CGIAR SYSTEMWIDE LIVESTOCK PROGRAMME RESEARCH GRANTS:
CONSERVATION AGRICULTURE, LIVESTOCK AND LIVELIHOOD STRATEGIES
IN THE INDO-GANGETIC PLAINS OF SOUTH ASIA: SYNERGIES AND TRADE OFFS

# Report of the Project Progress Review Workshop

September 22-25 2008, New Delhi

Compiled by:
Arindam Samaddar, Nils Teufel & Olaf Erenstein

Contact:
Olaf Erenstein (o.erenstein@cgiar.org)
CIMMYT (International Maize and Wheat Improvement Center)
CG Block, NASC Complex, Todapur Road, Pusa,
New Delhi-110012, India

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# 1 Introduction

In the Indo-Gangetic Plains (IGP) of South Asia, the rice-wheat cropping system is widely practiced and covers about 13.5 million ha. Ruminant livestock play an important role in the rice-wheat system. These crop-livestock systems support the livelihoods of millions of families, most of them resource poor. Integrating crop and livestock production has a number of advantages, including complementarities in terms of resource use and income and risk reduction. These systems have seen rapid and significant intensification of rice-wheat cultivation in response to the availability of improved inputs and policy and institutional support. Lately though, the rice-wheat cropping system is experiencing stagnant or declining grain yields, falling water tables and soil degradation (Kumar et al., 1999; Pingali and Shah, 1999). These threats are being addressed by the Rice-Wheat Consortium (RWC, www.rwc.cgiar.org) through research on resource-conserving technologies (RCTs, including zero-tillage, permanent beds and mulching) within the context of conservation agriculture. The RCTs are having some success in improving resource use efficiency for crop production, but there is a lack of information about their impacts on overall farm productivity and its livestock components and the implications for the livelihood strategies of poor households.

The terms “conservation agriculture” (CA) and “resource conserving technologies” (RCTs) are quite different. CA refers to crop management practices that involve a minimum level of soil movement, soil cover (particularly through retention of crop residues) and the use of sensible, profitable crop rotations. RCTs refer to those practices that enhance resource/input use efficiency. The RCTs are typically part of conservation agriculture practices, but may become unsustainable in the long run, if they do not meet all the components of conservation agriculture. Although the adoption of zero/minimum tillage in wheat is spreading fast, adopters often do so without retaining significant amounts of crop residues as mulch. In part, this seems to relate to practical difficulties with crop residue management, particularly in view of changes in harvesting practices (use of combiners) and the current zero-till drills in use. However, even without zero-tillage, the practice of burning crop residues is common in certain locations (Gupta et al., 2004; Sidhu et al., 1998). The crop residues are also removed for use in agro-based industries and as household fuel and building material. However, the most important factor appears to be that crop residues are an important source of fodder for both landed and landless livestock keepers. Applying conservation agriculture practices typically implies the need to retain crop residues on the soil surface, which reduces the availability of crop residue for livestock production. Thus, to adopt conservation agriculture practices, farmers face trade-offs between crop and livestock production.

Retention of crop residue in the field improves the soil organic matter content. In principle, using the crop residue as fodder and returning the manure to the soil should improve soil productivity and be environmentally sustainable. However, in the IGP the widespread use of dung as household fuel limits its availability for crop production. Further, recent technological changes in the agricultural systems, e.g. mechanization, have had varying direct and indirect implications for the crop and livestock enterprises and their integration. The advent of conservation agriculture further decreases the role of draft animals, which may lead to specialized dairy or meat enterprises. This will have varying implications for landed and landless households in terms of land allocation decisions for food and fodder production and dependence on markets for purchase of livestock inputs.

Not much is documented about crop-livestock interactions in the IGP (Paris, 2002; Parthasarathy Rao et al., 2004; Parthasarathy Rao and Hall, 2003; Thomas et al., 2002). Indeed, research and technical interventions typically focus on crops or on livestock, often

without a system perspective (Devendra et al., 2000; Thomas et al., 2002). Yet a better understanding of the system and the livelihood objectives of landed and landless families are essential for successful alleviation of poverty and improving rural livelihoods. Under this context, the present project proposes to research the crop-livestock interactions in the rice-wheat-livestock systems of the IGP to quantify the trade-offs faced by farmers who have adopted or are considering conservation agriculture practices. An important part of the research will be to assess the livelihood impacts of RCTs – including those beyond the farm gate like institutional change and the social implications for the large number of landless livestock keepers in the IGP. The research will assess: (i) the trade-offs affecting crop and livestock production and natural resource management (NRM); (ii) the impacts of the trade-offs on the livelihoods of poor households; and (iii) their implications for the design of research and extension programs in support of improved livelihoods and NRM in the IGP.

