Rainfed Rabi Cropping in Rice-fallows of Nepal:
Rainfed Agriculture Impact Assessment Study No. 4

Monitoring Impact Assessment and Learning Component (MIL) of the Research into Use Programme (RiU)

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Prepared by:

Part A: Czech Conroy

Part B: Dave Harris

Part C: Marlene Buchy and Ambika Sapkota

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In addition to the authors of the different parts of this case study, several staff members of FORWARD were involved in collecting and processing the information for both the structured survey and the qualitative survey (see relevant parts of the report for details): we are grateful to them all. We would also like to thank FORWARD management for their support throughout the study. We are also grateful to Dr Sheelagh O'Reilly of IOD for her continual support, advice and encouragement throughout the study; and to Dr Krishna Joshi for his liaison role and logistical support in Nepal. Finally, we acknowledge the contribution of the many farmers who made this study possible and gave so freely of their time.

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Prepared by:

Czech Conroy
Natural Resources Institute
University of Greenwich, ME4 4TB
UK

INTRODUCTION

This case study is an impact assessment of Rainfed Rabi Cropping (RRC) technologies, developed in DFID Renewable Natural Resource Strategy (RNRRS) supported projects of the Plant Sciences Research Programme (PSP). A study supported by the PSP estimated the extent of rice-fallows and their spatial and temporal distribution in South Asia by using geographic information system and satellite remote sensing techniques. Rice fallows are those lands that, although used to grow rice during the monsoon (*kharif*) season, are left fallow during the following post-rainy (*rabi*) season. The study suggested that rice-fallows in Nepal amounted to 26% of the total rice area.

To try to promote sustainable intensification of rainfed rice fallows, the Rainfed Rabi Cropping (RRC) project was conceptualized and a one-year pilot phase was implemented in four districts from October 2001 to June 2002. The project was managed by Bangor University's CAZS Natural Resources and was implemented in collaboration with FORWARD, a Nepal-based NGO. It was found that more than half (58%) of the farmland in the project area remained fallow after rice harvests. This was due to the low motivation of farmers to take up winter cropping, as they perceived low productivity of crops and high risk of crop failure as a result of poor soil fertility, lack of dry farming technologies and lack of drought tolerant crops and varieties. Drawing on the experience of the pilot phase, the second phase of the project was implemented from July 2002 to 2006, in the same districts. Most households only received seeds of new varieties in any reasonable quantity from 2004 onwards.

In the second phase, the project aimed to validate suitable agronomic and social activities that were intended to support sustainable intensification of the rice-fallow system by: integrating short duration rice varieties into the main season to make easier the growing of winter legumes (e.g. lentil, chickpea); making Mungbean, a spring season crop which can be grown after winter legumes, available for testing by farmers. In addition to new varieties, the project sought to validate and support the use of: integrated pest management (IPM) and Integrated Plant Nutrient Management system (IPNM) approaches to improve the soil health and to increase productivity. For the purposes of this study, the technologies were grouped into:

- new rice varieties, often the products of client-oriented breeding produced in sister projects;
- new chickpea varieties;
- new mungbean varieties;
- 'on-farm' seed priming;
- Improved composting;
- Integrated Pest Management;
- Integrated Plant Nutrient Management.

This impact assessment used a variety of structured and semi-structured methods. Part B of this report describes the methodology and findings of fieldwork undertaken by CAZS-NR, in collaboration with the Nepali NGO, FORWARD. Part C describes a subsequent semi-structured and more qualitative piece of fieldwork undertaken by Dr Marlene Buchy and FORWARD staff. This part of the document:

- describes the overall methodology used in the case study;
- synthesizes the key findings from the two studies, identifying both similarities and differences; and also
- draws lessons from the findings relating to impact assessment, technology development and innovation processes.

This is one of seven case studies on rainfed agriculture innovations in south Asia, which are part of a broader 'cluster study'. Each case study, and the broader cluster study, aims to obtain information regarding:

1. *extent* of use of the innovation
2. factors *explaining extent* of innovation (factors influencing use)
3. *Sustainability* of use of innovations by farmers.
4. *who the innovators are* and are not
5. *impact* (including benefits and disbenefits) of the innovation
6. factors *explaining differential impact* among potential users/innovators.

GENERAL OVERVIEW OF THE METHODOLOGY

The structured survey was undertaken in the four districts where the PSP project had been implemented, namely: Kapilvastu, Siraha, Saptari and Jhapa. Six villages that had been involved with project activities since 2004 were randomly selected in each of the districts, but in one district only four villages were surveyed because there were insufficient users in the other two. (See Part B for details.)

The *structured survey* involved village-wide group discussions, in which all households in each of the 22 survey villages were identified as either Users of RRC technologies or Non-users. From the lists thus generated, 12 users and four non-users were randomly selected in each village for household interviews. In total, 287 User households (HH) and 96 Non-user HHs were interviewed, using a user- and a non-user questionnaire respectively. (See Part B for further details).

The *qualitative (semi-structured) study* was conducted in two (Jhapa and Kapilvastu) of the four districts covered by the structured survey, representing high and low adoption of the project outputs respectively. Three villages (out of the six covered in the structured survey) were selected purposively in each district, based on two criteria: the initial level of interest in the new varieties; and the level of social differentiation within the village. Villages were selected with high level of use of the varieties introduced by the project, whilst also making sure that they were representative of other characteristics such as ethnic diversity.

Key informant discussions were used as the initial contact activity in the village to gather generic information on the village and to find help to identify and contact the possible different groups to interview subsequently. The focus group discussion (FGD), a tool used to explore one specific theme at a time by a group of selected participants (6-7 maximum), was chosen as the preferred tool. Depending on the theme explored, people were selected on

the basis of their gender, class or caste or in relation to their professional status. Although the group discussions were fairly open-ended the survey aimed to cover a number of core topics, such as changes in livelihoods and sustainability of livelihoods.

What kind of comparison?

Assessing the impact of any particular development intervention – be it a technology, policy or institutional change – is seldom straightforward. The context in which the intervention takes place is real life – dynamic, complex, uncontrolled and often spatially heterogeneous – and this makes it difficult to separate the effects (if any) of the intervention from any other changes in people's lives that may have been taking place. There may be other contextual changes in rural study areas - such as electrification, development and roads and schools - that could have contributed to any general positive changes in local livelihoods that have taken place since the intervention was implemented or initiated.

In controlled experiments scientific researchers often make *'with and without'* comparisons involving two or more very similar groups of people, livestock, crops or whatever is being studied and is expected to be affected by the 'intervention' or 'treatment'. Any differences that develop between the groups during the period of the experiment can then be plausibly attributed to the 'intervention'. However, use of a *'with and without'* approach was not possible in this study, as it would have been difficult to ensure that any two villages involved in a comparison were sufficiently similar, and hence be confident that any differences subsequently identified between farmers in the two villages were due to the PSP project technologies.

The 'before and after' approach was used. This approach has its challenges – for example, if we had been measuring impact in terms of changes in household income since technologies had been 'adopted' by farmers then any increase in income could have been due to many other factors. The 'before and after' comparison was made on the basis of survey data on the current situation for certain factors, and farmers' recall of equivalent data prior to use of the project technologies. For example, the total quantity of food grain produced by a household was estimated, for two points in time, on the basis of farmer recall data about crop yields, areas planted etc. Another challenge has been the fact that the PSP projects tested a very large number of technologies, which makes it difficult, if not impossible, to attribute benefits to any particular technology.

Minimising bias

The senior staff of RIUP's MIL component decided that the structured survey would be implemented by staff of the organisations that had been involved in developing and distributing the RRC technologies and varieties, as they were familiar with the technology and with the locations where the projects had operated and the villagers living there. An independent Cluster Study Team Manager (Czech Conroy) was appointed to oversee the design and implementation of this and several other case studies. He had the final say on survey methods, wording of questionnaires etc. In the structured survey household selection was random, and for practical reasons the selection was done by the field teams implementing the survey.

In the questionnaire used in the structured household survey almost all of the questions were closed (e.g. Yes/No) rather than open in order to avoid bias (sub-conscious as well as conscious) in the way that answers were recorded. The qualitative study, on the other hand, would be inherently semi-structured or unstructured, which would have increased the

potential for bias among survey team members creeping in. For this reason, and also because of the special skills required to undertake qualitative work of this nature, the original plan was that this study would be done by a suitable qualified independent researcher. However, the person concerned withdrew his services as the work was about to commence. It was then decided that the study would be done by suitably qualified FORWARD staff, under the supervision of the Study Team's social development advisor, Dr Marlene Buchy.

The use of two different sets of study methods was seen as advantageous in terms of triangulation – cross-checking – of survey findings.

Assessing the wealth status of respondents

The Cluster Study Team developed a poverty index (PI) to be used in four technology impact assessment studies, including this one. The PI enables the study to distinguish wealthier households from the rest of the households among those surveyed, and to compare the wealth status of technology users with that of non-users. There were six indicators selected for the poverty index, each of which was given a set of possible scores (see Part B, Table 5 for details), namely:

- Livestock units
- Total quantity of all food grains produced in the season 07-08 per capita
- Roof type
- Number of jobholders in household who provide income
- Ownership of a tractor
- Extent of unskilled labour migration.

CASE STUDY FINDINGS

This section synthesizes the findings from the structured survey (found in Part B) and the semi-structured, qualitative survey (Part C), and frames them around the six study questions listed earlier. By and large the two sets of findings are consistent and complementary: where discrepancies occur they have been noted.

(1) Extent of Use and (2) Factors Influencing Extent

Use on survey household land

New *rice varieties* were grown on an average of 0.1 to 0.23 ha (9% to 24% of household land) except for Barkhe 2014 in Saptari where it was grown on 43% of users' land. The other major rice success story was that of BG 1442 in Jhapa where 82 households (99% of the households sampled) grew it as a spring (*Chaite*) crop on an average of 0.46 ha.

As land suitable for growing *chickpea* is scarcer than that which is suitable for rice cultivation, mean area per HH growing chickpea was only around 0.05 ha to 0.15 ha. Although yields per unit area were often reasonable (given the low levels of inputs used) amounts of chickpea grown per HH were small. (In Kapilvastu *chickpea* was grown on small areas of land and so production per HH was relatively low; whereas in Saptari and Siraha larger areas were sown (but proportion of users was less) and hence production per household was higher.)

The land area sown to *mungbean* per HH was low so production per HH was also low.

Use in survey villages

The proportion of HHs growing *mungbean* in Jhapa and Kapilvastu has been steady at around 30-40%. The household survey results suggest that *seed priming* has been adopted, on average, by around 50% of those HHs initially trained to do it. On average, the rate of adoption of *improved composting* was around 40% of those HHs initially trained.

Extent of use in and between survey districts

Surrounding non-project villages were not surveyed and accurate information on the spread of the new varieties elsewhere in the districts is not available. However, seeds of new varieties had been re-distributed by relatively few households, which is not surprising given the short timescale.

Rice Use levels of new rice varieties varied by district and by variety. In Siraha, adoption of PVS rice varieties was low (only 4%) because the RRC project mostly tested (through PVS) short duration varieties which proved to be unsuitable for the project villages. Adoption of rice varieties bred from COB was highest in Saptari (63%) which was mainly due to the rapid uptake of Barkhe 2014 that was particularly preferred as a very good replacement for Kanchhi Masuli, the most popular local variety. Adoption of COB varieties (short to medium duration) was lowest in Jhapa and Siraha (2%) where medium- to longer duration varieties are preferred.

Chickpea was not adopted in Jhapa where soils are deficient in boron and where disease pressure, particularly from Botrytis Grey Mould, for chickpea is very high. Adoption of chickpea cvs Awarodhi and Tara was substantial in Kapilvastu and Saptari.

Mungbean, particularly cvs Kalyan and Prateeksha, was grown in all four districts on very small areas, ranging from 0.03 – 0.14 ha, and was particularly popular in Siraha.

Improved composting, IPM and *IPNM* were all quite popular in Jhapa but less so in the other three districts, the only exception being IPNM in Siraha and, possibly, improved composting in Kapilvastu. These relatively high values for adoption of these three technologies in Jhapa are due to high rates of adoption in rice and in mungbean but not in chickpea (which is not grown).

Table A1 summarises the extent to which different technologies were found to be used in each district.

Table A1: Extent of Use of the Crop and RRC Technologies by District

Technology	Jhapa	Kapilvastu	Saptari	Siraha
Crop varieties				
Rice - COB	Low	Medium	High	Low
Rice - PVS	High	Medium	Low	Low
Chickpea	Low (0)	Medium	High	Low
Mungbean	Medium	Medium	High	High
RRC technologies				
Seed priming	High	High	Low	Low
Composting	High	High	Medium	Low
IPM	High	Medium	Low	Low
IPNM	High	Low	High	High

Note: High = >30%; medium = 15-30%; low = <15%.

3. Sustainability - continuity of use

A limited amount of information suggests that for all three crops the number of households using new varieties, and the area of land that each household sows, are at least being maintained and may be increasing. Averaged over all four districts, the percentage of sampled households growing new *rice* varieties, the area grown per household and the production per household all increased steadily between 2004 and 2008, although the time course of adoption varied between districts. The mean production per hectare remained relatively constant over this period at between 3 and 4 t ha^{-1}.

In the case of *chickpea and mungbean* the proportion of households in Kapilvastu that grew *chickpea* was high during all four years; and the proportion growing *mungbean* in Jhapa and Kapilvastu remained fairly steady during the four years at around 30-40%. In contrast, adoption by HHs in Saptari and Siraha increased steadily over the four years and areas sown were also larger in those two districts.

In the household survey findings the one major exception to continued use was *chickpea* growers in Jhapa, where the number of user households declined steadily over the four years, down to zero in 2008: this was due to the factors mentioned earlier – disease pressure and boron deficiency. The qualitative study, however, found that *mungbean* use had also declined among some farmers due to various factors such as the higher labour requirements and lack of access to markets.

4. Who are the innovators?

Virtually 100% of the 287 users covered by the household survey were poor as defined by the PI. This is not surprising, given that the original selection by FORWARD of target communities and households was highly poverty-focused. There were some significant differences between districts in the mean PI. On average, households in Jhapa were relatively less poor than those in Kapilvastu and Saptari; and these, in turn, were less poor than those in Siraha. Regarding ethnicity, Brahmins/Chhetris (50.5%) and members of the Terai group (35.9%) constituted the vast majority of the users.

5. Differential impact

The *poorest farmers* were less likely to be users; and even if they were users they would tend to benefit from the technologies less then *poor farmers* with more land. Nevertheless, even the latter are poor - around 99% of all HHs sampled had a PI <12.5.

The household survey results show that overall User HHs (5.84) were statistically significantly less poor (as measured by the PI) than Non-user HHs (4.18). Users' food grain production per capita was much greater (except in Kapilvastu) than that of Non-users and Users kept more livestock than did Non-users. There were also small differences in ethnic composition between users and non-users. Brahmins/Chhetris were the best-represented ethnic group among both users and non-users, but made up a higher proportion of the users (50% versus 38%): whereas more non-user households were Janjatis (13% versus 5%)

6. Benefits and Impact of New Varieties

Benefits of technologies and new varieties

In the *household survey* User households reported that mean HH food grain self-sufficiency had increased from 10.2 months to 13.2 months (29%) since project crop varieties[1] had been adopted. Reported change was greatest in Jhapa (63%) where BG1442 was adopted

[1] It should be noted that the survey question did not mention other RRC technologies such as seed priming, IPM, etc.

widely on relatively large areas of land per HH. In districts where legume adoption was significant (Kapilvastu and Saptari) they were grown on small areas of land and contributed less, in absolute terms, to household food grain self-sufficiency. The *qualitative survey* also found that HH food grain self-sufficiency has improved by 2 to 4 months per year and in all groups people reported that this had resulted in a decrease in food-related expenditure.

All the groups involved in the *qualitative study* mentioned that their agricultural knowledge had increased – e.g. in soil fertility management, including organic approaches and organic pesticides – which they attributed to FORWARD's intervention (see Part C). Even though some farmers may not have been growing some of the initially distributed rice or chick pea varieties anymore, they were now more likely to choose fast growing varieties of rice.

Limitations and constraints of technologies and new varieties

Overall, in the *household survey* the two most important problems cited by users of the new varieties of rice, chickpea and mungbean were pests and diseases. However, it should be noted that these are also the most important problems in general for these crops irrespective of variety. These constraints were also identified in the *qualitative survey*.

The other important problems cited in the *household survey* were lack of seed and inputs, lack of irrigation and theft or damage from stray animals (in relation to legumes, particularly mungbean). Inadequate technical know-how was also considered important by users of legumes, particularly in Saptari and Siraha. Again, the findings from the *qualitative survey* were quite similar.

Farmers involved in the qualitative survey identified insufficient water and lack of irrigation as another major constraint on mung bean and chickpea production. They also reported that Kabuli chick pea is not grown intensively as it is prone to pest damage and sensitive to moisture. It also requires more frequent weeding then local varieties. The threat of stray cattle was given as another factor discouraging mungbean cultivation; and the absence of good markets was mentioned as a deterrent to investing in large scale mungbean cultivation.

The qualitative survey found that in Jhapa the reduction of fallows has had an impact on green fodder availability. In all the groups farmers reported a decrease in livestock because the increase in the growing period had reduced the area available for grazing.

The current lack of clarity on land tenure policy is a more generic factor hindering risk taking for farmers (see Part C for details).

Impact

The qualitative survey found that there has been a general improvement in rural livelihoods in the terai during the last few years, due to various factors: for example, electrification and roads construction were mentioned by farmers as factors of change. It is very difficult to separate the impacts of the new technologies and crop varieties from those of other changes that have been taking place.

Farmers in Kapilvastu reported that the increased availability of home grown lentils had resulted in an increased consumption of lentils; and they perceived a link between this and other dietary improvements and their children becoming 'stronger'. Farmers in Kapilvastu also reported that the increase in food grain production had resulted in better education for children; and that the introduction of winter crops had created more job opportunities for the landless and small holders.

LEARNINGS and INSIGHTS

The RRC project was highly complex. It used a community-development type approach in which many different technologies, and combinations of technologies, were made available to farming households. The technologies themselves were: plant-based ones (new varieties) that could be readily tested by farmers without much additional project involvement; and knowledge-based (e.g. seed priming, improved composting) interventions that required varying degrees of farmer training. It was perhaps inevitable, then, that the impact of individual technologies would be difficult to determine.

The striking differences between districts in use levels of different technologies serve as a reminder of the complexity and variability of farming systems, even within one recognisable region like the terai. The case study findings provide yet another example of the inappropriateness of a one-size-fits-all approach to technology generation and dissemination, which has implications for agricultural research and development. They highlight the importance of having a wide range of technologies such as crop varieties (as in the RRC project studied here).

The need for PVS approach in order to match varieties to farmers' needs for particular situations was confirmed. For example, in at least one of the districts where the RRC project tested short duration rice varieties it became apparent through the PVS process that most farmers were interested in medium and long duration varieties; and in Jhapa district it became apparent the agro-ecological conditions were not conducive to chickpea production.

Availability of land is a key issue for projects that seek to improve livelihoods by increasing agricultural productivity. Average land holding per household is very small in the project villages and even very large relative increases in crop production are not large in absolute terms.

The focus of the PSP projects was on technological *research* rather than supportive *extension* approaches. The RNRRS programme relied on spontaneous spread of effective technologies by farmers; or on research project managers linking up with extension-oriented programmes. However, the latter was not available in this case, and the former is often inadequate. The absence of a funding mechanism to promote promising research outputs was a generic weakness of the RNRRS programme: this is now being addressed for some technologies through DFID's RIU programme.

A methodological learning from this study is that group discussions tended to (a) underestimate the level of use within a village of varieties that are relatively rare; and (b) overestimate the more popular varieties. This throws into question the accuracy of results from group discussions, particularly those at which the entire village is not represented. It also suggests that group discussions are particularly poor for estimating the early adoption of new varieties when they are likely to occur at a low frequency in a village.

PART B REPORT ON THE STRUCTURED SURVEY

Prepared by:

Dave Harris, CAZS Natural Resources, Bangor University

Acknowledgements

The following people from FORWARD contributed to the study:

SN	Name	Position	Role
1	Narayan P Khanal	Senior Program Manager	Coordination
2	Ujjal Tiwari	Program Officer	Data cleaning
3	Ambika Sapkota	Program Officer	Coordination and data cleaning
4	Lakpa T Sherpa	Senior Technician	Data collection
5	Krishna P Gupta	Field Officer	Data collection
6	Shova R Devkota	Senior Technician	Data collection
7	Achyut P Upreti	Senior Technician	Data collection
8	Yaba N Tiwari	Senior Technician	Data collection
9	Prativa Aryal	Consultant	Data entry
10	Santosh Poudel	Senior Program Officer	Questionnaire development
11	Bala R Bhandari	Program Officer	Data collection
12	Mani R Aryal	Consultant	Data entry

EXECUTIVE SUMMARY

- The uptake and impact of a number of technologies, designed to improve the livelihoods of resource-poor farming households in rice fallow areas of Jhapa, Kapilbastu, Saptari and Siraha districts of Nepal, were assessed in 2008 using Group Discussions and Household Questionnaires.

- A wide range of Rainfed Rabi Cropping (RRC) technologies had been disseminated and promoted by FORWARD and its partners during DFID-funded projects since 2002. For the purposes of impact evaluation, the technologies were grouped into:
    - new rice varieties, often the products of client-oriented breeding produced in sister projects;
    - new chickpea varieties;
    - new mungbean varieties;
    - 'on-farm' seed priming;
    - Improved composting;
    - Integrated Pest Management (IPM);
    - Integrated Plant Nutrient Management.

- On the basis of village-wide group discussions, all (1365 households) households in 22 villages across the four districts were identified as either Users of RRC technologies or Non-users. From the lists (630 User households and 735 Non-user households) thus generated, twelve users and four non-users were randomly selected in each village for household interviews. In total, 287 User households (HH) and 96 Non-user HHs were interviewed using a user- and a non-user questionnaire, respectively.

- There were some significant differences between districts in HH Poverty Index (PI). On average, HHs in Jhapa were relatively less poor than those in Kapilvastu and Saptari that were, in turn, less poor than those in Siraha. Overall, User HHs were significantly less poor (PI=5.84) than Non-user HHs (PI=4.18) although around 99% of all HHs sampled had a PI<12.5, i.e. were poor. Of the components that contribute to PI, only two differed significantly between Users/Non-users. Users' food grain production per capita was much greater (except in Kapilvastu) than that of Non-users and Users kept more livestock (3.51 units per HH) than did Non-users (2.67 units per HH).

Users

- Adoption of new rice varieties varied by district and by variety. They were grown on an average of 0.1 to 0.23 ha (9% to 24% of HH land) except for Barkhe 2014 in Saptari where 36 households (50% of the sample) grew it on an average of 0.47 ha which was 43% of their land. The other major rice success story was that of BG 1442 in Jhapa where 82 households (99% of the households sampled) grew it as a spring (*Chaite*) crop on an average of 0.46 ha.

- Chickpea was not adopted in Jhapa where soils are deficient in boron and where disease pressure, particularly from Botrytis Grey Mould, for chickpea is very high. Adoption of chickpea cvs Awarodhi and Tara was substantial in Kapilvastu and Saptari. However, because land suitable for growing chickpea is scarcer than that which is suitable for rice cultivation, mean area per HH growing chickpea was only

around 0.05 ha to 0.15 ha. Although yields per unit area were often reasonable (given the low levels of inputs used) amounts of chickpea grown per HH were small.

- Mungbean, particularly cvs Kalyan and Prateeksha, was grown in all four districts on smaller areas still, ranging from 0.03 – 0.14 ha and was particularly popular in Siraha.

- There was confusion amongst farmers (and enumerators) about what constitutes 'seed priming' in rice; and responses do not differentiate between seed priming of dryland, direct-sown rice and rice sown into nursery beds prior to transplanting. Similarly in legumes seed priming with water was confused with nutrient priming in which micronutrients such as molybdenum are added to the priming water. Nevertheless, seed priming seems to have been adopted, on average, by around 50% of those HHs initially trained to do it, although it was not possible to account for any spontaneous adoption by non-trained HHs.

- Improved composting, IPM and IPNM were all quite popular in Jhapa but less so in the other three districts, the only exception being IPNM in Siraha and, possibly, improved composting in Kapilvastu. These relatively high values for adoption of these three technologies in Jhapa are due to high rates of adoption in rice and in mungbean but not in chickpea (which is not grown). On average, the rate of adoption of improved composting was around 40% of those HHs initially trained.

- Most HHs only received seeds of new varieties in any reasonable quantity from 2004 onwards so adoption or rejection was predominantly based on only 3-4 years of self-testing. Seeds of new varieties were re-distributed by relatively few HHs, which is not surprising given the short timescale.

- Averaged over all four districts, User HHs reported that mean HH food grain self-sufficiency had increased from 10.2 months to 13.2 months (29%) since project varieties had been adopted. It should be noted that the question did not mention other RRC technologies such as seed priming, IPM, etc. Reported change was greatest in Jhapa (63%) where BG1442 was adopted widely on relatively large areas of land per HH. In districts where legume adoption was significant (Kapilvastu and Saptari) they were grown on small areas of land and contributed less, in absolute terms, to HH food security.

- Specific benefits of technologies reported by HHs may reflect values imparted during training rather than views formed after adoption and use. For instance, farmers in Saptari and Siraha reported the obvious benefits to be expected from seed priming even though very few actually practiced it. A similar pattern was observed in views on improved composting, IPM and IPNM.

- Averaged over all four districts, the percentage of sampled HHs growing new rice varieties, the area grown per HH and the production per HH all increased steadily between 2004 and 2008, although the time course of adoption varied between districts. The mean production per hectare remained relatively constant over this period at between 3 and 4 t ha^{-1}.

- The pattern of adoption with time of chickpea and mungbean differed from that of rice. Although the proportion of HHs in Kapilvastu that grew chickpea was high during all four years, they did so on small areas of land and so production per HH was relatively low. In contrast, the proportion of chickpea growers in Saptari was lower but larger areas were sown so that production per HH was higher. This was a pattern

also observed in Siraha, albeit with fewer HHs. The number of HHs in Jhapa declined steadily over the four years, down to zero in 2008.

- The proportion of HHs growing mungbean in Jhapa and Kapilvastu remained fairly steady during the four years at around 30-40% but land area sown per HH was low so production per HH was also low. In contrast, adoption by HHs in Saptari and Siraha increased steadily over the four years and areas sown were also larger in those two districts. Since production per hectare was also higher, production per HH was substantially greater than in Jhapa and Kapilvastu.

- Most grain from new rice varieties was sold as grain or eaten by the HHs, with relatively little sold as seed, fed to animals or given as gifts. Rice seed was saved by virtually all HHs in 2008, around 40 kg per HH on average, which is enough to re-sow the average land area used for these varities. In contrast, home consumption was the majority use for new chickpea varieties, with less sold as grain. Although most HHs saved seed, particularly in Kapilvastu, Saptari and, to a lesser extent, in Siraha, amounts saved were small and reflected the low levels of production and of the small areas sown. Most HHs in all districts ate the new varieties of mungbean and saved some for seed. A large proportion of HHs in Saptari (56% and 47% in the two years) sold grain and a significant minority of HHs in Saptari and Siraha sold seed. As for chickpea, the amounts of the new mungbean varieties transacted were small.

