Empowerment Through Enrichment

On-farm IPM of Chickpea in Nepal 2

International Crops Research Institute for the Semi-Arid Tropics
Natural Resources Institute (NRI) and University of Greenwich
Nepal Agricultural Research Council
Department for International Development

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Abstract

Empowerment Through Enrichment is the second information bulletin and is the part of the Project on 'IPM of chickpea in Nepal'. It contains information about the mid-term evaluation of the project. This is in continuation of the first study, *Chickpea Production Constraints and Promotion of Integrated Pest Management in Nepal*. The mid-term evaluation revealed that the success of adoption of IPM technology was due to socio economic emancipation of peasants, freedom from the clutches of usurers and poorest among the poor being benefited. Market linkage strengthened farmer's faith in technologies. Since the chickpea is highly remunerative as a crop of rice fallow lands in winter (*rabi*), the technology is fast spreading to other villages. Sustainable environment will make the intervention spread faster. Removal of poverty by IPM-chickpea in Nepal is quantified in the third bulletin, *Wealth Generation through Chickpea Revolution*.

Acknowledgments

The study is a part of ICRISAT/DFID research project on IPM of chickpea adoption and its impact on livelihood, improvement of family income, nutrition and poverty elimination in Nepal. We are thankful to the executive director, scientists and field staff of Nepal Agricultural Research Council (NARC), Regional Resesarch Station (RRS), Khajura, and National Oil-seed Research Programme (NORP), Nawalpur, who helped in conducting the field surveys.

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Contents

Preface

The study *EmpowermentThrough Enrichment* is a part of an on-farm IPM of chickpea project in Nepal. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) along with Nepal Agricultural Research Council (NARC) and Natural Resources Institute (NRI) conducted the study. The Crop Protection Program (CPP) of the Department of International Development (DFID), UK, funded the study. ICRISAT, NRI and NARC jointly propagated an Integrated Pest Management (IPM) approach in major chickpea-growing regions in Nepal in a farmer participatory approach for two years. A quick mid-term participatory rural appraisal (PRA) was conducted to determine the impact of the improved IPM of chickpea on rural livelihoods, poverty alleviation and nutrition in target districts during the sowing period (October-November 2002). The data was collected from farmers who were divided into four separate groups. This base line data has provided an opportunity to assess the mid-term impact and made corrections for the successful accomplishment of the project objectivies. The final socio economic impact with PRA and the quantification of chickpea-IPM benefits will be published as a third separate bulletin detailing impact evaluation.

The authors have been successful in making farmers understand the benefits of using IPM technology for a good chickpea crop. Farmers from neighboring villages have begun to show interest in the new technology. Today, farmers sell seeds to NARC and other NGOs working in promoting IPM of chickpea technologies in Nepal.

William D Dar
Director General
ICRISAT

Executive summary

Nepal is a land-locked economy and 53% of the population is below poverty line. Eighty one percent population is involved in agriculture. The major factor limiting agricultural development is lack of proper irrigation. Farmers in Nepal have marginal and sub marginal land holdings. Agro inputs is scarcely available and maximum population in rural areas have no *pucca* houses. Moreover, Nepal has the lowest per capita income of $210 among the SAARC countries. Poverty is widespread and unemployment is acute in rural areas.

In such an environment, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and Nepal Agricultural Research Council (NARC), through their research for development of legumes, share the common mission of helping poor farmers. Integrated Pest Management (IPM) package for chickpea production was introduced to help farmers escape from the vicious circle of poverty.

Chickpea production in Nepal has been declining mainly because of botrytis gray mold (BGM) disease and pod borer (*Helicoverpa armigera*) insect. The joint mission of ICRISAT and NARC reversed this trend by using improved pest management techniques. IPM rehabilitated chickpea, which was once an important crop of Nepal, specifically in hillside-*Terai* regions. Abiotic and biotic stresses relegated chickpea production. The stresses changed chickpea economics for marginal and sub marginal farmers. Nepalese farmers were not in a position to bear continuous crop failure. Farmers adopted either less remunerative crops or preferred to leave the land fallow in winter (*rabi*). This affected the quality of life of poor farmers badly.

Together IPM and rehabilitation of chickpea, has again made the life of the farmers happy with more income, food, use of fallow lands, addition of capital equipment, construction of *pucca* houses, purchasing more livestock, improved healthcare and sending children to school.

Chickpea made tremendous impact on the farmers' livelihood, which was probably beyond the dreams of the scientists of ICRISAT and NARC in the year 2000.

The project can create employment opportunities, increase income and soil structure, long term agriculture sustainability and food security to the poorest among the poor people. It will also encourage import substitution and improve soil and farmers' health.

Introduction

Chickpea is the most preferred pulse crop in Nepal. The crop production in Nepal has been declining mainly because of botrytis gray mould (BGM) disease and pod borer (*Helicoverpa armigera*) insect. BGM epidemic and pod borer infestation brought chickpea production to zero level in central and eastern *Terai* of Nepal. The vicious circle made rehabilitation of chickpea farming very difficult. Constant crop failure left farmers poorer.

ICRISAT and NARC reversed this trend by using IPM technology. Use of this technology changed the economics of the crop. A large number of marginal and poor farmers participated, learned technologies to avert the risk of crop failure, and improved their livelihood.

Nepal is the poorest country among all the SAARC nations. It has the lowest per capita income of $210 (Fig 1).

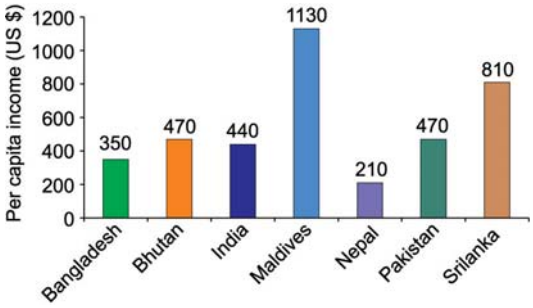


Figure 1. Per capita income of SAARC nations.

Poverty is widespread and unemployment is acute in rural areas. Employment opportunities in rural farms and non-farm sectors are limited. Agriculture engages 81% of the rural population; the pace of transfer of labor from agriculture to non-agriculture sector has been very slow. Lack of adequate opportunities in the agricultural sector is creating social problems like mass migration to neighboring countries, cities and agriculturally prosperous areas in search of employment. Poverty, unemployment, illiteracy, sale of female children and migration are rampant in Nepal.

Since 1995-96 import bills of Nepal, particularly for the food and animals, are showing an increasing trend. In 1995-96, it was NRs 4785.8 million. In 1998-99, it increased to NRs 7619.5 million (Fig 2).

Nepal can reduce the import burden to some extent by cultivating remunerative crops. The Nepal *Terai* has 0.26 million-

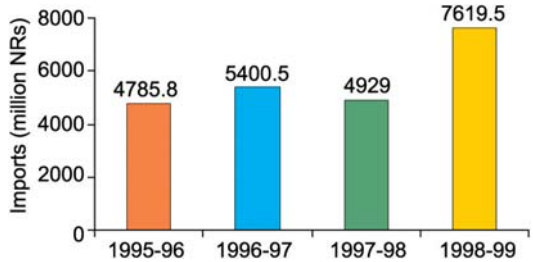


Figure 2. Imports by Nepal.

hectare rice fallow lands. This vast resource goes waste during winter. Farmers either grow less remunerative crops or leave it fallow due to non-availability of technology and irrigation. Maximum rice fallow lands lie in the central region. Use of this area for cultivation has benefited poor, deprived, small and marginal holders. But the IPM package has increased the area under cultivation of chickpea and its yield. Chickpea is a price competitive crop in Nepal *Terai*.