The present document provides a report of the Project Progress Review Workshop, September 22-25 2008, New Delhi. The workshop encompassed:

i) A presentation and discussion of village and household survey results and a progress report from each site.
ii) Cluster discussions to highlight contrasts, similarities and implications (trade-offs, CA-feed links, R&D) from the presentations.
iii) Some initial discussion on the qualitative study and market survey.
iv) Technical issues on data processing and results.
v) Group meetings with each of the three clusters to review progress, problems, methodological issues, partners & roles and work plan.

The next section summarizes the outcomes of the progress review workshop. Annex 1 provides the workshop program and Annex 2 the workshop participants. Annex 3 includes all presentations made during the workshop.

# 2 Project progress review workshop

The project progress review workshop was held in New Delhi on September 22-26, 2008 (Annex 1). The main purpose of the workshop was to review the progress of survey work, to share preliminary salient findings and to facilitate discussion on data processing and preliminary results. The workshop intended to provide an improved understanding of current problems and issues, and determine the responsibilities for the remaining work plans of the nine site partners.

Partners from nine sites were invited to participate and share their experiences in different stages of the project progress. Each site team comprised different disciplinary backgrounds including crop, livestock and social scientists. Along with the scientists, enumerators and computer operators took part so as to share their day to day experiences in the field and with data entry and get a better grasp of the implications of their contributions (Annex 2). The program comprised four main components (Annex 1).

## *2.1 Village and household survey presentation*

The first component was introduced by Olaf Erenstein who also provided an overview of the SLP study (Annex 3.1). This was followed by detailed site presentations by each of the nine partners (Annex 3.2). The site presentations provided initial results from the village and household surveys. From the village survey, each site synthesized the findings focusing on the description of farming systems (crops, livestock, livelihoods, markets) and technology use with an emphasis on crop-livestock interactions. Preliminary results from the household survey focused on areas closely related with conservation agriculture, such as technology use, crop residue use and the factors affecting such uses. Each site also presented a brief update on progress with data collection, data entry and data cleaning regarding the various phases of the study. The presentations were discussed cluster-wise to emphasize the communalities between sites.

## *2.2 Cluster discussion – contrast, similarities and implications*

In the second workshop component, partners were grouped by cluster to discuss contrasts, similarities and implications from the village survey and household survey findings within the cluster. A brief presentation introduced the working group process as well as some of the emerging cross-cutting issues and gradients (Annex 3.3). The cluster groups were based on their locations within the Indo-Gangetic Plains:

1. North west (Punjab, Haryana and Uttarakhand),
2. Central (Eastern Uttar Pradesh and Bihar); and
3. East (West Bengal and Bangladesh).

Each group was relatively balanced in terms of number, disciplines and proposed districts. At first, each group identified different important indicators under the category given in the outline and pointed out the striking similarities and contrasts according to site characteristics. These indicators were grouped under the category of crops, livestock, crop-livestock interactions, RCTs/CA, livelihoods and environment. Each cluster also tried to point out the drivers of change and modifiers of the indicators identified.

In the second phase, partners discussed the implications particularly in terms of emerging rice-wheat-livestock systems, CA-feed links, CA trade-offs in livelihood, poverty and environment, RCTs/CA adoption. Each cluster also noted some important points related to

R&D and Gaps & Needs. After the completion of exercise, each cluster presented their observations to the plenary.

Due to time constraints the group discussion could not dwell at length on each and every indicator and discuss its importance. Instead, each group discussed those indicators that appeared to be most relevant. All three groups indicated the site specific crop preferences, livestock types, ZT/RT adoption level, Crop-livestock income share based on land holding (LF- large farms, SF- small farms) and landless and some major environmental issues that are important in each cluster. It was clear that the conservation agriculture trade-off farmers face in the field of livelihood, poverty and environment showed varying complexity based on site specific characteristics. All the clusters highlighted the environmental benefits of conservation agriculture. Each site shared their experiences and suggested some research and developmental effort in the context of zero till machine design based on soil characteristics, seeding in the residue retained field, suitability of multi crop etc. All the sites projected the importance of knowledge and extension effort required for the fruitful application of conservation agriculture. Tables 1 to 6 provide the tentative contrasts, similarities and implications identified during group discussion by each clusters. These will be revisited as actual survey results become available, but are helpful to guide thinking and write-up of the various project outputs. An important aspect of the group discussions was also to improve communication between sites. Bringing cluster scientists physically together in the working groups and the workshop helped to transcend disciplinary, geographical and institutional boundaries and strengthen personal linkages and mutual understanding.

