

**CLIMATE CHANGE AND AGRICULTURE IN NEPAL; Ricebean as  
an alternative crop for adaptation, a case of Western Development  
Region.**

A dissertation submitted in partial fulfilment of the requirement for the  
degree of Masters of Science in International Natural Resources  
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## ABSTRACT.

All ricebean (*Vigna Umbellata*) related studies, reports and publications have not investigated its contribution to the livelihood of those who grow it at a household level and how this has been influenced by the extension services available to them. Ricebean is a nutritiously rich source of Carbohydrates, Proteins, Fibre, Ash and Soluble ether for human food. It also provides a rich source of animal fodder, can be used as green manure and in some hill communities it is used as cover crop to act as a deterrent against soil erosion.

This study compared Gulmi and Tanahun districts in Nepal categorized as high ricebean growing districts based on expert knowledge of District Agricultural Development Officers. It linked extension services available to farmers in respective districts to the role ricebean plays in their household food security, how households use ricebean for different purposes and how the potential of ricebean can be enhanced by extension services.

Field data collected from Simichaur and Darbardevisthan Village Development Committee and Manpang and Bandipur in Gulmi and Tanahun district respectively were analysed, tabulated and graphically represented. Visual differences were crucial for identifying differences but where they could not be obviously noted, statistical tests; Chi-square, Kruskal wallis and ANOVA were carried out to determine relationships, significant differences and effect margins between VDC's and between districts.

The study revealed that comparatively more households in Gumi district had received extension services to those in Tanahun and this has contributed to the higher percentage of households that; grow ricebean as one of the main source of pulse, sell ricebean to generate household income, had improved agricultural knowledge and more households that reported an overall increase in ricebean production over the past three years. Additionally, a one way measures ANOVA between VDC's suggested significant difference in the proportion of income devoted to purchase of other pulses in favour of Darbardevisthan and between districts it suggested a significant difference and moderate effect size in favour of Gulmi.

With adequate extension services, ricebean can play a crucial in enhancing the livelihood of households in resource poor communities and also contribute to their adaptation to climate change which is widely affecting rain fed agricultural

communities not just in Nepal but also globally because of its adaptability to marginal areas, high yield, contribution to enhancing soil fertility and multiple use.

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## INTRODUCTION.

Climate change such as rising annual temperature, delayed monsoon season, increased annual rainfall resulting from increased glacial melting and increased occurrence of intense rainfall (Regmi and Adhikari, 2007) among others has affected many rainfed farmer communities in Nepal and it is forecasted by the United Nations Framework Convention on Climate Change and Inter governmental Panel on Climate Change to create even more damage to agricultural production in the coming 20 years (IPCC third assessment report, 2001; UNFCCC report, 2000).

Furthermore, with 686 persons per square kilometre (Population census report, 2002), the land resource map indicates that cultivated land coverage is 20%, forest covers 29%, grassland covers 12%, shrubs cover 11% and rocks, snow lands settlements make the rest (UNEP, 2001). Nepal has one of the highest population densities in the world with regards to cultivable land (MoPE, 2000), this will exacerbate pressure on available fertile land for agriculture. Increased land pressure will intensify agricultural anthropogenic factors through negative land use practices such as increased slash and burn agricultural practices, deforestation to increase access to agricultural and settlement land among others.

Due to the change in climate being widely experienced in Nepal, soil quality is declining due to increased precipitation and occurrences of intense rainfall leading to higher levels of erosion and sedimentation of fertile land; temperature is rising at an average of 0.4° Celsius per decade hence affecting soil moisture because of increased evapotranspiration; rainy days are decreasing at a rate of 0.8 days per year (Regmi and Adhikari, 2007) leading to a delay in monsoon season and scarcity of water which in turn is causing a change in cropping patterns and crop maturity periods. Additionally high humidity provides a conducive environment for breeding of insects, bacteria and fungi leading to the rise of tropical diseases and also crop destroying pests become more prevalent (Regmi and Adhikari, 2007).

The effects of climate change is felt hardest by those who depend on the environment and natural resources for livelihood especially resource poor farmers because they lack alternatives to provide adequate coping mechanisms. Their risks and exposure to food insecurity and malnutrition are greatly increased in the event of any change in rainfall patterns leading to declining crop yields and crop variety. This inevitably indicates that the general economic well being of the majority of Nepalese and the economy of the country will be affected.

The Ministry of Finance estimates that 88% of Nepali are rural based, 80% of the population depend on agriculture for livelihood, and rely on traditional agricultural practices for production, 31% of the population live below the absolute poverty level and Illiteracy is estimated at 62% for the above 15 years of age population (CBS, 2006).

However this predicted adverse impact of climate change on agriculture and rural livelihoods and subsequently economic welfare of the country can be mitigated by improved agro-extension programs, diversifying crops varieties, intensifying crop developments, and promoting the cultivation of highly adaptive crop types like ricebean among others.

*Ricebean (Vigna umbellata)* is a multipurpose grain legume crop which is largely pest and disease resistant, highly adaptive to different soil types and sub humid climate conditions- drought tolerant and to a certain amount of water logging, high yielding, highly nutritious in protein, essential amino and fatty acids, vitamins and minerals. It can be sole or intercropped and used as green manure, animal fodder and a rich source of pulse with at least eight different traditional recipes prepared out of it (Gautam *et al*, 2007; Kadhka and Acharya, 2009).

Despite its high value and potential to improve food security and rural livelihoods, ricebean is still a minor crop and not widely grown. It is not listed under common fund for commodities or the European catalogue of varieties besides it is not mandated for varietal improvements by Nepal Agricultural Research Council (NARC) which considers it a subsistence crop due to its low production and under utilization at household and National level. Additionally little has been researched on the crop, land races dominate, no improved varieties have so far been developed, little improvement in adaptation and grain quality has been done, and seed supply is limited (Gautam *et al*, 2007).

European Union is funding a project- Food Security through Ricebean Research in India and Nepal (FOSRIN) under the 6<sup>th</sup> Framework Program for research and technical development (FP6). And in the Western Development Region of Nepal, Local Initiatives for Biodiversity Research and Development (LIBIRD) a local Nepali organisation is working with resource poor farmers in Gulmi, Palpa and Tanahun districts to improve ricebean farming through distribution of different landraces, seed multiplication, germplasm evaluation and trainings on recipes preparation and ricebean farming practices (Gautam *et al*, 2007).

### **Rationale**

The livelihood of most poor communities is linked to the performance of the agricultural sector especially level of productivity; it provides both a direct and indirect source of sustenance which determines on farm and off farm income, food security index and activities both upstream and downstream of farming notably supply of inputs, credit services and technical assistance, processing, transportation and marketing of crops and other farm products. Ricebean presents a strong potential opportunity for improving the livelihood and welfare of the farmers in resource poor communities because of its various potential uses and adaptability to marginal conditions. Understanding its significance to the livelihood of resource poor communities in Nepal is crucial for raising its potential, profile and facilitate its improvement through adequate participatory agricultural extension services.

### **Objectives.**

Broadly the study compared in two districts of Western Development region, four Village development committees the role of ricebean farming in improving people's livelihoods, and how it has been affected by the performance of agricultural extension services.

Specifically the study focussed on;

1. Understanding the importance and contribution of ricebean to household food security and its role in the livelihood of farmers in Western development region.
2. Investigating how agricultural extension services has contributed in improving ricebean farming in communities of Western development region

To achieve the above objectives, the study sought to answer the following key questions

**Research Objective 1;**

1. What is the importance of ricebean to the livelihood of households and what are its roles in household food security?
2. Has ricebean farming improved the livelihood of the households in Western Development region and how can it be improved?

**Research Objective 2;**

1. What extension services and providers are available in Western development region?
2. What have been the benefits of these extension services to the farmers?
3. How has extension contributed in ricebean farming in Western development region?
4. How can extension work be improved?

## LITERATURE REVIEW.

### **Climate change in the agricultural sector of Nepal.**

Climate change is defined as the variability in average weather and ultimately state of the climate system over a specified timeframe. This variability is normally evidenced by changes in the mean temperature, precipitation and rainfall levels among others. Changes in climate can be caused by natural factors such as sun light intensity, and volcanic activity among others or anthropogenic factors such as burning fossil fuel, deforestation and other human activities ( Orindi and Eriksen, 2005).

Nepal experiences four seasons; Winter, Summer, Autumn and Spring and with a mean annual temperature of 15° Celsius; summer and late spring temperature oscillates between 28° Celsius and 40° Celsius or more respectively in the hilly regions and Terai regions (the plain belt of grassland, savannah and forests at the foot of the Himalayas range in Southern Nepal), annual rainfall of 1500mm and mean annual precipitation of 1800mm; more than three quarters of which is experienced between June to September (monsoon season). Studies conducted by the Nepali Ministry of Environment, Science and technology, department of Hydrology and meteorology indicate that annual temperature increase between 1977 and 1994 is approximately 0.06°Celsius per year yet another study carried out in the vicinity of Tsho Rolpa glacial lake in Dolakha district also revealed an annual temperature increase of 0.019°Celsius; 0.44° Celsius in the summer (Dahal, 2006; Regmi and Adhikari, 2007).

A temperature increase of more than 2.5° Celsius will severely affect crop production in Nepal because of increased evaporation and evapo-transpiration leading to increased heat stress on the soil and crops, decreased annual precipitation and subsequently resulting into shortage of water for domestic and agricultural use especially noting that 80% of national water usage in Nepal is for irrigation (Regmi and Adhikari, 2007).

Additionally as humidity increases, conditions conducive for pests breeding increase hence escalating the prevalence of crop destroying pests.

Geographically over 75% of the country is composed of rugged hills and mountains, with increased occurrences of intensive rains largely during the monsoon season and compounded by more occurrences of glacial lake outburst floods there has been increased soil erosion, floods and landslides (Srestha *et al*, 1999). As a result of these, soil quality has significantly reduced in the hill communities while salinity has increased in the plain regions and destructions of agricultural fields and crops has become common

Nepal has about 85.8% of its population in rural areas (Population census report, 2002) who greatly rely on wood fuel to meet their domestic energy needs and currently fuel wood consumption is estimated at 12.5 mt/year and this will emit up to 5 metric tonnes of carbon into the atmosphere (Regmi and Adhikari, 2007). Additionally this high rural population density has led to more forest clearing for settlement and agriculture use. Studies conducted by the Water and Energy Commission Secretariat indicate that 80% of the population depend on forests for daily fuel requirement and 42% of fodder for animals is acquired from forests (WECS, 1997). Additionally a simulation study on deforestation in Chitwan suggested that by 2030 all forestland will be depleted and replaced by agricultural land at the current consumption rate of 24% per year secondly assuming subsistence crop production increases at the rate 1%, then only 124hm<sup>2</sup> of forestland will be left by 2038 (YingQiu, *et al*, 2001).

This phenomena of forest depletion will intensify on a regional scale insolation and dessication and this will affect crop yields significantly, threaten food security and livelihood greatly because of intensified solar radiation on the cleared land, intensified heat stress on the ground, increased loss of soil moisture, loss of organic matter in the soil and inevitably affecting growth of crops and yields. In the future, efforts by private input dealers to increase their sales and maximise profits are likely to increase the sale of fertilizers that boost crop production (which is the primary focus of farmers) and soil quality with little attention to giving information on their shortcomings to farmers. Artificially enhancing soil quality and boosting yields through chemical fertilizers will affect soil organic matter, increase leakage of nitrogen oxides into water, loss of biodiversity and sedimentation among others.

### **Agricultural extension.**

According to Savile (1965 p 2) "...agricultural extension should not be confused with the original concept of an agricultural advisory service, designed to assist farmers increase their productivity. It is an evolution of the advisory service which can be regarded as a form of community development with an agricultural bias and educational approach to the problems of rural communities"

Agricultural extension should be viewed from a wider context of a part of the effort to realise balanced social and economic development of rural communities and not simply in the context of agricultural output.

Therefore agricultural extension should be described as "...a service or system which assists farm people, through educational procedures, to improve farming methods and techniques, increase production efficiency and income, better levels of living, and lift the social and educational standards of rural life" (Ministry of Agriculture, Bangladesh, 1996 p3)

### **Agricultural extension in Nepal**

There are three main actors in agricultural extension services provision namely; District Agricultural Development Office (DADO) which provides technical support and technologies transfer to farmers through agricultural service centres (ASC). DADO extends its services mostly to farmers groups though individually farmers can also get access to technical support but not inputs. Agro-research is not part of DADO's mandate but it is responsible for identifying farmers' research needs, linking and coordination with Nepal Agricultural Research Council (NARC) on research related interventions (Ojha and Morin, 2001). Additionally, it maintains linkages with other extension providers- Non Governmental Organisations (NGO) and Private Organisations (PO). However linkages between DADO and PO/NGO is mainly evident where government extension agents participate in research outreach sites and joint service provision many at times target a particular crop. Little is known of other collaborative efforts between the three main extension service providers (Ojha and Morin, 2001).

The advantages of government provided extensional services include the fact that programs are designed in line with the national strategic plan for agriculture and rural development and also its wide coverage; at least every district in Nepal has DADO's office however not all Village Development Committee (VDC's) has an agricultural service centre, this therefore makes accessibility of services difficult for farmers in VDC's without an ASC. More so, ASC's are understaffed and under facilitated making it

difficult for extension agents to effectively and efficiently carry out their mandate (Baikuntha Nath Khanal, DADO Gulmi, personal communication). A study comparing the efficiency of government and NGO provided extension services conducted by Bhatta *et al*, 2008, revealed a significantly positive level of efficiency in service provision in favour of NGO's and a negative though insignificant efficiency level in government provided initiatives.

Non Governmental organizations are also widely engaged in extension provision, they have a wide range of activities that include conducting trainings, facilitating farmers groups and supervision of their activities, input distribution, participatory agro-researches and technical support. In some cases they also help in marketing of farmers produce on behalf of farmers group. NGO's are considered more pro-poor and as such their efforts are targeted to particular communities or marginalized groups, besides they are viewed to deliver better participatory agricultural extension services because of their better technical support, specialised staff recruitments, better funding as compared to government departments and also because they are less bureaucratic. (Bhatta *et al*, 2008; Upadhyay, 2004; Ojha and Morin, 2001; Merz *et al*, 2003).

NGO provided extensional services has significantly made a positive contribution and improved technical efficiency of farmers on farms as compared to those provided by other extension providers as acknowledged by Bhatta *et al*, 2008.

However good NGO interventions might be, they are time bound and most of their activities are between 3 to 5 years and this makes it hard for continuity of activities and sustainability by the extremely resource farmers. Also because of their content and target specific nature of activities, programs, and interventions, NGO's cover fewer communities geographically as compared to PO's and government services.

The third key actor in agricultural services provision are the private organisations largely known in Nepal as agrovets. These are commercially driven private, family or joint investments, mainly engaging in providing inputs like veterinary medicines, hybrid seeds, insecticides, pesticides, fertilizers and other agro-equipments. Some also have collection centres and do marketing of agricultural products locally, nationally or even beyond the national boundaries. These businesses are mostly retailers but also some are wholesalers with good resource base and strong linkages with companies both nationally and internationally (Ojha and Morin, 2001).

Generally, private organisations are considered input suppliers, less bureaucratic than government agencies and well connected with other companies both within and outside Nepal. Being commercially driven, they are known for good quality service provision though limited to their customers, also because majority of them are family businesses, man power is inadequate to facilitate large scale operations and conducting agricultural researches like crop improvements, varietal experimentation and plant breeding among others (Ojha and Morin, 2001).

### **Ricebean**

Ricebean belongs to the *Vigna* species and *Ceratotropis* sub genus, it is a vine legume that is both used as food, fodder for animals and also green manure (Lawn, 1995). In light of associated cultivation practices, it is sole cropped in uplands on a small scale but mostly intercropped with Maize (*Zea mays*) and to some extent Sorghum (*Sorghum bicolor*) and Cowpea (*Vigna unguiculata*) (Gautam *et al*, 2007). Rachie & Roberts (1974) noted the distribution of the crop in different environments notably humid tropical, sub-tropical and sub temperate climate. Additionally, they suggested it as a high yielding crop with potentials of upto 1200kg/ha<sup>-1</sup> though average yields are noted to be between 200 and 300kg/ha<sup>-1</sup>. It is drought tolerant and can tolerate a certain degree of water logging, grows well on a range of soils including acidic ones and largely pest and disease resistant (Chatterjee & Mukherjee, 1979; Carvallho & Veira, 1996; Mukherjee *et al*, 1980).

Studies in Nepal on farmer's local knowledge on ricebean revealed its tolerance to high temperature with best yields requiring between 18-30°Celsius and annual rainfall of between 1000-1500mm however it is susceptible to frost (Khanal *et al* 2007). Furthermore, farmers acknowledged it as a rich source of green manure, enhances soil fertility and improves water retention "...it results in porous and friable soil...ricebean roots are thicker than those of other legumes, and have a special effect on soil quality in the root zone which is greater than that of the cowpea, black gram, lentil and chickpea." (Khanal *et al* 2007, p 25).

### **Linking agricultural extension, climate change and ricebean.**

Extension enhances the link between agricultural technology and research to achieve sustainable productivity and improved livelihoods of farmers. It also facilitates

exchange of valuable information between farmers and extension agents subsequently enhancing farmers' use of existing technologies, identifying and overcoming production, farm management and marketing problems at farm levels. In India and Bangladesh, farmer cooperatives, collective learning, use of village change agents, regular group discussions, seminars and publication of farm magazines were undertaken and achieved significant benefits to farmers (NAEP, 1996; Sulaiman and Holt, 2002).

The third IPCC report (2001) confirmed that the poorest in the community are at the greatest risk of climate change induced poverty because of their reliance on agriculture, financial constraint, illiteracy and lack of technical and institutional capacity for adaptation. Agricultural extension contributes to empowerment and capacity building of vulnerable groups like youth and women hence improving their capacity to adapt to climate change. In India for example Women/Youth Training Extension Project (WYTEP) have provided micro-credit schemes, set up training centres, encouraged collective inputs procurement, arranged extension programmes and learning as a group. Similarly in Nepal, Local Initiatives for Biodiversity, research and Development (LIBIRD) engages in interdisciplinary and participatory interventions for sustainable management of renewable natural resources and improvement of rural livelihoods targeting resource poor and marginalized groups or communities (Sulaiman and Holt, 2002, LIBIRD, 2009; Ojha and Morin, 2001)

There is need for changes in crops, varieties, water management, better tillage practices, landuse planning and irrigation systems to enable communities cope and adapt to climate change. The IPCC (2001b), UNFCCC and UNEP (2002) all recommend undertaking information dissemination on climate change, encouraging crop improvements especially the development of varieties that will adapt to changing climatic conditions like drought, soil quality loss and increased pest prevalence. More so, trainings on better farming practices to improve farmer's technical efficiency so as to enhance productivity and farm profits are crucial for improving rural livelihoods (Bhatta *et al*, 2006).

The significance of extension on land management technologies is further acknowledged after a study on land management practices in mountain water sheds of Nepal using stepwise multiple linear regression of 10 variables suggested extension services as the strongest factor influencing farmers adoption of technologies (Paudel and Thapa, 2003).

Using ricebean as a climate change adaptive crop type, extension service can further play a significant role in enhancing rural livelihoods by increasing the distribution of improved seeds, training farmers on its associated cultivation practices, marketing and relevant varietal improvement.

# LOCATION

## **General information on Nepal**

The Federal Republic of Nepal is a landlocked South Asian Country bordered by China to the North and India to the East, West and South. It covers an area of 147, 181 square kilometres and in 2007 it had a projected population of 28.1 million persons (Government of Nepal, 2009; World Bank, 2008).

It has 14 administrative zones which are grouped into five Development Regions; Eastern, Central, Western, Mid-Western and Far Western Development region and 75 districts headed by a Chief District Officer (CBS, 2009).

Nepal is composed of three main ecological regions; the mountains in the North covering 35% of total area, the Terai (low lying plain area) in the South covering 23% and the hills in the middle covering 42% of total area (Regmi and Adhikari, 2007). Almost half of the population live in the Terai region (CBS, 2009).

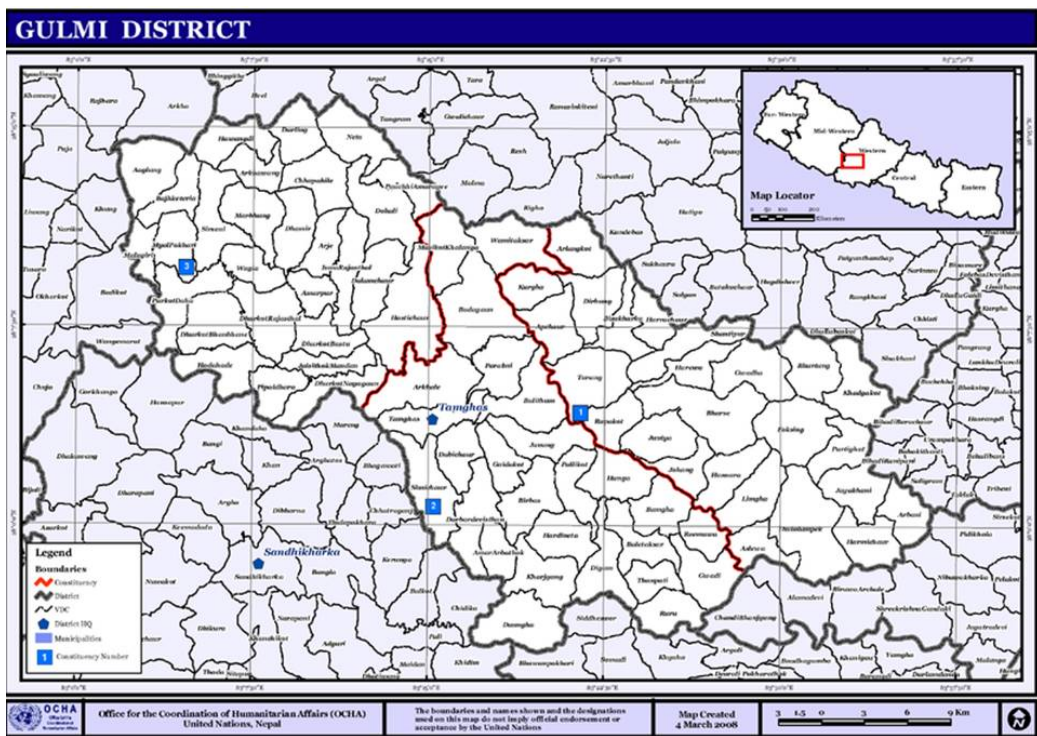
Agriculture the mainstay of the Country provides livelihood to more than 80% of the population and accounts for about 33.8% of Gross Domestic Production (GDP). Services contribute 48.9% of GDP while Industry contributes 17.2% (World Bank, 2008)

## **Information on the study areas.**

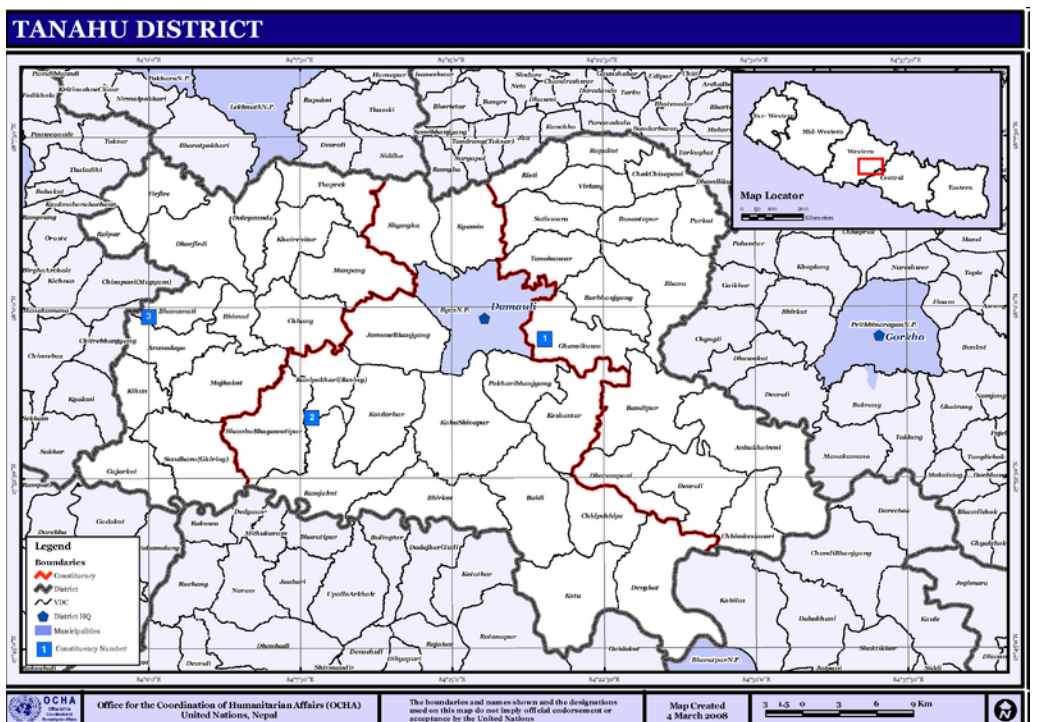
The study was carried out in two districts in Western Development Region; Gulmi and Tanahun. They were identified after consultation with FOSRIN project staff. The project currently has intervention in three districts in the region; Gulmi, Palpa and Tanahun. Additionally two Village Development Committees were identified for each District as data collection sites. By area coverage, all three are major ricebean growing districts (Gautam *et al*, 2007)

Gulmi district lies on 28°4'N 83°15'E, it has a population of 296654 and with a total area of 1149km<sup>2</sup> while Tanahun lies on 27°55'N 84°15'E, has a population of 315239 and covers 1546 km<sup>2</sup>. Both districts are located in the mid hills region and predominantly agricultural (Government of Nepal, 2009; Population census report, 2002).