- There was a premium of around 100% for rice sold as seed over that sold as grain. The unit price for chickpea grain was much higher than for rice but the premium for chickpea sold as seed rather than for grain was smaller, around 40%, than that for rice. However, there is already generally a premium for Kabuli (bold-seeded) chickpea over Desi (local) varieties. For mungbean, prices of both grain and seed were higher than those for chickpea and differed between districts, being highest in Jhapa, although there was actually very little premium for seed over grain in any district.

- Overall, the two most important problems cited by users of the new varieties of rice, chickpea and mungbean were pests and diseases although it should be noted that these are also the most important problems in general for these crops irrespective of variety. The other important problems cited were lack of seed and inputs, lack of irrigation and theft or damage from stray animals (in relation to legumes, particularly mungbean). Inadequate technical know-how was also considered important by users of legumes, particularly in Saptari and Siraha.

Non Users

- The number of Non-users sampled in each district was not large so disaggregation of responses by district may be unreliable. Over all four districts, 68% of Non-user HHs knew about short-duration (SD) rice varieties but only 38% of those (25 HHs) had grown them. Of the latter, 88% (22 HHs) cited as a benefit being able to grow winter crops (vegetables) in time. When asked why they had not then tried any of the project SD rice varieties, the most frequently cited reasons were “don’t know about the varieties”, “unavailability of seed” and, to a lesser extent “lack of technical knowledge”. The most important reasons for not growing SD rice varieties cited by Non-users who knew about them but had <u>not</u> tried them were “lack of irrigation”, “not the best variety for the land” and “lower yield than existing variety”. “Lack of land” and “not suitable for existing cropping pattern” were not considered very important.

- Almost all Non-user HHs sampled in Jhapa, Saptari and Siraha knew about winter season legumes (WSLs, including chickpea) but only around half the sample in Kapilvastu knew about them. However, only 9% of the knowledgeable HHs (2 HHs)

in Jhapa had actually grown them, in contrast with the high proportion of HHs in the other three Districts who had tried them. Overall, 86% knew about them and, of those, 63% (52 HHs) had grown them. The main reasons cited for not growing project WSLs were similar to those cited for not growing project SD rices, i.e. “don’t know about the varieties”, “unavailability of seed” and “lack of technical knowledge”. For those Non-user HHs that were aware of WSLs but had not grown any, the most important reason cited was “high moisture” followed by “lack of family labour”, although the responses are highly skewed towards those from Jhapa (where adoption of WSLs, i.e. chickpea was very poor). Although the most common constraint on growing chickpea cited by Users was pests and diseases, Non-users barely mentioned it.

- Overall, 72% of Non-users knew about spring season legumes (SSLs, including mungbean) and, of those, only 30% (21 HHs) had grown them. As for the other two crops, the main reasons cited for not growing project SSLs were “don't know about the varieties” followed by “lack of seed” and “lack of knowledge”. “Lack of irrigation”, “lack of labour” and “lack of seed” were the main reasons cited by Non-user HHs who knew about SSLs but had never grown them.

- The percentage of the Non-users interviewed who intended to grow short duration rice was 53%, 29% of non-users intended to grow chickpea and 36% intended to grow mungbean, although the question was ambiguous about whether they intended to grow project varieties or not. Of these, most (61%) intended to use rice seed obtained from neighbours while 31% reported that they would use their own seed. Intending chickpea growers reported that they would seek seed from a variety of sources including FORWARD, neighbours, the bazaar, Agrovets or use their own seed. Almost 70% of Non-user HHs intending to grow mungbean were looking to neighbours to provide seeds.

- Of the 45 Non-user HHs who were not intending to grow SD rice in 2009, the main reasons cited were “lack of family labour” and “lack of land”. These reasons, together with “lack of irrigation” were also the ones cited most for not growing chickpea and mungbean.

- Surrounding non-project villages were not surveyed and accurate information on the spread of the new varieties elsewhere in the districts is not available so it is not possible to estimate the overall impact of the project. We can conclude however that, within the project villages sampled, there has been substantial adoption of a range of technologies and the farmers report that, since those technologies have been available, food grain self sufficiency has improved.

INTRODUCTION

A study supported by the UK Department for International Development Plant Sciences Research Programme (DFID-PSRP) estimated the extent of rice-fallows and their spatial and temporal distribution in South Asia by using geographic information system (GIS) and satellite remote sensing techniques. Rice fallows are those lands that, although used to grow rice during the monsoon (*kharif*) season, are left fallow during the following post-rainy (*rabi*) season. Based on the satellite image analysis, rice-fallows in Nepal were estimated as 392,000 ha, and this amounted to 26% of the total rice area (Subbarao *et al*. 2001). To try to promote sustainable intensification of rainfed rice fallows, the Rainfed R*abi* Cropping (RRC) project was conceptualized and a one-year pilot phase was launched in October 2001 in selected villages of four eastern *Terai* districts from October 2001 to June 2002. Based on information from 389 households it was found that more than half (58%) of the farmland remained fallow after rice harvests. The high incidence of rainfed rice fallows in the project districts was due to low motivation of farmers to take up winter cropping. Farmers perceived low productivity of crops and high risk of crop failure as a result of poor soil fertility, lack of dry farming technologies and lack of drought tolerant crops and varieties. Less than 4% of the sampled farmland in the project districts had irrigation facilities. About two-thirds of the farm households perceived stagnant or declining productivity of crops on their farm and thought that external interventions were necessary to enable them to reverse the trend (Khanal et al., 2004).

Drawing on the experience of the pilot phase and based on improved understanding of the constraints and opportunities for crop intensification and diversification, the second phase of the project (R 8221) was implemented from July 2002 to 2006. In the second phase, the project aimed to validate suitable agronomic and social activities that were intended to support sustainable intensification of the rice-fallow system. The project sought to improve the overall system by integrating short duration rice varieties into the main season to make easier the growing of winter legumes such as lentil and chickpea in the residual moisture remaining after rice harvest. Mungbean, a spring season crop which can be grown after winter legumes, mainly in partially irrigated and irrigated areas, was relatively unknown and was made available for testing by farmers.

In addition to new varieties, the project sought to validate technological and resource management options and to empower farmers to adopt integrated pest management (IPM) and Integrated Plant Nutrient System (IPNM) approaches to improve the soil health and to increase productivity. These approaches included, among others: farmers' trials of "on-farm" seed priming (soaking seeds in water for pre-determined times before sowing); nutrient loading (whereby trace elements such as molybdenum are added to the water used for priming seeds, particularly in the case of mungbean and chickpea); soil solarization (sterilization, using plastic sheeting, of the soil in rice nursery beds before sowing); improvements to animal housing, including designs to facilitate collection of cattle urine, a valuable material; use of that urine for foliar feeding of plants and as an insecticide; compost making; establishment and maintenance of nurseries for multi-purpose tree seedlings. Parallel activities included the development, training and mobilization of Local Resource Persons (LRPs) and community based seed producer groups (CBSPs). Table 1 summarises the chronology of major project activities.

It is important to note that these were all research activities, funded from a research budget, and widespread dissemination of the technologies was not a stated major objective. A project funded by RiUP to scale out the validated outputs of this project is currently being implemented (2008-2011).

Table 1: Timeline of major events in PVS, COB, and RRC technologies/approaches

Process	Year	Event
Participatory Varietal Selection	2001-2002	• One-year RNRRS pilot phase of R8221 project on RRC in four *Terai* districts (Kapilvastu, Siraha, Saptari and Jhapa). These districts were selected based on the distribution of rice fallows determined using GIS and satellite remote sensing (Subbarao *et al.*, 2001).
	2002-2006	• New varieties of rice, chickpea, mungbean (from 2003) tested in PVS trials
	2005	• Barkhe 2014 in rice, Kalyan and Prateeksha in Mungbean, and Tara and Avrodhi in chickpea identified as the most popular varieties with farmers. • Verification and scaling up of promising varieties began on small scale
	2006	• Most promising two mungbean varieties officially released by GoN (Kalyan and Prateeksha)
	2008	• Most promising two varieties of chickpea officially released by GoN (Tara and Avarodhi)
RRC technologies	2002	• Trials of seed priming, nutrient loading,
	2003	• Trials of seed priming, soil solarisation
	2004	• Trials of seed priming, nutrient loading, soil solarisation
	2005-2007	• Trials of seed priming, nutrient loading, soil solarisation, animal shade improvement, use of animal urine in plants, establishing multi-purpose nurseries and plantation of saplings/seedlings
	2008-2011	• Scaling out RRC technologies to wider communities (new RiUP project)

The adoption and impact of short duration rice, legumes and other crop varieties and agronomic interventions were investigated in four selected districts (Figure 1). The study was implemented between June 2008 and February 2009 to assess the impact of the Rainfed Rabi Cropping (RRC) activities that were implemented by FORWARD from 2002-2006 with support from CAZS-NR and in partnership with the Department of Agriculture (DoA) and the Nepal Agriculture Research Council (NARC). This report presents the results from that study.

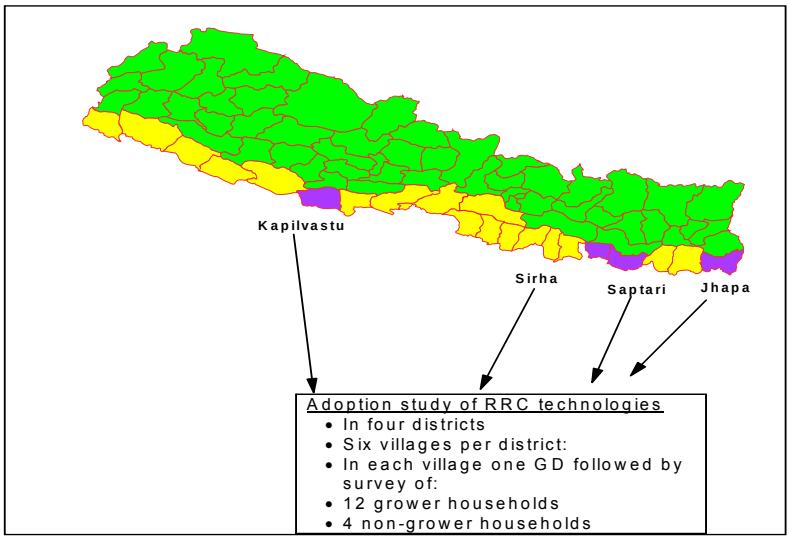


Fig. 1. The main activities and their locations in the two studies. GD = Group discussion.

METHODOLOGY

A combination of methods (structured and semi-structured) was used to triangulate the information and make the study robust and more reliable. Details of the methods used are summarized in Table 2.

Table 2: Summary of survey methods used

Survey Method	To measure	Who does it?	Where?**	What villages?
1. Select at random 6 villages per district from the list of those involved with the project.	(i) Adoption levels (ii)Benefits	FORWARD	Selected villages of ; Jhapa Saptari Siraha Kapilvastu	*Recipient villages*: 2004/5
2. Village-level group discussions to compile a list of all Users and Non-Users in the village. Users defined as households growing at least one of the new varieties.	(i) Adoption levels (ii)Benefits	FORWARD	Selected villages of ; Jhapa Saptari Siraha Kapilvastu	*Recipient villages*: 2004/5
3. Select randomly 12 farmers per village from the household list and administer the questionnaire in Annex 1.	(i) Adoption levels (ii)Benefits	FORWARD	Selected villages of ; Jhapa Saptari Siraha Kapilvastu	*Recipient villages*: 2004/5
4. In-depth semi-structured, survey of: (a) individual (♀ & ♂) receivers/adopters (b) individual non-users, esp. landless labourers (c) focus groups	IMPACT Including related emerging issues, e.g. impact on landless livestock grazers, organisation of social fencing	Independent	Sample of project villages covered by method 1 Numbers will depend on results of 1 & degree of variability indicated	To be determined

Only results from methods 1-3 are presented in this report.

Structured study

The structured study was done in all four project districts in which project activities (Table 3) were implemented during the RNRRS project. Six project villages from each district that had been involved with project activities since 2004 were randomly selected for the study. Altogether 24 group discussions (GD) were conducted with 15-20 participants in each GD to identify all the User- and the Non-user households in a village. The criterion for classifying a household as a User was that they were growing at least one of the varieties introduced by the project. From the list of users and non-users, twelve users and four non-users per village were randomly selected to be interviewed using the questionnaires in Annexes 1 (for users) and 2 (for non-users). In two villages (Bhotiya Tole and Laxmaniya of Padariya VDC) of

Siraha district, the number of users for the study was insufficient so these villages were disregarded and the number of respondents (users and non-users) that needed to be covered in lieu of those villages was covered by increasing the number of respondents from other districts (Jhapa, Saptari and Kapilvastu). In total, 287 users and 96 non-users were interviewed (Table 4).

Table 3: Various crop varieties and technologies promoted in RRC and total number of farmers and quantity of seeds/inputs used in RRC projects in Siraha, Saptari, Kapilvastu and Jhapa districts 2001 to 2006.

Crop/approach	Varieties	No of farmers	Amount of seed (kg)
Rice	Barkhe 1027	455	3000
	Barkhe 2001	125	225
	Barkhe 2014	100	200
	Sugandha 1	700	2500
	Ashoka 228	20	50
	PR 101	350	800
	BG 1442	890	2450
	KPG 59	350	650
Chickpea	Avarodhi	630	1200
	Tara	650	1365
	ICCV 2	158	105
	KAK 2	160	365
	Kalyan	1200	2886
	Pratiksha	1425	3210
Mungbean	NM 92	400	850
	VC 3960	350	600
Technology	IPM	981	
	IPNM, of which:	981	
	seed priming	(455)	(in 41 villages)
	improved composting	(526)	
	Multipurpose nursery	120	
Approach	LRP	32	
	CBSP	110	
Total		10187	20456

Field staff were trained to administer the survey questionnaires (Annexes 1 and 2) and they were pre-tested with 15 farmers each from Badahara and Purena VDCs in Kapilvastu district to check for relevancy, consistency, measurement errors, ambiguities, and missing information. Based on the feedback from pre-testing, necessary corrections were made in the questionnaire.

Generally, the questionnaires were administered with the head of each household irrespective of their sex. If a randomly selected HH was not available for interview, we replaced it with new HHs taken randomly from the GD list. Households were revisited, if necessary, to collect any missing information, correct inconsistencies and clarify inappropriate responses.

Table 4: The villages in which the interviews took place and the number of farmers that were interviewed (users and non users) by district and village in 2008

District	Village	Users	Non Users	Total
Kapilvastu	Badehara A	12	5	17
	Badehara B	7	5	12
	Purinea	13	5	19
	Mahendrakot (Valali)	13	4	17
	Gajeda (Kubarpur)	14	4	18
	Motipur (Lagain)	14	3	16
District total		**73**	**26**	**99**
Siraha	Bishanpur	12	5	17
	Bakhar	14	5	19
	Padariya	13	5	18
	Ghaletole	12	4	16
District total		**51**	**19**	**70**
Saptari	Madhupatti	12	5	17
	Kadmaha	15	4	19
	Shreepur	13	4	17
	Kadorbana	12	5	17
	Mahuliya	14	5	19
	Karmonia	14	4	18
District total		**80**	**27**	**107**
Jhapa	Thakthake A	13	4	17
	Thakthake B	16	4	20
	Pragati tole	13	5	18
	Jambadi A	15	4	19
	Jambadi B	10	3	13
	Singhadevi	16	4	20
District total		**83**	**24**	**107**
Grand Total across districts		**287**	**96**	**383**

Poverty index

A poverty index was constructed to enable the study to distinguish between poor and wealthier households among those households surveyed. The poverty index did not attempt to place households in relation to the poverty line established by the government of Nepal as the data demands for such an exercise were too big.

There were six indicators selected for the poverty index, each of which was given a set of possible scores (Table 5).A total score (overall poverty index), for which the maximum possible was 23, was calculated for each household derived from the sum of the individual scores.

Table 5: Scores for the poverty indicators

	Score							
Indicator	**-1**	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Livestock units†		<1	1-<3	3-<5	5-<10	>=10		
Food grain production per capita††		<180	180-<365	365-<730		>=730		
Roof material		Thatch	Tile	Tin	Concrete			
Jobholders in the family		No job		1 job		2 jobs		3 or more
Tractor ownership		No tractor					Own tractor	
Seasonal unskilled labour migration	Migration		No migration					

†*Livestock units.* The weighted sum of all livestock owned by the household by four animal types. The relative weightings were: Cows, buffaloes, horses, donkeys = 1; Goats, sheep = 0.1; Poultry = 0.01; Pigeons = 0.005. The number of animals owned of each type was multiplied by the corresponding weight and the products added up.

††*Food production per capita.* The total quantity (kg) of food grains (cereals and legumes) produced in the 2007-2008 season (including grain produced for consumption and sale) was divided by the number of adult equivalents per household. Adult equivalents per household were calculated as a weighted sum using the following weights: Adults = 1; 10 – 17 years = 1; children under 10 = 0.1.

RESULTS

Characteristics of users and non users

Of the 287 user households surveyed, 253 (88%) were male-headed whereas 90 (94%) of the 96 non-user households surveyed were male-headed. Gender of the respondent was determined by who was available at the time of survey; 109 (38%) of the respondents in user households were women and 37 (39%) of the respondents in non-user households.

Tractor ownership was rare and did not differ between users and non-users (Table 6). Use of rented tractors was similar for each category at 32-35% but use of their own animals for traction was more common (74%) by users than by non-users (51%) who were more dependent on rented animals (25% versus 16%).

Table 6: Type of traction used

Type of traction	Users (n=287)		Non-users (n=96)	
	Number	Percent	Number	Percent
Own animal	212	74	49	51
Rented animal	47	16	24	25
Own tractor	3	1	2	2
Rented tractor	99	35	31	32
Labour exchange	2	1	5	5
Total*	363 (287)	127 (100)	111 (96)	115 (100)

*Totals do not sum as expected because of citation of more than one type of traction. Numbers in parentheses are expected totals in the absence of multiple responses.

There was a tendency for user households to be more likely to own ruminant livestock, particularly large ruminants, although a higher proportion of non-user HHs owned poultry (Table 7). There were no user/non-user differences between HHs who did own any particular type of animal, except for poultry where non-user HHs owned more of them than user HHs. It is possible that poultry ownership requires less capital and infrastructure than for other categories of livestock and so there might be a link to HH poverty status (see later).

Table 7: Household livestock ownership (users, n=287; non-users, n=96).

Animal	HHs owning livestock (%)		Mean no. per owning HH		Mean no. per all HHs	
	User	Non-user	User	Non-user	User	Non-user
Cow	45	40	1.65	1.68	0.73	0.67
Ox	70	50	2.19	2.22	1.54	1.06
Buffalo (m)	8	1	1.74	2.17	0.14	0.14
Buffalo (f)	45	30	1.79	1.59	0.81	0.48
Goat	82	77	3.41	3.53	2.81	2.72
Pig	<1	<1	1.5	1	0.01	0.01
Poultry	27	35	5.59	13.47	1.52	4.77
Pigeon	19	15	6.58	7.43	1.26	1.08

The ethnic composition of the sample was similar for users and non-users although there was a larger percentage of Janjatis and a smaller proportion of Brahmins/Chhetris in the non-user group of HHs sampled (Table 8).

Table 8: Ethnic group of households surveyed

Ethnicity	Users (n=287)		Non-users (n=96)	
	Number	Percent	Number	Percent
Dalit	24	8.4	10	10.4
Janjati	15	5.2	13	13.5
Terai group	103	35.9	36	37.5
Brahmin/Chhetri	145	50.5	37	38.5

User households were significantly larger (6.5 adult equivalents) than non-user households (5.7 adult equivalents). A slightly higher percentage of user households had male members with full-time jobs although the mean number per household of male full-time jobholders was the same for user and non-user households (Table 9). Almost all user households had women who work on the farm and, in those households where women did so, the mean number of farm-working women was slightly higher (1.81) in user households than in non-user households (1.69).

Table 9: Male and female work patterns

	Users (n=287)		Non-users (n=96)	
	Percent of HHs	No. per HH	Percent of HHs	No. per HH
Full time job				
M	35	1.23	27	1.23
F	4	1.30	5	1.20
Work on farm				
M	87	1.54	78	1.53
F	97	1.81	88	1.69

Note: number per HH is calculated for only those HHs that had jobholders.

User households both owned and cultivated more upland and medium land than non-user households, although non-users owned and cultivated slightly more low land (Table 10). However, the greatest proportion of household land was medium land so users owned 51% more total land and cultivated 60% more total land than non-users. Users also had more than twice as much irrigated land. Both users (34%) and non-users (38%) transferred in similar proportions of the land they cultivated whereas non-users transferred out about twice as much land (23%) as users (13%) when expressed as a proportion of the land they eventually cultivated. Giving land out for share cropping was much more common than renting or mortgaging.

Table 10: Land ownership and use in kattha (30 kattha = 1 hectare). U = user household; NU = non-user household

	Upland		Medium land		Low land		Total	
	U	NU	U	NU	U	NU	U	NU
Total owned	6.78	4.10	22.69	13.52	2.11	3.24	31.58	20.85
Total cultivated	3.60	1.79	19.61	11.20	1.71	2.55	24.92	15.55
Own irrig. cultivated	1.62	1.05	8.01	2.69	0.85	0.82	10.49	4.56
Rented out	0	0	0.14	0.21	0.07	0	0.20	0.21
Shared out	0.38	0.79	2.21	1.89	0.33	0.48	2.92	3.16
Mortgaged out	0.07	0	0.14	0	0	0.21	0.21	0.21
Rented in	0.18	0.18	1.49	0.83	0.32	0.65	1.99	1.66
Shared in	1.54	0.19	3.45	3.94	1.21	0.23	6.18	4.25
Mortgaged in	0	0.05	0.22	0	0	0	0.22	0.05

Twenty-five percent of user households reported that members had migrated in 2007-2008 whereas only 15% of non-user households reported migration (Table 11). This trend was consistent for all Districts except Saptari where a higher proportion (26%) of non-users reported migration versus only 9% of users. No-one migrated from non-user HHs in Kapilvastu.

Table 11: Percent of Households with members who migrated in 2007-2008

Households with member migrating		Jhapa	Kapilvastu	Saptari	Siraha	Overall
A. Non-users						
	Total (%)	21	0	26	11	15
	Unskilled (%)	4	0	26	0	8
	Semi-skilled (%)	13	0	0	11	5
	Skilled (%)	4	0	0	0	1
	No. of HH sampled	24	26	27	19	96
B. Users						
	Total (%)	41	30	9	18	25
	Unskilled (%)	23	14	6	10	14
	Semi-skilled (%)	13	5	3	6	7
	Skilled (%)	11	11	0	6	7
	No. of HH sampled	83	73	80	51	287

Table 12: Mean poverty index by District (combined users and non-users)

	Jhapa	Kapilvastu	Saptari	Siraha
Mean Poverty Index	5.91	4.83	4.95	4.37
(SE mean)	(0.27)	(0.27)	(0.26)	(0.32)

There were statistically significant differences (P=0.002) in Poverty Index (PI) between Districts. Households in Jhapa were better off than those in Kapilvastu and Saptari that were, in turn, better off than those in Siraha (Table 12). Combined over all Districts, non-users were significantly (Table 13, P<0.001) les well off (PI = 4.18) than users (PI = 5.84).

Table 13: Mean poverty index by User/Non-user (all Districts combined)

	Users	Non-users
Mean Poverty Index	5.84	4.18
(SE mean)	(0.14)	(0.24)

Some individual components of the PI also differed by District (Table 14). Crop production (food grains) per capita in Jhapa was about double that in Saptari and Siraha and three times that in Kapilvastu. Saptari had half as many jobholders per HH as Siraha that, in turn had half as many as in Jhapa and Kapilvastu. Tractor ownership was rare and did not differ between Districts. Similarly, there were no significant differences between Districts in the mean number of unskilled migrants per HH. Livestock units per HH were significantly lower in Kapilvastu than in the other three Districts (reasons not known) and the most common roof type in all Districts was Tiles/sheet. It is suggested that choice of roof type may not be influenced by wealth alone but may have a cultural component that reflects traditions that differ between people indigenous to the *Terai* and those who have migrated from the hills.

Table 14: Mean components of Poverty Index by District

District	Prodn. (kg) per capita	Job holders per HH	Own tractor (per HH)	Unskilled migrants (per HH)	Livestock units (per HH)	Thatch roof (%)	Tiles/ sheet roof (%)	Concrete roof (%)
Jhapa	939	0.64	0.02	0.14	3.46	37	61	3
Kapilvastu	299	0.66	0.03	0.07	2.53	13	40	47
Saptari	597	0.15	0	0.16	3.22	12	74	14
Siraha	419	0.33	0.01	0.05	3.15	10	84	6
Sig.	***	***	ns	ns	*	***	***	***

Users produced significantly more food per capita (80% more) than non-users, owned 30% more livestock units and were less likely to have a thatched roof (Table 15). Other components of the Poverty Index did not differ between users and non-users.

Table 15: Mean components of Poverty Index by User/Non-user

User/ Non-user	Prodn. (kg) per capita	Job holders per HH	Own tractor (per HH)	Unskilled migrants (per HH)	Livestock units (per HH)	Thatch roof (%)	Tiles/ sheet roof (%)	Concrete roof (%)
User	726	0.49	0.01	0.13	3.51	13	67	19
Non-user	401	0.39	0.02	0.08	2.67	23	62	16
Sig.	***	ns	ns	ns	***	*	Ns	ns

There were statistically significant interactions between District and User/Non-user only for production per capita and for the number of unskilled migrants per HH (Table 16). Whereas production per capita was greater for users than for non-users in Jhapa, Siraha and Saptari, there was no difference in Kapilvastu. In Saptari, more non-user HHs had unskilled migrants than did user HHs, whereas the reverse was true in the other three Districts. The reason for these differences between Districts is not known.

Table 16: Mean components of Poverty Index by District and by User/Non-user

District		Prodn. (kg) per capita	Job holders per HH	Own tractor (per HH)	Unskilled migrants (per HH)	Livestock units (per HH)	Thatch roof (%)	Tiles/ sheet roof (%)	Concrete roof (%)
Jhapa	U	1332	0.69	0	0.23	4.02	28	71	1
	NU	545	0.58	0.04	0.04	2.91	46	50	4
Kapilvastu	U	296	0.66	0.03	0.14	2.71	7	37	56
	NU	301	0.65	0.04	0	2.34	19	42	38
Saptari	U	766	0.23	0	0.06	3.72	9	77	14
	NU	428	0.07	0	0.26	2.73	15	70	15
Siraha	U	509	0.39	0.02	0.10	3.58	10	84	6
	NU	328	0.26	0	0	2.72	11	84	5
Sig. of interaction		*	ns	ns	**	ns	Ns	ns	ns

Pattern of adoption of varieties and RRC technologies

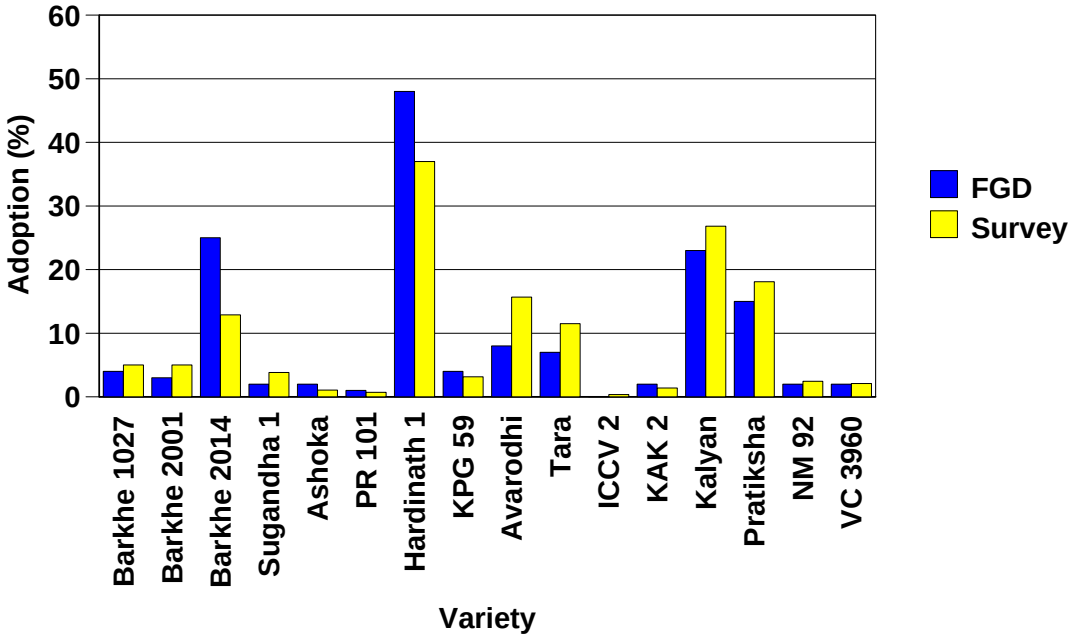
During the Focus Group Discussions (FGDs), a total of 1365 households were identified as either users (630) or non-users (735) on the basis of whether or not they grew at least one of the new rice, chickpea or mungbean varieties that had been promoted by the project. From within the 630 households identified as users, 287 were sampled using the user questionnaire while 96 were randomly sampled from the 735 non-users using the non-user questionnaire. Table 17 shows the percentage of the 630 users who were reported in the FGDs as growing a particular variety in the four districts, together with the percentage of the 287 sampled users who reported growing the same varieties.