**Table 1 Tentative contrasts & similarities of cluster I reported by working group**

| **Category** | **Indicator** | **Cluster 1** | | |
|---|---|---|---|---|
| | | **Patiala** | **Karnal** | **Pantnagar** |
| Crops | Main crops | Wheat & Paddy | Wheat & Paddy | Wheat & Paddy |
| | Supplemented crops | Cotton & Sugarcane | Fodder crops | Sugarcane |
| Livestock | Types | Buffalo, cross breed | Buffalo, cross breed | Buffalo cross breed |
| Crop-livestock interactions | Dry fodder | Mainly wheat bhusa | Mainly wheat bhusa | Mainly wheat bhusa |
| | Fodder area | 10% – 12% | 3% - 4% | 4% |
| | Draft animal use | No ploughing, only transport | No ploughing, only transport | No ploughing, only transport |
| RCTs/CA | Zero-till (ZT) wheat | 15% | 10% | 13% |
| | Reduced till (RT) wheat | 21% | 20% | 20% |
| | Crop diversification effort | To switch the cropping pattern away from paddy coarse | To switch the cropping pattern away from paddy coarse | To switch the cropping pattern away from paddy coarse |
| | Combined harvester | Paddy(coarse) straw burning | Paddy(coarse) straw burning | Paddy(coarse) straw burning |
| Livelihoods | Crop-livestock Income share | Large Farmer (LF) – 85%<br>Small Farmer (SF) – 65 % | LF – 85%<br>SF – 85% | LF – 70%<br>SF – 52% |
| | Landless income share | Labour – 68%<br>Livestock–10% | Labour – 73%<br>Livestock-15% | Labour – 56%<br>Livestock-3% |
| Environment | Water table | Declining | Declining | Less problem |
| | Burning rice straw (pollution) | More intensified | More intensified | Less intensified |
| | Soil fertility | Declining | Declining | Less declining |
| Drivers of change | Population growth, Technology increase (new machines), Purchasing power | | | |
| Modifiers | Higher yield of paddy wheat, Better price of paddy wheat, Assured income of paddy wheat | | | |

**Table 2 Tentative implications for cluster I reported by working group**

| Category | Cluster I |
|---|---|
| Rice-wheat-livestock systems | - Due to ecological problem, there is need to divert the crop from paddy to some alternative crops<br>- Need to explore the alternative uses of paddy straw presently being burnt<br>- Livestock population is decreasing as people prefer to keep better yielding cross breed cows, buffaloes<br>- Due to urbanization & declining common land, the grazing facilities is reduced |
| CA-feed links | - RT/ZT requires more straw as mulch – Less livestock feed available |
| CA trade-offs livelihoods | - Potentially less availability of straw<br>- Prices of straw goes up<br>- Landless is most sufferer<br>- Livestock keeping is less economical<br>- Relative contribution of livestock in income share might decline |
| CA trade-offs poverty | - Landless might leave livestock production<br>- Adverse impact on the income of landless |
| CA trade-offs environment | CA will improve the environmental condition of all three sites<br>- soil fertility<br>- Irrigation water saving<br>- Less tractor use – less burning of fuel, less air pollution<br>- Potentially less burning of paddy straw – less pollution, less health hazards |
| RCTs/CA adoption | - Adoption mainly at larger farms<br>- Inadequate extension efforts in whole cluster<br>- Machine is not always available |
| R&D | - Cost effective zero till drill<br>- More efficient machine – Redesign (soils) |
| Gaps & needs | - Knowledge<br>- Extension effort |

**Table 3 Tentative contrast & similarities of cluster II reported by working group**

| Category | Indicator | Cluster II | | |
|---|---|---|---|---|
| | | **Balia** | **Samastipur** | **Jamui** |
| Crops | Crop types | Paddy & Wheat Increasing | Paddy & Wheat Increasing | Paddy stagnant, Wheat increasing |
| | | Sugarcane & pulses decreasing | Sugarcane & pulses decreasing | Sugarcane & pulses decreasing |
| | Diversification (Need/Site based) | Increasing | Increasing | Increasing |
| Livestock | Types | Buffalo increasing, desi cattle decreasing | Buffalo decreasing, desi cattle decreasing | Buffalo decreasing, desi cattle decreasing |
| | Number | Herd decreasing | Herd decreasing | Herd decreasing |
| Crop-Livestock interaction | Fodder | Wheat straw | Wheat straw | Rice straw |
| | Dung | Fuel/manure | Fuel/manure | Fuel/manure |
| RCTs/CA | ZT/RT wheat | Increasing | Increasing | Increasing |
| | DSR/Double ZT | Increasing | No practice | Increasing |
| | Residue retention | Slightly increasing (combine use) | | |
| Livelihood | Crop-livestock income share | LF & SF- crop more important | LF & SF- crop more important | LF & SF- crop more important |
| | Landless income share | livestock +other | livestock + other | livestock + other |
| Environment | Temp. in summer/winter increasing | Decreased the yield of wheat | Decreased the yield of wheat | Decreased the yield of wheat |
| | Less winter rain | Decreased the yield of wheat | Decreased the yield of wheat | Decreased the yield of wheat |
| Drivers of change | ZT- early sowing, less seed rate, low cost & higher production,<br>Diversification- More remunerative, irrigation water availability.<br>Livestock- High milk yield of cross breed cow | | | |
| Modifiers | Lack of knowledge, small land holding, unavailability of assured irrigation facility, lack of community approach, less income from crops | | | |