**Map of Gulmi showing all its VDC's**



**Map of Tanahun District showing all its VDC's**



Maps developed by United Nations Office for the Coordination of Humanitarian affairs accessed from [www.un.org.np/maps/district-maps/western/](http://www.un.org.np/maps/district-maps/western/) on 7<sup>th</sup> September, 2009

## METHODOLOGY.

### **Selection of samples and data collection**

Information on the role of extension services in improving ricebean farming and the contribution of ricebean to the livelihoods of the households was collected in Simichaur and Darbardevisthan VDC's in Gulmi. In Tanahun data was collected from Manpang and Bandipur VDC's. To ensure equal probability in selection of respondents for the study, households were randomly chosen (Laws *et al*, 2003) and responses elicited from either the head of household or the spouse depending on their availability at that time but in some cases, both contributed. In each VDC, five wards were randomly chosen and from the chosen wards, the sample target was six respondents. Each respondent represented a household, In Simichaur they were from wards Two, Three, Four, Five and Six. In Darbardevisthan respondents were from wards One, Two, Three, Five and Six while in Manpang respondents were from wards One, Two, Three, Six and Seven then in Bandipur wards One, Three, Four, Five and Six.

### **Information Elicitation Strategy**

To generate data for the study, a pre-coded questionnaire (Laws *et al*, 2003; Berg, 1998) was designed and had three sections; the background which captured information about the household, section two captured information on extension services available to the farmers and how it has been beneficial to them in regards to ricebean farming and agriculture generally while section three encompassed information on the role of ricebean and its importance to the livelihood of the household.

Before data collection, a face to face interview pre-testing the questionnaire was done in Sarangkot VDC in Kaski District with four respondents (Laws, *et al* 2003). The questionnaire and responses were analysed, errors in the appropriate unit for measuring household land and parameter of household land size, interpreting major crops grown by a household, extension services providers and frequency of ricebean consumption in post harvest season and biases in estimation of household expenditures and income were corrected and out of the adjustments to the pre-test questionnaire a final copy was developed. Initially the questionnaire had open end questions but after the pre-test it was changed into a closed questionnaire with coded answers, unit of land measurement was changed to Ropani and later converted to hectares, crops grown by the household was subdivided into cereals and pulses and proportional piling (Laws *et al*, 2003;

Bryman, 2004) was adopted as a better approach for generating data on household expenditure and household allocation of ricebean for respective purposes because of their sensitivity and to eliminate biases in responses (Wates, 2000)

At the field level, 117 respondents; 30 in Simichaur, 29 in Darbardevisthan, 28 in Manpang and 30 in Bandipur were interviewed using the questionnaire, their responses were recorded and at the end of each day, data collected was cleaned, coded and captured in a created SPSS database. Focus was put to ensure that all respondents answered all questions (Bryman, 2004; Laws *et al*, 2003).



*Plate 1. Spouse and household head in Simichaur jointly proportionally piling the household's expenditures for different purposes.*

Triangulation is “...a means of mutual confirmation of measures and validation of findings” Berg, 1998 p. 5). It helps to counteract the validity and limitations of a data collection tool for a subject under investigation and involves the use of more than one (usually three) data collection tool (Berg, 1998; Bryman, 2004; Laws *et al*, 2003 )

To triangulate information captured by the questionnaire for this study, focus group discussions were conducted in Shimichaur, Darbardevisthan and Monapang VDC's. However, in Bandipur a Focus Group Discussion was not conducted because of the engagement of key informants in their gardens and homes. Respondents for Focus Group Discussion were key informants randomly chosen by the extension agent of FOSRIN in Gulmi (in both Simichaur and Darbardevisthan) and the chairperson of Manpang VDC in Tanahun District on voluntary terms. The ward where a respondent lived was not a factor in determining their participation in the discussion. Plate 2 and 3 on the next page show Key informants in a Focus Group Discussion in Darbardevisthan and Simichaur respectively



*Plate 2. Focus group discussion with key informants in Darbardervisthan. The gentleman in the cap is an extension worker for Gulmi District and staff of LIBIRD*



Plate 3. Focus group discussion with key informants in Simichaur

Semi-structured interviews were also conducted with the District Agricultural Development Officers (DADO) for Gulmi and Kaski Districts. The DADO of Tanahun district was out of duty station for official engagement but since Kaski district is the headquarters for the Western Development Region, an interview was conducted with the DADO of Kaski to provide information on extension services and ricebean farming in Tanahun. Additionally, unstructured (and informal) interviews were conducted with 3 FOSRIN staff working with LIBIRD and the South Asia Research Coordinator for CAZS-Natural Resources whose office coordinates the ricebean project in India and Nepal. Samples for the Semi Structured Interviews were identified and interviewed basing on their relevance to the study; purposive sampling (Laws, *et al*, 2003; Bryman, 2004).

### **Sample representation**

The actual sample size for this study would require 362 households with a 5% confidence interval and 95% confidence level (Krejcie and Morgan 1970). However due to logistical, financial and time constraints the sample size was considerably low. After

consultation with FOSRIN staff, 120 households was agreed as reasonable but still there were three non responses.

Representative samples were determined by dividing the number of respondent households by total number of households in a respective VDC and multiplying it by 100 to determine percentage. Darbardevisthan and Simichaur have total populations of 5681 and 5512 respectively while total households are 1148 and 1130. Their respective representative samples are therefore 2.5% and 2.7% (rounded off).

Manpang has a total population of 7648 and 1524 total households, while Bandipur has a total population of 11415 and 2354 households in total. Similarly their representative samples are 1.8% and 1.3% (rounded off) respectively (Population census report, 2002). Overall the representative sample for the study is 1.9%

### **Working with research assistants**

This study was conducted in a foreign country hence research assistants (Laws *et al*, 2003) were crucial for translation and interpretation during the interview process as well as Focus Group Discussion. Also, directions to the field site and while in the field when looking for respondents were important roles the Research assistant played. However limitations were also evident in regards to data collection for example uncertainties over the succinct translation, interpretation and relaying of responses were at times evident but this was reduced with time. The researcher learnt key words and observation of respondent's body language and this helped reduce on the disadvantage of intermediaries in research. Devereux and Haddinott, (1992) acknowledge this as a common phenomena in overseas researches.

### **Data Management**

An SPSS data base capturing all elements of the questionnaire was created (Pallant, 2006). Before entry, all data collected were cleaned and screened at the end of the day to eliminate errors in VDC of respondent, calculating percentages for respective proportional piles and errors in recording responses for open end questions on sources of income and how to improve ricebean farming. If errors are not eliminated, subsequent analysis will be affected (Pallant, 2006). A series of descriptive statistics were assessed and from it many tables and figures were developed for graphical representation and visual comparison. Statistical tests; chi-square, Kruskal wallis and analysis of variance (ANOVA) (Pallant, 2006) were carried out to show and compare

relationships, significant differences among VDC's and between districts. ANOVA tests give identical result to that of T-Tests and it also gives the effect sizes between variables (Pallant, 2006). Chi-square tests were used to determine if there is a relationship between land sizes and a VDC and tests results were corroborated using Kruskal Wallis tests. ANOVA was used to determine if there is a significant difference between the fur VDC's and between the two districts in percentage of household income devoted to purchasing other pulses for food, it was also used to determine the significance difference in ricebean production trend over the past three years between VDC's and also between districts. Kruskal Wallis test was used to determine if there is significance difference in the role ricebean plays in household food security between VDC's.

### **Study Limitations.**

Voluntary participation is one of the principles of research as noted by Laws *et al*, (2003). Respondents should not be forced to provide answers for a study they are not willing to be part of, it is their right and choice to get involved or not.

Quoting Laws *et al*, (2003)

*“...the questionnaire will always be an intrusion into the life of the respondent, be it in terms of time taken to complete the questionnaire, the level of threat or sensitivity of the questions, or the possible invasion of privacy. Questionnaire respondents are not passive data providers for researchers; they are subjects not objects of research” (p.245)*

During the process of data collection, some respondents were not willing to be part of the study and this affected the eventual number of respondents for instance in Bandipur key informants were not willing to participate in focus group discussion citing other household duties as reasons for non participation.

Key informants for the Focus group discussion were identified by the local guide (Wates, 2000) and research assistant and as such the likelihood of flaws should not be negated. The lack of a strict methodology for identifying key informants subjects it to biases. For Instance in Manpang, the Chairperson of the VDC who acted as the local guide was briefed about the purpose of the study and this might have influenced his identification of key informants for the focus group discussion. Eventual key informants could have been his close allies.

Sampling in research is built on the notion that, a study cannot usually involve everyone hence a representation of the larger group should be adopted. A sample size using 5% confidence interval as suggested by Krejcie and Morgan (1970) would require up to 362 households, for this study the timeframe (6weeks) and resource constraints could not support this hence the sample size is considerably lower and the confidence interval is 3.91% using 95% confidence level.

Validity of research findings is reflected by the truth in the data collected (Laws *et al*, 2003). At times respondents can be biased and give information they wish to give which at times may not be the truth, their responses maybe influenced by their interests in the study or what they expect to benefit from a study. The internal validity (truth in the responses) of this study cannot therefore be determined.

A stakeholders' analysis is important for improving response rates (Laws *et al*, 2003; Berg, 1998; Bryman, 2004). This study however did not involve an in-depth stakeholders' analysis and this affected the timing of data collection. In many households, farmers were in their gardens. In Tanahun poor timing affected the interview with the DADO who was out of office at the time of the visit and instead an interview was conducted with the DADO of Kaski hence data was generated from a secondary source and not the principal target.

# STUDY FINDINGS.

## Descriptive Summary

### Gender of respondents

Though the geographical location of the study site was predetermined, gender of eventual respondents was not considered a factor since a respondent represented a household. With this strategy, respondents were either a household head or spouse though in exceptional cases another adult member of the household responded.

Simichaur had the biggest variance in gender of questionnaire respondents with 30% males and 70% females contributing to the study. Other VDC's did not indicate a wide difference in gender composition of respondents

Overall the gender composition of questionnaire respondents was 42.7% males and 57.3% female. The gender composition of Focus Group Discussion respondents was 50% for males and 50% for female's, however the six (6) semi-structured interview respondents were all males. The summary of respondents is represented in the table 1.below

*Table 1. Gender distribution of respondents in each (VDC)*

	Questionnaire		Total
	Male	Female	
Samichaur	9	21	30
Darbardevisthan	14	15	29
	23	36	59
Manpang	14	14	28
Bandipur	13	17	30
	27	31	58
Total	50	67	117
Focus Group Discussion			
Samichaur	6	4	10
Darbardevisthan	5	5	10
	11	9	20
Manpang	4	6	10
Total	15	15	30

### Age group of respondents.

117 respondents across 4 VDC's produced a range of ages hence for better statistical analysis it had to be categorised. When all 4 study sites are combined the 46-60 years age group, represents the highest count of respondents then followed by the 31-45 years

age group while the lowest count of respondents is from the 76 years and above age group shown by figure 1 below.

In percentages this is represented as 38.46% for the 46-60 age group, 28.21% for the 31-45 years age group, 18.8% for the 15-30 years age group, 11.11% of respondents were from the 61-75 age group while the least count of respondents that contributed 3.42% were from the 76 and above age group.

Important to note is that in Manpang, there were no respondents in the 76 years and above age category.

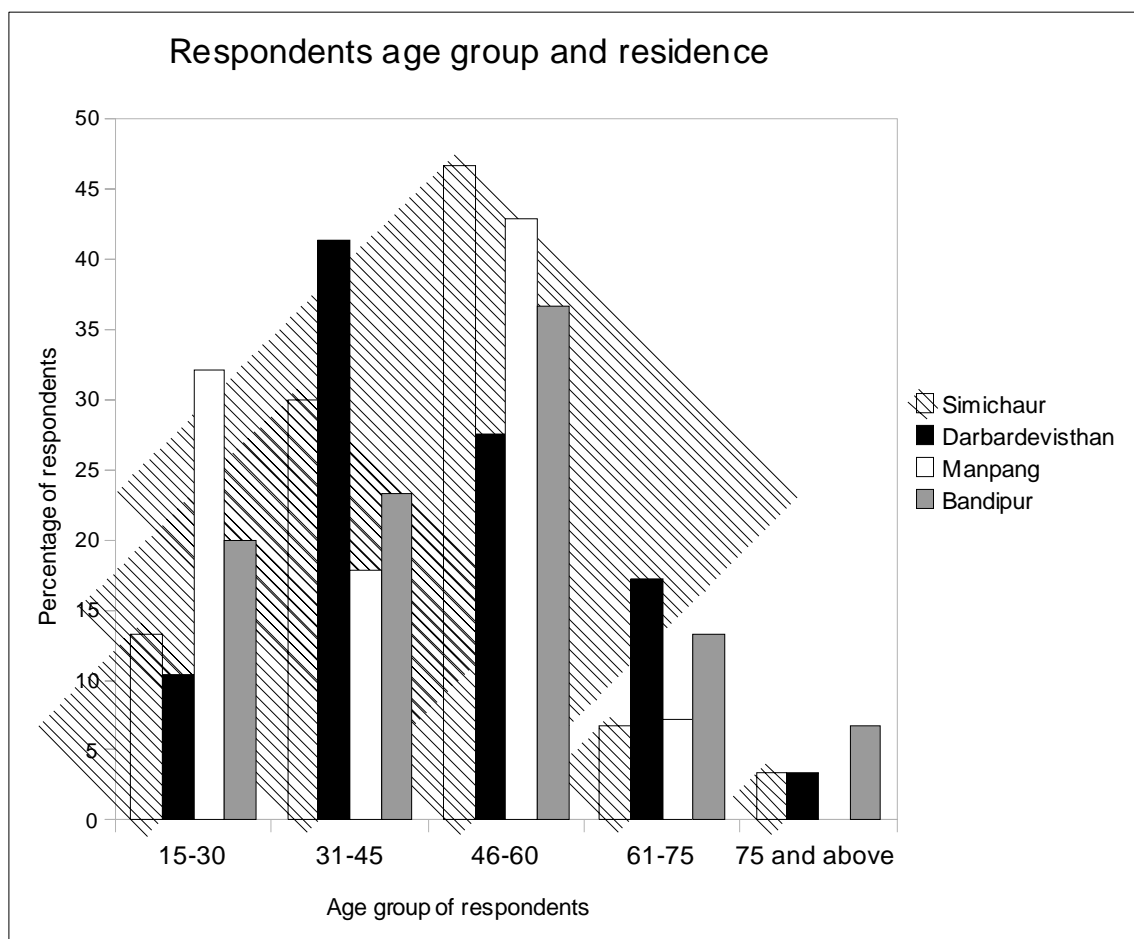
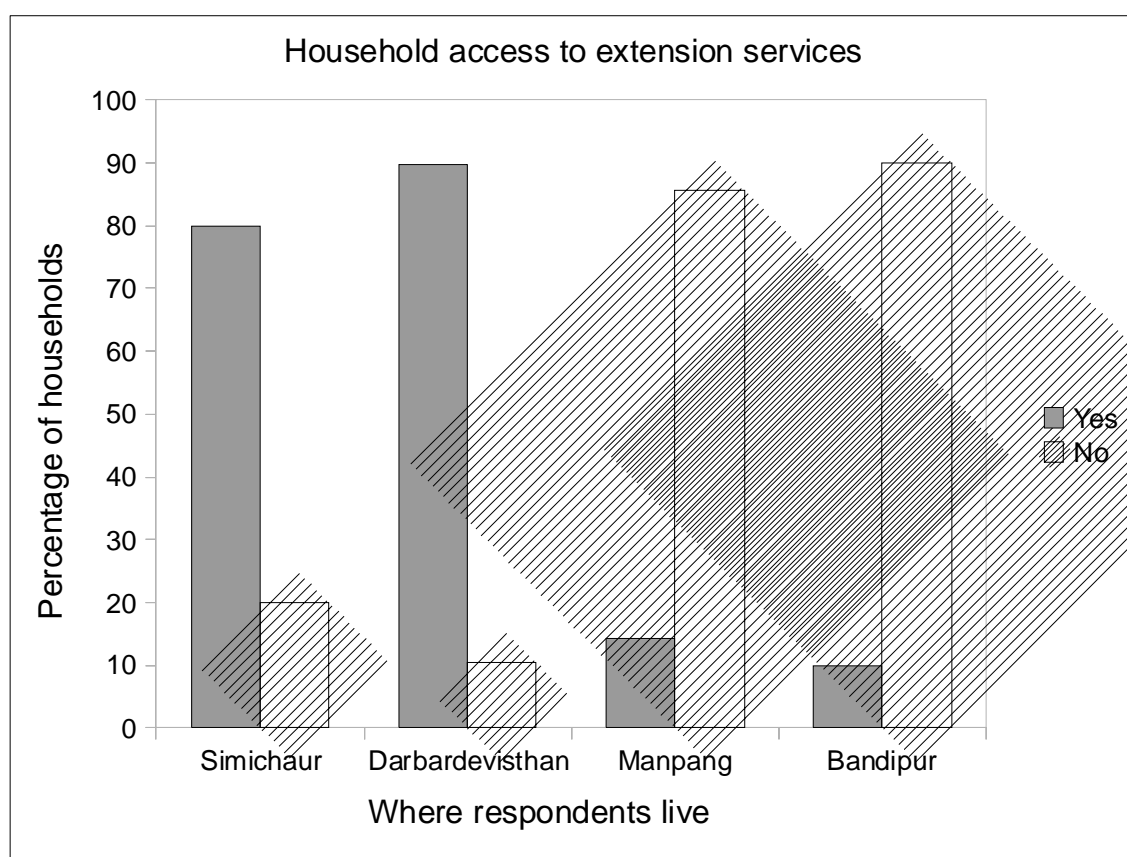


Figure 1. Percentage of respondents for each age group from respective VDC's

### Households access of extension service.

Of the 117 respondents 48.72% had received some form of extensional service within the past four years. Considering only the proportion that has received extension at the VDC level (figure 2), 80% of households in Simichaur had received some form of extension in the past four years. In Darbardevisthan, 90% of households reported having received extension service. In Manpañg 14% of households had received extension and in Bandipur, 10% of households acknowledged having benefited from extension work.



*Figure 2. Proportion of households that have received some form of extension service in the past four years for respective VDC's*

It is visually obvious that there is a significant difference in households that have accessed and benefited from extension services Gulmi district and Tanahun district. Much as there are District Agricultural Development Offices in all districts in Nepal, the limited number of households that have accessed extension services in Tanahun suggests that service delivery is inadequate and information on available services and providers is also lacking.

### **Information source for involvement in extension service.**

From the 49% of respondents who had received some form of extension service in the past four years in the four VDC's, 50% of attributed their involvement in extension service to an NGO extension worker providing them with information on available services (figure 2 below). 21% of respondents reported that they acquired information on extension services available from a neighbour. Friends also disseminated information extension services available to 14% of respondents. 13% of respondents received information on available services from a Government extension agent. The mass media such as radios, local newspaper and television among others provided information on extension services available for 2% of respondents.



*Figure 2. Method by which respondents acquired information on extensional services*

On inspection the margin of difference between the percentage of respondents that got involved in extension work after contact with an NGO extension agent as compared to those that got involved after contact with a Government extension agent from Agricultural Service Centres is significantly high hence this suggests that there is limited follow up, monitoring and technical support by government extension agents This also supports the personal communication of the DADO of Gulmi noting that the

department is understaffed and underfunded hence service delivery of ASC extension agents is inadequate.

### **Households land holding**

Household land holding is skewed across all 4 VDC's. Overall 35.04% of households have land of not more than quarter of an hectare (5 Ropanis<sup>1</sup> or less), while households with land of an hectare or more are 10.26%. The smallest household land holding is represented by the land category of between half an hectare and three quarter of an hectare, contributing 3.42% of overall land total. This is represented in figure 3 below.

Tellingly, at the respective VDC level, Simichaur and Darbardevisthan did not have any households with land holding of more than half an hectare but less than an hectare while Bandipur had the least number of households with land of an hectare or more i.e. represented by 3.3%

*Table 2. Comparison of household land holding category in the four VDC's*

<b>Number of households for respective land size category in the 4 VDC's</b>		Land size in hectares				
District	VDC	0.05 to 0.25	0.26 to 0.5	0.51 to 0.75	0.76 to 1 hectare	More than 1 hectare
Gulmi	Simichaur	12	9	6	0	3
	Darbardevisthan	10	10	4	0	5
Tanahun	Manpang	7	8	9	1	3
	Bandipur	12	11	3	3	1

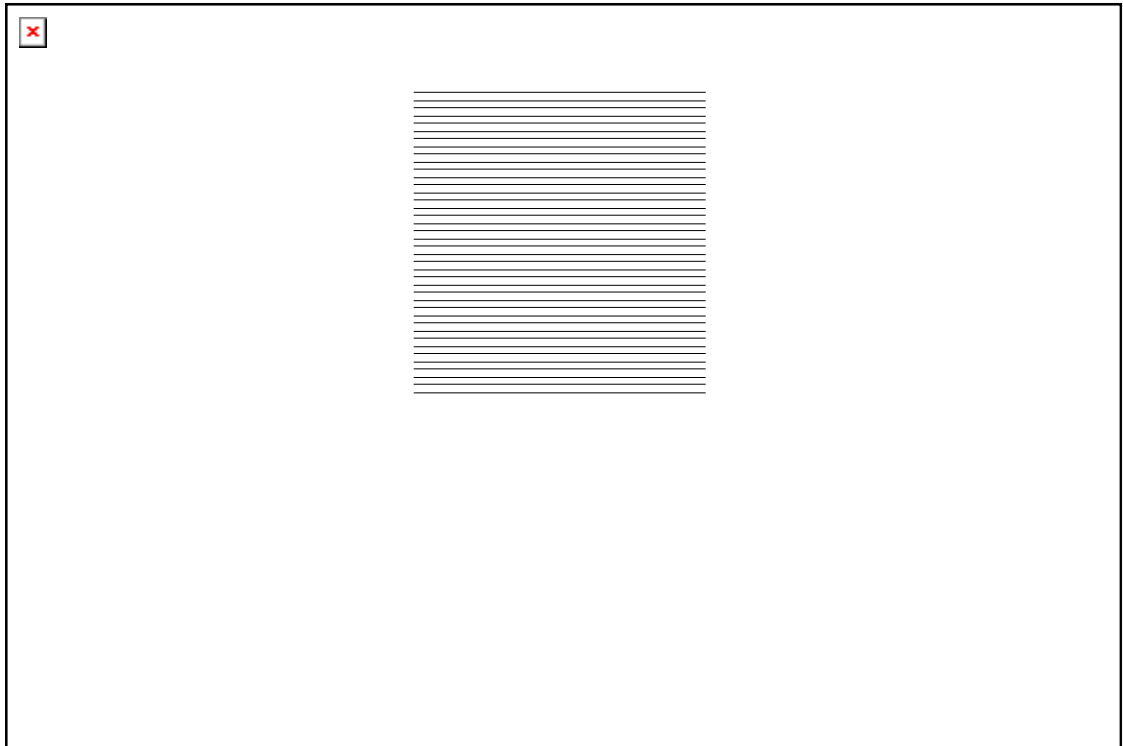
<sup>1</sup> Land conversion; 1 hectare = 20 Ropanis

A one way ANOVA test to determine if there is a relationship between household land sizes and VDC indicated no significant difference. This was also corroborated by a Kruskal Wallis tests that showed no significant difference in land size between VDC's.

