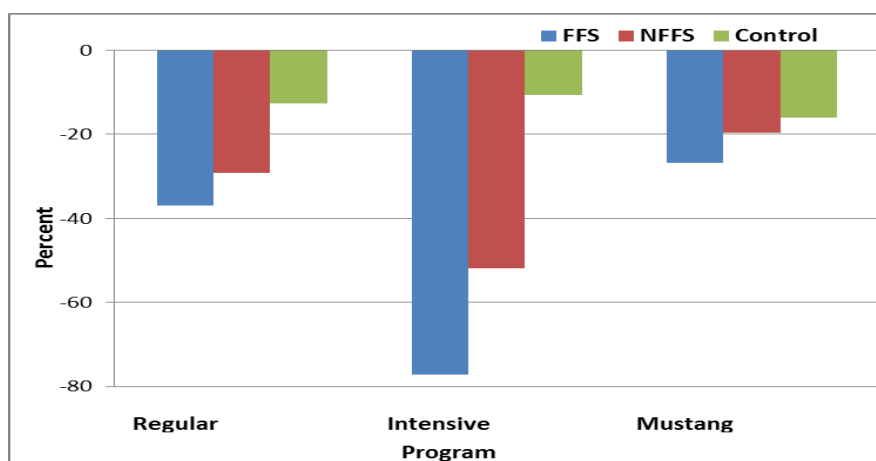


Figure 7. 2: Change in Frequency of Pesticide Application by Program and Household Type

Reduction in number of crops with pesticide use was mainly due to NIPM Program. Pesticide using FFS farmers were 60 in baseline and 33 in impact under regular and 71 in baseline and 36 in impact under intensive program.

Table 7. 2: Number of Farmers Using Pesticides and Total Applications by Program and Household Type

Program	Household type	Baseline			Impact		
		Number of Farmer ¹	Application ²	Frequency ³	Number of Farmer ¹	Application ²	Frequency ³
Regular	FFS	60	131	239.0	33	39	83.0
	NFFS	41	100	163.0	16	29	45.0
	Control	36	90	417.0	24	49	116.0
	Total	137	321	819.0	73	117	244.0
Intensive	FFS	71	220	598.0	36	56	69.0
	NFFS	56	142	337.0	28	52	81.0
	Control	37	120	231.0	37	117	256.0
	Total	164	482	1166.0	101	225	406.0
Mustang	FFS	30	111	229.0	24	62	134.0
	NFFS	28	95	208.0	29	92	154.0
	Control	25	64	100.0	18	33	46.0
	Total	83	270	537.0	172	187	334.0

¹Actual number of farmers applying pesticides. ²Total applications made by the actual number of farmers, and it is obtained as a farmer used a pesticide on 2 or more crops, or 2 or more pesticides on one or more crops. ³total of all repetitions of all applications.

The total applications and frequencies made by FFS farmers under regular program were 131 and 239 in baseline and 39 and 83 in impact study, respectively. The corresponding values in the baseline study were 220 and 598, and that of impact study were observed 56 and 69, under intensive program, respectively (Table 7.2). Number of farmers using pesticides was lower in impact than baseline also in Mustang except NFFS farmers.

7.2 Type, Area, Amount, and Dose of Pesticide Application

A total of 40 and 31 different types of pesticides were used in baseline and impact studies, respectively (**Appendix 7.3**). Out of them 6 class Ia and Ib pesticides (carbofuran, dichlorovos, methyl parathion, monocrotophos, phorate and triazophos) were used during baseline and only 3 class Ib pesticides (carbofuran, dichlorovos and triazophos) during impact. Three pesticides (BHC, methyl parathion and monocrotophos) banned in Nepal were also applied in baseline but not in impact. Safer pesticides were used more in impact than in baseline. A total of 6 types of mixed pesticides were applied in Baseline as well as impact study, with a total application of 171 and 32, respectively. The pesticides Krinoxyl Gold (metalaxyl + mancozeb), Anth (chlorpyrifos + cypermethrin), Krosin (streptomycin + tetracycline) and Saaf (carbendazim + mancozeb) were used in both the studies, while Endocel (endosulfan + epichlorohydrin) and Spark (deltamethrin + triazophos) only in Baseline, and Viraat (cypermethrin + quinalfos) and Krinoximate Gold (cymoxanil + mancozeb) only in impact studies. Out of them, only triazophos was WHO hazard class Ib pesticide. Total amount of mixed pesticides was reduced in impact than in baseline in most of the cases. The amount was decreased from 1.71 kg to 0.35 kg (-79.53%) in regular, FFS, and 5.05 kg to 4.25 kg (-15.84%) in intensive, FFS farmers during impact (**Figure 7.3, Appendix 7.4**). Only one NFFS farmer was using mixed pesticide in Mustang. Among the two programs, total reduction was high under regular (-60.53%) than intensive (-27.64%) program. Due to safer pesticides, their reduction in amount was low under intensive than regular program.

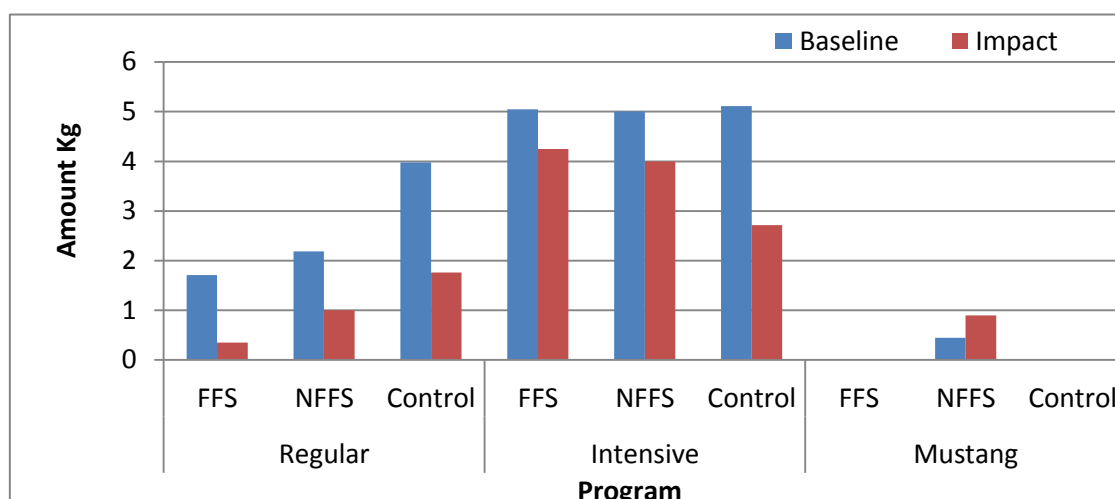


Figure 7. 3: Total Amount of Mixed Pesticides Used by Program and Household Type

Total 4 groups of pesticides, i.e. insecticide, fungicide, herbicide and antibiotic, were used in both, baseline and impact, studies, except pheromone traps in impact occasionally (**Appendix 7. 5**). Herbicides were used during baseline and impact, only under intensive program. Total amount of insecticides was decreased from 262.31 kg to 53.9 kg in FFS, from 300.3 to 140 kg in NFFS and from 153.9 to 133.1 kg in control farmers from baseline to impact, respectively, while of fungicides slightly decreased from 70.35 kg to 43.3 kg in FFS, from 58.09 to 51.2 kg in NFFS, but increased from 53.05 kg to 85.8 kg in control farmers during impact as compared to baseline. As the insecticides were more toxic than fungicides, the FFS farmers were reducing the amount of insecticides and increasing fungicides to reduce pesticides hazard to the environment.

Total number of farm households using class I type of pesticide has been drastically reduced in impact study period against the baseline values. In baseline study, there were many farmers using class I pesticides (even class Ia type), but this was not found in impact study in all types of farm households. However, still there were many farmers using class Ib pesticides from control and NFFS groups in all district except Mustang. Intensive FFS categories of farmers reported the highest reduction in Class Ib pesticides in both intensive and regular programs (**Figure 7.4**).

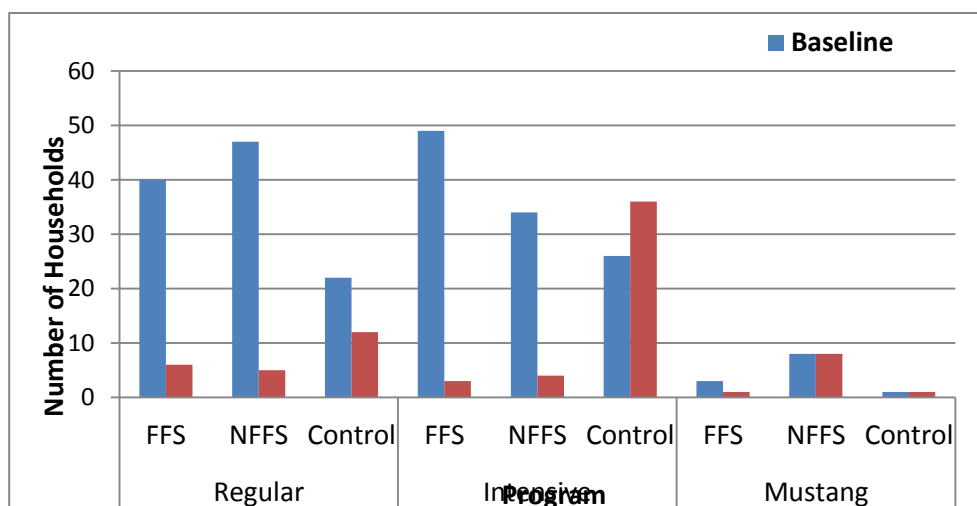


Figure 7. 4: Households Using Class I Pesticides (including Ia during baseline) by Program and Household Type

Figure 7.5 presents the percent change in area under Class I pesticide application. There was no use of class Ia pesticides at all during impact. Intensive, FFS farmers had only 0.28 ha during impact study as compared to 10.68 ha during baseline, and reduction was the highest (-97.38%) among all household types. Second highest area reduction was with regular, FFS farmers (-90.78%). NFFS farmers had -76.46% and -62.38% reduction during regular and intensive programs, respectively. It appeared that FFS

farmers were reducing area under class Ib pesticides considerably and there was also a good spillover effect.

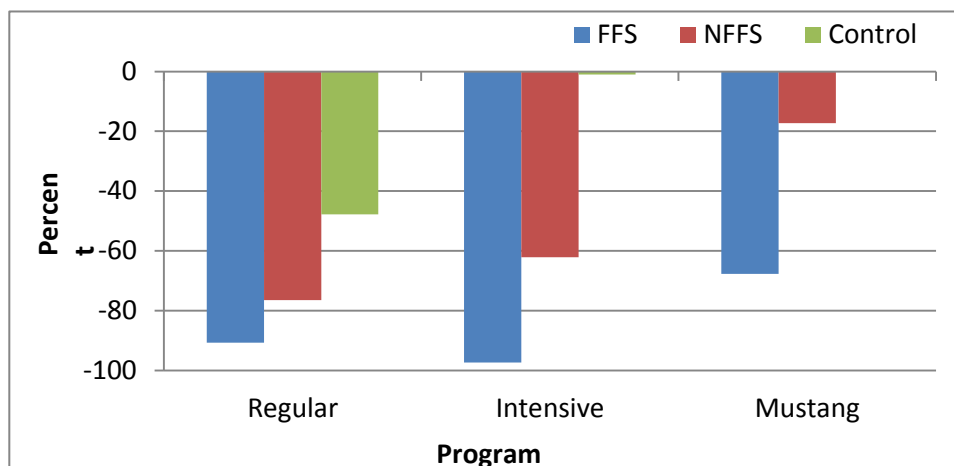


Figure 7. 5: Change in Area Under Class Ib Pesticide by Program and Household Type

Total area reduction under total pesticide was also very high from baseline to impact. Among intensive, FFS farmers, the area of 49.21 ha in baseline was decreased to 10.45 ha in impact with a reduction of -78.76% (Figure 7.6, Appendix 7.5). Second highest decrease was found in regular, FFS, i.e. 41.97 ha to 12.45 ha, with a reduction of -70.34%.

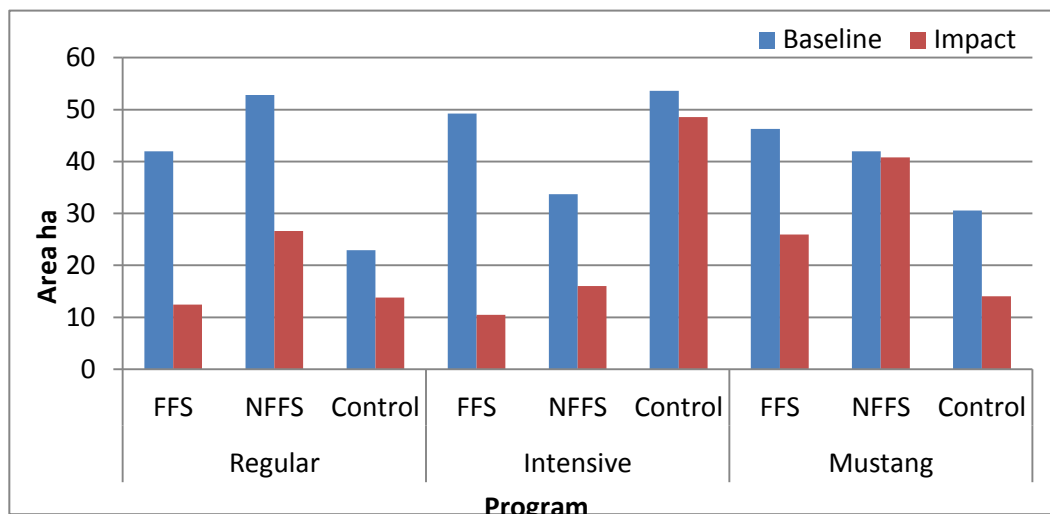


Figure 7. 6: Total Area Under Total Pesticide Applications by Program and Household Type

Spillover effect was also very high (-52.56%) under intensive, NFFS farmers. In Mustang, reduction was exceptionally high with control-54.12%), followed by FFS-43.97%). From the study it can be concluded that farmers, specially FFS and NFFS, were reducing area under total pesticide use due to the knowledge of pesticide hazards on soil generated by IPM training and its spillover effect.

Total annual pesticide consumption was 914.88 kg and 619.23 kg during baseline and impact studies, respectively, and the reduction in amount during impact was -32.32% from baseline. Among the household types, highest reduction in amount was found on intensive, FFS farmers, that was from 95.41 kg to 12.68 kg (Figure 7.7), with a decrease of -86.71 percent. Decrease in total amount of pesticides was also very high with regular, FFS (-77.54%), regular, NFFS (-59.61%), Mustang, FFS (-59.91%) and intensive, NFFS (-56.19%), farmers during impact (**Appendix 7. 6**). Increment in total amount of pesticides during impact among intensive, control farmers indicated that there was no effect of IPM training to those farmers, and the amount was increased probably due to pesticide resistance of the pests.

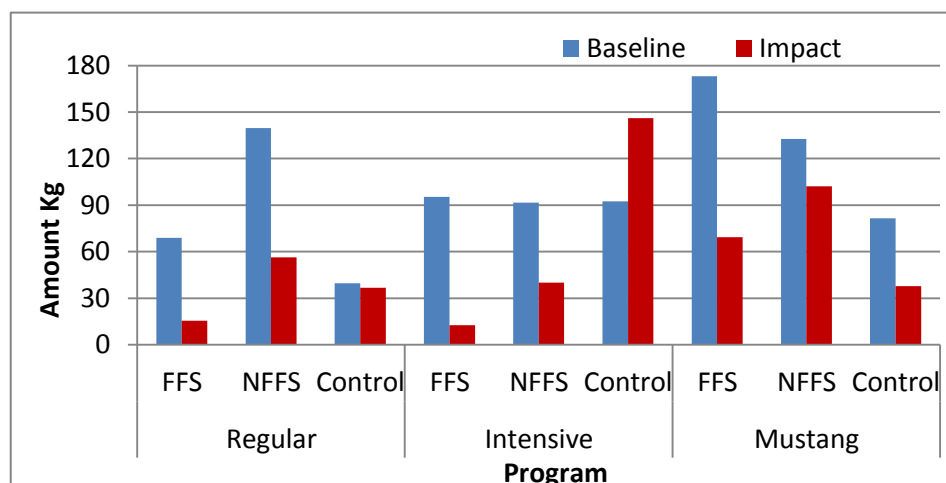


Figure 7.7: Total Amount of Pesticides by Program and Household Type

Total amount of pesticides used in key crops has been reduced in impact than baseline in most of the crops under both the programs and in Mustang. Among the crops, higher amount of pesticides was used in apple, followed by rice and potato. The amount used in rice under intensive program was 65.98 kg and 4.92 kg, 65.45 kg and 11.91 kg and 73.63 kg and 104.33 kg by FFS, NFFS and control farmers during baseline and impact, respectively (**Appendix 7. 7**). In apple, total amount of pesticides used was 165.92 kg and 64.35 kg of FFS, 124.36 kg and 95.02 kg of NFFS and 78.92 kg and 37.67 kg of control farmers during baseline and impact, respectively. The data showed that total amount of pesticides used was reduced in impact, and sharply on FFS farmers, under intensive program.

Dose of class Ib pesticides ranged from 0.08 to 50.00 kg or l/ha and 0.25 to 10.00 kg or l/ha, with a mean of 3.65 kg/ha (± 5.60) and 3 kg/ha (± 1.82) in Baseline and impact studies, respectively. Mean doses were lower in impact than baseline in all farmer types and programs except NFFS and control farmers in Mustang. Lowest mean doses were with FFS farmers from Mustang (0.70 kg/ha and 1.76 kg/ha) and intensive (0.89 kg/ha and 1.87 kg/ha) program during impact and baseline, respectively (Figure 7.8). Highest dose during baseline was found with regular, NFFS (5.28 kg/ha), and during impact with regular, control (3.83 kg/ha) farmers. Maximum reduction in mean dose of class Ib pesticides was found with Mustang, FFS (-60.23%), followed by intensive FFS (-52.41%) and regular FFS (-46.51%) farmers. It was observed that FFS farmers were highly aware of highly toxic substances and were reducing the doses highly during impact.

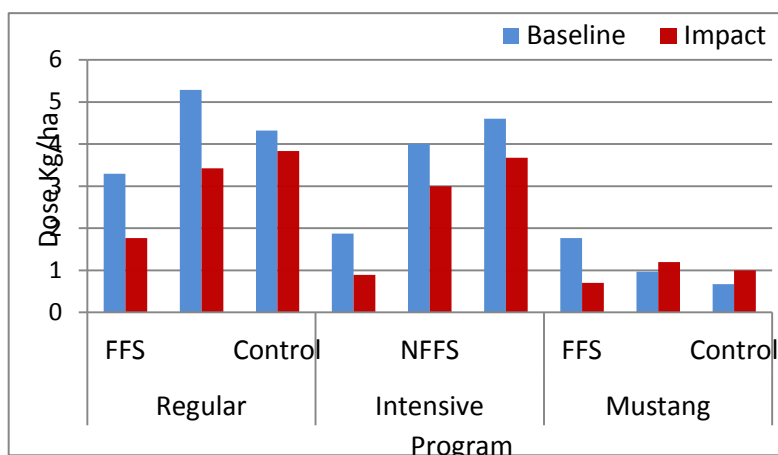


Figure 7. 8: Mean Dose of Class Ib Pesticides by Program and Household Type

Mustang, FFS (-60.30%) farmers had the highest mean dose reduction, followed by intensive, NFFS (-54.06%) and FFS (-52.53%) farmers during impact (**Appendix 7.8**). There was increment on dose with NFFS and control farmers from Mustang. The study revealed that the FFS farmers were more aware of pesticide hazard and were reducing class Ib pesticide doses greater than NFFS and control farmers.

Dose of total pesticides ranged from 0.02 to 192.00 kg or l/ha and 0.14 to 15.00 kg or l/ha, with a mean of 3.17 kg/ha and **2.62 kg/ha** (± 2.33) in Baseline and impact studies, respectively. Mean dose of all the pesticides used in all crops in 5 districts was lowest with intensive, FFS (1.23 kg/ha), followed by regular FFS (1.49 kg/ha) and intensive NFFS (1.56 kg/ha) farmers, with a decrease of -41.43%, -58.15% and -16.58%, respectively, during impact than in baseline (**Figure 7.9, Appendix 7. 9**). Among the programs too, mean dose was lower under intensive (1.60 kg/ha), than regular (2.35 kg/ha), while it was highest in Mustang (3.30 kg/ha) during impact. Lower reduction percent in intensive, FFS and NFFS farmers was due to sharp reduction in the use of class Ib pesticide and increase in amount of class II and lower classes pesticides, and opposite situation in regular, FFS and NFFS farmers.

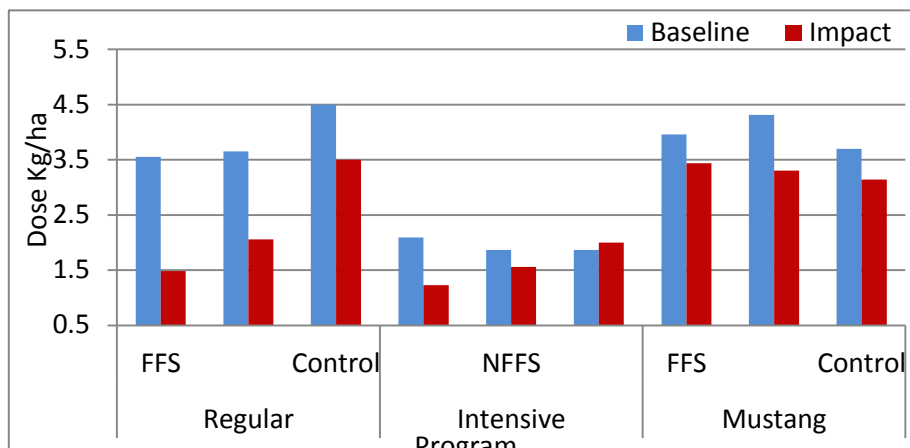


Figure 7. 9: Mean Dose of Total Pesticides by Program and Household Type

The study showed that there was a great effect of IPM training especially to FFS farmers in reducing the doses of the pesticides.

7.3 Total Annual Expenditure on Pesticides

Total cost on class Ib pesticides was reduced drastically in impact (32495.0 Rs.) than baseline (77201.0 Rs.). Cost reduction was highest (-96.60%) with intensive, FFS farmers, which was 9421.0 Rs. to 320.0 Rs., followed by intensive, NFFS (-89.22%), from 12892.0 Rs. to 1390.0 Rs., and regular FFS (-88.44%) from 10939.0 to 1265.0 Rs. during impact (**Figure 7.10**).

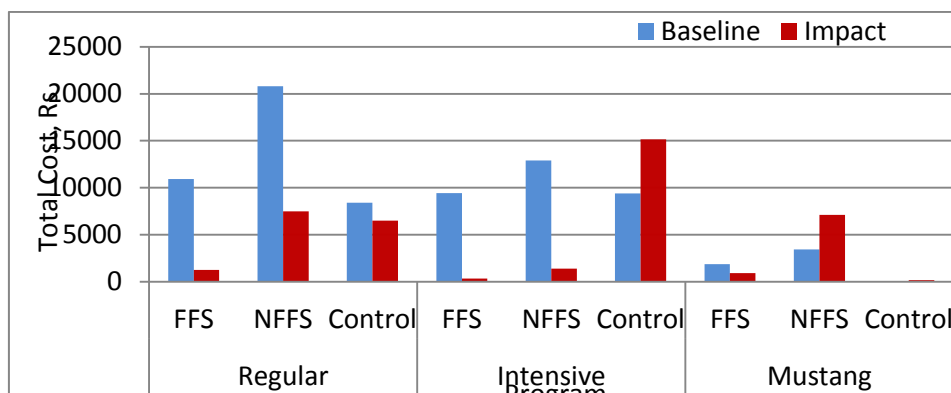


Figure 7.10: Total Expenditure on Class I Pesticides by Program and Household Type

Because of increment in amount, cost of intensive, control and Mustang, NFFS and control farmers was increased. Altogether, change in annual expenditure of class Ib pesticides was -88.82%, -68.88% and 3.28% in FFS, NFFS and control farmers, respectively, during impact. It was obvious that FFS and NFFS

farmers from intensive and regular programs, and FFS farmers from Mustang were reducing their expenditure on hazardous class Ib pesticides considerably.

Total expenditure on all pesticides used in sampled districts has been decreased during impact than baseline with all the FFS and NFFS farmers except Mustang. Reduction in cost was maximum with intensive, FFS farmers, i.e. 69087.0 to 20198.0 Rs (-70.76%), accompanied by regular, FFS, i.e. 28761.0 to 13278.0 Rs. (-53.83%) and intensive, NFFS, i.e. 55849.0 to 34895.0 Rs. (-37.88%) (Figure 7.11). Among the programs, cost reduction was maximum under intensive program (-41.13%), followed by Mustang (-34.05%) and regular (-32.10%) program. The study also clarified that specially FFS and NFFS farmers were reducing cost in all the pesticides and contributing toward development of healthy environment by the knowledge of IPM training.

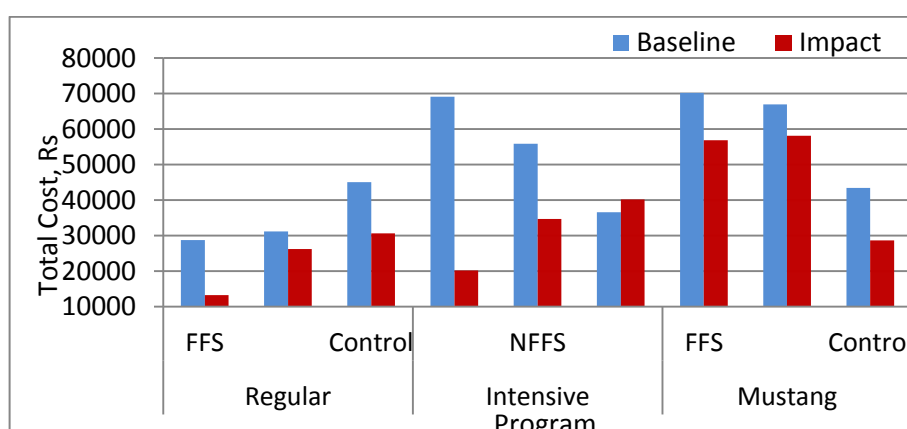


Figure 7. 11: Total Expenditure on Pesticides by Program and Household Type

7.4 Field EIQ Assessment

Environmental Impact Quotient (EIQ) is one of the tools to assess the impact/risk of the pesticides on health and different environmental components. EIQ was initially developed by Cornell University in 1992 and revised in 2007 (FAO, 2008). Because of commercialization in some vegetables, cereals, fruits and other crops, use of pesticides, micronutrients and other growth stimulating substances is increasing gradually in Nepal. Unregulated use of pesticides may cause a heavy burden in the environment.

Pesticide risk is related to hazard of active ingredient, i.e. its inherent potential to cause harm and the likelihood of exposure of the active ingredient to actually cause harm. Therefore, risk assessments combine toxicity information of the pesticides with information on use of products and its spread through as well as persistent in the environment. EIQ is a method to calculate the environmental impact of the pesticides, and the values obtained from these calculations can be used to compare different pesticides and be able to make more environmentally sound pesticide choices in Integrated Pest Management (IPM) and other crop pest management programs (Walter-Echolas, 2008). Thus, EIQ is an

indicator of pesticide risk to the environment. EIQ value is a figure calculated for a single active ingredient. It serves as a basis for calculation of Field Use EIQ.

The EIQ value for a specific active ingredient is calculated according to a formula that includes parameters for toxicity (dermal, chronic, bird, bee, fish and beneficial arthropod), soil half-life, systemicity, leaching potential, and plant surface half-life (Kovach *et al.*, 1992) (Table 7.3). Each of these parameters is given a rating of 1, 3 or 5 to reflect its potential to cause harm. Six of these ratings are based on measured or known properties, and five others on judgments of low, moderate or severe impact.

Table 7.3: Parameters and Rating System Used in Calculating EIQ Values of Single Active Ingredients

Variable	Symbol	Score 1	Score 3	Score 5
Long-term health effects	C	Little-none	Possible	Definite
Dermal toxicity (Rat LD ₅₀)	DT	>2000 mg/kg	200-2000 mg/kg	0-200 mg/kg
Bird toxicity (8 day LC ₅₀)	D	>1000 ppm	100-1000 ppm	1-100 ppm
Bee toxicity	Z	Non-toxic	Moderately toxic	Highly toxic
Beneficial arthropod toxicity	B	Low impact	Moderate	Severe impact
Fish toxicity (96 hr LC ₅₀)	F	>10 ppm	1-10 ppm	<1 ppm
Plant surface half-live	P	1-2 weeks pre-emerg. herbic.	2-4 weeks post-emerg. herbic.	>4 weeks
Soil residue half-live (TI/2)	S	<30 days	30-100 days	>100 days
Mode of action	SY	Non-systemic; all herbicides	Systemic	
Leaching potential	L	Small	Medium	Large
Surface runoff potential	R	Small	Medium	Large

(hexaconazole fungicide as a reference)

An example of rating on the given variables is cited in **Table 7.4** below for hexaconazole (fungicide). In case of unknown value, simply 2 is used. The maximum possible EIQ score is 210 and the minimum is 6.7 (FAO, 2008).

Table 7.4: EIQ Ratings for Hexaconazole

Variables	Symbol	Score 1	Score 3	Score 5	Final Score
Chronic toxicity	C			X	5
Dermal toxicity	DT	X			1
Bird toxicity	D	X			1
Bee toxicity	Z		x		3
Beneficial arthropod toxicity	B	X			1
Fish toxicity	F	X			1
Plant surface half-live	P	Unknown			2
Soil half-live	S			X	5
Systemicity	SY		x		3
Leaching potential	L	X			1
Surface runoff potential	R	Unknown			2

$$EIQ = \{[(C(DT \times 5) + (DT \times P))] + [(C \times (S + P) / 2 \times SY) + (L)] + [(F \times R) + (D \times (S + P) / 2 \times 3) + (Z \times P \times 3) + (B \times P \times 5)]\} / 3$$

$$EIQ = (EI \text{ Farm workers} + EI \text{ Consumer} + EI \text{ Ecology}) \div 3$$

$$EI \text{ Farm worker} = EI \text{ Sprayer/Applicator} + EI \text{ Picker} = 25 + 10 = 35$$

$$EI \text{ Applicator} = C \times DT \times 5 = 5 \times 1 \times 5 = 25$$

$$EI \text{ Picker: } C \times (DT \times P) = 5 \times 1 \times 2 = 10$$

$$EI \text{ Consumer} = EI \text{ Consumer} + EI \text{ Ground water user} = 52.5 + 1 = 53.5$$

$$EI \text{ Consumer} = C \times ((S + P) \div 2) \times SY = 5 \times ((5 + 2) \div 2) \times 3 = 5 \times 3.5 \times 3 = 52.5$$

$$EI \text{ Ground water} = L = 1$$

$$EI \text{ Ecology} = EI \text{ Fish} + EI \text{ Bird} + EI \text{ Honey Bee} + EI \text{ Natural Enemies}$$

$$EI \text{ Ecology} = 2 + 10.5 + 18 + 10 = 40.5$$

$$EI \text{ Fish} = F \times R = 1 \times 2 = 2$$

$$EI \text{ Bird} = D \times ((S + P) \div 2) \times 3 = 1 \times ((5 + 2) \div 2) \times 3 = 1 \times 3.5 \times 3 = 10.5$$

$$EI \text{ Honey Bee} = Z \times P \times 3 = 3 \times 2 \times 3 = 18$$

$$EI \text{ Natural Enemies: } B \times P \times 5 = 1 \times 2 \times 5 = 10$$

$$EIQ = (EI \text{ Farm workers} + EI \text{ Consumer} + EI \text{ Ecology}) \div 3$$

$$EIQ = (35 + 53.5 + 40.5) \div 3$$

$$EIQ = (129) \div 3$$

$$EIQ = 43$$

Thus, EIQ of hexaconazole is 43.