To overcome these deficiencies and to address the plight of chickpea farmers, ICRISAT and NRI in collaboration with NARC have launched an aggressive program in the *Terai* region. The Department for International Development (DFID), UK, supported and funded the project. The aim of this program was to raise chickpea productivity through technology intervention and improve the economic well being of chickpea producers. It was also anticipated that augmentation of chickpea area through an ensuring innovation program would enrich the nutritional security of the chickpea producers and improve the sustainability of eroding soil and water resources. The initiative of the proposed program was to integrate available technology to manage insect-pests and diseases and make chickpea production more competitive.

The introduction of IPM package has helped deprived farmers improve soil health, utilization of fallow land and change crop pattern from less remunerative to more remunerative one. In Nepal hillside-*Terai*, where the technology has reached, farmers' livelihood pattern has changed. The magnitude of change in livelihood differs from group to group, village to village and farmer to farmer. The impact on

livelihood is visible clearly during the quick PRA/RRA (participatory rural appraisal/ rapid rural appraisal) in Nepal.

The land holdings in Nepal are very small and marginal, approximately 89% land holdings are uneconomic, 8.4% are medium and only 2.6% are in large categories (Fig 3). Nepal is a small country and 50.3% of its population lives below poverty line. There are 12 million poor in the country (Fig 4).

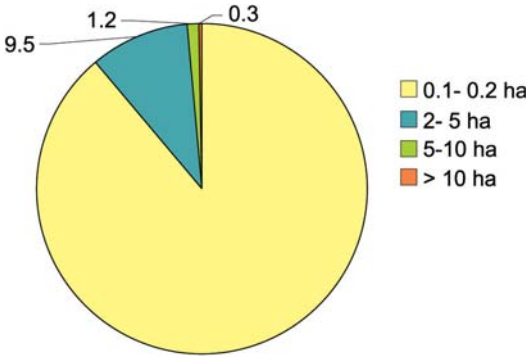


Figure 3. Size of land holding in Nepal 1991–92.

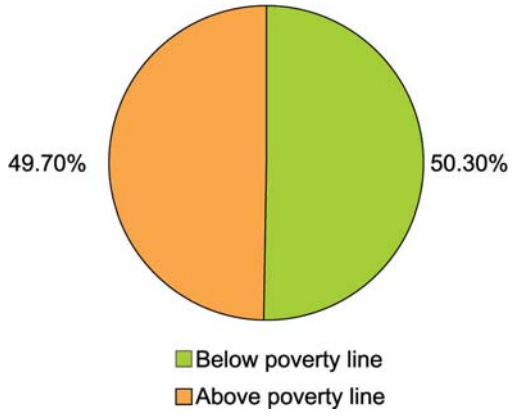


Figure 4. Population below poverty line in Nepal.

To improve the economic status of the poor farmers and the poverty-ridden small landholders, ICRISAT, NARC and NRI are in the process of exploring ways to increase production of chickpea with the help of IPM technology and agro economic interventions. This program aims at demonstrating the technical feasibility of introducing IPM for *rabi* crops. For the *rabi* season of 2000-2001, chickpea along with IPM package was promoted in midwest and central regions that have minimal inputs under rainfed conditions. The present mid-term project evaluation was conducted to assess the promotion and adoption of IPM technology in Nepal.

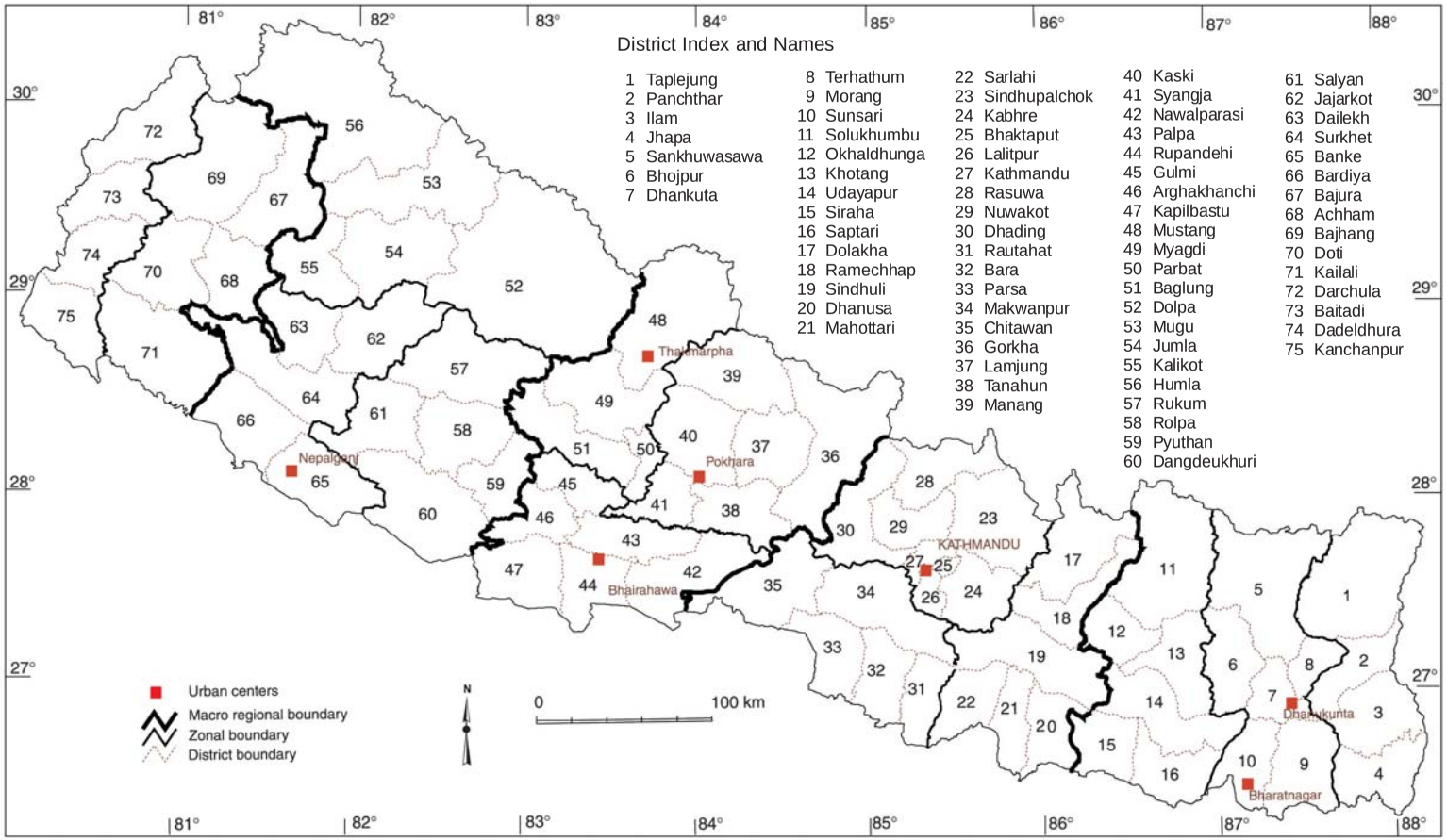
The main objectives of this study were:

- Impact of IPM on chickpea production.
- Impact of chickpea production on livelihood of Nepalese farmers.