## **Crop production**

### **Pulses**

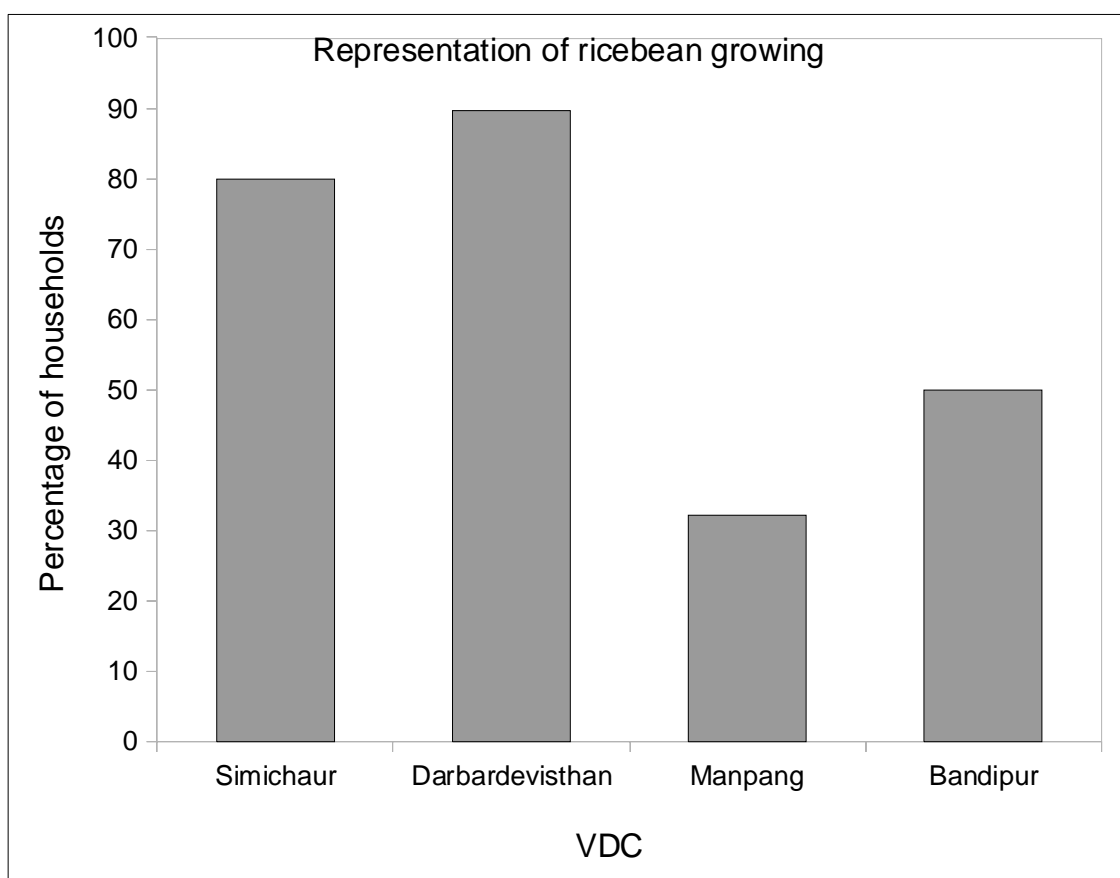
In the 4 VDC's households grow 6 main types of Pulses all year round. The most cultivated being Cowpeas with a representation of 31% of respondents and the followed by ricebean, 24%. The least grown pulse crop is Lentil with a representation of 3% of respondents. A representation of main pulse crops is shown in Figure 4 below.



*Figure 3. showing major pulses crops grown by households*

## Ricebean

Ricebean growing among respondent households was highest in Darbardevisthan with 90% of households closely followed by Simichaur with 80% of households. In Bandipur, 50% of respondent households grow ricebean a main pulse crop while in Manpang only 32% noted that they grow ricebean as a main pulse crop. It is likely that more households in Darbarderisthan and Simichaur grow ricebean as a main source of pulse because they have benefited from ricebean related extension service for example distribution of improved seeds and ricebean related trainings.



*Figure 4. Percentage of households that grow ricebean as a main pulse in respective VDC's*

On inspection, there is a clear indication of a variance in the percentage of households growing ricebean in the four VDC's. A Chi-square test using VDC as independent variable and number of households that grow ricebean as the dependent variable proved this as very significant ( $\chi^2_{3, 1N=117} = 26.241, p < .0005.$ )

### Cereals

All 177 respondents noted maize as one of the key cereals that their household grows, this was followed by Kodo millet with 50% of household, 35% of households grow Wheat and 33% grow rice as a main cereal crop. This is shown in figure 6 below. The high level of maize growing as noted by all respondents is linked to the national focus on improving cereal production in Nepal through wide maize seed distribution by agricultural improvement actors especially DADO's office, NGO's and private input sellers.

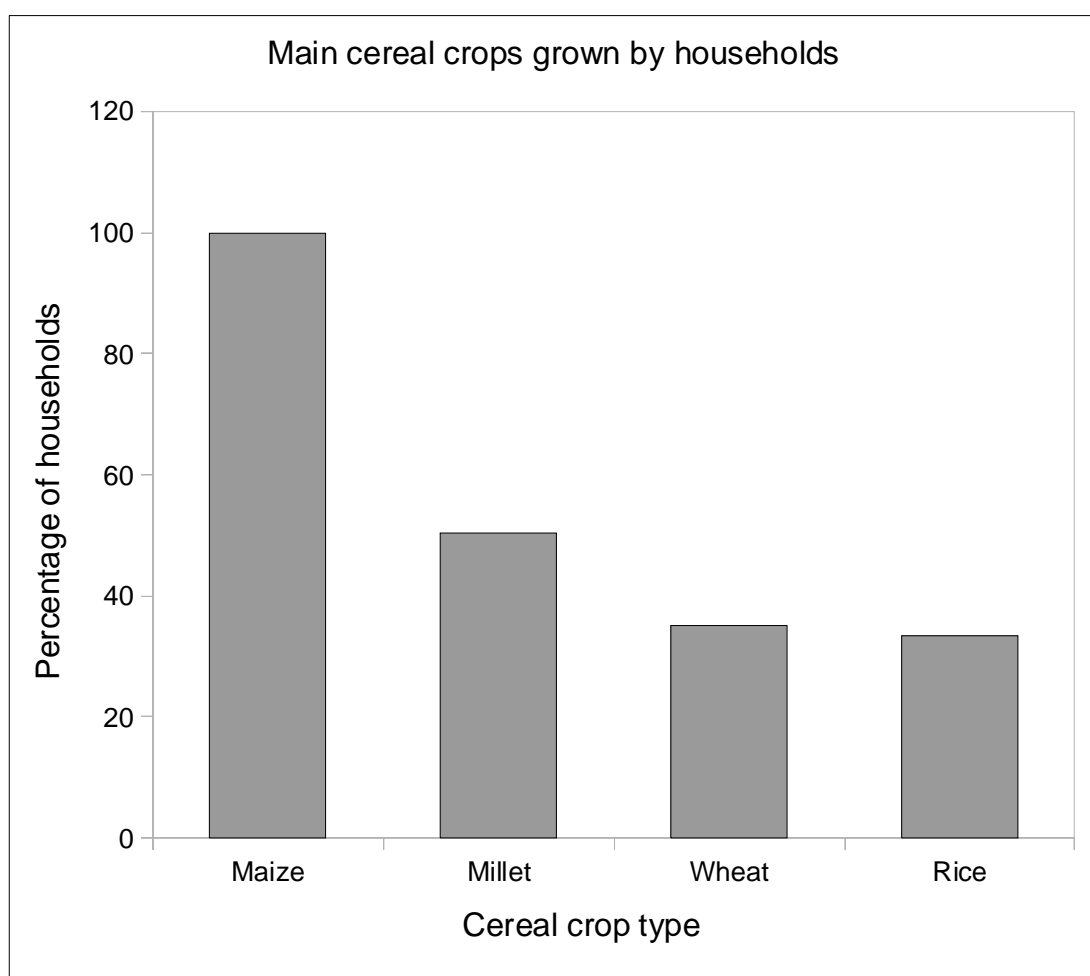


Figure 5. Percentage of households that grow different types of cereal crops in all four VDC's

Ricebean when inter-cropped with maize helps to improve soil moisture and water retention in the soil through its leaves while the maize stalks act as stake for the vine and this helps to improve ricebean yields. Trainings on cultivation practices of ricebean can help households to improve yields, improve soil quality and maximise usage of their limited land for agriculture.

### Household income sources.

Overall respondents noted ten main sources of income (figure 7) for their household in the four VDC's. 76.92% of households reported animal sales as their income source, 43.95% noted crop sales, 39.32% of households acknowledged monthly salary as one of the main source of household income, 35.9% of households reported remittances from relatives and family members outside Nepal as one of their source of income. Sale of animal products like meat, milk, cheese among others was reported by 34.19% of households, pension is a main source of income for 23.93% of households, petty businesses like village shop and pharmacy is a source of income for 18.8% of households. Daily wages and Poultry sales are income sources for 13.68% of households. The least source of household income reported is property rentals, 2.56%.

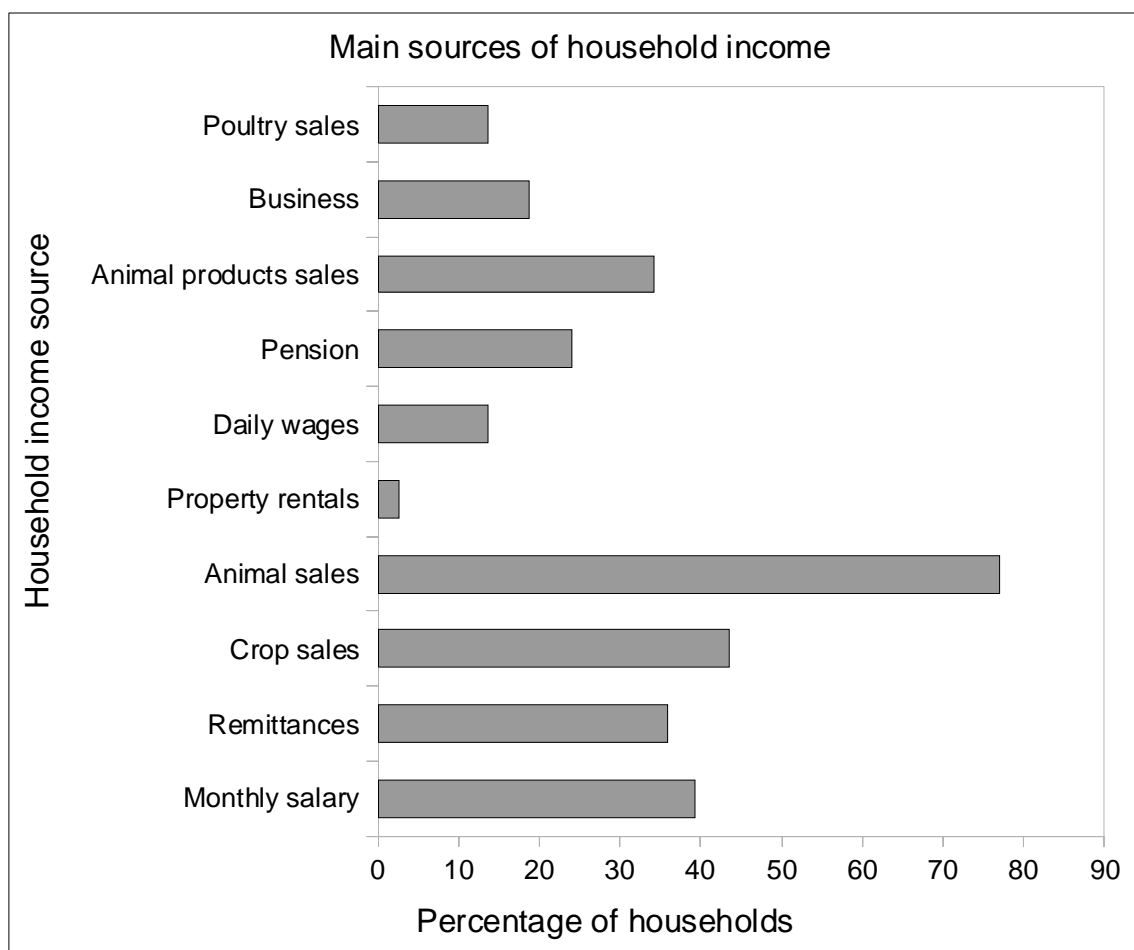
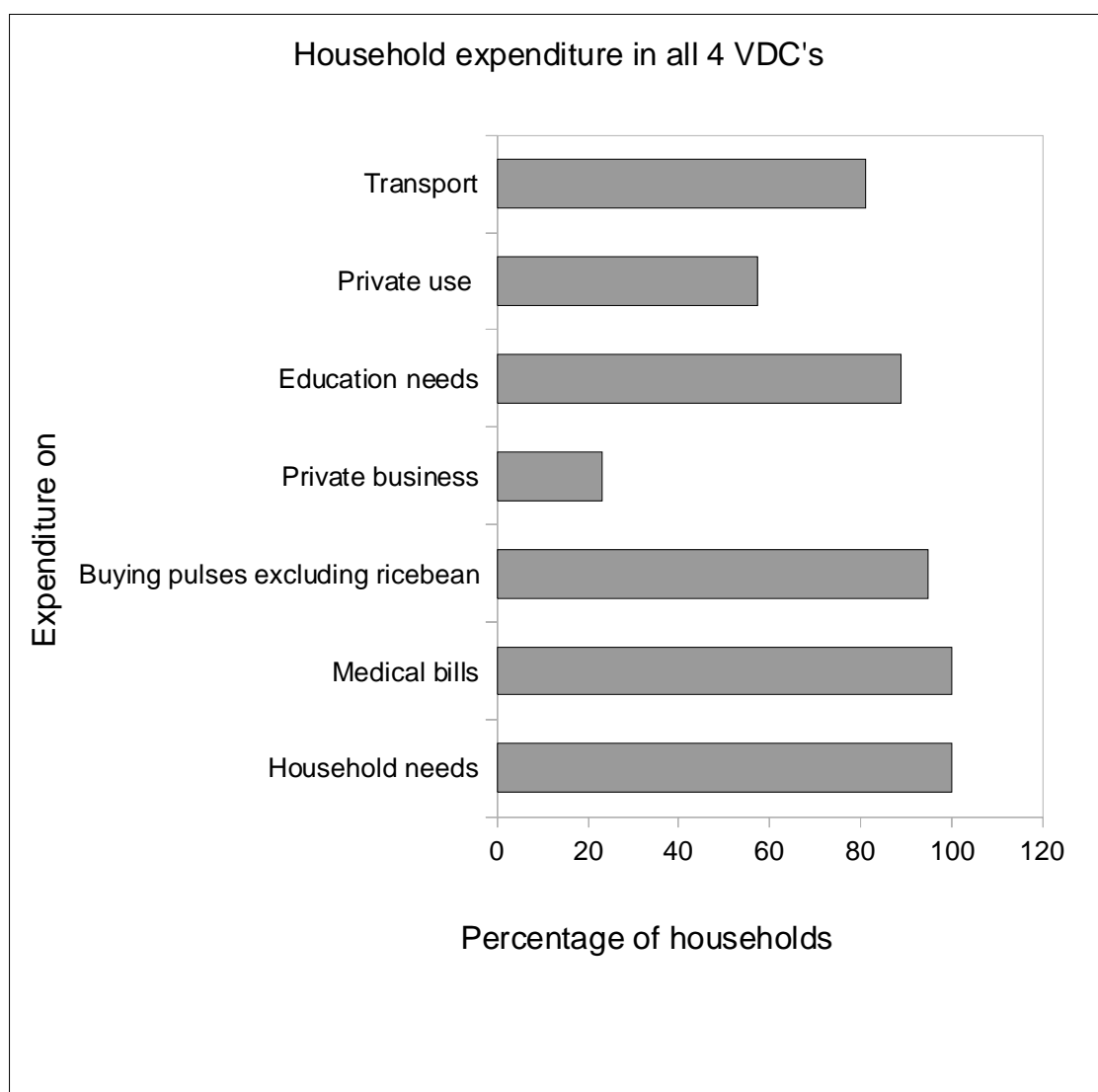


Figure 6. Sources of income for households in the 4 VDC's; Data show all income sources reported

### Household expenditures

Over all respondents reported seven areas of household expenditure (figure 8 below). All respondents acknowledged spending on general household needs and medical bills. 98.47% of households spend on buying pulses excluding ricebean, 88.89% of households spend their income on educational needs, 81.2% reported that their household spends on transport needs. Private use of income by spouse or household head such as buying cigarettes, alcohol, donation to community groups, offering in temple, financial support to relatives and also pocket money was reported by 57.26% of respondents. The least percentage of households, 23.08% noted household expenditure on private business such as petty retail trading, pharmacy and grocery shops.



*Figure 7. How households in the 4 VDC's spend their income. Data shows main areas of reported household expenditures*

### **Household expenditures on pulses other than ricebean**

Pulses are central to the diet of most households; a household's expenditure on other pulses other than ricebean suggests the importance of ricebean to that household's food needs. It can be suggested that, lower expenditures on other pulses is linked to higher production and subsequently greater importance of ricebean to the household. From figure 9 below, Darbardevisthan the leading ricebean growing VDC (refer figure 4) had 93.1% of households spending not more than 30% of their income on purchase of other pulses excluding ricebean for food as compared to 50% in Simichaur, 35.71% in Manpang and 40% in Bandipur.

Additionally there was no household in Dardevisthan that reported that their household spends more than 40% of household income on purchase of other pulses while respective percentage of households in Simichaur, Manpang and Bandipur are 16.67%, 25% and 43.33%. Overall more households in Gulmi district spend less of their income on purchasing pulses other than ricebean as compared to Tanahun. Significantly more households in the two Gulmi VDC's grow ricebean as main pulse crop as compared to the two VDC's of Tanahun.

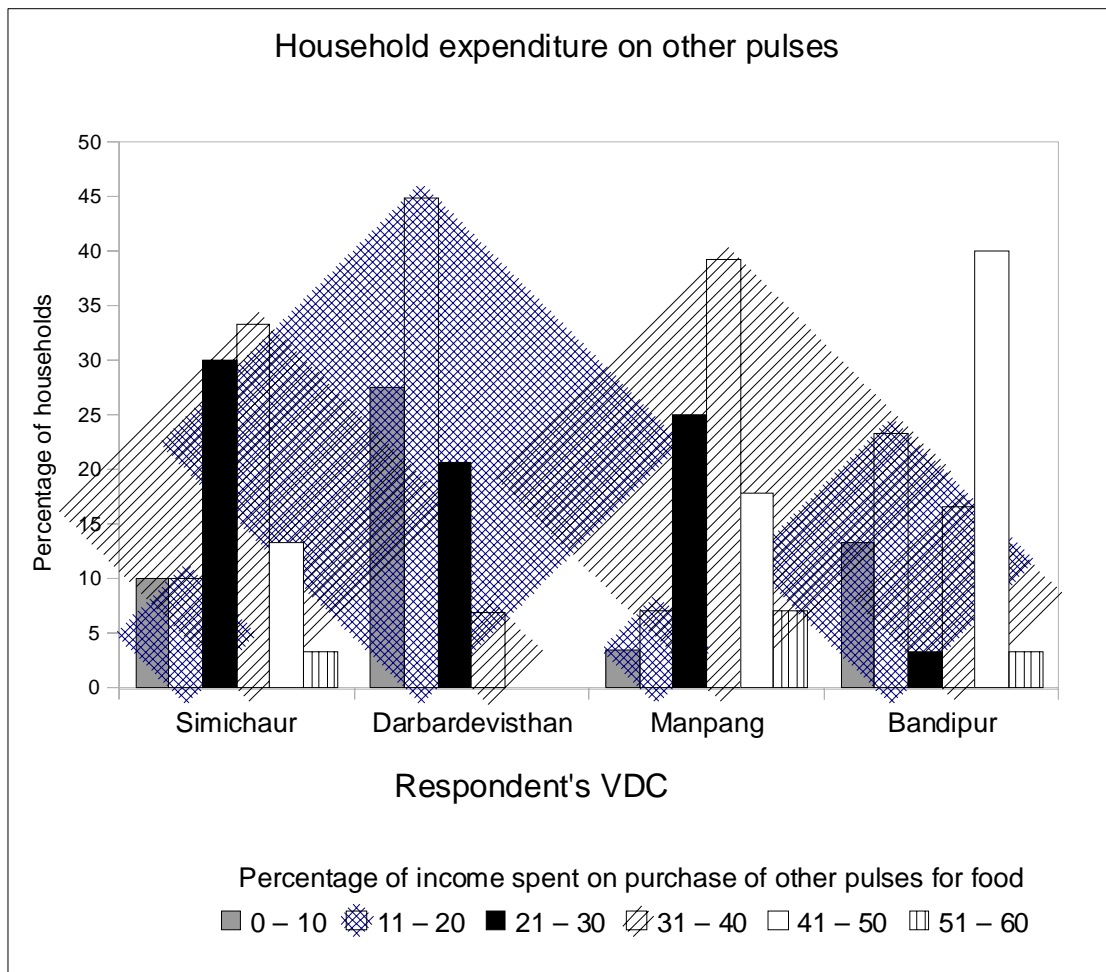


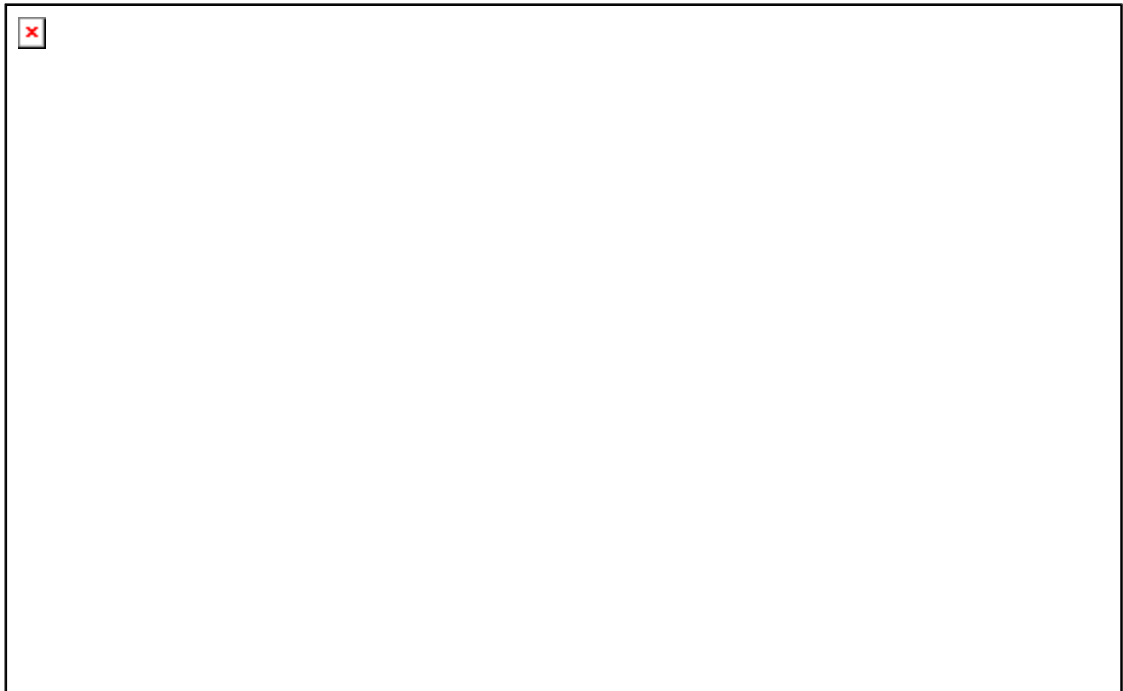
Figure 8. Percentage allocation of household expenditure on purchase of other pulses other than ricebean for food for respective VDC's

A one way between measures ANOVA (DV, proportion of household income devoted to other pulses; IV VDC) revealed a significant difference,  $F_{3, 113} = 12.02, p < .0005$ . The effect size was large ( $\eta_p^2 = .242$ ). Post-hoc tests (Tukey's HSD) revealed the only differences concerned Darbardevisthan, which was significantly different ( $p < .0005$  in all cases) from each of the other villages. The ANOVA violated assumption of equality of error variances, however. Thus, although there seems little doubt as to the differences, their magnitude is uncertain.