Field use EIQ is further development of EIQ which is an indicator of pesticide risk to users/applicators, agricultural produce consumers and users, in addition to environmental impact, relative to degree of toxicity (expressed in different ways), ways of uses, quantity and frequency of applications, etc of a pesticide. Field EIQ value of all the single pesticides was computed. All EIQ values and other related values to calculate EIQ were taken from Cornell, 2007 and 2010, as kindly provided by Dr. Gerd Echols Walter. Other data, such as, a.i. percent of the chemicals, frequency of applications and dose/ha were calculated from the collected data. Field EIQ value of all the single pesticides was calculated using the following formula:

$$\text{Field EIQ} = EIQ \text{ value of a chemical} \times (ai \% / 100) \times \text{Frequency} \times \text{Dose/ha (lt or kg)}$$

As an example, Field EIQ of cypermethrin, applied to a colecrop by a NFFS farmer from Bara under intensive program is as below:

Pesticide: cypermethrin (class II insecticide)

EIQ: 27.3

AI %: 25

Frequency: 2

Dose: 0.5 l/ha

Now, Field EIQ = EIQ value of a chemical x (ai %/100) x Frequency x Dose/ha (lt or kg/ha)

$$=27.3 \times 0.25 \times 2 \times 0.5$$

$$= 6.82$$

Thus, Field EIQ value of the cypermethrin is 6.82. The field EIQ values of all the pesticides were calculated in the same way.

Mean field EIQ values of pesticides, especially with FFS and NFFS farmers were decreased in impact than baseline. There was a sharp reduction with intensive, FFS (below 20), followed by intensive, NFFS (below 40), and there was very slow decline in control type of households under intensive program (Figure 7.12).

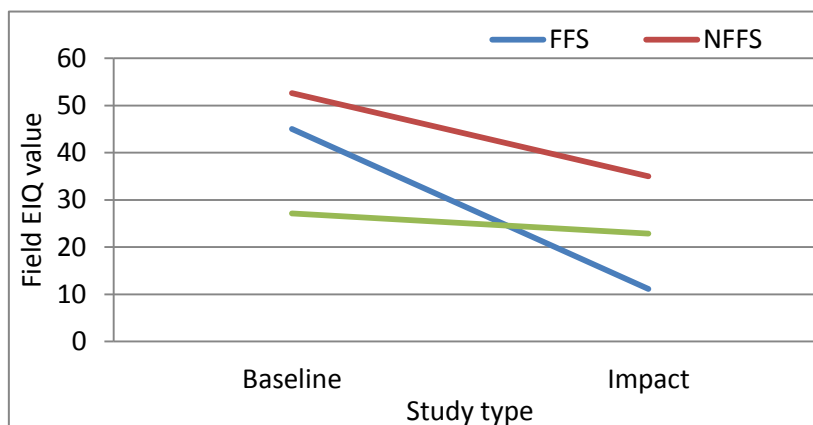


Figure 7. 12: Mean Field EIQ Values for Class Ib Pesticide by Program and Household Type

Maximum reduction was from 34.73 to 13.57 (-60.93%) of intensive, FFS farmers, followed by intensive NFFS, i.e. from 42.04 to 21.86 (-48.00%) and regular, FFS farmers, i.e. from 61.00 to 46.35 (-24.76%) during impact (**Figure 7.13**). Level of mean field EIQ values with all farmer types in Mustang was higher than that of other two programs, which was due to 100% a.i. of servo oil used in Mustang. There was slight reduction in mean field EIQ values during impact with all household types in Mustang. Increment in field EIQ values of regular, NFFS and intensive, control farmers was due to more use of mancozeb, dimethoate, servo oil and sulphur pesticides, with high active ingredient values.

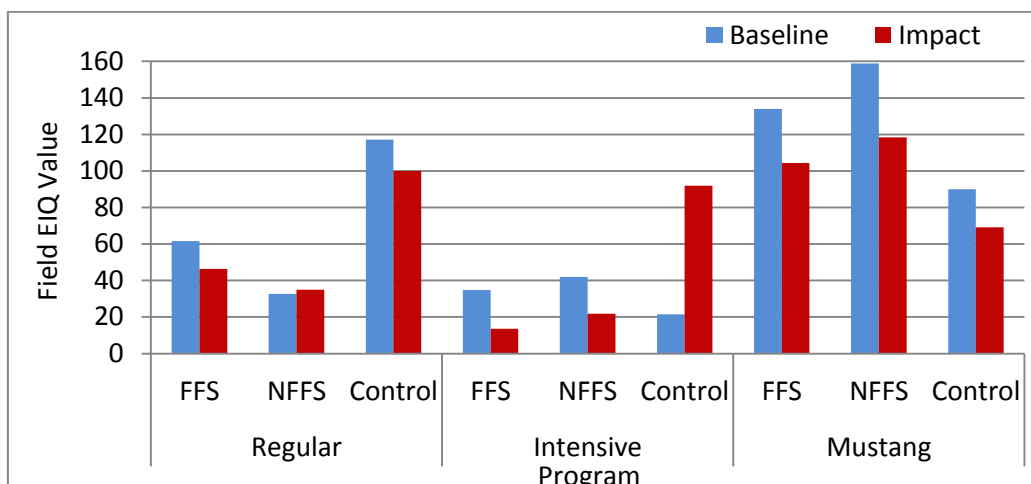


Figure 7. 13 Mean Field EIQ Value of Single Pesticides by Program and Household Type

The lower field EIQ values in FFS than in NFFS and control farmers were mainly due to lower doses, lower frequency and use of the pesticides with low toxic constituent content used by the IPM trained farmers. The study showed that farmers were shifting from more hazardous to safer pesticides to manage the pest problems of their crops due to impact of IPM training specially among FFS farmers.

Field EIQ value of the pesticides alphasmethrin, dichlorovos, pretilachlor and triazophos could not be computed because of unavailability of their EIQ values. Mean field EIQ values in key crops were decreased in impact than in baseline, and were lowest with FFS than other types of farmers. Among the key crops, highest values were found with potato, and they were 175.88 and 52.75 of FFS farmers, 147.33 and 87.60 of NFFS farmers, and 597.30 and 98.59 of control farmers during baseline and impact, respectively, under regular program (**Appendix 7. 11**). Mean field EIQ values on potato under intensive program were reduced sharply to 41.31 and 18.90 of FFS, 39.48 and 23.49 of NFFS and 43.44 and 62.06 of control farmers during baseline and impact, respectively. In Mustang, field EIQ values were higher, in general, than in other 2 programs, and the values were higher on apple than on potato except with FFS farmers. Other crops with high field EIQ values were tomato, followed by colecrops. Among the 2 programs and Mustang, mean field EIQ values were quite lower under intensive program. The study showed that among the key crops, more pesticides were used on apple, potato and tomato than other crops, however, the use has been reduced considerably among FFS farmers under intensive program, in addition, the used pesticides were moresafertype too in FFS group.

Field EIQ value of mixed pesticides ranged from 0.31 to 237.81 and 0.65 to 1304.39 with a mean of 28.82 and 73.50 during baseline and impact, respectively (Appendix 7.4). The highest field EIQ (1304.39) in impact was due to very high frequency (20) of SAAF used on potato by a NFFS farmer from Bara.

7.5 Use of Micronutrients and Other Substances

In addition to pesticides, micronutrients by 6, 12 and 15 and plant growth regulators by 3, 4 and 0, control, FFS and NFFS farmers, respectively, had used in their crops during baseline study. In impact study, micronutrients were used by 11, 58 and 28, control, FFS and NFFS farmers with a volume of 37.39 kg or l, 188.38 kg or l and 84.91 kg or l, respectively (Table 7.5). Other growth substances, like *jholmal*, cattle and buffalo urine, vitamins, etc were also used specially by FFS farmers in impact study. The study revealed that the farmers, mostly FFS group, became more cautious about pesticide hazards to the crops, human beings, animals and other environments, and were gradually shifting toward safer substances, like bioproducts, from toxic ones, due to the knowledge of the IPM training.

Table 7. 5: Use of Micronutrients and Other Substances

Substances	Study	FFS		NFFS		Control	
		No. of farmers	Quantity (kg)	No. of farmers	Quantity (kg)	No. of farmers	Quantity (kg)
Micronutrient	Baseline	12	36.89	15	35.15	6	23.10
	Impact	58	188.38	28	84.91	11	37.39
Plant growth regulator	Baseline	4	0.23	0	0	3	0.33
	Impact	5	1.06	0	0	3	0.50
Jholmol	Baseline	0	0	0	0	0	0
	Impact	20	122.58	1	0.02	1	3
Cattle/Buffalo urine	Baseline	0	0	0	0	0	0
	Impact	3	10	2	7	0	0
Vitamin	Baseline	0	0	0	0	0	0
	Impact	6	0.51	2	0.15	1	0.04
Pheromone trap	Baseline	0	0	0	0	0	0
	Impact	1	0.10	0	0	0	0

Thus, it looks such that IPM training with availability of various safer pesticides and micronutrients should be continued to the new areas and farmers of the country to reduce hazardous pesticides use, and supply healthy products in the markets.

8. Use of Fertilizers and Micro-nutrients

The average amount of chemical fertilizers (nitrogen, phosphorous, and potash) and farm yard manure with their costs were considered. Total dose, amount, average cost of chemical fertilizers were analysed. Similarly, amount of FYM and organic fertilizers used by households under different NIPM program also evaluated. More use of FYM and organic fertilizers substituting chemical fertilizers could be taken as the positive impact of NIPM Program.

8.1 Annual Use of Chemical Fertilizers

Figure 8.1 shows that average cost of fertilizers found decreasing significantly on IPM FFS household under the intensive program. Similarly, lower level of fertilizers used was found in Mustang district. Recently, Nepal Government is going to consider as organic zone of some area under control type in Mustang district. The increased use of fertilizers was observed in the control household under regular and intensive program and NFFS household of regular program. The incremental use in the chemical fertilizers in NFFS under regular program may be due to heavy use of fertilizers in Sarlahi districts.

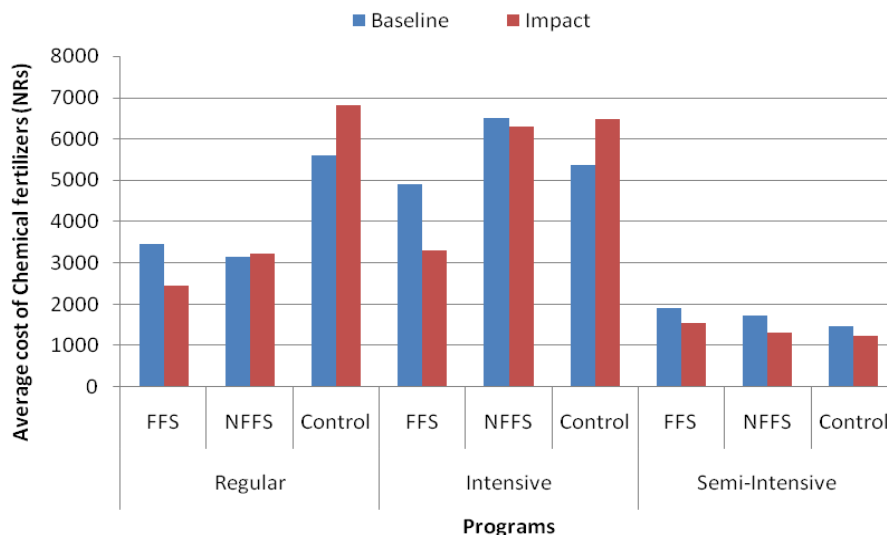


Figure 8. 1: Average Cost of Fertilizers Used by Program and Household Type

The annual average application of chemical fertilizers per sample household in terms of nitrogen, phosphorous, and potash and the average cost incurred while purchasing these fertilizers were analyzed. During impact study, it is observed that nitrogen application (measured as Kg/ha) by sample households under FFS decreases in all districts compared to baseline study. Maximum increase in use of nitrogen is observed in Sarlahi under control i.e. 299 Kg/ha and NFFS household types i.e. 290 Kg/ha. Similarly sampled households under control group are also found using higher amount of nitrogen except for Arghakhanchi (Appendix 8.1).

In case of phosphorous application it was decreased except for Mustang. Comparatively, higher increase in use of phosphorous was found in all household types of Bara district. The average highest amount of phosphorous used per sample household was found 189 kg in the NFFS category of Sarlahi district followed by 188 kg by FFS farmers of Bara district. In case of phosphorous and potash, the average amount per household used was highest in control group i.e. 3597 Kg/ha followed by NFFS i.e. 2615.47 Kg/ha and FFS i.e. 3032.89 Kg/ha in sampled households of Bara district—Application of potash was found higher in all sample household types of Sarlahi district and FFS household type of Surkhet while decreased in use of potash was observed in other districts.

In case of phosphorous application, it was found increased amount of use in Sarlahi and NFFS and control group of Arghakhanchi district. Comparatively, higher increase in use of phosphorous was found in all household types of Bara district. The average highest amount of phosphorous used per sample household was found as 189 kg in the NFFS category of Sarlahi district followed by 159 kg by FFS farmers of Bara district. In case of phosphorous and potash, the average amount per household used is found highest in NFFS group i.e. 181 Kg/ha followed by control i.e. 164 Kg/ha sample households of Sarlahi district. The amount of nitrogen and phosphorous application in rice crop was reduced in FFS sample households in all districts except for Sarlahi district. Similarly reduction of use of potash is observed in all districts except for Surkhet district.

8.2 Use of Farm Yard Manure

The farm yard manure (FYM) was used in all sample household categories and districts. The average amount of cash spends for Farm Yard Manure was found increased in FFS household type of all districts except for Bara district. The highest amount used was found in FFS sample households of Surkhet district and the lowest amount is observed in Control sample households of Mustang district in impact assessment.

Figure 8.2 shows that annual household expenditure on farm yard manure and organic manure by the programs and household types. The decreased cost of chemical fertilizers on the IPM FSS was compensated by the increased cost of FYM and organic fertilizers. The increased expenditure on FYM and organic fertilizers was found in FFS in all programs (regular, intensive and Mustang). However, higher proportional increment on the cost of FYM and organic manure was found in FFS under Intensive

program of Bara and Surkhet districts. This result showed that farmers were replacing chemical fertilizers by FYM and organic manure mainly in IPM FFS households.

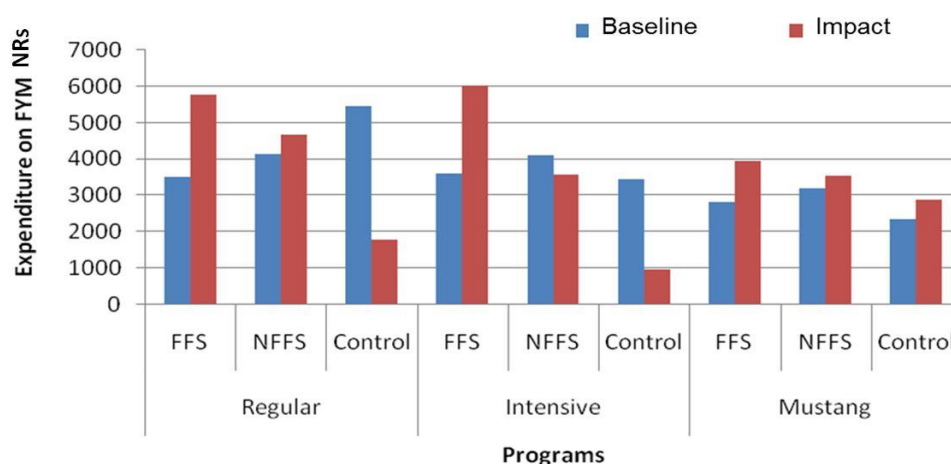


Figure 8. 2: Average Expenditure on FYM and Organic Fertilizers by Program and Household Type (NRs.)

Increase of use of FYM in rice crop was found in all districts (Appendix 8. 2) compared to baseline study. Average FYM and chemical fertilizers used in potato compared to baseline study shows increase in use of FYM and nitrogen fertilizers in FFS household type of Sarlahi, Bara, Arghakhanchi and Mustang (Appendix 8. 3). Highest use of phosphorous was found in NFFS sample households of Bara i.e. 60 Kg/ha, followed by NFFS sample households of Arghakhanchi i.e. 22.75 Kg/ha. Similarly highest use of potash was revealed in NFFS of Arghakhanchi district. Increase in use of FYM, nitrogen, phosphorous fertilizer was reported in NFFS household type of Bara and Arghakhanchi districts (Table 8.1). In Mustang district, decrease in use of FYM, phosphorous and potash and increase in use of nitrogen fertilizer was found in all household types (Table 8.1) compared to baseline study.

Table 8. 1: Average Amount of Fertilizer Used in Apple in Mustang

Household Type	FYM (Kg)		Nitrogen (Kg)		Phosphorous (Kg)		Potash (Kg)	
	Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact
FFS	1957	3986	281.25	16.33	14.4	12.5	9.53	0
NFFS	3100	5335	23.33	12.93	12.8	0	2.2	0
Control	2447	3196	170.71	1.67	1.67	8.3333	0	0

The highest use of FYM in cole crops was found in FFS household type of Arghakhanchi, followed by NFFS household type of Bara district (Appendix 8. 4).

9. Use of Seeds

Seed is the one of the major determining factors of increased production and productivity. The accessibility and timely availability of seeds is very crucial for farmers. This chapter highlights on the use and amount of local and improved seeds for major crops grown in the sampled households under survey districts.

9.1 Use of Improved Seed of Rice

Figure 9.1 shows that farmers were using more improved seeds once they became members of IPM FFS. It was found that FFS household under regular and intensive programs were using more improved seeds of major crops like rice, potato and tomato. Moreover, improved tomato seed users in the FFS household under intensive program were found remarkably increased as compared to baseline study. Similar results were found in case of improved seed users of rice and potato.

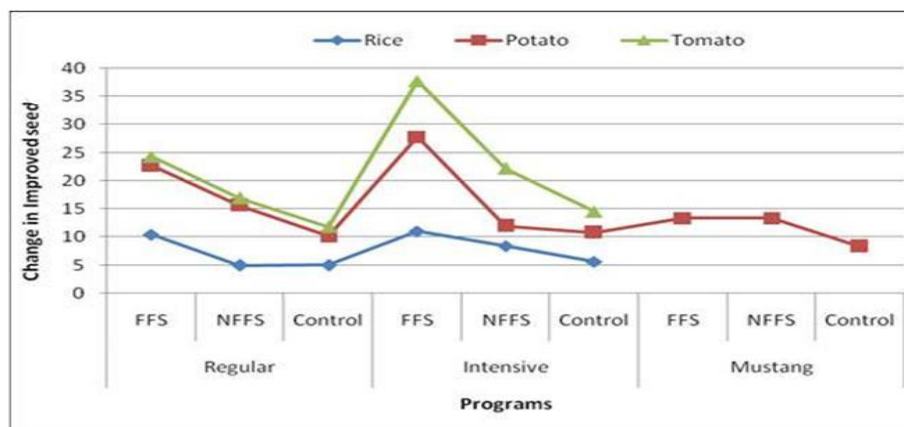


Figure 9. 1: Percentage Change in Improved Seed Users by Program and Household Type

Total percentage of households using improved seeds for rice in both baseline and impact study as well as the percentage difference in the use of improved seeds for rice is given in **Appendix 9. 1**. It was found that the use of improved seeds for rice was increased mainly in the FFS type of household in all districts except for Arghakhanchi district. The most significant increase in use of seeds was found in Surkhet district. However, for control households the use of improved seeds was found very low in most of the districts (except for Sarlahi). In overall, highest percentage of farmers using improved seeds of rice was found in Bara district (96%).

9.2 Use of Improved Seeds of Potato

Potato is considered as one of the most important cash as well as vegetable crops in Nepal. It is grown all over the country. The **Appendix 9. 2** shows the total percentage of households using improved seeds for potato in both baseline and impact study as well as the percentage difference in the use of improved seeds of potato. Corresponding to its baseline data, all of the sampled households irrespective of the household type or farm categories were found using improved seeds of potato. Except Surkhet, very significant increase in use of improved potato seeds was found in impact compared to the baseline. Similarly, the change in use of potato seeds in FFS type of households only, it was evident that the farmers of all the survey district were found using increased amount of improved seeds of potato. The most significant increase was found in FFS type household in Arghakhanchi district (i.e. the percentage increase was 207%). There was also positive change in using improved seed in Mustang in all household types.

9.3 Use of Improved Seeds of Tomato

The total percentage of households using improved seed of tomato in both baseline and impact study as well as the percentage difference in the use tomato improved seed is presented in Appendix 9.3. The use of improved seed of tomato by FFS household in Bara district was found tremendously increased (117%) compared to its baseline data. Consequently, it is also found that highest percentage of farmers in Bara district (29%) used the improved seeds of tomato compared to other sampled districts.

9.4 Seed Rate

This impact survey also made an assessment of the seed rates of rice, potato and tomato. The average amount of seed rate applied for all these crops and the percentage change in application in comparison to baseline data is shown in **Appendix 9. 4**. The highest rate of rice seed application was found in Arghakhanchi district (in all type of households) followed by Surkhet, Sarlahi and Bara. While analyzing the percentage difference of use of seed rate of rice, it was found significantly increased in control households of Sarlahi district. Whereas, the decrease in seed rate of rice was seen in FFS type of households of Arghakhanchi and Surkhet districts. Similarly, in terms of seed rate application of potato, the highest increase was found in control households of Bara (55%) and Arghakhanchi (45%). However, the significant percentage decrease in seed rate application of potato was found in FFS households of Bara followed by FFS households of Sarlahi and Arghakhanchi districts.

Regarding, the percentage change in use of seed rate of tomato, the maximum increase was found in control households of Sarlahi district whereas, the significant decrease was found in FFS households of Arghakhanchi and Surkhet districts. However, for most of districts (of all household types) the seed rate application of tomato was found more or less same as in baseline study.

10. Environmental and Health Impact

The farmers' knowledge and awareness on use of pesticide was found highly increased. The increment was higher in FFS followed by It was found that majority of FFS and NFFS farmers were adopting appropriate environmental and health protection measures. Annual poisoning cases on human and livestock were found decreased since farmers were using pesticide safely and stored in safe places. Respondents who keep pesticide in safe places were increased during impact survey as compared to baseline study. Similarly, farmers' awareness on identification and preservation of beneficial insects was also found increasing.

10.1 Pesticide Users

The number of pesticide users and changes in comparison to baseline among sampled households and program type are presented in Table 10.1 (details are given in **Appendix 10. 2**). Results showed that decreased in the number of farmers using different pesticides among the FFS farm household type by 20%. The highest reduction was found in FFS farm households under intensive program districts (24.29%) in impact study compared to baseline study. Similarly, the numbers of farmer in NFFS groups were also found reduced in the use of pesticides in all program type. But, there was an increment in number of farmers using pesticides under the control category of regular and intensive program by 32.3 and 15.8%, respectively.

Table 10.1: Number of Households Using Pesticides by Program and Household Type

Program	Household Type	Baseline			Impact			Percent Change
		N	Frequency	Percent	N	Frequency	Percent	
Regular	FFS	90	69	76.67	89	59	66.29	-14.49
	NFFS	60	31	51.67	58	31	53.45	0.00
	Control	60	34	56.67	60	45	75.00	32.35
Intensive	FFS	84	70	83.33	84	53	63.10	-24.29
	NFFS	67	58	86.57	63	38	60.32	-34.48
	Control	61	38	62.30	62	44	70.97	15.79
Mustang	FFS	30	26	86.67	30	20	66.67	-23.08
	NFFS	30	24	80.00	30	22	73.33	-8.33
	Control	30	19	63.33	30	14	46.67	-26.32

On the other hand, NFFS households under intensive program were found decreased in the use of pesticides by 34%. This might be due to increase in farmers' knowledge and awareness on use of pesticide after the implementation of IPM program and information diffusion from FFS farmers to NFFS farmer situated in adjoining area. In Mustang, It was found that the percentage of pesticide users in all household types decreased, where reduction was higher in control group (26.32%), followed by FFS group (23.08%) and NFFS group (8.33%). This may be due to the introduction of organic vegetable production program in the control site.

10.2 Use of Pesticide Protective Measures

The baseline and impact data were collected on number of households using mask/handkerchief, gloves while mixing of pesticides, and using eye protection and head cover during pesticide applications. Figure 10.1 revealed percentage increase in sampled households using mask/handkerchief in FFS of both regular and intensive types. The highest percent increase was observed in FFS households under intensive program.

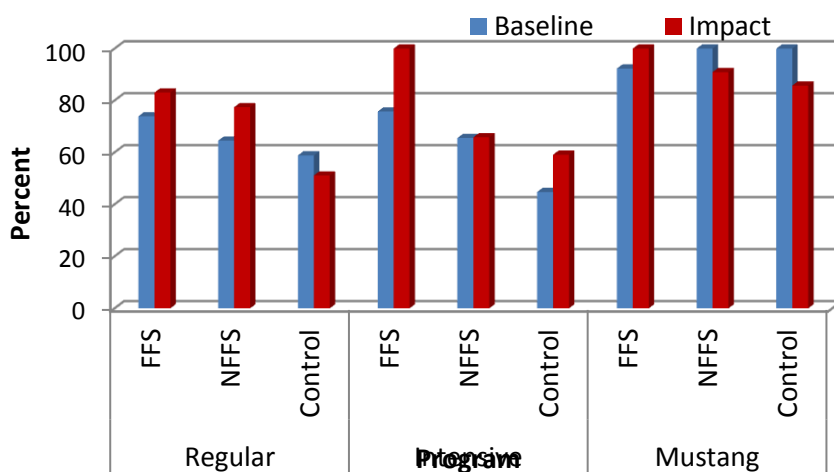


Figure 10.1: Change in Household Using Mask by Program and Household Type

In case of NFFS household type, there was also increased use of protective measures (mask) during pesticide application under regular program but there was no big difference among number of farmers using mask in baseline and impact study under intensive program. In case of control group, the number of farmers was increased in the use of mask under intensive program. But, in control group of regular program, there was slight decrease in the use of mask. Figure 10.2 shows the percentage change in respondents using of gloves while applying pesticides. There was increased use of gloves by FFS and NFFS farmers under both regular and intensive programs. While in case of control group no significant change was observed in use of gloves under regular program whereas significant increment was observed under intensive program (Appendix 10.2).

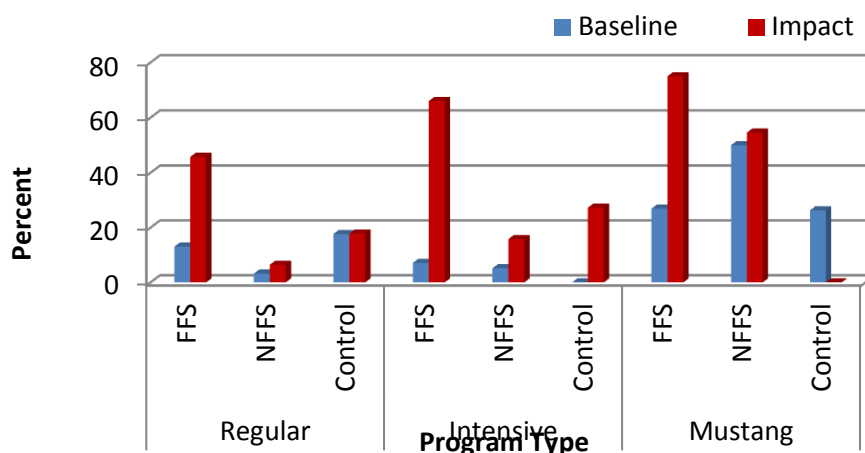


Figure 10.2: Change in Household Using Gloves by Program and Household Type

10.3 Human and Livestock Poisoning Cases

The human and livestock poisoning cases by household types and sampled district and before and after the project are presented in **Appendix 10. 4**. Numbers of pesticide poisoning case as impact value was found lower than the baseline value. The highest percentage of pesticide poisoning in baseline was observed in NFFS farmers in Sarlahi district (33.33%) whereas in impact study the highest percentage of pesticide poisoning case was observed in FFS of the same district (8.9%). However, this value is more than four times less than that observed maximum in the baseline study. In comparison to Sarlahi, very low percentage of pesticide poisoning cases was reported in FFS and NFFS households of Bara district in impact study.

Among the sampled households of Surkhet and Arghakhanchi, low pesticide poisoning cases were reported in Arghakhanchi in both studies. In case of percentage change over baseline, highest decrease in pesticides poisoning cases was reported in FFS and NFFS households of Arghakhanchi in comparison to the corresponding household category of Surkhet. In case of Mustang, drastic reduction in the pesticide poisoning cases was observed in impact study than in baseline study. Results showed reduction of pesticide poisoning cases from 6.67% in FFS to zero in impact study. Similarly in case of NFFS and Control group. In overall, pesticide poisoning cases was greatly reduced in FFS of intensive program than in regular program.

10.4 Keeping Pesticides in Safe Places

The percentage of famers who keep pesticide safely were found increased in FFS of all districts. The FFS households of Sarlahi district had the highest number (25.58%) keeping pesticides in safe places.. There was positive change among NFFS households of Sarlahi. Negative change over baseline was found in control group of both districts (**Appendix 10. 5**). Similarly in case of FFS households of Arghakhanchi and Surkhet district, farmers keeping pesticides safely was found highest in Arghakhanchi district (49.93%)

and lowest in Surkhet district (10.85%) in impact study. In case of NFFS, there was increased in households keeping pesticides in safe places by more or less same percentage in both districts. There was positive change among NFFS households of Sarlahi. In case of control group, greater positive change over baseline was observed in Surkhet in comparison to Arghakhanchi. In Mustang, highest increase in percentage of households keeping pesticides in safe places was reported in NFFS households, followed by FFS households. Decrease in percentage was observed in control group.

10.5 Perception of Farmers on Different Insects

The sampled household respondents were inquired their perception on whether all the insects should be killed. The underlying motto of putting this question was to assess the knowledge of the sample household respondents on not only beneficial insects but also importance of harmful insects in contributing ecological balance. The percentage of respondents having perception on 'all insects should be killed' has drastically decreased after the project implementation. In case of FFS sampled households of Sarlahi and Bara there was drastic decrease in percentage of households agreeing on killing all insects by 100%. In case of NFFS households, highest decrease in percentage over baseline was found in Sarlahi in comparison to Bara district. No or slight decrease was observed in control group of both districts. No change in household responses on agreeing on killing all insects was found in FFS households in Arghakhanchi after project implementation while reduction in households of FFS type was found in Surkhet district by 75.65%. Farmers' responses on killing all insects under regular and intensive program baseline and after project implementation are shown in **Appendix 10.5**. Results showed that perception of FFS households under regular and intensive program on killing insects reduced up to 100% after project implementation. It seemed that NFFS households under regular program might more aware of importance of insects. Situation was more or less same in case of control households under regular and intensive program.