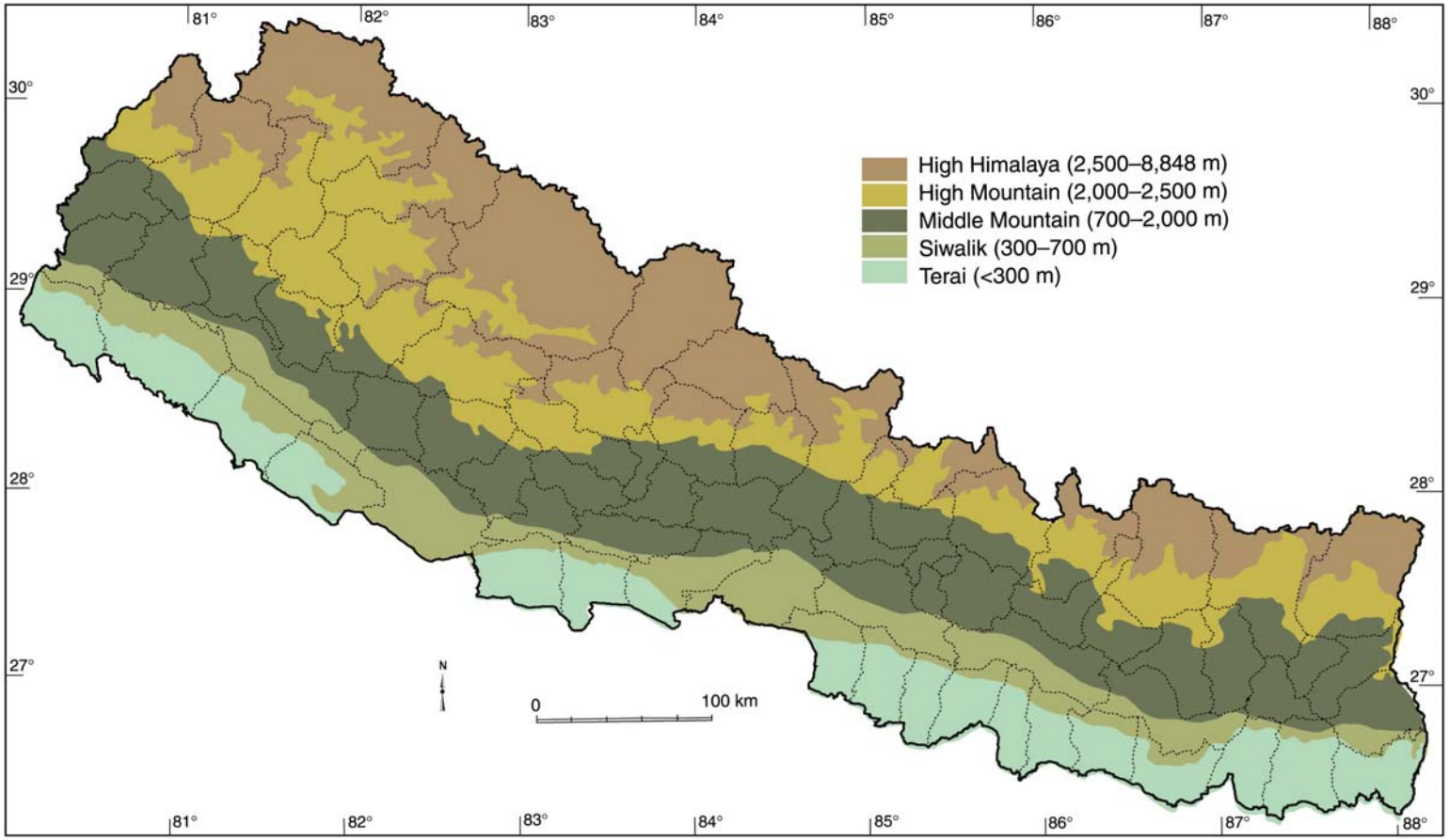
2. Methodology

2.1. Study sites

Nepal has borders with China in the north and India in east, south and west (Map 1 and Map 2). The east-west length of the country is 800 km and the width varies between 130 and 240 km. There is a wide climatic variation ranging from hot and humid subtropical in the low lands to captive areas four meters above sea level. The whole of *Terai* region adjoins the Indian *Terai* and is the most fertile and productive belt in Nepal. Agriculture in Nepal *Terai* is deteriorating in the absence of appropriate products and policy environment. This section provides an outline of the study area, sampling approaches and the data for the study. Only midwest and central economic development regions are considered for the study.



Map 1. Administrative divisions (districts) and major urban centers in legume-growing areas of Nepal.



Map 2. Physiographic regions of Nepal (Source: Topographic Survey Branch, Department of Survey, His Majesty's Government, Nepal, 1983).

The districts selected for livelihood study are Sarlahai and Bardia situated in central and midwest eco region of Nepal (Map 1). The districts are in the hillside-*Terai* of Nepal. The land area of the *Terai* is 23% of the total area of Nepal, but accounts for 52% of the total cultivated land in the country. It was originally a forest and was largely composed of alluvial soil, highly suited for agricultural activities. The *Terai* region is referred to as the country's breadbasket. The Sarlahai district lies in the central economic development region and Bardia in the midwest development region of Nepal.

More than 90% of chickpea area in the country is confined to the *Terai* region. To understand and diagnose the impact of chickpea cultivation on the livelihood of people, two economic development regions were selected for the study. *Terai*-foothill region lies in the extreme south along Nepal-India border and varies in height from 60-750m. It is a narrow belt of 50 to 20 km in breadth, which stretches along the entire length of the country. The slope or gradient ranges from 2-10 m/kilometer.

2.2 Sampling

Through random group interviews, data was recorded. Four groups were selected from each village where the IPM package was given by ICRISAT. If a particular group was not available in the village then another village was selected for such a group.

The farmer study groups are:

I. Farmers growing chickpea not using IPM.
II. Farmers growing chickpea using IPM (indirect).
III. Contact farmers of ICRISAT/NARC.
IV. Farmers neither using IPM nor growing chickpea.

The data was collected in groups in all the selected villages. In the first group, the number of farmers growing chickpea but not using IPM was 57. These farmers usually grew local varieties of chickpea.

The number of farmers in second group for livelihood study was 67, these farmers grew chickpea using IPM, but they were non-contact farmers. They learned about the technology from contact farmers of ICRISAT/NARC.

The third group consisting of 106 farmers was given IPM package by ICRISAT/NARC. They adopted IPM practices for the last two years.

The fourth group is a control group, which has 74 farmers. They neither grow chickpea nor use IPM. They did have experience in growing chickpea but due to biotic and abiotic stresses, they discontinued growing the crop.

The study was conducted in villages where IPM technology was disseminated to farmers directly; indirectly or where the package was not given. In central region, Lalbandi, Bardibas and Jabdik villages were selected for the study, while in midwest region Munalbasti, D-gaon, E-gaon, Lalpur, Khajura and Bhandar were selected.