A one way between measures ANOVA (DV, proportion of household income devoted to other pulses; IV, district) revealed a significant difference,  $F_{1, 115} = 16.126, p < .0005$ . The effect size was moderate ( $\eta_p^2 = .123$ ).

**Research question 1; What is the importance of ricebean to the livelihood of households and what are its roles in household food security?**

Overall ricebean is central to the livelihood of all households in a number of ways as represented by figure 10 below. The most important uses of ricebean are source of food and fodder for the animals as reported by all respondents. Additionally 55% of all households reportedly use ricebean for social, religious and ritual purposes. Use of ricebean as green manure was reported by 37% of households. Respondents noted that leaves of ricebean drop and this makes the soil more moist soft and rich in fertility, they reported they realise this improvement in soil fertility by the darkening of the soil and ease of clearing and preparing the garden. For 18% of households, ricebean is sold to generate income for the household.



*Figure 10. Overall percentage of households that use ricebean for different purposes.*

Ricebean usage by households for social and ritual values is noted during festivals like marriage where households prepare traditional ricebean recipes *Batuk and Bara*. During the *Raksha Bandhan*; a festival to celebrate the relationship between brothers and sisters, households prepare a mixture of nine grain legumes including ricebean called *Kwanti*. In January, households prepare a mixture of rice and blackgram or ricebean called *Khichadi* to mark the end of the perceived ill omened month of *Poush* (the 9<sup>th</sup>

month of the Nepali calendar). *Biruda* is prepared using five grain legumes including ricebean during the *Gaura parba* as an offering for the festival deity (Kadhka and Acharya, 2009).

Respondents reported five ways how they use their household ricebean. As source of food; 1% of households use between 1% and 20% of their ricebean, 31% of households use between 21% and 40%, 41% of households use between 41% and 60% of their ricebean for food and 32% of households reported that their household uses between 61% and 80% of their ricebean for food needs (figure 11). 25% of respondents reported that their household utilises between 1% and 20% of its ricebean as animal feeds, 71% of households utilise between 21% and 40% while 4% of households use between 41% and 60% of ricebean for the same purpose. As a source of income; 15% of households allocate between 1% and 20% of their ricebean, 3% households allocate between 21% and 40% and only 1% households use more than 41% of ricebean to generate income. Use of ricebean as green manure; 29% households use between 1% and 20% while only 8% use 41% of its ricebean for this purpose. The comparatively high percentage of households allocating more than 40% of their ricebean for food further strengthens its importance in household food security. Figure 11 below shows the percentage allocation (usage) of ricebean by a household for different purposes.

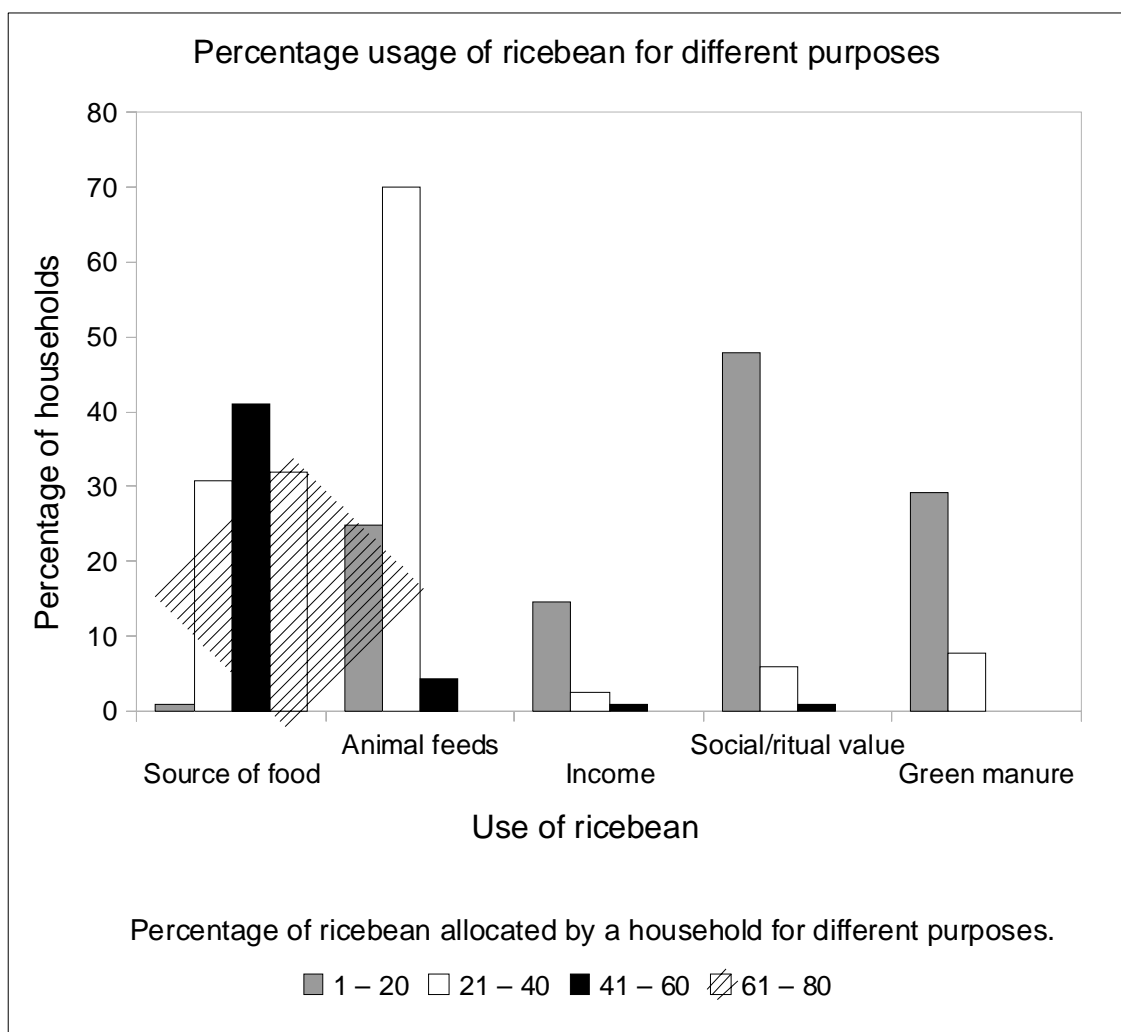


Figure 11. Proportion of ricebean allocated by household for different purposes as proportionally piled by respondents using 20 stones.

Comparatively there is little difference in the percentage of households using ricebean for food and animal feeds in the four VDC's as shown by figure 14. However 43% of households use (sell) ricebean to generate income for the household as compared to 38% in Simichaur, 14% in Manpang and 5% in Bandipur. Proportion of household's that use ricebean as green manure was also markedly different in the four VDC's; 46% in Darbardevisthan, 26% in Simichaur, 14% in Manpang and 14% in Bandipur. For ritual and social activities, festivals and obligations, the comparative percentage of households are 33% in Simichaur, 28% in Dardardevisthan, 28% in Bandipur and 11% in Manpang.

Higher proportion of households selling ricebean and using it as green manure in Darbardevisthan and followed by Simichaur as compared to Manpang and Bandipur can be linked to improved market access for households through farmers groups and also

ricebean related trainings and availability of information on multi-purpose value of ricebean provided by FOSRIN through LIBIRD.

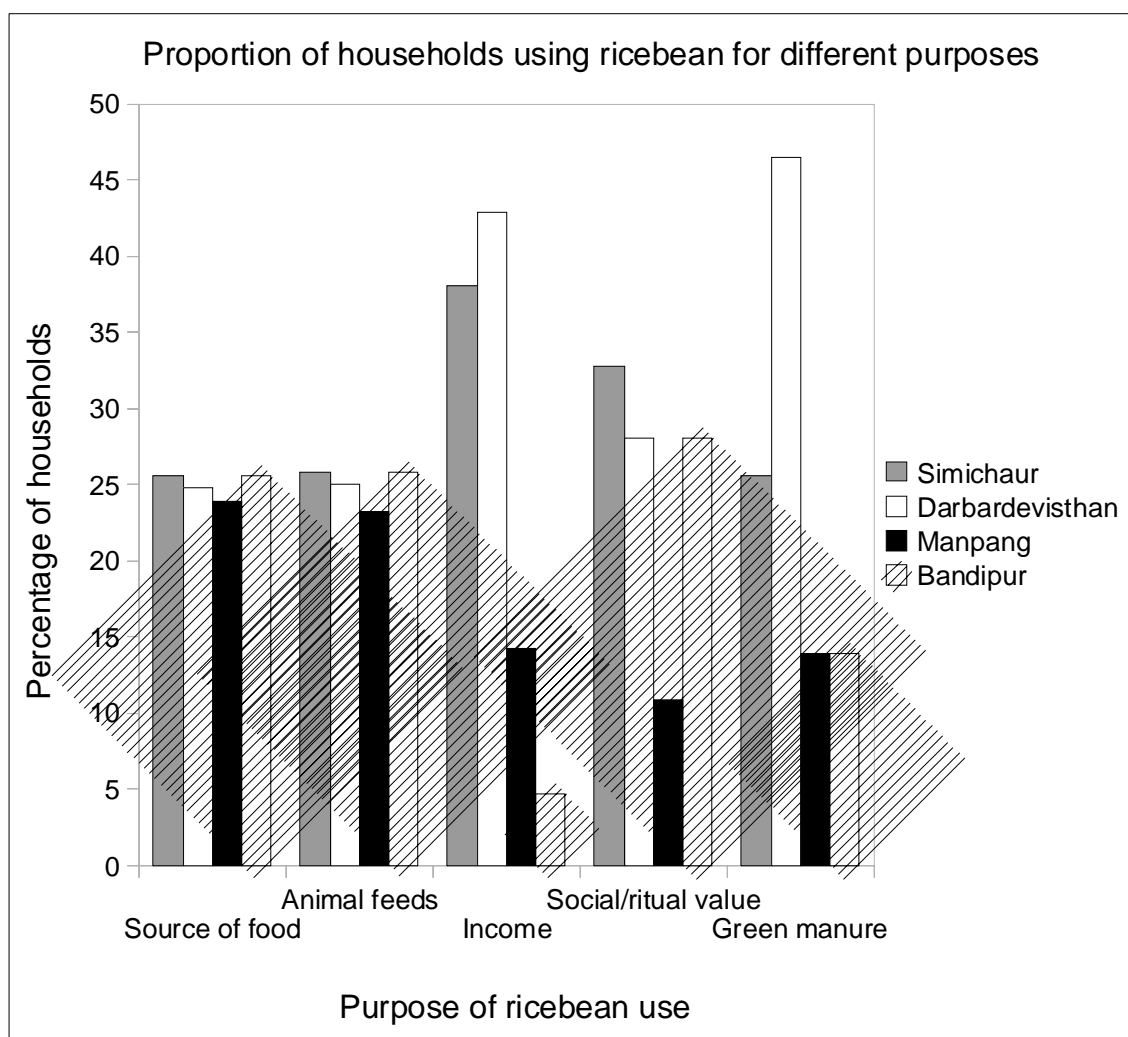


Figure 12. A comparison of the percentage of households in the 4 VDC's and how they contribute for respective ricebean usage.

### Roles of ricebean in household food security.

Respondents noted four main contributions of ricebean to their households' food security but also pointed out that these are in different levels. Significantly it contributes as source of food with some households relying heavily on it during periods after harvest while some household reserve it for the consumption from winter season and onwards (a period in which, food prices rise because of limited supply of food). Though it does not contribute significantly as source of income to most households, most respondents agreed that it helps reduce on their spending on pulses and seeds for the next season hence freeing valuable income for other household responsibilities/needs. Key informants also highlighted the early maturity of ricebean as a major contribution

to food security; households grow ricebean because it matures early hence giving them food while other pulse crops are not yet ready for harvest.

On a scale of one to ten (one to three, slightly; four to six, moderately; seven to ten, highly) 31% of respondents in the four VDC's rated the contribution of ricebean to their household food security as slightly, 49% as moderately and 18% as highly. 39% of respondents reported that ricebean slightly reduces their household's expenditure on other pulses, 38% reported it as moderately contributing to reduced expenditure on purchase of pulses for food and 9% of respondents reported that it highly reduces their household expenditure on other pulses.

Ricebean also significantly contributes to lowering household expenditure on buying animal feeds, although it should be noted that few households reported purchasing animal feeds on a regular basis. 30% of respondents noted that ricebean reduces their expenditure on animal feeds slightly, moderately, 23% of households and highly, 5%. As a source of income for the household, 11% of respondents noted it contributes slightly while 9% reported a moderate contribution.

## Research Question 2; how can ricebean farming be improved?

Key informants noted that ricebean farming can be improved with the distribution of improved seeds especially early maturing, pest resistant and high yielding land races. Using pair wise ranking (table 2 below), in Darbardevisthan high yielding landraces was considered more crucial for improving ricebean farming as compared to pest resistant and early yielding landraces. In Simichaur, pest resistant landraces was favoured and this was linked to the problem of pests that affected production in the last harvest season. In Manpang, key informants noted that both early maturing and pest resistant landraces are important for improving ricebean farming. Additionally the DADO of Gulmi also acknowledged the role of distributing high yielding landraces to the community to enhance production levels and trigger government interest in the crop.

*Table 2. Summary of pair wise ranking scores of different seed types. Data compiled from responses of key informants during Focus Group Discussions in three VDC's*

District	VDC	Scores from pair wise ranking				
		Pest resistant	High yielding	Better tasting	Rainfall resistant	Early maturing
Gulmi	Simichaur	1	4	2	2	1
	Darbardevisthan	1	4	3	2	0
Tanahun	Bandipur	3	2	2	3	2

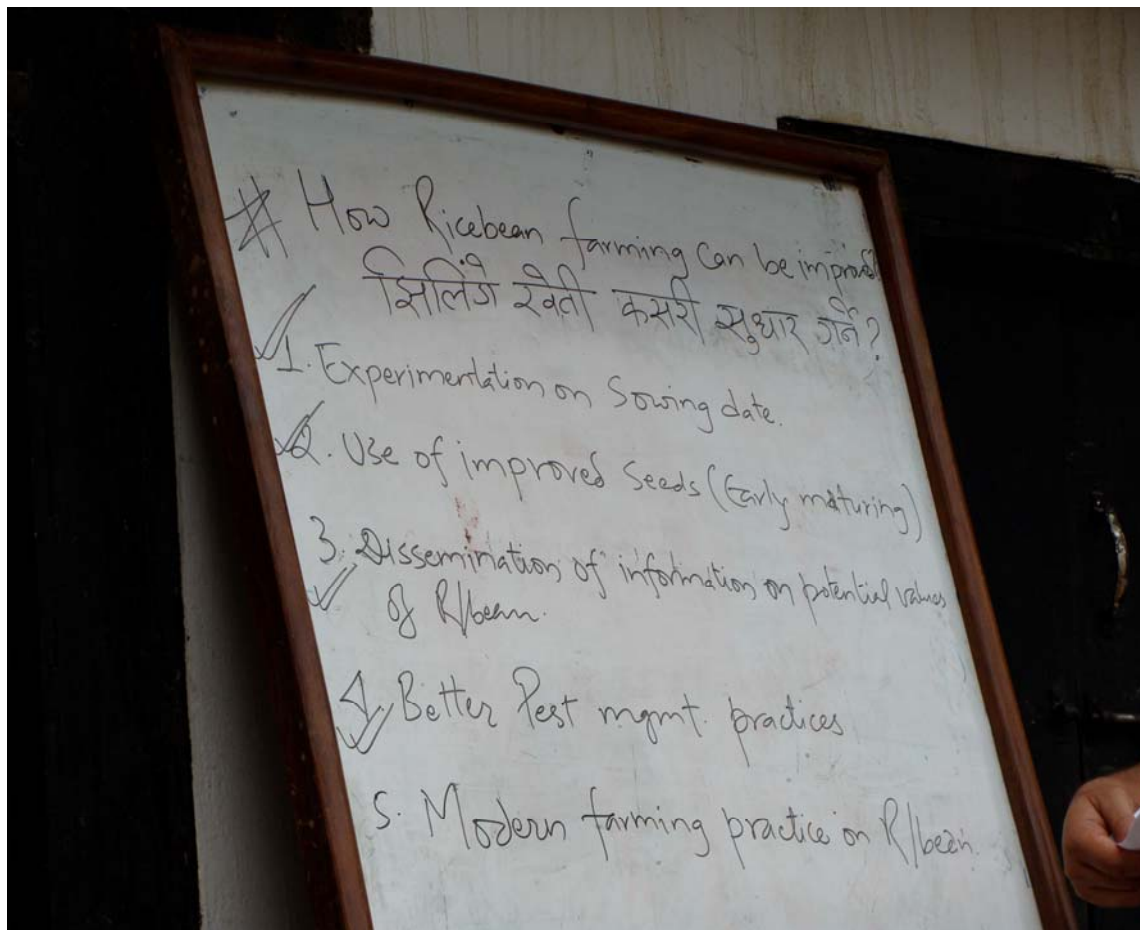
Experimentation on sowing dates was also noted as important for improving ricebean farming. Key informants noted that, at the moment they do not know when exactly to plant ricebean and this has affected production. As a result of poor timing of the planting season, rainfall during flowering season has been a common occurrence hence severely affecting pod formation.

Trainings on pest management and modern ricebean farming practices is also important for boosting ricebean farming according to key informants. They noted that there are serious problem of pest attacks during certain periods of the year besides farmers still rely on the traditional farming practices which are high seed requirement and not productivity efficient. They suggested that trainings on biological pest management and efficient production techniques be conducted for the farmers.

The DADO Kaski suggested that extension agents and providers should disseminate information on the multi-purpose value of ricebean to communities, this he noted would help motivate households to produce more ricebean as an alternative to other pulses and secondly communities should be trained on how to make different ricebean recipes so that with the rising prices of some pulses like Lentils, Chickpea, Cowpea among others in Nepal, ricebean can then be a substitute for these pulses hence saving valuable income for poor households

In Darbardevisthan, key informants pointed the need for an external market for their ricebean and other farm harvest, at the moment the farmers group takes charge of marketing their products however the limited market provided by the farmers group makes it difficult for the community to raise production substantially. Linked to these suggestions, the DADO acknowledged that marketing can be done by his department however this largely depends on the level of production.

FOSRIN staff also noted there is need for cooperation and collaborative efforts in ricebean related research among extension providers and research institutions. At the moment, there is no clear involvement of other agencies and institutions in ricebean improvements, therefore if joint efforts are undertaken, researches conducted and findings extended to farmers then ricebean's status as a minor crop shall be improved. For example the National Grain Legume Program of the National Agricultural Research Council should include ricebean in their national catalogue for research and varietal developments.



*Plate 4. Key informants' suggestions on how to improve ricebean farming. Picture taken from a Focus Group Discussion in Darbardevisthan.*

**Research Question 3; What extension services and providers are available to farmers?**

*Table 2 Summary of general extension services available in the four VDC's. Data compiled from responses of key informants during Focus Group Discussions, interviews with DADO's and FOSRIN staff of LIBIRD.*

Gulmi District	
Simicahaur VDC	Darbardevisthan VDC
<p>Libird</p> <ul style="list-style-type: none"> <li>- agricultural trainings and conferences</li> <li>- varietal selection</li> <li>- seed production</li> <li>- seed distribution</li> <li>- agricultural input to farmers group</li> <li>- visits to demonstration sites</li> </ul> <p>GARDP</p> <ul style="list-style-type: none"> <li>- seed dressing drum</li> </ul> <p>Farmers group</p> <ul style="list-style-type: none"> <li>- seed collection, storage and marketing</li> <li>- micro credit for group members</li> </ul> <p>DADO, Libird, GARDP and farmers group jointly provide seed bin and storage</p>	<p>Libird</p> <p>Agricultural trainings on</p> <ul style="list-style-type: none"> <li>- varietal selection, seed production, varietal selection and maize crossing</li> <li>- ricebean recipe preparation</li> <li>- nursery establishment and management practices of crops</li> <li>- agricultural input to farmers group</li> <li>- visits to demonstration sites</li> </ul> <p>CIMMYT, LiBird and RPGA funding for Farmers Group</p> <p>Farmers group</p> <ul style="list-style-type: none"> <li>- seed collection, storage and marketing</li> <li>- micro credit for group members</li> </ul> <p>District soil conservation program; trainings on terrace preparation</p> <p>ASC and LiBird, Regular technical support</p> <p>GARDP and LIBird; Seeds and saplings distribution</p>
Tanahun	
Manpang VDC	Bandipur VDC
<p>No clear NGO provided agricultural extension services</p> <p>No clear knowledge of farmers group existence in the VDC</p> <p>Farmers are not sure of the existence of the ASC office in the VDC</p>	<p>No clear NGO provided agricultural extension services</p> <p>No clear knowledge of farmers group existence in the VDC</p> <p>Farmers are not sure of the existence of the ASC office in the VDC.</p> <p>There is a women's cooperative group focussing on retailing of agro-products</p> <p>Embassy of Finland provided training on off season vegetable production, sericulture and distributed related inputs 2 years ago</p>

According to the DADO of Gulmi, there are numerous extension services that his department provides, farmers can only access them through farmers group save for technical support which can be received individually. Extension services available he noted are, technical and financial support to farmers groups (25 farmers per group), a

variety of seeds for distribution, problem oriented trainings, seed production, small irrigation projects, inputs distribution such as seed bins, fertilizers (free on demonstration plots but individually farmers can received them at subsidized rates and collection centres for marketing of farm products (weekly village markets). In addition to the above, he stressed that farmers can form groups and then go through the ASC from which they will then start receiving the extension services but after follow up and confirmation of the existence of the group.