**Table 4 Tentative implications for cluster II reported by working group**

| Category | Cluster II |
|---|---|
| Rice-Wheat-Livestock system | - Rice-Wheat system are common in all three sites |
| CA- feed links | - CA will not affect the feed, no conflicts between CA and feed |
| CA trade-offs livelihoods | - Although, there are 1-7 % area under CA in cluster II has reported but no trade-offs has been observed. |
| CA trade-offs livelihoods | - CA will be helpful in decreasing the poverty and improve the livelihood. |
| CA trade-offs poverty | - No effects |
| CA trade-offs environment | - System sustainability and environment<br>- Conserve the natural resource<br>- Improve soil health |
| RCTs\CA adoption | - RCT/CA adoption will reduce cost<br>- Improve yield |
| R&D | - Machines for small holding farmers and animal drawn machine<br>- Suitable machines for residue conditions<br>- Appropriate crop establishment options in residue situations/double no till system . |
| Gaps & needs | - Unavailability of appropriate drills at local level<br>- Precise leveling of lands ,assured supply of water<br>- Awareness & community approach. |

**Table 5 Tentative contrasts & similarities of cluster III reported by working group**

| Category | Indicator | Cluster III | | |
|---|---|---|---|---|
| | | **Murshidabad** | **Rajbari** | **Dinajpur** |
| Crops | Types of crops | Paddy, wheat, maize, potato, vegetables, jute | Paddy, wheat, maize, potato, vegetables, jute, onion | Paddy, wheat, maize, potato, vegetables |
| | Tilling implement | Power tiller, Tractor | Power tiller, PTOS | Power tiller, PTOS |
| | Irrigation | Shallow tubewell (D+E), Deep tubewell, River lift irrigation | Shallow tubewell (D+E) | (Shallow) tubewell (D+E) |
| Livestock | Types | Zebu cattle, more cross breed, Less goat compared to other clusters | Zebu cattle, Less cross breed, more goat | Zebu cattle, Less cross breed, more goat |
| | Fodder area | Few (LF) | None | None |
| | Milk yield | More | Less | Less |
| | Milk marketing | Co-operative | Middleman | Middleman |
| | Green grass | Field collection | Field collection | Field collection |
| | Insemination | Natural + AI | Natural + AI | Natural |
| Crop-livestock interactions | Feed | Rice straw, few wheat straw, rice bran | Rice straw, less boro rice straw, no wheat straw, rice & wheat bran | Rice straw, less boro rice straw, no wheat straw, rice & wheat bran |
| | Dung | Manure | Manure | Manure |
| | Drought power | Tillage + bullock cart | Tillage | Tillage |
| RCTs/CA | Area | Lesser | More | Less |
| | Tillage | ZT wheat, RT – wheat/paddy | PTOS, RT -paddy | PTOS |
| | Residue | Wheat straw burning | Boro rice residue left | Boro rice residue left |
| Livelihoods | Landless group | Higher, Ag-lab, non Ag-lab | Lesser, Ag-lab, Non Ag-lab | Higher, Ag-lab, non Ag-lab |
| | Income | Crop, livestock | Crop, livestock | Crop, livestock |
| | Poverty | Higher | Lesser | Higher |
| Environment | Rainfall & flood | High & skewed, Flood prone – some portion | High & skewed, Flood prone – some portion | High & skewed, long winter |
| Drivers of change | Population pressure, Reduction of animal draft, pasture land, less/no irrigation, marginalization of land, less profitability – paddy, wheat, Input price, Government policy support | | | |
| Modifiers | Price trend, climatic factor, consumption habits, availability & access of appropriate technology, religious belief, market access, extension system, individual attitude/belief, promotion of alternative enterprise | | | |

**Table 6 Tentative implications for cluster III reported by working group**

| Category | Cluster III |
|---|---|
| CA-feed links | Feed - Negative balance |
| CA trade-offs livelihoods | - Positive link mainly in Murshidabad<br>- Less number of cattle, |
| CA trade-offs poverty | To some extend poor impact |
| CA trade-offs environment | Better environmental sustainability |
| RCTs/CA adoption | |
| R&D | - Modification of implement<br>- Suitability for multi crop/soil |
| Gaps & needs | - Subsidy<br>- Credit<br>- Training<br>- Access |

## *2.3 Initial discussion on qualitative and market survey*

Arindam Samaddar shared some initial findings of the qualitative and market surveys conducted in the nine project sites (Annex 3.4). Perceptions on tilling, ZT adoption, residue retention and straw use and importance of livestock are the major points that were covered in the presentation on the qualitative study.