10.6 Beneficial Insects Identified by Respondents

All respondents were requested to name beneficial insects found their farming areas. **Table 10.2** provides the details of types and number of beneficial insects identified by sample respondents' baseline and impact of the project and their percent change. Detail is given in **Appendix 10. 7**. It was found that in impact study number of respondents identifying beneficial insects increased in all 3 types of households. However, FFS and NFFS group showed higher increment in percentage of respondents. After the project implementation, more farmers under FFS type were able to identify beneficial insects in Arghakhanchi in comparison to Surkhet district whereas situation is quite reverse in case of NFFS and control group. In case of Mustang, greater positive change was observed in NFFS household type, followed by FFS type and control household type. Because of organic village development program in Kagbeni Mustang, percentage of respondents identifying beneficial insects has increased by 200 percent. The overall percent changes were the highest in Mustang district for all categories.

Table 10.2: Beneficial Insects Identified by Program and Household Type

Program	Household Type	Baseline	Impact	Percent Change
Regular	FFS	27	47	74.10
	NFFS	15	36	140.00
	Control	12	19	58.30
Intensive	FFS	32	51	59.40
	NFFS	14	33	135.70
	Control	11	18	63.60
Mustang	FFS	6	20	233.30
	NFFS	3	15	400.00
	Control	2	6	200.00

10.7 Environmental Implication of Pesticide Use

All the sample respondents were inquired to get their observation in terms of adverse effect of pesticide application on soil, biodiversity, and water. The baseline and impact index value on such observation was calculated for all these three things, soil, water and biodiversity. The higher the index value means the higher the adverse impact on soil, water and biodiversity.

Table 10.3 shows that all farmers were aware about the adverse effect of pesticide use for the environment. All FFS households' index values in impact study showed lower index value indicating that there is decrease in adverse effect on soil, water and biodiversity due to NIPM Program. This indicates that the pesticide problem has been gradually decreasing in FFS farmers in all districts. This adverse effect on soil, water and biodiversity has decreased more distinctly in FFS intensive districts (Bara and Surkhet) as compared to regular program districts (Sarlahi and Arghakhanchi) while comparing baseline value with impact value.

Appendix 10. 1: Index Value of Effect of Pesticide Use on Soil, Biodiversity and Water

District	Household Type	Index Value soil		Index Value Biodiversity		Index Value Water	
		Baseline	Impact	Baseline	Impact	Baseline	Impact
Sarlahi	FFS	0.6	0.51	0.3	0.27	0.5	0.45
	NFFS	0.4	0.39	0.2	0.41	0.3	0.53
	Control	0.4	0.43	0.2	0.41	0.3	0.53
	Total	0.5	0.45	0.2	0.34	0.4	0.49
Bara	FFS	0.4	0.33	0.3	0.26	0.4	0.34
	NFFS	0.3	0.36	0.3	0.34	0.3	0.31
	Control	0.4	0.50	0.3	0.49	0.3	0.43
	Total	0.4	0.39	0.3	0.35	0.3	0.36
Arghakhanchi	FFS	0.4	0.40	0.1	0.10	0.4	0.37
	NFFS	0.3	0.31	0.1	0.18	0.3	0.45
	Control	0.4	0.25	0.1	0.23	0.2	0.44
	Total	0.4	0.33	0.1	0.16	0.3	0.41
Surkhet	FFS	0.5	0.34	0.2	0.17	0.2	0.19
	NFFS	0.4	0.58	0.2	0.23	0.3	0.38
	Control	0.2	0.18	0.1	0.08	0.1	0.42
	Total	0.4	0.36	0.2	0.16	0.2	0.25
Mustang	FFS	0.3	0.26	0.1	0.10	0.2	0.19
	NFFS	0.3	0.27	0.1	0.14	0.1	0.17
	Control	0.3	0.31	0.2	0.15	0.2	0.28
	Total	0.3	0.28	0.1	0.13	0.2	0.22

Index ranges from 0 to 1. Higher the index value higher the adverse impact on soil, water and biodiversity.

11. Household Income and Expenditure

11.1 Household Income Analysis

Household members in the sampled districts are engaged in different kind of farm and off-farm activities to sustain their livelihoods. The major economic activities comprise producing crops, rearing livestock that includes poultry and fish farming, wage laboring, services in different organizations/institutions, business and remittances. The major farm enterprises include rice, maize, wheat, millet, apple and several types of fresh vegetables. Likewise cattle, buffalos, sheep, goats, fish and poultry are the major livestock enterprises. Forestry sector including farm forest, natural forest and non-timber forest products are also important sources of household income. In addition farming, migration of human resource for foreign employment is also a vital source of household earning.

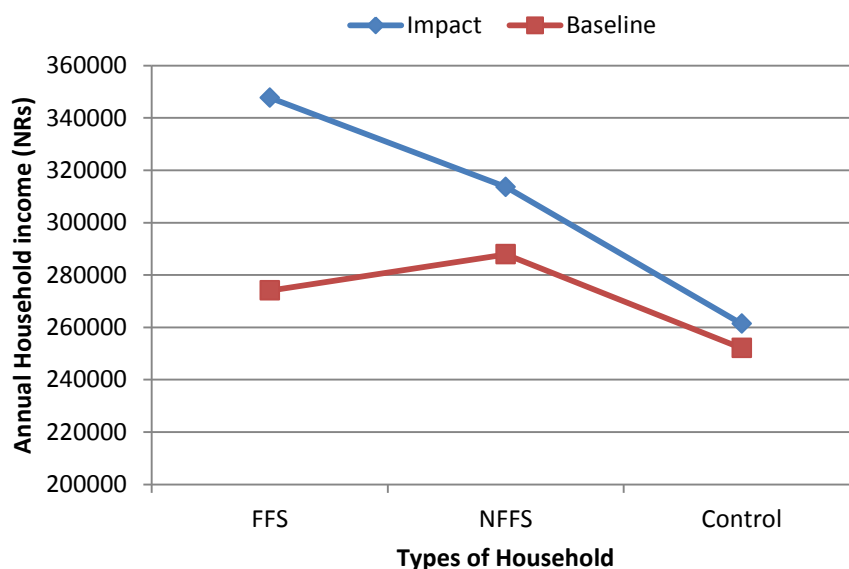


Figure 11. 1: Annual household Income by Household Type

Figure 11.1 compares the average annual household income of three different types of households; FFS, NFFS and control at before and after NIPM. The annual household income as impact value was found increased compared to baseline value in all types of household. Furthermore, increase in the annual household income was higher in the FFS followed by NFFS and Control group. The increased annual household income of the NFFS group is more than control because of spillover effect of project. Almost 35 percent increase in the income was reported in the FFS households.

Annual household income by the different programs: regular, intensive and Mustang was shown in Figure 11.2. The figure shows that nearly two folds increase in the income was observed under the intensive program compared to before the implementation of IPM FFS. Increase in the income household of both regular and Mustang program was found to some extent but lesser than intensive program. Hence the IPM FFS was found as the effective intervention. On a total average, annual household income increased significantly (Paired t value- 5.18, $P < 0.01$) compared to baseline study.

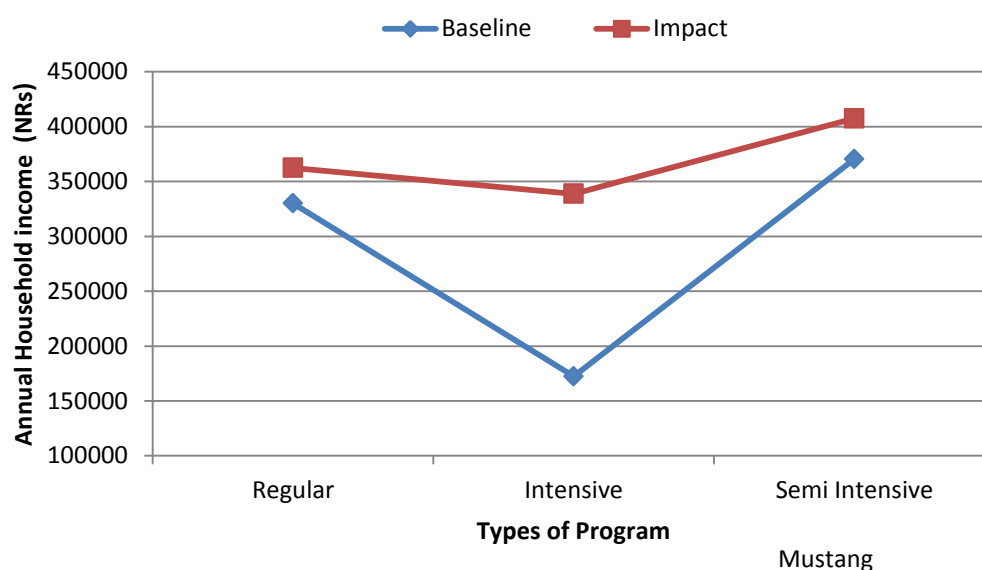


Figure 11. 2: Annual Household Income by Program

Of different sources of income, the income from crops was found increased in regular, intensive and Mustang. Similarly, very high increase (by 308%) in income from crops for FFS households was observed in Arghakhanchi district. As for the case of Surkhet the increase was not as high as Arghakhanchi and was observed to be meager 13%. In case of Mustang, the FFS households also showed 19% increase in annual income from crops. The **Appendix 11.1** displays the percentage change in annual household income by districts. Likewise, the percentage change analysis of income from livestock indicates a growth in annual income in all districts for FFS households. In Mustang, a 19% increase in annual income for the same category of households was found. Furthermore, compared to Bara district, the income from remittances and off farm decreased in Sarlahi district for FFS households. The same result was found in Arghakhanchi, compared to Surkhet, the income from remittances and off farm has significantly decreased for Surkhet district.

Table 11.1 gives the percentage change in annual household income from different sectors like crops, livestock, remittance, and off farm activities by the program and household types. The overall net income was found increased in all programs; intensive, regular and Mustang. However the greatest proportion (35.1%) increased was observed in intensive program with FFS household followed by NFFS household (28.0%). Meanwhile, similar percentage change in net annual household was observed in FFS

household for both regular and Mustang program. Of the different sectors of economy income from crops in FFS household of intensive program increased remarkably (158%). Likewise income from livestock sector was found increased significantly in the control group of Mustang program (97%) followed by FFS group in the intensive program. Remittance obtained by household in the NFFS type of household in the regular program was found highest.

Table 11.1: Percentage Change in Annual Household Income by Program and Household Type

Program	Household Type	Crops	Livestock	Remittance	Off-farm	Net Annual Income
Regular	FFS	15.7	9.1	50.0	10.0	17.6
	NFFS	7.8	3.1	84.8	-17.7	7.9
	Control	-56.0	1.9	38.8	18.5	-1.6
Intensive	FFS	158.0	92.4	-18.1	-43.1	35.1
	NFFS	98.0	11.3	26.8	-36.2	28.0
	Control	-21.6	-49.0	53.1	-25.8	-13.8
Mustang	FFS	19.2	19.3	55.0	-39.6	17.7
	NFFS	5.9	25.9	81.9	-55.4	-4.2
	Control	-85.7	97.7	57.1	21.9	9.6

Income from major cereal crops such as rice, maize, wheat was shown in **the Appendix 11.2**. Increased income from different crops was found in FFS households of intensive program as compared to that of regular and Mustang. Similarly, relatively more percentage increase in income of cereals was observed in FFS household of all three program types. Detail of annual household income from crops is presented in **Appendix 11.3**.

Similarly, of the different sources of income, the majority of income in a household was from crops in Sarlahi and Bara district followed by income through off-farm sources during baseline study. Similarly the major sources of income in Arghakhanchi and Surkhet district were from remittance and from off-sources, respectively. While in Mustang district, the major income was from crops and from off-farm sources. The **Appendix 11.4** displays the change in annual household income of sample household by district in baseline and impact study. The net annual income of Sarlahi district was found higher than that of Bara district while the net annual income was greater in Arghakhanchi district compared to Surkhet district. The annual household income of Sarlahi district has shifted from crop to remittance after the project followed by income from off-farm sources while the sources of annual household income remain unchanged in Bara district.

The net annual household income was found increased in FFS households of all districts. At the mean the greatest increase in the annual household was observed in FFS of Sarlahi district followed by the Mustang and Surkhet district. However, decreased annual household income was found in control

households of Surkhet district. **Appendix 11.5 to 11.9** gives the detail of annual income in baseline and impact under different category.

11.2 Household Expenditure

Figure 11.3 shows percentage increase in the annual household expenditure by program and household types. Figure shows that household expenditure was found increased in all programs i.e. regular, intensive and Mustang. However, higher increment in the annual household expenditure was found in the FFS households under the intensive program. **Appendix 11. 10** gives the detail of annual expenditure in baseline and impact under different category.

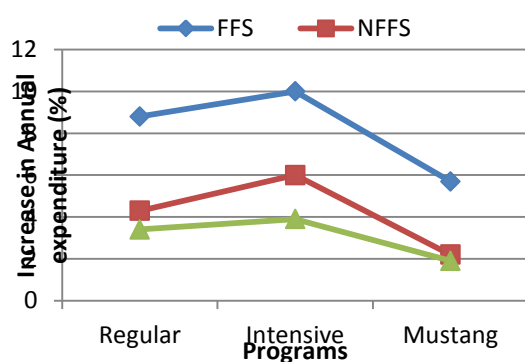


Figure 11. 3: Percentage Change in Annual Household Expenditure by Program and Household Type

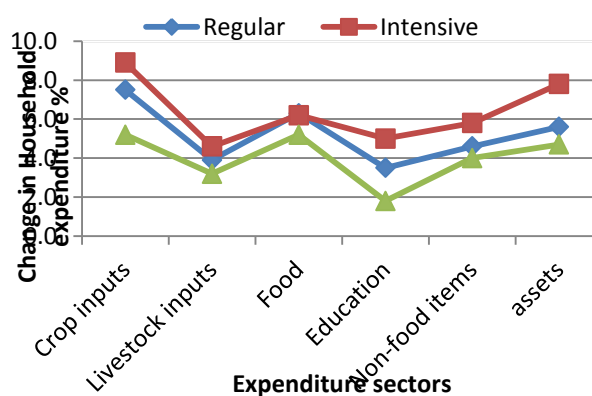


Figure 11. 4: Change in Household Expenditure by Items and Program

Figure 11.4 indicates the percentage change in the annual household expenditure in different items such as crop, livestock, food, education, non-food items and assets by program comparing baseline values with impact values. It was found that expenditure in each sectors like crop inputs, livestock inputs, food, education, non-food items and purchasing of household assets increased while comparing expenditure before launching the IPM FFS program. However, the change was found higher in the intensive followed by regular and Mustang district. Among different sectors, farmers were expending more of their annual income in purchasing crop inputs followed by the purchasing in household assets while least expenditure was found on livestock inputs.

Figure 11.5 depicts that household expenditure was higher in all sectors of IPM-FFS household because of their higher annual household income. Households in all categories were expending more in crop inputs as compared to livestock inputs, food items, education, non-food items and purchasing of household assets. Expenditure in all sectors of IPM FFS household was higher as compared to the NFFS and control types of household. Average annual household expenditure by different households in

Sarlahi, Bara, Arghakhanchi and Surkhet Districts are given in Appendix Tables **Appendix** 11.11, 11.12, 11.13 and 11.15, respectively. Average annual household expenditure for Food in Sarlahi, Bara, Arghakhanchi and Surkhet Districts are given in Appendix Tables **Appendix** 11.15, 11.16, 11.17 and 11.18, respectively. Similarly, annual expenditure for education in Surkhet, Arghakhanchi, Bara, Sarlahi and Mustang are given in Appendix tables 11.19 to 11.23, respectively.

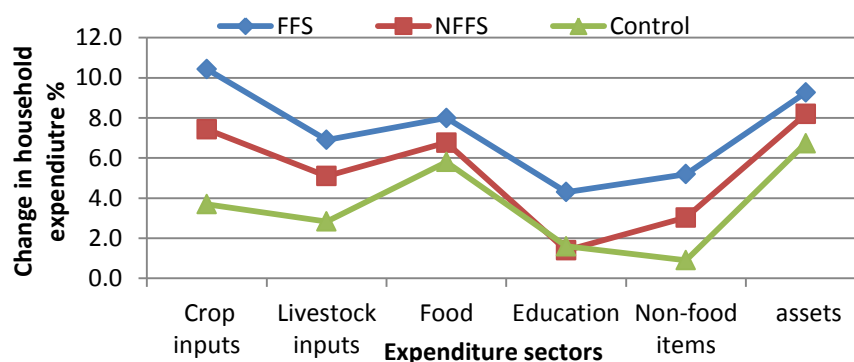


Figure 11. 5: Annual Household Expenditure by Items and Household Type

The analysis of household expenditure based on baseline and impact study by sample district is presented in Appendix 11. 24 considering major household expenditure items as crop inputs, livestock inputs, education, food, non-food items (clothes, water, electricity, fuel, health and insurance, social functions and recreation) and purchasing assets (livestock, land, gold and other items). The percentage change in expenditure considering the major household expenditure items such as crop inputs, livestock inputs, education, food, non-food items (clothes, water, electricity, fuel, health and insurance, social functions and recreation) and purchasing assets (livestock, land, gold and other items) are given in Appendix 11. 25.

The annual expenditure for crops and livestock unit has increased for both Sarlahi and Bara district with slightly more increase in Sarlahi district. However for education, food, non-food and purchasing assets, the percentage increase in expenditure is slightly more for Bara district compared to Sarlahi. Further, in the case of Surkhet and Arghakhanchi, the increase in expenditure for crop input and livestock input was found slightly higher for FFS household of Surkhet. In case of FFS households in Mustang, the increase in expenditure was found higher for crop inputs, non-food items and purchasing assets. However, the noticeable observation for Mustang is that the annual expenditure was found decreased for education for both NFFS and control households.

In comparing expenditure of household for education sector for different household types under regular and intensive program (Table 11.2), FFS households under intensive program were found to raise their expenditure in higher percentage for female in comparison to male. Similar results were also observed

in regular and Mustang program. Household expenditure in female among the household under Mustang program found to decrease in the control group. The annual household expenditure for food data reveals (Appendix 11. 26) that highest increase in expenses in Surkhet district followed by Bara district in contrast to maximum decrease in Arghakhanchi district. This decrease in expenses is mostly due to the drop in expenditure on purchasing all crops except fruit and vegetables.

Table 11.2: Percentage Increase in Annual Expenditure for Education by Gender

Program	Household Type	Male	Female	Education
Regular	FFS	5.2	5.8	5.1
	NFFS	3.5	4.5	4.8
	Control	1.8	3.5	2.5
	Total	3.3	3.4	3.5
Intensive	FFS	6	6.9	4.3
	NFFS	3.6	4.1	4.5
	Control	3.5	4	2.8
	Total	4.2	4.7	3.0
Mustang	FFS	2.5	3.5	3.5
	NFFS	1.7	6.5	5.1
	Control	3.2	-5.7	-1.5
	Total	2.8	3.2	1.8

A decrease in expenditure for cereals is seen in all districts. An increase in expenditure only for legume is observed in Sarlahi district while there is increase in expenditure only in fruits and vegetables, livestock and spices/oil/salt in Bara district. Furthermore, an increase in expenditure for only fruits and vegetables is found in Arghakhanchi district while a decrease in expenditure only for cereals and legumes is found in Surkhet district.

11.3 Factor Affecting Annual Household Income

The regression function was used to determine the factor affecting annual household income. Heteroscedasticity problem was arisen since the residual variance increases as income level. To achieve approximately normality and homogeneity of error term, the variable of annual household income is transformed by taking logarithms. Log transformation of annual household income as dependent variable was regressed against ten independent variables. Control household was taken as the benchmark category to make comparison and it was omitted to avoid multicollinearity problem (Table 11.3).

The regression result was based on 403 observations that results the stability of the equation (F value = 8.55, $P < 0.01$), and 17 percent of the variation in the annual household income is explained by the independent variables included in the regression model ($R^2 = 0.17$). There is no multicollinearity between independent variables included in the model since variance Inflation Factor smaller (VIF mean = 1.09) and none of the variables have VIF value higher than 1.29. Residual versus fitted plot (rvfplot) and added value plot (in the appendix 11.27) shows that the error terms are also randomly distributed that it was

checked by plotting them against predicted value of the dependent variable to confirm randomness of the errors term and variables linearity (Appendix 11.27).

Ten variables including age, occupation, education, caste, ownership of land, livestock standard unit and intensive program were used in the regression and found statistically significant. Among these, having agriculture as main occupation is considered negative and significant impact while remaining variables has positive but significant impact on the annual household income. The study depicts that (Table 11.3) a year increase in age of respondent, the annual household income from is increased by 0.5 percent. Similarly, having educated household head, the likelihood of increase in annual household income is by 14.2 percent keeping other factors constant which was statistically significant ($P < 0.05$). Ownership of land is another important factor that determine the household income, the annual household income was increased by 1.1 percent with household having own land compared to those without own land.

Table 11.3: Factor Affecting Annual Household Income

Variables	Coefficient	Std. Deviation	P-value
Sex	0.134	0.111	0.23
Age	0.005**	0.002	0.02
Education	0.142**	0.065	0.02
Occupation	-0.177**	0.071	0.01
Caste	0.171***	0.062	0.00
Own land	0.011***	0.002	0.00
LSU	0.024***	0.008	0.00
Membership	0.050	0.059	0.39
Intensive	0.142*	0.080	0.07
Training	0.066	0.062	0.29
Constant	11.684***	0.184	0.00

Observations = 414, R-squared = 0.175, Mean VIF = 1.09, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Moreover, one unit increase in the livestock standard unit the household income was found to increase by 2.4 percent ($P < 0.01$). While household having agriculture as main occupation, household income likely to drop by 17.7 percent. At the mean the farmers participation on the IPM FFS was found to be the most important factor that determine the household income that means, with farmers participating in the IMP FFS under intensive program the increment in the household income was by 14.2 percent compared to those in control under regular program.

11.4 Annual household income Vs Expenditure

Figure 11.6 shows that annual household income as well as expenditure got increased at impact compared to baseline study. However, incremental annual income and expenditure was higher in FFS household followed by NFFS and control.

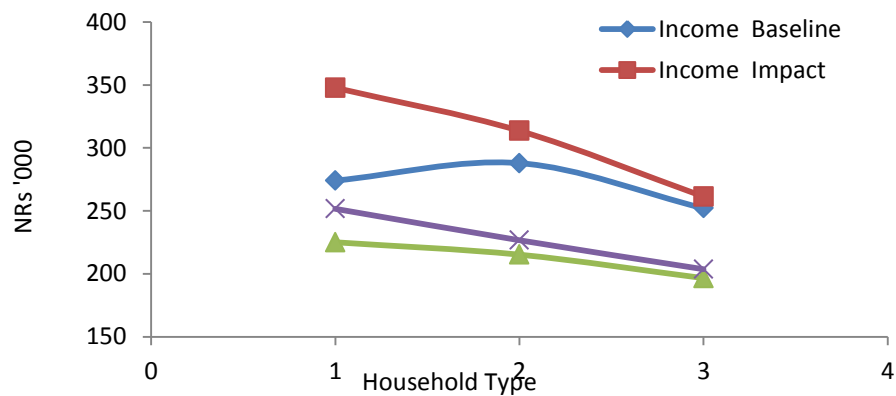


Figure 11. 6: Annual Household Income and Expenditure by Household Type

12. Cost Benefit Analysis of Major Crops

Rice, maize, wheat, millet, barley, buck wheat, lentil were the major food crops in the sampled districts. Similarly, mustard, potato, apple, and sugarcane were major cash crops. Vegetables like cucurbits, cole crops, tomato, and capsicums were also grown in the study area for both subsistence and commercial purposes. The economics of crop production especially benefit cost ratio (BCR) and gross margin of major crops grown by the sampled households under sample districts are presented in this chapter.

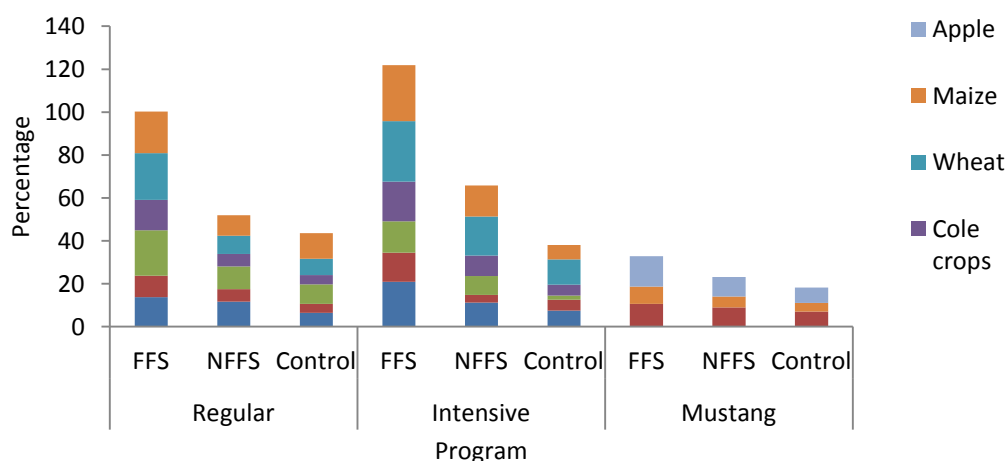


Figure 12. 1: Change in Gross Margin of Major Crops by Program and Household Type

Error! Reference source not found. shows the percentage change in the gross margin of major ousehold crops in the study area. It depicted that gross margin of all crops was increased compared to baseline. However, significant increase in the gross margin of rice was found in FFS household of intensive program followed by the FFS of regular program. Similarly, greatest proportion increase in the gross margin of potato was seen in the FFS of intensive program followed by the FFS of regular and Mustang. The higher percent increase in the gross margin of tomato, cole crops, wheat, and maize was resulted in the FFS household of intensive program.

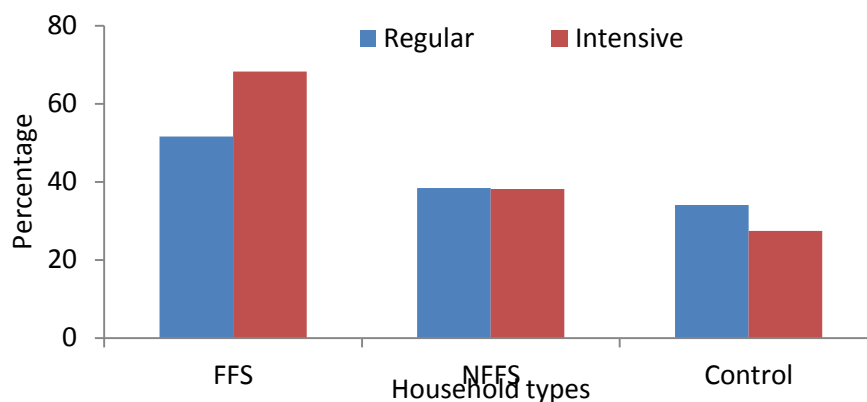
12.1 Rice

The change in gross margin of rice after the adoption of IPM technology by program is shown in Table 12.1 which depicts that the average overall increment in the Gross Margin of rice for FFS type of Household was highest followed by the NFFS and Control.

Table 12. 1: Change in Gross Margin of Rice by Program and Household Type (NRs./ha)

Program	Type of household	Baseline	Impact	Difference
Regular	FFS	14973.4	15670.2	696.7
	NFFS	8678.0	8756.7	78.7
	Control	6791.8	6860.6	68.8
Intensive	FFS	14744.7	19534.2	789.5
	NFFS	10920.9	10950.7	29.8
	Control	8450.8	8474.2	23.4

Highest increment in the GM of rice was found in FFS household (NRs./ha 789) under intensive program followed by that of regular program (NRs./ha 697). However, increment in the gross margin of rice after the implantation of IPM FFS was least in the control household under intensive program. From this Table it could be concluded that IPM in rice farming has got significant impact in the study area. The greatest increased in the gross margin of rice in FFS household mainly due to adoption improved and hybrid seed, use of FYM and organic manure instead of chemical fertilizers and improved package of practices as wells as practiced of IMP principles once farmers became IPM FFS member.

**Figure 12. 2: Change in B/C Ratio of Rice by Program and Household Type**

The Benefit Cost ratio of rice was found increased by 25 percent in the control household and 70 percent increase in the FFS household under intensive program. The mean increment in the NFFS under regular and intensive program was found somewhat similar (Figure 12.2).

12.2 Potato

Table 12.2 and Figure 12.3 show percentage change in Benefit and Cost ratio of potato crop by program and type of households. Remarkably increased (30%) B/C ratio of potato was found in FFS household under intensive program followed by NFFS of same program and FFS of regular program. At the same time, increment in the B/C ratio was least in NFFS of regular program followed by control household of Mustang district.

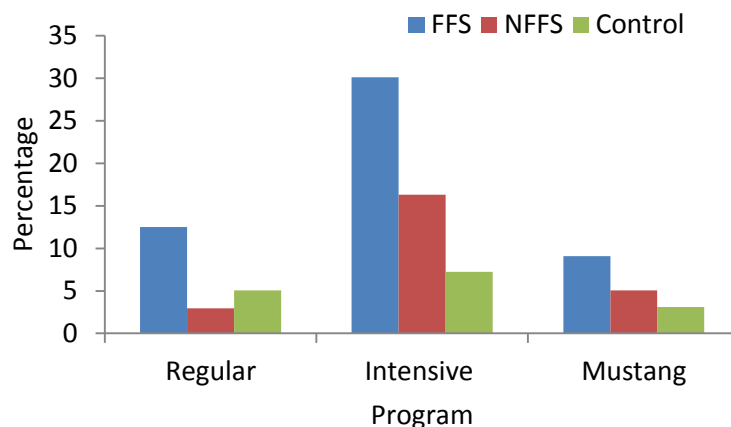


Figure 12. 3: Change on B/C Ratio of Potato by Program and Household Type

Table 12. 2: Impact of IPM on Gross Margin of Potato Production by Program (Value in NRs./ha)

Program	Type of household	Baseline	Impact	Difference
Regular	FFS	2876.95	3352.85	475.90
	NFFS	3226.80	3780.25	553.45
	Control	1844.85	1920.85	76.00
Intensive	FFS	5164.85	5805.35	640.50
	NFFS	4811.90	5318.60	506.70
	Control	2682.10	2990.75	308.65
Mustang	FFS	3373.60	3714.20	340.60
	NFFS	2423.00	2717.10	294.10
	Control	4127.60	4181.60	53.90

Similarly, the highest increase in gross margin of potato was observed in the FFS type of household under intensive program followed by NFFS of regular program while the least increment was reported in control household under regular program.