Table 17: Comparison of use levels (%) of varieties as determined by GD and by household survey (HS).

	Jhapa		**K'bastu**		**Saptari**		**Siraha**		**Total**	
	GD	**HS**	**GD**	**Survey**	**GD**	**Survey**	**GD**	**Survey**	**GD**	**Survey**
Rice										
Barkhe 1027	0	1	8	8	6	10	0	0	4	5
Barkhe 2001	0	0	9	7	6	11	0	0	3	5
Barkhe 2014	0	0	7	0	65	45	4	2	25	13
Sugandha 1	0	0	0	3	4	11	1	0	2	4
Ashoka	0	0	9	4	3	0	0	0	2	1
PR 101	2	0	2	3	1	0	1	0	1	1
BG 1442	95	99	16	16	30	11	16	4	48	37
Chickpea										
KPG 59	0	0	4	0	8	11	3	0	4	3
Avarodhi	0	0	7	32	12	24	19	6	8	16
Tara	0	0	21	27	9	15	3	2	7	11
ICCV 2	0	0	0	1	1	0	0	0	0	0
KAK 2	0	0	0	0	2	4	4	2	2	1
Mung bean										
Kalyan	24	28	7	11	7	13	81	71	23	27
Pratiksha	3	11	15	10	26	28	16	27	15	18
NM 92	0	1	8	4	1	4	0	0	2	2
VC 3960	0	0	11	7	1	1	1	0	2	2
Total farmers	**218**	**83**	**100**	**73**	**223**	**80**	**89**	**51**	**630**	**287**

The data in Table 17 are compared in graphical form in Fig 2 and it is clear that the level of adoption within a village of varieties that are relatively rare was underestimated by GD whereas more popular varieties were overestimated. This throws into question the accuracy of results from group discussions, particularly those at which the entire village is not represented. It also suggests that group discussions are particularly poor for estimating the early adoption of new varieties when they are likely to occur at a low frequency in a village.

Figure 2. Comparison of adoption of new varieties according to the FGDs and the data from the questionnaires



Users were defined during the GD as those households that were growing at least one new variety promoted by the project. Analysis of the responses from the questionnaires suggests a minor anomaly in that only 97% of the households in Kapilvastu had actually adopted any new varieties (Table 18). Most (in Jhapa and Saptari) and all (in Kapilvastu and Siraha) variety users were also users of some other RRC technologies (seed priming, improved composting, IPM or IPNM).

Table 18: Adoption by variety or technology of 287 surveyed farmers (%)

Households	District				
	Jhapa	Kapilvastu	Saptari	Siraha	Total
Users (by FGD definition)	100	100	100	100	100
Variety user	100	97	100	100	99
Technology users	98	100	86	100	95
COB rice user	2	18	63	2	23
PVS rice user	100	18	11	4	37
Total Number of HH	**83**	**73**	**80**	**51**	**287**

New rice varieties were grown on an average of 0.1 to 0.23 ha (9% to 24% of HH land) except for Barkhe 2014 in Saptari where 36 households (50% of the sample) grew it on an average of 0.47 ha which was 43% of their land Tables (19 and 20). The other major rice success story was that of BG 1442 in Jhapa where 82 households (99% of the households sampled) grew BG 1442 as a spring (*Chaite*) crop on an average of 0.46 ha.

In Siraha, adoption of PVS rice varieties was low (only 4%) because the RRC project mostly promoted short duration varieties which were unsuitable for the project villages. Adoption of rice varieties bred from COB was highest in Saptari (63%) which was mainly due to the rapid uptake of Barkhe 2014 that was particularly preferred as a very good replacement for Kanchhi Masuli, the most popular local variety. Adoption of COB varieties (short to medium

duration) was lowest in Jhapa and Siraha (2%) where medium- to longer duration varieties are preferred.

Chickpea varieties were not adopted at all in Jhapa as soils there are generally deficient in boron which results in poor- or no pod set in chickpea. Chickpea is also particularly susceptible to fungal diseases, particularly Botrytis Grey Mould, in Jhapa. In contrast, in Kapilvastu and Saptari, groundnut cvs Awarodhi and Tara were grown by appreciable numbers of households (Table 20) on mean amounts of land ranging from 0.05 ha to 0.15 ha (Table 19). The smaller (relative to rice) areas of land used for chickpea reflect the lesser availability of medium land suitable for chickpea and may also be a consequence of the smaller amounts of chickpea seed circulating in the villages.

Mungbean, particularly Kalyan and Prateeksha, was grown in all four Districts on smaller areas still, ranging from 0.03 – 0.14 ha. These mungbean varieties were particularly popular in Siraha (Tables 19 and 20). On the whole, reported yield levels for all crops were similar to those reported from previous Mother and Baby trials exercises in the Districts.

Table 19: Area of adoption of varieties of rice, chickpea and mungbean among the 287 surveyed user HHs in hectares and as a percentage of the total cultivated land

	Jhapa		**Kapilvastu**		**Saptari**		**Siraha**		**All**		
	(ha)	**(%)**	**(ha)**	**(%)**	**(ha)**	**(%)**	**(ha)**	**(%)**	**(ha)**	**(%)**	**N**
Rice											
Barkhe 1027	0.50	100	0.24	25	0.19	9			0.23	14	15
Barkhe 2001			0.14	20	0.26	25			0.22	24	14
Barkhe 2014					0.47	43	0.17	33	0.46	43	37
Sugandha 1			0.07	8	0.17	10		0	0.15	9	11
BG 1442 main	0.42	17	0.05	14	0.08	4	0.22	23	0.11	9	25
BG 1442 spring	0.46	43							0.46	43	82
Chickpea											
KPG 59					0.14	10			0.14	10	9
Awarodhi			0.07	10	0.15	7	0.07	9	0.11	8	45
Tara			0.05	11	0.11	6	0.17	33	0.07	8	33
KAK 2					0.08	3	0.02	3	0.07	3	4
Mungbean											
Kalyan	0.04	3	0.05	7	0.13	15	0.14	12	0.10	9	77
Prateeksha	0.04	5	0.04	10	0.12	9	0.12	9	0.09	9	52
NM 92	0.03	1	0.03	20	0.09	5			0.06	4	7
VC 3960			0.03	8	0.10	6			0.04	7	6

Table 20: Number of observations on which the areas are based (in Table 19) among the 287 surveyed user HHs, plus mean yield.

	Jhapa (no)	Kapilvastu (no)	Saptari (no)	Siraha (no)	All (no)	Mean yield (t ha^{-1})
Barkhe 1027	1	6	8		15	3.14
Barkhe 2001		5	9		14	3.70
Barkhe 2014			36	1	37	3.47
Sugandha 1		2	9		11	3.47
BG 1442 main	2	12	9	2	25	4.52
BG 1442 spring	82				82	4.55
KPG 59			9		9	0.78
Awarodhi		23	19	3	45	0.51
Tara		20	12	1	33	0.57
KAK 2			3	1	4	0.41
Kalyan	23	8	10	36	77	0.39
Prateeksha	9	7	22	14	52	0.46
NM 92	1	3	3		7	0.47
VC 3960		5	1		6	0.48

Source of seed of new varieties

None of the HHs obtained any seed of the new COB rice and Mungbean varieties from the project (the only source of seed at the time) before 2002 and most HHs obtained seeds of new varieties in any reasonable quantity only from 2004 onwards (Table 21), so adoption or rejection were predominantly based on only 3-4 years of self-testing, although HHs may have been exposed previously to the new varieties if grown by neighbours, etc. Very few of the HHs received new seeds for the first time in 2007, apart from 22 HHs who took up Hardinath 1 (BG1442) for the first time.

Table 21: Number of HHs obtaining seed of project varieties for the first time in any particular year

	2002	2003	2004	2005	2006	2007	Total
Chickpea							
KPG 59	1	2	15	7	1	1	27
Awarodhi	13	9	11	11	6	0	50
Tara	20	10	9	13	6	0	58
ICCV 2	0	3	6	5	0	0	14
KAK 2	2	3	5	4	1	0	15
Mungbean							
Kalyan	6	4	14	30	40	0	94
Prateeksha	17	8	8	17	22	0	72
MN 92	6	6	1	2	1	0	16
VC 3960	1	1	1	2	2	0	7
Rice							
Barkhe 1027	0	6	1	2	8	0	17
Barkhe 2001	3	1	2	5	4	2	17
Barkhe 2014	3	0	6	21	11	1	42
Barkhe 3004	0	1	0	1	0	0	2
Sughanda 1	5	3	10	11	3	0	32
PR 101	9	4	10	7	2	0	32
Hardinath 1	0	2	10	40	25	22	99
Ashoka	1	3	2	4	0	1	11
Total	**87**	**66**	**111**	**182**	**132**	**27**	**605**

Analysis of the original source of seed of two rice varieties and one mungbean variety suggests that, for rice, neighbours – farmer-to-farmer spread – are the main source while for mungbean it is FORWARD (Tables 22-24). The small numbers of non-users who reported receiving seed are probably dis-adopters. Any impact following adoption of these varieties can be safely attributed to the project as, apart from neighbours, there is no major source of seed other than FORWARD.

Table 22: Original source of seed of Barkhe 2014 rice

Source	Non user	User	Total
FORWARD	6	10	16
Neighbour		26	26
Not received	244	1	245
Grand Total	**250**	**37**	**287**

Table 23: Original source of seed of BG 1442 rice

Source	Non user	User	Total
AGROVET		1	1
FORWARD	3	56	59
Govt Farm		2	2
Neighbour	1	47	48
Not received	177		177
Grand Total	**181**	**106**	**287**

Table 24: Original source of seed of Kalyan mungbean

Source	Non user	User	Total
Bazaar		1	1
FORWARD	17	61	78
Neighbour	4	11	15
Not received	189	4	193
Grand Total	**210**	**77**	**287**

Pattern of adoption of new crop varieties with time

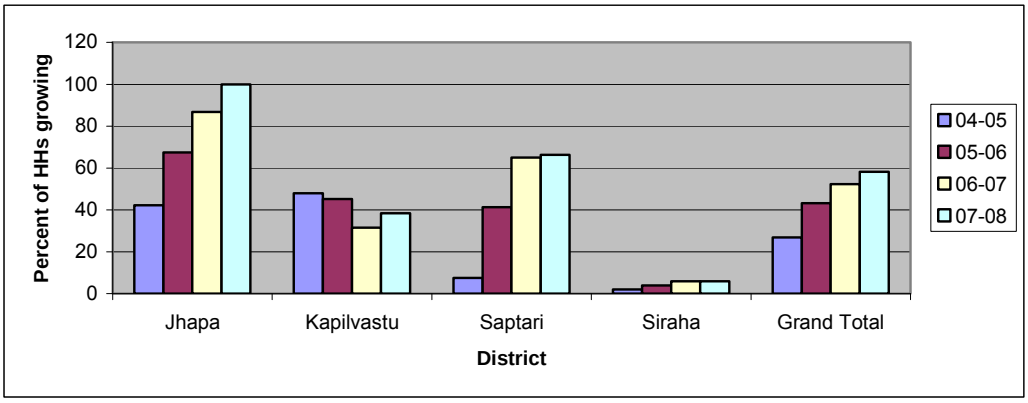
Rice

Overall, the percentage of user HHs (as defined in 2008) that grew one or more of the new rice varieties increased steadily from 2004-2005 (Fig. 3A). However, this was mostly due to steady increases with time in Jhapa (where there was 100% adoption in 2007-08) and in Saptari. Adoption in Kapilvastu was moderate, at around 40%, over all four years, whereas adoption in Siraha was very low. Area grown per HH mostly followed the same pattern (Fig. 3B), reaching around 0.5 ha in Jhapa by 2007-08, 0.45 ha in Saptari and 0.15 in Kapilvastu. In Siraha, however, although only a small proportion of households grew them, they did so on a reasonably large area of 0.25 ha compared, for instance with those HHs in Kapilvastu. Production per HH followed closely the area grown (Fig. 3C) as the yield per hectare, as

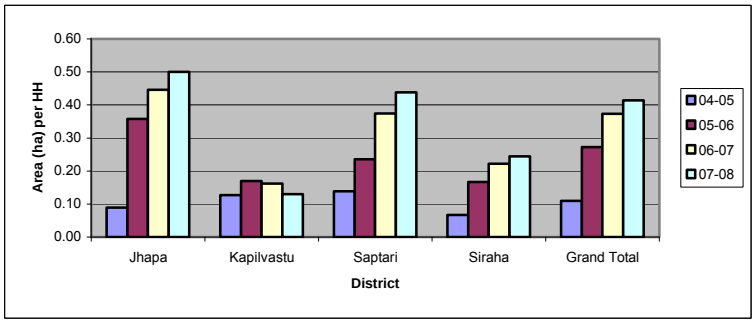
recalled by farmers, (Fig. 3D) was quite constant within each District (apart from unusually high yields in Siraha in 2005-06)over the four years, averaging around 4 t ha^{-1} in Jhapa and Kapilvastu and around 3.5 t ha^{-1} in Saptari and Siraha.

Figure 3. New rice varieties from 04-05 to 07-08

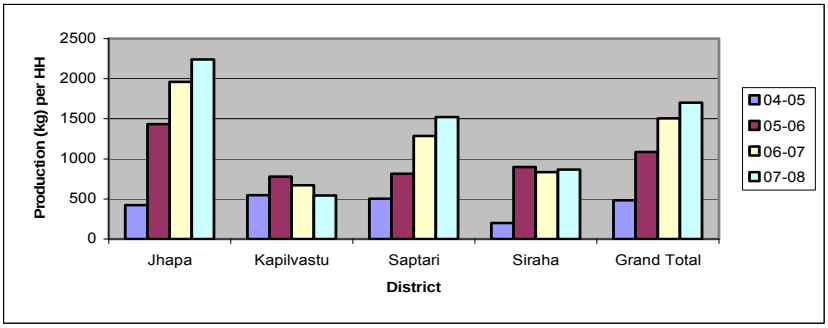
A. Percent of HHs growing



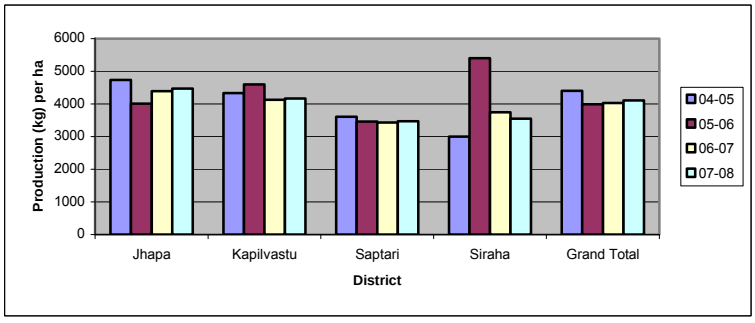
B. Area grown per HH



C. Production per HH



D. Production per hectare



Chickpea

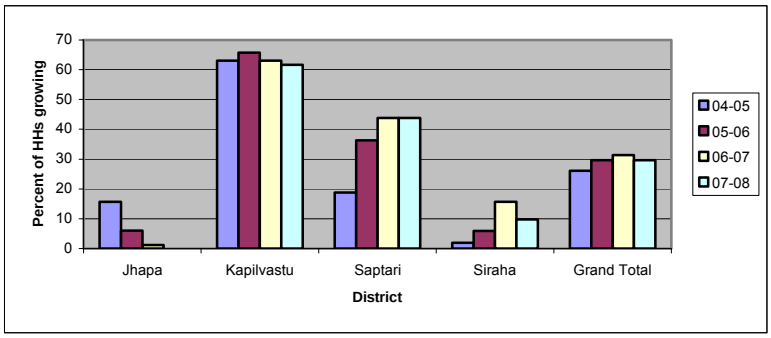
There were large contrasts between Districts in the uptake of new chickpea varieties (Fig. 4A). In Kapilvastu, adoption was over 60% in all four years whereas adoption in Saptari increased over the four years to reach around 45% in 2007-08. Adoption in Jhapa, however, declined steadily from a small initial number of HHs and, by 2007-08, was zero. The incidence of insect pests such as pod borer was similar in all the four districts, whereas Botrytis Gray Mould was higher in Jhapa. In addition, Jhapa is particularly unsuitable for successful chickpea cultivation because of soil boron deficiency that results in poor- or no pod set. In Jhapa, once farmers had access to seeds of BG 1442 and irrigation, most started growing *Chaite* rice (their seasons overlap considerably) and did not bother about chickpea which was not profitable. In Siraha, adoption never rose above 15% of User HHs. The reason for this low adoption is not known.

Chickpea was grown on much smaller areas than rice. Overall, mean areas grown over the four years were in the range 0.08 to 0.1 hectares but there were large differences between Districts (Fig. 4B). In Jhapa, where chickpea was the least popular, when it was grown during the first three years it was only grown on around 0.02 ha per HH. In Kapilvastu, where the highest percentage of HHs grew chickpea, it was grown on a relatively constant area of 0.06 ha per HH. In Saptari the area grown per HH followed the increase in the percentage of HHs growing the varieties, up to about 0.16 ha per HH in 2007-08. In contrast, the few HHs in Siraha that did grow the varieties in 2004-05 did so on a similarly large area but the average area per HH declined during the subsequent three years to around 0.07 ha.

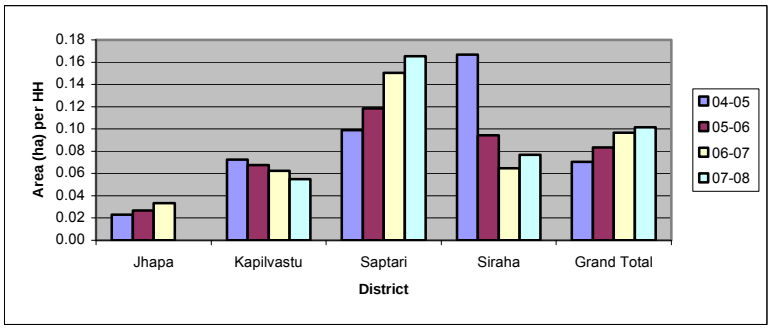
Production per HH was negligible (around 20 kg) in Jhapa and in Kapilvastu (Fig. 4C), reflecting the small areas sown (Fig. 4B) and the relatively low productivity, around 400 kg ha^{-1} (Fig. 4D). In contrast, HHs in Saptari produced around 100 kg per HH, reflecting the larger areas sown and also higher productivity of around 700 kg ha^{-1}. Productivity in Siraha was similar or slightly higher, with a particularly good season in 2005-06, the same season when better yields of rice were obtained in this District (see Fig. 4D).

Figure 4. New chickpea varieties from 04-05 to 07-08

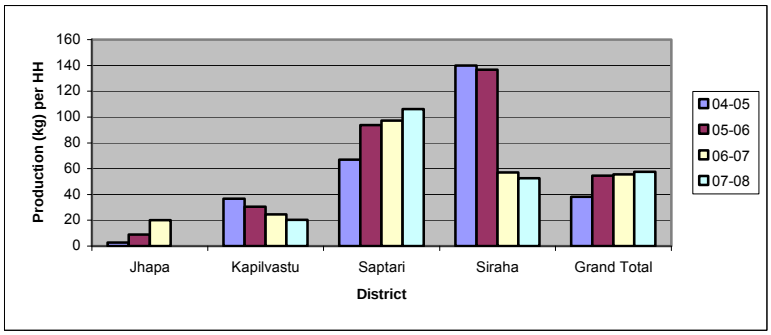
A. Percent of HHs growing



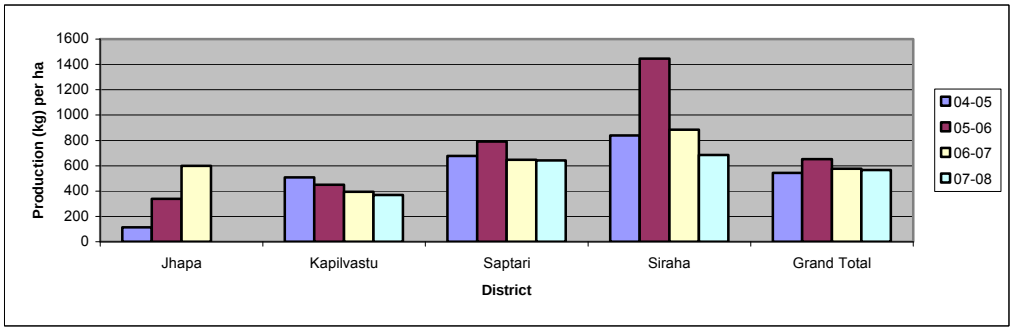
B. Area grown per HH



C. Production per HH



D. Production per hectare



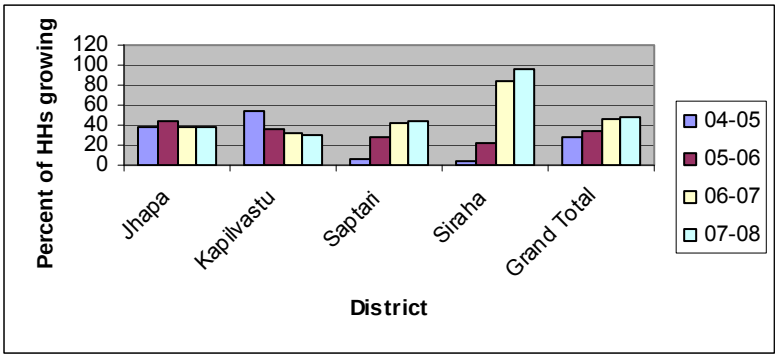
Mungbean

There was appreciable adoption (above 40% of all HHs) of new Mungbean varieties in all Districts (Fig. 5A). Adoption was steady around this level over all four years in Jhapa and Kapilvastu but increased to that level from a low base in Saptari. In Siraha, adoption was relatively low in the first two years but increased to around 90% in 2006-07 and 2007-08.

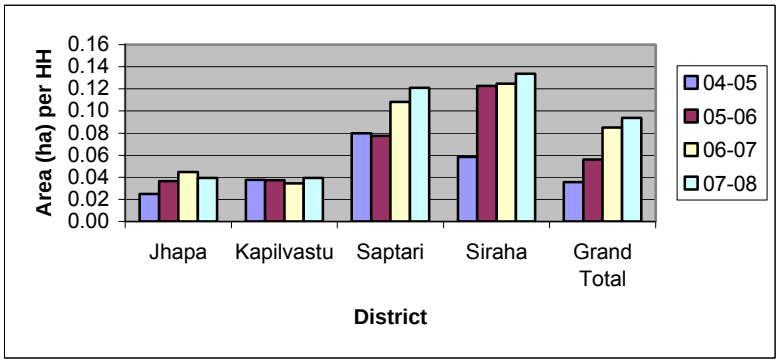
Areas grown per HH were of a similar order of magnitude to those of chickpea (Fig 5B) around 0.04 ha in Jhapa and Kapilvastu and around 0.12 ha in Saptari and Siraha. Production per HH (Fig. 5C) was very low (below 20 kg) in Jhapa and Kapilvastu but higher in Siraha (around 50 kg, with a 'spike' in 2004-05) and in Saptari (around 70-80 kg). In terms of per unit productivity, Saptari, Jhapa and Kapilvastu had similar productivity while Siraha had the lowest productivity of all. Apart from Kapilvastu, where productivity was relatively constant at around 400 kg ha^{-1} over the four years, there was a trend towards declining productivity with time in each of the other three Districts, albeit from initially higher levels than Kapilvastu (Fig. 5D). Mungbean is mainly grown as a rainfed crop in the *Terai*, in a season where irrigation water and residual soil moisture are scarce, so yields tend to be directly proportional to current, local rainfall. The crop is also susceptible to insect pests and competition with weeds.

Figure 5. New mungbean varieties from 04-05 to 07-08

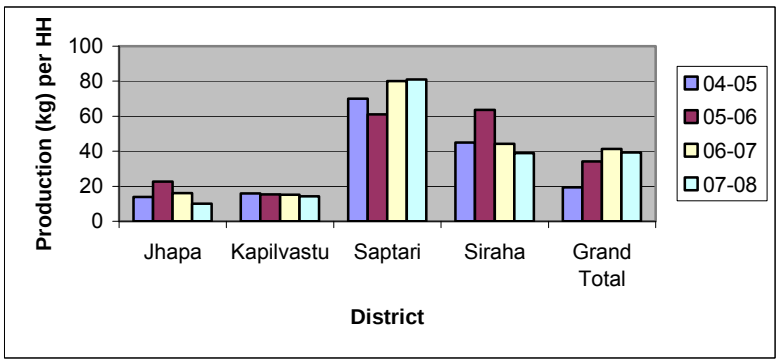
A. Percent of HHs growing



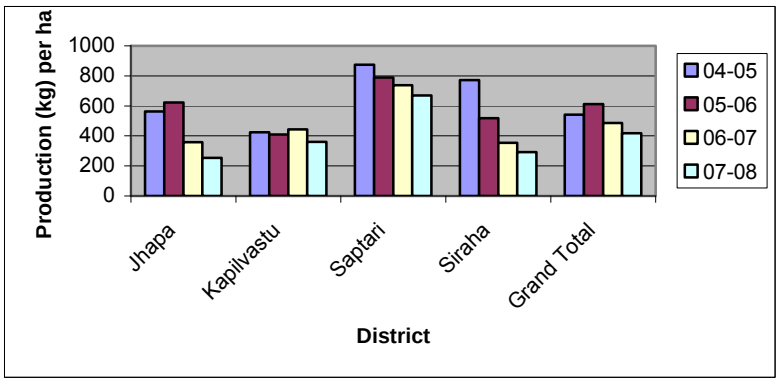
B. Area grown per HH



C. Production per HH



D. Production per hectare



Use of grains and seeds by user households

Rice

Almost all HHs saved seed of new rice varieties in 2006-07 and 2007-08 (Table 25) apart from in Kapilvastu where the percentage of HHs saving seed was lower in both years. There were more HHs that sold grain in Jhapa than in the other three Districts. The other common fate of new rice grain was to be eaten by the family. Very few HHs sold seed, gave it as a gift, or fed it to livestock. Only one HH (in Jhapa) gave grain to a landowner.