To obtain unbiased results, non-contact farmers (not growing chickpea and not using IPM) were also interviewed. This group of 74 farmers comprised about 17 farmers from Jabdik village, 17 from Lalpur, 11 from Khajura and 29 from Bardibas.

In a single village if all the category farmers were unavailable, interviews were held in other villages also. A total of 304 respondents were interviewed (Appendix 1).

2.3 Data

The respondents were the only decision makers regarding new crops (Appendix 2).

Male as well as female farmers equally participated in the focus group interviews. The questions asked related to the respondents' livelihood and impact of IPM packages. This exercise of participatory learning with the help of a brief questionnaire (Appendix 3) tried to bring out the impact of IPM technologies provided by ICRISAT/NARC on the livelihood of farmers. Farmers' participation was the key source of information and data collection.

2.4 Strong ordering

Strong ordering of preferences was the basis for collection of data. Ordering means listing of preferences given to a person. In the strong ordering of preferences, a farmer group chooses from a basket of goods, crops, etc revealing one's definitive preference from the alternatives open. Strong ordering rules out the possibility of indifference on the part of the farmers between alternative combinations. In this way the preferences regarding various choices of production, consumption, expenditure, agriculture output and consumption were decided.

These questions were written in Nepali on bid posters, so that any literate person could understand the questions and react to them. The villagers responded in Nepali and it was recorded in Nepali as well as in English.

2.5 Village and household characteristics

This section presents the characteristics of villages, where farmers are growing chickpea not using IPM, farmers growing chickpea using IPM (indirect), contact farmers of ICRISAT/NARC and farmers neither using IPM nor growing chickpea.

Sub-marginal, marginal and small farm agriculture is a noted feature of the selected villages. These villages came into being 25 years back. His Majesty's Government (HMG) of Nepal allotted the land to the farmers after clearing the forests. In three villages, landless farmers were also identified (Table 1). While maximum holding in all the villages under study other than Jabadik and Lalpur, is less than one hectare in size. The average size of a family in Nepal is 6.89 (Bourai et al. 2002). The agriculture holding of less than one hectare for such a family size becomes economically non-viable.

The agricultural pattern of Lalbandhi and Bardhibas is rice-wheat/chickpea/lentil-rice. While the agriculture pattern of Jabdik is rice-wheat-rice.

Table 1. Landholding in villages.

Land (Katha)*	Lalbandi	Bardibas	Jabdik	Munal Basti	Lalpur	E-gaon	D-gaon	Khajura	Bhandari
0-5	1	2	0	4	0	0	1	2	1
5-10	17	12	0	11	0	0	2	7	3
10-15	11	14	0	20	0	4	0	2	1
15-20	42	32	0	2	0	1	0	0	11
> 20	11	17	15	0	23	5	16	0	1
Landless	2	9	2	0	0	0	0	0	0

Survey report 2002 (Reported by the groups of the farmers).
* 1 hectare = 29.53 kathas

The agriculture pattern of D-gaon, E-gaon and Munalbasti is rice-wheat/chickpea/lentil/mustard-rice. While in Lalpur and Khajura the agriculture pattern is rice-wheat/lentil/mustard-rice.

Agriculture is the main source of employment in villages. More than 95% farmers reported agriculture as the source of employment. A large number of Nepalese migrate for petty jobs to towns in Nepal and India. Temporary migration increases during *rabi* season thereby causing scarcity of human labor in the sowing period.

Village and household characteristics indicate underdevelopment of agriculture, lack of opportunities for employment in farm and non-farm sectors, and poor infrastructure facilities to promote agricultural development.

The size of land holding in Nepal when compared to other developing countries is small (less than one hectare). Often these holdings are economically non-viable. The land holdings in the *Terai* region are relatively better. But there have been again divisions of these holdings in last 20 years making them economically non-viable in the process.

Across the region, the holding size is unevenly distributed. It ranges from 0.83 hectare in central region to 2.58 hectare in midwest region. There are reports that non-wheat and non-chickpea producers keep the land fallow during winter season after rice and maize crop.

The rice fallow land in Nepal *Terai* is 0.39 million hectares (Subbarao et al. 2001). While another report (Bourai et al. 2002) says 0.26 million-hectare is rice fallow land. The average cropping intensity of Nepal is about 200%. In general, most of the land of a chickpea producer is upland and rainfed.

3. Livelihood of nepalese farmers

Nepalese farmers are poor and have a very low agricultural capital. They are caught in the vicious circle of poverty. The villagers are unable to fulfill even their basic needs of life and the society seems to be plagued with mass poverty. The Population Reference Bureau 1997, estimated 50.3% of the Nepalese population live below poverty line. The villages like Jabadik reported in a group interview that approximately 50% household are landless, same as in Hong Kong Danda and Bardibas. Farmers in these villages use land on rent. The rent is usually about 50% of the agricultural output. During PRA group interviews, farmers chose house, agricultural land, livestock and agricultural infrastructure as the most important assets.

The strong order of assets decided by the farmers is as follows:

- House
- Agricultural land
- Livestock
- Agricultural infrastructure

3.1 Housing

Housing is also a problem in Nepal. A farmer defines the quality of house as *pucca* and *kaccha*. The *pucca* house is better than the *kaccha* one (mud house). On an average, in all groups only 8% farmers had *pucca* houses. The other 92% had *kaccha* houses (Fig 5). A farmer considers *pucca* house as an important asset for survival. A few farmers were houseless. Low income forced farmers to live in *kaccha* houses.

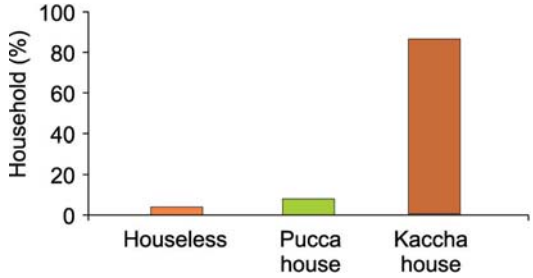


Figure 5. Asset (housing).

3.2 Agricultural land

Agricultural land is considered by the farmers as one of the most important asset for livelihood.

3.3 Livestock

In the first group, farmers growing chickpea without using IPM reported their preference in the order of cow, buffalo, goat and poultry. In this group, not all the farmers possessed all these assets. Fig 6 shows 82% farmers had cows, 59% ox, 54% buffaloes, 33% goats and 9% poultry. In the first group, asset deficit farmers are evident. Ox and plough are the most important agricultural capital assets of a farmer. Absence of these increased the cost of production. Ox is considered an important capital livestock but only 59% farmers had them in the first group, 23% in the second group, 23% in the third group and only 7% in the fourth group.

3.4 Agricultural infrastructure

The farmers consider agricultural infrastructure as an important asset. However, a few could not even afford a plough which is the basic equipment for agriculture. Eighty percent farmers had plough; the other 20% were without one. Lack of money pushed up the cost of production. Only a few possessed spray pump, also an important asset. In non-contact villages, improved seed availability practices were absent. In the two study regions, only 10% farmers had access to irrigation pump set or tube wells. The farmers could not invest in assured irrigation. Only 2.98% sample farmers in non-contact group had tractors. In ordering of infrastructure, second and third groups had more agricultural infrastructure when compared to fourth and first group who were not a part of contact programs of ICRISAT/NARC (Fig 7).