Tilling is perceived to make the soil fertile was the common rationality by the farmers of all the villages with varied level of expression. Different villages have different types of traditional aphorism related to tilling and crop production, which gives them the traditional knowledge about tilling procedure based on soil type, cropping pattern and season cultivated. It was found that the experiences of learning new technologies like zero tillage and unlearning of conventional tilling are dependent on how the technology was introduced to the farmers. Different types of knowledge sources and the process of technology dissemination determine the key role of the fruitful adoption of such technology. In all the nine sites farmers having adopted ZT mentioned cost minimization as the most important driving force for adopting this technology.

Although all farmers consider retaining residue as being good for the soil as it adds organic matter, no conscious effort has been found among farmers to keep residue in the field, even amongst those who are practicing ZT. Farmers mentioned that no one likes to retain residue after harvesting as it gives a very ugly look compared to a clean field without crop residues. It was found that the tradition of wheat and rice dictates which straw is preferred as feed. In addition, straw quality and availability also depend on the employed harvesting technology. Livestock keeping as tradition and showcasing the status of the farmer was the common character in all the nine sites. Reduced herd sizes with the tendency to keep cross-bred cattle for more milk is a common trend found in the villages leading to qualitative changes in the feeding, milk production and selling.

A preliminary brief discussion on straw markets was made on the following topics

- Market characterization
- Product differentiation
- Who are the sellers
- Who are the buyers
- Volume traded
- Trends and variation
- Outlook and perception on residue marketing

## *2.4 Technical issues on data processing and results*

The main purpose of this session was to discuss with the partners about the data processing and results from the different survey modules. Nils Teufel presented different aspects under four major topics (Annex 3.5). The first topic dealt with the technical issues related with data entry, data correction and initial analysis. In this discussion major emphasis was given to '0' versus null (' ') entries, using standard units for weight and area, decimals and significant figures in output tables and formatting of GPS data entry. In addition the use of MS Access queries, the procedures for extracting data from for the data base for use by other software for analysis was also presented and clarified for initial data analysis. Another presentation by Olaf Erenstein showed the differences in output due to different handling of zeros in the data and the implications of significant figures in the table output (Annex 3.6).

The introduction of the access data entry form for the enterprise surveys I, II and III were covered under the next topic. At first, the data entry process was explained and then each site was provided with an example database including the data entry forms to gain practical experience and also to identify problems. Due to time limitation partners only could try few pages. Nevertheless, a variety of questions and problems faced by the partners were discussed and clarified during this practice session.

Some initial synthesis results from village survey were also presented. From this presentation partners also got more insight on the need for consistent table formatting in the context of units, decimals and percentages.

Finally, some important points on of the remaining data analysis were discussed. It was emphasized that the results should provide answers to questions related to the research objective on conservation agriculture. Such questions include "Who is using straw?" What is the role of straw?", "What is the availability of straw for RCT?". A brief discussion followed on how these questions will be translated into hypotheses and appropriate analysis. The main purpose of this particular presentation was to encourage the partners to think independently on the important issues and findings and also to make hypotheses from their understanding and experiences for analysis and report writing. All partners were encouraged to contribute to the upcoming World Congress on Conservation Agriculture, which will be held in New Delhi on February 4 to 7, 2009. The end of project workshop is planned just before the World Congress to facilitate participations of project partners.

## *2.5 Group meeting with the clusters*

The final workshop component consisted of separate group meetings within the three clusters to review progress, problems, methodological issues, partner roles and work plans. Progress of data collection was reviewed and tentative time lines for completion agreed.

Each site discussed and clarified actual GPS data collection and residue measurement on the selected plots. It was found that in most of the sites GPS data and residue measurement at the plots was done after the completion of data collection from the sampled households. The central and eastern clusters faced most problems in identifying the plots due to small plots and dispersed locations. To the enumerator, it was difficult to manage the farmers to take him to the selected plots if the plot is located far from the house. In many cases they selected one key informant who knows about the plot locations of different farmers for assistance. In some of the sites, residue measurements on the selected plots could not be completed within the scheduled period (within a month of crop establishment) due to the delays in survey work initiation. Some sites, e.g. Samastipur, Murshidabad, Rajbari, could not collect residue measurements in all selected kharif (rice) plots due to flooding. Overall it was found that more plots were covered for residue measurement in the winter season compared to the rainy season. Almost all the sites mentioned the problem of measuring residue in rice field after the crop is established due to the standing water in the field.