Table 25: Percentage of HHs that disposed of grain of new project rice varieties in a particular fashion in 2006-07 and 2007-08

% of HHs disposing of harvest.	**Year**	**Jhapa**	**Kapilvastu**	**Saptari**	**Siraha**	**Grand Total**
Sold as grain	06-07	76	43	21	33	51
	07-08	77	25	23	33	50
Sold as seed	06-07	6	13	13	33	10
	07-08	8	11	11	33	10
Eaten by family	06-07	75	87	100	67	85
	07-08	78	100	100	100	89
Saved for seed	06-07	99	43	100	100	91
	07-08	99	86	100	100	97
Given as gift	06-07	0	4	0	0	1
	07-08	0	4	2	33	2
Feed for livestock	06-07	1	9	0	0	2
	07-08	1	7	0	0	2
Given to landowner	06-07	1	0	0	0	1
	07-08	1	0	0	0	1
Number of growers of project rice varieties	**06-07**	**72**	**23**	**52**	**3**	**150**
	07-08	**83**	**28**	**53**	**3**	**167**

When grain was sold, the largest amounts per HH were in Jhapa and Saptari and the least in Siraha (Table 26); conversely, HHs in Saptari ate the most grain. The amount saved for seed in Jhapa and Kapilvastu (only in 06-07) was around twice as much as in Saptari and Siraha. Note, however, that there were only three growers in Siraha. The few HHs in Jhapa and Kapilvastu who fed grain to livestock fed amounts ranging from 30-120 kg/HH. Only one landowner, in Jhapa, was repaid with rice grain but the repayment was substantial in both years. No other landlords were reported as being repaid with chickpea or mungbean (Tables 28 and 31) although, as there were significant areas of land shared in (around a quarter of cultivated land, Table 10) re-payments may have been with cash, in kind or with grain from other crops or of non-project rice varieties.

Table 26: Amount of grain (kg per 'disposing' HH) of new rice varieties disposed of in a particular fashion in 2006-07 and 2007-08

Amounts of grain disposed (kg per HH)	Year	Jhapa	Kapilvastu	Saptari	Siraha	Grand Total
Sold as grain	06-07	1910	609	1339	485	1641
	07-08	1960	551	813	200	1658
Sold as seed	06-07	259	227	37	40	134
	07-08	66	243	53	20	90
Eaten by family	06-07	558	400	967	960	706
	07-08	695	351	1301	762	847
Saved for seed	06-07	56	47	27	18	43
	07-08	57	30	28	27	43
Given as gift	06-07	0	25	0	0	25
	07-08	0	30	30	15	25
Feed for livestock	06-07	40	85	0	0	70
	07-08	120	30	0	0	60
Given to landowner	06-07	920	0	0	0	920
	07-08	800	0	0	0	800

For those HHs that sold grain or seed, the price obtained varied slightly between years and between Districts (Table 27). In particular, grain sold for a higher price in Saptari whereas the price for seed was consistently highest in Siraha (where there were very few growers). There was a premium of around 100% for seed relative to grain, reflecting the perceived higher quality (and extra production cost) of seed.

In Saptari, where cv Kanchhi Masuli is the most popular local variety, farmers sell grain of the new varieties regardless of their quality at the price of Kanchhi Masuli and vice versa. The likely reason for the differences in price of new rice varieties in Siraha and Saptari is that the CBSP group in Saptari is more experienced than that of Siraha. So, the group fixes the price of seed in consultation with DADOs and Agrovets/seed companies. Whereas in Sirha, the group is not as mature and individual farmers sold the seed to other farmers without knowledge of any price fixation policy of seed in 2006-08. Generally farmers are ready to pay higher prices for new varieties but once the varieties are locally produced then their price gradually declines and becomes stable.

Table 27: Price of grain and seed (Rs/kg) of new rice varieties sold in 2006-07 and 2007-08

Price	Year	Jhapa	Kapilvastu	Saptari	Siraha	Grand Total
Price of grain sold (Rs/kg)	06-07	7.6	10.7	16.6	8.0	9.3
	07-08	8.4	10.3	13.3	9.0	9.3
Price of seed sold (Rs/kg)	06-07	18.0	17.7	17.0	25.0	17.9
	07-08	18.6	21.3	18.3	25.0	19.4

Chickpea

All HHs in Kapilvastu and Saptari in both years (and the single HH in Jhapa in 2006-07) ate some of the chickpeas that they grew whereas a slightly lower percentage of HHs in Siraha did so (Table 28). Around 30% of HHs in Saptari sold seeds whereas only a few HHs in any of the other three Districts did so. A few (7 in Kapilvastu and 1 in Saptari) HHs gave seed as gifts. Only two HH, in Kapilvastu, used chickpea to feed livestock.

Table 28: Percentage of HHs that disposed of grain of new chickpea varieties in a particular fashion in 2006-07 and 2007-08

% of HHs disposing of harvest.	Year	Jhapa	Kapilvastu	Saptari	Siraha	Grand Total
Sold as grain	06-07	100	20	66	13	38
	07-08	0	13	69	0	35
Sold as seed	06-07	0	2	34	13	16
	07-08	0	2	29	0	13
Eaten by family	06-07	100	100	100	75	98
	07-08	0	100	100	80	99
Saved for seed	06-07	0	96	100	63	93
	07-08	0	100	100	80	99
Given as gift	06-07	0	15	3	0	9
	07-08	0	16	3	0	9
Feed for livestock	06-07	0	4	0	0	2
	07-08	0	4	0	0	2
Number of growers of new chickpea varieties	**06-07**	**1**	**46**	**35**	**8**	**90**
	07-08	**0**	**45**	**35**	**5**	**85**

The amounts of grain of new chickpea varieties transacted were small, reflecting the low levels of production (Table 29). The larger amounts sold and eaten in Siraha were attributable to only one HH.

For those who sold grain or seed, the unit price (Table 30) was much higher than for rice (Table 27) but, of course, the returns per HH were low because the volumes traded were small. The premium for chickpea sold as seed rather than for grain was smaller, around 40%, than that for rice but note that there is already generally a premium for Kabuli (bold-seeded) chickpea over Desi (local, small-seeded) varieties.

Table 29: Amount of grain (kg per 'disposing' HH) of new chickpea varieties disposed of in various ways in 2006-07 and 2007-08.

Amounts of grain disposed (kg per HH)	Year	Jhapa	Kapilvastu	Saptari	Siraha	Grand Total
Sold as grain	06-07	10	29	48	180	46
	07-08	0	25	57	0	51
Sold as seed	06-07	0	7	31	130	36
	07-08	0	16	37	0	35
Eaten by family	06-07	10	15	45	18	27
	07-08	0	14	46	60	29
Saved for seed	06-07	0	3	10	8	6
	07-08	0	2	10	6	6
Given as gift	06-07	0	7	15	0	8
	07-08	0	58	54	0	55
Feed for livestock	06-07	0	4	0	0	4
	07-08	0	30	59	0	56

Table 30: Price of grain and seed (Rs/kg) of new chickpea varieties sold in 2006-07 and 2007-08

Price	Year	Jhapa	Kapilvastu	Saptari	Siraha	Grand Total
Price of grain sold (Rs/kg)	06-07	40	50	51	48	40
	07-08	None sold	58	54	None sold	55
Price of seed sold (Rs/kg)	06-07	0	40	55	70	40
	07-08	None sold	30	59	None sold	56

Mungbean

Most HHs in all Districts ate the new varieties of mungbean and sold some for seed (Table 31). In addition, a large proportion of HHs in Saptari (56% and 47% in the two years) sold grain. A significant minority of HHs in Saptari and Siraha sold seed.

Table 31: Percentage of HHs that disposed of grain of mungbean varieties in a particular fashion in 2006-07 and 2007-08

% of HHs disposing of harvest.	Year	Jhapa	Kapilvastu	Saptari	Siraha	Grand Total
Sold as grain	06-07	9	0	56	14	21
	07-08	6	5	47	10	18
Sold as seed	06-07	22	4	29	30	23
	07-08	6	0	47	18	20
Eaten by family	06-07	97	100	100	95	98
	07-08	91	91	100	80	89
Saved for seed	06-07	91	92	100	100	96
	07-08	88	95	100	82	90
Given as gift	06-07	3	4	6	30	13
	07-08	3	5	0	16	7
Number of mungbean growers	**06-07**	**32**	**24**	**34**	**43**	**133**
	07-08	**32**	**22**	**36**	**49**	**139**

As for chickpea, the amounts of the new mungbean varieties transacted were small (Table 32). Prices for both grain and seed were higher than those for chickpea and differed between Districts, being higher in Jhapa, although there was actually very little premium for seed over grain in any District (Table 33).

Table 32: Amount of grain (kg per 'disposing' HH) of new mungbean varieties disposed of in a particular fashion in 2006-07 and 2007-08.

Amounts of grain disposed (kg per HH)	Year	Jhapa	Kapilvastu	Saptari	Siraha	Grand Total
Sold as grain	06-07	9	0	56	25	45
	07-08	4	45	46	31	40
Sold as seed	06-07	11	20	14	29	20
	07-08	3	0	22	17	19
Eaten by family	06-07	12	12	39	27	24
	07-08	9	13	44	33	27
Saved for seed	06-07	2	2	5	4	4
	07-08	2	2	5	5	4
Given as gift	06-07	1	3	14	6	6
	07-08	1	2	0	10	9

Table 33. Price of grain and seed (Rs/kg) of new mungbean varieties sold in 2006-07 and 2007-08

Amounts of grain disposed (kg per HH)	Year	Jhapa	Kapilvastu	Saptari	Siraha	Grand Total
Price of grain sold (Rs/kg)	06-07	73	None sold	54	54	56
	07-08	73	50	59	66	61
Price of seed sold (Rs/kg)	06-07	74	60	58	62	63
	07-08	80	None sold	73	67	72

Distribution of seeds of particular varieties by user households

Seed of new varieties was distributed by relatively few HHs and seed travelled, on average, quite short distances (Table 34). However, when HHs did supply seed to others, *total* amounts transacted could be quite large, e.g. 460 kg of BG 1442 rice by six HH in Jhapa and 700 kg of Barkhe 2014 by two farmers in Kapilvastu. Distribution of legume seeds (mungbean and chickpea) was generally in smaller amounts, perhaps reflecting the smaller volumes of seed available as a consequence of low productivity and the inherently smaller multiplication rates of legumes relative to rice. Farmers in Saptari distributed seed more than those in other Districts.

Table 34: Seed distribution patterns by variety users

Seed supplied	Jhapa	Kapilvastu	Saptari	Siraha	Overall
BG 1442 (no. HH supplying)	6.0	1.0			7.0
BG 1442 mean distance (km)	1.4	1.0			1.3
BG 1442 total supplied (kg)	460.0	30.0			490.0
Barkhe 2014 (no. HH supplying)		2.0	6.0	1.0	9.0
Barkhe 2014 mean distance (km)		2.0	2.9	50.0	7.9
Barkhe 2014 total supplied (kg)		700.0	295.0	20.0	1015.0
Sughanda 1 (no. HH supplying)			1.0		1.0
Sughanda 1 mean distance (km)			2.0		2.0
Sughanda 1 total supplied (kg)			25.0		25.0
KPG59 chickpea (no. HH supplying)			6.0		6.0
KPG59 chickpea mean distance (km)			6.9		6.9
KPG59 chickpea seed total supplied (kg)			192.0		192.0
Awarodhi chickpea (no. HH supplying)		1.0	4.0		5.0
Awarodhi chickpea mean distance (km)		1.0	1.6		1.5
Awarodhi chickpea total supplied (kg)		16.0	95.0		111.0
KAK 2 chickpea (no. HH supplying)			4.0		4.0
KAK 2 chickpea mean distance (km)			9.8		9.8
KAK 2 chickpea total supplied (kg)			81.0		81.0
Tara chickpea (no. HH supplying)			1.0		1.0
Tara chickpea mean distance (km)			2.0		2.0
Tara chickpea total supplied (kg)			5.0		5.0
Prateeksha mungbean (no. HH supplying)	1.0		10.0		11.0
Prateeksha mungbean mean distance (km)	1.0		2.0		1.9
Prateeksha mungbean total supplied (kg)	3.0		223.0		226.0
Kalyan mungbean (no. HH supplying)	1.0		6.0	9.0	16.0
Kalyan mungbean mean distance (km)	1.0		1.0	4.2	2.8
Kalyan mungbean total supplied (kg)	2.0		145.0	148.5	295.5
VC 3690 mungbean (no. HH supplying)			1.0		1.0
VC 3690 mungbean mean distance (km)			2.0		2.0
VC 3690 mungbean total supplied (kg)			5.0		5.0

Specific benefits reported by users

The proportion of technology users who mentioned a specific benefit when asked an 'open' question, i.e. a list of possible answers was not read out, is a crude measure of the importance of that benefit. However, farmers' rankings of the cited benefits allow the calculation of a more informative index of the relative importance of benefits. For each technology in Tables 35 – 39, data are first presented (column A) on the crude basis of what

proportion of respondents (users of that technology) cited any particular benefit. In column B, that value is then divided by the mean rank value for that benefit. Thus, for example, for a benefit from a range of 10 benefits that was cited by all HHs (100% mention it) its importance could range from 100% (if all ranked it 1st out of 10) down to 10% (if all ranked it 10th out of 10).

From new varieties

Farmers were asked about benefits of new varieties in general and answers cannot be disaggregated according to crop or variety (Table 35). Increased consumption of legumes and improved soil fertility was less important in Jhapa (where chickpea adoption was zero) than benefits likely to be associated with increased rice production such as increased consumption of cereals and increased food self-sufficiency (Table 35). Better health was associated with increased consumption of legumes, i.e. was not thought as important in Jhapa as in the other three Districts.

Cropping as a source of cash was particularly important in Saptari, while increased soil fertility was most important in Siraha. Reducing or avoiding migration was the least important benefit mentioned in all Districts. Overall, source of cash and increased consumption of cereals were cited as the most important benefits.

Table 35: Percentage (A) of new chickpea/mungbean/rice users who mentioned a particular benefit from new crops and varieties and (B) that percentage divided by the mean rank for that benefit

Benefit	Jhapa		Kapilvastu		Saptari		Siraha		Overall	
	A	***B***	**A**	***B***	**A**	***B***	**A**	***B***	**A**	***B***
Source of cash	90	*33*	62	*19*	95	*53*	75	*24*	82	*32*
Increased consumption of legumes	42	*11*	80	*37*	76	*30*	90	*34*	70	*26*
Increased consumption of cereals	99	*42*	92	*35*	94	*27*	75	*22*	91	*32*
Increased food self sufficiency months	100	*50*	39	*13*	86	*22*	76	*20*	77	*25*
Better health	35	*6*	79	*22*	76	*16*	61	*13*	62	*13*
Reduce or avoid migration	25	*5*	48	*10*	3	*0*	4	*1*	21	*4*
Increased soil fertility	69	*14*	86	*18*	75	*21*	98	*54*	80	*21*
Increased fodder for livestock	98	*23*	83	*16*	84	*14*	45	*8*	81	*16*
No. HHs growing new varieties	**83**	***83***	**71**	***71***	**80**	***80***	**51**	***51***	**285**	***285***

From RRC technologies

Project records do not allow the intensity of promotion of these activities to be disaggregated by district so, for a given district, the link between level of promotion and level of adoption is unclear. We do know, however, that the project trained 455 farmers in 41 villages in seed priming techniques and 526 farmers in the same 41 villages in IPNM (Table 4).

Seed priming

On average, we would expect 244 HHs in the 22 sampled villages (22/41 x 455) to have been trained in seed priming, so the 128 HHs that reported using seed priming (Table 36) represent around 50% adoption of those initially trained (although this takes no account of any spontaneous adoption by HHs who were not initially trained).
The most obvious benefits of seed priming are quick- and higher germination and that is reflected in the farmers' views in all districts, although that conclusion is based on only a small number of farmers in Saptari and Siraha (Table 36). Most farmers in Kapilvastu also cited plant vigour and resistance to drought and disease and increased yield although they

ranked these benefits lower than quick germination. It should be noted that these six benefits are those generally put forward during training sessions as justification for implementing seed priming, so citation of them might reflect on the effectiveness of the training. Farmers need reasons to try new technologies and persuasion almost always includes information on expectations from the intervention so confounding of expected benefits with actual benefits when asked is always a possibility.

Table 36: Percent (A) of users who mentioned a particular benefit from seed priming and (B) that percentage divided by the mean rank for that benefit.

Benefit	Jhapa		Kapilvastu		Saptari		Siraha		Overall	
	A	***B***	**A**	***B***	**A**	***B***	**A**	***B***	**A**	***B***
Higher germination	92	*42*	90	*30*	100	*50*	100	*50*	91	*35*
Quick germination	96	*77*	100	*52*	100	*100*	100	*75*	98	*61*
Disease resistance	8	*2*	93	*32*	83	*25*	67	*15*	60	*19*
Drought resistance	33	*10*	94	*27*	100	*22*	100	*33*	72	*21*
Plant vigour	48	*17*	96	*23*	100	*23*	67	*17*	77	*20*
Increase yield	23	*7*	80	*16*	100	*19*	100	*19*	60	*13*
Uniform growth	8	*3*	0	-	0	-	0	-	3	*1*
Reduces bird damage	13	*5*	0	-	0	-	0	-	5	*2*
Fewer pest problems	0	-	3	*1*	0	-	0	-	2	*0*
No. seed priming users	**48**	***48***	**71**	***71***	**6**	***6***	**3**	***3***	**128**	***128***

Improved composting

As for seed priming, *on average* we would expect 282 HHs in the 22 sampled villages (22/41 x 526) to have been trained in improved composting techniques, so the 119 HHs that reported using improved composting (Table 37) represent around 40% adoption of those initially trained. Again, this takes no account of any spontaneous adoption by HHs who were not initially trained.

The main perceived benefit of improved composting in all districts was improved soil fertility and, to a lesser extent, low cost of production (Table 37). Surprisingly, increased production (usually a consequence of improved soil fertility) was barely mentioned and it may be that there had been some substitution of lower-cost compost for more expensive fertilizers. It is thought that fewer HHs in Saptari and Siraha adopted improved composting because, unlike in Kapilvastu and Jhapa, cattle dung is widely used there for making dung cakes for cooking and is not available for making compost. It seems likely that 'increased shelf life' may be an expectation carried over from initial training (see above).

Table 37: Percentage (A) of composting users who mentioned a particular benefit from improved composting and (B) that percentage divided by the average ranking for that benefit.

Benefit	Jhapa		Kapilvastu		Saptari		Siraha		Overall	
	A	***B***	**A**	***B***	**A**	***B***	**A**	***B***	**A**	***B***
Improve soil fertility	100	*87*	98	*63*	100	*88*	67	*44*	98	*76*
Low cost of production	98	*50*	88	*39*	100	*50*	67	*44*	94	*45*
High product price	27	*9*	52	*23*	33	*13*	33	*8*	37	*14*
Increase shelf-life	37	*12*	43	*13*	0	-	33	*11*	34	*11*
Increase in production	8	*4*	19	*7*	7	*2*	0	-	12	*4*
Use of local resources	5	*2*	0	-	7	*2*	0	-	3	*1*
Fewer disease problems	3	*2*	0	-	0	-	0	-	2	*1*
No. of HH composting	**59**	***59***	**42**	***42***	**15**	***15***	**3**	***3***	**119**	***119***

IPNM

The expected primary benefit of IPNM – increased soil fertility – was the most important one, cited by almost all IPNM users in all Districts (Table 38). Increased yield, low cost of production and use of local materials were also all cited widely and deemed to be quite important, whereas pest and disease control were deemed to be less important benefits. The soils in Kapilvastu are generally more fertile than that of the other districts and might explain why so few HHs adopted IPNM there (impact of IPNM practices is often more visible in marginal areas). Unanimous reporting of all six benefits in Kapilvastu and Saptari again suggests recall of benefits mentioned during training.

Table 38: Percentage (A) of IPNM users who mentioned a particular benefit from IPNM and (B) that percentage divided by the mean rank for that benefit

Benefit	Jhapa		Kapilvastu		Saptari		Siraha		Overall	
	A	***B***	**A**	***B***	**A**	***B***	**A**	***B***	**A**	***B***
Increase soil fertility	92	*41*	100	*30*	100	*45*	100	*95*	96	*49*
Increase yield	77	*24*	100	*30*	100	*31*	100	*51*	89	*32*
Low cost of production	84	*27*	100	*27*	100	*31*	100	*33*	93	*30*
Disease control	36	*8*	100	*23*	100	*23*	5	*1*	46	*10*
Insect/Pest control	69	*20*	100	*33*	100	*20*	5	*1*	61	*15*
Use of local resources	97	*38*	100	*30*	100	*33*	54	*14*	86	*29*
No. of HHs using IPNM	**64**	***64***	**3**	***3***	**36**	***36***	**37**	***37***	**140**	***140***

IPM

Benefits of IPM were mentioned by relatively few users in Kapilvastu, Saptari and, particularly, Siraha (Table 39). The expected primary benefits from IPM – disease and pest control – were cited in all Districts but were only considered to be the most important benefits in Jhapa. One reason why increased soil fertility was cited widely as being moderately important was that use of animal urine was one of the most important components of IPM. Although animal urine repels some pests and reduces the incidence of fungal foliar diseases, it is also a source of nitrogen (and and some hormones such as auxins) and can be used as a foliar feed. Increased growth and yield could thus be interpreted as resulting from 'increased (soil) fertility', although a similar interpretation – 'improved plant vigour' – was barely mentioned.

Table 39: Percent (A) of IPM users who mentioned a particular benefit from IPM and (B) that percentage divided by the average ranking for that benefit

Benefit	Jhapa		Kapilvastu		Saptari		Siraha		Overall	
	A	***B***	**A**	***B***	**A**	***B***	**A**	***B***	**A**	***B***
Increase soil fertility	55	*11*	94	*31*	58	*12*	100	*20*	64	*14*
Increase yield	64	*17*	88	*31*	83	*23*	100	*25*	72	*20*
Low cost of production	75	*21*	94	*33*	100	*32*	100	*50*	83	*25*
Disease control	77	*25*	88	*27*	100	*30*	0	-	82	*26*
Insect/Pest control	96	*57*	88	*20*	100	*33*	100	*100*	95	*40*
Better environment	96	*41*	88	*21*	92	*46*	100	*33*	94	*35*
Knowledge of IPM	2	*1*	0	-	0	-	0	-	1	*1*
Plant vigour	2	*1*	0	-	0	-	0	-	1	*0*
No. of HHs using IPM	**53**	***53***	**17**	***17***	**12**	***12***	**1**	***1***	**83**	***83***

Interaction between RRC technologies and crops

Table 40 shows the reported application of other (non-cultivar) RRC technologies (seed priming, improved composting, IPM, IPNM) to each of the crops. Note that there seems to have been some confusion over what constitutes 'seed priming' in rice. It is customary in some areas to pre-germinate or sprout rice seeds before sowing them into nurseries. Farmers may have confused this practice, applicable to the transplanted rice that is commonly grown, with seed priming (NOT pre-germination) that is appropriate for direct-seeded rice that is uncommon in these areas. Thus we do not have any confidence in the results for seed priming in rice in Table 40 (nor, by inference, in those for the 'any crop' category that includes rice).

Seed priming in chickpea was only used by appreciable numbers of farmers in Kapilvastu (hardly any chickpea was grown in Jhapa) whereas mungbean seed was primed by 33% of mungbean growers in Jhapa and 36% of mungbean growers in Kapilvastu. The 'other' crops primed by 51% of HH in Kapilvastu are not known.

Improved composting, IPM and IPNM for 'any crop' were all quite popular in Jhapa (where poor soil fertility is perceived to be a major problem) but less so in the other three Districts, the only exception being IPNM in Siraha and, possibly, improved composting in Kapilvastu. These relatively high values for adoption of these three technologies in Jhapa are due to high rates of adoption in rice and in mungbean but not in chickpea (which is barely grown) or in 'other crops'.

Table 40: Use of technologies in particular crops (% of users of each crop) within the 287 surveyed farmers in the four districts

	District				
	Jhapa	**Kapilvastu**	**Saptari**	**Siraha**	**Overall**
Any crop					
Seed priming	64	97	10	4	47
Improved Composting	78	58	20	6	44
IPM	64	23	15	2	29
IPNM	77	4	45	73	49
Number of farmers	**83**	**73**	**80**	**51**	**287**
Rice crop					
Seed priming	57	47	1	2	29
Improved Composting	70	30	8	4	31
IPM	54	8	0	0	18
IPNM	61	1	34	20	31
Number of rice users	**83**	**73**	**80**	**51**	**287**
Chickpea crop					
Seed priming	25	32	3	9	18
Improved Composting	25	45	0	0	22
IPM	25	25	11	9	18
IPNM	0	2	0	9	2
Number chickpea users	**4**	**44**	**38**	**11**	**97**
Mung bean crop					
Seed priming	33	36	8	4	17
Improved Composting	64	23	3	4	21
IPM	73	5	0	2	18
IPNM	64	5	0	44	31
Number mungbean users	**33**	**22**	**36**	**50**	**141**
Other crops					
Seed priming	8	51	5	0	17
Improved Composting	14	27	15	2	16

IPM	13	11	13	0	10
IPNM	18	3	16	12	13
Number	**83**	**73**	**80**	**51**	**287**

Household food self sufficiency of users

The majority of households reported a change in food self-sufficiency in Saptari, Siraha and Jhapa but only 40% of the households in Kapilvastu reported a change (Table 41). The reason for this is unknown. Overall there was a 29% increase in household food grain self sufficiency reported by users following adoption of RRC technologies, an increase of 3 months up from 10.2 months. However, the increase was greatest in Jhapa (63%) where mean food grain self-sufficiency was already the highest (Table 41). It seems likely that the widespread adoption of BG1442 as a *Chaite* rice crop (in effect, an 'extra' rice crop) in Jhapa would have contributed to this large increase. As a general principle, increased productivity of the staple crop rice, that is grown on most of the land types available, is more likely to increase household food grain self sufficiency than improvements in other crops (such as chickpea and mungbean) that have more restrictive land requirements.

Table 41: Reported change in household food self-sufficiency of users.

HH food self-sufficiency	Jhapa	Kapilvastu	Saptari	Siraha	Overall
Percent of HH reporting change	100.0	39.7	86.3	76.5	76.7
Average before RRC (months)	11.9	8.8	9.9	10.0	10.2
Average after RRC (months)	19.4	9.7	11.2	11.2	13.2
Average Change (months)	7.5	0.8	1.3	1.3	3.0
Percent change	+62.8	+9.4	+13.2	+12.6	+29.0

Problems with the new varieties as perceived by users

For each technology in Tables 42 – 44, data are first presented (column A) on the crude basis of what proportion of respondents (users of that technology) cited any particular benefit. In column B, that value is then divided by the mean rank value for that benefit. Thus, for example, for a benefit from a range of 10 benefits that was cited by all HHs (100% mention it) its importance could range from 100% (if all ranked it 1st out of 10) down to 10% (if all ranked it 10^{th} out of 10).