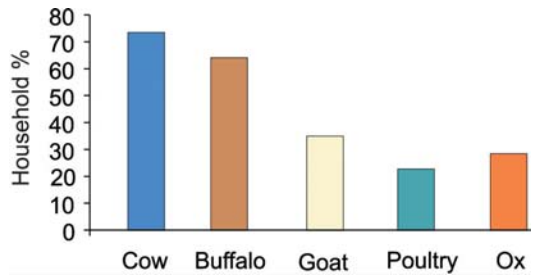


Figure 6. Assets (Livestock %).

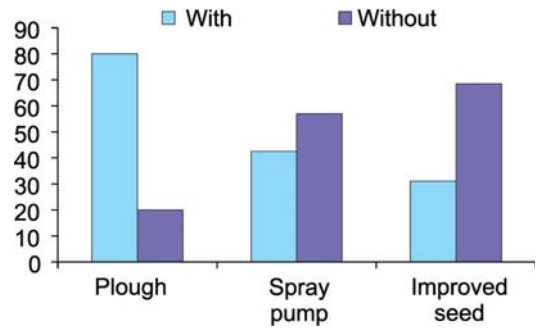


Figure 7. Agricultural infrastructure.

3.5 Expenditure priorities

Expenditure priorities reported by farmers of all the groups were almost the same; food was the first preferred expenditure. Maximum number of farmers reported that the crops they grew were sufficient to feed them only for six months in a year. The contact farmers along with the other two groups reported expenditure on education as the second priority. The groups selected clothes as third priority. Agricultural inputs were the last among the expenditure priorities. Fulfillment of basic minimum needs was very difficult in study villages. Table 2 shows the preference for expenditures. Vicious circle of poverty compelled farmers to use their incomes to fulfill basic needs for survival.

4. IPM impact on chickpea cultivars

Impact on consumption

The first group chose rice, wheat and maize from the list of food grains. Two groups – contact and indirect contact – placed chickpea in second place. Farmers growing chickpea and not using IPM placed chickpea in the third place. The fourth group consisting of farmers who neither used IPM nor grew chickpea did not give any preference despite liking the chickpea crop. The role of this product is no more in their life (Table 3).

Table 2. Expenditure priorities.

	Priorities ranking				
Groups	Food	Cloth	Education	Fertilizer	Pesticide
Group I	1	3	2	5	6
Group II	1	3	4	5	6
Group III	1	3	2	4	5
Group IV	1	3	2	4	5

Source: Field survey December 2002

Table 3. Preferences for food consumption.

Preference for food consumption	Groups			
	Group I	Group II	Group III	Group IV
Cereals				
1.	Rice	Rice	Rice	Rice
2.	Wheat	Wheat	Wheat	Wheat
3.	Maize	Maize	Maize	Maize
Pulses				
1.	Pigeonpea	Pigeonpea	Pigeonpea	Lentil
2.	Lentil	Chickpea	Chickpea	Pigeonpea
3.	Chickpea	Lentil		Blackgram

Source: Field survey December 2002

For maximum pulse consumption, and under no choice conditions, many preferred pigeonpea. However, in places where chickpea regenerated, farmers preferred it in the second place.

4.2 Impact on production

Rice, wheat, maize and vegetables was the households order of preference (Table 4). Only one group – growing chickpea not using IPM – preference was rice, maize, wheat and vegetables. The preference of foodstuffs was mainly due to the food security problems in Nepal. The farmers who directly or indirectly had IPM technology preferred chickpea.

4.3 Chickpea awards

Krishna Kumari Shrestha, received an award from his Majesty's Government of Nepal (HMG) for her record chickpea yield of four tons per hectare. A scientist from ICRISAT also received an award for regeneration and rehabilitation of chickpea in Nepal. On completing 25 years of partnership with ICRISAT, HMG honored scientists from NARC for bringing about a chickpea revolution in Nepal.

The choice of production preferences among pulses was in the order of chickpea, pigeonpea and lentil in both contact farmers of ICRISAT / NARC as well as indirect contact farmers or nearby village farmers to whom the IPM technology was disseminated through farmers or relatives. The IPM adoption rate in the contact villages was quite high. It is also spreading to nearby villages due to its high economic value and market clearance. This is one of the reasons for other farmers to switch

Krishna Kumari Shrestha

Table 4. Preferences for food production.

Preference for food consumption	Groups			
	Group I	Group II	Group III	Group IV
All food				
1.	Rice	Rice	Rice	Rice
2.	Maize	Wheat	Wheat	Wheat
3	Wheat	Maize	Maize	Maize
4	Vegetable	Vegetable		
Pulses				
1.	Lentil	Chickpea	Chickpea	Lentil
2.	Pigeonpea	Pigeonpea	Pigeonpea	Pigeonpea
3.	Chickpea	Lentil	Lentil	Pea
4	Pea			Horse gram

Source: Field survey December 2002

over to use of IPM technology. Chickpea price is highly preferable when compared to the other winter crops. It was once a highly profitable crop for the farmers. Since IPM package has limited biotic and abiotic constraints, the rate of adoption in contact villages became quite high with neighboring villages also joining them.

IPM study has shown the results of investment made from 2000 to 2002. In course of time, this crop will dominate Nepal because it directly affects the quality of life of the poorest people.

Once lentil was the main choice among pulses in the Nepal *Terai*. This was because of good yield, easy availability of seed and less labor. Since lentil was disease-resistant, it was considered risk-free. Now lentil dominates only where IPM technologies for chickpea do not exist.

Pigeonpea was the second choice. Pigeonpea is a low cost crop, improves health, good to taste, provides cattle feed, protects from diseases, does not require much irrigation and involves less labor. Despite of all these qualities, direct or indirect contact farmers have preferred chickpea (Table 5).

Farmers from all villages preferred chickpea due to availability of seeds, high selling price, multiple uses, high profit margin, yield, increase in soil fertility and health benefits. Pea was the last in order of preference.

4.4 Earning for livelihood

Eighty one percent population of Nepal depends on agriculture, which is the main source of income of the rural people.

In case of the first group, the order of preference for profitable crops was rice, lentil, pigeonpea, wheat and chickpea. These are subsistence crops and sometimes the farmers use the little surplus for barter or sale. The first group reported chickpea as the least profitable crop. This is because they grew it without using IPM package. The yield and profit decreases in case of this group, due to biotic and abiotic stresses.

Table 5. Preference in food consumption and production.

Groups		Causes of preference in food consumption and production
Group I	*Lentil*	- High yield, seed available, easy to cultivate, land fertility
	Pigeonpea	- Low cost, good for health, tasty, cattle feed.
	Chickpea	- Local seed availability, high price, multipurpose uses, high margin of profit.
Group II	*Pigeonpea*	- Helps protect them from the diseases, health benefits, no irrigation, drought tolerant.
	Chickpea	- High yield, Increased price, multiple uses.
	Lentil	- Easy to produce.
Group III	*Chickpea*	- High yield, high price, multiple uses, soil fertility, good for health.
	Pigeonpea	- Helps protect them from diseases, good for consumption.
Group IV	*Lentil*	- Easy to cultivate, income provider, lowland crop, disease resistant, multipurpose
	Pigeonpea	- Low cost, less hard work, good taste.
	Pea	- For consumption.

Source: Field survey December 2002

The second group, indirect contact, learned IPM and preferred chickpea as a profitable crop. In this group, chickpea occupied the third place, but stands last in profit earning. The change in ranking of chickpea was due to the IPM package.