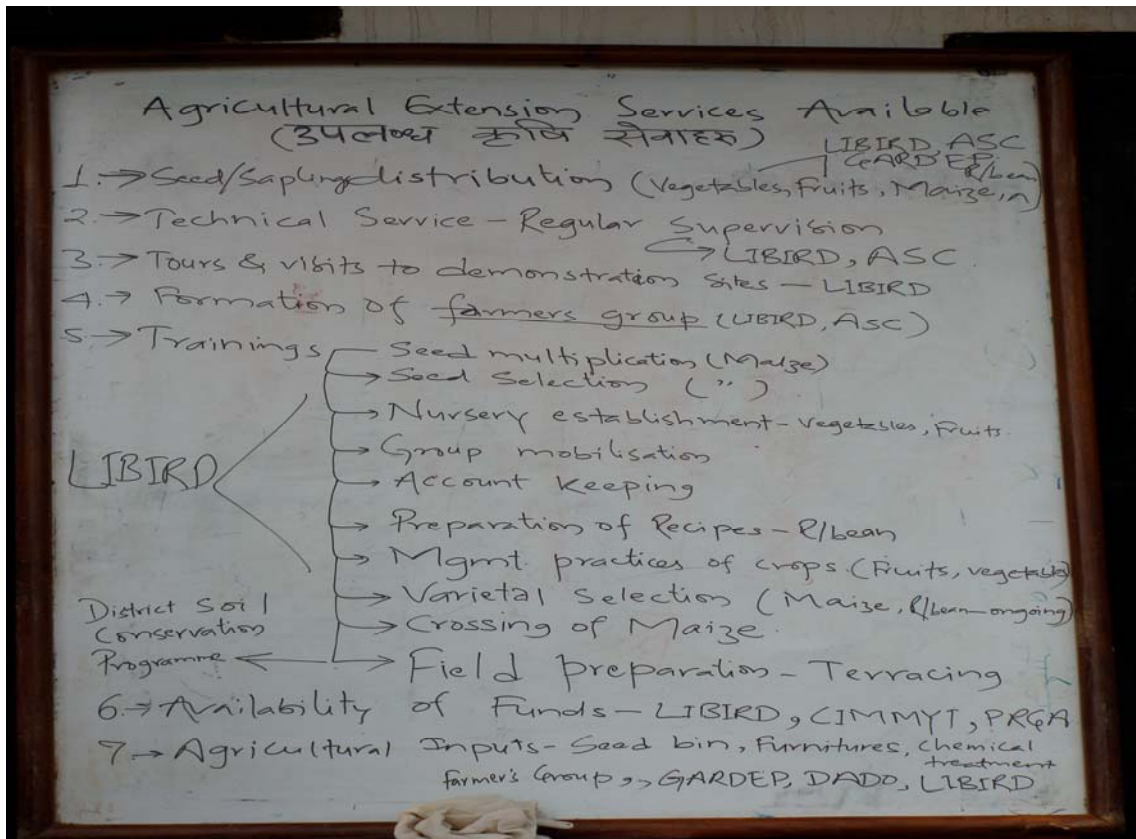


Plate 5; Extension services available in Darbardevisthan as reported by key informants during a Focus Group Discussion.

The DADO of Kaski and Gulmi both noted that there are no ricebean related extension services currently provided by the government, this they linked to the under utilisation of ricebean. However they also noted that much as there is no research for varietal improvements in ricebean, the National Grain Legume Research Program is trying to engage in trials for ricebean as green manure.

Baikuntha Nath Khanal, the DADO of Gulmi, reported that farmers can also play a role in speeding up ricebean researches by approaching the department for support, he remarked

*“We conduct problem oriented trainings and researches, so if a farmers group identifies that they need research on ricebean then we shall help though it is a long process because at the moment ricebean is considered a very minor crop”*

The LIBIRD project officer FOSRIN and Dr. Krishna Joshi the CAZS-NR South Asia research coordinator added that currently there is ongoing crossing of ricebean landraces, study on ideal planting season of ricebean, post rainy season planting and evaluation of ricebean as a winter crop. More to that, the project will fund two Masters of Science students in Nepal for a course in plant breeding but specifically targeting ricebean and focussing on pollination behaviour and plant breeding of ricebean.

Overall the role of extension work in improving ricebean farming through increased availability of better yielding landraces, trainings on crop management practices, regular supervision, improved access to markets, trainings on ricebean recipe preparation among others as noted by respondents in Darbardevisthan and Simichaur is responsible for the higher proportion of households that reported an increase in ricebean production at the household level over the past three years (figure 18) as compared to households in Manpang and Bandipur.

Comparatively 43% of households in Darbardevisthan and 38% of households in Simichaur sell ricebean to generate income for the household as compared to 14% in Manpang and 5% in Bandipur (figure 14). This difference is directly linked to improved market access provided by the LIBIRD and other external buyers through the farmers groups.

90% of households in Darbardevisthan and 80% of households in Simichaur grow ricebean as one of the main pulse crops of the household (figure 5). In Bandipur and Manpang the respective percentages are 50% and 32%. Linking production of ricebean at a household level to expenditure on purchase of pulses excluding ricebean; more than 90% of households in Darbardevisthan spend not more than 30% of income on purchasing pulses (figure 4) while respective proportions of households for the other three VDC's are Simichaur, 50%; Bandipur, 40%; Manpang, 35.71%. Training on ricebean recipe preparation in Darbardevisthan by LIBIRD can therefore be linked to increased consumption of ricebean by households which subsequently led to an increase in ricebean farming and reduction in household expenditure on other pulses.

#### **Research Question 4; What Have Been the Benefits of These Extension Services**

Overall, all respondents that have received some form of extension service in the past four years reported that it has benefited them and their household. Reported benefits of extension services were variously noted, with majority of respondents acknowledging having benefited from distribution of improved seeds notably maize and ricebean. Ricebean seeds distribution is one of the main activities of FOSRIN in Gulmi, while maize is part of a wider national strategic plan to increase cereals production in Nepal.

The farmers group is supported by LIBIRD and DADO's office. It has a revolving fund for its members, provides a collection centre for crops and offers the marketing of the products on behalf of the farmers subsequently it has contributed to improved accessibility of market and micro credit. Additionally, some respondents noted that with guidance from LIBIRD they formed the farmers group while some reported joining the group later as a result they were able to work better as a group and tap extensional services which predominantly target groups; in Nepal, most extension services from NGO's and government departments are available through farmers groups and not individuals. Key informants in both Simichaur and Darbardevisthan noted that through the farmers group they received a maize thresher procured by LIBIRD and this has helped with value addition of the maize grain for sale

Benefit of improved agricultural knowledge at the VDC was represented by 57% of households in Simichaur, 66% of households in Darbardevisthan, 11% of households in Manpang and 7% of households in Bandipur.

37% of households in Simichaur, 41% of households in Darbardevisthan and 7% of households in Manpang reported that contact and discussion with an extension agent influenced them to form or join a farmers group to improve their access to extension services. This was not reported by any household in Bandipur.

80% of households in Simichaur have benefited from distribution of improved seeds respective household percentages for the other three VDC's are, Darbardevisthan, 90%; Manpang, 14%; Bandipur, 10%.

In terms of access to micro credit, 53% of households in Simichaur, 59% of households in Darbardevisthan and 7% of households in Manpang reported having benefited from improved micro credit because of extension work. In Bandipur no household reported an improved access to micro credit.

Farmers group has increased market access for 57% of households in Simichaur and 59% of households in Darbardevisthan however in Manpang and Bandipur, this benefit was not reported by any household.

It is likely that distribution of better quality of seeds in Simichaur and Darbardevisthan is central to the higher production level of ricebean and also the higher proportion of households who have experienced an increase in ricebean yields at the household level in the past three years. Secondly increased market accessibility in Simichaur and Darbardevisthan has contributed to a higher comparative proportion of households selling ricebean (figure 12). The limited extension services available in Manpang and Bandipur has contributed to the low percentage of households that have benefited from improved micro credit, market accessibility, improved seeds and agricultural knowledge as shown by figure 14 and figure 16.

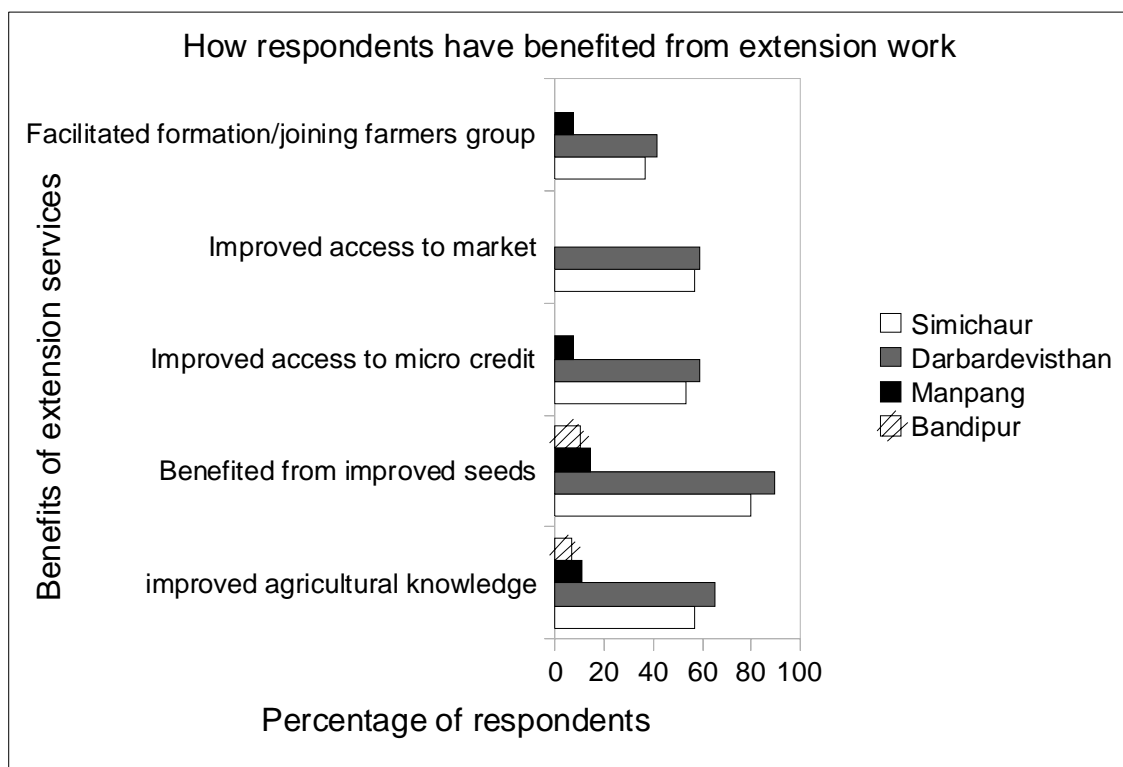
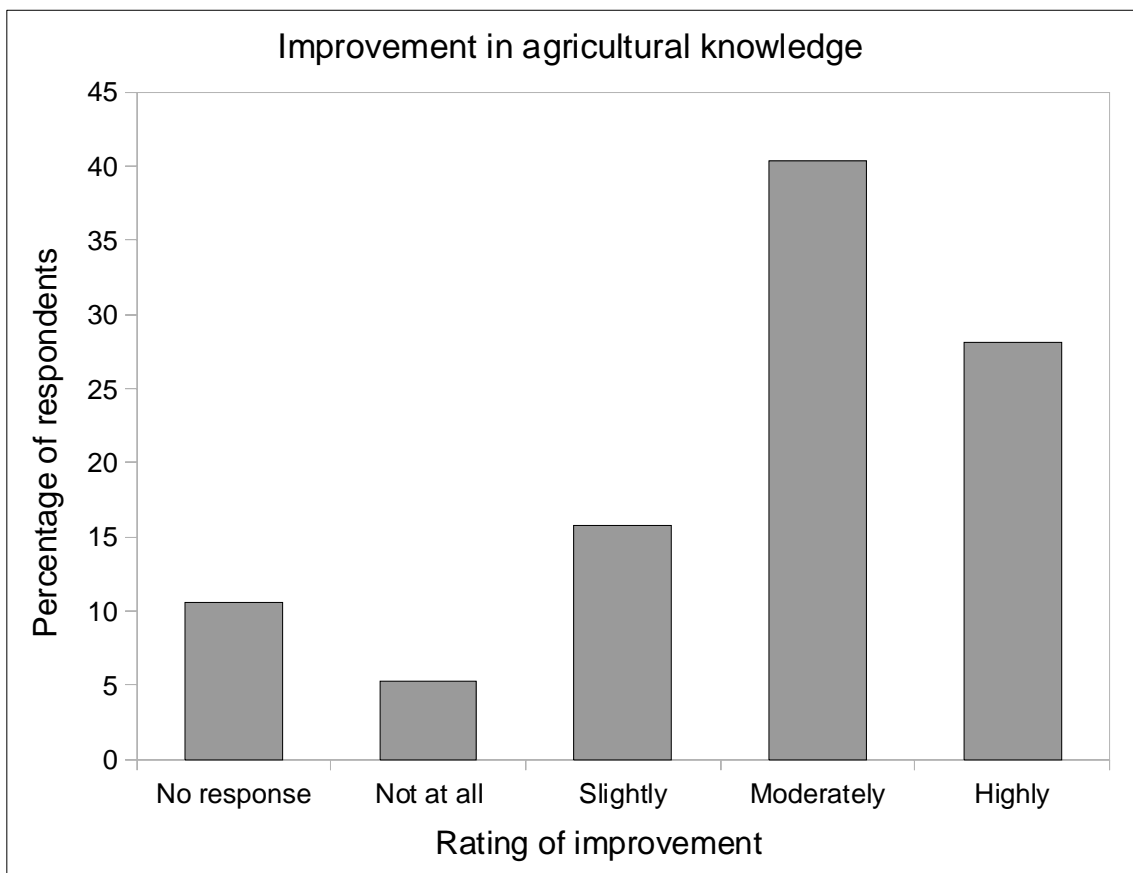


Figure 14. Comparative percentage of respondents and households in the four VDC's for respective benefits of extension services.

From the 49% of households that have received some form of agricultural extension in the past four years (refer to figure 2), respondents reported different levels of how visits to demonstration sites organised for members of the farmers group and facilitated by LIBIRD, agricultural trainings on seed selection, nursery establishment and crop management practices, terrace preparation, off season vegetable production, and home garden program among others have enhanced their agricultural knowledge (figure 15). Respondents rated improvement in their agricultural knowledge on a scale of one to ten (one to three, slightly; four to six, moderately; seven to ten, highly)

40% of respondents reported that their agricultural knowledge has improved moderately because of extension service they received, 28% reported that their agricultural knowledge had improved highly, 16% of respondents rated their level of improvement in agricultural knowledge as slightly, 5% of respondents reported that extension work had not improved their agricultural knowledge and 11% of respondents did not give responses on the rating of their agricultural knowledge after receiving extension service



*Figure 15. Respondents' rating of how extension services they have received has improved their agricultural knowledge.*

Overall, 84% of those who have received some form of extension service in the past four years and reported an improvement in agricultural knowledge also noted different areas where they felt their agricultural knowledge had been improved. Percentage cumulative frequency of multiple responses of respondents on areas of improvement in agricultural knowledge showed a difference in the four VDC's. The percentage cumulative frequency of areas of improvement in agricultural knowledge as noted by respondents are; Better farming practices, 38%; seed preservation, 31%; pest management and disease control, 16%; preparation and application of green manure, 15%.

In the area of better farming practices, farmers are more knowledgeable of cropping seasons, matching crops for mixed cropping, farm preparation and also seeds efficiency during planting. At respective VDC level (figure 16), the percentage of respondents that reported an improvement in farming knowledge were; 67% in Simichaur, 72% in Darbardevisthan, 11% in Manpang and 10% in Bandipur.

Improvements in seed preservation and seed selection for respective VDC's were 53% in Simichaur, 72% in Darbardevisthan, 4% in Manpang while in Bandipur no respondents noted an improvement in their knowledge of seed selection and preservation.

Respondents and key informants noted that most farmers can identify pests and diseases effectively but then biological control of these pests and diseases is a still a challenge for the majority. As such they use the traditional method of uprooting the affected plant. In the four VDC's, the percentage of responses for improvement in pest management and disease control were 23% in Simichaur, 38% in Darbardevisthan, 7% in Manpang and none in Bandipur. 13% of respondents in Simichaur, 38% in Darbardevisthan, 4% in Manpang and 7% in Bandipur reported that they can apply green manure in their gardens however they still have a problem with its preparation

The comparative representative percentage of respondents in each VDC that reported improvement in the different areas of agricultural knowledge shows that extension work has been crucial to improving agricultural knowledge of farmers in Simichaur and Darbardevisthan. This is enhanced by the low percentage of respondents in Manpang and Bandipur reporting improvements in farming practices, seed selection and preservation, pest management and disease control and preparation and application of

green manure. Additionally it is likely that this variance in agricultural knowledge across the four VDC's has contributed to the low production and decreasing ricebean yields in Manpang and Bandipur.

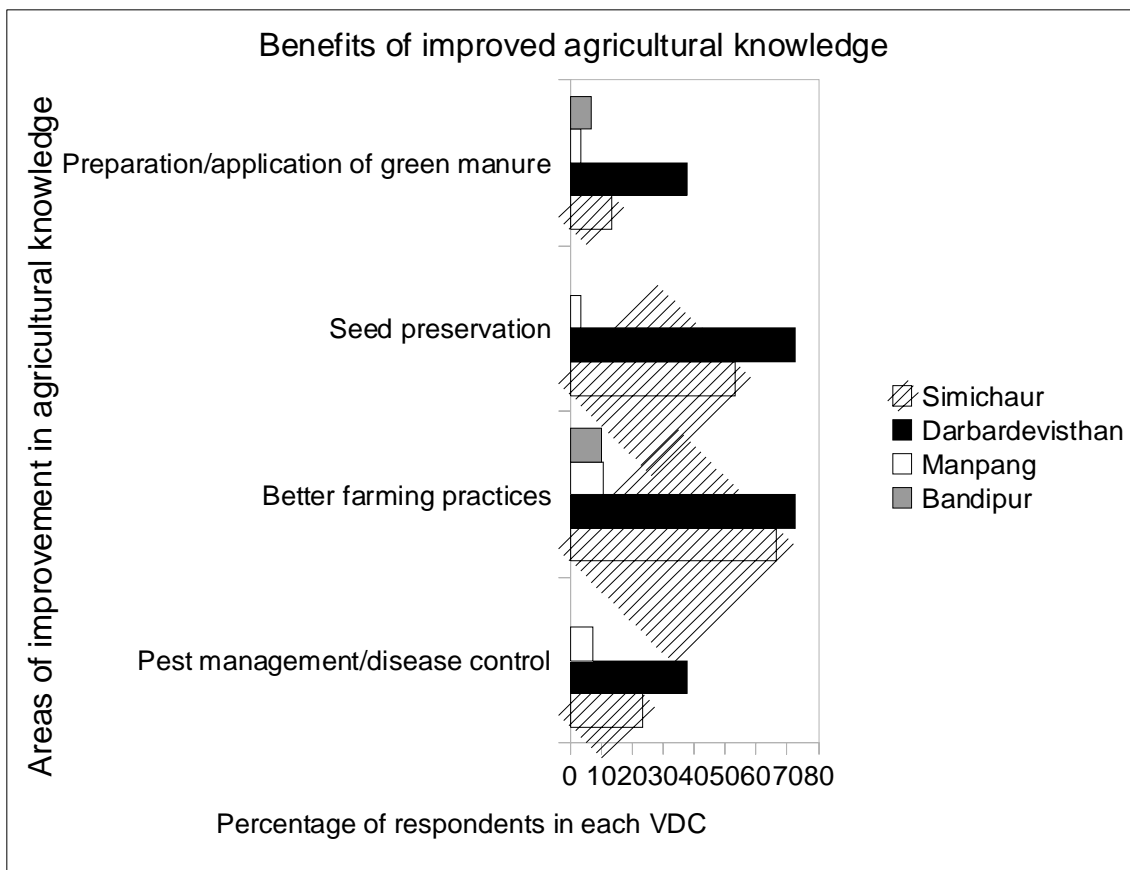


Figure 16. Percentage of respondents in the four VDC's reporting improvement in their agricultural knowledge after receiving some form of agricultural extension service in the past four years.

It is visually obvious that there is a significant difference in respondents reporting different ways they felt their agricultural knowledge had improved in Gulmi district as compared to Tanahun district.

### **Research Question 5; How has Extension Contributed in Ricebean Farming?**

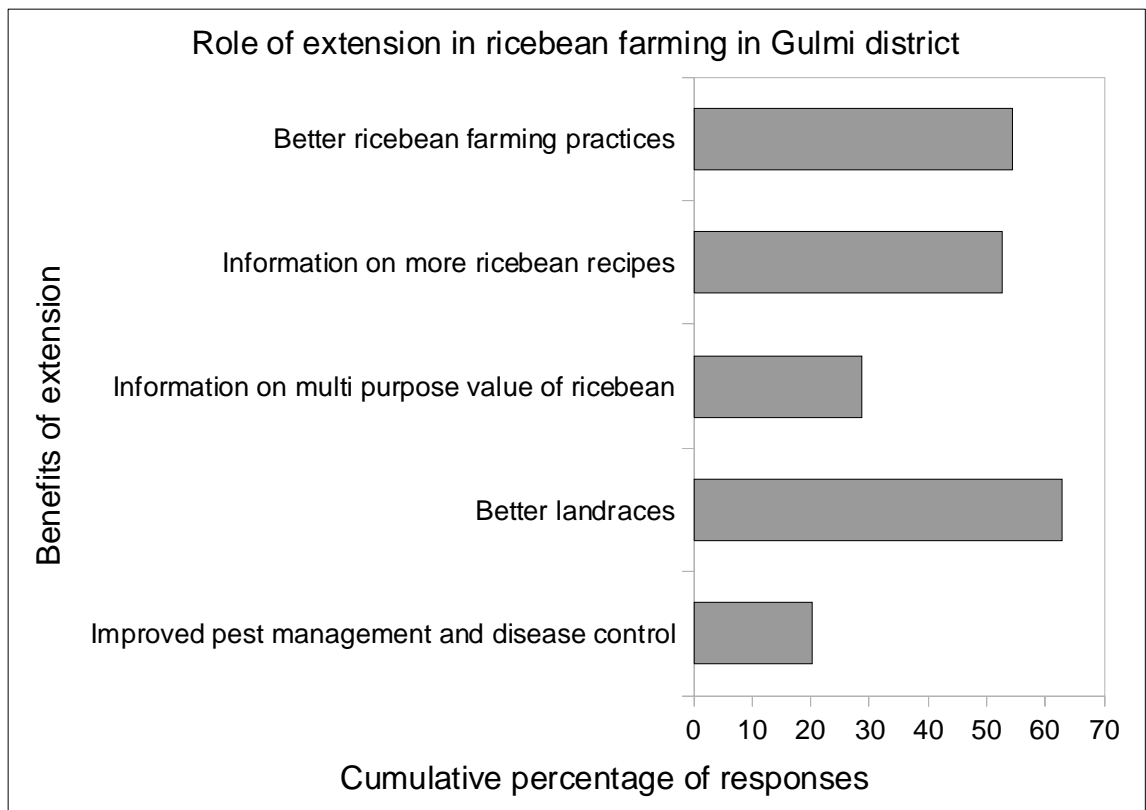
All households in Manpang and Bandipur reported that they have not received any form of ricebean related extension services hence findings on the role of extension work in improving ricebean farming was from Gulmi VDC's; Simichaur and Darbardevisthan. Respondents reported multiple roles of extension in improving ricebean farming in their households this was cumulated and represented as a percentage.

Overall, better land races (63%) had the highest percentage cumulative frequency for reported contribution of extension work in improving ricebean farming at the household level, respondents reported that it has contributed to increased yields. Respective percentage cumulative frequencies of other roles were; better ricebean farming knowledge, 54%; information on more ricebean recipes, 53%; information on multipurpose value of ricebean, 29%; better pest management and disease control, 20%.