Rice

Overall, the two most important problems cited by growers of the new rice varieties were pests and diseases (Table 42) although it should be noted that these are also the most important problems for rice in general. Lack of irrigation was reported to be a significant problem in Kapilvastu. Most rice is produced in the *kharif* season when irrigation availability is less of an issue although, even in the kharif, irrigation can increase yield when rainfall is erratic. Lack of seed was also deemed quite important, particularly in Kapilvastu and Siraha.

Table 42: Percentage (A) of new rice variety users who mentioned a particular problem with growing new rice varieties and (B) that percentage divided by the average ranking for that problem

Benefit	Jhapa		Kapilvastu		Saptari		Siraha		Overall	
	A	*B*	A	*B*	A	*B*	A	*B*	A	B
Lack of market	4	*2*	67	*16*	22	*4*	0	-	12	*3*
Lack of seed	10	*5*	75	*40*	44	*9*	50	*25*	21	*9*
Lack of inputs	10	*4*	58	*15*	89	*37*	100	*40*	24	*8*
Pests	92	*68*	83	*40*	78	*39*	100	*40*	90	*60*
Disease	48	*22*	75	*24*	78	*29*	100	*29*	55	*22*
Inadequate technical know how	27	*9*	67	*17*	78	*29*	50	*50*	36	*12*
Need of more fertilizer	4	*2*	0	-	0	-	0	-	3	*2*
Low seed germination	11	*5*	0	-	0	-	0	-	8	*4*
Need of more irrigation	16	*11*	17	*45*	11	*11*	0	-	15	*9*
No. HHs using new rice varieties	**83**	***83***	**12**	***12***	**9**	***9***	**2**	***2***	**6**	***106***

Chickpea

Insects, pests and diseases were also the most important problems cited for growing new varieties of chickpea (Table 43) – again, these are the most important constraints for chickpea in general. There were no responses from Jhapa because there were no growers of new chickpea varieties. Lack of seed and lack of other inputs were mentioned frequently, as were theft and damage from stray animals, the latter particularly in Kapilvastu and Saptari. Inadequate technical know-how was also considered important in Saptari and Siraha (although there were only 5 growers in Siraha).

Table 43: Percentage (A) of new chickpea users who mentioned a particular problem with growing new chickpea varieties and (B) that percentage divided by the average ranking for that problem

Benefit	Jhapa		Kapilvastu		Saptari		Siraha		Overall	
	A	B	A	*B*	A	*B*	A	*B*	A	*B*
Theft	0	-	43	*9*	89	*17*	40	*13*	62	*13*
Space required for grazing	0	-	59	*13*	11	*2*	40	*13*	38	*8*
Damage from stray animals	0	-	57	*12*	91	*19*	60	*16*	71	*15*
Encroachment from wild animals	0	-	43	*7*	9	*1*	20	*7*	27	*4*
Lack of seed	0	-	77	*24*	74	*14*	40	*9*	74	*18*
Lack of other inputs	0	-	59	*12*	89	*23*	40	*7*	70	*16*
Insects/Pests	0	-	95	*44*	100	*57*	80	*53*	96	*49*
Diseases	0	-	93	*24*	100	*35*	60	*13*	94	*27*
Inadequate technical know how	0	-	55	*10*	86	*21*	80	*36*	69	*15*
Too late to sow after rice harvest	0	-	39	*5*	3	*0*	40	*11*	24	*3*
Low pod formation	0	-	0	-	0	-	20	*20*	1	*1*
High moisture	0	-	0	-	23	*18*	0	-	10	*8*
No. HHs using new chickpea varieties	**0**	***0***	**44**	***44***	**35**	***35***	**5**	***5***	**84**	***84***

Mungbean

Again pests and diseases, particularly pests, were considered most important for new varieties of mungbean (as well as for mungbean in general, see above) followed by lack of other inputs and of seed (particularly in Saptari) and inadequate technical know-how (particularly in Saptari and Siraha) (Table 44). Thrips and sucking bugs are the major pests of mungbean and there are no resistant varieties. Although spraying with chemical pesticide at the time of flowering is recommended to manage these pests, successful adoption requires technical know-how and access to inputs.

Table 44: Percentage (A) of new mungbean users who mentioned a particular problem with growing new mungbean varieties and (B) that percentage divided by the average ranking for that problem

Benefit	**Jhapa**		**Kapilvastu**		**Saptari**		**Siraha**		**Overall**	
	A	***B***	**A**	***B***	**A**	***B***	**A**	***B***	**A**	***B***
Space required for grazing	0	-	14	*5*	8	*2*	10	*5*	8	*3*
Encroachment from wild animals	0	-	5	*1*	8	*1*	12	*3*	7	*2*
Lack of seed	9	*3*	27	*10*	83	*17*	42	*11*	43	*10*
Lack of other inputs	12	*5*	18	*7*	94	*27*	40	*12*	44	*13*
Weeds	15	*7*	5	*5*	28	*5*	24	*6*	20	*5*
Pests	88	*65*	100	*73*	97	*47*	78	*39*	89	*50*
Disease	33	*15*	68	*30*	97	*32*	80	*25*	72	*25*
Lack of labour	3	*3*	5	*2*	0	-	8	*4*	4	*2*
Lack of knowledge on how to grow	18	*8*	14	*5*	89	*26*	76	*30*	56	*19*
Too late to sow after winter crop harvest	3	*2*	5	*2*	8	*2*	4	*2*	5	*1*
Low moisture	9	*5*	5	*2*	31	*22*	18	*10*	17	*10*
Low pod formation	18	*11*	9	*6*	3	*1*	22	*20*	14	*11*
No. HHs using new mungbean varieties	**33**	***33***	**22**	***22***	**36**	***36***	**50**	***50***	**14 1**	***141***

Non-users' views on new project varieties

These questions were designed to find out why non-users were not users. However, it should be noted that this part of the questionnaire did not mention 'new' or 'project' varieties so there may be some confusion in the minds of the respondents as to what they were being asked. For instance for rice, staff may have used "SD varieties" and "new varieties" synonymously while asking questions.

Rice

The proportion of the non-user HHs sampled that knew about short-duration (SD) rice varied from 32% in Siraha to 96% in Saptari (Table 45). Only 3 HH (11% of those that knew about SD rice) in Jhapa had ever grown them, whereas around 50% had tried them in the other three Districts.

Table 45: Non-user HHs that know about SD rice varieties and have grown them

Households	**Jhapa**	**Kapilvastu**	**Saptari**	**Siraha**	**Overall**
% of HHs who know about SD rice cvs	79	54	96	32	68
% of those HHs who have grown SD rice cvs	11	57	46	50	38
Number of HHs in sample	**24**	**26**	**27**	**19**	**96**

The number in each District of non-user HHs that had tried SD rice was rather small but, overall, the most frequently mentioned benefit was that of being able to grow winter crops (vegetables) in time (Table 46). Other benefits were mentioned with a frequency of around 10% – 20% except for 'high crop density' and 'moisture retained', both mentioned by only one respondent.

Table 46: Percentage of non-user HHs who had grown SD rice and reported a particular benefit

Benefits*	**Jhapa**	**Kapilvastu**	**Saptari**	**Siraha**	**Overall**
Increase in year round production	50	13	0	33	12
Winter crops (vegetables) in time	50	100	92	67	88
High crop density	0	0	0	33	4
Low irrigation requirement	0	0	42	0	20
Moisture retained	0	0	8	0	4
Production in less fertile land	0	0	33	0	16
Production in food scarce month	0	0	33	0	16
Number of HHs in sample	**2**	**8**	**12**	**3**	**25**

*Ranking was not asked for this question.

The main reasons for not growing project SD rice varieties even after having tried SD rice in general were "Don't know about the varieties", "unavailability of seed" and, to a lesser extent "lack of technical knowledge" (Table 47).

Table 47: Percentage (A) of non-user HHs who have grown SD rice who cite any particular reason why they have not grown project SD rice varieties and (B) that percentage divided by the mean rank for that reason

Reason	**Jhapa**		**Kapilvastu**		**Saptari**		**Siraha**		**Overall**	
	A	***B***	**A**	***B***	**A**	***B***	**A**	***B***	**A**	***B***
Don't know about the varieties	50	*50*	88	*68*	92	*56*	100	*60*	88	*59*
Unavailability of seed	50	*25*	63	*31*	92	*46*	100	*50*	80	*40*
Lack of market	50	*25*	13	*13*	0		0	-	8	*5*
Pests	0	-	0	-	58	*16*	0	-	28	*8*
Diseases	0	-	0	-	58	*14*	0	-	28	*7*
Lack of tech. knowledge	50	*17*	13	*6*	100	*38*	100	*43*	68	*26*
Lack of family labour	50	*50*	13	*4*	8	*4*	0	-	12	*6*
Lack of land	0	-	0	-	8	*8*	0	-	4	*4*
Lack of irrigation	50	*50*	13	*13*	0	-	0	-	8	*8*
No. of HHs in sample	**2**	***2***	**8**	***8***	**12**	***12***	**3**	***3***	**25**	***25***

The most important reasons for not growing SD rice varieties cited by non-users who knew about SD rice but had NOT tried it were "lack of irrigation", "not the best variety for the land" and "lower yield than existing variety". "Lack of land" and "not suitable for existing cropping pattern" were not considered very important. (Table 48)

Table 48: Percentage (A) of non-user HHs who know about SD rice but have NOT grown it who cite any particular reason why they have not grown any SD rice varieties and (B) that percentage divided by the mean rank for that reason.

Reason	Jhapa		Kapilvastu		Saptari		Siraha		Overall	
	A	***B***	**A**	***B***	**A**	***B***	**A**	***B***	**A**	***B***
Not the best variety for land	65	*51*	17	*17*	57	*35*	67	*33*	55	*38*
Lack of seed	0	-	67	*44*	14	*6*	100	*100*	23	*14*
Lower yield than existing variety	53	*32*	17	*8*	79	*36*	33	*33*	55	*29*
Not suitable for existing cropping pattern	18	*9*	17	*6*	0	-	0	-	10	*4*
Low consumer preference	29	*12*	33	*8*	36	*9*	0	-	30	*9*
Lower market price	18	*6*	17	*8*	64	*23*	0	-	33	*12*
Lack of family labour	29	*21*	33	*17*	21	*16*	67	*33*	30	*19*
Lack of land	12	*4*	33	*33*	0	-	33	*33*	13	*4*
Lack of irrigation	59	*37*	17	*17*	43	*64*	67	*67*	48	*39*
No. of HHs in sample	**17**	***17***	**6**	***6***	**14**	***14***	**3**	***3***	**40**	***40***

Winter season legumes (chickpea and lentil)

Almost all non-user HHs in Jhapa, Saptari and Siraha knew about winter season legumes (WSLs) but only around half the sample in Kapilvastu knew about them (Table 49). However, only 9% of the knowledgeable HHs (2 HHs) in Jhapa had actually grown them, in contrast with the high proportion of HHs in the other three Districts that had tried them.

Table 49: Non-user HHs that know about winter season legumes (WSL) and have grown them

Households	Jhapa	Kapilvastu	Saptari	Siraha	Overall
% of HHs who know about WSL	96	54	100	100	86
% of those HHs who have grown WSL	9	86	93	68	63
Number of HHs in sample	**24**	**26**	**27**	**19**	**96**

In contrast to the case for rice (Table 46), respondents were not asked their opinion of the potential benefits of WSLs. For those HHs that had grown WSLs before, the main reasons for not growing project WSL varieties were “Don’t know about the varieties”, “unavailability of seed” and “lack of technical knowledge” (Table 50). This is a similar pattern of response to that for rice.

Table 50: Percentage (A) of non-user HHs who have grown winter season legumes (WSL) who cite any particular reason why they have not grown project WSL varieties and (B) that percentage divided by the mean rank for that reason.

Reason	Jhapa		Kapilvastu		Saptari		Siraha		Overall	
	A	***B***	**A**	***B***	**A**	***B***	**A**	***B***	**A**	***B***
Unknown about the varieties	0	-	75	*36*	92	*47*	100	*93*	87	*50*
Lack of seed	50	*50*	67	*33*	96	*32*	77	*31*	83	*31*
Pests	0	-	58	*21*	72	*19*	8	*2*	50	*14*
Dsease problem	0	-	42	*30*	72	*21*	15	*4*	48	*16*
Lack of knowledge	0	-	50	*18*	92	*34*	92	*40*	79	*30*
Theft	50	*50*	0	-	8	*8*	0	-	6	*6*
Low moisture	0	-	0	-	4	*4*	0	-	2	*2*
Lack of land	0	-	17	*8*	4	*4*	0	-	6	*3*
No. of HHs in sample	**2**	***2***	**12**	***12***	**25**	***25***	**13**	***13***	**52**	***52***

For those non-user HHs that were aware of WSLs but had not grown any, the most important reason cited (Table 51) was “high moisture” followed by “lack of family labour”, although the responses are highly skewed towards those from Jhapa (where adoption of WSLs, i.e. chickpea was very poor). Interestingly, although the most common constraint cited by users for growing chickpea was pests and diseases (Table 43), non-users barely mentioned it (Table 51).

Table 51: Percentage (A) of non-user HHs who know about winter season legumes (WSL) but have NOT grown them who cite any particular reason why they have not grown any WSL varieties and (B) that percentage divided by the mean rank for that reason.

Reason	**Jhapa**		**Kapilvastu**		**Saptari**		**Siraha**		**Overall**	
	A	***B***	**A**	***B***	**A**	***B***	**A**	***B***	**A**	***B***
Long duration rice varieties	5	*2*	0	-	0	-	17	*8*	6	*3*
Damage from grazing	5	*5*	0	-	0	-	0	-	3	*3*
Lack of seed	10	*10*	100	*67*	0	-	17	*6*	16	*10*
Weeds	5	*2*	0	-	0	-	0	-	3	*1*
Pests	10	*3*	100	*50*	0	-	0	-	13	*5*
Lack of family labour	48	*28*	0	-	100	*67*	33	*17*	45	*26*
Inadequate technical know how	14	*6*	0	-	50	*13*	17	*8*	16	*6*
No access to draught power	10	*10*	0	-	50	*50*	0	-	10	*10*
Lack of money	5	*2*	0	-	50	*17*	17	*6*	10	*4*
High moisture	71	*47*	0	-	0	-	50	*50*	58	*40*
Lack of land	14	*9*	0	-	0	-	33	*33*	16	*12*
Unsuitable land/soil	5	*2*	50	*25*	0	-	17	*17*	10	*6*
No. of HHs in sample	**21**	***21***	**2**	***2***	**2**	***2***	**6**	***6***	**31**	***31***

Spring season legumes (mungbean)

Knowledge of spring season legumes (SSLs) was high in Jhapa and Saptari, lower in Siraha and lower still in Kapilvastu. In contrast to the case for WSLs, the percentage of those knowledgeable HHs who had tried SSLs was relatively low (Table 52).

Table 52: Non-user HHs that know about spring season legumes (SSL) and have grown them

Households	**Jhapa**	**Kapilvastu**	**Saptari**	**Siraha**	**Overall**
% of HHs who know about SSL	92	27	93	79	72
% of those HHs who have grown SSL	36	57	16	33	30
Number of HHs in sample	**24**	**26**	**27**	**19**	**96**

As for WSLs, respondents were not asked their opinion of the potential benefits of SSLs. The number in each District of non-user HHs that had tried SSLs was rather small (Table 53). Overall, however, their pattern of response was very similar to that for SD rice and WSLs, i.e. “Don't know about the varieties” followed by “Lack of seed” and “Lack of knowledge” were the most frequently cited, and perceived to be the most important, reasons for not growing them.

Table 53: Percentage (A) of non-user HHs who have grown spring season legumes (SSL) who cite any particular reason why they have not grown project SSL varieties and (B) that percentage divided by the mean rank for that reason

Reason	Jhapa		Kapilvastu		Saptari		Siraha		Overall	
	A	*B*	A	*B*	A	*B*	A	*B*	A	*B*
Don't know about the varieties	50	*33*	50	*25*	75	*45*	100	*83*	67	*44*
Lack of seed	50	*29*	100	*80*	100	*29*	100	*50*	81	*38*
Pests	13	*6*	75	*28*	75	*20*	0	-	33	*11*
Disease	0	-	25	*25*	75	*28*	0	-	19	*8*
Lack of knowledge	38	*16*	0	-	100	*36*	80	*29*	52	*20*
Low moisture	13	*13*	0	-	25	*13*	0	-	10	*6*
Lack of irrigation	13	*13*	0	-	0	-	0	-	5	*5*
Need of intensive care	13	*6*	25	*8*	0	-	0	-	10	*4*
No. of HHs in sample	**8**	***8***	**4**	***4***	**4**	***4***	**5**	***5***	**21**	***21***

"Lack of irrigation", "lack of labour" and "lack of seed" were the main reasons cited by HHs who knew about SSLs but had never grown them (Table 54).

Table 54: Percentage (A) of non-user HHs who know about spring season legumes (SSL) but have NOT grown them who cite any particular reason why they have not grown any SSL varieties and (B) that percentage divided by the mean rank for that reason

Reason	Jhapa		Kapilvastu		Saptari		Siraha		Overall	
	A	*B*	A	*B*	A	*B*	A	*B*	A	*B*
Place for livestock grazing	0	-	33	*17*	0	-	0	-	2	*1*
Encroachment from wild animals	0	-	33	*7*	0	-	30	*15*	8	*3*
Lack of seed	21	*13*	67	*27*	76	*20*	50	*23*	54	*17*
Lack of other inputs	7	*2*	33	*11*	71	*18*	0	-	35	*9*
Weeds	7	*4*	0	-	5	*1*	0	-	4	*1*
Insects/Pests	36	*15*	0	-	86	*23*	0	-	48	*14*
Disease	7	*2*	0	-	81	*19*	0	-	38	*9*
Lack of labour	43	*26*	0	-	57	*21*	50	*31*	48	*22*
Lack of knowledge on how to grow	36	*22*	0	-	86	*24*	60	*33*	60	*21*
No access to draft power	21	*16*	0	-	43	*19*	20	*13*	29	*15*
Lack of family labour	7	*7*	0	-	10	*6*	10	*10*	8	*7*
Lack of irrigation	93	*67*	67	*67*	33	*29*	20	*13*	50	*39*
Unsuitable land/soil	14	*7*	33	*17*	5	*1*	10	*10*	10	*4*
No. of HHs in sample	**14**	***14***	**3**	***3***	**21**	***21***	**10**	***10***	**48**	***48***

Non-users' intentions

Rice

Only around 50% of non-users intended to grow SD rice the following year (Table 55). Of those intending to grow SD rice, most (61%) intended to get seed from a neighbour (Table 56) while 30% said that they would use their own seed which implies that, since they are non-users of project varieties, they intend to grow other, non-project SD rice varieties.

Table 55: Percentage of non-user HHs intending to grow short duration rice next year

Households	Jhapa	Kapilvastu	Saptari	Siraha	Overall
% intending to grow SD rice next year	50	42	59	63	53
Number of HHs in sample	24	26	27	19	96

Table 56: Percentage of non-user HHs intending to grow SD rice next year – intended source of seed

Source of seed	Jhapa	Kapilvastu	Saptari	Siraha	Overall
Neighbour	58	82	38	75	61
Agrovet	8	27	0	17	12
Own	17	9	75	8	31
Nearby agricultural farm (i.e. NARC farm)	17	0	0	8	6
Bazaar	0	0	6	0	2
FORWARD	0	9	25	0	10
Number of HHs in sample	**12**	**11**	**16**	**12**	**51**

The main reasons why non-users were not going to grow SD rice next year were "lack of family labour" and "lack of land" (Table 57). Lack of seed was not deemed to be an important constraint.

Table 57: Reasons why HHs (%) do not intend to grow SD rice next year

Reasons cited	Jhapa	Kapilvastu	Saptari	Siraha	Overall
Lack of family labour	42	7	27	0	20
Lack of land	25	33	45	43	36
Lack of irrigation	50	0	0	0	13
Unavailability of seed	0	7	0	14	4
High moisture	0	7	0	14	4
Unknown about varieties	0	0	0	29	4
Low production	0	13	27	0	11
Unsuitable land	0	13	9	0	7
Low consumer preference	0	13	0	0	4
Lack of market	0	7	0	0	2
Number of HHs in sample	**12**	**15**	**11**	**7**	**45**

Chickpea

Only 8% (2) of HHs intended to grow chickpea the following year in Jhapa (where chickpea does not grow well) whereas 21% to 44% said that they would grow it the next year in the other three Districts (Table 58). Intending growers reported that they would seek seed from a variety of sources (Table 59) including FORWARD, neighbours, the bazaar, Agrovets and even use their own seed (again implying that they intend to grow non-project varieties).

Table 58: Percentage of HHs intending to grow chickpea next year

Households	Jhapa	Kapilvastu	Saptari	Siraha	Overall
% intending to grow chickpea next year	8	38	44	21	29
Number of HHs in sample	**24**	**26**	**27**	**19**	**96**

Table 59: Percentage of HHs intending to grow chickpea next year – intended source of seed.

Source of seed	Jhapa	Kapilvastu	Saptari	Siraha	Overall
Own	50	10	33	0	21
Neighbour	50	50	25	0	32
Bazaar	0	0	25	75	21
Agrovet	0	30	0	50	18
Farmers' group	0	0	0	25	4
FORWARD	0	40	50	0	36
Number of HHs in sample	**2**	**10**	**12**	**4**	**28**

Non-users who did not intend to grow chickpea the next year cited “lack of land” most frequently (31%) as a reason, followed by “lack of irrigation”, “insects”, “lack of seed” and “low yield/production” (Table 60). On average, non-users owned less (13.5 kattha) medium land (generally the land type most suited to chickpea cultivation) than users (22.7 kattha).

It is interesting that non-users in Jhapa, where chickpea is known to perform poorly, no-one cited insects and pests were not mentioned, although “low yield/production” was cited by 41% (9) HHs. No-one cited “lack of technical knowledge” but it seems likely that non-users are not particularly knowledgeable about chickpea cultivation.

Table 60: Reasons (%) why HHs do NOT intend to grow chickpea next year

Reasons cited	Jhapa	Kapilvastu	Saptari	Siraha	Overall
Unfruiting	5	0	0	0	1
Unsuitable land/soil	5	13	7	13	9
High moisture	5	0	0	13	4
Low yield/production	32	0	7	0	12
Lack of irrigation	41	0	7	7	16
Lack of family labour	14	6	20	7	12
Lack of land	14	38	53	27	31
Theft	0	0	20	20	9
Lack of seed	0	0	0	13	3
Insects	0	38	13	13	15
Disease	0	6	13	0	4
Low market price	0	0	7	0	1
Low moisture	5	0	7	0	3
Prefer lentil rather chickpea	0	0	7	0	1
Lack of technical knowledge	0	6	0	0	1
Number of HHs in sample	**22**	**16**	**15**	**15**	**68**

Mungbean

The number of non-users who intended to grow mungbean was quite small (Table 61). Overall, the percentage of non-user HHs intending to grow mungbean averaged 36%, ranging from 22% in Saptari and 58% in Siraha. They intended to obtain seed predominantly from neighbours and, to a lesser extent Agrovets and FORWARD (Table 62). A significant proportion of intending HHs in Jhapa and Saptari planned to use their own seed of, presumably, non-project varieties.

Table 61: Percentage of HHs intending to grow mungbean next year

Households	Jhapa	Kapilvastu	Saptari	Siraha	Overall
% intending to grow mungbean next year	38	35	22	58	36
Number of HHs in sample	**24**	**26**	**27**	**19**	**96**

Table 62: Percentage of HHs intending to grow mungbean next year – intended source of seed

Source of seed	Jhapa	Kapilvastu	Saptari	Siraha	Overall
Neighbour	78	67	33	82	69
Own	22	0	33	0	11
Bazaar	0	0	33	18	11
Agrovet	0	56	0	18	20
Farmers' group	0	0	0	9	3
FORWARD	0	22	33	9	14
Nearby agricultural farm (i.e. NARC farm)	0	0	0	9	3
Number of HHs in sample	**9**	**9**	**6**	**11**	**35**

HHs not intending to grow mungbean cited most frequently “lack of irrigation”, “lack of family labour”, “low moisture” and “lack of land” as their reasons why not (Table 63). “Lack of irrigation” and “low moisture” reflect the reality of trying to grow mungbean with the unpredictable rainfall of the spring season.

Table 63: Reasons (%) why HHs do NOT intend to grow mungbean next year

Reasons cited	Jhapa	Kapilvastu	Saptari	Siraha	Overall
Lack of family labour	40	18	19	13	23
Lack of high yielding variety	7	0	0	0	2
Unsuitable land/soil	7	12	5	0	7
High moisture	7	6	0	0	3
Lower yield than other crops	13	6	0	0	5
Lack of land	20	24	5	38	18
Lack of draft power	7	0	0	0	2
Lack of irrigation	47	18	19	0	23
Insects	7	0	5	13	5
Disease	0	0	5	0	2
Low moisture	0	6	48	13	20
Problem of stray animals	0	12	0	13	5
Problem of harvesting	0	6	0	0	2
Number of HHs in sample	**15**	**17**	**21**	**8**	**61**

Extent of adoption and sustainability

This study did not sample any HHs in non-project villages so there are no estimates of village-to-village spread. Within project villages, however, overall adoption of new rice varieties was the most high-profile impact of the project as, when adopted, they were grown on an average of 0.1 to 0.23 ha (9% to 24% of HH land). Using data in Tables 19 and 20 it is possible to calculate that 65.5 ha were sown with project rice varieties by the users sampled. Since total land owned by user HHs in the 22 sampled villages was 663 ha (1.05 ha x 630 user HHs identified during group discussions), these varieties were being grown on more than 140 ha in those villages. Adoption of individual varieties varied by district and by variety, however. Particularly successful were Barkhe 2014 in Saptari where 36 households (50% of the sample) grew it on an average of 0.47 ha (43% of their land) and BG 1442 in Jhapa where 82 households (99% of the households sampled) grew it as a spring (*Chaite*) crop on an average of 0.46 ha. Although project chickpea and mungbean varieties were adopted by significant numbers of HHs (apart from chickpea in Jhapa) they were grown on much smaller amounts of land per HH and production was much less than for rice. The PVS approach was very effective in matching varieties to farmers' needs for particular situations.

The percentage of HHs growing project rice varieties and the amount per HH of land used to grow them increased steadily from 2004 to 2008 (Fig 3). That was also the case for mungbean (Fig. 5) whereas the proportion of HHs growing chickpea and the amount of land they used to grow them remained relatively constant over the same period (Fig. 4). Since HHs seem to be saving enough seed to at least maintain these areas it is possible to infer that use of these varieties, by HHs that perceive them to be useful, can be sustained within the constraints of land availability.

It is not possible to estimate the sustainability of the more knowledge-based RRC technologies. While adoption of seed priming and of improved composting, for instance, were estimated to be around 50% and 40%, respectively, of the number of HHs initially trained, there is no information on whether or not user HHs intend to continue to use these technologies. Since these technologies require few or no resources to implement, future use will not be constrained by anything other than HHs' perception of whether they continue to give benefits.

Conclusions

The project, the impact of which this survey attempts to evaluate, was highly complex. It used a community-development type approach in which many different technologies, and combinations of technologies, were made available to farming households. The technologies themselves were both plant-based (new varieties) that could be readily tested by farmers without much additional project involvement, and knowledge-based (e.g. seed priming, improved composting) interventions that required varying degrees of farmer training. It is perhaps inevitable, then, that the impact of individual technologies would be difficult to determine, and that has, indeed, been the case.