In the contact farmers choice regarding profitable crops, chickpea stood in the second place. These farmers made use of IPM and had knowledge about the technology. In Lalbandhi village, there was a chickpea revolution among the farmers. They considered it as the most profitable crop. Some earned profits up to NRs 60,000 one season, which is a fat margin in the rural areas. There are a number of farmers in this category (Table 6). The order of preference changed according to the use of IPM by the farmers.

4.5 Chickpea area

The interviews of focus group farmers revealed area under chickpea increased after the introduction of IPM package (Fig 8). Its impact was also visible on indirect groups. The first group (those without IPM package) explained that the chickpea area was decreasing very fast. All the farmers in this group reported that the chickpea area was declining. The second group (indirect contact) had mixed responses. Fifty percent farmers reported increase in chickpea area due to high price of the product as well as consumption preferences. Twenty five percent reported decrease in chickpea area due to drought and decreasing fertility of land. About 25% farmers of this group reported that land area of chickpea was constant because they replaced tomato crop by chickpea. This was because chickpea could be stored for a longer period and they could earn price fluctuation benefits. Farmers reported that tomato suffered huge losses due to its perishable nature. The profitability in chickpea was very high when compared to other winter crops. Since tomato was replacing chickpea, the area remained constant. But the facts speak otherwise (ie, durable chickpea is gaining while perishable tomato is loosing). The reduced output of tomato also provided profitable price to the farmers. The ICRISAT/NARC contact farmers reported 100% increase in chickpea area due to IPM (Fig 8).

Improved seeds and availability, high yields, profits, enhancement of knowledge during training and the use of less labor were

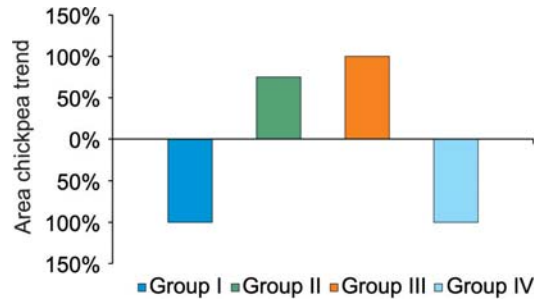


Figure 8. Area chickpea trend.

Table 6. Main source of profit earning.

	Sources preference				
Groups	I	II	III	IV	V
Group I	Rice	Lentil	Pigeonpea	Wheat	Chickpea
Group II	Vegetable	Diary	Chickpea	Lentil	Poultry
Group III	Vegetable	Chickpea	Milk product	Lentil	_

Source: Field survey December 2002

causes of increase in chickpea area and yield in Nepal. Pod borer epidemic, BGM and abiotic stresses have led to many farmers discontinue chickpea production.

The yield of local seed and product price were not competitive due to biotic and abiotic stresses. If a few farmers grew chickpea, the fallow farmers resorted to stealing green chickpea in villages. In a few cases, sugarcane replaced chickpea due to environmental and economic externalities.

4.6 Land use for chickpea

The farmers reported use of land categories for chickpea production differently. The farmers grew chickpea mainly on the rice and maize fallow lands. Use of fallow land generated more employment in Nepal. Farmers also reported use of uplands. Optimum land use provided employment and income to deficit and marginal farmers of Nepal *Terai* (Table 7).

Table 7. Land type for chickpea cultivation.

	Land quality (ranking)	
Groups	I	II
Group I	Rice and maize fallow land	Upland
Group II	Upland	Rice fallow
Group III	Upland	Rice and maize fallow

Source: Field survey December 2002

Utilization of rice and maize fallow lands and uplands increased because of IPM. It generated substantial income and employment opportunities for many smallholders in the midwest and central region. Chickpea cultivation is estimated to yield a minimum of NRs 8000 ha^{-1}.

If the IPM program spreads with the same spirit to other parts of Nepal, it can generate a total of 1.29 million man days of employment and that too only at the 10% utilization of reported rice and maize fallow land. This seems to be a huge untapped resource for optimum utilization of livelihood for future generations.

4.7 Use of chickpea profits

Farmers are earning good profits from chickpea production. These farmers are direct contact and indirect contact farmers of NARC/ICRISAT. These groups have reported use of profits for their economic emancipation.

Utilization of profits by direct contact and indirect contact farmers:

- Child (male/female) education.
- Medicine for health (healthcare).
- Deficit food purchases.
- Discharge of debts.
- Purchase of agriculture land.
- Purchase of livestock.
- Construction of *pucca* house.

The chickpea farmers who adopted IPM were earlier living in abject poverty. Now they are using profits for children's education and buying medicines. In general, the agriculture output is insufficient to feed a peasant's a family. Thus, the surplus is used to purchase food in deficit. A number of farmers have reported that they have been able to repay their debts and freeing themselves from the debt trap. Farmers have also purchased agricultural land and cattle particularly ox. Some farmers who produced chickpea with IPM on 20-30 katha lands in Lalbandi and D-gaon have constructed a new *pucca* houses.

Another group, indirect IPM users, reported differently. All farmers of this group are using chickpea for self-consumption, discharge of debts, food security, education and healthcare. Farmers from other villages contacted us and showed interest in IPM intervention and training. The farmers from nearby villages contacted the NARC officials for intervention of IPM in their villages. They were keen due to the economic changes taking place in contact villages. These farmers are not aware about the IPM packages (Fig 9 and Fig 10).

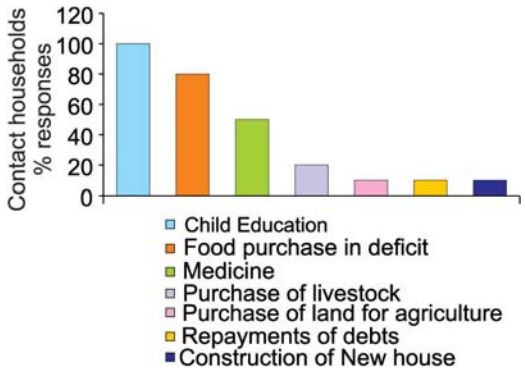


Figure 9. Chickpea profit utilization (contact farmers).

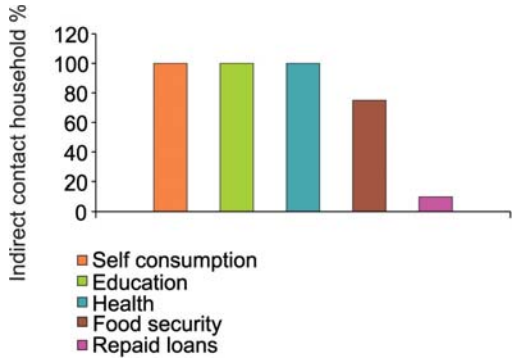


Figure 10. Chickpea profit utilization (indirect contact farmers).

4.8 Seed sector

Chickpea farmers have adopted the practice of seed storage for next season. This has been possible due to IPM use. Some farmers preserved seed to sell to other farmers who do not have the seed with them. The price of chickpea seed is quite high in villages. The chickpea seed market/ business is thriving in villages. In the first group, the farmers stored on an average of about 15 kg seed, while the rest stored 10-20 kg. In second group, indirect contact farmers stored 25 kg seed on an average. The IPM package knowledge has increased seed storage among the chickpea cultivators. This practice of storage has increased due to less seed storage losses. Overall, it has been found that the rate of damage of chickpea was reduced.