12.3 Tomato

Change in Cost Benefit ratio and gross margin of the tomato crop before and after implementation of National IPM program is shown in the **figure12.4 and Appendix 12.1, respectively**. The figure shows noticeable increase in gross margin of tomato in FFS household under intensive program at the impact study. However, decrease in the B/C cost ratio of tomato was resulted under regular program at the impact study compared to baseline. Increase in B/C ratio may be due to awareness of farmers about improved package of practices and reduction of cost of cultivation especially on the chemical fertilizers and pesticides.

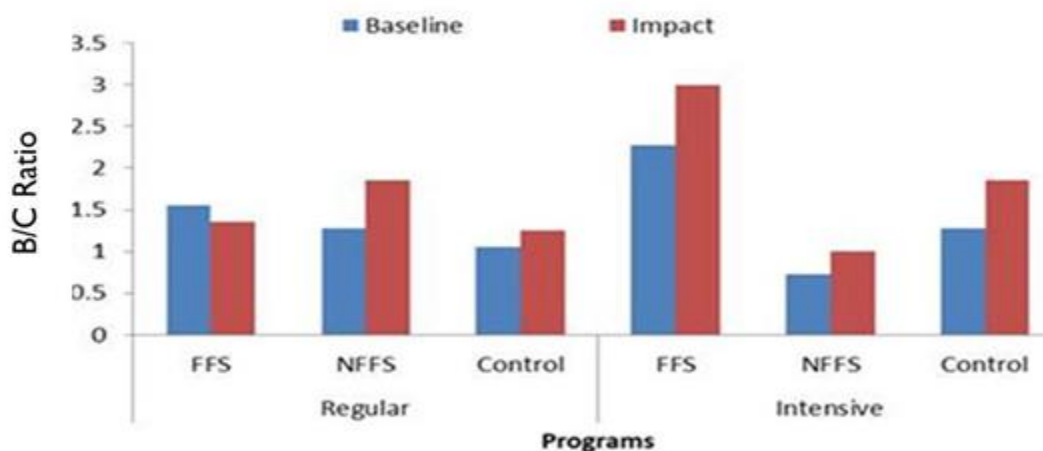


Figure 12. 4: Change in B/C Ratio of Tomato by Program and Household Type

12.4 Cole crops

B/C ratio of Cole crops in study area in baseline and impact study is shown in **Figure 12.5** and that of gross margin is presented in **Appendix 12.2**. Nearly, 40 and 36 percent increase in gross margin of tomato was found in FFS and NFFS sampled households, respectively. In control group, the slight decrease in gross margin was found by nearly 0.2%. In comparing the change in gross margin of Cole crops within the FFS households of study districts, highest increment is noticed in Bara district, followed by Arghakhanchi and Surkhhet. Highest decrease in gross margin among the control households group is inferred in Arghakhanchi, followed by Bara district. Figure 12.5 shows B/C ratio of cole crops by program at baseline and impact study. Increased B/C ratio was reported in all household types. Moreover, higher increment was resulted in FFS household under intensive i.e. from 2.1 in baseline to 2.6 in impact study. Similarly, somewhat same B/C ratio was found in NFFS household under regular program but lesser than that of intensive program.

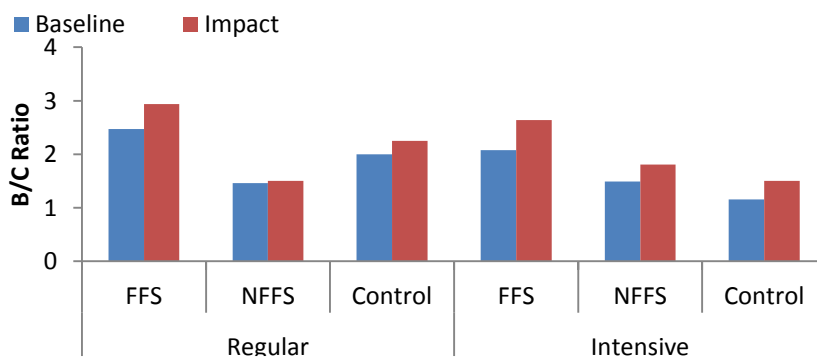


Figure 12. 5: Benefit Cost Ratio of Cole Crops by Program and Household Type

12.5 Wheat

Figure 12.6 gives percentage change in B/C ratio of wheat by program. B/C ratio of wheat was higher in each type of household under intensive program than regular one and FFS household received increased B/C ratio compared to NFFS and control under both regular and intensive program. Moreover, the greatest increment in B/C ratio was found in FFS under intensive program than that of regular one. While, only some percent increase in the B/C ratio of wheat was reported in control household of both regular and intensive program. Similarly, there was remarkable increment in the B/C ratio of wheat in the FFS household under intensive program.

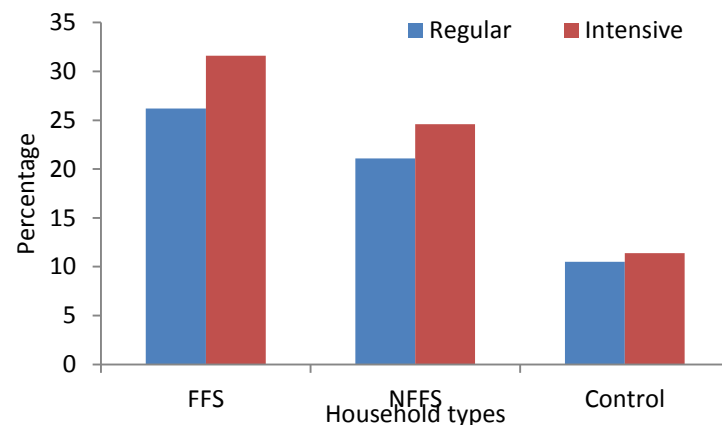


Figure 12. 6: Change in Benefit Cost Ratio of Wheat Production by Program and Household Type

12.6 Maize

Similarly, changes in gross margin and B/C ratio of maize production are presented in the **Appendix 12.4** and Figure 12.7.

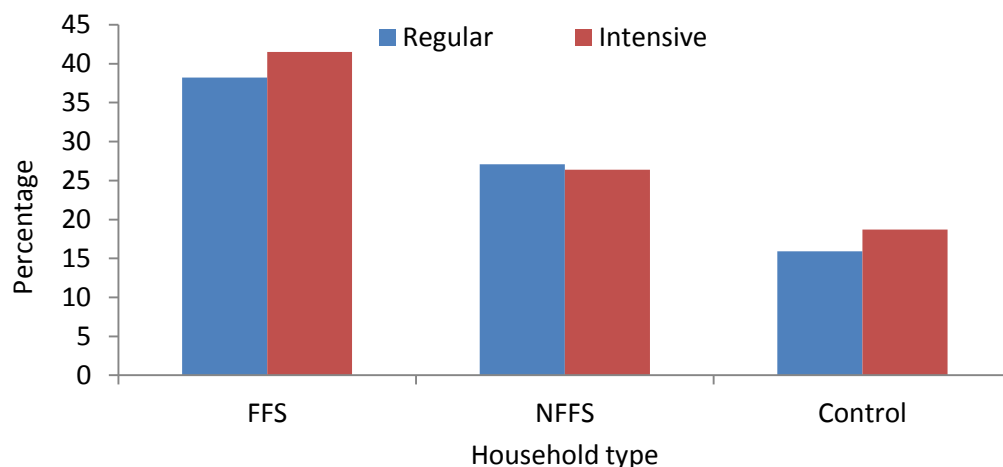


Figure 12. 7: Change in Benefit Cost Ratio of Maize Production by Program and Household Type

Result of B/C ratio analysis of maize was similar with that of other crops under study. Specifically, percentage increase in B/C ratio was higher in FFS household as compared to NFFS and control under both regular and intensive program (Figure 12.8). Moreover, the increment in the B/C ratio of maize was highest in FFS household under intensive (42%) followed by FFS under regular program (38%).

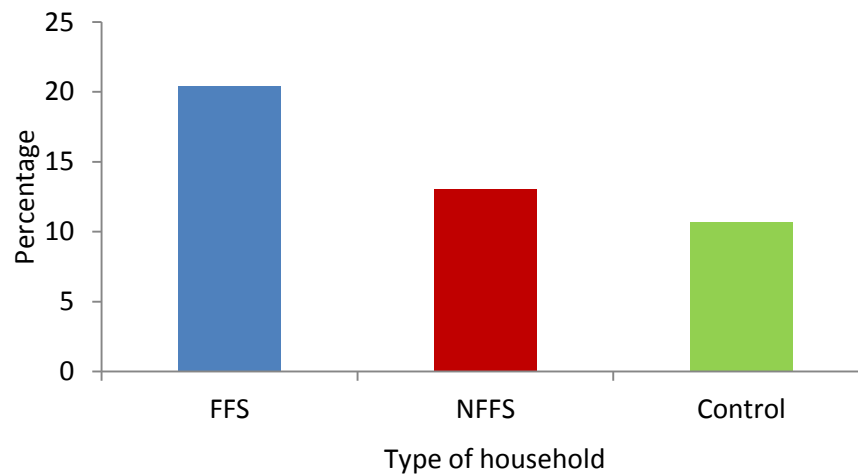


Figure 12. 8: Change in B/C Ratio of Apple Production in Mustang by Household Type

While analyzing B/C ratio of apple in Mustang district, greatest increment was found in FFS household (20%) followed by NFFS (12%) and control (10%).

13. Social Capital, Participation and Decision Making

The NIPM program is primarily based on the farmer field school (FFS) approach. The FFS is a learning-centered intervention which uses discovery learning and adult education principles to improve farmer knowledge and strengthen decision-making capacity. It is found that the FFS approach is flexible and has been adapted for various purposes for training farmers for promotion, production and consumption of healthy farm products, pest management of annual and perennial crops, soil management, gender and social inclusion and protection of environment and health awareness. The key guiding principles valued by all FFS include: farmer-centered, group-based discovery learning led by competent facilitators, learning rather than a technology or message focus, an emphasis on self-help and a systems approach. An attempt was made to assess the impact of FFS trainings in terms of two aspects. The first is sustainability, the expectation that farmers would use the improved decision-making capacity and experimentation skills acquired from FFS to adapt crop and pest management strategies to changing circumstances. The participant farmers were expected to make sound decisions, particularly in terms of farm and pest management based on improved knowledge and observations through FFS training.

The second is social¹ and human² capital strengthening. It is expected that the various exercise carried out at FFS such as agro-ecosystem analysis (AESA) to observe farm conditions, presentation of AESA results to the group, discovery learning exercises that allow farmers to learn by observing and drawing their own conclusions, working in small groups, and group dynamic exercises to improve group interaction have enhanced the social and human capital of the participant farmers. This chapter is primarily based on the household survey data against baseline value and the findings of field observation and focused group discussions.

¹ Social capital is defined as the networks, associations, institutions, rules and procedures as well as the attitudes, norms of behaviour, shared values and reciprocity and trust that enable people to engage in mutually beneficial collective action. Three forms of social capital have been identified: within groups (bonding), between groups (bridging) and between local groups and networks and institutions or agencies in higher influential positions (linking) (Njuki et al., 2008, cited in David and Asamoah, 2011).

² Human capital refers to health, physical capability, skills and knowledge that enable the successful pursuit of livelihood strategies. FFS are expected to contribute to human capital development by improving farmers' technical knowledge and skills and enhance social capital by developing leadership ability, encouraging membership in groups and networks, improving relationships between people and promoting farmer-to-farmer diffusion of knowledge and skills (David and Asamoah, 2011)

13.1 Sustainability, Human and Social Capital

The focus group discussions and interaction with the FFS participant farmers clearly showed that various exercises carried out at FFS imparted following types of knowledge and skills to the participant farmers:

- Working in groups
- Sharing of knowledge, farmer as an expert
- Pest and farm management decisions based on observation and experimentation
- Public speaking, confidence, consensus building, negotiation skills
- Strength of working in groups, leadership skills (for group leaders)
- Conflict resolution, team building, respecting differences

The following two expressions made by the FFS participant farmers reflects an impression that how effective was FFS in human and social capital generation.

Nandkala Rokaya, a women farmer of Thakleni VDC-2, Sahare, Surkhet said:

“IPM- FFS trainings have taught me enough about the harmful effects of chemical pesticides and fertilizers. Before FFS, I used to use Dhoom (insecticide) in vegetables and I was not aware about harmful aspect of using insecticide. The IPM- FFS made me aware of useful and harmful insects and botanical method (Jholmol) to control the pest. Now I can make Jholmol easily from Tetipati, Asuro, Ketuki, Neem, Khursani and cattle/buffalo urine. I spray 10 liters of jholmol in one ropani area for two times. I have realized it as an effective way to control harmful pest like beetles. It helps us to reduce the use of poisons in our crops and have healthy crops”.

Similarly, Hema Shahi and Lalita Oli, IPM farmers in Sahare Surkhet mentioned:

“We are able to take right decisions for crop production and optimum use of pesticides in different crops after we received FFS training. Besides we are now confident to decide when, what and where to take our farm product (vegetables) for selling which was not the case before the FFS training. The FFS training has not only increased our knowledge on crop production but also has increased our decisive power for crop and livestock production and marketing. Besides, we now are able to take more risk in production of vegetables than before”.

The expressions of the FFS participants clearly indicated that these farmers were practicing agriculture largely depending on expensive external inputs particularly chemical fertilizers and pesticides were used indiscriminately, resulting in high production costs. The IPM- FFS initiations empowered them to switch over to alternative farming practices, which are eco-friendly in general, and low production costs farming in particular. Besides, the farmers have enhanced their capacity to take independently crop and pest management decision. Similarly, farmers reported that after the FFS training they started producing their own quality seed, tested out new planting methods to reduce their reliance on herbicides, started applying cattle and poultry manure to the field, and initiated marketing of IPM products. Some of them

found extended their new knowledge to other crops using new methods of pest management learned at FFS.

The FFS group formed as result of project interventions created new avenues for knowledge exchange and support (bridging social capital), extending across villages in many cases, by informally training other farmers through demonstration and verbal instruction. It was found that FFS farmers were more capable of knowledge sharing compare to NFFS and control groups. According to Mr. Yam Prasad Kadaria Haripur Sarlahi, IPM farmers are teaching and sharing their knowledge and experience to neighbors and relatives even across the villages. He further asserted that IPM training at FFS has greatly helped farmers in producing environment friendly crops. However it is currently confined to small area and must be scaled up in large area for an effective result of IPM technologies.

The project also promoted group formation (bonding social capital) through FFS. For example, 3500 farmers in all 12 pilot districts are organized into 136 FFS groups. Women constitute 63% of the total IPM group member, whereas 48% farmers are from the Brahmin/Chhetri and Sanyasi castes followed by Janajatis (28%), Madhesi (15%) and Dalit (9%). All 136 groups of 12 pilot districts are registered in respective DADO. All the farmers have their individual farm plan which they document in farmer's record books, also known as *Green Book* among the IPM farmers. It was also reported that FFS participant farmers began working together to address new farming issues and to organize joint actions as a consequence of IPM training. For example, the Project Progress Report (2012) stated that

“the FFS groups registered in DADO are more organized in terms of developing coordination and linkages with various service providers at VDC as well as District level. In this way they have increased access to quality seeds, fertilizer, small irrigation, safer pesticides and tools from agro-vets, DADO and private sectors. They have identified wholesale buyers and middlemen for product marketing. Besides, the IPM group farmers have become aware for promotion, production and consumption of healthy farm products”.

After FFS training the participating farmers have realized that unity among the farmers has increased. “Working in FFS has not only improved our knowledge in terms of pest and farm management but we also feel comfortable to work in group” said Dil Sara Oli, Sahare 4, Surkhet. She further added that due to male and female participation in FFS group work and IPM training, co-operation and we-feeling among the farmers has increased. It was also revealed during the FGDs that farmers perceived the IPM technology as a novel technique for farming system efficiently. So they have used local resource like crop residue, litter, well decomposed Farm Yard Manure (FYM) in the field. On the other hand, some farmers are using farm resources very efficiently in the farm.

The FGD participant farmers reported enhanced social skills as a result of FFS in three areas: public speaking, arriving at consensus as a group and being able to work in groups more effectively. Developing the ability to respect and accept the view of others was another important social benefit mentioned by several farmers during the focus group discussions. For example, when survey team approached to the villagers especially IPM farmers in the village for field observation and data collection, farmers were found very curious and asking many questions including purpose of the survey. Even the women

participants were very curious to know the purpose of visit and observation at the villages. Both males and females who received training from FFS are actively participated in FGDs in all districts. On the other hands, there was a huge gap between male and female in Babuween VDC, Bara district and Sasapur VDC, Sarlahi (both represent the Control group). In Both VDCs Female didn't participate actively in the meetings and males were always dominating the female which was also revealed in the participation in different organization (**Tables 13.3 and 13.4**).

13.2 Knowledge Enhancement and Attitude Changes

Both farmers and facilitators indicated that once field schools have started meeting regularly, addressing a wide range of issues, farmers' attitudes and competencies changed. For example the participant farmers now easily recognize beneficial insects, harmful insects, and can estimate pesticides required for harmful insect's pests. According to IPM group in Surkhet and Arghakhanchi, they are using lower dose of pesticides, from less hazardous group like nuvan, than before. The same situation was found among the almost all FFS and few N-FFS group farmers in Bara and Sarlahi districts.

Similarly, it was reported that the participant farmers have been using chemical fertilizer more or less same as before. However, mode of application and frequency has changed visibly. Previously farmers were applying urea only once or twice in the rice field, but now they are using at least two to three split does. They think that applying 2-3 split does supply nutrient as required resulting increase in production of rice. Similarly, their knowledge on the rational use of chemical fertilizers for other crops has greatly improved. Farmers have become more aware on (local) production constraints, including diseases and pests, water and soil problems, and social impediments to intensification of production (labor shortages at peak periods, etc.). Review field findings by individual members of the group and sharing of knowledge and experiences with other farmers in a structured way during FFS trainings have enhanced their critical thinking. This, combined with their enhanced analytical capabilities, have increases the levels of self-consciousness of farmers. It also has made them more outward looking and more critical towards externally imposed solutions to their problems.

It was found that farmers have enhanced knowledge on crop management techniques as a result of IPM-FFS trainings. For example, the participant farmers, after training follow crop calendar-wise cultural operations and they themselves found that it has reduced the insects' pest and disease infestation in the all crops. This was possible only when they learned rational use of inputs (fertilizer, irrigation water, pesticides etc) in the field during IPM- FFS training. Till few years ago, the farmers used to mix different insecticides to get the quick impact and avoid repeated application of pesticide and fungicides especially for rice and vegetables. The trend has been changed according to Mr. Madan Prasad Saha, an agro-vet dealer in Bhalue Bharwalia, Bara district. "Farmers' knowledge on safe use of pesticide has been enhanced remarkably".

It was also reported that farm workers, who sprays pesticides, are paid higher wage or incentives either in cash or in-kind. Besides, they used head cover, gloves, and full sleeve clothe etc. while spraying

pesticides. In this context, IPM facilitator Rajesh Yadav in Bara district rightly observed that not only the farmers but also farm workers are aware about harmful pesticides which were not the case two-three years ago.

13.3 Participation and Decision Making

The involvement in public and decision making by the local farm households matters a lot in getting access to the productive resources and related services. The sampled households under different categories were viewed from the perspective of their membership in any social organization, membership by gender mainly for the above the community level positions, households actively participating in community meetings, feeling of discriminatory behaviors by the minorities and *dalits* households, level of satisfaction with the current level of crop yields, households participating in group in getting public funds for community development activities, and household members participating in public meetings by gender.

13.4 Membership in Different Organizations

Error! Reference source not found. shows that the proportion of sample household having membership in any social organization has increased against the baseline value among all categories in all program type. However, it is visibly increased in FFS group in intensive category. The main reason beyond this finding could be the FFS trainings related to leadership and group building provided by the project.

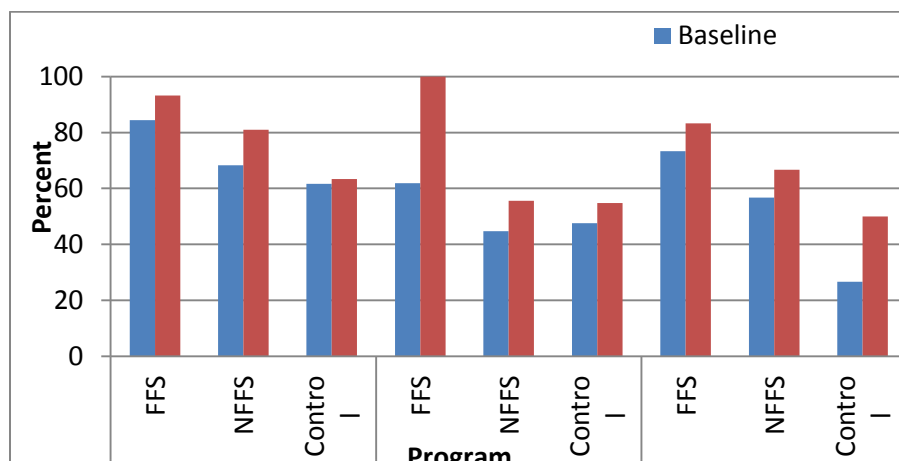


Figure 13. 1: Household with Members in Social Organization by Program and Household Type

Appendix 13.1 shows that FFS category (100%) and Control categories (33%) of sampled households in Bara district have the highest and lowest percentages of membership in any social organization. Comparative analysis of baseline and impact study depicted overall increase in sampled households with

members in social organization by zero in control category of regular district (Arghakhanch) to 53% in FFS category of intensive district (Bara). Similarly the FFS category of intensive districts had increased members in any social organization by 38% compared with only by 8% in FFS category of regular district.

In baseline study two categories of social organizations were considered for analysis, namely agriculture related organizations but not IPM and other community development organization including NGOs, CBOs, and political parties. In some sample VDCs the farmers' field schools were already started and in others the initiation was made but not completed. Therefore membership in agricultural organization excluding IPM related organizations were considered in this analysis. In impact study, three categories-- agriculture related organizations, community development organization and IPM related organizations were considered separately.

Table13. 1 shows that the sample households with FFS group had higher percentage of membership in IPM related institution followed by agriculture related organizations and community organization, respectively as compared to the baseline value in all sample districts. The membership in IPM related institution of NFFs and control households in Mustang and Arghakhanchi districts found non-existence. On the other hand, membership in IPM related institutions are also reported by control groups in Sarlahi and Bara districts indicating spillover effect of the project. After the project, all households (100%) in FFS category in intensive districts are found to be involved in IPM related institutions whereas only 65% households of FFS category in regular district are involved in IPM related institution (Error! Reference source not found.).

Table 13. 1: Membership Percent in Agriculture and Community Development Organization

Program	Household Type	Baseline			Impact			
		Sample household	Agriculture	Organization	Sample household	IPM	Agriculture	Organization
Regular	FFS	90	38.9	54.4	89	65.2	46.07	60.67
	NFFS	60	21.7	65.0	58	8.6	43.10	58.62
	Control	60	15.0	58.3	60	3.3	10.00	35.00
Intensive	FFS	84	25.0	40.5	84	100.	44.05	50.00
	NFFS	67	32.8	35.8	63	22.2	44.44	52.38
	Control	61	4.9	59.0	60	5.0	31.67	63.33
Mustang	FFS	30	40	56.7	30	53.3	50.00	60.00
	NFFS	30	30	36.7	30	0.0	36.67	43.33
	Control	30	13.3	16.7	30	0.0	33.33	20.00

Source: Field Study 2013

Respondents were inquired on how many of their family members had membership in organization above the community (district, region, national and international) levels organizations. Table 13.2 shows that FFS households had higher number of members having memberships in organizations above the community level except in Bara where control group had higher family members above the community level during baseline study. The after project situation indicates a steady increase of sample

households of all types having memberships in organizations above the community level in all sample project districts except in Control Group, Arghakhanchi. The numbers of households having memberships in organizations above the community level in Control Group, Bara has same value to baseline value. The total numbers of respondents participating in above community level organization were found to be increased in FFS and NFFS categories of all districts by 15 to 40 percent and 10 to 23 percent, respectively. Engagement in IPM-FFS activities could be a reason of increasing numbers of household having memberships in organizations above the community level in FFS and NFFS category. In terms of gender, after project intervention, involvements of female members in organizations above the community level have increased visibly in all districts (Table 13.2). Increase in female participation was observed in impact study which ranges from 3.33 (control category in Sarlahi and Bara) to 26.67 (FFS category in Mustang) and that of corresponding values for the baseline study were each 3.33, respectively (Appendix 13.3).

Table 13. 2: Percent Households with Members in Organizations above Community Level by Gender

Program	Household Type	Baseline				Impact			
		N	Male	Female	Total	N	Male	Female	Total
Regular	FFS	90	17.78	8.88	26.6	89	11.3	20.20	31.46
	NFFS	60	3.33	6.66	10	58	6.9	13.81	20.71
	Control	60	10	10	20	60	10.0	10.00	20.00
Intensive	FFS	84	14.41	5.26	19.7	84	12.1	31.97	44.10
	NFFS	67	14.78	2.78	17.6	63	9.4	21.82	31.21
	Control	61	19.78	6.56	26.4	62	19.6	9.58	29.17
Mustang	FFS	30	6.67	3.33	10	30	13.3	26.67	40.00
	NFFS	30	6.67	0	6.7	30	6.7	16.67	23.33
	Control	30	0	0	0	30	10.0	10.00	20.00

The sample households were inquired about the members in the households who were actively participating in community meetings. Figure 13.2 presents the modes of participation of all sample households under different sample categories before and after project situation. Before project, the lowest percentage (36) was reported in the NFFS group of Sarlahi district as against to the highest percentage (91) of FFS households of Arghakhanchi district reporting actively participating members in community meetings among the sample households. The after project situation clearly indicates a visible increment of households having actively participating members in all categories but 100% FFS households in particular for intensive districts (Appendix 13.4). It indicates that the IPM-FFS participants have gained a reasonable level of confidence and communication skills after the project.

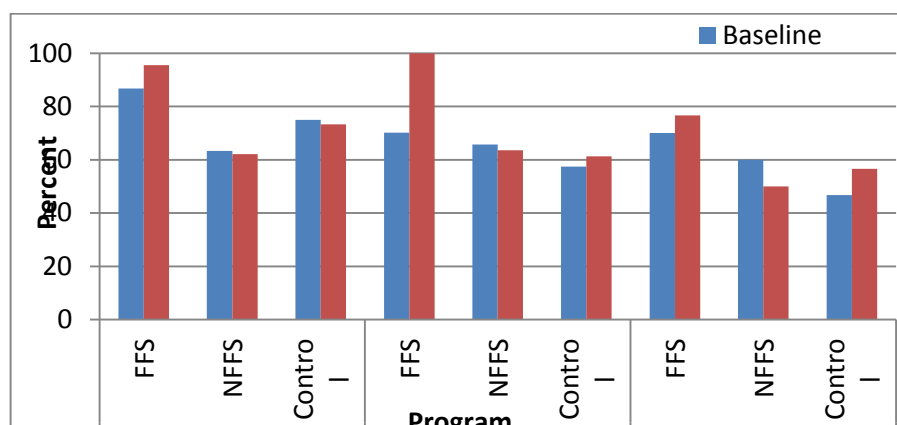


Figure 13. 2: Households Members with Actively Participating in Community Meetings by Program and Household Type

13.5 Feeling of Discrimination

Table 13.3 shows baseline scenario indicating that the highest level of discrimination was felt by Janajati households in Sarlahi, Dalits households of Sarlahi, Bara, and Arghakhanchi while getting public resources. The middle caste population is only concentrated in Sarlahi and Bara where 22 and 24 percent of the respondents, respectively, indicated that these groups usually discriminated while carrying out community development activities.

The impact scenario is noticeably different compared to the baseline situation in terms of feeling of discrimination by underprivileged and minority groups. The percentage of respondent who perceived feeling of discrimination against Janajati and Dalits has reduced drastically during the impact study. Further, the numbers of respondents who have perceived that middle caste group are discriminated while carrying out community development activities are slightly reduced in Sarlahi and Bara districts.

Table 13. 3: Respondent's Perception on Discrimination by Underprivileged and Minorities

Group Category		Baseline					Impact				
		Sarlahi	Bara	Arghakhanchi	Surkhet	Mustang	Sarlahi	Bara	Arghakhanchi	Surkhet	Mustang
Janjati	HHs	7	2	1	10	68	7	2	1	11	68
	N	4(57)	0	1(100)	4(40)	19(28)	3(43)	0	0	0	10(13.3)
Dalit	HHs	1	1	11	17	10	1	1	11	15	10
	N	1(100)	1(100)	11(100)	8(47)	6(60)	1(100)	0	4(36)	2(13)	2(20)
Middle Caste	HHs	23	90	0	0	0	21	90	0	0	0
	N	5(22)	22(24)	0	0	0	4(19)	15(17)	0	0	0

HH= indicates total number of household in respective cast

N = number of respondent indicating discrimination (Figures in the parentheses are in percent)

Source: Field Study 2013

An inquiry was made on the level of satisfaction with quantity and quality of own yield. **Figure 13.3** provides details on the level of satisfaction of all categories of sample households by both before and

after project scenarios. Before project, the highest percentage of sampled households under FFS category (66.67%) in intensive districts reported that they were satisfied. Whereas, the lowest level of satisfaction (26%) was found in case of FFS category of regular district before the project. After the project intervention, a large majority of FFS farmers (89%) in intensive districts compared to only 56% FFS farmers in regular district expressed that they were satisfied with the quantity and quality to their own yield. Whereas decreased numbers of farmers in all categories in Mustang expressed that they are satisfied with the yield compared with the before project situation. This is mainly due to the delayed in project implementation (**Appendix 13.5**).

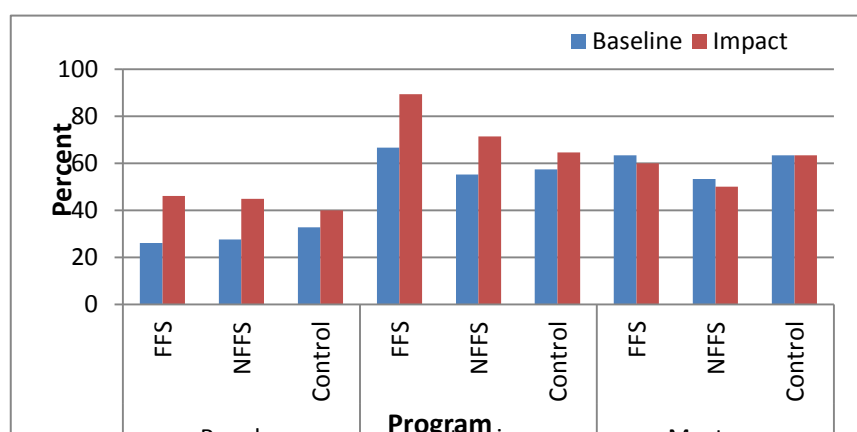


Figure 13. 3: Level of Satisfaction with Quality and Quantity of Own Yield by Program and Household Type

13.6 Community Effort for Getting Public Fund

The numbers of sample households which were engaged in joint efforts in getting public fund for community development before and after project intervention were enquired and the responses are presented in **Appendix 13.6**. During baseline study the highest percentage of households engaged in collaborative attempt (78% of the FFS sample households) to access government and community resources was reported in Arghakhanchi district whereas the lowest (13 percent of control sample households) were involved in getting public funds for community development in Bara district.