Nevertheless, it is reasonably clear that new rice varieties have been adopted throughout the four districts, although different varieties have found favour in different districts. Some farmers are growing some rice varieties on significant portions of their land. Similarly, project varieties of chickpea and mungbean are also being grown by appreciable numbers of households. A limited amount of information suggests that the number of households adopting new varieties, and the area of land that each household sows, of all three crops are at least being maintained and may be increasing.

Availability of land is the key issue for projects that seek to improve livelihoods by increasing agricultural productivity. Average land holding per household is very small in the project villages and even very large relative increases in crop production are not very large in absolute terms. Nevertheless, households are of the opinion that adoption of these new varieties has increased food grain self sufficiency quite substantially, although the largest gains reported are where adoption of rice varieties has been the greatest. This is because rice is more productive than legumes and the new rice varieties can be grown on larger land areas (chickpea and mungbean require specific land types of which HHs have relatively little).

It is noteworthy that non-users were significantly less well off than users (Poverty Index of non-users = 4.18; for users = 5.84) and non-users own significantly less total land (0.7 ha) than users (1.05 ha) and the disparity is even greater for irrigated land (0.15 ha *versus* 0.35 ha). It may be that non-users' relative scarcity of suitable land is a major factor in not adopting the project varieties but, interestingly, although lack of land was occasionally cited by non-users as a reason for non-adoption it was never cited as a major reason.

The impact of knowledge-based technologies is much harder to evaluate than that of varieties. Although specific technologies such as seed priming have been adopted by around 50% of the number of households initially trained, we have no information on the spread with time of the technologies (time-course information was only gathered for crops); neither do we know if farmers considered that such technologies had contributed to the changes reported in food grain self sufficiently (the question was specifically limited to varieties). Overall, although appreciable numbers of farmers cited "increased yield" as a benefit of seed priming, it was not ranked as being very important compared with benefits concerning germination, stand establishment etc., and "increased yield" was not mentioned at all as a benefit of improved composting, IPM or IPNM. We can assume that, as long as farmers continue to perceive benefits from these relatively simple technologies, they will continue to employ them.

Surrounding non-project villages were not surveyed and accurate information on the spread of the new varieties elsewhere in the districts is not available so it is not possible to estimate the overall impact of the project. We can conclude however that, within the project villages sampled, there has been substantial adoption of a range of technologies and the farmers report that, since those technologies have been available, food grain self sufficiency has improved.

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ANNEXES

ANNEX 1

RFA HOUSEHOLD SURVEY QUESTIONNAIRE FOR RRC GROWERS IN NEPAL

	Interview Information	
1.	Enumerator Name	
2.	Date of survey	Day Month Year
3.	District	
4.	Village	
5.	*Gaon* or *Tole* name (hamlet name)	

	Household Profile	
6.	Household head	Male/Female
7.	Name of respondent	
8.	Family status of the respondent	a. Male household head b. Female household head c. Wife of household head d. Husband of household head e. Son f. Daughter g. Others, please specify
9.	Type of roof	a. Thatched b. Tiles/GI sheet c. Concrete
10.	What type of traction do you use?	a. Own animal b. Rented animal c. Own tractor d. Rented tractor e. Others, please name
11.	For how many months in a normal year do your home-grown cereals (rice, maize, wheat etc) feed the households?	…….months

	Household composition	
12.	Caste/ethnicity	a. Dalit b. Janjati c. Terai group d. Brahmin/Chhetri, Newar e. Others
13.	No. of adults (18 years old and above):	Male…… Female…..
14.	No of children aged 10-17	Male…… Female…..
15.	No of children aged under 10	Male…… Female…..
16.	No. of HH members who regularly work on farm	Male…… Female…..

17. <u>Farm Profile</u>

Land holding	**Kattha†: only unit allowed**		
	Upland	Medium land	Low land
Total land owned by respondent			
Total land cultivated by respondent			
Irrigated land cultivated by respondent			
Land rented out by respondent			
Land shared out by respondent			

† *Bigha = 6667; Kattha* = 338 m^2

18. Does your household cultivate any land other than your own? Yes……No…..
If yes,

Land holding	**Kattha†: only unit allowed**		
	Upland	Medium land	Low land
Land rented in by respondent			
Land shared in by respondent			

19. If you have Irrigation, what is the source of water?	a. Canal b. Tube well c. Open well d. Pond e. River f. Treadle pump g. Others

20. In 2007 main season what crops did you grow on what area?

Crop	Area (Kattha)	Kg harvested
1. Rice		
Barkhe 1027		
Barkhe 2001		
Barkhe2014		
Sugandha 1		
PR101		
Others		
2. Maize		
3. Other (please name)		
4.		
5.		
6.		
7.		
Total		

21. In 2007-2008 winter what crops did you grow on what area? (name varieties of chickpea)

Crop	Area (Kattha)	Kg harvested
1. Chickpea		
KPG 59		
Awarodhi		
Tara		
ICCV2		
KAK 2		
Others		
2. Lentil		
3. Wheat		
4. Mustard		
5. Maize		
6. Other (please name)		
7.		
Total		

22. In 2008 spring what crops did you grow on what area? (name varieties of mungbean)

Crop	Area (Kattha)	Kg harvested
1. Mungbean		
Kalyan		
Prateeksha		
NM92		
VC3960		
2. Maize		
3. Other (please name)		
4.		
5.		
6.		
7.		
Total		

23. Did you grow any winter crops on your *khet* land (after harvesting rice) BEFORE five years? YES___NO____

If YES, what were they (Please list).

What was your total winter crop area in a typical year?

24. Did you grow any spring crops on your *khet* land (in rice fallow areas OR after harvesting winter crops, e.g. vegetables, potato, wheat, lentil, chickpea) BEFORE five years? YES___NO____

If YES, what were they (Please list).

What was your total spring crop area in a typical year?

25. Where did you first get the seeds of chickpea, mungbean and rice from?

Variety	Year of first introduction	How much seed did you receive?	Who from?
Chickpea			
KPG 59			
Awarodhi			
Tara			
ICCV2			
KAK 2			
Others			
Mungbean			
Kalyan			
Prateeksha			
NM92			
VC3960			
Rice			
Barkhe 1027			
Barkhe 2001			
Barkhe2014			
Sugandha 1			
PR101			
Others			

26. Please describe your area of chickpea, mungbean and rice you grew during last four years?

Year	Area COB/PVS varieties of rice (*Kattha*)	Area chickpea (*Kattha*)	Area mungbean (*Kattha*)
2007-08			
2006-07			
2005-06			
2004-05			

27. What are the benefits your household gains from growing chickpea/mungbean/rice?

Reason	YES / NO	Rank - only if YES. (1 = most important)
Source of cash		
Increase consumption of legumes		
Increase consumption of rice		
Increase food self sufficiency months		
Better health		
Reduce or avoid migration		
Increase soil fertility		
Increase fodder for livestock		
Other (please name)		

28. What happened to the chickpea/mungbean/rice your household grew?

Use of chickpea, mungbean, rice	This year (2007/2008)		Last year (2006/2007)	
	Amount (kg)	Price per kg	Amount (kg)	Price per kg
Rice				
Sold as grain				
Sold as seed				
Eaten by family				
Saved for seed				
Given as gift				
Other (e.g. eaten by livestock)				
Chickpea				
Sold as grain				
Sold as seed				
Eaten by family				
Saved for seed				
Given as gift				
Other (e.g. eaten by livestock)				
Mungbean				
Sold as grain				
Sold as seed				
Eaten by family				
Saved for seed				
Given as gift				
Other (e.g. eaten by livestock)				

29. From the 2007/08 harvest did your household supply mungbean/chickpea/rice for seed?
YES __ NO __

a. If YES, to whom seed was supplied?

To whom did you supply seed?	What variety did you supply?	How far away? (km)	How much did you supply? (kg)	Type of transaction†
Rice				

Chickpea				
Mungbean				

[†]1. Exchange; 2. Gift; 3. Sold; 4. Seed Bank; 5. Other.

30. Have you received training or information on how to grow chickpea/COB/PVS rice/mungbean?

YES __ NO __

If YES, from whom…….and when?

31. Did anyone in your household migrate in the last year (2007-2008)? YES __ NO __

a. If YES, how many people? …….

b. Who are they? Please circle correct answer.

   a. Male household head
   b. Female household head
   c. Wife of household head
   d. Husband of household head
   e. Son
   f. Daughter
   g. Others, please specify……

Record the details for each HH member who migrated in the following table. (please record the number of weeks on migration)

Hints for enumerator to get information for question c (please ask the following questions in sequence):

- Who migrated;
- How many times in the year;
- When was the first trip;
- First trip - for how long (weeks)
- When was the second trip
- Second trip - for how long (weeks)

Who migrates?	Jul	A	S	O	N	D	Jan	F	M	A	May	June	Total weeks
Male HH head													
Female HH head													
Wife of HH head													
Husband of HH head													
Son													
Daughter													
Others, please specify													

32. Before your household started to grow COB/PVS rice/mungbean/chickpea, how many people used to migrate in a typical year?.....

33. Before your household started to grow COB/PVS rice/mungbean/chickpea, who used to migrate? (Male HH head / Female HH head/wife of HH head /husband of HH head/son / daughter / other……. please name)

If there is any changes in migration pattern

a. Please describe in detail how they have changed…… ……..

b. Please explain WHY your migration patterns have changed…… ……..

c. Are you happy with these changes? YES __ NO __

34. Does your household have any problems growing chickpea/mungbean/rice? YES __ NO __

35. If YES, what are they? (PLEASE DO NOT READ OUT LIST ONLY TICK IF RESPONDENT MENTIONS)

a. Rice COB/PVS

Reason	YES / NO	Rank – only if YES. (1 = most important)
Damage from grazing		
Encroachment from wild animals		
Lack of market		
Lack of seed		
Lack of other inputs		

Weeds		
Pests		
Diseases		
Lack of labour		
Inadequate technical know how		
Inadequate access to irrigation		
No access to draft power		
Other (please name)		

b. Chickpea

Reason	YES / NO	Rank – only if YES. (1 = most important)
Theft		
Damage from grazing		
Encroachment from wild animals		
Lack of market		
Lack of seed		
Lack of other inputs		
Weeds		
Pests		
Diseases		
Lack of labour		
Inadequate technical know how		
Too late to sow after rice harvest		
No access to draft power		
Other (please name)		

c. Mungbean

Reason	YES / NO	Rank – only if YES. (1 = most important)
Damage from grazing		
Encroachment from wild animals		
Lack of market		
Lack of seed		
Lack of other inputs		
Weeds		
Pests		
Diseases		
Lack of labour		
Lack of knowledge on how to grow		
Too late to sow after rice harvest		
No access to draft power		
Other (please name)		

36. If you have grown COB and PVS rice/Chickpea/Mungbean, has the adoption of these varieties changed your household food self sufficiency? (YES_____NO_____)

a. If YES, what was your average food self sufficiency?

Before ……(months)

After ……(months)

37. If you have grown COB and PVS, have you grown chickpea after it in the same field?

YES __ NO __

a. If YES, does it make a difference to when you sow chickpea? YES __ NO __

b. If YES, please explain ……...

38. If you have grown new Mungbean and Chickpea, is the rice yield on the same field changed after Mungbean?

YES __ NO __

c. If YES, how has it changed? (a) Increased (b) decreased

d. Please also explain possible reasons……...

39. Have you adopted one of the following RRC technologies? (Please circle the one or more appropriate technologies)

a. Seed priming
b. Composting
c. IPM/IPNM

40. If you have adopted the technologie/s, in which crops you have adopted?

Crops	Technologie/s
COB/PVS rice	
Chickpea	
Mungbean	

41. What are the benefits your household gains by the following RRC technologie/s?

Seed Priming

Reason	YES / NO	Rank - only if YES. (1 = most important)
Higher germination		
Quick germination		
Drought resistance		
Plant vigor		
Increase yield		
Other please specify		

Composting

Reason	YES / NO	Rank - only if YES. (1 = most important)
Increase soil fertility		
Low cost of production		
High product price		
Increase crop self life		
Other please specify		

IPM/IPNM

Reason	YES / NO	Rank - only if YES. (1 = most important)
Increase soil fertility		
Low cost of production		
High product price		
Disease resistance/control		
Insect/Pest control		
Other please specify		

ANNEX 2

RFA HOUSEHOLD SURVEY QUESTIONNAIRE FOR RRC NON-GROWERS IN NEPAL

	Interview Information	
1.	Enumerator Name	
2.	Date of survey	Day …… Month ……Year……
3.	District	
4.	Village	
5.	*Gaun* or *Tole* name (hamlet name)	

6.	**Household Profile**	
7.	Household head	Male/Female
8.	Name of respondent	
9.	Family status of the respondent (**PLEASE CIRCLE CORRECT ANSWER**)	h. Male household head i. Female household head j. Wife of household head k. Husband of household head l. Son of household head m. Daughter of household head n. Others, please specify
10.	LIVESTOCK OWNERSHIP **(GIVE THE NUMBER OF ADULT ANIMALS)**	o. Cow …….. p. Buffalo ……. q. Goat …….. r. Pig …….. s. Poultry ……. t. Others (specify)…….
11.	Type of roof (**PLEASE CIRCLE CORRECT ANSWER**)	u. Thatched v. Tiles/GI sheet w. Concrete
12.	What type of traction do you use?	x. Own animal

	(**PLEASE CIRCLE CORRECT ANSWER**)	y. Rented animal z. Own tractor aa. Rented tractor bb. Others, please name
13.	For how many months in a normal year do your home-grown cereals (rice, maize, wheat etc) feed the households?	…….months

	Household composition	
14.	Caste/ethnicity (**PLEASE CIRCLE CORRECT ANSWER**)	cc.Dalit dd. Janjati ee. Terai caste groups ff. Brahmin/Chhetri, Newar gg. Others
15.	No. of adults (18 years old and above):	Male…… Female…..
16.	No of children aged 10-17	Male…… Female…..
17.	No of children aged under 10	Male…… Female…..
18.	No. of HH members who are full time job holder and contribute income to HH	
19.	No. of HH members who regularly work on farm	

Farm profile

20. <u>Land holding</u>

Note:

Land owned	**Kattha†: only unit allowed**		
	Upland	Medium land	Low land
Total land owned by respondent's household			
Land cultivated by respondent's household			
Irrigated land cultivated by respondent's household			
Land rented out by respondent's household			
Land shared out by respondent's household			

† *1 Bigha = 6667; 1 Kattha* = 338 m^2 1.5 *Bigha* = 1 ha, 20 *Kattha* = 1 *Bigha*

20. Do you irrigate any of your crops? Yes/No

21. If yes, what is the source of water?	hh. canal ii. deep tube well jj. shallow tube well kk. Treadle pump ll. pond mm. River nn. others

22. Does your household cultivate any land other than your own? Yes……No…..
If yes,

Land holding	**Kattha†: only unit allowed**		
	Upland	Medium land	Low land
Land rented in by respondent's household			
Land shared in by respondent's household			

23. In the last year's main, winter (2007-08) and spring (2008) season what crops did you grow and how much did you harvest?

Crop	**Ps tick against each crop grown**	**Kg harvested**	**Source of seed**
1. Main season			
Rice			
Maize			
Other (please name)			
2. Winter season			
Chickpea			
Wheat			
Lentil			
Mustard			
Linseed			
Maize			
Kidney bean			
Others (please name)			
3. Spring season			
Mungbean			
Rice			
Maize			
Mungbean			

Others (please name)			

Source of seed Own =O; Market =M; Friend =F; Relative =R; DOA=DOA; NGO=NGO, other

(If the family do not grow winter/Spring crops after main season then go to question no 24)

24. What are the reasons for not growing winter/Spring crops?

Reason	Tick if respondent mentions any reason	Rank – only if ticked (1 = most important)
Lack of Technical know-how		
Can not obtain seeds		
Lack of Suitable variety		
Land not suitable for winter/Spring crops		
Not Profitable relative to the cost of production		
Place for livestock grazing/stay animals		
Lack of Manpower		
Market inaccessibility		
Low soil fertility		
Low moisture/No irrigation		
High moisture		
Social cause like theft		
Lack of cost/Money		
Other (please, specify)		

25. Do you know about Short duration rice varieties? YES…….NO…….
IF THE ANSWER IS NO THEN GO TO QUESTION NO 31
IF THE ANSWER IS YES THEN ASK QUESTION 26 (NEXT QUESTION)

26. **Have you ever grown short duration rice varieties? Yes…….No**
IF YES ASK QUESTION 27 IF NO, ASK QUESTION 30

27. What are those short duration rice varieties that you grow?

a. ……..

b. ……..

c. ……..

d. ……..

28. What are the advantages of those short duration rice varieties that you are practitioning???

a……...

b……

c……

29. Why are not you adopting other short duration rice varieties like: Barkhe 2001, Barkhe 2014, Ashoka, Pant dhan, Barkhe 1027, BG 1442sugandha-1,

Reason	Tick if respondent mentions any reason	Rank – only if ticked (1 = most important)
Don't know about these varieties		
Not available		
More devotion		
Lack of seed		
Lack of market		
Lack of other inputs		
Weeds		
Pests		
Diseases		
Lack of labour		
Lack of knowledge		
No access to draft power		
No money		
Other (please name)		

30. What are the reasons of not growing any short duration rice varieties? **FILL IN THE TABLE BELOW**

Reason	Tick if respondent mentions any reason	Rank – only if ticked (1 = most important)
Not the best variety for my land		
Can not obtain seeds		
Not cultivating suitable type of land for those varieties		
Not higher yielding than the existing variety		
Not suitable for existing cropping pattern		
Market has not been established yet		
No market price		
Other (please, specify)		

31. Do you know about winter season crop varieties? YES……NO…….
IF THE ANSWER IS NO THEN GO TO QUESTION NO 37
IF THE ANSWER IS YES THEN ASK QUESTION 32 (NEXT QUESTION)

32. Have you ever grown winter season crops? Yes……No
IF YES ASK QUESTION 33
IF NO, ASK QUESTION 36

33. Name the winter crop … ……..
What are those winter crop varieties that you grow?

a. ……..

b. ……..

c. ……..

d. ……..

34. What are the advantages of those winter crops that you are practitioning???

a……...

b……..

c……

35. Why are not you adopting winter season legumes like **chickpea** like Tara, Awarodhi, ICC37,ICCV2,GNG469, KPG59 and **lentil** like Sital, ILL7723?

Reason	Tick if respondent mentions any reason	Rank – only if ticked (1 = most important)
Because of long duration rice varieties		
Don't know about these varieties		
Lack of seed		
Lack of market/price		
Lack of other inputs		
Weeds		
Pests(Name…….)		
Diseases(Name……)		
More time		
Lack of labour		
Lack of knowledge		
No access to draft power		
Theft		
Other (please name)		

36. What are the reasons of not growing winter season crop varieties? **FILL IN THE TABLE BELOW**

Reason	Tick if respondent mentions any reason	Rank – only if ticked (1 = most important)
Because of long duration rice varieties		
Theft		
Damage from grazing		
Encroachment from wild animals		
Lack of market		
Lack of seed		
Lack of other inputs		
Weeds		
Pests		
Diseases		
Lack of labour		
Inadequate technical know how		
Too late to sow after rice harvest		
No access to draft power		
Other (please name)		

37. Do you know about spring season crop varieties? YES……NO…….
IF THE ANSWER IS NO THEN GO TO QUESTION NO 43
IF THE ANSWER IS YES THEN ASK QUESTION 38 (NEXT QUESTION)

38. Have you ever grown spring season crops? Yes……No
IF YES ASK QUESTION 39
IF NO, ASK QUESTION 42

39. Name the legume crop ……..
What are those spring crop varieties that you grow?

a. .....

b. .....

40. What are the advantages of those spring crop that you are practitioning???

a……...

b…….

c…….

41. Why are not you adopting spring season legumes Like Mungbean varieties (Kalyan, Prateekshya, NM92, VC3960)

Reason	Tick if respondent mentions any reason	Rank – only if ticked (1 = most important)
Because of long duration rice varieties		
Don't know about these varieties		
Not easily available		
Lack of seed		
Lack of market		
Lack of other inputs		
Weeds		
Pests		
Diseases		
More devotion		
Lack of labour		
Lack of knowledge		
No access to draft power		
Other (please name)		

42. What are the reasons of not growing spring season crop varieties?

Reason	Tick if respondent mentions any reason	Rank – only if ticked (1 = most important)
Place for livestock grazing		
Encroachment from wild animals		
Lack of market		
Lack of seed		
Lack of other inputs		
Weeds		
Pests		
Diseases		
Lack of labour		
Lack of knowledge on how to grow		
Too late to sow after rice harvest		
No access to draft power		
Other (please name)		

43. Would you like to grow short duration rice varieties in next kharif? (2008-2009)? YES __ NO __

a. If yes which crop you like to grow?

b. How will your household get seed? Please explain
…….

c. If NO, please explain why not

……..

44. Would you like to grow winter crops in next winter? (2008-2009)?
YES __ NO __

a. If yes which crop you like to grow?

45. Would you like to grow chickpea (Tara, Awarodhi, KPG59, ICC 37, ICCV2, and GNG469)

a. if YES, how will your household get seed? Please explain …….

b. If NO, please explain why not

……..

46. Would you like to grow spring crops in next spring? (2008-2009)? YES __ NO __

a. If yes which crop you like to grow?

……

47. Would you like to grow spring legumes Mungbean (Kalyan, Prateekshya, NM92, VC3960) in next spring ?

a. If YES, how will your household get seed? Please explain …….

……

b. If NO, please explain why not ……....

……

Migration

48. Did anyone in your household migrate in the last year (2007-2008)? YES _ NO_

a. If YES, how many people? …….

b. Who are they? (Male HH head /Female HH head/wife of HH head/husband of HH head/son of HH head/ daughter of HH head/ other……. please name). **PLEASE CIRCLE CORRECT ANSWER**.

c. Record the details for each HH member who migrated in the following table. (**PLEASE RECORD THE NUMBER OF WEEKS ON MIGRATION**)

Hints for enumerator to get information for question c (**PLEASE ASK THE FOLLOWING QUESTIONS IN SEQUENCE**):

- Who migrated;
- How many times in the year;
- When was the first trip;
- First trip - for how long (weeks)
- When was the second trip

Who migrates?	Jul	A	S	O	N	D	Jan	F	M	A	May	June	Total weeks
Male: (HH head)													
Female (HH head's wife)													

PART C REPORT ON THE QUALITATIVE SURVEY

Prepared by:

Dr M. Buchy and Ambika Sapkota (FORWARD)

With the help of the following staff of FORWARD:
Lakpa T. Sherpa, Krishna Gupta, Dil R. Yadav , Balram Bhandari, Achyut P. Uprety and Yoba, N. Towari

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FGD: Focus Group Discussion
HDI: Human Development index
LGP: Local Governance program
NGO: Non Governmental Organisation
PVS: Participatory Varietal Selection
RNRRS: Renewable Natural Resources Research Strategy
VDC: Village Development Committee

LIST OF MAP, BOXES AND TABLES

ANNEXES

EXECUTIVE SUMMARY

Field work was conducted in 6 villages and 2 districts.

Given the overall changes in the Terai in the last 10 years following the Local Governance Program (LPG) as well as various INGOs' and NGOs' efforts to develop the area it is difficult to isolate the impacts of any specific intervention. Methodologically it is also impossible to measure impact as we were working with recall and farmers' perceptions of change rather than with hard evidence collected over time. It is also likely that it is the combination of a number of factors or interventions in different parts of the livelihoods systems that generate changes rather than any single intervention.

The last decade has seen important changes linked to electrification (which has also helped in the development of irrigation), the development of rural roads infrastructure and the increase in health and education facilities across the Terai. The LGP has also promoted self help groups, women's literacy and empowerment and increased awareness about rights. It is difficult to measure what role these changes would play in facilitating innovation and supporting farmers in taking risks and trying out new crops or new agriculture practices. But at the same time these contextual factors cannot be ignored.

There is also extreme diversity within this case study. Each district visited has slightly different agro-ecological conditions and farming systems. There is ethnic and caste diversity with communities split between Tharus and Bahun Chhetris, some communities with a greater mix of Ray, *Dalits*, and Bahun Chhetris or homogenous communities of Rajbanshis. There is a difference of economic status between villages - even at times between villages close to each other. The economic differences are often linked to the quality of land, but also to the history of settlement and the differences between 'migrants' from the hills and 'indigenous' communities, though some communities like the Satars are in fact originating from India. This then makes it difficult to disentangle factors of influence in such a short study and small sample. But it also re-emphasises the need to target interventions at very local specific scales.

The land holding per household is relatively small and hence the impact of any increase in agriculture production can only be limited. Farmers in different places face different constraints with land size and type of land (Upland, Medium, Low Land) which, combined with availability of labour and access to irrigation, are the major limiting factors for expansion or intensification; availability of seeds seems to play less of a role except perhaps for marginal farmers who mentioned purchasing expensive seeds of improved varieties as a problem.
In both districts farmers have reported that grain production has increased the food self sufficiency of the household by 2-3 months maximum. This of course is not negligible at the household level but it is not at a scale of increase that will pull most small farmers out of poverty. For most households an increase in rice production and the diversification of crops such as legumes and vegetables resulted in increased home consumption and better diets. This in turn has resulted in decreased expenditure on food grains rather than increased revenue from crop sales.

Women in all groups, including the poorest, have commented on the changes in their status within the household and the community. They reported that discrimination has decreased and that husbands are more likely to share some of their wife's housework. They feel they are more aware of their rights and have been exposed to new ideas. This is mainly due to the LGP promoted by the Village Development Committee across Nepal, but also to numbers of NGO programmes which all seem to have a women empowerment component. Credit schemes (as well as rural banks) are now very common across the sample villages which have reduced dependency on money lenders. Women's labour involvement on the

farm has also changed with the increased intensity of farming, as the slack agriculture period has disappeared. Despite what women said, however, wage discrimination is still rife with women getting ½ of the daily agriculture wage given to men for similar work. We held discussions with groups of groups in all villages, and women also came along to most FGDs.

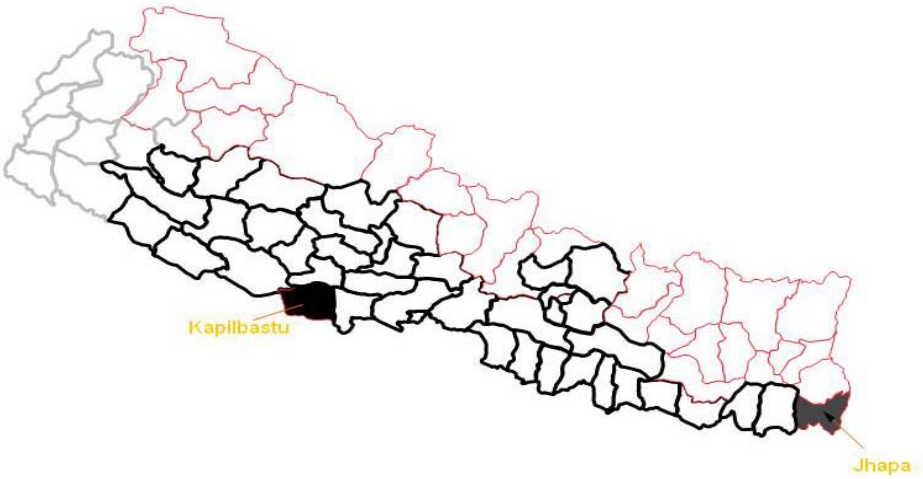
Learning about agriculture practices has been for farmers at least as important as the introduction of new varieties of seeds. All groups in all districts have mentioned learning new techniques and ideas about practices as one major impact and change (if not the greatest). Even when farmers have stopped growing the variety of seeds introduced by the project they are aware of the possibility of cultivating 2 rice seasons, rather than the traditional one, and to cultivate other crops. Farmers have in the past been seeking shorter rotation rice varieties and the project intervention, by providing shorter but also higher yielding varieties has increased opportunities and farmers interests. Farmers have integrated shorter rice varieties in their farming system.