Most households noted that initially they used to broadcast ricebean seeds and this was not seed efficient but with the trainings they have received on ricebean farming practices, they now dibble seeds and use stakes to support the ricebean vines hence increased yields and better seed utilisation. Some key informants reported that increased knowledge of ricebean recipes motivated them to increase production at the household level and this has reduced expenditure on purchase of other pulses. One respondent who has benefitted from ricebean recipe preparation training in Darbardevisthan remarked that

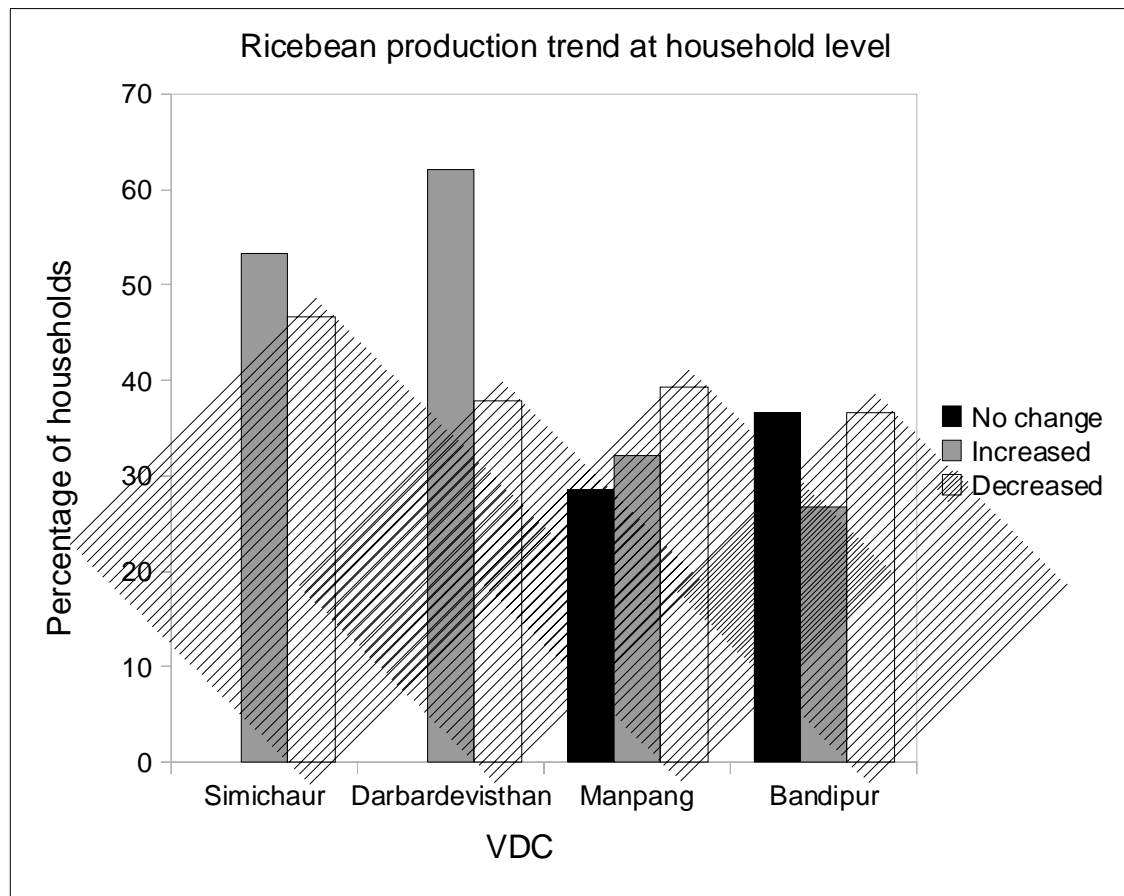
*“...i can prepare six different ricebean recipes so I had to increase my farm size and also production and now I longer spend anything on buying other pulses during the 4 months after harvesting ricebean”.*

Respondents and key informants reported that they can identify the pests and diseases affecting the ricebean and other crops but they still have a problem adequately overcoming the problem of diseases and pest control.



*Figure 17. Role of extension services in improving ricebean farming at a household level in Gulmi district.*

The role of extension work in improving ricebean farming is also reflected in the production trends at the household level in the four VDC's. More households reported an increase in their production trend over the past three years in Gulmi VDC's as compared to Tanahun VDC's. A graphical representation of production trend is shown in figure 18 below.



*Figure 18. Trend of ricebean production at a household level over the past three years in the 4 VDC's*

It is visually obvious that there are differences between the VDC's. A between measures ANOVA confirms this,  $F_{3, 113} = 8.512, p < .0005$ . The effect size is substantial,  $\eta_p^2 = .184$ . Post-hoc tests (Tukey's HSD) revealed significant differences between some VDC's but not between others. The difference between Districts is also significant on inspection.

More households in Simichaur (53%) and Darbardevisthan (62%) noted an increased production trend as compared to a decrease in production, while in Manpang more

households (39%) reported a decrease in their production. In Bandipur the percentage of households that reported a decline in their production of ricebean was same the percentage of households that reported a decline in production.

Increased production was linked to use of better yielding landraces, knowledge of more ricebean recipes and to a lesser extent increased farm size allocation. Key informants did not link their increased production to demand for ricebean.

Declining production was more noted in Manpang and Bandipur where households reported use of local unimproved landraces, rainfall, wrong application of urea in the garden leading to intensive vegetative growth and pest attacks as key factors for the decline. In Simichaur and Darbardevisthan pest attacks was not highlighted as a key factor but instead changes in climate; rainfall during flowering period hence affecting pod formation.

## **Research Question 6; How Can Extension be Improved**

Suggestions by households on how to improve extension services is linked to how their expectations have not been met by extension services currently available. In Simichaur and Darbadevisthan (the two VDC's with extension services), distribution of inputs, setting up village demonstration sites and diversified trainings were key suggestions with the most percentage of households (figure 19). In Manpang and Bandipur where there are no clear extension services currently available for the community, distribution of improved seeds, formation of farmers group and regular supervision by extension workers had the highest percentage of households suggesting them as key for improving extension services in the VDC. Key informants in Simichaur and darbardevisthan suggested regular extension visit by ASC extension agents while in Manpang reported that both NGO and Government extension agents should visit regularly.

Though respondents in both Districts suggested trainings as important for improving extension work, there was a split in the content and type of trainings; key informants in Manpang suggested trainings on general agricultural practices while those in Simichaur and Darbardevisthan suggested trainings on preparation of green manure, vermi composting, trainings on land management, biological control of pests and value addition among others.

The DADO of Gulmi District and the LIBIRD project officer for FOSRIN reported that extension services can be improved and coverage of target communities widened if there is adequate funding. With adequate funding, financial support to farmers groups is enhanced, more extension agents can then be recruited hence improving the frequency of visits, secondly it also improves the procurement and provision of high quality improved seeds and inputs to farmers. More so, adequate funding helps to increase the project duration thereby making it more sustainable for farmers after end of project.

In Darbardevisthan key informants reported that the market currently available through farmers group cannot adequately meet their production levels. The farmers group collects and sets prices for crops and this is most times lower than the price in the external markets therefore extension can help provide external linkages with other buyers and this will be an incentive to increase production, raise income levels and improve the welfare of households in the long run.

Involvement of farmers in agro-technologies and researches such as soil testing, plant breeding, plant crossings, varietal testing among other was reported by key informants in Simichaur as beneficial to improving extension work in the VDC.

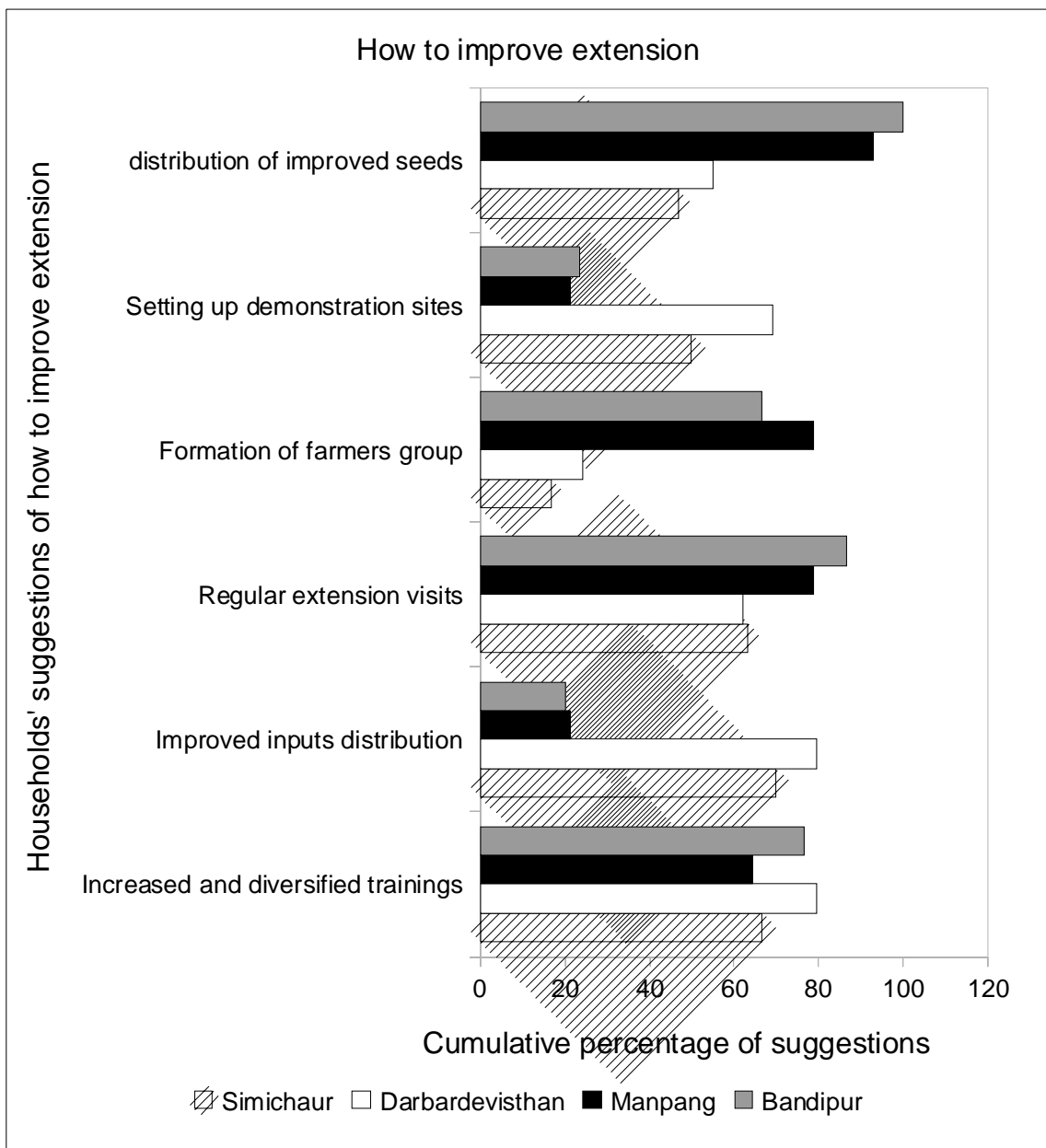
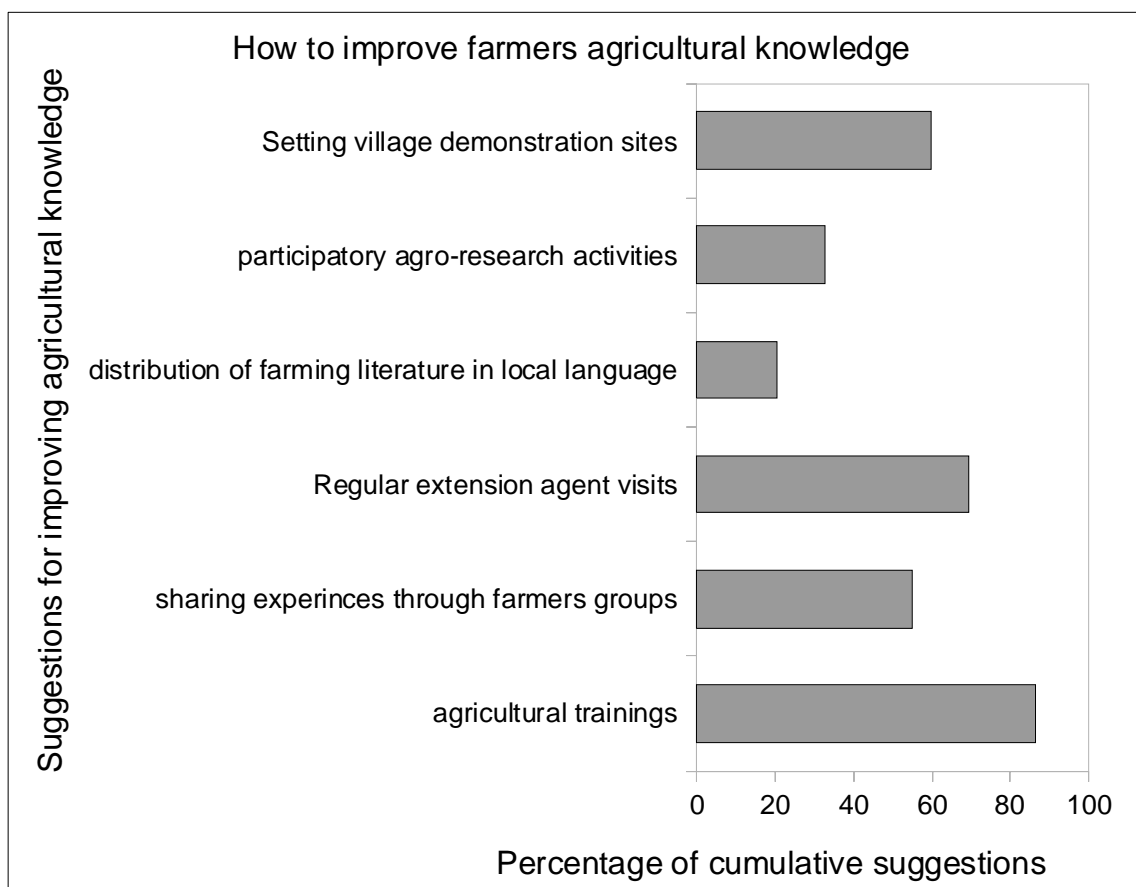


Figure 19; Suggestions by households on how extensional services can be improved. Data shows percentage of households in respective VDC's.

Farmer's agricultural knowledge is central to their management of natural resources, improving productivity and diversifying their alternative. Generally from cumulative frequency of suggestions, 86% was for agricultural trainings, 69% for regular visits by

both government and NGO extension agents. Key informants in Simichaur and Darbardevisthan succinctly noted their irregular contacts with government extension agents from the ASC. Setting demonstration sites in the VDC had a cumulative percentage of 60%, respondents suggested that it will provide an opportunity for the majority households in the community to learn modern agricultural practices, participate in agricultural related studies among others. Farmers group provide an increased opportunity to members for reflective learning from local examples and success and also contributes to group empowerment, as such it had 55% of reported suggestions. Respondents noted that sharing experiences in farmers groups is crucial for improving their agricultural knowledge. Participatory agro-researches such as varietal testing, soil testing for crop compatibility, seed selection and crop experimentations had a share of 32%. Cumulative suggestions of respondents reporting that distribution of literature developed in the local language on farming practices can help improve farmers agricultural knowledge was only 21% and this further highlights the effect of high illiteracy levels for the population above 15 years in Nepal is noted with



*Figure 20. Percentage cumulation of multiple suggestions by households in the four VDC's on how their agricultural knowledge can be improved.*

## DISCUSSION.

Ricebean's multi-purpose value as noted by Gautam et al, 2007 was acknowledged by respondents from the four VDC's for its contribution to the livelihood of households. Mainly it is used as source of food but also as fodder for animals and green manure. The green leaves of ricebean provide a rich source of fodder for cows, goats, sheep and buffaloes. As source of food, household's reported that besides using it as a vegetable, they can also make different recipes from ricebean; *Batuk, Bara, Biraunla, Masyaura, Kwanti, Rot, Furaula and Khichadi* (Kadhka and Acharya, 2009).

Ricebean is rich in nutrients; Carbohydrates 58.2 to 72.0%, Crude Protein 18.3 to 32.2%, Ash 3.5 to 4.9%, Soluble Ether extract 0.1 to 0.5% and Crude fibre of between 3.6 to 5.5% (Buergelt *et al*, 2009)

Ricebean's contribution to household food security especially its role in reducing expenditure on purchase of other pulse for food is significantly high in Darbardevisthan, this is linked to trainings on recipe preparation conducted by LIBIRD hence more households devote lower amounts of household income to purchase other pulses for food needs and also grow ricebean on a wider scale. Reduced expenditure on purchase of other pulse increases income available for other household needs because household demand for goods and services is intrinsically linked to income level (Bernstein, Crow and Johnson, 1992; Scoones *et al*, 1996; Chambers, Pacey and Thrupp, 1989).

Household income generated from ricebean sales is still low because of limited market information and availability, at present marketing is done through farmers group which also determines the prices per unit of ricebean. Significance of ricebean to household food security as income source can be enhanced with exploration of external markets, this will increase market availability, motivate households to produce more ricebean and it will also enhance price competition and boost ricebean prices.

Overall more than 50% of households have land sizes not exceeding half an hectare (figure 3) therefore this significantly affects crop production level and also limits the number of crops a household can cultivate in a given season. Figure 6 also shows that all households grow maize as main cereal crop hence, intercropping maize and ricebean (Kadhka and Acharya, 2009) will maximise land usage, boost farm productivity,

improve soil fertility and after harvesting the maize, the stalk act as stake for ricebean hence boosting ricebean yields. Growing ricebean on the margins of the garden will maximise the use of marginal land and reduce erosion in the hill communities hence reducing intensive decline in soil quality which is widely being experienced in Nepal.

Overall ricebean plays various important roles in the livelihood of resource poor households in the Western Development Region. Its contribution in enhancing the livelihood of such households can be significantly improved with adequate funding to facilitate implementation of extension programs such as trainings, distribution of improved seeds and information dissemination among others.

Extension services available in Gulmi and Tanahun are mainly provided by government departments and Non Governmental Organization but agrovets were not reported. Government sector extension is underfunded and understaffed hence there is inadequate monitoring and contact between extension agents and farmers. There is also limited provision of a broad range of services, inputs and trainings to farmers due to financial constraints at the department level. Government extension agents undertake a multiplicity of roles outside the mandate of agricultural extension some of which are completely unrelated to agriculture (Sulaiman and Holt, 2002).

Much as the DADO's interviewed reported that various extension services such as trainings, distribution of inputs, research and funding to farmers group are available to the farmers, farmers groups in Gulmi did not receive extension services directly from the ASC as suggested by the DADO but after liaison through LIBIRD.

Comparatively NGO provided extension services are more effective and efficient in enhancing agricultural knowledge and filling the inputs gap of resource poor households. However, the scope of coverage and duration of intervention is minimal as compared to Government provided extension services (Sulaiman and Holt, 2002). The disadvantage associated with this is, many times NGO projects conclude before sustainability at the household level is achieved.

Despite there being various extension services available to the farmers provided by both NGO's and DADO's department, there is not adequate information to suggest that they are farmer-led (Chambers *et al*, 1989). Farmers receive extension services from different providers but their role in determining the quality and type of service is not known in both Gulmi and Tanahun District additionally in both districts there was no report of a farmers group requesting extension providers for specific researches or

trainings. To some extent, this may be linked to the high illiteracy level in Nepal (CBS, 2006).

Findings from group discussions and interviews also suggests no clear link between extension service providers; co-ordination and cooperation between the NGO Government and Private extension providers hence all extension providers seem to work in isolation. Working in isolation affects the holistic contents of extension services available to the farmer. There is need for a concerted approach in delivering extension services to facilitate agricultural growth and improve the livelihood of poor communities in Nepal.

Public sector agricultural extension is often affected by financial constraints leading to understaffing and budget cuts and this affects the resources available to enable extension workers carry out their jobs effectively such as transport and trainings. As a consequence of limited resources, there is limited feedback hence culminating into ineffectiveness which in turn leads to further budget cuts (Birner and Anderson, 2007). This is similar in the two districts studied, the DADO of Gulmi oversees 79 VDC's and the district has 6 ASC's, In Tanahun, there are 46 VDC's and 6 ASC's with 8 contact offices. With such a staff level it is difficult to provide adequate technical support to farmers individually and also more difficult to make follow ups with farmers groups, ensure routine monitoring and keep a close contact with farmers.

On the other hand, NGO programs are considered more efficient and effective in execution of activities and generally considered more adequately funded compared to government departments however they are often short term; lasting between three to five years hence projects/programs close before sustainability on the part of beneficiaries is achieved. This was highlighted in the group discussions in Simichaur and Darbardevisthan, informants wondered about the continuity of the FOSRIN project in their VDC.

Extension services such as distribution of improved seeds, regular monitoring by NGO (LIBIRD) extension agent, different kinds of trainings and financial support to farmers group has widely benefited households in Gulmi though this has not been possible in Tanahun District. The benefits of these services have been increased access to improved seeds, market and micro-credit. Trainings and visits to demonstration sites have increased farmer's agricultural knowledge. Improved agricultural knowledge enhances

household resource management and empowerment of an individual farmer (DFID, 2005).

Extension work has contributed to ricebean farming in a number of ways; improved access to better seeds, trainings on ricebean cultivation practices and recipe preparation and sale of ricebean. However the most significant contribution of extension work is that it has enhanced the profile of ricebean at a household level hence more households in Simichaur and Darbardevisthan now grow ricebean as one of the main pulse crops for the household. In Tanahun where ricebean related extension have not been widely received yet, few households cultivate it as one of the main pulse crop of the household. Additionally, households in Gulmi now do not cultivate ricebean just to supplement household food needs as can be suggested in Tanahun but also because it is important as green manure and animal fodder. The role of farmers group in marketing ricebean has also been significant in enhancing household attitude towards sale of ricebean. Ricebean was considered largely a subsistence crop with limited or no sales reported at a household level (Gautam *et al*, 2007). From this study, 18% of households in Gulmi reported that they sell ricebean and also key informants in Darbardevisthan and Simichaur suggested that improving market availability is crucial to enhancing ricebean farming at household level.

Findings from the study also suggest climate change such as increased prevalence of pests, rainfall during flowering season of ricebean, delayed monsoon season (this year it started in late June). The DADO of Gulmi acknowledged that temperature has increased but did not estimate by how much. This corroborates suggestions that communities are widely experiencing climate change in Nepal. It is also likely that the demand for inputs most notably fertilizers by farmers in all VDC's suggests that soil quality is declining (Regmi and Adhikari, 2007) hence affecting crop yields, therefore there is need to address and adapt to the change in climate and its effects on the livelihood of rainfed agricultural communities.

## RECOMMENDATIONS.

FOSRIN through LIBIRD should extend activities such as trainings on ricebean cultivation practices and recipe preparation, improved seeds distribution, and marketing to mention but just a few to other resource poor communities not limited to Bandipur and Manpang. This will help the households in those communities to also benefit from extension services and improve their livelihood and natural resource management in a way similar to the ones in Simichaur and Darbardevisthan. Ultimately this calls for increased funding from the European Union and other actors in International development to FOSRIN to facilitate implementation of ricebean related initiatives and activities and allow expansion of the scope of the project to the wider Nepali population.

There is need for wider and increased dissemination of information through various mass media and extension agents among others on ricebean; its uses, potentials and its adaptability to climate change. Information dissemination will enhance general awareness of climate change and its effects on agriculture and rural livelihoods consequently this will instigate greater consideration of ricebean as an important crop from farmers and the National Agricultural stakeholders. Information dissemination should also include how farmers can access extension services from the different providers, at present this appears to be inadequate because most households got involved in extension work after contact with an NGO extension agent.