Figure 13.4 shows that the percentage of effort of collective action, particularly to access government and community resources for public welfare, has been increased drastically after the project intervention. Significantly higher percentages of sample households in all categories (particularly FFS) and districts are found engaged in collective action after the project intervention. About 82% compared to 78% FFS farmers in Arghakhanchi followed by 81.5% compared to 50% NFFS farmers in Mustang and 70% compared to 40% Controlled farmers in Sarlahi districts were engaged in collaborative effort before and after the project respectively. It means cooperation and sense of solidarity among the farmers is enhanced as result of the project activities.

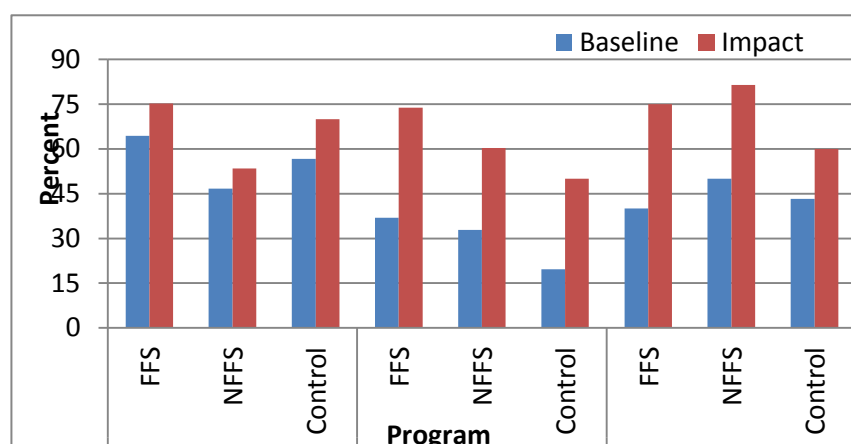


Figure 13. 4: Household Participation in Group Efforts in Getting Public Funds by Program and Household Type

14. Conclusion and Recommendations

The NIPM program is primarily based on the farmer field school (FFS) approach. The FFS is a learning-centered intervention which uses discovery learning and adult education principles to improve farmer knowledge and strengthen decision-making capacity and thereby improve crop production without deteriorating the human and animal health and crops environment. NDRI conducted impact assessment of NIPM from August 2013 to January 2014 and conclusion and recommendations based on findings are presented hereunder.

14.1 Conclusion

The same five districts, namely, Sarlahi and Arghakhanchi under regular program, Bara and Surkhet under intensive program and Mustang as a separate case were considered for the both baseline and the impact study. The Sarlahi and Bara are Tarai districts, Arghakhanchi and Surkhet are in Hills and Mustang is in Mountain region of Nepal. The required data and information were collected through both primary and secondary sources. The primary data were obtained through household survey of FFS, NFFS, and Control households, focus group discussions, and key informant interviews. The secondary data were collected from District Agriculture Development Offices, District Livestock Service Offices, District Level Agro-vet Shops and Associations, District Level Non-governmental Organizations of the selected study districts, NIPM Project Office, and Plant Protection Directorate at Kathmandu, Nepal. There were altogether 506 sample households constituted by FFS (203), NFFS (151), and Control (152) considered for the household survey for the impact study. Data were collected from the same households of five districts using the same questionnaires as used in baseline study in 2010. Data were analyzed by using statistical tools and indexing methods. The environmental impact quotient (EIQ) analysis was done by adopting the existing methodology designed by the Cornell University USA to find out the pesticide risk indicators for this study. Considering the baseline and impact study, results were compared and following conclusions and recommendations are made about the performance of the national IPM program phase II implemented Nepal.

The household head in majority of sampled district were male dominated with the average age of 53. There was slight increase in assets owned by all category of households particularly related to owning land, livestock, and mobile phones. Comparative analysis of sampled households using roofing materials during baseline and impact analyses revealed that there was shift in use of roofing materials from mud, and thatched/bamboo to CGI sheet, slate/local tiles and concrete. This was significantly higher in intensive districts (Bara and Surkhet). The average farm size of sampled households was found higher

under intensive program than regular program. The farm size under fully irrigation was found higher in all FFS in comparison to the farm size under partially irrigation and semi-irrigation land types except for Arghakhanchi. Similarly, livestock standard unit (LSU) was found increased more in sampled FFS households under intensive and regular programs. The increase in cropped area was more in intensive program and also in FFS type of households compared to the NFFS and control households. The highest increase in cropping intensity was found in FFS households under intensive program. In terms of vegetable farming, largest area was found in intensive program and FFS type of households.

It was observed that farmers knowledge and awareness on use of pesticide has increased. From the findings it was observed that majority of FFS and NFFS farmers were adopting appropriate environmental and health protection measures and this has been observed increased except in some cases. Besides, annual poisoning cases on human and livestock has decreased as farmers are using pesticide safely and stored in safe places. FFS farmers were found fully convinced that pesticides especially class I, are very harmful/hazardous to human beings, land and aquatic animals and other environments. There was also very good spillover effect. There was a sharp reduction in type and quantity of pesticides mainly in intensive and regular programs and FFS type of households. Farmers were preparing and using *Jholmal* (fermented extract of various herbs in cattle urine) as a pesticide and source of nutrients, but it was effective only for a few soft body insects. Average cost of fertilizers found decreased significantly on IPM FFS household under the intensive program compared to regular one. Annual household expenditure on farm yard manure and organic manure was found increased mainly in FFS households under Intensive Farmers were using more improved seeds once they became members of IPM FFS. We observed that FFS household under regular and intensive programs had been started using improved seeds of major crops like rice, potato and tomato in their farms.

The annual household income was found increased in all types of household, however, much higher in the FFS followed by NFFS and Control households. Nearly 40 percent increase in the income was reported in the FFS household which was significantly ($P < 0.01$) higher compared to baseline study. Comparative analysis of baseline and impact study revealed overall increase in sampled households with members in any social organization by 2-86%. Sampled households with FFS group have higher percentage of membership in agriculture related organizations and community organization respectively as compared to the base line value in all sample district. The total numbers of respondents participating in above community level organization were found increased in FFS and NFFS category of all districts by 10 to 40 percent. Increase in female participation was also observed in impact study in FFS and NFFS-groups. The percentage of respondent who perceived feeling of discrimination against Janajati and Dalits has reduced drastically after the project intervention in all districts. The IPM-FFS participant farmers were found engaged more in public/community affairs and became more confident talking in public; are better in communicating, negotiating and arguing; discussed IPM technology with new people after the training and better reached consensus and cooperated in groups.

The gross margin of almost all crops was found increased against baseline values. However, significant increase in the gross margin of rice, potato, tomato, cole crops and maize was observed in FFS household of intensive program followed by the FFS of regular program.

14.2 Recommendation

The overall findings indicated that the household assets and income along with safe use of pesticides have been increased more significantly in FFS household types under intensive program. The use of Class Ia pesticides are totally reduced and in all types of households and programs. However, the use of Class Ib type of pesticides was found negligible in FFS households under intensive program and reduced drastically in other household types and programs. The FFS farmers' confidence has been highly increased in IPM and decision making particularly in intensive program type. The key recommendations based on findings can be summarized as to provide easy access to bio or safer pesticides, reduction in the current level of tax on bio and organic pesticides, strengthening of local agro-vests and monitoring of pesticide markets and market provision on IPM products. The further expansion of the IPM FFS is highly recommended. The current districts under intensive program should be declared as IPM districts.

To sum up, the national IPM program has very good impact in reducing type and quantity of pesticide use and creating social awareness among women and poor farmers, increasing knowledge of pesticide use, generating higher profit by reducing costs etc. Therefore, to develop and maintain a sound environment and to supply healthy food products, the IPM program, not only should be continued, but also should be expanded to other farmers and districts of the country intensively by the government of Nepal.

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Appendix

Appendix 2. 1: Baseline IPM report 2010

Appendix 2. 2: Field Survey Plan NIPM impact study 2013

Date	Activities/location	Remarks
24 August, 2013	Departure from Kathmandu to Sarlahi	
25 August	Field work at Sarlahi	
26 August	Field work at Sarlahi and moved to Bara	
27 August	Field work at Bara	
28 August	Field work at Bara and heading to Surkhet and Night stay at Chitwan	
29 August	Reached to Surkhet	
30 August	Field work at Surkhet	
31 August	Field work at Surkhet	
1 September	Reached to Arghakhanchi	
2 September	Field work at Arghakhanchi	
3 September	Field work at Arghakhanchi and moved to Chitwan	
4 September	Back to Kathmandu	
October	Field work at Mustang	

Appendix 3. 1: Physical Setting and Political Boundary by Survey Districts

District	Latitude (North)	Longitude (East)	Political Boundary			
			East	West	North	South
Sarlahi	26° 45'-27° 10'	85° 20'-85° 50'	Mahotari District	Rautahat District	Sindhuli District	India Bihar
Bara	26° 51'-27° 02'	84° 51'-85° 16'	Rautahat District	Parsa District	Makawanpur District	India Bihar
Arghakhanchi	27° 45'-28° 06'	80°45'-83° 23'	Palpa District	Dang & Pyuthan	Gulmi District	Kapilbastu & Rupandehi
Surkhet	28° 20'-28° 58'	80°59'-82° 02'	Salyan	Doti & Accham	Accham, Dailekh & Jajorkot	Bardiya & Kailali
Mustang	28° 30'-29° 05'	83°30'-84° 15'	Manang	Dolpa	(China-Tibet)	Myagdi

Appendix 3. 2: Demographic Trend in Survey Districts

Particulars	Sarlahi		Bara		Arghakhanchi		Surkhet		Mustang	
	2001 census	2011 census	2001 census	2011 census	2001 census	2011 census	2001 census	2011 census	2001 census	2011 census
Total pop.	635,701	769,729	559,135	687,708	208,391	197,632	288,527	350,804	14,981	13,452
Male	329,182	389,756	289,397	351,244	96,349	86,266	14,2817	169,421	8,180	7,093
Female	306,519	379,973	269,738	336,464	112,042	111,366	145,710	181,383	6,801	6,359
Sex Ratio	107	102.4	107	104.4	86	77.5	98	93.4	120	111.5
Total HHs	111076	139,980	87,706	108,635	40,869	4,6835	45,047	72,863	3,243	3,354
HH Size	5.72	5.79	6.38	6.33	5.1	4.22	5.34	4.81	4.62	4.01
Literacy%	36.17	46.30	42.38	52	55.9	72.6	62.48	73.1	51.75	66.2
Pop. Density per Sq. Km	505	611	470	578	175	166	118	143	4	4

Source: District Development Profile of Nepal, 2011/12. HH= households

Appendix 3. 3: Survey Districts by Selected Development Indicators

Districts	Overall Composite Index	Women Empowerment Index	% of Irrigated Area	% of marginal farm household	Farm Size	Per Capita food production(in Kilo Calories)
Sarlahi	61	63	61.11	20.87	1.03	2738
Bara	55	67	51.24	23.71	0.87	4915
Arghakhanchi	42	26	10.66	53.91	0.48	2474
Surkhet	28	34	24.26	28.64	0.54	3462
Mustang	19	17	82.62	37.30	0.47	2196

Source: CBS/ICIMOD/SNV -District of Nepal-Indicators of Development 2010/11

Appendix 3. 4: Land Use Pattern of Survey Districts (area in Ha)

Districts	Cultivation area	Forest	Pasture	Built up	Others	Total
Sarlahi	76357.28	29808.16	5495.84	1690.88	8484.08	121836.24
Bara	69251.55	47463.87	1371.52	745.38	8539.37	127371.69
Arghakhanchi	53622.87	50184.21	4611.57	NA	15758.06	124176.71
Surkhet	43699.24	173272.87	4474.81	605.81	26708.68	248761.41
Mustang	99844.07	33882.53	1364.44	30.31	221455.41	356576.76

Source: National Land Use Planning, 2010/11

Appendix 4. 1: Age of Household head (detail)

Program type	Districts	Type of Household	Baseline			Impact		
			Minimum	Maximum	Mean	Minimum	Maximum	Mean
Regular	Sarlahi	FFS	29	75	48.26	32.00	78.00	51.27
		NFFS	30	80	49.97	33.00	83.00	52.97
		Control	28	65	48.50	31.00	68.00	51.50
	Arghakhan chi	FFS	24	80	51.89	27.00	83.00	54.89
		NFFS	34	73	54.25	37.00	76.00	57.25
		Control	30	78	54.47	33.00	81.00	57.47
	Total	FFS	24	80	50.06	27.00	83.00	53.06
		NFFS	30	80	52.03	33.00	83.00	55.03
		Control	28	78	51.48	31.00	81.00	54.48
Intensive	Bara	FFS	23	77	49.73	26.00	80.00	52.71
		NFFS	22	80	49.63	25.00	83.00	52.63
		Control	27	77	48.47	30.00	80.00	51.43
	Surkhet	FFS	22	77	46.29	25.00	80.00	49.29
		NFFS	22	76	47.56	25.00	79.00	50.56
		Control	25	71	46.97	28.00	74.00	49.97
	Total	FFS	22	77	48.16	25.00	80.00	51.14
		NFFS	22	80	48.53	25.00	83.00	51.53
		Control	25	77	47.69	28.00	80.00	50.68
Intensive	Mustang	FFS	27	80	53.73	30.00	83.00	56.13
		NFFS	22	82	51.33	25.00	84.00	54.30
		Control	28	66	50.33	31.00	69.00	53.50

Appendix 4. 2: Education Level of Household Head

District	Type of House hold	Percentage of Education Level (Baseline)							Percentage of Education Level (Impact)						
		Illiterate	Literate	Primary	Secondary	Higher Secondary	Bachelor & above	Total (%)	Illiterate	Literate	Primary	Secondary	Higher Secondary	Bachelor & above	Total (%)
Sarlahi	FFS	8.9	44.4	4.4	33.3	6.7	2.2	100	8.3	44.2	4.4	34.1	6.7	2.2	100
	NFFS	33.3	26.7	0	26.7	6.7	6.7	100	27.6	37.9	0.0	27.6	3.4	3.4	100
	Control	36.7	30	0	30	3.3	0	100	33.3	29.6	3.7	29.6	3.7	0.0	100
Bara	FFS	53.3	13.3	20	13.3	0	0	100	46.7	15.6	15.6	22.2	0.0	0.0	100
	NFFS	65.6	3.1	9.4	18.8	3.1	0	100	66.7	6.7	16.7	6.7	3.3	0.0	100
	Control	43.3	13.3	6.7	36.7	0	0	100	43.3	13.3	6.7	36.7	0.0	0.0	100
Arghakhanchi	FFS	8.9	26.7	17.8	37.8	8.9	0	100	8.2	27.7	19.5	36.4	9.1	0.0	100
	NFFS	20	30	13.3	23.3	13.3	0	100	14.8	33.3	14.8	25.9	11.1	0.0	100
	Control	20	16.7	10	40	10	3.3	100	20.0	16.7	10.0	40.0	10.0	3.3	100
Surkhet	FFS	18.4	26.3	2.6	44.7	2.6	5.3	100	15.9	27.7	3.0	44.9	2.9	5.7	100
	NFFS	8.3	27.8	16.7	36.1	5.6	5.6	100	6.7	33.3	16.7	36.7	3.3	3.3	100
	Control	16.1	45.2	3.2	32.3	3.2		100	16.7	41.7	4.2	33.3	4.2	0.0	100
Mustang	FFS	10	26.7	23.3	33.3	3.3	3.3	100	0.0	30.0	26.0	44.0	0.0	0.0	100
	NFFS	20	30	16.7	23.3	6.7	3.3	100	16.7	50.0	0.0	16.7	0.0	16.7	100
	Control	43.3	33.3	20	3.3	0	0	100	42.9	57.1	0.0	0.0	0.0	0.0	100

Appendix 4. 3: Household occupation in surveyed districts

Program Type	District	House hold Types	Baseline						Impact					
			Agriculture	Service	Business	Wage	Unemployed	Others	Agriculture	Service	Business	Wage	Unemployed	Others
Regular	Sarlahi	FFS	88.9	8.9				2.2	88.9	8.9				2.2
		NFFS	83.3	13.3				3.3	83.3	13.3				3.3
		Control	90		3.3			6.7	90		3.3			6.7
		Total	87.6	7.6	1			3.8	87.6	7.6	1			3.8
	Arghakhanchi	FFS	65.9	4.5	6.8	13.6	2.3	6.8	65.9	4.5	6.8	13.6	2.3	6.8
		NFFS	64.3	10.7	3.6	3.6	7.1	10.7	64.3	10.7	3.6	3.6	7.1	10.7
		Control	56.7	20	10	3.3	3.3	6.7	53.3	20	10	3.3	6.7	6.7
		Total	62.7	10.8	6.9	7.8	3.9	7.8	61.8	10.8	6.9	7.8	4.9	7.8
	Total	FFS	77.5	6.7	3.4	6.7	1.1	4.5	77.5	6.7	3.4	6.7	1.1	4.5
		NFFS	74.1	12.1	1.7	1.7	3.4	6.9	74.1	12.1	1.7	1.7	3.4	6.9
		Control	73.3	10	6.7	1.7	1.7	6.7	71.7	10	6.7	1.7	3.3	6.7
		Total	73.3	10	6.7	1.7	1.7	6.7	71.7	10	6.7	1.7	3.3	6.7
Intensive	Bara	FFS	95.6				2.2	2.2	95.6				2.2	2.2
		NFFS	70	6.7		6.7		16.7	70	6.7		6.7		16.7
		Control	86.7			10		3.3	86.7			10		3.3
		Total	85.7	1.9		4.8	1	6.7	85.7	1.9		4.8	1	6.7
	Surkhet	FFS	68.4	15.8	2.6	5.3		7.9	68.4	15.8	2.6	5.3		7.9
		NFFS	79.4	2.9	8.8	2.9		5.9	79.4	2.9	8.8	2.9		5.9
		Control	84.4	3.1	6.3		3.1	3.1	84.4	3.1	6.3		3.1	3.1
		Total	76.9	7.7	5.8	2.9	1	5.8	76.9	7.7	5.8	2.9	1	5.8
	Total	FFS	83.1	7.2	1.2	2.4	1.2	4.8	83.1	7.2	1.2	2.4	1.2	4.8
		NFFS	75	4.7	4.7	4.7		10.9	75	4.7	4.7	4.7		10.9
		Control	85.5	1.6	3.2	4.8	1.6	3.2	85.5	1.6	3.2	4.8	1.6	3.2
		Total	85.5	1.6	3.2	4.8	1.6	3.2	85.5	1.6	3.2	4.8	1.6	3.2
Intensive	Mustang	FFS	96.7				3.3		86.7		3.3			10
		NFFS	73.3	6.7	6.7		3.3	10	70	13.3	10		3.3	3.3
		Control	90	3.3	6.7				93.3		6.7			
		Total	86.7	3.3	4.4		2.2	3.3	83.3	4.4	6.7		1.1	4.4

Appendix 4. 4: Total Population and Family Size by Household Type and District

District	Baseline					Impact				Percent Difference			
	Type of Household	Total Population	Total Male	Total Female	Family Size	Total Population	Total Male	Total Female	Family Size	Total Population	Total Male	Total Female	Family Size
Sarlahi	FFS	246	128	118	5.5	278	138	140	6.2	13.0	7.8	18.6	12.3
	NFFS	168	81	87	5.6	195	93	102	6.5	16.1	14.8	17.2	16.1
	Control	189	112	77	6.3	225	133	92	7.5	19.0	18.8	19.5	19.0
	Total	603	321	282	5.7	698	364	334	6.6	15.8	13.4	18.4	16.6
Bara	FFS	304	180	124	6.9	340	193	147	7.6	11.8	7.2	18.5	9.5
	NFFS	218	117	101	6.8	193	101	92	6.4	-11.5	-13.7	-8.9	-5.4
	Control	242	129	110	8.1	201	115	86	6.7	-16.9	-10.9	-21.8	-17.3
	Total	764	426	335	7.2	734	409	325	7.0	-3.9	-4.0	-3.0	-2.9
Arghakhanchi	FFS	279	147	132	6.3	251	129	122	5.7	-10.0	-12.2	-7.6	-9.5
	NFFS	200	99	101	6.7	162	84	78	5.8	-19.0	-15.2	-22.8	-13.6
	Control	188	102	86	6.3	190	103	87	6.3	1.1	1.0	1.2	0.5
	Total	667	348	319	6.4	603	316	287	5.9	-9.6	-9.2	-10.0	-7.6
Surkhet	FFS	257	123	134	6.8	255	119	136	6.5	-0.8	-3.3	1.5	-3.8
	NFFS	223	117	106	6.4	208	110	98	6.3	-6.7	-6.0	-7.5	-1.5
	Control	198	91	107	6.6	184	89	95	5.8	-7.1	-2.2	-11.2	-12.9
	Total	678	331	347	6.6	647	318	329	6.2	-4.6	-3.9	-5.2	-5.7
Mustang	FFS	163	79	84	5.4	175	80	95	5.5	7.4	1.3	13.1	1.9
	NFFS	148	70	79	4.9	160	73	87	5.2	8.1	4.3	10.1	5.4
	Control	147	83	63	4.9	158	80	78	5.4	7.5	-3.6	23.8	10.8
	Total	458	232	226	5.1	493	233	260	5.4	7.6	0.4	15.0	5.9

Appendix 5. 1: Total rented in and rented out farm size by household type and district

Program	District	Household Type	Baseline	Impact	Baseline	Impact
			Total Rented in area	Total Rented in area	Total Rented out	Total Rented out
Regular	Sarlahi	FFS	0.43	0.45	1.05	0.31
		NFFS	0.51	0.28	0.3	0.33
		Control	0.23	0.26	0.2	0.23
	Arghakhanchi	FFS	0.34	0.39	1.04	0.23
		NFFS	0.13	0	0.45	0.56
		Control	0	0	0.17	0.26
	Total	FFS	0.39	0.42	1.05	0.27
		NFFS	0.32	0.14	0.38	0.45
		Control	0.12	0.13	0.19	0.25
		Total	0.28	0.23	0.54	0.32
Intensive	Bara	FFS	0.7	0.73	0.17	0.06
		NFFS	0.39	0.36	0.58	0.88
		Control	0.25	0.18	0.37	0.50
	Surkhet	FFS	0.37	0.39	0.37	0.50
		NFFS	0.36	0.31	0.76	0.78
		Control	0.15	0.1	0.3	0.44
	Total	FFS	0.54	0.56	0.27	0.28
		NFFS	0.38	0.34	0.67	0.83
		Control	0.20	0.14	0.34	0.47
		Total	0.37	0.35	0.43	0.53
Intensive	Mustang	FFS	0.6	0.69	0.71	0.71
		NFFS	0.4	0.36	0.22	0.30
		Control	0.48	0.35	0.69	0.70

Appendix 5. 2: Average Farm Size under Irrigation by Sample Households and Districts

District	Household Type	Baseline				Impact			
		Fully Irrigated Area (Ha)	Partial Irrigated Area (Ha)	Unirrigated Area (Ha)	Total	Fully Irrigated Area (Ha)	Partial Irrigated Area (Ha)	Unirrigated Area (Ha)	Total
		Mean	Mean	Mean		Mean	Mean	Mean	
Sarlahi	FFS	0.47	0.23	0.21	0.91	0.55	0.16	0.29	1
	NFFS	0.62	0.18	0.4	1.2	0.57	0.18	0.32	1.07
	Control	0.47	0.42	0.89	1.78	0.31	0.4	0.8	1.51
	Total average	0.52	0.28	0.50	1.30	0.48	0.25	0.47	1.19
Bara	FFS	0.87	1.22	0.18	2.27	0.96	0.69	0.14	1.79
	NFFS	0.69	0.08	0.14	0.91	0.74	0.54	0.1	1.38
	Control	0.72	0.1	0.07	0.89	0.56	0.25	0.13	0.94
	Total average	0.76	0.47	0.13	1.36	0.75	0.49	0.12	1.37
Arghakhanchi	FFS	0.36	0.15	0.29	0.8	0.35	0.52	0.42	1.29
	NFFS	0.27	0.15	0.35	0.77	0.2	0.38	0.59	1.17
	Control	0.19	0	0.25	0.44	0.25	0.24	0.39	0.88
	Total average	0.27	0.10	0.30	0.67	0.27	0.38	0.47	1.11
Surkhet	FFS	0.45	0.28	0.21	0.94	0.7	0.34	0.2	1.24
	NFFS	0.3	0.32	0.3	0.92	0.34	0.33	0.31	0.98
	Control	0.42	0.14	0.35	0.91	0.48	0.43	0.29	1.2
	Total average	0.39	0.25	0.29	0.92	0.51	0.37	0.27	1.14
Mustang	FFS	0.78	0.1	0	0.88	0.8	0.25	0	1.05
	NFFS	0.62	0.23	0	0.85	0.64	0.76	0	1.4
	Control	0.84	0	0	0.84	0.68	0.63	0	1.31
	Total average	0.75	0.11	0.00	0.86	0.71	0.55	0.00	1.25

Appendix 5. 3: Average Farm Size of Rented In Land by Sample Households and District

District	Household Type	Baseline			Impact		
		Rented in Irrigated Area (Ha)	Rented in Partial Irrigated Area (Ha)	Rented in Unirrigated Area (Ha)	Rented in Irrigated Area (Ha)	Rented in Partial Irrigated Area (Ha)	Rented in Unirrigated Area (Ha)
		Mean	Mean	Mean	Mean	Mean	Mean
Sarlahi	FFS	0.43	0	0	0.39	0	0.06
	NFFS	0.51	0	0	0.28	0	0
	Control	0.02	0	0.21	0.19	0	0.07
Bara	FFS	0.19	0.51	0	0.73	0	0
	NFFS	0.39	0	0	0.36	0	0
	Control	0.25	0	0	0.14	0.04	0
Arghakhanchi	FFS	0.26	0	0.08	0.39	0	0
	NFFS	0.13	0	0	0	0	0
	Control	0	0	0	0	0	0
Surkhet	FFS	0.32	0.05	0	0.39	0	0
	NFFS	0.36	0	0	0.31	0	0
	Control	0	0	0.15	0.1	0	0
Mustang	FFS	0.32	0.28	0	0.39	0.3	0
	NFFS	0.3	0.1	0	0.22	0.14	0
	Control	0.48	0	0	0.35	0	0

Appendix 5. 4: Average Farm Size of Rented Out Land by Irrigation and Sample Households

District	Household Type	Baseline			Impact		
		Rented out Irrigated Area (Ha)	Rented out Partial Irrigated Area (Ha)	Rented out Un irrigated Area (Ha)	Rented out Irrigated Area (Ha)	Rented out Partial Irrigated Area (Ha)	Rented out Un irrigated Area (Ha)
		Mean	Mean	Mean	Mean	Mean	Mean
Sarlahi	FFS	0.54	0	0.51	0.26	0	0.05
	NFFS	0.3	0	0	0.33	0	0
	Control	0.2	0	0	0.1	0	0.13
	Total av.	0.35	0	0.17	0.23	0	0.06
Bara	FFS	0.17	0	0	0.03	0.03	0
	NFFS	0.58	0	0	0.88	0	0
	Control	0.27	0.1	0	0.3	0.2	0
	Total av.	0.34	0.03	0	0.40	0.08	0.00
Arghakhanchi	FFS	0.51	0	0.53	0.06	0.06	0.11
	NFFS	0.25	0	0.2	0.3	0.26	0
	Control	0.17	0	0	0.16	0.1	0
	Total av.	0.31	0	0.24	0.17	0.14	0.04
Surkhet	FFS	0.37	0	0	0.35	0.08	0.07
	NFFS	0.76	0	0	0.63	0.07	0.08
	Control	0.1	0.2	0	0.14	0.3	0
	Total av.	0.41	0.07	0	0.37	0.15	0.05
Mustang	FFS	0.71	0	0	0.71	0	0
	NFFS	0.22	0	0	0.3	0	0
	Control	0.69	0	0	0.7	0	0
	Total av.	0.54	0	0	0.57	0	0

Appendix 5. 5: Roofing Materials Used by Sample Households and Districts

District	Household Types	Number of Households by Roofing Materials (Baseline)								Number of Households by Roofing Materials (Impact)							
		Mud	Thatch/ Bamboo	Slate / Local Tiles	CGI Sheet	Concrete	Asbestos Sheet	Mud and Slate	Total	Mud	Thatched / bamboo	Slate/ Local Tiles	CGI Sheet	Concrete	Asbestos Sheet	Others	Total
Sarlahi	FFS	0	4	41	0	0	0	0	45	0	1	30	4	3	1	0	39
	NFFS	0	3	27	0	0	0	0	30	0	3	21	7	0	1	1	33
	Control	1	3	26	0	0	0	0	30	0	24	2	1	0	2	3	32
	<i>Total</i>	1	10	94	0	0	0	0	105	0	28	53	12	3	4	4	104
Bara	FFS	0	8	30	0	6	2	0	46	0	1	13	22	4	2	1	43
	NFFS	0	7	14	0	10	0	0	31	0	0	17	4	2	1	3	27
	Control	0	5	18	0	6	1	0	30	0	0	4	21	2	3	0	30
	<i>Total</i>	0	20	62	0	22	3	0	107	0	1	34	47	8	6	4	100
Arghakhanchi	FFS	0	1	18	21	4	0	0	45	0	3	34	2	5	1	0	45
	NFFS	0	0	20	9	1	0	0	30	0	2	17	1	9	1	0	30
	Control	0	1	2	27	0	0	0	30	0	5	19	1	3	1	0	29
	<i>Total</i>	0	2	40	57	5	0	0	105	0	10	70	4	17	3	0	104
Surkhet	FFS	0	1	33	2	2	0	0	38	0	0	40	2	2	0	1	45
	NFFS	0	8	22	6	0	0	0	36	0	1	28	0	0	1	0	30
	Control	1	23	2	4	1	0	0	31	0	1	28	0	1	0	0	30
	<i>Total</i>	1	32	57	12	3	0	0	105	0	2	96	2	3	1	1	105
Mustang	FFS	19	0	0	0	1	0	10	30	17	0	0	0	3	0	10	30
	NFFS	21	0	0	0	1	0	8	30	16	0	0	0	2	0	12	30
	Control	19	0	0	0	0	0	11	30	19	0	0	0	0	0	11	30
	<i>Total</i>	59	0	0	0	2	0	29	90	52	0	0	0	5	0	33	90

Appendix 6. 1: Percentage change in total crop land by sample households and districts