During the last stage of this session work plans and guidelines for project completion were presented and discussed as well as a tentative timeframe and responsibilities of report writing (Tables 7 & 8). A brief guideline for each report along with the responsibility and proposed deadlines were provided to each partner.

**Table 7 Envisaged project reports/working papers (unpublished)**

| | Title | Content | Responsibility | Proposed deadline |
|---|---|---|---|---|
| 1. | Village survey (VS) report (9x) | VS | Each site team | Done (9 drafts) |
| 2. | Household survey report (9x) | Household survey ; enterprise surveys I-III. Min 10 pages + annex tables | Each site team | Mid Nov 08 |
| 3. | Working paper qualitative survey | 20 pager by cluster | Arindam et al | Mid Nov 08 |
| 4. | Working paper residue markets | 20 pager by cluster | Arindam et al | Mid Nov 08 |
| 5. | Working Paper Household survey | 10 pager by cluster + annex tables | Nils et al | Mid Jan 09 |
| 6. | Working Paper enterprise surveys I-III | 20 pager by cluster + annex tables | Nils et al | Mid Jan 09 |

**Table 8 Envisaged reports to be published**

| | Title | Content | Responsibility | Deadline |
|---|---|---|---|---|
| 1. | Village survey synthesis | 1. Intro<br>2. Methodology<br>3. Cluster I<br>4. Cluster II<br>5. Cluster III<br>6. Cross-cluster analysis & synthesis<br>7. Conclusion | SLP coordination team (Nils et al) | Full draft: Mid Oct. 08<br>Printed: end March 09 |
| 2. | Cluster report I | 1. Intro<br>2. Methodology<br>3. Site I (20 page synthesis village/household/-enterprise surveys following similar format)<br>4. Site II<br>5. Site III<br>6. Cross-site analysis & synthesis<br>7. Conclusion | Editors: SLP coordination team<br>Authors site chapters: site coordinators + collaborators | draft site chapters: mid Jan 09<br>Full draft: end Feb 09 |
| 3. | Cluster report II | - " - | - " - | - " - |
| 4. | Cluster report III | - " - | - " - | - " - |
| 5. | Overall synthesis | 1. Intro<br>2. Methodology<br>3. Cluster I<br>4. Cluster II<br>5. Cluster III<br>6. Cross-cluster analysis & synthesis<br>7. Conclusion | SLP coordination team | Full draft: end Mar 09 |

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**Annex 1: Progress review workshop program**

| Day | Mon 22/09/08 | Tue 23/09/08 | Wed 24/09/08 | Thu 25/09/08 |
|---|---|---|---|---|
| 09:00 - 10:30 | plenary<br>presentations<br>Punjab<br>Haryana | plenary<br>presentations<br>West Bengal<br>Dinajpur | Plenary<br>Qualitative discussion<br>plenary<br>synthesis results<br>(VS, HS)<br>plenary training<br>data handling | group meeting<br>cluster III |
| 10:30- 11:00 | tea | tea | Tea | |
| 11:00 - 12:30 | plenary<br>presentations<br>Uttarakhand<br>discussion on<br>cluster | presentations<br>Rajbari<br>discussion on<br>cluster<br>intro cluster disc;<br>planned reports | plenary training<br>analysis, reporting<br>wrap up | |
| 12:30 - 14:00 | lunch | lunch | Lunch | |
| 14:00 - 15:30 | plenary<br>presentations<br>UP<br>Bihar north | cluster discussion<br>contrasts &<br>similarities (based<br>on presentations);<br>implications<br>(trade-offs, CA-<br>feed links, R&D) | group meeting<br>cluster I | |
| 15:30 - 15:45 | tea | tea | Tea | |
| 15:45 - 17:00 | plenary<br>presentations<br>Bihar south<br>discussion on<br>cluster | plenary<br>feedback from<br>cluster<br>discussions;<br>synthesis results | group meeting<br>cluster II | |
| | | | | |
| | dinner | dinner | Dinner | |