Simulation modelling of ricebean and other pulse types should be studied to suggest how different pulses will cope with climate change such as increasing temperature, declining rainfall and declining soil fertility among others. From such a study, it is likely that ricebean because of its adaptability to marginal conditions as compared to some pulse crops which require fertile soils and do not adapt well to high temperature will be considered for research and varietal improvements to cope with climate change by the National Agricultural stakeholders. I can assume that findings from such a model will provide significant positive suggestions on ricebean.

Ricebean can be considered a major pulse crop if its production significantly increases and this will influence national programs targeting crop improvements and national

strategic agricultural plans. The production of ricebean can be enhanced significantly if farmers are aware of its market. FOSRIN implementing partners and other community development stakeholders should explore market potentials for ricebean and disseminate such information to farmers in all communities. Market availability is a strong motivator for boosting production at a household level for example it influences farmers' attitude towards ricebean cultivation and increases farm size allocation for ricebean. Additionally, increased market will improve financial returns from ricebean sales and this contributes significantly to household income and influences the welfare and livelihood of that household.

Findings from the planned study on pollination behaviour of ricebean should lead to breeding of improved ricebean varieties to supersede the current landraces. Plant breeding requires adequate time and resources to produce quality results but the value it produces and its associated benefits should never be underestimated. Improved varieties of ricebean such as; better tasting, early maturing, high yielding and winter season varieties will also contribute to enhancing the profile of ricebean at a household and national level.

Ricebean's contribution to household food security especially through reducing expenditure on purchasing other pulses can be significantly improved if more households are trained on preparation of different recipes. FOSRIN should therefore focus strategically on training as many households as possible in different communities on how to prepare these recipes. As a result already identified in Darbardevisthan, production and consumption of ricebean at a household level will increase and this will inversely lead to a reduction on expenditure on pulses and increase of income level to meet other household purposes and needs. This should go hand in hand with increased distribution of improved landraces.

FOSRIN should lobby with European Union and Nepal Agricultural Research Council to provide funding, undertake studies and development of ricebean as green manure and organic fertilizer. With the increasing loss of soil fertility due to soil erosion in the hill communities and flooding in the terai regions, pressure on available fertile land will be intensified and this will affect agriculture thereby influencing increased demand for crop yield enhancing products such as fertilizers. Ricebean's value in improving soil fertility should be tapped, improved and extended to rainfed communities in Nepal. Unlike inorganic fertilizers which have negative effects on the environment and soil

formation among others, ricebean as an organic fertilizer will not pose such environmental and health impacts.

## REFERENCES.

- Adams, M.E, 1982, *Agricultural Extension in Developing Countries*, Longman Group, Essex, England
- Agricultural Research and Extension*; an evaluation of the World Bank's experience, 1985, Washington DC
- Berg, L. B, 1998. *Qualitative Research methods for the social sciences*, Library of Congress cataloguing-in-publication data
- Bernstein, H; Crow, B and Johnson, H, 1992, *Rural livelihoods*; crisis and responses, oxford university press, Oxford
- Buergelt,D.,M.von Oppen and J.P.Yadavendra, 2009. Quality parameters in relation to consumer preferences in ricebean. Presentation at the International Conference on Grain Legumes; Quality Improvement, Value Addition and Trade, February 14-16, 2009, Kanpur, India
- Bryman, A, 2004, *Social Research methods*, Oxford University press
- Carney, D, 1998, *Sustainable Rural Livelihoods*; what contribution can we make? Papers presented at DFID Development Natural Resources Advisers Conference.
- Central Bureau of Statistics, 2009. available at [www.cbs.gov.np](http://www.cbs.gov.np) accessed on 20<sup>th</sup> May 2009.
- Chalise, S. R. , Shrestha, M. L. , Bajracharya, O. R. , Shrestha, A. B., 2006, Climate change impacts on glacial lakes and glacierized basins in Nepal and implications for water resources, *Climate variability and change: hydrological impacts*, 2006, pp. 460-465
- Chambers, R; Pacey, A and Thrupp, L. A, 1989, *Farmer's first*; First innovation and agricultural research, Intermediate technologies Publishers, UK

Chatterjee, BN & Mukherjee, AK (1979) A new rice bean for fodder and grain pulse *Indian Farming* **29**, 5, 29- 31

Dahal, N. 2006, Implications of Climate Change in Nepal; Some observations and Opportunities, paper presented at 23<sup>rd</sup> Warden Seminar, November 2006 in Pokhara, Nepal

De Carvalho, NM & Vieira, RD (1996) *Rice bean* (*Vigna umbellata* (Thunb.) Ohwi et Ohashi) In: Nwokolo, E & Smartt, J (Eds) *Legumes and Oilseeds in Nutrition*. Chapman and Hall, ISBN 0-412-45930-2, pp 222-228.

[Devereux, S and Hoddinott, J 1992, fieldwork in developing countries, harvester wheatleaf. Newyork; london.](#)

[DFID, 2005 Growth and Poverty reduction; the role of agriculture, a DFID policy paper. Available at <http://www.dfid.gov.uk/news/files/growth-poverty-agriculture.asp> accessed on 18th march 2009.](#)

Ellis, F, 2000, Rural Livelihoods and Diversity in developing countries, Oxford University press, Oxford

Gallup, J., S. Radelet and A. Warner (1997) **“Economic Growth and the Income of the Poor”**. CAER II Discussion Paper No.36. Harvard Institute for International Development, Boston MA.

Gautam, R, Kumar, N, Yadavendra, JP, Neog, SB, Thakur, S, Khanal, A, Bhandari, B and Hollington, PA, (2007) Food Security through Ricebean Research in India and Nepal (FOSRIN). Report 1. Distribution of ricebean in India and Nepal. Pokhara, Nepal, Local Initiatives for Biodiversity, Research and Development and Bangor, Wales, UK, CAZS Natural Resources, College of Natural Sciences, Bangor University.

Hall, M, Dixon, J, Gulliver, A, and Gibbon D. 2001, ***Farming systems and Poverty***; improving farmer’s livelihoods in a changing world, FAO and World Bank, Rome and Washington DC

IPCC, 2001b. Climate change 2001; Impacts, Adaptation and Vulnerability- Summary for policy makers, IPCC, Geneva, available at [www.ipccc.ch](http://www.ipccc.ch) accessed on 3<sup>rd</sup> June 2009

Ison, R and Russell, D, 2000, ***Agricultural Extension and Rural Development***; Breaking out of traditions, Cambridge University press, Cambridge

[Jonathan Kydd, 2002, Agriculture and rural livelihoods: Is globalisation opening or blocking paths out of rural poverty? Agricultural Research & Extension Network Network Paper No121 available at \[www.odi.org.uk/resources\]\(http://www.odi.org.uk/resources\) accessed on 15th April 2009.](#)

Joshi, K.D., Bhandari, B., Gautam, R., Bajracharya, J. and Hollington, P.A., Ricebean: a multipurpose underutilised legume. Paper presented at the 5th International Symposium on Underutilised crops, Southampton University, UK, September 3-4, 2007 available at [www.ricebean.org](http://www.ricebean.org) accessed on 10th february 2009

Katharina Raabe, 2008 Reforming the Agricultural Extension System in India: What Do We Know About What Works Where and Why? IFPRI Discussion Paper 00775 available at <http://www.ifpri.org/> accessed on 12th April 2009

Khanal, AR, Khadka, K, Poudel, I, Joshi, KD and Hollington, PA (2007) Food Security through Ricebean Research in India and Nepal (FOSRIN). Report 3. Farmers' local knowledge associated with the production, utilization and diversity of ricebean (*Vigna umbellata*) in Nepal. Pokhara, Nepal, Local Initiatives for Biodiversity, Research and Development, Rampur, Chitwan, Nepal: Institute of Agriculture and Animal Sciences, and Bangor, Wales, UK: CAZS Natural Resources, College of Natural Sciences, Bangor University.

Krejcie, R V and Morgan D W, 1970, Determining sample size for research activities. Educational and psychological measurement

Lawn, RJ (1995) The Asiatic Vigna species. Chapter 65 in Smartt, J and Simmonds, NW (Eds) *Evolution of crop plants*. Second edition. Longman Scientific and Technical, Harlow, UK. ISBN 0-582-08643-4, pp 321-326.

Laws, S; Harper, C and Marcus, R. 2003, ***Research for Development***; A practical guide, Sage publications

Merz, B. P. , Shah, P. B. , Gopal Nakarmi , Bhandari, N. P, 2003, On-farm research with and for farmers: experience from PARDYP in Nepal. Resource constraints and management options in mountain watersheds of the Himalayas. Proceedings of a Regional Workshop, Kathmandu, Nepal, 8-9 December 2003, 2005, pp. 33-49, 16 ref.

Ministry of Agriculture, Bangladesh, 1996, New Agricultural Extension Programme available at <http://bangladeshgateway.org/agriculture.php> accessed on 3rd march 2009

MOPE, 2000. Implementation of UN Convention to Combat Desertification, Ministry of Population and Environment, HMG/N

Mukherjee, AK, Roquib, MA & Chatterjee, BN (1980) Ricebean for the scarcity period. *Indian Farming*, 30: 26-8

Nugent (2000) The impact of urban agriculture on the household and local economies. In N. Bakker, M. Dubbeling, S. Gundel, U. Sabel-Koscella and H. de Zeeuw (eds.) *Growing Cities, Growing Food*, DSA, Eurasburg.

[Nurul Islam, 2008, Agricultural and Rural Development for Reducing Poverty and Hunger in Asia: Past Performance and Priorities for the Future, 2020 vision For Food, Agriculture, And the environment available at <http://www.ifpri.org/> accessed on 19th April 2009](#)

Pallant, J. 2006, *SPSS Survival Manual*, 2<sup>nd</sup> Edition. Open university Press

Paudel, G. S. , Thapa, G. B., 2004 Impact of social, institutional and ecological factors on land management practices in mountain watersheds of Nepal, *Applied Geography*, 2004, Vol. 24, No. 1, pp. 35-55, 45 ref.

[Peter C Timmer, 2008, Reducing poverty and hunger in Asia, Poverty in Asia and the transition to high priced staples Past Performance and Priorities for the Future, 2020 vision For Food, Agriculture, And the environment available at <http://www.ifpri.org/> accessed on 19th April 2009.](#)

[Rachie, KO and Roberts, LM \(1974\) Grain legumes of the lowland tropics. \*Advances in Agronomy\* 26: 1-132](#)

Rai, K. K. S. , 2008 Climate change and its impact on indigenous peoples in Nepal Himalaya .*Indigenous Affairs - International Work Group for Indigenous Affairs*, 2008, No. 1-2/08, pp. 60-65, 13 ref.

[Rasheed Sulaiman V, Andy Hall and Suresh N, 2005, Effectiveness of private sector extension in india and lessons for the new extension policy agenda, \*Agricultural Research & Extension Network Paper No. 141\* available at \[www.odi.org.uk/resources\]\(http://www.odi.org.uk/resources\) accessed on 15th April 2009.](#)

[Regina Birner and Jock R. Anderson, How to Make Agricultural Extension Demand-Driven? The Case of India's Agricultural Extension Policy IFPRI Discussion Paper 00729 November 2007 available at <http://www.ifpri.org/> accessed on 12th April 2009.](#)

Savile, A. H 1965, *Extension in Rural Communities*, Oxford Tropical handbooks.

Scarborough, V, Killough, S, Johnson, A. D, and Farrington, J, 1997, *Farmer led Extension: Concepts and Practices*, Intermediate Technology Publications.

Scoones, I; Chibudu, C; Chikura, S; Jeranyama, P; Machaka, D; Machanja, W; Mavedzenge, B; Mombeshora, B; Mudhara, M; Mudziwo, B; Murimbarimba and Zirereza, B, 1996,

*Hazards and Opportunities*; Farming livelihoods in dryland Africa, lessons from Zimbabwe, Zed books limited, London.

Shrestha, A.B., Wake, C.P., Mayewski, P.A. and Dibb, J.E., Maximum Temperature Trends in the Himalaya and its Vicinity: An Analysis Based on Temperature Records from Nepal for the period 1971-94 in *Journal of Climate*, (12) 2775-2789.

Stern, R. D; Coe, R; Allan, E. F and Dale, L.C, 2004, *Good statistical Practice for Natural Resources research*, CABI publishing, Oxford

[Sulaiman R and Holt G, 2002, Extension, Poverty and Vulnerability in India: Country study for the Neuchatel Initiative, ODI working paper 154 available at \[www.odi.org.uk/resources\]\(http://www.odi.org.uk/resources\) accessed on 15th April 2009](#)

[Tripp, R, 2006, is low input technology contributing to sustainable agricultural development? Natural resource perspectives 102 available at \[www.odi.org.uk/nrp\]\(http://www.odi.org.uk/nrp\) accessed on 13th April 2009](#)

[UNEP, 2001. State of the Environment of Nepal, UNEP, NORAD, MOPE/HMG](#)

[UNEP and UNFCCC, 2002. Climate Change Information Kit, UNEP/IUC/2002/7. Geneva](#)

[UNFCCC, 2000a Review of the Implementation of commitments and of the other provisions of the convention: Report of the Global Environmental Facility to the conference FCCC/CP/2000/3Add.1.](#)

Upadhyay, B. 2004, Policy supportive issues in home gardening with respect to agricultural biodiversity and improving rural livelihood. Home gardens in Nepal. Proceedings of a national workshop, Pokhara, Nepal, 6-7 August, 2004, 2004, pp. 115-118, 3 ref.

Van Den Ban, A.W and Hawkins, H.S, 1988, Agricultural extension, Longman scientific and technical, Essex, England

Wates, N. 2000, The Community Planning Handbook, London Earthscan

WECS, 1997 Water and Energy Commission Secretariat, Singh Darbar, Kathmandu, Nepal.

World Bank; Nepal at a glance, 2008, available at [www.worldbank.org](http://www.worldbank.org) accessed on 20<sup>th</sup> July 2009.

Xiao YingQiu , Wei LiJuan , Zhou RongJun, Simulating deforestation of Nepal by area production model. *Journal of Forestry Research*, 2001, Vol.12, No.1, pp.47-50, 6 ref.

# APPENDIXES.

## 1. Questionnaire.

No.	Date:	District:	VDC:	Ward:
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## RICEBEAN QUESTIONNAIRE

This questionnaire is being implemented to provide information on the role of extension work on ricebean farming in Western Development region and also to determine the contribution of ricebean to the livelihoods and welfare of farmers. It is entirely for an educational purpose i.e for a thesis as part of a requirement leading to the award of a MSc. in International Natural Resource Development of the University of Wales, Bangor.

### Section 1; Background Information

Initials (Name) of the respondent		Major crops grown	Cereals	
			Pulses	
Sex of respondent		Total Number of household members		
Age of respondent		Number of economically active persons in the household		
Total household land area in Ropani		Sex of household head		

Note;

Common land measurement in Nepal is in Ropani,; 20 Ropani's is equivalent to 1 hectare

**Section 2; Extension work.**

1. Have you or your household received any form of agricultural extension service in the past 4 years?

Yes       No

a) *If No:* Why have you not received any agricultural extension service?

- Limited interest in extension services
- Lack of extension providers
- Inaccessibility of extension services.
- Unfair credit repayment terms
- others; specify .....

b) *If Yes:* what type of extension was it?

- Government agricultural programme
- NGO agricultural programme
- Farmers group programme
- others; specify .....

*If you have answered NO for questions 1 please answer question 6 and 8 then proceed to section 3.*

2. Name of extension work provider .....

.....

.....

3. How did you hear about this extension? (*please tick all boxes that apply*)

- Friends     NGO extension worker     Government Extension worker
- Neighbour     Mass media     Others; Specify
- \_\_\_\_\_

4. What were your reasons for getting involved in this extension work?

- a) Need for agricultural trainings
- b) Access to micro-credit
- c) Improve market access
- d) Benefit from inputs distribution
- e) Others; Specify .....

5. Has extension been beneficial to you?  Yes  No

*If yes:* How has it benefited you?

- a) Improved agricultural knowledge
- b) Benefited from seed distribution
- c) Increased access to micro credit
- d) Improved access to market
- e) Facilitated formation of farmer group
- f) others; specify .....

*If No;* Why has it not benefited you?

- a) Limited agricultural trainings
- b) Limited input distribution
- c) Unfair micro credit repayment terms
- d) Limited contact with extension worker
- e) Discrimination.
- f) Others; specify .....

6. How can extension be improved to meet your needs?

- a) Increased and various agricultural trainings
- b) Improved inputs distribution
- c) More regular extension visits
- d) Formation of farmer groups
- e) Setting up demonstration sites
- f) Others; specify .....

7 a). Has your involvement in extension work improved your agricultural knowledge?

Not at all  slightly  moderately  Highly

b) *If it has improved;* then what are these improvements in your agricultural knowledge?

- i) Pest management and disease control
- ii) Better farming practices
- iii) Seed preservation
- iv) Preparation and use of fertilizers
- v) Others; specify .....

8. How can your agricultural knowledge be further improved

- i) Sharing experiences in farmer groups
- ii) Regular supervision by extension worker
- iii) Provide farmers with local literature on farming
- iv) Involve farmers in agro-research programmes
- v) Others; specify .....

9. Has extension work improved ricebean farming?

Not sure  Not at all  Slightly  Moderately  Highly

b) *If you did not tick not sure or not at all*, Are these improvements because of;

- |                                                  | Yes                      | No                       |
|--------------------------------------------------|--------------------------|--------------------------|
| i) Better pest and disease control               | <input type="checkbox"/> | <input type="checkbox"/> |
| ii) Improved land races                          | <input type="checkbox"/> | <input type="checkbox"/> |
| iii) Information on potential values of ricebean | <input type="checkbox"/> | <input type="checkbox"/> |
| iv) Knowledge of more ricebean recipes           | <input type="checkbox"/> | <input type="checkbox"/> |
| v) Others; specify _____                         | <input type="checkbox"/> | <input type="checkbox"/> |

**Section 3; Ricebean and Livelihoods.**

10. Did you grow ricebean in the last planting season? Yes  No

a) *If No*; why did you not grow ricebean in the last planting season?

.....  
.....  
.....

b) Have you grown ricebean for more than 3 years? Yes  No

c) If you have grown ricebean for more than 3 years, what is your household's ricebean production trend?

Increased  Decreased  No change

d) Reasons for increased production;

- i) Increased farm size allocation to ricebean
- ii) Use of better yielding land races
- iii) Increased demand for ricebean seeds

- iv) Increased knowledge of ricebean recipes
- v) Others; specify .....
  
- e) Reasons for decrease in production;
  - i) Pest and diseases
  - ii) Limited land for agriculture
  - iii) Declining interest in growing ricebean
  - iv) Limited value of the crop
  - v) Others; specify .....

11. What are the main reasons for growing ricebean in your household? (Tick appropriately)

- a) Source of food
- b) Green manure
- c) Animal feeds
- d) Income from sales
- e) Social and ritual value
- f) Others; specify .....

12. Using proportional piling with 20 stones, estimate the percentage usage of ricebean for your household as answered in question 12 above.

- a) Source of food .....
- b) Green manure .....
- c) For animal feeds .....
- e) Income from sales .....
- f) Social and ritual value .....
- g) Others; specify .....

13 a). How important is ricebean to your household food security?

Not sure  Not at all  Slightly  Moderately  Highly

b) *If it plays a role*, Rate its importance to your household food security in terms of? slightly moderately highly

- i) Source of food
-

- ii) Reduced expenditure on other pulses
- iii) Reduced expenditure on animal feeds
- iv) Income source
- v) Others; specify \_\_\_\_\_

14. During which months does your household mostly consume ricebean?  
 .....

15. *During the period given above in question 14; rate its contribution as a source of food*

- Not sure  Not at all  Slightly  Moderately  Highly

16. Do you sell ricebean for household cash income? Yes No

i) If no; why? .....  
 .....

ii) If yes, to what extent does ricebean contribute to the household income?

- Not at all  very small  Slightly  Moderately  Highly

b) Other sources of household income

Income source

17. What are the main uses of this income? (Tick where appropriate)

- a) Buying other household needs
- b) Medical bills
- c) Other food items (not ricebean) for diet
- d) For private business
- e) Education needs
- f) Others; specify \_\_\_\_\_

b). From question 18 (a) above, use proportional piling with 20 stones to estimate the percentage expenditure allocation of income



## 2. Focus Group Discussion.

Location; \_\_\_\_\_ No. of Farmers by Gender; Male \_\_\_\_\_

Female; \_\_\_\_\_

<p>Question 1.</p> <p>What are the agricultural extension services available in this VDC?</p>	
<p>Question 2.</p> <p>What weaknesses can you identify with the extension service you are currently receiving?</p>	
<p>Question 3.</p> <p>How can agricultural extension be improved in this VDC.</p>	

<p>Question 4.</p> <p>What contribution does ricebean make to your household livelihood?</p>	
<p>Question 5.</p> <p>How has agricultural extension work contributed in ricebean farming in this VDC?</p>	
<p>Question 6.</p> <p>What more can be done to improve the contribution of ricebean to your the livelihoods of your household?</p>	

**Thanks a lot for all your contributions.**

**3. Semi Structured Interview.**

No. \_\_\_\_\_ Date: \_\_\_\_\_ Data collector's ID: \_\_\_\_\_

Sex; \_\_\_\_\_ Title \_\_\_\_\_ Organisation \_\_\_\_\_

1. Explain the agricultural extension services currently available to the farmers and how they can acquire them?

2. What ricebean related extension services are available?

3. How can extension services be improved to the benefit of the farmers?

4. What are the plans of your organization/department that aim to improve ricebean farming at a household level?

5. What other efforts can be done to improve ricebean farming and its contribution to livelihood of the households. ?

#### **4. Budget**

## 5. Statistical tests.

### Univariate Analysis of Variance

#### Notes

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#### Between-Subjects Factors

		Value Label	N
VDC	0	Simichaur	30
	1	Darbardevisthan	29
	2	Manpang	28
	3	Bandipur	30

#### Descriptive Statistics

Dependent Variable: Total household land in Hectares

VDC	Mean	Std. Deviation	N
Simichaur	.5383	.63350	30
Darbardevisthan	.4828	.31995	29
Manpang	.5750	.38042	28
Bandipur	.4450	.34073	30
Total	.5094	.43618	117

#### Levene's Test of Equality of Error Variances(a)

Dependent Variable: Total household land in Hectares

F	df1	df2	Sig.
1.058	3	113	.370

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+Locvdc

#### Tests of Between-Subjects Effects

Dependent Variable: Total household land in Hectares

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	.291(a)	3	.097	.503	.681	.013
Intercept	30.439	1	30.439	157.934	.000	.583
Locvdc	.291	3	.097	.503	.681	.013
Error	21.779	113	.193			
Total	52.430	117				
Corrected Total	22.070	116				

a R Squared = .013 (Adjusted R Squared = -.013)

## Post Hoc Tests

### VDC

#### Multiple Comparisons

Dependent Variable: Total household land in Hectares

Tukey HSD

(I) VDC	(J) VDC	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Simichaur	Darbardevisthan	.0556	.11433	.962	-.2426	.3537
	Manpang	-.0367	.11536	.989	-.3375	.2642
	Bandipur	.0933	.11335	.843	-.2023	.3889
Darbardevisthan	Simichaur	-.0556	.11433	.962	-.3537	.2426
	Manpang	-.0922	.11632	.857	-.3956	.2111
	Bandipur	.0378	.11433	.988	-.2604	.3359
Manpang	Simichaur	.0367	.11536	.989	-.2642	.3375
	Darbardevisthan	.0922	.11632	.857	-.2111	.3956
	Bandipur	.1300	.11536	.674	-.1708	.4308
Bandipur	Simichaur	-.0933	.11335	.843	-.3889	.2023
	Darbardevisthan	-.0378	.11433	.988	-.3359	.2604
	Manpang	-.1300	.11536	.674	-.4308	.1708

Based on observed means.