District	House hold Type	Summer Cereals / Legumes	Winter Cereals / Legumes	Spring Cereals / Legumes	Summer Vegetable s	Winter Vegetable s	Spring Vegetabl es	Area under Fruits	Total
Sarlahi	FFS	13.0	13.2	254.4	100.0	50.0	433.3	662.8	65.7
	NFFS	29.3	22.7	523.5	239.0	28.6	239.0	-100.0	75.1
	Control	5.6	0.8	35.6	33.3	20.0	*	438.8	15.2
Bara	FFS	92.4	102.3	834.8	158.5	218.9	1110.7	*	222.3
	NFFS	43.0	84.0	483.8	1148.1	80.0	984.8	*	143.7
	Control	102.5	135.8	472.5	213.6	123.6	*	*	148.8
Arghakhanchi	FFS	9.5	4.5	102.2	510.2	16.6	27.1	-100.0	25.3
	NFFS	67.8	-38.3	130.6	27.1	20.8	-100.0	-100.0	-2.4
	Control	70.4	-53.4	-12.8	154.3	-78.8	-100.0	-100.0	-25.4
Surkhet	FFS	-2.4	8.9	16.2	1194.4	609.2	662.8	306.8	39.8
	NFFS	185.3	-52.9	832.3	217.8	1264.9	*	*	56.5
	Control	2747.2	14.4	290.8	-100.0	-68.2	281.4	-100.0	32.5
Mustang	FFS	11.4	0.0	50.0	295.8	*	81.8	4.0	27.7
	NFFS	30.0	-25.0	0.0	465.0	*	0.0	6.7	25.1
	Control	-3.4	-4.7	700.0	1849.3	*	-100.0	16.7	11.3
*in baseline survey the value is 0									

Appendix 6. 2: Total cropping intensity by districts and sample households

District	Household Types	Cropping Intensity Baseline	Cropping Intensity Impact
Sarlahi	FFS	211.7	220.0
	NFFS	198.9	211.0
	Control	196.0	203.2
Bara	FFS	199.8	243.0
	NFFS	208.4	215.7
	Control	216.7	221.9
Arghakhanchi	FFS	199.8	227.0
	NFFS	182.0	205.6
	Control	188.2	182.1
Surkhet	FFS	220.8	225.0
	NFFS	220.9	222.0
	Control	194.0	197.8
Mustang	FFS	189.9	194.0
	NFFS	176.2	170.0
	Control	166.4	165.0

Appendix 6. 3: Area under different crops by the programs and household types

Programs	Type of Household		Rice		Potato		Tomato		Cole crops		Cucurbits		Apple	
			Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact
Regular	FFS	Mean	7.8	10.0	0.3	1.7	0.3	0.5	1.8	2.9	0.0	1.5		
		SD	6.3	6.7	0.6	1.1	0.2	0.2	2.4	3.1	0.1	.		
	NFFS	Mean	8.3	10.3	0.2	0.5	0.2	0.2	1.5	2.1	0.0			
		SD	7.7	9.1	0.4	.	0.2	0.1	0.8	1.3	0.0			
	Control	Mean	3.6	7.8	0.3	0.7	0.3	0.3	1.0	0.9	0.0			
		SD	4.4	5.7	0.2	0.6	0.5	0.4	.	1.3	0.0			
	Total	Mean	6.7	9.7	0.3	1.3	0.3	0.4	1.7	2.4	0.0	1.5		
		SD	6.6	7.4	0.5	1.0	0.3	0.3	1.9	2.5	0.1	.		
Intensive	FFS	Mean	13.0	17.6	0.7	4.1	0.1	0.6	2.0	2.6	0.4	2.8		
		SD	11.5	20.7	1.8	4.9	0.1	0.9	2.1	1.9	1.0	1.5		
	NFFS	Mean	9.6	11.9	0.3	2.1	0.1	0.2	1.7	2.6	0.5	2.3		
		SD	8.4	7.3	0.6	1.8	0.1	0.2	2.4	2.5	1.5	0.9		
	Control	Mean	10.1	15.8	0.5	1.3	0.2	0.1	1.2	1.7	0.1	7.0		
		SD	10.1	10.3	0.8	1.0	0.1	0.1	1.1	1.0	0.3	.		
	Total	Mean	11.1	15.4	0.5	2.3	0.1	0.4	1.7	2.4	0.3	2.9		
		SD	10.3	15.5	1.3	3.0	0.1	0.8	2.0	2.0	1.1	1.7		
Mustang	FFS	Mean			0.5	1.9	0.1	0.6	2.0	2.7			0.5	0.9
		SD				0.5		.	2.1	2.2			0.3	0.4
	NFFS	Mean				3.5	0.1	0.6	1.7	2.5			0.4	0.6
		SD				0.9		.	2.2	2.3			0.5	0.3
	Control	Mean				3.1	0.2	0.5	1.2	1.6			0.5	0.7
		SD				1.1	0.2	0.7	1.1	1.0			0.2	0.3
	Total	Mean			0.5	2.5	0.1	0.2	1.7	2.4			0.5	0.8
		SD			1.3	3.2	0.2	0.2	2.0	2.1			0.4	0.3

Appendix 6. 4: Area (ha) under vegetable farming by sample household and district

District	Household Type	Area Baseline	Impact	Percent Difference
Sarlahi	FFS	0.16	0.28	75.0
	NFFS	0.11	0.17	60.9
	Control	0.08	0.11	37.5
Bara	FFS	0.14	0.51	264.3
	NFFS	0.07	0.22	214.3
	Control	0.04	0.11	175.0
Arghakhanchi	FFS	0.41	0.54	31.7
	NFFS	0.21	0.22	4.8
	Control	0.15	0.18	20.0
Surkhet	FFS	0.5	0.51	5.0
	NFFS	0.4	0.33	-17.5
	Control	0.39	0.38	-2.56
Mustang	FFS	0.17	0.24	41.2
	NFFS	0.14	0.18	28.6
	Control	0.17	0.19	11.8

Appendix 7. 1: Sources of pesticide application in different program

Program\ Source	Baseline			Impact	
	Local agro-vet	Distant Agro-vet	I/NGO/DADO	Local agro-vet	Distant agro-vet
Regular	83.75	16.25	0	96.58	3.42
Intensive	94.10	5.90	0	91.56	8.44
Mustang	23.71	9.91	66.38	84.49	15.51

Appendix 7. 2: Total frequency of pesticide application by program and household type

Program Type	Household Type	Baseline			Impact		
		n	Total Frequency	Average	n	Total Frequency	Average
Regular	FFS	60	239.0	3.98	33	83.0	2.52
	NFFS	41	163.0	3.98	16	45.0	2.81
	Control	36	417.0	11.58	24	116.0	4.83
	Total	137	819.0	5.98	73	244.0	3.34
Intensive	FFS	71	598.0	8.42	36	69.0	1.92
	NFFS	56	337.0	6.02	28	81.0	2.89
	Control	37	231.0	6.24	37	256.0	6.92
	Total	164	1166.0	7.11	101	406.0	4.02
Mustang	FFS	30	229.0	7.63	24	134.0	5.58
	NFFS	28	208.0	7.43	29	154.0	5.31
	Control	25	100.0	4.00	18	46.0	2.56
	Total	83	537.0	6.47	71	334.0	4.70
Total	FFS	161	1066.0	6.62	93	286.0	3.08
	NFFS	125	708.0	5.66	73	280.0	3.84
	Control	98	748.0	7.63	79	418.0	5.29
	Total	384	2522.0	6.57	245	984.0	4.02

n= Actual Farmers applying Pesticides

Range of frequency in Baseline and Impact study

Study type	N	Minimum	Maximum	Mean	Std. Deviation
Baseline	1073	1.00	40.00	2.3532	2.23463
Impact	529	1.00	7.00	1.8507	.97429

Appendix 7. 3: Total Types of Pesticides Used in Baseline and Impact Studies
(mark with √ (tick) are users and mark with x (cross) are not used)

S.No.	Common Name	Trade name(s)	Baseline	Impact	Ai Percent	Action ₃	WHO hazard class ^{4 and 5}
1	2,4-dichlorophenoxy acetic acid	2-4-D, ec	√	√	3	H	II
2	alphamethrin	Alphaplus	√	√	10	I	II
3	azadiractin	Multineem,Neem fighter, Niconeem, Nimbicide, ec	√	√	0.03-0.3	I	NH
4	benzene hexachloride*	BHC	√			I	II
5	butachlor	Anuchlor, Trap, Meco, ec	√	√	50	H	III
6	carbendazim	Devistin,Arestin, Dhanustin, Derosal, etc, wp	√	√	50	F	NH
7	carbofuran	Furadan, G	√	√	3	I	Ib
8	carbosulphan	Marshal, ec	√	√	25	I	II
9	cartap hydrochloride	Keldan, sp	√	√	50	I	II
10	chlorpyrifos	Nagpyriphos, Kisan, Deviwan, Baradan,Lara 909, ec	√	√	20	I	II
11	copper oxychloride	Curex, Anucop, Nagcopper, etc, ec	√	√	50	F	II
12	copper sulphate + lime	Bordeaux mixture/paste,	√	√	1	F	II/III
13	cymoxanil 8% + mancozeb 64%	Krinoximate Gold		√	72	F	NH
14	cypermethrin	Amezer, ec	√	√	10, 25	I	II/III
15	dhanchlor	Dhanchlor	√	x	50	H ?	III ?
16	deltamethrin	Decis, AMMO, K-othrin, etc, ec	√	√	2.8	I	II
17	dichlorovos	Doom, Nuvan, Bloom, etc, ec	√	√	76	I	Ib
18	dimethoate	Devigon, Rogor, Roghit, etc, ec	√	√	30	I	II
19	dinocap	Karathane, ec	√	√	48	F	II
20	endosulfan	Thiodan,Endocel, Endosulfan, Devisufan, etc, ec	√	√	35	I	II

³ A = antibiotic, B = bactericide, F = fungicide, H= herbicide, I = insecticide, NH = nonhazardous.

⁴ Plant Protection Directorate (PPD). 2066. A Handbook of Pesticide Statistics. Pesticide Registration and Management Section, Hariharbhawan, Lalitpur. 75 pp.

⁵ IPCS. 2009. The WHO Recommended Classification of Pesticides by Hazard and Guideline to Classification. FAO. 78 pp

S.No.	Common Name	Trade name(s)	Baseline	Impact	Ai Percent	Action ₃	WHO hazard class ^{4 and 5}
21	fenechlor	?	√	x	50	H/?	?
22	pretilachlor	Prince	√	√	50	H	III
23	epichlorohydrin	?	√	x	2	I ?	?
24	fenpyroximate	Mitigate, ec	√	x	5	I	II
25	fenvalerate	Refen, Fenvalerate, Fenkil, ec	√	x	20	I	II
26	hexaconazole	Contaf, Cresole, Comfort, etc, wp	√	√	5	F	III
27	imidachloprid	Admire	√	√	17.8	I	II
28	malathion	Malathion, Cythane, Devimalt, etc, wp	√	√	50	I	III
29	mancozeb	Dithane M 45, Endofil, Anu M 45, etc	√	√	75	F	NH
30	metalaxyl 8% +mancozeb 64%	Himil	√	√	72	F	II/NH
31	methyal parathion*	Metacid, ec/wp	√	x	50	I	Ia
32	monocrotophos*	Monorus	√	x	36	I	Ib
33	servo oil	Servo Oil, Soybean oil, ec	√	√	100	I, F	?
34	pendimethalin	Peuda 30	√	√	30	I	?
35	phorate	Thimet, Dhan, Pharmet, Umet, Hitatox, etc, G	√	x	10	I	Ia
36	profenofos	Nayak	√	x	50	I	II
37	quinalphos	Ekalux	X	√	25	I	II
38	streptocycline (streptomycin 9 + tetracycline 1)	Krosin AG, sp	√	√	10	A/B	NH
39	sulphur	Sulfex, Supersulf, Insaf, etc, wp	√	√	80	F	NH
40	thiosulfan	Endocel	√	x	50	I	II
41	thiamethoxam	Actara	X	√	25	I	III
42	triazophos	Bravo	√	√	40	I	Ib
43	zineb	Dithane Z, Endofil Z, etc, wp	√	x	75	F	NH
Total			40	31			

Appendix 7. 4: Field EIQ values of mixed pesticides used on 9 crops during impact study

S. No.	District	Farmer Types	Crop	Common name	Trade name	Action	Hazard class	AI% total	AI% single	Formulation	Area: ha	Amt: kg/l	Frequency	Dose: kg/l/ha mixed	Dose: kg/l/ha single	Total price paid (Rs)	EIQ	Field EIQ single	Field EIQ mixed
1	Sarlahi	Control	Rice	carbendazim 12% +	Cyclone	F	NH	75	12	WP	0.500	0.075	1	0.15	0.02	200	50.5	0.15	x
				mancozeb 63%					63				1		0.13		14.6	1.16	1.30
2	Bara	FFS	Cauliflower	carbendazim 12% +	SAAF	F	NH	75	12	WP	0.167	0.200	1	1.20	0.19	200	50.5	1.16	x
				mancozeb 63%					63				1		1.01		14.6	9.27	10.44
3	Bara	NFFS	Cauliflower	carbendazim 12% +	SAAF	F	NH	75	12	WP	0.067	0.100	2	1.50	0.24	45	50.5	2.91	x
				mancozeb 63%					63				2		1.26		14.6	23.18	26.09
4	Bara	NFFS	Cucumber	carbendazim 12% +	SAAF	F	NH	75	12	WP	0.067	0.100	2	1.50	0.24	60	50.5	2.91	x
				mancozeb 63%					63				2		1.26		14.6	23.18	26.09
5	Bara	Control	Potato	carbendazim 12% +	SAAF	F	NH	75	12	WP	0.067	0.100	3	1.50	0.24	120	50.5	4.36	x
				mancozeb 63%					63				3		1.26		14.6	34.77	39.13
6	Bara	FFS	Cucurbit/Sp onge gourd	carbendazim 12% +	SAAF	F	NH	75	12	WP	0.167	0.250	1	1.50	0.24	300	50.5	1.45	x
				mancozeb 63%					63				1		1.26		14.6	11.59	13.04
7	Bara	Control	Cauliflower	carbendazim 12% +	SAAF	F	NH	75	12	WP	0.133	0.400	3	3.00	0.48	400	50.5	8.73	x
				mancozeb 63%					63				3		2.52		14.6	69.54	78.26
8	Bara	FFS	Rice	carbendazim 12% +	Saaf	F	NH	75	12	WP	0.333	2.000	2	6.00	0.96	500	50.5	11.64	x
				mancozeb 63%					63				2		5.04		14.6	92.72	104.35
9	Bara	NFFS	Potato	carbendazim 12% +	SAAF	F	NH	75	12	WP	0.033	0.250	20	7.50	1.20	350	50.5	145.44	x
				mancozeb 63%					63				20		6.30		14.6	1158.95	1304.39
10	Bara	FFS	Cauliflower	carbendazim 12% +	SAAF	F	NH	75	12	WP	0.033	0.003	1	0.08	0.01	300	50.5	0.07	x

				mancozeb 63%					63				1		0.06		14.6	0.58	0.65
11	Bara	FFS	Cauliflower	carbendazim 12% +	SAAF	F	NH	75	12	WP	0.133	0.200	1	1.50	0.24	400	50.5	1.45	x
				mancozeb 63%					63						1.26		14.6	0.00	1.45
12	Bara	FFS	Rice	chlorpyrifos 50% +	Noorani, Anth	I	II	55	50	EC	1.667	0.200	1	0.12	0.11	200	43.5	2.37	x
				cypermethrin 5%					5				1		0.01		27.3	0.01	2.39
13	Bara	Control	Cauliflower	chlorpyrifos 50% +	Missile	I	II	55	50	EC	0.067	0.010	3	0.15	0.14	150	43.5	8.90	x
				cypermethrin 5%					5				3		0.01		27.3	0.06	8.95
14	Bara	NFFS	Rice	chlorpyrifos 50% +	Noorani, Anth	I	II	55	50	EC	0.500	0.100	1	0.20	0.18	200	43.5	3.95	x
				cypermethrin 5%					5				1		0.02		27.3	0.02	3.98
15	Bara	FFS	Rice	chlorpyrifos 50% +	Terminator- 505, Anth	I	II	55	50	EC	0.667	0.200	1	0.30	0.27	500	43.5	5.93	x
				cypermethrin 5%					5				1		0.03		27.3	0.04	5.97
16	Bara	FFS	Cauliflower	chlorpyrifos 50% +	Lara 55 ec	I	II	55	50	EC	0.167	0.075	3	0.45	0.41	600	43.5	26.69	x
				cypermethrin 5%					5				3		0.04		27.3	0.17	26.86
17	Bara	NFFS	Rice	chlorpyrifos 50% +	Lara, Anth, Rocket	I	II	55	50	EC	0.467	0.500	1	1.07	0.97	270	43.5	21.19	x
				cypermethrin 5%					5				1		0.10		27.3	0.13	21.32
18	Bara	NFFS	Rice	chlorpyrifos 50% +	Lara	I	II	55	50	EC	0.667	0.750	1	1.13	1.02	350	43.5	22.24	x
				cypermethrin 5%					5				1		0.10		27.3	0.14	22.38
19	Bara	Control	Maize	chlorpyrifos 50% +	Anth	I	II	55	50	ec	0.167	0.200	2	1.20	1.09	480	43.5	47.45	x

				cypermethrin 5%					5				2		0.11		27.3	0.30	47.75
20	Bara	Control	Maize	chlorpyrifos 50% +	Anth	I	II	55	50	ec	0.333	2.000	1	6.00	5.45	400	43.5	118.64	x
				cypermethrin 5%					5				1		0.55		27.3	0.74	119.38
21	Arghakhanchi	NFFS	Wheat	chlorpyrifos 50% +	Lara	I	II	55	50	EC	0.025	0.025	2	1.00	0.91	90	43.5	39.55	x
				cypermethrin 5%					5				2		0.09		27.3	0.25	39.79
22	Arghakhanchi	FFS	Potato	cymoxanil 8% +	Krinoximate Gold	F	NH	72	8	WP	0.056	0.010	2	0.18	0.02	90	35.5	0.11	x
				mancozeb 64%					64				2		0.16		14.6	2.95	3.07
23	Arghakhanchi	FFS	Potato	cymoxanil 8% +	Krinoximate Gold	F	NH	72	8	WP	0.075	0.050	2	0.67	0.07	60	35.5	0.42	x
				mancozeb 64%					64				2		0.59		14.6	11.07	11.50
24	Sarlahi	Control	Potato	cymoxanil 8% +	Krinoximate Gold	F	NH	72	8	WP	0.333	0.250	1	0.75	0.08	300	35.5	0.24	x
				mancozeb 64%					64				1		0.67		14.6	6.23	6.47
25	Sarlahi	Control	Tomato	cymoxanil 8% +	Krinoximate Gold	F	NH	72	8	WP	1.333	1.000	14	0.75	0.08	500	35.5	3.31	x
				mancozeb 64%					64				14		0.67		14.6	87.21	90.52
26	Bara	FFS	Cucumber	cypermethrin 3% +	Viraat/Virolat ?	I	II/III	23	3	ec	0.133	0.100	10	0.75	0.10	100	27.3	0.80	x
				quinalphos 20%					20				10		0.65		35.5	46.30	47.11
27	Bara	FFS	Cabbage	cypermethrin 3% +	Viraat	I	II	23	3	ec	0.067	0.100	10	1.50	0.20	100	27.3	1.60	x
				quinalphos 20%					20				10		1.30		35.5	92.61	94.21
28	Bara	NFFS	Rice	cypermethrin 3% +	Viraat	I	II	23	3	EC	0.833	1.600	2	1.92	0.25	1760	27.3	0.41	x
				quinalphos 20%					20				2		1.67		35.5	23.71	24.12

29	Arghakhanchi	FFS	Potato	metalaxyl 8% + mancozeb 64%	Himil	F	II/NH	72	8	wp	0.075	0.050	2	0.67	0.07	160	29.4	0.35	x
									64				2		0.59		14.6	11.07	11.42
30	Bara	FFS	Cabbage	metalaxyl 8% + mancozeb 64%	Kriloxyl MZ	F	NH	72	8	wp	0.133	0.100	2	0.75	0.08	200	29.4	0.39	x
									64				2		0.67		14.6	12.46	12.85
31	Bara	NFFS	Rice	streptomycin 9%+ tetracycline 1%	Krosin	A	NH	10	9	WP	0.467	0.030	1	0.06	0.05	300	45	0.20	12.66
									1				1		0.01				
32	Mustang	NFFS	Potato	metalaxyl 8% + mancozeb 64%	Krinoxil Gold	F	NH	72	8	wp	0.1	0.2	2	2.00	0.22	400	29.4	1.05	!
									64				2		1.78		14.6	33.22	34.27

Appendix 7. 5: Total Consumption of insecticides and fungicides in all crops in five districts

Household Type	Pesticides	Regular program				Intensive program				Mustang				Total	
		Baseline		Impact		Baseline		Impact		Baseline		Impact		Baseline	Impact
		n	Amount kg	n	Amount kg	n	Amount kg	n	Amount kg	N	Amount kg	n	Amount kg	Amount kg	Amount kg
FFS	Insecticide	101	65.82	35	14.82	133	77.17	28	5.41	54	119.32	17	33.65	262.3	53.9
	Fungicide	28	2.96	4	0.65	78	13.64	27	6.90	57	53.75	45	35.73	70.3	43.3
NFFS	Insecticide	87	137.96	27	51.64	84	79.08	33	24.87	55	83.26	54	63.53	300.3	140.0
	Fungicide	11	1.14	2	4.80	52	7.56	18	7.75	40	49.39	38	38.71	58.1	51.2
Control	Insecticide	74	38.36	34	31.66	84	77.90	86	95.48	37	37.72	17	6.05	153.9	133.1
	Fungicide	16	1.22	15	5.06	31	8.08	28	49.01	27	43.75	16	31.72	53.0	85.8
Total	Insecticide	262	242.14	96	98.12	301	234.15	147	125.76	146	240.30	88	103.26	716.6	327.1
	Fungicide	55	5.32	21	10.51	161	29.28	73	63.66	124	146.89	99	106.14	181.5	180.3

n = Total number of application.

Appendix 7. 6: Total amount of all pesticide used in different corps

Program Type	Household Type	Baseline	Impact	Total Percent change
Regular	FFS	68.89	15.47	-77.54
	NFFS	139.75	37.00	-73.52
	Control	39.58	36.72	-7.23
	Total	248.22	80.41	-67.61
Intensive	FFS	95.41	12.68	-86.71
	NFFS	91.66	20.07	-78.10
	Control	92.40	146.14	58.16
	Total	279.47	178.89	-35.99
Mustang	FFS	173.07	69.38	-59.91
	NFFS	132.65	101.75	-23.29
	Control	81.47	37.82	-53.58
	Total	387.19	208.95	-46.04
Total	FFS	337.37	97.53	-71.09
	NFFS	364.06	150.05	-58.79
	Control	213.45	220.67	3.38
	Total	914.88	468.25	-48.82

Appendix 7. 7: Total amount (kg) of pesticides used in key crops

	Program	Regular				Intensive				Mustang			
		Baseline		Impact		Baseline		Impact		Baseline		Impact	
Household Type	Crops	n	Total amount Kg	n	Total amount Kg	n	Total amount Kg	N	Total amount Kg	n	Total amount Kg	n	Total amount Kg
FFS	Rice	33	8.42	18	9.23	40	65.98	12	4.92				
	Colecrops	18	2.07	11	2.64	59	8.95	19	3.54	4	0.48		
	Cucurbits	6	0.35	2	0.70	31	2.26	5	1.08				
	Tomato	6	0.59	1	0.05	15	0.99	7	0.95				
	Potato	31	6.50	3	0.95	62	5.90	7	1.40	18	5.56	17	5.03
	Apple									83	165.92	45	64.35
	Total	94	17.93	35	13.57	207	84.08	50	11.89	105	171.96	62	69.38
NFFS	Rice	31	20.07	16	24.24	36	65.45	18	16.83				
	Colecrops	4	0.14	1	1.20	34	17.90	11	3.10	2	0.08		
	Cucurbits	2	0.05	1	2.40	16	2.04	9	7.34				
	Tomato			1	0.60	5	0.36	3	1.00				
	Potato	14	4.05	1	4.00	30	2.32	8	2.89	15	7.95	13	6.16
	Apple									73	124.36	76	95.02
	Total	51	24.31	20	32.44	121	88.07	49	31.16	90	132.39	89	101.18
Control	Rice	21	3.90	13	7.24	58	73.63	62	104.33				
	Colecrops	2	0.10	1	0.50	20	2.86	11	3.79				
	Cucurbits	11	1.16	2	0.02			1	0.50				
	Tomato	20	2.31	7	10.65	1	0.01	3	0.86				
	Potato	15	4.84	17	5.11	17	1.64	9	3.13	6	2.55	1	0.10
	Apple									58	78.92	32	37.67
	Total	69	12.31	40	23.51	96	78.14	86	112.60	64	81.47	33	37.82

Empty boxes mean data not available.

Appendix 7. 8: Dose (Kg/ha) of class I pesticide used in all crops

Program Type	Household Type	Baseline	Impact	Percent Change
Regular	FFS	3.29	1.76	-46.39
	NFFS	5.28	3.42	-35.25
	Control	4.32	3.83	-11.28
Intensive	FFS	1.87	0.89	-52.53
	NFFS	4.00	3.00	-25.07
	Control	4.60	3.67	-20.18
Mustang	FFS	1.76	0.70	-60.30
	NFFS	0.97	1.19	23.46
	Control	0.67	1.00	50.00
Total	FFS	2.49	1.06	-57.22
	NFFS	4.41	2.00	-54.62
	Control	4.40	3.66	-16.78

Appendix 7. 9: Mean Dose all pesticide

Program	Household Type	Baseline Mean	Sd.	Impact Mean	Sd.	Percent Change
Regular	FFS	3.556	10.375	1.486	1.139	-58.21
	NFFS	3.650	7.781	2.058	0.959	-43.62
	Control	4.500	18.844	3.500	2.778	-22.22
Intensive	FFS	2.095	12.753	1.230	0.904	-41.29
	NFFS	1.868	3.929	1.557	0.784	-16.65
	Control	1.864	2.531	2.000	1.936	7.30
Mustang	FFS	3.962	4.691	3.439	2.339	-13.20
	NFFS	4.316	7.645	3.307	3.382	-23.38
	Control	3.697	5.174	3.140	2.621	-15.07
Total	FFS	2.958	10.657	2.166	1.954	-26.77
	NFFS	3.087	6.467	2.571	2.651	-16.72
	Control	3.688	11.320	3.008	2.276	-18.44

Appendix 7. 10: Field EIQ value of pesticides under different category

Program	Household Type	Baseline	Impact	Percent change
Regular	FFS	61.60	46.35	-24.76
	NFFS	32.62	35.06	7.48
	Control	117.10	99.97	-14.63
Intensive	FFS	34.73	13.57	-60.93
	NFFS	42.04	21.86	-48.00
	Control	21.44	91.87	328.55
Mustang	FFS	134.06	104.35	-22.16
	NFFS	158.91	118.38	-25.50
	Control	89.97	69.15	-23.13

Appendix 7. 11: Mean Field EIQ values of pesticides in key crops in all five districts

	Program	Regular				Intensive				Mustang			
		Baseline		Impact		Baseline		Impact		Baseline		Impact	
Household Type	Crops	n	Mean	n	Mean	n	Mean	N	Mean	n	Mean	n	Mean
FFS	Rice	22	6.47	12	37.05	35	14.54	9	10.39				
	Colecrops	16	58.94	7	86.04	43	49.95	8	10.53	4	132.21		
	Cucurbits	6	31.47	2	31.56	19	30.48	2	0.65				
	Tomato	6	81.33	1	50.50	12	20.73	5	13.16				
	Potato	20	175.88			52	41.31	7	18.90	18	88.43	17	85.60
	Apple									83	152.43	36	113.21
	Total	70	75.43	22	52.75	161	34.99	31	12.17	105	140.69	53	104.36
NFFS	Rice	20	11.15	16	43.96	29	26.54	7	17.84				
	Colecrops	4	37.60	1	6.83	20	70.07	9	14.79	2	17.23		
	Cucurbits	1	9.10	1	10.92	11	37.60	8	16.44				
	Tomato			1	5.46	5	56.99	3	70.17				
	Potato	8	147.33	1	87.60	24	39.48	7	23.41	15	74.97	13	75.85
	Apple									72	190.43	68	131.55
	Total	33	47.31	20	40.71	89	42.89	34	22.47	89	167.08	81	122.61
Control	Rice	17	15.97	12	51.83	48	16.91	58	82.84				
	Colecrops	2	61.68	1	616.82	15	25.94	9	24.44				
	Cucurbits	7	61.93	2	53.38			1	315.75				
	Tomato	8	72.69	6	222.95			2	52.42				
	Potato	8	597.30	9	98.59	13	43.44	8	62.06	6	52.70	1	30.84
	Apple									58	93.82	16	71.55
	Total	42	147.34	30	119.02	76	23.23	78	76.18	64	89.97	17	69.16

Empty boxes mean data not available.