**Annex 2: List of participants - Progress review workshop**

| S. No | Name | Specialization | Contact address | Phone/E-mail | Cluster |
|---|---|---|---|---|---|
| 1 | Dr. Virender Pratap Singh | Agronomy | GBPUA&T, Department of Agronomy, Pantnagar Uttarkhand 263145<br>India | +91 9411159669<br>+91 (5944) 234- 098<br>vpratapsingh@rediffmail.com | North-west |
| 2 | Dr. B.M. Kumar | Social Science | Professor, Sociology, Pantnagar Uttarkhand 263145<br>India | +91 919412905043 Cell<br>+91 (5944) 233-170<br>+91 (5944) 233-346<br>drbmkumar@rediffmail.com | North-west |
| 3 | Dr. Brijesh Singh | Animal Breeding | SR Officer, Animal Breeding, Pantnagar Uttarkhand 263145<br>India | +91 9411160035 Cell<br>+91 (5944) 234-560<br>+91 (5944) 234-528<br>singhagb@rediffmail.com | North-west |
| 4 | Mr. Ajay Singh | Agricultural Economics | SR Fellow, Department of Agronomy, Pantnagar Uttarkhand 263145<br>India | 09410118160 | North-west |
| 5 | Dr. D.K. Grover | Agricultural Economist | Director<br>Agro-Economic Research Centre<br>Punjab Agricultural University, Ludhiana - 141004 | Phones: Home 911612553897<br>Cell 09888896201<br>Work 911612407008<br>Fax 911612400945<br>dkgrover@pau.edu, dkgrover59@yahoo.co.in | North-west |
| 6 | Mr. Inderpal Singh | Agricultural Economist | Research Scholar, Department of Economics<br>Punjab Agricultural University, Ludhiana - 141004 | +91 988007827<br>ips_saini1@yahoo.com | North-west |
| 7 | Dr. R.V. Singh | Agricultural Economics | Principle Scientist, Division of Dairy Economics, Statistics and Management, National Dairy Research Institute, Karnal Haryana 132001 India | +91 9896037479 Cell<br>+91 (184) 2259224<br>+91 911842274090<br>rajvirsingh5@yahoo.com | North-west |
| 8 | Dr. Kulwant Singh | Agricultural Economics | Senior Scientist (Retired) Division of Dairy Economics, Statistics and Management, National Dairy Research Institute, Karnal Haryana 132001 India | +91 9813084516 Cell<br>+91 911842265662<br>+91 (184) 259-229<br>kagtech@rediffmail.com | North-west |
| 9 | Mr. Ram Suresh | Agricultural Economics | Senior Research Fellow Division of Dairy Economics, Statistics and Management, National Dairy Research Institute, Karnal Haryana 132001 India | | North-west |
| 10 | Mr Rajesh Kumar | Enumerator | Research Assistant,<br>National dairy research Institute, Karnal Haryana 132001, India | +91 9813720586 | North-west |

| | | | | | |
|---|---|---|---|---|---|
| 11 | Dr. U.P. Singh | Agronomy | Professor, Department of Agronomy, BHU, Varanasi Uttar Pradesh 221005 India | +91 9415303524<br>udaipratap.singh1@gmail.com | Central |
| 12 | Dr. H.P. Singh | Agricultural Economics | Associate Professor, Department of Agricultural Economics, BHU, Varanasi Uttar Pradesh 221005 India | +91 915422307112<br>+91 915422575465<br>hpsingh@bhu.ac.in | Central |
| 13 | Mr. Ashesh Kumar | Enumerator | Research Assistant,<br>Department of Agricultural Economics, BHU, Varanasi Uttar Pradesh 221005 India | 09415618969 | Central |
| 14 | Mr. Pramod Kumar | Enumerator | Research Assistant,<br>Department of Agricultural Economics, BHU, Varanasi Uttar Pradesh 221005 India | | Central |
| 15 | Dr. R.N. Singh | Agronomy | Program Coordinator, Shrambharati KVK,<br>Khadigram Jamui Bihar 811313, India | +91 9934734126 Cell<br>+91 (6348) 232-227<br>singhrajnarain@yahoo.com | Central |
| 16 | Dr. Sudhir Singh | Agronomy | SMS, Agronomy<br>Shrambharati KVK, Khadigram Jamui Bihar 811313, India | +91 9931939353 Cell | Central |
| 17 | Mr. Brajesh Kumar | Soil Science | SMS, Soil Science<br>Shrambharati KVK, Khadigram Jamui Bihar 811313, India | | Central |
| 18 | Dr. Mritunjay Kumar | Agronomy | Associate Professor, Department of Agronomy, RAU, Pusa, Samastipur<br>Bihar 848 125, India | +91 9430891658 Cell<br>+91 (6274) 240-462<br>dr_mritunjay@sify.com | Central |
| 19 | Dr. Amlendu Kumar | Agricultural Economics | Assistant Professor. Department of Agricultural Economics, Dhouli, RAU, Pusa, Samastipur, Bihar 848 125, India | +91 9431205321<br>dramlendukumar@yahoo.com | Central |
| 20 | Mr. Narendra Kumar | Data collection | Research Assistant<br>Department of Agronomy, RAU, Pusa, Samastipur<br>Bihar 848 125, India | | Central |
| 21 | Mr. Ranjan Kumar | Data collection | Research Assistant<br>Department of Agronomy, RAU, Pusa, Samastipur<br>Bihar 848 125, India | +91 9934272551 | Central |
| 22 | Mr. Jai Prakash | Data entry | Computer operator,<br>RAU, Pusa, Samastipur, Bihar 848 125, India | +91 9934855348<br>jaiprakash_857@yahoo.com | Central |
| 23 | Dr. Debabrata Basu | Agricultural Extension | Reader,<br>Bidhan Chandra Agricultural University (BCKVV), Dep. of Agricultural Extension, P.O. Krishi Viswavidyalaya, Mohanpur West Bengal 741252 India | +91 9830031075<br>drdbasu@gmail.com | East |
| 24 | Dr. Sudipta Banerjee | Agricultural Extension | BCKVV, Department of Agricultural Extension<br>P.O. Krishi Viswavidyalaya, Mohanpur West Bengal 741252 India | +91 9732514682 | East |