In the second group, farmers stored approximately 25 kg of chickpea seed per household. These farmers had more knowledge of IPM package. The third group consisting of direct contact farmers of NARC/ICRISAT had 45 to 55 kg seeds for storage per household. The chickpea seed business is flourishing in contact villages. These farmers sell seed on high prices to the farmers of other villages. In the year 2000, seed storage was high and rate of damage reduced (Fig 11).

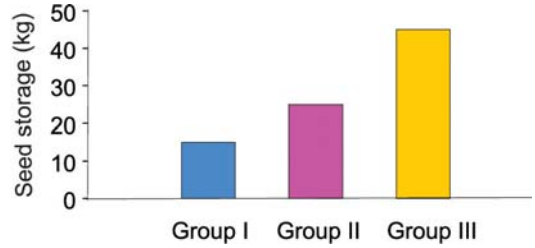


Figure 11. Seed storage of chickpea.

Price of chickpea seed is higher than chickpea for consumption. There are number of seed farmers in Lalbandhi and D-gaon who are selling seed in large quantities. The farmer-to-farmer sale of chickpea seed is quite popular and remunerative in the villages (Table 8). In crisis, farmers purchase chickpea seed from agriculture input dealers in the open market. D-gaon dealer has also provided 500 kg of *Avrodhi* seed to FORWARD, a national NGO, based in Chitwan for seed distribution for rice fallow sowing in 2002.

Table 8. Source of buying seed.

	Source of buying seed (ranking)	
Groups	I	II
Group I	Farmer to farmer	From market
Group II	Produce ourselves	From market
Group III	From project	Farmer to farmer

Source: Field survey December 2002

In central region, a Lalbandi private entrepreneur took the initiative to produce seed. He went in for tripartite agreement with a large number of farmers. He has plans to procure 7000 kg of seed in this winter.

4.9 Market linkages

Dahal, an entrepreneur, who deals in agriculture inputs and has market linkages for agricultural products, developed linkages with chickpea farmers of Lalbandi. The NARC has made a tripartite agreement between farmer, entrepreneur and NARC. According to Dahal, the output of an improved variety of chickpea seed named *Avrodhi* is 120 kg/katha. He estimated the cost of production per katha at NRs 500. It includes all inputs. The agreement, which he made with the farmers, is at 10% higher than the market price of same quality of chickpea. Dahal has reported the market price of *Avrodhi* seed is between NRs 30-35 for one kilogram. The farmer is getting NRs 3600/katha and after deducting the cost of products, the net value generated equals to NRs 3100. This product is beneficial for the small farmers as it enhances their incomes. In this particular area of Lalbandi and Bardibas, the crop is replacing tomato very fast. The entrepreneur's agreement is for a period of three years for seeds of sunflower, mustard and chickpea. In Lalbandi, area chickpea ranks high in farmers preference. Among the pulses it is preferred for production. Before the introduction of IPM, it was preferred at the last.

Now IPM has eliminated the uncertainties in the lives of chickpea farmers. The market demand and supply price mechanism works in their favour without adding additional burden. Chickpea in their opinion is:

- Drought resistant.
- Remunerative.
- Less labor intensive.
- Less water intensive.
- Good for storage.
- Good for consumption.

The use of IPM package is much more helpful to the poorest migrated hill farmers with small landholdings.

4.10 Employment from chickpea production

In the first group, 25% households considered that the chickpea output would provide

additional employment opportunities to the unemployed farmers in *Terai* of Nepal. They believed that could create additional gainful employment for them in winter. In the second group, (indirect contact) 50% reported increase in employment opportunities (Figure 12).

In the third group (contact farmers), 80% reported that use of IPM increased employment opportunities because they were utilizing rice fallow and maize fallow land along with uplands.

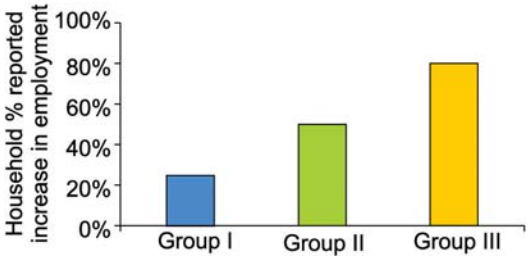


Figure 12. Work out of chickpea production.

4.11 Why chickpea cultivation

The chickpea has high yield, market price, increases the fertility of soil, has multiple uses and is good for consumption. A higher profit is an important reason for chickpea production. The farmers reported that the introduction of improved pest management technology and knowledge is the main cause of chickpea regeneration (Fig 13).

4.12 Why not chickpea cultivation

The first group has reported that the fear of insect pod borer, unknown disease, BGM, scarcity of seed, lack of technical knowledge and terminal drought are the main causes for not growing chickpea. In other groups, high price of quality seed and poor yield due to pests are the main reasons for not growing chickpea. The third group reported that pod borer, diseases, land quality, low and uneconomic output are the main causes (Fig 14).

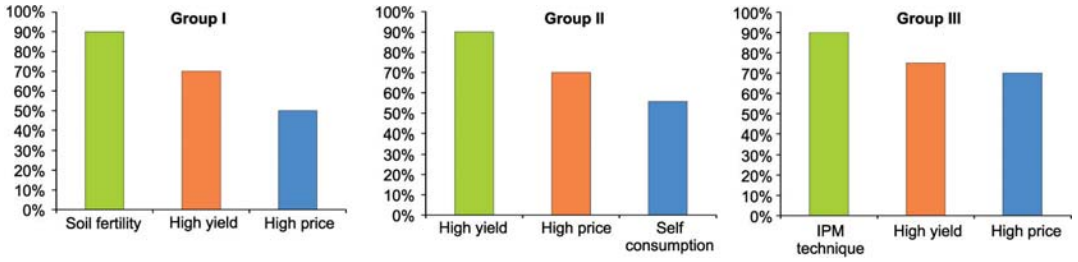


Figure 13. Causes of growing chickpea (household%).

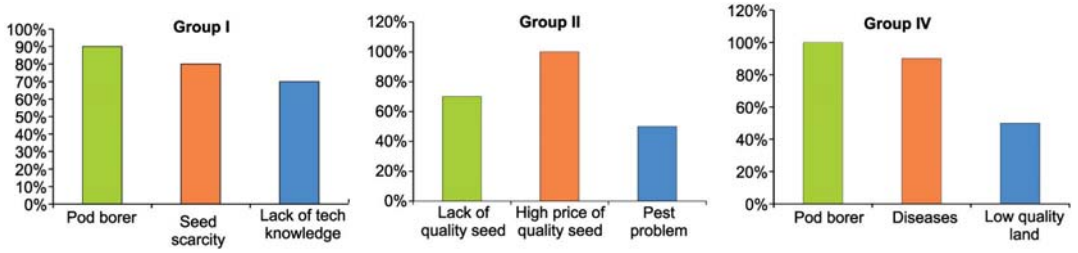


Figure 14. Causes for not growing chickpea (household%).

4.13 Chickpea yield after IPM use

Chickpea yield has increased substantially after the introduction of IPM package. Where it was not used, the yield per katha is either very low or it is at zero level. The first group did not use IPM while second and third group used IPM (Fig 15).