(Except mixed pesticide)

Appendix 8. 1: Annual Use of Chemical Fertilizers and Related Costs by Sample Households

District	Household Type	Chemical fertilizers (kg/ha)					
		Nitrogen		Phosphorous		Potash	
		Baseline	Impact	Baseline	Impact	Baseline	Impact
Sarlahi	FFS	112	77	189	524	32	135
	NFFS	189	290	112	752	33	181
	Control	178	299	128	115	41	164
Bara	FFS	188	167	159	133	62	52
	NFFS	170	125	143	115	56	42
	Control	156	166	110	197	56	55
Arghakhanchi	FFS	61	59	41	39	11	8
	NFFS	51	41	39	67	33	2
	Control	26	23	29	36	13	1
Surkhet	FFS	66	42	52	18	11	40
	NFFS	20	22	25	30	21	5
	Control	29	33	38	40	0	0
Mustang	FFS	32	21	42	26	35	0
	NFFS	33	26	41	33	49	0
	Control	15	17	34	36	0	0

Appendix 8. 2: Average Farm Yard Manure and Chemical Fertilizers Used in Potato Crop

District	Type of Household	FYM (Kg)		Nitrogen (Kg)		Phosphorous (Kg)		Potash (Kg)	
		Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact
Sarlahi	FFS	107.67	1200.0	12.0	10	2.56	5	0.09	2
	NFFS	37.50	253.5	0	0	0.27	0	0.1	0
	Control	0	200.0	0	0	0	0	0	0
Bara	FFS	45.11	700.0	17.5	12.5	7.13	5	2.54	2
	NFFS	37.10	600.0	1.47	30	1.77	60	0.66	30
	Control	73.33	805.0	1.93	9.66	3.03	16.3	1.62	6.3
Arghakhanchi	FFS	552.00	833.3	1.24	8	2.51	13	0.88	14
	NFFS	530.67	768.8	1.93	12.90	3.6	22.7	0.67	12.2
	Control	50.00	1840.7	0.05	3.33	0.07	4.2	0	2.9
Surkhet	FFS	166.58	1000.2	2.54	0	2.51	0	0.59	3
	NFFS	250.83	506.0	1.12	0	1.24	0	0.27	0
	Control	185.81	1614.4	0	4.11	0	8.2	0	2.1
Mustang	FFS	1865.00	2050.0	1.0	3	0.97	2.7	1.13	0.5
	NFFS	1358.33	500.0	1.2	0	0.83	0	0	0
	Control	2431.67	0	2.5	16.66	1.6	25	0	0

Appendix 8. 3: Average Farm Yard Manure and Chemical Fertilizers Used in Tomato Crop

District	Type of Household	FYM (Kg)		Nitrogen (Kg)		Phosphorous (Kg)		Potash (Kg)	
		Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact
Bara	FFS	240.22	453.02	13.54	25	13.89	15	5.61	0
	NFFS	200.32	650.50	14.15	52.33	13.13	89.25	4.42	26
	Control	124.17	130.5	10.55	11.3	9.85		4.55	
Arghakhanchi	FFS	302	560.35	2.18	1.95.2	2.71		0.96	
	NFFS	212	533.3	1.4	19.4	1.13	22.4	0.47	8.8
	Control	50	68.6	0.17		0.1		0.07	
Surkhet	FFS	137.37	352.6	5.64	2.5	5.53	5.0	2.83	5
	NFFS	71.67	153.2	0.29	1.3	0.38		0.06	
	Control	18.39	180.	0	2.3	0	19	0	10
Mustang	FFS	73.33	275.4	0.97	2.6	0.97	2.8	1.13	1.8
	NFFS	48.33	250.9	1.2	2.5	0.83	1.0	0	2.9
	Control	20	286.2	2.5	1.2	1.6	2.3	0	1.5

Appendix 8. 4: Per Sample Household Average Amount of Fertilizer Used in Cole Crops

District	Type of Household	FYM (Kg)		Nitrogen (Kg)		Phosphorous (Kg)		Potash (Kg)	
		Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact
Sarlahi	FFS	0	0	0	0	0		0	
	NFFS	0	0	0	0	0		0	
	Control	770	0	7.3	0	22		9.13	
Bara	FFS	46.74	0	2.72	10	3.83	12.5	1.17	5
	NFFS	0	2166.6	0	20	0	30.25	0	18
	Control	0		0	8	0	28	0	12
Arghakhanchi	FFS	202.22	4640	1.14	20.3333	2.49	25.2	0.46	5.5
	NFFS	0	0	0	0	0	0	0	0
	Control	0	0	0	0	0	0	0	0
Surkhet	FFS	48.95	1070	0.16	5.75	0.7	7.6	0.01	3
	NFFS	45	600	0.38	4	0.29	8	1.78	
	Control	0	0	0	0	0	0	0	0

Appendix 9. 1: Percentage of Households Using Improved Seeds of Rice by Sample Districts

District	Type of Household	Baseline			Impact			Percentage change in use of improved seeds
		Total (Number)	Using Improved Seeds (Number)	Using Improved Seeds (Percent)	Total (Number)	Using Improved Seeds (Number)	Using Improved Seeds (Percent)	
Sarlahi	FFS	45	32	71.1	45	35	77.8	9.4
	NFFS	30	23	76.7	30	25	83.3	8.7
	Control	30	10	33.3	30	11	36.7	10.0
	Total	105	65	61.9	105	71	67.6	9.2
Bara	FFS	45	42	93.3	45	43	95.6	2.4
	NFFS	32	31	96.9	30	29	96.7	-0.2
	Control	30	30	100.0	30	29	96.7	-3.3
	Total	107	103	96.3	105	101	96.2	-0.1
Arghakhanchi	FFS	45	37	82.2	44	32	72.7	-11.5
	NFFS	30	18	60.0	28	17	60.7	1.2
	Control	30	9	30.0	30	9	30.0	0.0
	Total	105	64	61.0	102	58	56.9	-6.7
Surkhet	FFS	38	32	84.2	39	37	94.9	12.7
	NFFS	36	24	66.7	33	25	75.8	13.6
	Control	31	18	58.1	32	13	40.6	-30.0
	Total	105	74	70.5	104	75	72.1	2.3

Appendix 9. 2: Percentage of Households Using Improved Seeds of Potato by Sample Districts

District	Type of Household	Baseline			Impact		
		Total Number	Number	Percent	Total Number	Number	Percent
Sarlahi	FFS	45	7	15.6	45	9.0	20.0
	NFFS	30	3	10.0	30	2.0	6.7
	Control	30	0	0.0	30	.0	0.0
	Total	105	10	9.5	105	11.0	10.5
Bara	FFS	45	6	13.3	45	6.0	13.3
	NFFS	32	2	6.3	30	2.0	6.7
	Control	30	7	23.3	30	3.0	10.0
	Total	107	15	14.0	105	11.0	10.5
Arghakhanchi	FFS	45	10	22.2	44	30.0	68.2
	NFFS	30	4	13.3	28	10.0	35.7
	Control	30	1	3.3	30	3.0	10.0
	Total	105	15	14.3	102	34.0	33.3
Surkhet	FFS	38	24	63.2	39	26.0	66.7
	NFFS	36	18	50.0	33	14.0	42.4
	Control	31	1	3.2	32	2.0	6.3
	Total	105	43	41.0	104	42.0	40.4
Mustang	FFS	30	0	0.00	30	8	26.67
	NFFS	30	0	0.00	30	8	26.67
	Control	30	0	0.00	30	5	16.67
	Total	90	0	0.00	90	21	23.33

Appendix 9. 3: Percentage of Households Using Improved Seeds of Tomato by Sample Districts

District	Type of Household	Baseline			Impact		
		Total Number	Improved seed users	Percent	Total Number	Improved seed users	Percent
Sarlahi	FFS	45	0	0	45	16	32
	NFFS	30	0	0.0	30	1	3.3
	Control	30	11	36.7	30	3	10.0
	Total	30	11	36.7	60	4	6.7
Bara	FFS	45	6	13.3	45	13	28.9
	Control	30	0	0.0	30	1	3.3
	Total	45	6	13.3	75	14	18.7
Arghakhanchi	FFS	45	5	11.1	44	5	11.4
	Total	45	5	11.1	44	5	11.4
Surkhet	FFS	38	5	13.2	39	6	15.4
	NFFS	36	5	13.9	33	5	15.2
	Control	31	5	16.1	32	0	0.0
	Total	105	15	14.3	104	11	10.6

Appendix 9. 4: Seed Rate of Rice, Potato, and Tomato by Sample Households

District	Household Type	Seed Rate (Kg/ha)								
		Baseline			Impact			Percentage change		
		Rice	Potato	Tomato	Rice	Potato	Tomato	Rice	Potato	Tomato
Sarlahi	FFS	45.99	1278.46	0	47.02	1082.58	.00	2.2	-15.3	0.0
	NFFS	50.06	905.84	0	58.22	1020.72	.75	16.3	12.7	0.0
	Control	50.86	0	1.29	66.04	.00	2.53	29.9	0.0	95.8
Bara	FFS	38.89	1226.96	0.75	34.82	732.26	.68	-10.5	-40.3	-9.3
	NFFS	38.56	1452.32	0	40.45	1239.56	.00	4.9	-14.6	0.0
	Control	44.88	881.97	0	46.83	1365.99	.00	4.3	54.9	0.0
Arghakhanchi	FFS	115.87	1291.43	1.2	94.69	1095.82	.31	-18.3	-15.1	-74.2
	NFFS	110.06	1439.31	0	92.97	1541.43	.00	-15.5	7.1	0.0
	Control	117.27	1272.22	0	98.67	1842.04	.00	-15.9	44.8	0.0
Surkhet	FFS	79.25	1196.73	1.1	49.56	1063.85	.41	-37.5	-11.1	-62.6
	NFFS	71.38	1239.78	1.6	42.23	1568.61	.66	-40.8	26.5	-58.8
	Control	91.23	910.54	0	63.42	764.99	.00	-30.5	-16.0	0.0
Mustang	FFS		799.51			750.5				
	NFFS		669.7			810.3				
	Control		845.33			866.8				

Appendix 10. 2: Number of Sample Households Using Pesticides by Sample District

District	Type of Household	Baseline			Impact			Percent Change
		Total households	Frequency	Percent	Total households	Frequency	Percent	
Sarlahi	FFS	45	34	75.56	45	32	71.11	-5.88
	NFFS	30	16	53.33	30	21	70	31.25
	Control	30	16	53.33	30	18	60	12.50
	Total	105	66	62.86	105	71	67.62	7.58
Bara	FFS	46	36	78.26	45	30	66.66	-16.67
	NFFS	31	27	87.1	30	23	76.67	-14.81
	Control	30	20	66.67	30	29	96.67	45.00
	Total	107	83	77.57	105	87	82.86	4.82
Arghakhanchi	FFS	45	35	77.78	44	27	61.36	-22.86
	NFFS	30	15	50	28	10	35.71	-33.33
	Control	30	18	60	30	27	90	50.00
	Total	105	68	64.76	102	41	40.2	-39.71
Surkhet	FFS	38	34	89.47	39	23	58.97	-32.35
	NFFS	36	31	86.11	33	15	45.45	-51.61
	Control	31	18	58.06	32	15	46.88	-16.67
	Total	105	83	79.05	104	53	50.96	-36.14
Mustang	FFS	30	26	86.67	30	20	66.67	-23.08
	NFFS	30	24	80	30	22	73.33	-8.33
	Control	30	19	63.33	30	14	46.67	-26.32
	Total	90	69	76.67	90	59	65.56	-14.49
Total	FFS	204	165	80.88	203	132	65.02	-20.00
	NFFS	157	113	71.97	151	91	60.26	-19.47
	Control	151	91	60.26	152	103	67.76	13.19

Appendix 10. 3: Households using gloves by districts

District	Type of Household	Baseline			Impact		
		Using Pesticides (N)	Frequency (n)	% (n/N)	Total Household using pesticide	Frequency	% (n/N)
Sarlahi	FFS	34	5	14.7	32	20	62.5
	NFFS	16	1	6.3	21	2	9.5
	Control	16	4	25.0	18	6	33.3
Bara	FFS	36	2	5.6	30	13	43.3
	NFFS	27	3	11.1	23	3	13.0
	Control	20	0	0.0	29	10	34.5
Arghakhanchi	FFS	35	4	11.4	27	7	25.9
	NFFS	15	0	0.0	10	0	0.0
	Control	18	2	11.1	27	2	7.4
Surkhet	FFS	34	3	8.8	23	17	73.9
	NFFS	31	0	0.0	15	3	20.0
	Control	18	0	0.0	15	2	13.3
Regular	FFS	69	9	13.0	59	27	45.8
	NFFS	31	1	3.2	31	2	6.5
	Control	34	6	17.6	45	8	17.8
Intensive	FFS	70	5	7.1	53	30	56.6
	NFFS	58	3	5.2	38	6	15.8
	Control	38	0	0.0	44	12	27.3
Mustang	FFS	26	7	26.9	20	16	80.0
	NFFS	24	12	50.0	22	20	90.9
	Control	19	5	26.3	14	0	0.0
Total	FFS	165	21	12.7	132	73	55.3
	NFFS	113	16	14.2	91	28	30.8
	Control	91	11	12.1	103	20	19.4

Appendix 10. 4: Human and Livestock Poisoning Cases among Pesticide Users and Non Users

District	Type of Household	Baseline			Impact		
		Total Households	Total poisoning cases		Total Households	Total poisoning cases	
			Number (n)	% (n/N)		Number (n)	Percent (n/N)
Sarlahi	FFS	45	15	33.33	45	4	8.9
	NFFS	30	11	36.67	30	1	3.3
	Control	30	9	30	30	1	3.3
	Total	105	35	33.33	105	6	5.7
Bara	FFS	46	2	4.35	45	3	6.7
	NFFS	31	0	0	30	0	0.0
	Control	30	0	0	30	1	3.3
	Total	107	2	1.87	105	4	3.8
Arghakhanchi	FFS	45	9	20	44	1	2.3
	NFFS	30	3	10	28	0	0.0
	Control	30	2	6.67	30	0	0.0
	Total	105	14	13.33	102	1	1.0
Surkhet	FFS	38	10	26.32	39	3	7.7
	NFFS	36	13	36.11	33	1	3.0
	Control	31	2	6.45	32	0	0.0
	Total	105	25	23.81	104	4	3.8
Mustang	FFS	30	2	6.67	30	0	0
	NFFS	30	5	16.67	30	0	0
	Control	30	3	10	30	0	0
	Total	90	10	11.11	90	0	0

Appendix 10. 5: Keeping Pesticides in Safe Places by Sample Households among Pesticide Users

District	Type of House hold	Baseline			Impact			Percent change over baseline
		Total Pesticide users	Number (n)	Percent (n/N)	Total pesticide users	Number	Percent (n/N)	
Sarlahi	FFS	34	22	64.7	32	26	81.25	25.58
	NFFS	16	7	43.8	21	16	76.19	73.95
	Control	16	11	68.8	18	10	55.56	-19.24
Bara	FFS	36	28	77.8	35	28	80	2.83
	NFFS	27	18	66.7	23	15	65.22	-2.22
	Control	20	17	85	29	16	55.17	-35.09
Arghakhanchi	FFS	35	26	74.3	13	12	92.30	24.24
	NFFS	15	10	66.7	1	1	100	49.93
	Control	18	8	44.4	27	18	66.67	50.16
Surkhet	FFS	34	24	70.6	23	18	78.26	10.85
	NFFS	31	22	71	15	15	100	40.85
	Control	18	7	38.9	15	10	66.67	71.39
Mustang	FFS	26	20	76.9	20	18	78.26	1.77
	NFFS	24	17	70.8	22	20	74.07	4.62
	Control	19	18	94.7	14	13	92.86	-1.94

Appendix 10. 6: Sample Household Respondents Agreeing on All Insects should be killed

District	Type of House hold	Baseline			Impact			Percent change over baseline
		Total Sample Households (N)	Frequency	Percent (n/N)	Total Sample Households (N)	Frequency	Percent (n/N)	
Sarlahi	FFS	45	3	6.67	45	0	0.00	-100.00
	NFFS	30	17	56.67	30	2	6.67	-88.23
	Control	30	18	60	30	18	60.00	0.00
	Total	105	38	36.19	105	25	23.81	-34.21
Bara	FFS	46	9	19.57	45	0	0.00	-100.00
	NFFS	31	12	38.71	30	7	23.33	-39.72
	Control	30	9	30	30	10	33.33	11.11
	Total	107	30	28.04	105	29	27.62	-1.50
Arghakhanchi	FFS	45	0	0	44	0	0.00	0.00
	NFFS	30	10	33.33	28	5	17.86	-46.42
	Control	30	12	40	30	8	26.67	-33.33
	Total	105	22	20.95	102	26	25.49	21.67
Surkhet	FFS	38	4	10.53	39	1	2.56	-75.65
	NFFS	36	16	44.44	33	11	33.33	-24.99
	Control	31	22	70.97	32	16	50.00	-29.55
	Total	105	42	40	104	33	31.73	-20.67
Mustang	FFS	30	10	33.33	30	1	3.33	-90.00
	NFFS	30	15	50	30	5	16.67	-66.67
	Control	30	16	53.33	30	7	23.33	-56.25
	Total	90	41	45.56	90	18	20.00	-56.10
Regular	FFS	90	3	3.33	89	0	0.00	-100.00
	NFFS	60	27	45.00	58	7	12.07	-73.18
	Control	60	30	50.00	60	26	43.33	-13.33
Intensive	FFS	84	13	15.48	84	1	1.19	-92.31
	NFFS	67	28	41.79	63	18	28.57	-31.63
	Control	61	31	50.82	62	26	41.94	-17.48

Appendix 10. 7: Number of farmers identifying different beneficial insects in both studies

District	Type of House hold	Names	Baseline	Impact	Percent Change
Sarlahi	FFS	Spider, honey bee, wasp, ant, earthworm, ladybird beetle, dragonfly, preying mantids, <i>gyene kira</i> , tiger beetle, mud wasp, long horn grasshopper, blister beetle larvae (At least five)	17	25	47.1
	NFFS	Grass hopper, earthworm, wasp, butterfly, bee, spider, skipper, (At least five)	7	16	128.6
	Control	Earthworm, bee, wasp, butter fly , grubs, preying mantids (At least five)	6	10	66.7
Bara	FFS	Spider, bee, wasp, earthworm, ladybird beetle, dragonfly, preying mantids, butterfly, tiger beetle, long horned grasshopper, bug, <i>cheda</i> , ant, <i>badhe</i> (At least five)	16	26	62.5
	NFFS	Spider, tiger beetle, lady bird beetle, dragon fly, ant, butter fly, mantids, (At least five)	7	15	114.3
	Control	Tiger beetle, butter fly, spider, bee, lady bird beetle, earthworm, mantids, giant water bug (At least five)	8	12	50.0
Arghakhanchi	FFS	Bees, seven spotted beetle, spider, lady bird beetle, dragon fly, bumble bees, <i>kanche aunle</i> insect, butterfly, <i>budhi kira</i> , earth worm (At least five)	10	22	120.0
	NFFS	Bees, butterfly, seven spotted beetle, earthworm, <i>mudi kira</i> , spider, bumble bees, beetles (At least five)	8	20	150.0
	Control	Dung beetle, butterfly, bees, spider, bumble bees, wasp (At least five)	6	9	50.0
Surkhet	FFS	Spider, lady bird beetle, dragon fly, <i>gaine kira</i> , mantids, dung beetle, butter fly, grass hopper, <i>lamsinge kira</i> , wasp, bee, <i>gham kiri</i> , 7 spotted beetle, damsel fly, red beetle, eight spotted beetle (At least five)	16	25	56.3
	NFFS	Dragon fly, butterfly, earthworm, spider, honey bee, wasp, grasshopper (At least five)	7	18	157.1
	Control	Bees, silk worm, honey bees, wasp, dragon fly, 7 spotted lady bird beetle (At least five)	3	6	100.0
Mustang	FFS	Bee, lady bird beetle, honey bee, tortoise insect, butter fly (At least five)	6	20	233.3
	NFFS	Bee, lady bird beetle, butter fly, wasp, dragon fly (At least five)	3	15	400.0
	Control	Bee, lady bird beetle, honey bee, wasp, dragon fly (At least five)	2	6	200.0

Appendix 11. 1: Percentage change in annual household income of sampled household by district

Program	District	Types of Household	Crops	Livestock	Remittance	Off-farm
Regular	Sarlahi	FFS	7.00	101.92	-5.65	-3.70
		NFFS	3.52	19.49	516.78	-17.96
		Control	-2.81	-23.61	128.57	-44.19
		Total	1.96	54.36	184.07	-22.98
	Arghakhanchi	FFS	308.97	82.78	-30.48	-82.44
		NFFS	192.55	3.10	4.73	-54.39
		Control	-40.47	-74.30	-22.35	-7.36
		Total	195.66	6.58	-16.59	-60.12
Intensive	Bara	FFS	17.08	8.94	52.95	47.63
		NFFS	15.13	4.31	79.79	10.66
		Control	-22.79	46.91	11.0	-32.47
		Total	6.70	13.81	220.92	3.20
	Surkhet	FFS	14.23	9.29	46.95	-27.71
		NFFS	0.54	1.96	89.89	-46.15
		Control	-89.28	-43.11	77.65	69.52
		Total	-13.48	-2.56	67.96	-20.20
Intensive Mustang		FFS	19.18	19.25	254.97	-39.58
		NFFS	5.86	25.91	81.87	-55.37
		Control	-85.71	97.67	457.09	21.85
		Total	-14.26	61.72	205.87	-32.70

Appendix 11. 2: Household income from cereals by the program and household type

Program	Household Types		Rice		Maize		Wheat		Other Cereals	
			Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact
Regular	FFS	Mean	16527	28237	12292	12688	3010	8737	30185	5627
		SD	32161	28670	19084	16052	7574	13620	51228	31361
	NFFS	Mean	10795	16110	8294	15297	1965	6500	30694	4150
		SD	18876	21582	11078	22617	4708	8181	52323	24060
	Control	Mean	34043	7265	19732	9182	13188	3926	15681	1875
		SD	47873	14062	33350	14143	50240	7297	36767	8057
	Total	Mean	19950	24760	13315	12403	5630	6716	26162	4126
		SD	35773	24818	22917	17729	27684	10819	48092	24523
Intensive	FFS	Mean	27901	53891	10791	15586	6531	14575	3255	2186
		SD	29762	64893	16889	16257	8766	20717	12616	9486
	NFFS	Mean	22293	34224	8041	3579	6991	13587	5210	725
		SD	28494	38730	13623	4987	9827	15762	17943	3569
	Control	Mean	19213	29449	5718	6454	7129	8010	1663	1449
		SD	22358	31582	11680	12501	10962	54427	3435	5102
	Total	Mean	23741	40618	8526	5229	6842	15291	3426	1520
		SD	27602	50270	14670	12605	9703	33414	13019	6881
Mustang	FFS	Mean	0	0	0	0	0	0	0	5110
		SD	0	0	0	0	0	0	0	8111
	NFFS	Mean	0	0	0	2130	0	0	0	5920
		SD	0	0	0	5619	0	0	0	6679
	Control	Mean	0	0	0	0	0	0	0	0
		SD	0	0	0	0	0	0	0	0
	Total	Mean	0	0	0	789	0	0	0	4085
		SD	0	0	0	3468	0	0	0	6664

Appendix 11. 3: Annual households' income of different crops by program and household type

Program	Type of Household		Rice	Maize	Wheat	Barley	Legumes	Mustard	Potato	Tomato	Cole Crops
Regular	FFS	Mean	28237	12688	7026	0	15000	795	1329	2062	3461
		N	89	89	89	0	4	89	89	89	89
		SD	28670	16052	11704	0	6745	2689	4663	16129	17041
	NFFS	Mean	16110	15297	8513	600	0	537	207	172	0
		N	58	58	58	1	0	58	58	58	58
		SD	21582	22617	12031	.0	0	1792	1576	1313	0
	Control	Mean	7265	9182	2542	3050	24000	741	100	5667	0
		N	60	60	60	2	12	60	60	60	60
		SD	14062	14143	3818	2899	0	1980	775	25602	0
	Total	Mean	18760	12403	6143	2233	16800	707	658	2577	1488
		N	207	207	207	3	5	207	207	207	207
		SD	24818	17729	10413	2491	7094	2261	3239	17432	11270
Intensive	FFS	Mean	53891	5586	17464	0	18525	328	3567	2340	1481
		N	83	83	83	0	2	83	83	83	83
		SD	64893	16257	25262	0	16228	2166	16254	9921	5756
	NFFS	Mean	34224	3579	14693	0	40000	199	2073	1031	2172
		N	64	64	64	0	1	64	64	64	64
		SD	38730	4987	14785	0	0	1195	5103	5933	7696
	Control	Mean	29449	6454	12240	0	0	337	581	1613	581
		N	62	62	62	0	0	62	62	62	62
		SD	31582	12501	11783	0	0	1045	4572	12700	4572

Appendix 11. 4: Annual household income of sample household by district and household type

District	Types of Household	Baseline					Impact				
		Crops	Livestock	Remittance	Off-farm	Net annual income	Crops	Livestock	Remittance	Off-farm	Net annual income
Sarlahi	FFS	83,688	63,741	22,000	66,095	235,523	14,544	128,703	20,756	63,651	353,654
	NFFS	90,766	37,422	18,267	53,855	200,310	68,961	44,714	112,667	44,183	270,525
	Control	117,925	22,135	34,300	72,810	247,171	114,613	16,910	78,400	40,637	250,559
	Total	95,492	44,334	24,448	64,516	228,790	39,175	34,194	65,629	51,513	258,246
Bara	FFS	125,453	17,679	17,174	47,739	208,046	102,996	13,260	26,267	70,475	212,997
	NFFS	84,585	4,994	3,226	73,455	166,260	38,092	14,040	5,800	81,283	139,214
	Control	68,362	6,907	0	74,830	150,099	52,780	10,147	33,400	50,530	146,857
	Total	97,606	10,984	8,318	62,785	179,693	70,104	12,593	22,457	67,864	173,019
Arghakhanchi	FFS	66,022	52,371	199,053	214,890	532,336	270,010	95,725	138,386	37,745	541,867
	NFFS	45,731	51,079	163,300	120,277	380,387	133,785	30,660	171,026	54,857	390,329
	Control	31,079	47,142	124,933	77,867	281,021	18,500	12,114	97,012	72,133	289,760
	Total	50,241	50,508	167,661	148,708	417,117	38,338	19,626	135,177	52,557	445,698
Surkhet	FFS	56,892	31,285	51,858	63,026	203,062	64,988	34,192	76,205	45,564	220,948
	NFFS	36,728	18,690	44,556	79,438	179,412	27,259	19,056	84,606	42,777	173,698
	Control	27,592	11,222	11,655	28,255	78,724	2,959	6,384	20,705	47,897	77,945
	Total	41,328	21,044	37,485	58,387	158,244	10,334	19,333	61,794	45,397	136,859
Mustang	FFS	213,946	33,453	24,667	108,517	384,783	254,988	33,192	87,560	65,564	441,304
	NFFS	214,858	4,340	53,667	140,667	418,628	227,459	33,056	97,606	62,777	420,898
	Control	160,658	53,820	21,667	72,133	314,868	22,959	106,384	120,705	87,897	337,945
	Total	196,487	30,538	33,333	107,106	372,759	10,334	19,333	61,794	45,397	136,858

Appendix 11. 5: Annual Household Income of Sample Households in Sarlahi District

Type of Household	Baseline (NRs)					Impact (NRs)					Difference in net annual income
	Crops	Livestock	Remittance	Off-farm	Net annual income	Crops	Livestock	Remittance	Off-farm sources	Net annual income	
FFS	83688	63741	22000	66095	235523	14544	128703	20756	63651	353654	118131
NFFS	90766	37422	18267	53855	200310	68961	44714	112667	44183	270525	70215
Control	117925	22135	34300	72810	247171	114613	16910	78400	40637	250559	3389
Total	95492	44334	24448	64516	228790	39175	34194	65629	51513	258246	29456

Appendix 11. 6: Annual Household Income of Sample Households in Bara District

Type of Household	Baseline (NRs)					Impact (NRs)					Difference in net annual income
	Crops	Livestock	Remittance	Off-farm	Net annual income	Crops	Livestock	Remittance	Off-farm sources	Net annual income	
FFS	125453	17679	17174	47739	208046	102996	13260	26267	70475	212997	4951
NFFS	84585	4994	3226	73455	166260	38092	14040	5800	81283	139214	-27045
Control	68362	6907	0	74830	150099	52780	10147	33400	50530	146857	-3242
Total	97606	10984	8318	62785	179693	70104	12593	22457	67864	173019	-6674

Appendix 11. 7: Annual Household Income of Sample Households in Arghakhanchi District

Type of Household	Baseline (NRs.)					Impact (NRs.)					Difference in net annual income
	Crops	Livestock	Remittance	Off-farm sources	Net annual income	Crops	Livestock	Remittance	Off-farm sources	Net annual income	
FFS	66022	52371	199053	214890	532336	270010	95725	138386	37745	541867	9531
NFFS	45731	51079	163300	120277	380387	133785	30660	171026	54857	390329	9942
Control	31079	47142	124933	77867	281021	18500	12114	97012	72133	289760	8739
Total	50241	50508	167661	148708	417117	38338	19626	135177	52557	445698	10070

Appendix 11. 8: Annual Household Income of Sample Households in Surkhet District

Type of Household	Baseline (NRs)					Impact (NRs)					Difference in net annual income
	Crops	Livestock	Remittance	Off-farm sources	Net annual income	Crops	Livestock	Remittance	Off-farm sources	Net annual income	
FFS	56892	31285	51858	63026	203062	64988	34192	76205	45564	220948	17886
NFFS	36728	18690	44556	79438	179412	27259	19056	84606	42777	173698	-5713
Control	27592	11222	11655	28255	78724	2959	6384	20705	47897	77945	-779
Total	41328	21044	37485	58387	158244	10334	19333	61794	45397	136859	-21385

Appendix 11. 9: Annual Household Income of Sample Households in Mustang District

Type of Household	Baseline (NRs)					Impact (NRs)					Difference in net annual income
	Crops	Livestock	Remittance	Off-farm sources	Net annual income	Crops	Livestock	Remittance	Off-farm sources	Net annual income	
FFS	213946	33453	24667	108517	384783	254988	33192	87560	65564	441304	56521
NFFS	214858	4340	53667	140667	418628	227459	33056	97606	62777	420898	2270
Control	160658	53820	21667	72133	314868	22959	106384	120705	87897	337945	23077
Total	196487	30538	33333	107106	372759	10334	19333	61794	45397	136858	-235901

Appendix 11. 10: Annual expenditure by program and household type in impact survey

Program	Type of Household	Crop input	Livestock	Food	Non-food items	Education	Social function	Assets	Health
Regular	FFS	30065.6	14978.5	46613.8	28993.9	39152.6	28063.6	35820	11600.8
	NFFS	20712.8	3700	54079.7	19435.6	37171	16300	90615.3	13250
	Control	32368.5	21068.1	52123.4	19481.4	48190.9	25845.9	16350	20681.0
	Total	27833.7	13173.7	50519.7	23800.4	41734.6	24238.1	47824.1	14650.1
Intensive	FFS	32313.0	12553	38842.9	19104.1	26940.7	39512.6	66685.1	18529.6
	NFFS	26808.8	3820	35523.7	40359.6	27713.5	30690.5	19631.5	16168.3
	Control	32727.4	2691.02	43131.6	24116.1	33023.9	18056.3	34871.7	21031.9
	Total	30648.2	6936.03	39313.6	27677.2	29005.1	30880.9	43564.8	18496.0

Appendix 11. 11: Average Annual Household Expenditure in Surkhet District (NRs)

Type of Household s	Baseline							Impact							Difference
	Crop	Livestock	Food	Education	Non-food	Purchasing assets	Average annual	Crop	Livestock	Food	Non-food	Education	Purchasing assets	Average annual	
FFS	6097	2514	23229	26799	25246	59203	126237	25353	5702	31171	16302	38695	126889	202859	76621
NFFS	3751	2080	18812	16372	15849	29340	95155	15659	5930	33462	15202	37684	44738	134123	38968
Control	8260	4666	21763	22946	28632	55132	136226	19792	1716	30133	13103	39209	97941	150673	14447
Total	5907	2955	21282	22031	23024	46877	118529	20566	4548	31582	14974	38520	92777	164991	46462

Appendix 11. 12: Average Annual Household Expenditure in Arghakhanchi District

Type of Households		Baseline							Impact						
		Crop inputs	Livestock inputs	Food	Education	Non-food items	Purchasing assets	Average	Crop inputs	Livestock inputs	Food	Non-food items	Education	Purchasing assets	Average annual expenditure
FFS	Mean	24659	15919	61952	32638	97321	179821	367490	298387	21919	49051	27582	31738	62834	491512
NFFS	Mean	15055	7037	64781	39014	70118	421594	459599	217695	14504	56099	15944	34021	115600	453862
Control	Mean	16113	3522	55757	28975	84378	103120	236114	50501	9492	59857	16951	72538	31333	240672
Total	Mean	19473	9285	60990	33634	85851	237254	356271	25355	13483	54164	21261	45493	71941	231697

Appendix 11. 13: Average Annual Household Expenditure in Sarlahi District

Type of Household	Baseline							Impact						
	Crop inputs	Livestock inputs	Food	Education	Non-food	Purchasing assets	Average	Crop inputs	Livestock inputs	Food	Education	Non-food	Purchasing assets	Average
FFS	36660	16207	36601	43579	53861	126132	248511	45018	8884	33782	23454	200	236556	282737
NFFS	33495	5093	29252	31404	53048	114745	202062	31048	7047	35380	16691	34814	18214	125358
Control	37707	7925	33711	26004	48674	135317	227763	94147	16451	35735	19123	22660	20356	194123
Total	36055	10696	33675	35138	52147	125765	229312	55064	10521	34788	20296	35931	118084	212453