## Homogeneous Subsets

#### Total household land in Hectares

Tukey HSD

VDC	N	Subset
		1
Bandipur	30	.4450
Darbardevisthan	29	.4828
Simichaur	30	.5383
Manpang	28	.5750
Sig.		.671

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .193.

a Uses Harmonic Mean Sample Size = 29.226.

b The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c Alpha = .05.

## NPar Tests

### Notes

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	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.
Syntax		<pre> NPAR TESTS /K- W=Totlandh ect BY Locvdc(0 3) /MISSING ANALYSIS. </pre>
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a Based on availability of workspace memory.

[DataSet1] G:\Ricebean.sav

## Kruskal-Wallis Test

### Ranks

	VDC	N	Mean Rank
Total household land in Hectares	Simichaur	30	53.33
	Darbardevisthan	29	59.09
	Manpang	28	70.09
	Bandipur	30	54.23
	Total	117	

### Test Statistics(a,b)

	Total household land in Hectares
--	----------------------------------

Chi-Square	4.461
df	3
Asymp. Sig.	.216

a Kruskal Wallis Test

b Grouping Variable: VDC

## Univariate Analysis of Variance

### Notes

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	Cases Used	Statistics are based on all cases with valid data for all variables in the model.
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### Between-Subjects Factors

		Value Label	N
VDC	0	Simichaur	30
	1	Darbardevisthan	29
	2	Manpang	28
	3	Bandipur	30

### Descriptive Statistics

Dependent Variable: percentage expenditure on other pulses

VDC	Mean	Std. Deviation	N
Simichaur	31.50	12.942	30
Darbardevisthan	17.41	10.742	29
Manpang	36.25	11.990	28
Bandipur	33.67	15.862	30
Total	29.70	14.802	117

### Levene's Test of Equality of Error Variances(a)

Dependent Variable: percentage expenditure on other pulses

F	df1	df2	Sig.
4.009	3	113	.009

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+Locvdc

### Tests of Between-Subjects Effects

Dependent Variable: percentage expenditure on other pulses

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	6148.079(a)	3	2049.360	12.020	.000	.242
Intercept	103173.281	1	103173.281	605.123	.000	.843
Locvdc	6148.079	3	2049.360	12.020	.000	.242
Error	19266.451	113	170.500			
Total	128625.000	117				
Corrected Total	25414.530	116				

a. R Squared = .242 (Adjusted R Squared = .222)

## Post Hoc Tests

### VDC

#### Multiple Comparisons

Dependent Variable: percentage expenditure on other pulses

Tukey HSD

(I) VDC	(J) VDC	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Simichaur	Darbardevisthan	14.09(*)	3.400	.000	5.22	22.95

	Manpang	-4.75	3.431	.512	-13.70	4.20
	Bandipur	-2.17	3.371	.918	-10.96	6.62
Darbardevisthan	Simichaur	-14.09(*)	3.400	.000	-22.95	-5.22
	Manpang	-18.84(*)	3.460	.000	-27.86	-9.81
	Bandipur	-16.25(*)	3.400	.000	-25.12	-7.39
Manpang	Simichaur	4.75	3.431	.512	-4.20	13.70
	Darbardevisthan	18.84(*)	3.460	.000	9.81	27.86
	Bandipur	2.58	3.431	.875	-6.36	11.53
Bandipur	Simichaur	2.17	3.371	.918	-6.62	10.96
	Darbardevisthan	16.25(*)	3.400	.000	7.39	25.12
	Manpang	-2.58	3.431	.875	-11.53	6.36

Based on observed means.

\* The mean difference is significant at the .05 level.

## Homogeneous Subsets

### percentage expenditure on other pulses

Tukey HSD

VDC	N	Subset	
		1	2
Darbardevisthan	29	17.41	
Simichaur	30		31.50
Bandipur	30		33.67
Manpang	28		36.25
Sig.		1.000	.508

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = 170.500.

a Uses Harmonic Mean Sample Size = 29.226.

b The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c Alpha = .05.

## Univariate Analysis of Variance

### Notes

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	Cases Used	Statistics are based on all cases with valid data for all variables in the model.	
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		percentage expenditure on other pulses	
		BY Locdist	
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		HOMOGENEITY	
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		ALPHA(.05)	
		/DESIGN =	
		Locdist .	
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#### Between-Subjects Factors

		Value Label	N
District	0	Gulmi	59
	1	Tanahun	58

#### Descriptive Statistics

Dependent Variable: percentage expenditure on other pulses

District	Mean	Std. Deviation	N
Gulmi	24.58	13.781	59
Tanahun	34.91	14.064	58
Total	29.70	14.802	117

#### Levene's Test of Equality of Error Variances(a)

Dependent Variable: percentage expenditure on other pulses

F	df1	df2	Sig.
.120	1	115	.730

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+Locdist

#### Tests of Between-Subjects Effects

Dependent Variable: percentage expenditure on other pulses

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3125.554(a)	1	3125.554	16.126	.000	.123

Intercept	103510.170	1	103510.170	534.061	.000	.823
Locdist	3125.554	1	3125.554	16.126	.000	.123
Error	22288.976	115	193.817			
Total	128625.000	117				
Corrected Total	25414.530	116				

a R Squared = .123 (Adjusted R Squared = .115)

## NPar Tests

### Notes

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	N of Rows in Working Data File	117
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.
Syntax	<pre> NPAR TESTS /K- W=sosofood Redexponot hapalses redexpanimf ids Incsos BY Locvdc(0 3) /MISSING ANALYSIS. </pre>	
Resources	Elapsed Time	0:00:00.00
	Number of Cases Allowed(a)	78694

a Based on availability of workspace memory.

[DataSet1] G:\Ricebean.sav

## Kruskal-Wallis Test

### Ranks

	VDC	N	Mean Rank
Source of food	Simichaur	30	58.85
	Darbardevisthan	29	73.90
	Manpang	28	44.54
	Bandipur	27	51.83

	Total	114	
Reduces expenditure on other pulses	Simichaur	27	62.83
	Darbardevisthan	29	66.16
	Manpang	28	41.38
	Bandipur	27	53.43
	Total	111	
Reduces expenditure on animal feeds	Simichaur	23	71.91
	Darbardevisthan	29	72.55
	Manpang	28	35.21
	Bandipur	27	38.30
	Total	107	
Income source	Simichaur	9	76.28
	Darbardevisthan	29	50.31
	Manpang	28	44.55
	Bandipur	27	36.22
	Total	93	

### Test Statistics(a,b)

	Source of food	Reduces expenditure on other pulses	Reduces expenditure on animal feeds	Income source
Chi-Square	14.675	11.620	39.097	26.479
df	3	3	3	3
Asymp. Sig.	.002	.009	.000	.000

a Kruskal Wallis Test

b Grouping Variable: VDC

## NPar Tests

### Notes

Output Created		11-SEP-2009 16:50:26
Comments		
Input	Data	G:\Ricebean.sav
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	117
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.

Syntax		NPAR TESTS /K- W=sosofood Redexponot hapalses redexpanimf ids Incsos BY Locdist(0 1) /MISSING ANALYSIS.
Resources	Elapsed Time	0:00:00.00
	Number of Cases Allowed(a)	78694

a Based on availability of workspace memory.

[DataSet1] G:\Ricebean.sav

## Kruskal-Wallis Test

### Ranks

	District	N	Mean Rank
Source of food	Gulmi	59	66.25
	Tanahun	55	48.12
	Total	114	
Reduces expenditure on other pulses	Gulmi	56	64.55
	Tanahun	55	47.29
	Total	111	
Reduces expenditure on animal feeds	Gulmi	52	72.27
	Tanahun	55	36.73
	Total	107	
Income source	Gulmi	38	56.46
	Tanahun	55	40.46
	Total	93	

### Test Statistics(a,b)

	Source of food	Reduces expenditure on other pulses	Reduces expenditure on animal feeds	Income source
Chi-Square	10.225	9.222	38.940	13.433
df	1	1	1	1
Asymp. Sig.	.001	.002	.000	.000

a Kruskal Wallis Test

b Grouping Variable: District

## Univariate Analysis of Variance

### Notes

Output Created		11-SEP-2009 16:53:29
Comments		
Input	Data	G:\Ricebean.sav
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	117
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.
Syntax		<pre> UNIANOVA   rbpdtrend   BY Locvdc   /METHOD   =   SSTYPE(3)    /INTERCEP   T =   INCLUDE   /PRINT =   DESCRIPTI   VE ETASQ   HOMOGEN   EITY   /CRITERIA   =   ALPHA(.05)   /DESIGN =   Locvdc . </pre>
Resources	Elapsed Time	0:00:00.00

[DataSet1] G:\Ricebean.sav

### Between-Subjects Factors

		Value Label	N
VDC	0	Simichaur	30
	1	Darbardevisthan	29
	2	Manpang	28
	3	Bandipur	30

### Descriptive Statistics

Dependent Variable: Ricebean production trend over three years

VDC	Mean	Std. Deviation	N
Simichaur	.47	.507	30
Darbardevisthan	.38	.494	29

Manpang	.96	.793	28
Bandipur	1.10	.803	30
Total	.73	.727	117

### Levene's Test of Equality of Error Variances(a)

Dependent Variable: Ricebean production trend over three years

F	df1	df2	Sig.
2.292	3	113	.082

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+Locvdc

### Tests of Between-Subjects Effects

Dependent Variable: Ricebean production trend over three years

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	11.289(a)	3	3.763	8.512	.000	.184
Intercept	61.884	1	61.884	139.973	.000	.553
Locvdc	11.289	3	3.763	8.512	.000	.184
Error	49.959	113	.442			
Total	123.000	117				
Corrected Total	61.248	116				

a. R Squared = .184 (Adjusted R Squared = .163)

## Univariate Analysis of Variance

### Notes

Output Created		11-SEP-2009 16:53:44
Comments		
Input	Data	G:\Ricebean.sav
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	117
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.
Syntax	UNIANOVA rbpdntrend BY Locdist /METHOD = SSTYPE(3)  /INTERCEP T = INCLUDE /PRINT =	

		DESCRIPTIVE STATISTICS HOMOGENEITY /CRITERIA = ALPHA(.05) /DESIGN = Locdist .
Resources	Elapsed Time	0:00:00.00

[DataSet1] G:\Ricebean.sav

### Between-Subjects Factors

		Value Label	N
District	0	Gulmi	59
	1	Tanahun	58

### Descriptive Statistics

Dependent Variable: Ricebean production trend over three years

District	Mean	Std. Deviation	N
Gulmi	.42	.498	59
Tanahun	1.03	.794	58
Total	.73	.727	117

### Levene's Test of Equality of Error Variances(a)

Dependent Variable: Ricebean production trend over three years

F	df1	df2	Sig.
5.358	1	115	.022

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.  
a. Design: Intercept+Locdist

### Tests of Between-Subjects Effects

Dependent Variable: Ricebean production trend over three years

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	10.910(a)	1	10.910	24.925	.000	.178
Intercept	62.192	1	62.192	142.082	.000	.553
Locdist	10.910	1	10.910	24.925	.000	.178
Error	50.338	115	.438			
Total	123.000	117				
Corrected Total	61.248	116				

a. R Squared = .178 (Adjusted R Squared = .171)

## Univariate Analysis of Variance

Notes

Output Created		11-SEP-2009 16:55:43
Comments		
Input	Data	G:\Ricebean.sav
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	117
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.
Syntax		<pre> UNIANOVA   rbpdntrend   BY Locvdc   /METHOD   =   SSTYPE(3)    /INTERCEP   T =   INCLUDE    /POSTHOC   = Locvdc (   TUKEY )   /PRINT =   DESCRIPTI   VE ETASQ   HOMOGEN   EITY   /CRITERIA   =   ALPHA(.05)   /DESIGN =   Locvdc . </pre>
Resources	Elapsed Time	0:00:00.02

[DataSet1] G:\Ricebean.sav

### Between-Subjects Factors

		Value Label	N
VDC	0	Simichaur	30
	1	Darbardevisthan	29
	2	Manpang	28
	3	Bandipur	30

### Descriptive Statistics

Dependent Variable: Ricebean production trend over three years

VDC	Mean	Std. Deviation	N
Simichaur	.47	.507	30
Darbardevisthan	.38	.494	29
Manpang	.96	.793	28
Bandipur	1.10	.803	30
Total	.73	.727	117

### Levene's Test of Equality of Error Variances(a)

Dependent Variable: Ricebean production trend over three years

F	df1	df2	Sig.
2.292	3	113	.082

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+Locvdc

### Tests of Between-Subjects Effects

Dependent Variable: Ricebean production trend over three years

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	11.289(a)	3	3.763	8.512	.000	.184
Intercept	61.884	1	61.884	139.973	.000	.553
Locvdc	11.289	3	3.763	8.512	.000	.184
Error	49.959	113	.442			
Total	123.000	117				
Corrected Total	61.248	116				

a. R Squared = .184 (Adjusted R Squared = .163)

## Post Hoc Tests

### VDC

#### Multiple Comparisons

Dependent Variable: Ricebean production trend over three years

Tukey HSD

(I) VDC	(J) VDC	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Simichaur	Darbardevisthan	.09	.173	.958	-.36	.54
	Manpang	-.50(*)	.175	.026	-.95	-.04
	Bandipur	-.63(*)	.172	.002	-1.08	-.19
Darbardevisthan	Simichaur	-.09	.173	.958	-.54	.36
	Manpang	-.58(*)	.176	.007	-1.04	-.13
	Bandipur	-.72(*)	.173	.000	-1.17	-.27
Manpang	Simichaur	.50(*)	.175	.026	.04	.95
	Darbardevisthan	.58(*)	.176	.007	.13	1.04
	Bandipur	-.14	.175	.865	-.59	.32
Bandipur	Simichaur	.63(*)	.172	.002	.19	1.08
	Darbardevisthan	.72(*)	.173	.000	.27	1.17
	Manpang	.14	.175	.865	-.32	.59

Based on observed means.

\* The mean difference is significant at the .05 level.

## Homogeneous Subsets

### Ricebean production trend over three years

Tukey HSD

VDC	N	Subset	
		1	2
Darbardevisthan	29	.38	
Simichaur	30	.47	
Manpang	28		.96
Bandipur	30		1.10
Sig.		.958	.863

Means for groups in homogeneous subsets are displayed.

Based on Type III Sum of Squares

The error term is Mean Square(Error) = .442.

a Uses Harmonic Mean Sample Size = 29.226.

b The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c Alpha = .05.

## NPar Tests

### Notes

Output Created		11-SEP-2009 16:59:43
Comments		
Input	Data	G:\Ricebean.sav
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	117
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.
Syntax		NPAR TEST  /CHISQUAR E=pstmgtn ddiscontrl bttrfrmgrcti ces sdpreserv  prepandusof orgmanure  /EXPECTE D=EQUAL /MISSING

		ANALYSIS.
Resources	Elapsed Time	0:00:00.00
	Number of Cases Allowed(a)	112420

a Based on availability of workspace memory.

[DataSet1] G:\Ricebean.sav

## Chi-Square Test

### Frequencies

#### Pest management and disease control

	Observed N	Expected N	Residual
Yes	20	21.0	-1.0
No	22	21.0	1.0
Total	42		

#### Better farming practices

	Observed N	Expected N	Residual
Yes	47	27.0	20.0
No	7	27.0	-20.0
Total	54		

#### Seed preservation

	Observed N	Expected N	Residual
Yes	38	25.0	13.0
No	12	25.0	-13.0
Total	50		

#### Preparation and application of organic fertilizer

	Observed N	Expected N	Residual
Yes	18	19.5	-1.5
No	21	19.5	1.5
Total	39		

### Test Statistics

	Pest management and disease control	Better farming practices	Seed preservation	Preparation and application of organic fertilizer
Chi-	.095	29.630	13.520	.231

Square(a,b,c,d)				
df	1	1	1	1
Asymp. Sig.	.758	.000	.000	.631

a 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 21.0.

b 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 27.0.

c 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 25.0.

d 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 19.5.

## NPar Tests

### Notes

Output Created		11-SEP-2009 17:00:37
Comments		
Input	Data	G:\Ricebean.sav
	Filter	Locvdc=0 (FILTER)
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	30
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.
Syntax		NPAR TEST  /CHISQUAR E=pstmgtn ddiscontrl bttrfrmgrcti ces sdpreserv  prepandusof orgmanure  /EXPECTE D=EQUAL /MISSING ANALYSIS.
Resources	Elapsed Time	0:00:00.00
	Number of Cases Allowed(a)	112420

a Based on availability of workspace memory.

[DataSet1] G:\Ricebean.sav

## Chi-Square Test

## Frequencies

Pest management and disease control

	Observed N	Expected N	Residual
Yes	7	4.0	3.0
No	1	4.0	-3.0
Total	8		

#### Better farming practices

	Observed N	Expected N	Residual
Yes	20	20.0	.0
Total	20(a)		

a This variable is constant. Chi-Square Test cannot be performed.

#### Seed preservation

	Observed N	Expected N	Residual
Yes	16	16.0	.0
Total	16(a)		

a This variable is constant. Chi-Square Test cannot be performed.

#### Preparation and application of organic fertilizer

	Observed N	Expected N	Residual
Yes	4	2.5	1.5
No	1	2.5	-1.5
Total	5		

#### Test Statistics

	Pest management and disease control	Preparation and application of organic fertilizer
Chi-Square(a,b)	4.500	1.800
df	1	1
Asymp. Sig.	.034	.180

a 2 cells (100.0%) have expected frequencies less than 5. The minimum expected cell frequency is 4.0.

b 2 cells (100.0%) have expected frequencies less than 5. The minimum expected cell frequency is 2.5.

## NPar Tests

#### Notes

Output Created		11-SEP-2009 17:03:37
Comments		
Input	Data	G:\Ricebean.sav
	Filter	Locvdc=0 (FILTER)
	Weight	<none>
	Split File	<none>

	N of Rows in Working Data File	30
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.
Syntax	<pre> NPAR TEST /CHISQUAR E=pstmgtan ddiscontrl bttrfrmgrcti ces sdpreserv  prepandusof orgmanure  /EXPECTE D=EQUAL /MISSING ANALYSIS. </pre>	
Resources	Elapsed Time	0:00:00.02
	Number of Cases Allowed(a)	112420

a Based on availability of workspace memory.

[DataSet1] G:\Ricebean.sav

## Chi-Square Test

### Frequencies

#### Pest management and disease control

	Observed N	Expected N	Residual
Yes	7	15.0	-8.0
No	23	15.0	8.0
Total	30		

#### Better farming practices

	Observed N	Expected N	Residual
Yes	20	15.0	5.0
No	10	15.0	-5.0
Total	30		

#### Seed preservation

	Observed N	Expected N	Residual
Yes	16	15.0	1.0
No	14	15.0	-1.0
Total	30		

#### Preparation and application of organic fertilizer

	Observed N	Expected N	Residual
Yes	4	15.0	-11.0
No	26	15.0	11.0
Total	30		

### Test Statistics

	Pest management and disease control	Better farming practices	Seed preservation	Preparation and application of organic fertilizer
Chi-Square(a)	8.533	3.333	.133	16.133
df	1	1	1	1
Asymp. Sig.	.003	.068	.715	.000

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 15.0.

## NPar Tests

### Notes

Output Created		11-SEP-2009 17:04:22
Comments		
Input	Data	G:\Ricebean.sav
	Filter	Locvdc=1 (FILTER)
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	29
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.
Syntax		<pre> NPAR TEST /CHISQUAR E=pstmgtan ddiscontrl bttrfrmgrcti ces sdpreserv  prepandusof orgmanure  /EXPECTE D=EQUAL /MISSING ANALYSIS. </pre>
Resources	Elapsed Time	0:00:00.00

	Number of Cases Allowed(a)	112420
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a Based on availability of workspace memory.

[DataSet1] G:\Ricebean.sav

## Chi-Square Test

### Frequencies

#### Pest management and disease control

	Observed N	Expected N	Residual
Yes	11	14.5	-3.5
No	18	14.5	3.5
Total	29		

#### Better farming practices

	Observed N	Expected N	Residual
Yes	21	14.5	6.5
No	8	14.5	-6.5
Total	29		

#### Seed preservation

	Observed N	Expected N	Residual
Yes	21	14.5	6.5
No	8	14.5	-6.5
Total	29		

#### Preparation and application of organic fertilizer

	Observed N	Expected N	Residual
Yes	11	14.5	-3.5
No	18	14.5	3.5
Total	29		

### Test Statistics

	Pest management and disease control	Better farming practices	Seed preservation	Preparation and application of organic fertilizer
Chi-Square(a)	1.690	5.828	5.828	1.690
df	1	1	1	1
Asymp. Sig.	.194	.016	.016	.194

a 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 14.5.

### NPar Tests

### Notes

Output Created		11-SEP-2009 17:04:50
Comments		
Input	Data	G:\Ricebean.sav
	Filter	Locvdc=2 (FILTER)
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	28
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.
Syntax		<pre> NPAR TEST /CHISQUAR E=pstmgtan ddiscontrl bttrfrmprcti ces sdpreserv  prepandusof orgmanure  /EXPECTE D=EQUAL /MISSING ANALYSIS. </pre>
Resources	Elapsed Time	0:00:00.00
	Number of Cases Allowed(a)	112420

a Based on availability of workspace memory.

[DataSet1] G:\Ricebean.sav

## Chi-Square Test

### Frequencies

#### Pest management and disease control

	Observed N	Expected N	Residual
Yes	2	14.0	-12.0
No	26	14.0	12.0
Total	28		

#### Better farming practices

	Observed N	Expected N	Residual

Yes	3	14.0	-11.0
No	25	14.0	11.0
Total	28		

### Seed preservation

	Observed N	Expected N	Residual
Yes	1	14.0	-13.0
No	27	14.0	13.0
Total	28		

### Preparation and application of organic fertilizer

	Observed N	Expected N	Residual
Yes	1	14.0	-13.0
No	27	14.0	13.0
Total	28		

### Test Statistics

	Pest management and disease control	Better farming practices	Seed preservation	Preparation and application of organic fertilizer
Chi-Square(a)	20.571	17.286	24.143	24.143
df	1	1	1	1
Asymp. Sig.	.000	.000	.000	.000

a 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 14.0.

## NPar Tests

### Notes

Output Created		11-SEP-2009 17:05:12
Comments		
Input	Data	G:\Ricebean.sav
	Filter	Locvdc=3 (FILTER)
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	30
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.

Syntax		NPAR TEST  /CHISQUAR E=pstmgtan ddiscontrl bttrfrmgrpcti ces sdpreserv  prepandusof orgmanure  /EXPECTE D=EQUAL /MISSING ANALYSIS.
Resources	Elapsed Time	0:00:00.00
	Number of Cases Allowed(a)	112420

a Based on availability of workspace memory.

[DataSet1] G:\Ricebean.sav

## Chi-Square Test

### Frequencies

#### Pest management and disease control

	Observed N	Expected N	Residual
No	30	30.0	.0
Total	30(a)		

a This variable is constant. Chi-Square Test cannot be performed.

#### Better farming practices

	Observed N	Expected N	Residual
Yes	3	15.0	-12.0
No	27	15.0	12.0
Total	30		

#### Seed preservation

	Observed N	Expected N	Residual
No	30	30.0	.0
Total	30(a)		

a This variable is constant. Chi-Square Test cannot be performed.

#### Preparation and application of organic fertilizer

	Observed N	Expected N	Residual
Yes	2	15.0	-13.0
No	28	15.0	13.0
Total	30		

### Test Statistics

	Better farming practices	Preparation and application of organic fertilizer
Chi-Square(a)	19.200	22.533
df	1	1
Asymp. Sig.	.000	.000

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 15.0.