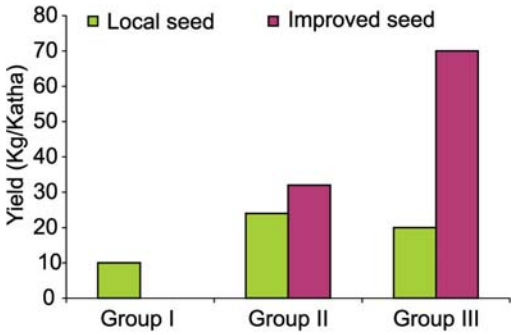


Figure 15. Chickpea production after using improved seed and IPM.

5. Conclusions and suggestions

Conclusions

Introduction of Integrated Pest Management (IPM) has made chickpea rehabilitation easier for farmers. The success of adoption is due to various strengths of the project.

- Socio economic emancipation of peasants.
- Freedom from the clutches of usurers.
- Chickpea is the most preferred crop
- The poorest among the poor are benefited.
- This crop affects the life of the rural poor in various ways.
- This crop is important from the sustainable cropping systems point of view.
- Market linkage has strengthened farmer's faith in the technologies.
- Highly remunerative crop during winter.
- Utilization of rice fallow, maize fallow and uplands.
- The technologies are spreading to nearby villages and farmers because of its economic value.

Suggestions

Suggestions can make this project fast spreading as it helps to bring about:

- Sustainable environment.
- Improves the quality of life of the poorest farmers and non-farmers alike.
- The interventionist can improve IPM extension rapidly
- IPM will be adopted very fast if eastern and western regions are covered for extensions. These regions have very large rice fallow lands.
- The education level of farmers in Nepal is very poor. IPM package should be broadly displayed in public places like *haats**, schools, market places and agriculture input dealers.
- Farmers have faith in the teaching communities and religious teachers. They can help in the faster dissemination of technologies.

* A small weekly village bazaar.

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Acronyms

BGM	Botrytis gray mould
FORWARD	Forum for rural welfare and agricultural reform for development
HMG	His Majesty's Government
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IPM	Integrated Pest Management
NGO	Non government organization
NARC	Nepal Agriculture Research Council
NRs	Nepalese rupee
PRA	Participatory rural appraisal
RRA	Rapid rural appraisal
Ha	Hectare

Conversions

1 hectare = 29.53 kathas
1 hectare = 01.47 bighas
$1 = 77.00 NRs

Appendix

Appendix 1. Number of participants.

	Center Region									Western Region																
Village /	Lalbandi			Bandhibar			Jabdik			MunalBasti			D-gaon			E-Gaon			Lalpur			Khajura			Bhandari			
Group	M[a]	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	GT[b]
Group I	16	4	20	20	1	21	-	-	-	-	-	-	-	-	-	4	6	10	6	0	6	-	-	-	-	-	-	57
Group II	13	8	21	15	4	19	-	-	-	8	2	10	-	-	-	-	-	-	-	-	-	-	-	-	10	7	17	67
Group III	15	12	27	12	4	16	17	0	17	-	-	-	22	5	27	13	6	19	-	-	-	-	-	-	-	-	-	106
Group IV		-		19	10	29	17	0	17		-			-			-		14	3	17	7	4	11		-		74

a: M= Male, F= Female, T= Total,

b: GT= Grand total

Appendix 2. Decision-making.

	Center Region									Western Region																
Village /	Lalbandi			Bandhibar			Jabdik			MunalBasti			D-gaon			E-Gaon			Lalpur			Khajura			Bhandari		
Group	M[a]	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
Group I	-	-	20	-	-	21	-	-	-	-	-	-	-	-	-	5	2	3	0	6	6	-	-	-	-	-	-
Group II	-	-	21	7	3	9	-	-	-	2	0	8	-	-	-	-	-	-	-	-	-	-	-	-	0	0	17
Group III	-	-	27	-	-	16	1	-	16	-	-	-	3	1	23	0	17	2	-	-	-	-	-	-	-	-	-
Group IV	-	-	-	-	-	29	-	-	17	-	-	-	-	-	-	-	-	-	-	-	17	-	-	11	-	-	-

a: M= Male, F= Female, T= Total

Appendix 3. Questionnaire (Quick PRA/RRA of Livelihood in Nepal)

(Instruction for the investigators kindly ask all the questions from the group. Let the group decides preferences etc. The investigators should not be suggestive to the farmers. The preferences should be in strong ordering only.)

Village name:

Block:

District:

Region:

1. **Group name:**

   No. of participant:

   No of male:

   No of female:

2. **Decision-making regarding new crop/varieties**

   Male ☐ Female ☐ Both ☐ Other ☐

3. **Assets**

   a. Livestock

   Cow ☐ Ox ☐ Buffalo ☐ Horse ☐ Goat ☐

   b. House:

   No of house ☐ No of kuccha house ☐ No of *Pucca* house ☐

   c. Agricultural infrastructure:

   Plough ☐ Spray pump ☐ Improved seed ☐ Pump set ☐

   Tractor ☐ Other ☐

4. **Most important expenditure priority of the group**

   Food ☐ Cloth ☐ Education ☐

   Medicine ☐ Fertilizer ☐ Chemical ☐

5. **Land details (Area in local unit per katha)**

   Landless ☐ 0-5 ☐ 5-10 ☐

   10-15 ☐ 15-20 ☐ 20 & above ☐

6. a. **Consumption preference out of all type food:**

I. _____

II. _____

III. _____

b. **Consumption preference out of pulses:**

I. _____

II. _____

III. _____

7. a. **Production preference out of all type food:**

I. _____

II. _____

III. _____

b. **Production out of all pulses:**

I. _____

II. _____

III. _____

8. **Why preference in food consumption and production?**

_____

_____

_____

9. **What is your main source of profit-earning?**

_____

_____

_____

10. **Is area of chickpea increasing, decreasing or constant**

Increasing ☐ Decreasing ☐ Constant ☐

11. **What type of land quality is used for growing chickpea?**

_____

12. **After using improved, seed how much production is increased of chickpea?**

_____

13. **How do you spend profit of chickpea production?**

---

14. **How much chickpea seed is stored?**

---

15. **From where do you buy seed, if not from project?**

---

16. **If there is increase in work out of chickpea production, specify**

---

17. **Why do you grow chickpea, specify**

---

18. **Why don't you grow chickpea, specify**

About ICRISAT

The semi-arid tropics (SAT) encompass parts of 48 developing countries including most of India, parts of southeast Asia, a swathe across sub-Saharan Africa, much of southern and eastern Africa, and parts of Latin America. Many of these countries are among the poorest in the world. Approximately one-sixth of the world's population lives in the SAT, which is typified by unpredictable weather, limited and erratic rainfall, and nutrient-poor soils.

ICRISAT's mandate crops are sorghum, pearl millet, chickpea, pigeonpea and groundnut – five crops vital to life for the ever-increasing populations of the SAT. ICRISAT's mission is to conduct research that can lead to enhanced sustainable production of these crops and to improved management of the limited natural resources of the SAT. ICRISAT communicates information on technologies as they are developed through workshops, networks, training, library services and publishing.

ICRISAT was established in 1972. It is supported by the Consultative Group on International Agricultural Research (CGIAR), an informal association of approximately 50 public and private sector donors. It is co-sponsored by the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP) and the World Bank. ICRISAT is one of 16 nonprofit, CGIAR-supported Future Harvest Centers.

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