The choice of which variety to grow is dictated by a combination of factors: the availability of appropriate land (and access to irrigation), availability of good quality seeds, labour input, productivity, quality of straw (for fodder), taste, availability of markets, market price, resistance to pest and storability. The last three criteria have been particularly important in the case of Mung beans and Chick peas. Both crops have been susceptible to pests and storage problems, and farmers have found it difficult to find satisfactory markets.

INTRODUCTION

This report presents the results of the qualitative survey conducted in 2 districts in the Terai between January and February 2008. Originally the qualitative survey, labelled as 'Method 4' in the overall case study methodology of the Monitoring and Learning component of the Research Into Use programme, was conceived as a tool to complement the analysis of the other 3 more structured methods applied by the case study team. The overall aim of the study is to document and explain impacts of the introduction of PVS and COB varieties together with Rabi crops such as Chickpea and Mung bean in the districts on livelihoods and agriculture practices; and to the extent possible get a measure of the impacts for the poorest sections of the community. It does not seek to measure the extent of impact – i.e. the numbers of households in the study districts using or affected by the technologies.

Map 1: Location of the surveyed districts



In order to understand the Nepali context within which this field study was conducted a few generic points are worth making. Nepal has only emerged recently from the violent decade of 'the Insurgency' which partly took its roots in the extreme social and hierarchical divisions, themselves linked to landlessness and poverty.

The society in Nepal is made up of 59 ethnic groups, 4 castes and 39 sub-caste groups (Khadka 2009).The high caste group of Indo Aryan origin, such as the Brahmin, the Chhetris and the Newars dominate politically and economically the country. The Janajati such as the Rai and Tharus, the Yadav and the Rajbanshi in our *Terai* districts, belong to the Tibeto-Burman language group. The Janajatis, together with the low castes, or *dalits* (also called 'occupational castes'), consistently score lower on all the Human development index criteria. For example, in 1998 the Brahmins had a Human Development index (HDI) of 0.441 (the national average (NA) is 0.325), a life expectancy of 60.8 years (NA 55) and a literacy rate of 58% (36%); whereas the ethnic groups from the Terai had a HDI of 0.239, a life expectancy of 50.3 years and a literacy rate of 23.8% The *dalits*, have HDI of 0.295, a life expectancy of 54.4 years and a 27.6% literacy rate (UNDP 1998). More recent data from 2004 show improvement but the gaps between groups remain: whilst for example the

national literacy rate is 53%, 75% of Brahmin, 60 % of Chhetris and 72% of Newars are literate, only 21.06 % or the Terai *dalits* are (UNDP 2004).

Historically agriculture land has been unequally shared - with 40% of agricultural households accessing only 9 percent of the total agricultural land and owning less than ½ ha per household; while 6 percent controls more than 33 percent of the total agriculture land available (Rai Paudyal 2008). In the Terai typically a small farmer owns a bit more than 1/3 of a hectare of land, which is not sufficient to ensure grain self sufficiency, and he will complement his income through wage work. A medium farmer who owns about 2/3 of a hectare may produce just enough food depending on the land quality. A family with about 2 hectares would be considered as a landlord family and represent a minority in the village. Women do not own land and have to access land through a male relative when in widowhood.

Interestingly, though land access and ownership are a major issue in a country where 80% of the population is rural, there are very few recent studies on the topic. Landlessness is an important factor of poverty in Nepal (Acharya 2004) as a small per capita area of land makes it impossible for most households to reach food grain self sufficiency all year around. There was an attempt in 1964 to reform land tenure by transforming share cropping into fixed rent contracts in order to increase access for the landless (Acharya 1999). This was strongly resisted by the landed groups and many of those who had managed to obtain such contract were subsequently evicted. Acharya (1999:2) has divided the share croppers into two distinct economic groups: the mixed-share tenants who own land and use share cropping as a way to extend their access to land - and the landless pure-share tenants who either rent the land or take it under share cropping arrangements.

Land tenure arrangements in the *Terai* are changing in different ways in different districts. Where food grain sufficient households send labour overseas, like in Jhapa, more land is becoming available for share cropping; but the poorer landless agriculture labourers do not necessarily have enough initial capital/assets to even start share cropping. A share cropper needs animals for ploughing, seeds and labour and by definition extremely poor landless people lack these initial assets. This is quite typical of the situation of the very poor who are not even able to take up development opportunities. Agreements between landowners and share croppers also vary between places and landowners are not always agreeable to provide draught animals as part of their share of inputs. Landowners tend (but not always) to dictate which crop/varieties the tenant has to grow and landowners prefer quality over quantity and are not always choosing the highest yielding varieties. For medium farmers the intensification of farming has meant that there is no slack season anymore and some have left share cropping to focus on their own land which now produces more and they are limited by labour availability in the household. In Jhapa, it seems landowners are looking keenly for share croppers but in Kapilsvastu farmers willing to find more land are struggling to find extra land. Share cropping however remains a vulnerable option as contracts are usually verbal and landowners, to avoid litigation of potential future claims, tend to rotate their tenants every 2 to 3 (sometimes 4) years. Where share croppers are in demand they are in a stronger position to choose the type of land.

However it is important to note that despite an increase in income poverty, human poverty has decreased in the country, although there is regional divergence. Acharya's study (2004) of the last 2 decades of the 20th century confirms that poverty is foremost a rural issue and is predominant in the mountain region followed closely by the Western *Terai* and then the Eastern *Terai* which is not as poor as the western parts of Nepal. There have, however, been dramatic improvements in education levels and health care across the country, partly thanks to the proliferation of NGOs since the beginning of the 1990s. These trends are confirmed by our data.

METHODOLOGY

It was originally envisaged that this study would be conducted by an independent academic researcher, as part of a wider contract, but this person withdrew their services shortly before the study was due to commence. FORWARD had been originally involved in the RNRSS project and therefore could be seen as biased partners. However, it was decided that their staff were professional enough to approach the work objectively, under Dr Marlene Buchy's supervision. In addition, their organisational knowledge of the context would be very valuable in site selection and also in establishing contacts in the villages. It was also felt that, as this study was not a project evaluation but more an investigation of more general changes, the teams would not have a vested interest in manipulating the data. The role of the external consultant was also to control any potential bias. It was also felt that from a learning perspective the field team would benefit from this exercise as they would be learning about livelihoods in more details and would also acquire some skills in qualitative field survey methods. In September 2008 Marlene Buchy met with the FORWARD partners in Kathmandu to discuss and refine the methodology and to select the study sites. In January 2009 the first field survey was conducted under the supervision of M. Buchy in Kapilvastu: the details of the timetable and process followed are included in Annexe A. Whilst the work in Kapilvastu was completed under the supervision of Ambika Sapkota from FORWARD, Marlene Buchy moved to Jhapa to start work there with another FORWARD team.

Based on the field knowledge of the FORWARD staff and a concern to cover a range of agro-ecological as well as economic conditions, 2 districts were chosen by FORWARD. Kapilvastu with a poverty index (PI) between 37-38, and Jhapa (PI:63-74)[2]. Jhapa is also in the far east of the country, Kapilvastu considered a central Terai district.

The work on the Rabi study followed the initial RIU MIL Rice survey in Nawalparasi district, with LI-Bird so based on that experience we considered that 3 villages per district would be sufficient. The number of people to interview was left open; and the factors determining choice of villages and the numbers of people per village to interview are listed below.

- *The level of interest in the introduced varieties*. The field staff categorised villages in to 'high adoption villages' and ' low adoption' villagers which represent the level of interest in the varieties at the time of the project interventions;
- *The level of social differentiation in the village*; the caste and/or ethnic heterogeneity of the village was an important factor to consider and so in heterogeneous villages we made sure all sections of the village would be involved, especially women, but we also made sure we had in our sample relatively homogeneous and heterogeneous villages; this is why in some of the villages we organised a larger number of group interviews - in order to account for caste and ethnic diversity;
- Once in the field during the early interviews, key informants divided the community according to *the number of months when the households are self-sufficient in grains*. This categorisation was then followed in all the other villages as a rough indicator of wealth status

[2] [2] Note: the higher the PI the lower the poverty level. PI: PI was calculated by Central Bureau of Statistics (CBS) Nepal and ICIMOD using the data from CBS.
CBS/ICIMOD (2003). Districts of Nepal Indicators of Development update 2003. Kathmandu Nepal: Central Bureau of Statistics, International Centre for Integrated Mountain Development. These categories of poverty are the same used by the quantitative work. It would have been better to use PI at the VDC or household level but these are not available. These indexes were calculated on the overall poverty features of that particular district and though there is disparity between villages, with some villages richer than others, within the district a lower PI indicates a higher overall poverty level.

Key informant discussions were used as the initial contact activity in the village to gather generic information on the village and to find help to identify and contact the possible different groups to interview subsequently. The Focus group discussion (FGD), a tool used to explore 1 specific theme at a time by a group of selected participants (between 6-7 maximum) was chosen as the preferred tool. Depending on the theme explored, people were selected on the basis of their gender, class or caste or in relation to their professional status (traders or shop keepers, for example). A mixed group (men and women) was also acceptable. In the field, the availability of people also dictated to some extent who took part to the discussions.

Though the discussions were open ended and touched on different aspects, overall between the groups we attempted to cover a number of core topics, which are presented in Box 1. These topics had been identified during the meeting in September by the field tem as being relevant to the context.

Box 1: core topics covered by the survey

Changes in livelihoods

a. quantitative changes like increased food self sufficiency or yield, increased trading etc. what is the meaning of these quantified changes. For example: What does an increase in grain self sufficiency mean for the households? Does it lead to consumption changes, to more sale and increased cash flow, does it result in shortened migration?

b. qualitative changes which would cover aspects like diversification, changes in the farming system. Here changes refer more to transformations (which can be small ones): has the livelihood strategy changed? Are people growing new crops or investing in irrigation?

Community empowerment

c. access to resources (seed, information services): Have the dynamism of the villages and the new livelihoods increased villagers' awareness of their rights, encouraged them to seek services from existing agencies? Are government agencies being accessed more?

d. Learning and knowledge: this relates to the influence of the PVS processes in the villages. Have some farmers simply adopted the new seeds of rice or chick peas/mung beans or have they also learnt something about the innovation technology. Have they become keen innovators? Have they innovated in other sectors of their farms? Has their willingness to innovate increased?

e. networking, new organisation developments: There have been signs in some places of villagers-lead new credit organisations. Is this a common pattern? How does it work? Who is left out? Who leads these organisations? Are villagers extending new networks outside the village with new partners (traders?, government offices?)

f. changes in Land tenure and share cropping arrangements: this is potentially a very important are of change which will affect mostly men as they are de land owners and the decision makers. Changes in tenure may benefit new groups traditionally excluded or it may increase their marginalisation.

Sustainability

g. livelihoods: Outstanding problems/issues (related to agricultural/farming) in the village that may be threatening sustainability; Who can do what to mitigate the given problems/issues in order to ensure sustainability?

h. Environment: has environmental sustainability been compromised? At what cost can sustainability be maintained?

In each of the districts we chose 3 villages. Based on the field teams' local knowledge, we wanted to look at villages with high level of use of the varieties introduced by the project, whilst also making sure that the selected villages were representative of other characteristics such as ethnic diversity. After the first group discussion which we held in Gajada we decided to adjust the field strategy as it turned out that in Gajeda the *tole* was relatively well off and perhaps not representative of the majority of villages. So we decided to seek out poorer groups or poorer villages rather than only look at 2 examples of high level of use villages. The level of poverty was decided based on the knowledge of the local field teams and the main criteria used were size of land, type of land and length of food security in the villages. As all the selected villages had seen FORWARD interventions, in Kapilvastu we also decided to see a village which had had no FORWARD intervention but was 2 km away from one that had seen some intervention. This we thought might give us some indication of spread but also see whether this village too was reporting similar overall changes. In each village we considered the ethnic/caste composition to determine the numbers of focus groups we needed to hold.

In Kapilvastu we met key informants in Jaynagar 3- Purina and Gajeda *Tole* (both considered by FORWARD team as villages with high level of use). It transpired later that 'High level of use' refers to high participation of the village at the time of the intervention. The same level of use might not have been subsequently maintained in the village. The Gajeda meeting turned into a Bahun-Chhetri food self sufficiency women meeting, so we decided afterwards to seek another *tole* in the same village.

In Jaynagar 3- Purina we held meetings with:

- a Tharu group with less than 3 months food self sufficiency ,
- one Tharu group with 6 months food security self sufficiency,
- one Bahun-Chhetri group with 6 months food security self sufficiency,
- one food self sufficient Bahun-Chhetri group and
- one women Bahun-Chhetri group with less than 3 months Food self sufficiency

Jaynagar is dominated by Tharus (67%) and Bahun Chhetris (only 2 *Janajati* households out of 103) which explains the ethnic/caste composition of the focus groups. In Gajeda, whilst waiting for the group to gather we opportunistically interviewed a group of male youths.

Badahara VDC (considered by the Forward team as a village with low level of use) is also a mixed caste village with a large number of *Dalits* and *Janajaty* people with Bahun Chhetris being a minority group. We met:

- a group of *Dalit* and *Janajaty*, landless with maximum food security of 3 months
- one women group,
- one Bahun-Chhetri food secure group,
- one Bahun-Chhetri group with 6 months food security (it was not possible to gather a group of food secure Tharu people)

Table 1: summary of number of FGDs conducted in Kapilvastu & Jhapa

Number of Groups	Jaynagar 3- Purina	Badahara VDC	Gajeda	Jurapani – 4	Thakthake	6 Gwalduba
Key informants	1	1	1	1	1	1
FGD mixed	4	4	4	2	1	3
Women FGD	1	1	1	1		

In Jhapa district we followed the same process.

In Jambadi chowk village, we met with Key informants to establish the list of farmers and decide which FGDs to convene. As about every household is food secure we decided to organise

- 2 food secure groups of Bahun-Chhetri and Janajatis (mostly Rais)
- 1 group of *Dalits* (ideally with only 6 months or less of food security, but it turned out to be a mixed food security status group)
- a group of women.

In Juropani – 4, Thakthake and 6 Gwalduba we also met with key informants. Both *tole* at the time of FORWARD project were considered as *tole* with high level of use. Thakthake is a Bahun-Chhetri dominated community and only the *Dalits* and Satar (adivasi group of tribes) are either landless or with very low food security. We interviewed a group of Satar people.
In Gwalduba the community is dominated by Satar people. We arranged FGDs with:

- 1 group of food secure Satars
- 1 group of above 6 months of food security Satar.
- 1 group of less than 6 month food security Satar
- 1 group of women.

In Thakthake we met a group of Bahun-Chhetri mung bean growers.

In Juropani-1, a village which has not had any FORWARD intervention, we convened:

- 1 FGDs with food secure Rajbanshi people
- 1 FGD with 6 months food self sufficient Rajbanshi people
- 1 FGD with Rajbanshi women.

This village is dominated by Rajbanshi people.

FINDINGS

Box 2 explains briefly the nature of the Rainfed rabi cropping intervention which was based on the participatory processes with the aim to address the issue of better utilisation of large areas of fallow lands.

Box 2: The Rainfed Rabi Cropping Project

The rainfed rabi cropping (RRC) project was initiated in 2001, with the aim to intensify the rice-fallow system in the Terai through capitalizing on low external input agricultural technologies. The project has followed a system-based participatory action research and development process, in which the interventions are reshaped through an experiential learning cycle over time to address the problem situation. A series of on-farm trials including participatory varietal selection, crop establishment methods, nutrient management and pest management was conducted and scaling up took place through community-based seed management and informal research and development approaches. Short to medium maturity rice varieties Sugandha 1, Barkhe 2017, BG 1442, Barkhe 2014 were selected by the farmers for their higher yields, better qualities, earlier maturity and good adaptation in farmers' management in upland and medium wet-land conditions. These varieties also allow timely planting of winter crops by utilizing the residual soil moisture in post-rainy season. Adaptation of chickpea, field pea, lentil, buckwheat and niger in post-rainy season; and mung-bean for spring, summer and

autumn season was tested. Varieties preferred by farmers were: Chickpea varieties KPG 59, GNG 469, Tara, Kak 2; field pea variety Sano Kerau (a small-seeded local land race); lentil variety ILL 7723; and mungbean varieties VC 3960-88, VC 6372 (45-8-1), NM-92 and NM-94 . Seed priming, molybdenum loading through seed, foliar spray of cattle urine and application of boron were found beneficial for increasing yields of test crops in rice fallows.

Extract from Khanal *et al*. (2004: ii)

During the field work it was not always easy to discriminate between varieties introduced, innovation technology and outcomes - because farmers, when they reflect on changes, do not discriminate between the causes of change. Another interesting point is that, as the interventions were through a research project, there was no subsequent follow up by the NGO in a conventional sense- because the aim was not to distribute the seeds to as many people as possible, but to test the crops and their potentials on farm with volunteer farmers. This is important to remember when we look at the nature of potential impact on people's livelihoods as the intervention aim was to test varieties of crops - not to improve livelihoods, though of course this might be the ultimate purpose.

Kapilvastu district

a. Changes in Livelihoods

During the interviews people have defined food security as the ability to produce enough food on the farm in the form of rice, wheat pulses and greens) to feed the family. The level of food security depends on the availability of land per household, the type of land and availability or not of irrigation; and also on the size of the family. Another factor which is more difficult to measure in a short field study is the impact on fragmentation of land within households and families. Bahun Chhetris are more likely to have better quality land than *dalits*, and the former are also more likely to have larger plots in one block than other groups (see below for Jhapa). In Kapilvastu farmers estimate that 1 bigha of medium land will feed a family of 4-6 people year round.

In the villages we visited the farmers were very clear that the new varieties of rice, with their increased yields and shorter cycle (allowing the intensified use of land which in the past lay fallow) were important causes of change. The main livelihood changes identified were:

- Food security has improved for everyone between 2 to 4 months per year and in all groups people have reported that this increase has resulted in a decrease in food related expenditure. More specifically, the increased availability of home grown lentils has resulted in an increased consumption of lentils and farmers have commented on their children being 'stronger' as the diet has increased in quantity and quality.
  .
- Increase in production has also resulted in better education for children. For those households who did not send their children to school, or for shorter periods, the children (girls *and* boys) are now going to school and stay there longer. For those (for example in Gajeda *tole)* who already sent the children to the government school it means sending them to private boarding schools.

- Other interventions, such as electrification and roads construction, were also mentioned by farmers as factors of change. One group of Brahmin Chhetri explained how they lobbied for the road and how they are now lobbying the Village Development Committee (VDC) for the school. They are also planning to construct an irrigation canal with help from the VDC.

- Long term migration differs between groups. It is increasing in some groups, possibly as a livelihood diversification strategy (rather than as a survival necessity). In the Gajeda *tole* group we met, most households are food sufficient and there is a male migrant in just about every household (see Table Annexe 2). For the *dalits* and the landless below 3 months of food security, migrating is a necessity but remains seasonal in Nepal or at the furthest India. In the group with 6 months food security (table 4) no one is migrating, so one could put forward the hypothesis that perhaps above a certain threshold of food security, local labour can be sufficient to fill in the gaps. The scale of increased production, given the small size of land holding, is still insufficient to change the level of reliance on migration-related income for the *dalit* households below 3 months of food security. Tables 2, 3 and 4 show two things: in our small sample, *dalits* have upland land, which is of poorer quality, whilst Tharus are more likely to have access to medium land. Tharus and *dalits* also have different opportunities to complement the household income: Tharus are more likely to do semi-skilled work locally; whilst *dalits* are more likely to migrate for several months, probably to do unskilled manual labour. From this we can draw a number of conclusions:

    - caste and ethnicity and skill endowments determine to a large extent the opportunities available for individuals. This is not a new finding of course, but it needs to be re-emphasised as pro-poor interventions tend to focus on economic status, which cannot be separated from social status;
    - migration should be seen as a range of options, not all of which are available to every group: in wealthier groups (those who are food secure) families are more likely to invest in migration abroad as the return of one family member working abroad is higher than if this person stayed to work on the farm. But migrating overseas is expensive and the investment is recovered only after the first year of migration which means that the migrant usually has to stay 2 -3 years to make it worthwhile. For groups at the other end of the spectrum migration overseas is too expensive: and, although seasonal labour migration may be a last resort, income from migration may be essential for the survival of the household; and as we discuss below (see Table 4) the opportunities to increase land holdings are still limited.

Table 2: Data from a group of Tharu with less than 3 months of food security (Jaynagar)

Family size	Area of land	Type of land	Off farm income
5	landless		Husband driver Wife agriculture labourer
8	(10Katthas)	Medium land	driver
4	4-5 (+ 10 Katthas)	Medium land	Truck work 2 months out of village migration
12	4 + (1 bigha)	Medium land	1 uncle off farm labourer; mother grading rice at paddy mill
6	5+(5 Katthas)	Medium land	Truck work

1 *kattha* = 3.333 sq metres
1 *bigha* = 20 *Kattha*s
Numbers in ( ) indicate area in share cropping

Table 3: data from a group of Dalits with 3 months or less food security, Gajeda

Family size	Land size	Land Type	Seasonal Migration
10	5 katthas	upland	7 month
6	1 katthas	upland	6 month
6	2 katthas	upland	6 month
7	1.5 katthas	medium	Local labour
7	1 katthas	medium	Local labour

Table 4: Data from 6 months food secure farmers in Badahara

S.N.	Farmers' name	Family size	Land size	Land Type	Seasonal Migration
Dalit	Kamal Biswakarma	6	3 kattha + (22 kattha)	upland	No migration
Dalit	Sete Sunar	3	2 kattha + (12 kattha)	upland	No migration
Dalit	Bal Bahadur Sunar	4	4 kattha + (5 kattha)	upland	No migration
Dalit	Gopal Sunar	5	4 kattha + (13 kattha)	upland	No migration
Chhetri	Hom Bahadur Bhandari	6	2 kattha + (18 kattha)	upland	No migration
Chhetri	Ramesh Khadka	6	6 kattha + (6 kattha)	upland	No migration

Numbers in ( ) show the area of share cropping.

b. Changes in agriculture

- One of the main changes seems to be increased learning about agriculture practices:
  All the groups we met commented on their increased knowledge in soil fertility management, including organic approaches and organic pesticides (this is also for better health) which they attributed to FORWARD's intervention. Disseminating better agricultural practices was part of the RNRRS intervention (see box 2). Even though farmers may not be growing some of the initially distributed rice or chick pea varieties anymore (see Table 5), they are now more likely to choose fast growing varieties of rice. Farmers also reported greater awareness of the necessity to maintain seed quality and of the need to renew the stock of seeds every 3-4 years. Very few farmers it seems however try to innovate and venture into different crops. In Jaynagar we met a farmer who, inspired by the project, experimented with sugar cane cultivation, banana and off season vegetables. He also tried some tomatoes demonstration. However, the costs attached to being the only farmer doing something new were too high. This increased the risk of theft and forced this farmer to manage straying livestock on his own. Straying livestock is also one of the reasons it seems people don't grow mung beans. This shows that innovating relies not only on appropriate technology, assets such as land or innovative attitudes but also on community support.

Table 5: Crops grown by different food security categories of farmers in Gageda

Groups of farmers	Crops and varieties grown	Comments
Tharus less than 3 months of food security	Radha 4, Hardinath 1, Gautam, Barkhe 2001 Local mustard peas, wheat, potatoes and Lathyrus Mungbeans, onions, green vegetables	
Brahmin, less than 3 months of food security	Radha 4, Gautam, Pant 10, war Mustard, lentils Chick pea KPG 59	Tara and Arvodhi were attacked by insects and disease Don't grow mungbeans because of insects and lack of water
Brahmin group Over 6 months food security	Sawa, Radha-4 Sugandha 1	Preference for these rice varieties as they give more yield, good taste, less pest diseases, less labour required
	Chickpeas: Avrodhi and Tara KPG 59 Used to grow mung-beans	Short duration Avrhodi is considered the best as it yield more and is less prone to disease but requires more water Stopped because of water shortage, insect attacks and grazing
Brahmin group food secure over 12 months	Sungandha, Sabarti, Judi-62, Radha 12 Barkhe 2017 & 3004, Sawa	Sawa and Radha are mostly grown and are the prefered variety because of taste and yield and early harvest for Radha 4; they don't like the taste of Sungandha, and Barkhe 1027 and Judi have scattered grains.
	Chickpea : KPG 59	Don't grow mungbeans anymore; lack of market and difficulty to protect the crop

- The introduction of winter crops (during the months of December to February) has allowed intensification of farming, which people claim has also created more job opportunities for the landless and small holders. We do not however have numbers or specific information supporting this claim.

- The diversity of crops has increased availability of forage, but overall, farmers have reported a decrease in animal numbers. The status of livestock rearing as a livelihood option is not clear. Key informants and FORWARD field technicians have all reported that livestock numbers are decreasing, yet during one group discussion with a group of Bahun Chhetris farmers identified buffalo milk production as a good earner estimating their net profit at about 5000 NRs per year. If one considers that, as someone reported, renting 1 Bigha of land costs 1380NRs per year, this makes milk production economically attractive (as 1 bigha would on average ensure food security for the year for an average family). Farmers were also interested in the production of farm yard manure. A group of Brahmin women also reported having invested one loan from the rural bank and bought a buffalo. The loan was repaid to invest in goats as the money from goats is 'good business'.

- The absence of irrigation is a major constraint to cultivating upland during the dry season between March and May and is identified by many farmers as the reason why they don't grow chick pea and mungbeans.

- Interviewed farmers reported a decrease in area under share cropping because now, with intensification of farming, smaller medium land owners have less need of extra land as they are busy on their own land which now produces more. At the same time bigger landlords are keen to get tenants so potential tenants are in stronger position to bargain the conditions – e.g. to choose land or accept only a minimum size of tenure. Tables 3 and 5 highlight the importance for small land owners of access to share cropping. In the case of Badehara, extra land ensures longer food self sufficiency but also no one is migrating whilst in the case of Gajeda where there is no share cropping in our sample group the reliance on migration is important for the household. Table 4 also shows that the land offered in share cropping can often be of poorest quality.
  Access to share cropping is not only dependent on availability of land but also is linked to the availability of labour within the household and the level of assets. During the discussion in Badahara with the group of *dalits* and *janajati* who are food secure for less than 3 months, they commented that most families (within their socio-economic category) are not involved in share cropping because they do not have sufficient capital to hire labour to fill their labour deficit; but also, as the landowners in Badahara refuse to share any of the inputs, most of the landless and small landowning families do not have enough money to cover the cost of seeds, fertilisers and ploughing. During the group discussion with women in Badahara this was confirmed: labour and cash availability limits access to share cropping. Some of the women also commented that out of those families involved in share cropping about half had to grow what the landowner dictates and none of the landowners share the production costs. This underlines the fact that in order to address food deficiency for the poor, improved technology is only one aspect and interventions should also consider other dimensions of livelihoods such as financial, human and natural capital. This is nothing new but still often ignored.