Appendix 11. 14: Average Annual Household Expenditure in Bara District

Type of Household	Baseline							Impact							Difference
	Crop inputs	Livestock inputs	Food	Education	Non-food	Purchasing assets	Average	Crop inputs	Livestock inputs	Food	Education	Non-food	Purchasing assets	Average	
FFS	40211	5312	24838	12734	33146	129331	166290	53330	5154	37374	19643	18567	59161	176627	10337
NFFS	33442	2148	24880	11429	31641	31100	134015	38998	5493	28138	56553	16896	6589	148561	14546
Control	43280	5956	22513	12807	68550	60281	185971	39235	2943	30860	28008	34354	58217	174636	-11335
Total	39110	4611	24198	12355	42636	73142	162457	45208	4619	32893	32623	22496	45553	168039	5582

Appendix 11. 15: Annual Household Expenditure for Food in Sarlahi District

Type of Household	Baseline						Impact						Difference
	Cereals	Legumes	Fruits & vegetables	Livestock	Spices/oil/salt	Total expenditure on food	Cereals	Legumes	Fruits & vegetables	Livestock	Spices/oil/salt	Total expenditure on food	
FFS	20655	3394	4622	9504	13182	36601	20659	4319	4965	7777	12944	43782	7181
NFFS	15408	3983	13050	7250	10444	29252	13112	5050	5211	10125	11858	35380	6128
Control	10950	2526	6350	10707	11897	33711	14389	5065	4533	6195	10122	35735	2024
Total	16425	3265	7257	9461	12070	33675	12637	4731	4921	8090	11861	34788	1113

Appendix 11. 16: Annual Household Expenditure for Food in Bara District

Type of Household	Baseline						Impact						Difference
	Cereals	Legumes	Fruits & vegetables	Livestock	Spices/oil/salt	Total expenditure on food	Cereals	Legumes	Fruits & vegetables	Livestock	Spices/oil/salt	Total expenditure on food	
FFS	12064	6885	5720	8926	7164	24838	8917	3888	7770	10044	11324	37374	12536
NFFS	11509	3408	4991	9774	5330	24880	8771	3022	5633	8432	9454	28138	3258
Control	11300	4169	4715	7593	5604	22513	4126	3308	6165	9038	9959	30860	8348
Total	11634	4629	5215	8800	6194	24198	7434	3493	6756	9286	10404	32893	8695

Appendix 11. 17: Annual Household Expenditure for Food in Arghakhanchi District

Type of Household	Baseline						Impact						Difference
	Cereals	Legumes	Fruits & vegetables	Livestock	Spices/oil/salt	Total expenditure on food	Cereals	Legumes	Fruits & vegetables	Livestock	Spices/oil/salt	Total expenditure on food	
FFS	12974	5004	5712	13228	31943	61952	29917	3888	12770	10044	11324	62374	421
NFFS	22529	4955	4140	10876	32189	64781	28771	3022	5633	8432	9454	48138	-16643
Control	13438	3365	4215	10154	29940	75757	4126	3308	10165	9038	9959	54860	-20896
Total	15671	4491	4763	11662	31429	60990	7434	3493	6756	9286	10404	32893	-28097

Appendix 11. 18: Average Annual Household Expenditure for Food in Surkhet District

Type of Household	Baseline						Impact						Difference
	Cereals	Legumes	Fruits & vegetables	Livestock	Spices/oil/salt	Total expenditure on food	Cereals	Legumes	Fruits & vegetables	Livestock	Spices/oil/salt	Total expenditure on food	
FFS	13281	4820	1724	8073	5558	23229	5100	2715	2143	13542	12771	31171	7942
NFFS	11863	2098	2118	6876	4120	18812	7275	2181	2086	11518	12326	23462	4650
Control	13971	2051	1765	7424	8398	21763	10091	2981	1545	8761	7568	24133	2369
Total	12900	2991	1851	7486	5893	21282	11522	2782	1930	11389	10999	31582	10300

Appendix 11. 19: Annual Expenditure for Education in Surkhet District by Gender

Type of Household	Baseline			Impact			Total Difference
	Male	Female	Total	Male	Female	Total	
FFS	18812	11851.9	26798.8	28435.3	25260.6	48694.7	21895.9
NFFS	10092.3	9017.2	16371.9	22514.3	10207.1	28683.9	12312.0
Control	11954.5	16680	22946.2	18611.1	12049.6	29208.6	6262.4
Total	13971.3	12040.8	22031.4	26625.8	15531.1	38520.0	16488.6

Appendix 11. 20: Annual Expenditure for Education in Arghakhanchi District by Gender

Type of Household	Baseline			Impact			Total Difference
	Male	Female	Total	Male	Female	Total	
FFS	24096.8	21911.7	32637.9	25248.4	22081.3	41737.8	9100
NFFS	38350	13089.5	39014.3	23977.3	16055.6	34020.8	-4993
Control	26176.2	14570	28975	24022.2	10800.0	27537.9	-1437
Total	28924.3	17363.8	33633.8	32672.5	19741.3	45493.3	11860

Appendix 11. 21: Annual Expenditure for Education in Bara District by Gender

Type of Household	Baseline			Impact			Total Difference
	Male	Female	Total	Male	Female	Total	
FFS	10164.9	5407.4	12734.1	13207.5	8752.5	20567.4	7833.3
NFFS	8891.2	5143.2	11428.6	12465.4	5504.2	16896.3	5467.7
Control	10084.7	6055.9	12807.0	12522.2	7286.5	19353.7	6546.7
Total	9753.0	5502.7	12355.0	15704.3	8018.3	22496.4	10141.4

Appendix 11. 22: Annual Expenditure for Education in Sarlahi District by Gender

Type of Household	Baseline			Impact			Total Difference
	Male	Female	Total	Male	Female	Total	
FFS	33593.5	21940.0	43579.5	30850.0	20516.2	45200.0	1620.5
NFFS	22963.2	22866.7	31403.7	22117.4	17026.3	31814.3	410.6
Control	15200.0	19227.8	26004.0	15414.5	9263.6	22660.1	-3343.9
Total	25452.9	21453.0	35138.5	24506.3	16492.3	35931.4	792.9

Appendix 11. 23: Annual Expenditure for Education in mustang District by Gender

Type of Household	Baseline			Impact			Total Difference
	Male	Female	Total	Male	Female	Total	
FFS	68833	37000	52916.65	79540	52040	65790.15	12873.5
NFFS	59167	48286	53726.2	60187	51451	55818.7	2092.5
Control	30800	34842	32821.05	34880	32842	33861.05	1040
Total	51231	39489	45360.1	174607	136333	155469.9	110109.8

Appendix 11. 24: Change in Annual household Expenditure of sample household

Programs	Type of Household	Crop Inputs		Livestock		Education		Food		Non food	
		Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact	Baseline	Impact
Regular	FFS	30659.5	34944.8	10329.6	16516.3	38108.7	38731.2	49276.6	41330.9	75591.1	25495.1
	NFFS	24275.0	22821.4	7401.3	5983.6	35278.2	34409.1	47016.4	45382.1	61582.8	16330.5
	Control	26910.0	50672.8	7136.5	12411.3	27459.2	48959.3	44920.7	48000.4	66526.0	18018.7
	Total	27764.1	36106.7	8580.6	12375.3	34386.2	40739.1	47398.1	44381.7	68998.7	20773.4
Intensive	FFS	25003.7	34849.2	3881.1	11171.9	19006.2	28120.0	24110.2	34491.6	29572.0	17953.4
	NFFS	17488.6	24358.3	1734.8	6116.1	14065.0	27857.6	21619.5	31037.0	23155.5	34835.3
	Control	25770.1	29606.2	1067.4	2898.4	18186.9	36825.3	22131.9	30478.6	48263.8	20307.3
	Total	22825.0	30081.3	2393.2	7169.4	17166.8	30508.2	22753.8	32240.9	32922.4	23883.9
Mustang	FFS	29756.8	12279.5	4483.3	1060.0	67200.0	4100.0	49645.8	40502.5	30277.0	16300.0
	NFFS	31844.7	21044.0	1768.3	2360.0	81529.4	27800.0	55061.7	30690.0	41646.9	12950.0
	Control	28701.9	9083.3	7756.7	833.3	51090.9	33333.3	55285.0	93333.3	40364.0	21493.3
	Total	30081.6	14081.3	4669.4	1507.7	65322.0	19961.5	53330.8	48920.2	37381.9	16210.0

Appendix 11. 25: Percentage change in average annual household expenditure by district

District	Type of Household	Percentage Difference in Expenditure (NRs)						
		Crop inputs	Livestock inputs	Food	Education	Non-food items	Purchasing assets	Average annual expenditure
Sarlahi	FFS	12.8	4.5	7.7	4.6	1.6	8.6	9.8
	NFFS	7.3	3.4	2.9	2.4	1.2	8.4	3.8
	Control	4.9	1.6	6.0	3.5	3.4	8.5	4.8
	Total	9.7	2.6	5.3	3.2	2.1	8.5	8.1
Bara	FFS	15.6	3.0	9.5	5.3	4.0	9.3	10.2
	NFFS	6.6	3.7	3.1	3.8	2.6	8.8	7.9
	Control	5.3	2.6	3.1	2.7	-3.9	3.4	6.1
	Total	9.6	3.2	5.9	4.0	4.2	7.7	3.4
Arghakhanchi	FFS	9.1	7.7	2.8	5.5	7.4	5.1	7.7
	NFFS	9.0	6.1	3.4	7.1	3.5	2.6	-1.2
	Control	3.4	6.5	7.4	-4.5	4.0	1.6	1.9
	Total	5.2	5.2	1.2	3.8	7.0	2.7	5.0
Surkhet	FFS	10.8	6.8	4.2	3.2	3.3	4.3	9.7
	NFFS	9.5	5.1	7.9	5.1	7.8	52.5	4.0
	Control	1.6	3.2	3.5	2.9	3.9	7.6	1.6
	Total	8.2	5.9	4.4	2.0	7.3	7.9	9.2
Mustang	FFS	7.1	3.7	2.8	1.5	7.4	5.1	5.7
	NFFS	6.0	6.1	-3.4	-5.1	1.5	-2.6	1.2
	Control	3.4	1.5	7.4	-1.5	-1.0	9.6	1.9
	Total	5.2	3.2	5.2	1.8	4.0	-6.7	5.0

Appendix 11. 26: Annual household expenditure for education by Gender

District	Household type	Baseline			Impact			Total Difference
		male	female	Total	male	female	Total	
Sarlahi	FFS	33593.5	21940	43579.5	30850	20516.2	45200	1620.5
	NFFS	22963.2	22866.7	31403.7	22117.4	17026.3	31814.3	410.6
	Control	15200	19227.8	26004	15414.5	9263.6	22660.1	-3343.9
	Total	25452.9	21453	35138.5	24506.3	16492.3	35931.4	792.9
Bara	FFS	10164.9	5407.4	12734.1	13207.5	8752.5	20567.4	7833.3
	NFFS	8891.2	5143.2	11428.6	12465.4	5504.2	16896.3	5467.7
	Control	10084.7	6055.9	12807	12522.2	7286.5	19353.7	6546.7
	Total	9753	5502.7	12355	15704.3	8018.3	22496.4	10141.4
Arghakhanchi	FFS	24096.8	21911.7	32637.9	25248.4	22081.3	41737.8	9100
	NFFS	38350	13089.5	39014.3	23977.3	16055.6	34020.8	-4993
	Control	26176.2	14570	28975	24022.2	10800	27537.9	-1437
	Total	28924.3	17363.8	33633.8	32672.5	19741.3	45493.3	11860
Surkhet	FFS	18812	11851.9	26798.8	28435.3	25260.6	48694.7	21895.9
	NFFS	10092.3	9017.2	16371.9	22514.3	10207.1	28683.9	12312
	Control	11954.5	16680	22946.2	18611.1	12049.6	29208.6	6262.4
	Total	13971.3	12040.8	22031.4	26625.8	15531.1	38520	16488.6
Mustang	FFS	68833	37000	52916.65	79540	52040	65790.15	12873.5
	NFFS	59167	48286	53726.2	60187	51451	55818.7	2092.5
	Control	30800	34842	32821.05	34880	32842	33861.05	1040
	Total	51231	39489	45360.1	174607	136333	155469.9	110109.8

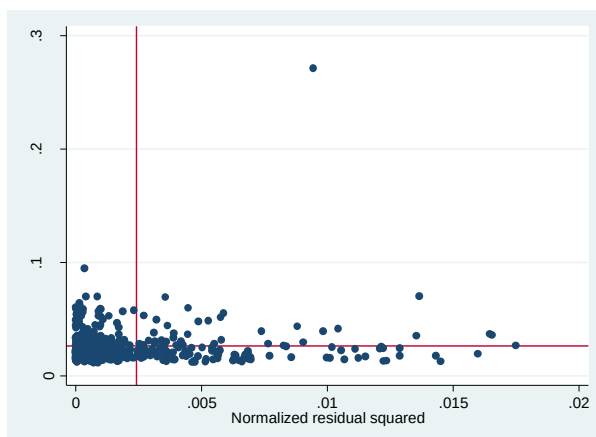
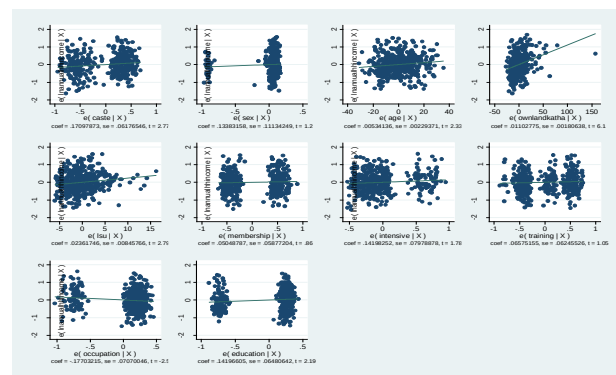
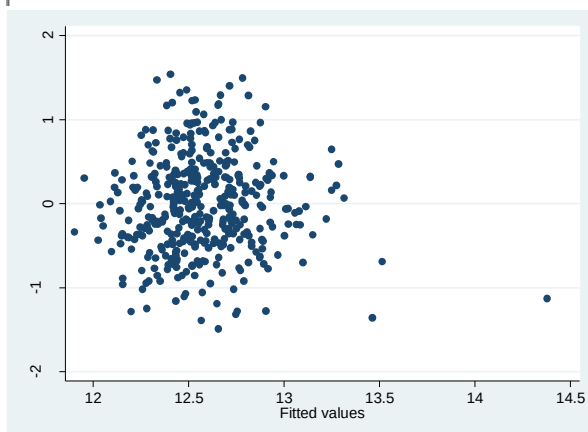
Appendix 11. 27: Regression model to determine the factors affecting annual household income

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. macro define X1 sex age education occupation caste ownlandkatha lsu membership intensive training
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. reg lnannualhhincome $X1
```

Source	SS	df	MS	Number of obs =	414
Model	28.6903218	10	2.86903218	F(10, 403) =	8.55
Residual	135.210426	403	.335509741	Prob > F =	0.0000
				R-squared =	0.1750
				Adj R-squared =	0.1546
Total	163.900747	413	.39685411	Root MSE =	.57923

lnannualhh~e	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
sex	.1338316	.1113425	1.20	0.230	-.085053 .3527162
age	.0053414	.0022937	2.33	0.020	.0008322 .0098505
education	.141966	.0648064	2.19	0.029	.0145652 .2693669
occupation	-.1770322	.0707005	-2.50	0.013	-.3160199 -.0380444
caste	.1709787	.0617655	2.77	0.006	.049556 .2924015
ownlandkatha	.0110277	.0018064	6.10	0.000	.0074767 .0145788
lsu	.0236175	.0084577	2.79	0.005	.0069908 .0402441
membership	.0504879	.058772	0.86	0.391	-.0650502 .1660259
intensive	.1419825	.0797888	1.78	0.076	-.0148717 .2988367
training	.0657515	.0624553	1.05	0.293	-.0570273 .1885303
_cons	11.68419	.1842877	63.40	0.000	11.3219 12.04647



```
. vif
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Variable	VIF	1/VIF
intensive	1.26	0.794174
training	1.20	0.834868
caste	1.13	0.888035
ownlandkatha	1.08	0.926543
lsu	1.07	0.937374
age	1.06	0.939928
occupation	1.06	0.945403
membership	1.05	0.950207
sex	1.03	0.972593
education	1.02	0.983340
Mean VIF	1.09	

Appendix 12. 1: Impact of IPM on Benefit Cost ratio of tomato

District Name	Type of Household	BC ratio Baseline	BC ratio Impact
Sarlahi	Control	1.28	1.86
Bara	FFS	2.82	3.71
Arghakhanchi	FFS	1.68	1.42
Surkhet	FFS	1.72	2.29
Total	FFS	2.08	2.56
	NFFS	0.73	1.00
	Control	1.26	1.49
	Total	1.48	2.94

Appendix 12. 2: Impact of IPM on gross margin of Cole crops production in study areas (Value in Rs.)

District Name	Type of Household	Gross margin Baseline	Gross margin Impact	Difference	Percentage change
Bara	FFS	2666.04	3663.96	997.92	37.43
	NFFS	2032.19	2603.29	571.10	28.10
	Control	6981.47	6172.38	-809.10	-11.59
Arghakhanchi	FFS	1908.20	2618.20	710.00	37.21
	NFFS	1758.50	1854.00	95.50	5.43
	Control	10982.00	8818.00	-2164.00	-19.70
Surkhet	FFS	1523.92	1905.58	381.67	25.05
	NFFS	663.77	906.63	242.86	36.59
	Control	911.66	1121.67	210.00	23.04
Total	FFS	1243.33	1746.67	503.34	40.48
	NFFS	1549.31	2106.86	557.55	35.99
	Control	1932.37	1928.22	-4.15	-0.21

Appendix 12. 3: Impact of IPM on gross margin of wheat production in study areas (Value in Rs.)

District Name	Type of Household	Gross margin Baseline	Gross margin Impact	Difference	Percentage change
Sarlahi	FFS	2831.13	3454.50	623.38	22.02
	NFFS	2893.29	2466.26	-427.03	-14.76
	Control	2090.00	2054.00	-36.00	-1.72
	Total	2731.78	2907.47	175.69	6.43
Bara	FFS	6846.68	7832.12	985.44	14.39
	NFFS	6371.16	6336.98	-34.18	-0.54
	Control	3738.25	3162.35	-575.90	-15.41
	Total	6701.06	6282.20	-418.86	-6.25
Arghakhanchi	FFS	1185.53	1678.18	492.65	41.56
	NFFS	2216.65	2270.60	53.95	2.43
	Control	1722.04	1427.45	-294.59	-17.11
	Total	1076.61	1153.37	76.77	7.13
Surkhet	FFS	669.57	950.70	281.12	41.99
	NFFS	1809.03	2455.86	646.83	35.76
	Control	1379.79	1632.38	252.59	18.31
	Total	1588.61	2174.23	585.62	36.86
Total	FFS	1495.29	1761.45	266.16	17.80
	NFFS	1477.99	1393.44	-84.56	-5.72
	Control	1610.78	1665.94	55.16	3.42
	Total	2316.66	3224.64	907.99	39.19

Appendix 12. 4: Impact of IPM on gross margin of maize production in study areas (Value in Rs.)

District Name	Type of Household	Gross margin Baseline	Gross margin Impact	Difference	Change in percentage
Sarlahi	FFS	9891.23	10446.39	555.16	5.61
	NFFS	1355.37	1397.03	41.66	3.07
	Control	996.85	642.87	-353.98	-35.51
	Total	8516.81	10461.51	1944.70	22.83
Bara	FFS	1946.50	2473.50	527.00	27.07
	NFFS	2601.00	3312.00	711.00	27.34
	Control	7659.50	5229.40	-2430.10	-31.73
	Total	13126.56	-8146.48	-21273.04	-162.06
Arghakhanchi	FFS	2817.95	3748.02	930.07	33.01
	NFFS	5294.40	4459.16	-835.25	-15.78
	Control	3261.89	2344.20	-917.69	-28.13
	Total	2511.84	2963.80	451.96	17.99
Surkhet	FFS	1856.99	2327.01	470.02	25.31
	NFFS	956.63	1164.81	208.18	21.76
	Control	1281.00	1086.27	-194.73	-15.20
	Total	1060.24	979.14	-81.10	-7.65
Total	FFS	5183.77	5964.68	780.91	15.06
	NFFS	3584.81	4015.05	430.24	12.00
	Control	3109.31	2063.63	-1045.68	-33.63
	Total	4191.64	5399.88	1208.24	28.83

Appendix 13. 1: Sample Households with Members in Any Social Organization

District/ Program	Type of Household	Baseline			Impact			Percent Change over baseline
		Total Household s	Numbe r	Percent	Total Households	Number	Percent	
Sarlahi	FFS	45	35	77.8	45	42	93.3	15.56
	NFFS	30	18	60	30	22	73.3	13.33
	Control	30	14	46.7	30	15	50.0	3.33
	Total	105	67	63.8	105	79	75.2	11.43
Bara	FFS	46	21	45.7	45	45	100.0	53.33
	NFFS	31	5	16.1	30	9	30.0	13.33
	Control	30	8	26.7	30	10	33.3	6.67
	Total	107	34	31.8	105	64	61.0	28.57
Arghakhanchi	FFS	45	41	91.1	44	41	93.2	0.00
	NFFS	30	23	76.7	28	25	89.3	7.14
	Control	30	23	76.7	30	23	76.7	0.00
	Total	105	87	82.9	102	89	87.3	1.96
Surkhet	FFS	38	31	81.6	39	39	100.0	20.51
	NFFS	36	25	69.4	33	26	78.8	3.03
	Control	31	21	67.7	32	24	75.0	9.38
	Total	105	77	73.3	104	89	85.6	11.54
Regular	FFS	90	76	84.44	89	83	93.26	7.87
	NFFS	60	41	68.33	58	47	81.03	10.34
	Control	60	37	61.67	60	38	63.33	1.67
	Total	210	154	73.33	207	168	81.16	6.76
Intensive	FFS	84	52	61.90	84	84	100.00	38.10
	NFFS	67	30	44.78	63	35	55.56	7.94
	Control	61	29	47.54	62	34	54.84	8.06
	Total	212	111	52.36	209	153	73.21	20.10
Mustang	FFS	30	22	73.3	30	25	83.3	10.00
	NFFS	30	17	56.7	30	20	66.7	10.00
	Control	30	8	26.7	30	15	50.0	23.33
	Total	90	47	52.2	90	50	55.6	3.33

Appendix 13. 2: Membership Percent in Agriculture and Community Development Organization

District/ Program	Type of Household	Baseline			Impact			
		Sample household	Agriculture	Community	Sample Household	IPM	Agriculture	Community
Sarlahi	FFS	45	42.2	55.6	45	60.0	48.89	62.22
	NFFS	30	10	63.3	30	16.7	43.33	66.67
	Control	30	10	36.7	30	6.7	10.00	26.67
	Total	105	23.8	48.6	105	32.4	36.19	53.33
Bara	FFS	46	19.6	21.7	45	100.	37.78	28.89
	NFFS	31	19.4	3.2	30	33.3	40.00	30.00
	Control	30	0	26.7	29	10.3	27.59	31.03
	Total	107	14	17.8	104	45.2	35.58	29.81
Arghakhanchi	FFS	45	35.6	53.3	44	70.5	43.18	59.09
	NFFS	30	33.3	66.7	28	0.0	42.86	50.00
	Control	30	20	80	30	0.0	10.00	43.33
	Total	105	30.5	64.8	102	70.5	33.33	51.96
Surkhet	FFS	38	31.6	63.2	39	100.	51.28	74.36
	NFFS	36	44.4	63.9	33	12.1	48.48	72.73
	Control	31	9.7	90.3	31	0.0	35.48	93.55
	Total	105	29.5	71.4	103	39.8	45.63	79.61
Regular	FFS	90	38.9	54.4	89	65.2	46.07	60.67
	NFFS	60	21.7	65.0	58	8.6	43.10	58.62
	Control	60	15.0	58.3	60	3.3	10.00	35.00
	Total	210	27.1	56.7	207	31.4	34.78	52.66
Intensive	FFS	84	25.0	40.5	84	100.	44.05	50.00
	NFFS	67	32.8	35.8	63	22.2	44.44	52.38
	Control	61	4.9	59.0	60	5.0	31.67	63.33
	Total	212	21.7	44.3	207	42.5	40.58	54.59
Mustang	FFS	30	40	56.7	30	53.3	50.00	60.00
	NFFS	30	30	36.7	30	0.0	36.67	43.33
	Control	30	13.3	16.7	30	0.0	33.33	20.00
	Total	90	27.8	36.7	90	17.8	40.00	41.11

Appendix 13. 3: Households with Members in Organizations above Community Level by Gender

District	Household type	Baseline				Impact			
		N	Male	Female	Total	N	Male	Female	Total
Sarlahi	FFS	45	8.89	4.44	13.3	45	4.4	11.11	15.56
	NFFS	30	0	3.33	3.3	30	3.3	6.67	10.00
	Control	30	3.33	3.33	6.7	30	6.7	3.33	10.00
Bara	FFS	46	6.52	0	6.5	45	4.4	8.89	13.33
	NFFS	31	6.45	0	6.5	30	3.3	6.67	10.00
	Control	30	13.33	3.33	16.7	30	13.3	3.33	16.67
Arghakhanchi	FFS	45	8.89	4.44	13.3	44	6.8	9.09	15.91
	NFFS	30	3.33	3.33	6.7	28	3.6	7.14	10.71
	Control	30	6.67	6.67	13.3	30	3.3	6.67	10.00
Surkhet	FFS	38	7.89	5.26	13.2	39	7.7	23.08	30.77
	NFFS	36	8.33	2.78	11.1	33	6.1	15.15	21.21
	Control	31	6.45	3.23	9.7	32	6.3	6.25	12.50
Regular	FFS	90	17.78	8.88	26.6	89	11.3	20.20	31.46
	NFFS	60	3.33	6.66	10	58	6.9	13.81	20.71
	Control	60	10	10	20	60	10.0	10.00	20.00
Intensive	FFS	84	14.41	5.26	19.7	84	12.1	31.97	44.10
	NFFS	67	14.78	2.78	17.6	63	9.4	21.82	31.21
	Control	61	19.78	6.56	26.4	62	19.6	9.58	29.17
Mustang	FFS	30	6.67	3.33	10	30	13.3	26.67	40.00
	NFFS	30	6.67	0	6.7	30	6.7	16.67	23.33
	Control	30	0	0	0	30	10.0	10.00	20.00

Appendix 13. 4: Sample Households with Actively Participating Members in Community Meetings

District	Type of household	Baseline			Impact		
		Household number	Households with actively participating member		Household number	Households with actively participating member	
			Number	Percent		Number	Percent
Sarlahi	FFS	45	37	82.2	45	43	95.6
	NFFS	30	11	36.7	30	22	73.3
	Control	30	18	60	30	19	63.3
	Total	105	66	62.9	105	84	80.0
Bara	FFS	46	29	63	45	34	75.6
	NFFS	31	16	51.6	30	17	56.7
	Control	30	18	60	30	22	73.3
	Total	107	63	58.9	105	73	69.5
Arghakhanchi	FFS	45	41	91.1	44	42	95.5
	NFFS	30	27	90	28	14	50.0
	Control	30	27	90	30	25	83.3
	Total	105	95	90	102	81	79.4
Surkhet	FFS	38	30	78.9	39	29	74.4
	NFFS	36	28	77.8	33	23	69.7
	Control	31	17	54.8	32	16	50.0
	Total	105	73	69.5	104	68	65.4
Regular	FFS	90	78	86.7	89	85	95.5
	NFFS	60	38	63.3	58	36	62.1
	Control	60	45	75.0	60	44	73.3
	Total	210	161	76.7	207	165	79.7
Intensive	FFS	84	59	70.2	84	84	100.0
	NFFS	67	44	65.7	63	40	63.5
	Control	61	35	57.4	62	38	61.3
	Total	212	136	64.2	209	141	67.5
Mustang	FFS	30	21	70	30	23	76.6
	NFFS	30	18	60	30	15	50
	Control	30	14	46.7	30	17	56.6
	Total	90	53	58.9	90	55	61.1
Change over Regular			24.36	18.96		20.99	16.28

Source: Field Study 2013

Appendix 13. 5: Respondents by Level of Satisfaction with Quality and Quantity of Own Yield

Program type	Household Type	Baseline			Impact			Percent change
		No of Respondent	Satisfied	Percent	No of respondents	Satisfied	Percent	
Regular	FFS	88	23	26.14	89	41	46.07	20.2
	NFFS	58	16	27.59	58	26	44.83	17.2
	Control	58	19	32.76	60	24	40.00	8.3
	Total	204	58	28.43	207	106	51.21	23.2
Intensive	FFS	84	56	66.67	84	75	89.29	22.6
	NFFS	67	37	55.22	63	45	71.43	12.7
	Control	61	35	57.38	62	40	64.52	8.1
	Total	212	128	60.38	209	151	72.25	11.0
Mustang	FFS	30	19	63.33	30	18	60.00	-3.3
	NFFS	30	16	53.33	30	15	50.00	-3.3
	Control	30	19	63.33	30	19	63.33	0.0
	Total	88	54	61.36	90	52	57.78	-2.2

Appendix 13. 6: Household Participation in group efforts in Getting Public Funds

District/program	Household Type	Baseline			Impact		
		Sample households	Number of household	Percent	Sample household	Number of household	Percent
Sarlahi	FFS	45	23	51.1	45	31	68.9
	NFFS	30	10	33.3	30	15	50.0
	Control	30	12	40.0	30	21	70.0
	Total	105	45	42.9	105	67	63.8
Bara	FFS	46	10	21.7	45	34	75.6
	NFFS	31	5	16.1	30	18	60.0
	Control	30	4	13.3	30	16	53.3
	Total	107	19	17.8	105	68	64.8
Arghakhanchi	FFS	45	35	77.8	44	36	81.8
	NFFS	30	18	60.0	28	16	57.1
	Control	30	22	73.3	30	21	70.0
	Total	105	75	71.4	102	73	71.6
Surkhet	FFS	38	21	55.3	39	28	71.8
	NFFS	36	17	47.2	33	20	60.6
	Control	31	8	25.8	32	15	46.9
	Total	105	46	43.8	104	63	60.6
Regular	FFS	90	58	64.4	89	67	75.3
	NFFS	60	28	46.7	58	31	53.4
	Control	60	34	56.7	60	42	70.0
	Total	210	120	57.1	207	140	67.6
Intensive	FFS	84	31	36.9	84	62	73.8
	NFFS	67	22	32.8	63	38	60.3
	Control	61	12	19.7	62	31	50.0
	Total	212	65	30.7	209	131	62.7
Mustang	FFS	30	12	40.0	30	21	75.0
	NFFS	30	15	50.0	30	22	81.5
	Control	30	13	43.3	30	15	60.0
	Total	90	40	44.4	90	58	72.5

Source: Field Study 2013