Jhapa district

Some of the villages we visited in Jhapa are clearly better off, with most farmers reporting greater food self sufficiency and much larger land holdings (of Medium land) than in Kapilvastu. This is consistent with Jhapa being in the category of wealthy districts in Nepal. Yet there is also great variation in land fertility within the district, linked to subtle topographical changes; in the same VDC of Juropani, 20 Kathas of medium land seem to ensure 12 months of food security in Thakthake whilst in Gwalduba 30 Kathas are not sufficient to feed a family of similar size for the whole year.

a. Changes in Livelihoods

- Similar changes have been reported to those in Kapilvastu. Overall health and nutrition status has improved and people send their children to school or to better schools. Social expenses have decreased and one group of Satar people reported that selling land to pay for marriages has now more or less stopped as ceremony expenses have decreased.

- Nutrition has improved because of a diversification in diet; and also due to better quality of product, mainly in rice. Even poorer women reported eating better quality rice which they found more nutritive (but they did not indicate the variety).

- Though dependency on private money lenders has decreased, cheap credit is not always available: an interest rate charged by one NGO of 25% per year has been reported. In *dalits* villages the dependency on more traditional sources of cash is still prevailing. Women reported that when they borrow in cash or kind against future labour the landowner will also charge a heavy interest rate. So for example if the daily rate is 100 NRs, a woman who is indebted to the landowner may get paid only 60 NRs/day.
  Overall the number of self help groups focusing on providing credit facilities has increased as a result of the LGP work, and people also commented that one of the changes in the last decade was a greater sense of group cohesion and solidarity.

- One group of Rajbanshi people with half a year of food security reported a decrease in seasonal migration due to increased labour demand in the village and more generally people have commented on the increased demand for local labour as a result of two growing seasons.

- Women have reported changes as well, but none are directly related to the RNRSS interventions. Women in Juropani for example reported that in the last decade, because of more external intervention such as the Local Governance Program, they have been exposed more to outsiders and outside ideas and feel more aware of the importance of education, especially for girl, and health. They also go to the local market to sell their vegetables and can go and work on other people's farms. In Gwaldubba, where women have traditionally been involved in the production of *bhuja*, or rice flakes, technology has made processed rice available in the market. This has decreased their labour and more people have been involved in the business. They also commented on decreased gender discrimination - though, as discussed above, women's labour is still exploited by landowners and women's wages for equal work are still below the men's wages.

b. Changes in agriculture

- Irrigation facilities with private tube wells have been a major change and farmers with no private facilities will pay per hour of use (NRs 50 per hour). Irrigation has become possible with the spread of electrification. But investing in irrigation requires a minimum area of land in one block as is it too costly to invest in irrigation for scattered plots. Informants reported that when Bahun Chhetris families divide the land between the heirs they try to maintain as far as possible holdings on single blocks; whilst other groups tend to divide each plot of land equally between each heir resulting in smaller and smaller plots and also scattered holdings. This could explain why Bahun Chhetris families we met in Jhapa were more likely than others to have access to their own irrigation facilities.

- All groups mentioned having increased their agriculture knowledge as a result of FORWARD's intervention. They have learnt about shorter duration rice varieties and the possibility to grow winter crops; and they use more fertilisers and pesticides.

- There does not seem to be a defined strategy for seed management. In all the groups different people do different things - from sharing and exchanging between relatives, sharing and exchanging between neighbour, storing seeds from their own harvest, to purchasing seeds from the markets, the Agrovets, or even India.

- The introduction of the shorter duration rice has allowed intensification of agriculture with considerable decrease of fallow land. This has increased labour requirements, as well as production, extended food self sufficiency by 2-3 months for the small and medium farmers. The reduction of fallows also has an impact on green fodder availability and hence every one reported decrease in livestock. In all the groups farmers have reported a decrease in livestock because of the reduction of grazing ground due to the increase of the growing period. It seems this intensification has also had an impact on share cropping with many farmers giving up the practice whilst landowners are seeking more and more share croppers. Because of their capacity to invest in migration some landowners are sending able male family members on overseas migration. This has decreased the availability of labour, increased the need to find share croppers - and hence increased availability of land for traditionally excluded people such as the Satars. At the same time, as share croppers get more yields from their fields and are also more busy on their own land they do not have enough surplus labour within the household to continue share cropping. Amongst the Satars (e.g. in Juropani), who have been traditionally landless, only a few have enough assets to start cultivating in share cropping arrangements. For those who have been able to invest 50% of the production costs they have been able to grow their own food for 3 to 6 months and hence buy less grain and also work less on other people's land. So there is definitively a shift in tenure patterns with traditionally excluded people starting to cultivate land partially for their own benefit. This can be partly attributed to the introduction of the shorter duration rice varieties, but not solely RNRSS varieties.

- Hardinath (formerly known as BG 1442) is the variety adopted by most farmers (see Tables 6 and 7) even in non FORWARD villagers. It was released by the DADO in 2006 or so and seeds are now easily available through the market. All the farmers in Tables 5 and 6 have only medium land. A few grow Mung beans and in small areas. Farmers reported that FORWARD distributed OR 367 but despite good yield and good quality straw the market price was not satisfactory and so people stopped growing the variety.

Table 6: Data from FGD Jambadi chowk Food secure B-C (Jhapa)

Farmer	Land size	Family size	Crops
B-C	10 (25)	7	Hardinath (during rainy season will lodge and prone to pest) Tori (local variety) 4-5 K sorghum
B-C	40	4	Mansuli 20K, Ranjit 20, Bhale 10 Rape seed, mustard, Hybrid Maize, Wheat (2-3K) (Fodder 4-5K) Chaite season Hardinate Does not grow Muong beans because of drought
B-C	30 (15 purchased recently)	4	Mansuli, Ranjit, Bhale Tori (4-5 K) Maize
B-C	25	6	Mansuli ½, Bhale ½ Tori (4-5 K) Maize, (4-5K), wheat (4-5K) Sargum Fallow
B-C	30	6	Mansuli 13K, Bhale 5K, Ranjit 12K Tori (10-12K) Wheat (5-7K)

Table 7: Data from FGD Jambadi chowk Food secure Rai (Jhapa)

Farmer	Land size	Family size	Crops
Rai	28	4	Mansuli (20K) Bhale (8K) Tori (3K), Maize (4 K) , Niger (2K) Chaite Rice: fallow, tried Mung beans but water logged and Hardinath (15 K)
Rai	21	4	Mansuli (15K), Bhale (10K) Tori (4-5 K) Hardinath (15K) Mung beans (1.5 K)
Rai	25	5	Mansuli ½, Bhale ½ Tori (4-5 K) Maize, (4-5K), wheat (4-5K) Sargum Fallow
Rai	30	6	Mansuli 13K, Bhale 5K, Ranjit 12K Tori (10-12K) Wheat (5-7K)
Rai	40	6	R.P Mansuli 30K, Mansoli 10 K Tori (10-12K), Maize (3K) potatoes (1-2K) Hardinath (20 K) as summer rice Mung beans (1K)

- Mung bean which was introduced by FORWARD has met with varied success. Most villagers who grow the crop, grow their local varieties as they reported that improved varieties are too risky to grow, even though local varieties are far less productive. Improved varieties are input dependent and more labour intensive: because they are grown on irrigated land for better yield it requires frequent weeding and hence it is costly to grow. In Thakthake we met with a group of growers who have adopted the improved varieties. However they reported decreasing interest as they cannot find satisfactory markets. Whilst mung bean is a profitable crop (a reported net benefit of NRS 1200 per Kattha as opposed to NRS600 per Kattha of Hardinath) only wealthier farmers can grow it. Farmers reported that initially FORWARD bought the beans at a higher price directly from the farmers. Improved varieties are input intensive especially require more labour than local varieties (due to irrigation more weeding is necessary). The storage of seeds has also been reported as a problem by many farmers. So in short the determining factors affecting adoption are a combination of: labour availability, capacity to absorb risk, ability and knowledge to store seeds, access to seeds, capacity to purchase fertilisers and market price.

- Kabuli chick pea is not grown intensively as it is prone to pest damage and sensitive to moisture. It also requires more frequent weeding then local varieties.

- Dependency on chemical inputs has been reported in many places. Less than a decade ago people used only organic fertilisers. Now though chemical fertilisers have increased productivity; and farmers notice that when they don't apply fertilisers they get even worse results that when they used to apply manure. They claimed that fertiliser is also of bad quality and is not always available on a timely basis.

INSIGHTS: IMPACT AND ISSUES OF RRC TECHNOLOGIES

Methodologically a straight forward assessment of impact is impossible, as no base lines were conducted by FORWARD at the time of the seeds release and no record was kept about who got seeds from whom and when. As already mentioned, it is also impossible to clearly attribute specific impacts solely to the introduction of the new rice varieties and mung beans or Chick pea, as many other interventions and changes occurred during the same period. Nevertheless, though it is impossible to quantify, it can be safely claimed that the introduction of higher yielding rice varieties (some of them RNRSS related), and spring rice varieties have allowed an increase in overall food production per household as well as of productivity per unit of land. The impact of mung beans and chick pea has been mixed as even for wealthier farmers, able to take risk are now reconsidering whether or not to reduce their area of land under these crops. However, given the small acreage of land available to most households, these increments will always have a limited impact. An increase of grain to satisfy food needs in a the household by 2 months can be crucial at the household level but for most small farmers it will never result in a drastic change of the farming system or livelihoods opportunities. Land availability and suitability are major constraining factors in Nepal, and though science and technical improvements are necessary and will help, they will never be enough unless structure constraints such as land scarcity will be addressed.

- *Tangible outcomes*: increased food security by 2-4 months for everyone thanks to the shorter duration rice variety such as Hardinath: a diversified diet with the increased availability of pulses (mostly lentils); and increased knowledge of agriculture practices. These points have been consistently mentioned throughout the survey and have been attributed by the respondents to the interventions.

- *Possible attributable outcomes*: improved diet, which is a logical consequence of the technologies introduced: there is more food to eat but also people commented on increased nutritional quality of rice. But these improvements could also be linked to a synergy between a number of other factors. Shifts in land tenure can be partly attributed to the intensification of agriculture. As wealthier landowners are increasingly short of labour this may open opportunities for traditionally landless groups. However here too some form of support is necessary to increase the assets of the poorest and the innovative technology is not enough.

People we spoke to have been very positive about these new varieties introduced and they have seen tangible benefits in higher production: yet there have been no reports of spectacular livelihoods improvements with increased investments on the farms or entrepreneurial take off. The absence of good markets for example has been mentioned as a deterrent to invest in large scale mung beans cultivation which is also a reminder of the role played by the broader context in the adoption of new technology and innovations. The current lack of clarity on land tenure policy is also a factor hindering risk taking for farmers. With the new government and the Maoist pledge for land reform, landowners are waiting to see what will happen. This influences their decisions: to invest or not in their farms; to diversify their livelihoods by integrating overseas migration as one option; to invest in better education for their children, who will leave agriculture; and to enter into share cropping or renting agreement for longer periods.

Crops requiring intensive management such as higher inputs in fertilisers or weeding like mung beans or chick pea are less likely to be suitable for the poor. The group of mung beans growers in Thakthake were all food secure Bahun Chhetris farmers and they were reconsidering their strategy because of unsatisfactory market access. This shows that if even relatively better off farmers struggle to adopt the technology, the technology on its own, without careful support packages, will remain out of reach for the poor. One potential worry, which has been commented on in many FGDs, especially in Jhapa, is the increased

dependency on chemical inputs because it compromises environmental sustainability but also makes it even harder for the poorest.

This would suggest that for future work more careful consideration should be given to the process of introducing and disseminating the technology. There seems to be the unspoken assumption that because some farmers have been involved at some point during the process of varietal selection or identification of suitable characteristics, the resulting technology will be adopted, attractive and produce positive impacts. The data would suggest that the seeds proved very attractive but have produced more impact for relatively better off farmers because the focus of the intervention has been on technological *research* rather than supportive *extension* approaches.

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ANNEXES

Annex A: Schedule and process

Arrival 9th January 2009: meeting with Dr K. Joshi to discuss schedule, logistics and selection of districts and villages. Due to current social unrest it was agreed to change the original choice of district for the field work in Kapilvastu makes sense from a logistic perspective and will save on transport time. Jhapa was also added because it is a district showing a different setting and a high adoption of one rice variety.

10th/1: travel to Bharatpur, meeting at FORWARD office with Li-BIRD and FORWARD teams to plan the field work. It is agreed to initial plan work in 2 villages with relative high adoption or intense activity as well as one village with low activity despite project intervention. We leave open the possibility to work in more villages depending on outcomes of first villages.
The plan at present is as follows:

- Initial meetings with Key informants in each village followed by a selection of FGD to explore the theme of livelihoods changes. The number of FGDs per village will depend on the context. For example in some ethnically homogeneous villages ethnicity will not be a factor to consider in selecting representative groups. On the theme of livelihood changes there needs to be FGDs compositions representing gender differences, ethnicity, economic and land ownership status, level of adoption or not with a possibly focus on some varieties of crops. For the question of sustainability and empowerment selective representativity is deemed less necessary.
- Depending on outcome of FGDs there may be a need for semi-structured interview of specific households or individuals.
- M. Buchy will lead the interviews on day 1 and subsequently the field teams will be divided into pairs. At the end of each day the results will be shared and discussed and influence the work for the following day.

Rice and Rabi Crop Study

16th : Travel to Kapilvastu, meet with Forward team
Key informant meetings in Jaynagar 3- Purina and Gajeda Tole (both considered by FORWARD team as high adoption villages).It transpired later that 'High adoption' refers to high adoption of the new technology at the time of the intervention. The same level of adoption might not have been maintained after the end of the BGO's presence in the village.
The Gajeda meeting turned into a B-C women, food secure meeting so we decided afterwards to seek another Tole in the same village

17th : FGD meetings in Jaynagar 3- Purina
FGD with Tharu with less than 3 months food security
FGD with Tharu with 6 months food security
FGD with BC with 6 months food security
FGD with food secure B-C
FGD with women B-C with less than 3 months Food security

18th : FGD meetings in Badahara VDC (considered by the Forward team as a low adoption village). This is also a mixed caste village with a large number of Dalits and Janajaty people with BC being a minority group in this village.
FGD with Dalit and Janajaty, landless and maximum food security of 3 months
FGD with women

FGD with BC Food secure
FDG with food security of 6 months
(it was not possible to gather a group of food secure Tharu people)

19th : travel to Khatmandu . meeting at CAZS office, choice of villages in Jhapa and travel on to Jhapa district. We chose 3 villages, 2 considered as high adoption villages, one ethnically and socially mixed and one low adoption village.

Note: Once in the field the strategy changed a bit and we decided to seek out poorer groups or poorer villages rather than only look at 2 examples of high adoption villages. We also decided to see a village which had had no FORWARD intervention but was 2 km away from one that had seen some intervention. This we thought might give us some indication of spread but also see whether this village too was reporting similar overall changes.

20th : Visit to Jambadi chowk village, Meeting with Key informants to establish list of farmers and decide on FGDs. As about every HH is food secure we decided to organise 2 food secure groups of B-C and Janajatis (mostly Rais) and a group of Dalits (ideally with only 6 months or less of food security, but it turned out to be a mixed food security status group) and a group of women.

21st : visit to Jurapani – 4 Thakthake and 6 Gwalduba and meetings with key informants. Both tole at the time of FORWARD project were considered as a high adoption tole. Thakthake is a B-C dominated community and only the Dalits and Satar (adivasi group of tribes) are either landless or with very low food security. We interviewed a group of Satar people.
In Gwalduba the community is dominated by satar people. We held a FGD with a group of food secure and an FGD with a group of above 6 months of food security.

22nd : Continued FGDs in Gwalduba with a group of less than 6 month food security and a group of women.
FGD in Thakthake with a group of B-C mung beans adopters
Visit to Juropani 1 a village which has not had any FORWARD intervention: 2 FGD with food secure and around 6 months food secure farmers and 1 FGD with women's. This village is dominated by Rajbanshy people.

Annex B: Complementary data

Table 8: Data provided by a women's meeting in Gajeda tole Kapilvastu on land ownership, food security and migration patterns

Caste/ethnicity of family	Family size	Land (Share Cropping)	Type of land	Food security (months)	Migration (months)
B-C		15	ML	12	
B-C		19	4ML/15LL	12	
B-C	5	1/2	ML	1	yearly
B-C	7	(40)	ML	12	yearly
B-C	5	20	ML	12	Indian Army
B-C	6	7	ML	6	India (2-4)
B-C	5	16	16LL	12	
B-C		7	3.5UP/3.5LL	12	(6)
B-C	4	3	3UP	2	yearly
B-C	8	12	ML	12	
B-C	6	9	LL	12	Malaysia
B-C	3	5	2.5UP/2.5LL	12	Service holder
B-C	4	5	2.5UP/2.5LL	12	yearly
B-C	6	11	5.5UP/5.5LL	12	Quatar
B-C	4	8	8UP	12	yearly
Janjaty	6	10	5UP/5LL	12	yearly
Janjaty	4	3(15)	ML	12	
Janjaty	4	3(10)	ML	6	Yearly
B-C	6	7	3.5UP/3.5ML	12	Quatar & India
B-C	6	3(9)	6UP/6ML	12	
B-C	7	15	ML	12	Quatar
B-C	4	4	ML	6-7	Yearly
B-C	4	25	ML	12	Quatar
B-C	6	5	ML	12	
B-C	6	5	ML	4	Yearly
B-C	4	10	ML	12	Dubai
B-C	4	3	ML	3	India (8)

Yearly migration means migration to India
B-C: Bahun-Chhetris

Table 9: Data from Jayanagar (Badahara 9) Kapilvastu on land ownership, food security and migration patterns provided by key informants

Caste/ethnicity of family	Family size	Land size (sc)	Type if land	Food security (months)	migration
Tharu	9	4	UP	4	yearly
Tharu	11	10 (60)	15UP/10ML/45LL	12	yearly
Tharu	4	10 (40)	10UP/30ML/10LL	12	9 months
Tharu	11	50	10UP/40ML	12	6 months
Tharu	6	5	5ML	2	yearly
Tharu	4	5 (200	5UP/20ML	9	6 months
Tharu	5	10	3UP/7ML	6	8 months
Tharu	9	30 (30)	15UP/45ML	12	
Tharu	9	35	10UP/25ML	12	
Tharu	8	10 (30)	15UP/25ML	12	9 months
Tharu	4	10 (20)	15UP/15ML	12	9 months
Tharu	4	1/2	1/2ML	no	yearly
Tharu	5	4 (all given sc)	4ML	1	yearly
Tharu	7	4 (all given sc)	4ML		yearly
Tharu	8	8 (all given sc)	2UP/6ML	2	yearly
Tharu	5	19	5UP/14ML	9	8 months
Tharu	7	8	2UP/6ML	3	yearly
Tharu	9	19	4UP/14ML	6	yearly
Tharu	5	1/2			yearly
Tharu	5	10	3UP/7ML	4	yearly
Tharu	4	4 (5)	9UP	6	
Tharu	2	4 (15)	5UP/14/ML	12	Local/yearly
Tharu	5	10	10UP	8	yearly
Tharu	4	15 (15)	15UP/15/ML	12	yearly
Tharu	5	10 (30)	10UP /30ML	12	yearly
Tharu	10	10 (5)	15UP	5	Katar
Tharu	5	1	1UP	0	Katar
Tharu	5	3	3UP	1	Katar (w)
Tharu	6	1	1UP	0	yearly
Tharu	2	2	2ML	2	retired
Tharu	4	1/2	1/2ML	0	yearly
Tharu	5	1/2	1/2ML	no	yearly
B-C	5	1	1UP	no	Saudi A (w)
B-C	14	18	9UP/9ML	8	local
B-C	9	10	30ML	12	
B-C	5	11	11ML	12	Oman(w)
B-C	3	1	1ML	no	Katar
B-C	13	2	2ML	no	Katar
B-C	5	15	15ML	12	Local Busisness

(w) indicates that the woman is migrating
LL= low land, ML= Medium land; UL= Up land

Table 10: Data from Gauradaha -5 Jambadi Chowk Jhapa (provided by key informants) on land ownership, food security and migration patterns

Caste/ethnicity of family	Family size	Land (Share Cropping)	Type of Land	Food security months	Migration
Rai	4	28	ML	12	
Rai	6	21		12	
Rai	4	2.5	UL	2	Khatmandu
Rai	6	22	ML	10	
Rai	5	30	ML	12	
Rai	6	(40)	ML	12	
Rai	2	15	ML	12	Gulf
Rai	5	15	ML	10	
Rai	7	16 (30)	ML	12	
Rai	7	5	UL	2	Local Labour
Dalits	8	20	ML	10	Gulf
Dalits	6	15	ML	11	Blacksmith
Dalits	11	30	ML	12	Goldsmith
Dalits	6	10		6	Bicycle repair
Dalits	5	10		6	Labour/India
Dalits	2	3		2	Local labour
Dalits	7	30		12	
Dalits	5	10		8	business
Dalits	9	20		8	Goldsmith
Dalits	9	20		8	½ year India
Dalits	7	20		8	Goldsmith
BC	6	25		12	Saudi A
BC	6	18		12	Local labour
BC	7	10 (25)		12	Local labour
BC	5	20		12	
BC	6	35	UL	12	
BC	6	13	UL	8	Gulf
BC	7	50		12	
BC	4	40		12	
BC	4	18		12	Gulf
BC	8	3 (rented) (30)	UL	12	carpenter
BC	5	20 (R) (20)		12	Gulf
BC	4	30		12	Malaysia
BC	4	30		12	Gulf
BC	9	30		12	Carpenter KTM
BC	5	30		12	Gulf
BC	8	20(R) (30)		12	Gulf+ police
BC	7	20 (20)		12	
BC	5	30		12	
BC	8	(40)	UL	10	Gulf
BC	6	30		12	
BC	6	10	UL	6	Gulf

LL= low land, ML= Medium land; UL= Up land

Table 11: Data from Juropani-6 Gwalduba (provided by key informants) on land ownership, food security and migration patterns

Caste/ethnicity of family	Family Size	Size of land	Months of Food security	Migration
Rajbanshi	4	5 K (UL) 13 K (ML)	6	
Rajbanshi	4	5 (UL) 12 (LL)	6	3 months, sweater weaving
Rajbanshi	4	2 (UL) 30 (ML)	9	
Rajbanshi	3	15 (UL) 65 (ML)	12	
Rajbanshi	4	40 (ML)	9	
Rajbanshi	4	½ (UL)	0	New Delhi 4 months
Rajbanshi	4	2 (UL)	1	carpenter
Rajbanshi	5	20 (UL) 15 (ML)	8	
Rajbanshi	3	2 (UL)	0	teacher
Rajbanshi	7	3(UL) 16 (ML)	2	2 men in New Delhi 6 months
Rajbanshi	5	14(UL)126 (ML)	12	2 teachers
Rajbanshi	6	4(UL)	2 weeks	Sweater weaver
Rajbanshi	5	½ (UL)	0	?
Rajbanshi	9	7(UL) 133 (ML)	12	
Rajbanshi	6	60(ML)	12	Local business
Rajbanshi	5	5(UL) 45(ML)	12	Local Business
Rajbanshi	7	3(UL)	2 weeks	Shop keeper
Rajbanshi	4	landless		Agriculture Labour
Rajbanshi	3	1/2(UL)	0	Agriculture labour
Rajbanshi	3	1(UL)	0	Agriculture Labour
Rajbanshi	4	1(UL)	0	Tea shop
Rajbanshi	3	landless		carpenter
Rajbanshi	5	10(UL) 10 (ML)	9	
Rajbanshi	5	20(UL) 30 (ML)	9	
Rajbanshi	6	1(UL) 19 (ML)	8	Sweater weaver
Rajbanshi	5	1.5(UL)		Tea shop
Rajbanshi	2	6.5(UL)	3	Agriculture Labour
Rajbanshi	5	1.5(UL)		2 in New Delhi, cycle repairs
Rajbanshi	5	3.5(UL)	2 weeks	Agriculture labour
Rajbanshi	5	4(UL) 6 (ML)	2	Agriculture labour
Rajbanshi	5	1.5(UL) 6.5 (ML)	2	Agriculture labour
Rajbanshi	7	1(UL)		Tea shop, + labour
Rajbanshi	2	6(UL)	1	Agriculture labour
Rajbanshi	4	5(UL) 20 (ML)	6	Agriculture Labour
Rajbanshi	6	5(UL) 25 (ML)	4	postman
Rajbanshi	5	15(UL) 95 (ML)	12	
Rajbanshi	6	5(UL) 45(ML)	10	postman

LL= low land, ML= Medium land; UL= Up land

Table 12: Data on crops grown by a sample of 6 months food secure farmers Tharu Purina village (Kapilvastu)

Farmers	Size of land (Share Cropping)	Family size	Type of land	Varieties grown	Migration
1	12K	4	upland	O.Ro (initially), Sarjhu Radha, Mayur (increasingly) Lentils 8k & mustard 4K (after rice) Stopped Mung beans because lack of irrigation Spring season fallow	Husband in Indian Army
2	9K (but has given for share cropping)	2	medium		
3	4 (10)	3	Upland	Sarju (increasingly), Gautam Mustard and Linseed 4 K each 6k Fallow Spring season Fallow	Local Labour
4	10	9	Upland	All O.R. Lentils (1K), mustard (2K) rest fallow Spring season Fallow	Local labour
5	20	12	Upland 4 K Medium 14K	Sarju 52 (20K) Linseeds (1K), wheat (2K), chick pea (1K), potatoes (1/2K), peas (2K), lentils (3K), fallow Spring season, fallow	Local labour 1-2 months/year

Table 13: data of variety grown by a sample of food sufficient Tharu group in Purina village (Kapilvastu)

Farmers	Size of land	Family size	Type of land	Varieties grown (source)	Migration
1	36 K (40)	13	medium	Malla (30K), Radha (15K), O.R. rest Mustard + lentils (10K), wheat (8K), linseed (6K), kheshari (8K), Potato + vegetables (2K) Spring season initially mung beans (a) but no more	1 son in India yearly
2	57K	13	medium	Gorakhnath (23K) Barkhe 2001 (Forward), Sawa (Agrovet), Bajigar Chickpea (1K), mustard Lentils (20K), Lathyrus (10K) Spring season sun flower (1K)	2 job holders locally
3	36 K	6	medium	Barkhe 2001 (Forward), rest sawa Chickpea (4K), mustard Lentils (15K), Lathyrus (1K). Vegetables (2K), wheat. After wheat total fallow	1 son India
4	37 K	8	medium	Gorakhnath (5K), Mayur (5K), Sawa (5K), Chota Mota (22K) Mustard, Lentils (5K), pure lentils (2K), Lathyrus (2K). Vegetables (2K), wheat (4K) Spring season fallow.	No
5	36 K(4)	8	medium	Gorakhnath (5K) Sawa (12). Barkhe 2001(4K), Radha (10K), Mala (1K), Mustard, Lentils (2 1/2K), pure lentils (2K), Lathyrus (2 1/2K), Linseed 11K Vegetables (2K), wheat (7K), coriander, (1/2K), chick pea (1K), large pea (1K) spring season fallow	1 son India
6	57	9	medium	Loknat, O.R., Radha, Mustard(4K), Lentils (4K), Lathyrus (2 K), Linseed 11K Vegetables (2K), wheat (7K),	

Rainy season: June- August
Autumn: Sept-Nov
winter: Dec-Feb
spring: Mar-May

and which of these seasons is considered the dry season? Mar-May

Gender/caste/ethnicity

Kamal Biswakarma: M/dalit
Sete Sunar: Male/dalit
Bal Bahadur Sunar: Male/dalit
Gopal Sunar: Male/dalit
Hom Bahadur Bhandari: M/Chhetri (2nd rank in high caste)
Ramesh Khadka: M/chhetri (2nd rank in high caste)