| | | | | | |
|---|---|---|---|---|---|
| 25 | Mr. Sisir sarkar | Data collection | Research Assistant,<br>BCKVV, Department of Agricultural Extension P.O. Krishi Viswavidyalaya, Mohanpur West Bengal 741252, India | +91 9332920124 | East |
| 26 | Mr. Amit Mondol | Data collection | Research Assistant,<br>BCKVV, Department of Agricultural Extension P.O. Krishi Viswavidyalaya, Mohanpur West Bengal 741252 India | | East |
| 27 | Dr. Nathuram Sarker | Animal Science | Senior Scientific Officer, Bangladesh Livestock Research Institute, Savar<br>Dhaka, Bangladesh | +880 1711733119 Cell<br>+880 (2) 7708321<br>+880 (2) 7708619<br>nathusarker@yahoo.com | East |
| 28 | Mr. Babul Akhtar | Data collection | Research Assistant,<br>Bangladesh Livestock Research Institute, Savar, Dhaka Bangladesh | +880 1715868335<br>+880 1718951179 | East |
| 29 | Mr. Ziaur Rahman | Data collection | Research Assistant,<br>Bangladesh Livestock Research Institute, Savar, Dhaka Bangladesh | +880 1717978400 | East |
| 30 | Dr. Elahi Baksh | Agricultural Economics | Principal Scientist, Wheat Research Centre,<br>Nashipur, Dinajpur<br>Bangladesh | +880 1712732479<br>me.baksh@yahoo.com | East |
| 31 | Jahangir Kabir | Agricultural Economics | Agricultural Economist,<br>Wheat Research Centre, Nashipur, Dinajpur, Bangladesh | +880 1718001593<br>skabir1974@yahoo.com | East |
| 32 | Mr. Manik Talukdar | Data entry | Research Assistant<br>Wheat Research Centre, Nashipur, Dinajpur Bangladesh | | East |
| 33 | Dr Olaf Erenstein | Agricultural Economics | Agricultural Economist,<br>CIMMYT, CG Block, NASC Complex, Todapur Road, Pusa, New Delhi – 110012, India | +919899003692 Cell<br>+91 1165441938 / +91 11 2584 2940 Extn 32 | Delhi |
| 34 | Dr Nils Teufel | Agricultural Economics | Agricultural Economist,<br>ILRI, CG Block, NASC Complex, Todapur Road, Pusa, New Delhi – 110012, India | +91 9871877035<br>+91 11 25609819<br>+91 11 26609800 | Delhi |
| 35 | Dr. Arindam Samaddar | Anthropology | Anthropologist<br>CIMMYT, CG Block, NASC Complex, Todapur Road, Pusa, New Delhi – 110012, India | +91 9811378000 | Delhi |

**Annex 3: Presentations**

1. SLP Workshop Introduction & Overview
2. Site presentations

| | |
|---|---|
| NW | Punjab |
| | Haryana |
| | Uttarakhand |
| Central | Ballia |
| | Samastipur |
| | Jamui |
| East | West Bengal |
| | Dinajpur |
| | Rajbari |

3. Cross cutting issues, reports, contrasts, similarities and implications
4. Qualitative round of SLP
5. Data processing and results
6. Data analysis issues

Conservation agriculture, livestock & livelihood strategies in the Indo-Gangetic Plains of South Asia: Synergies and tradeoffs

**SLP Workshop Introduction & Overview**

Presented by
Olaf Erenstein (CIMMYT India)

***SLP Project Progress workshop, New Delhi, September 22-25, 2006***

## SLP Project

Donor: CGIAR System-wide Livestock Program (SLP)
Period: 2006-2008
Lead centre: CIMMYT
Implementing partners: RWC, ILRI, ICAR, BARI, SAUs

| Collaborator coPIs | Institutional affiliation |
|---|---|
| Dr DK Grover | Punjab Agricultural University (PAU), Ludhiana, Punjab |
| Dr. Raj Vir Singh | National Dairy Research Institute (NDRI), Karnal, Haryana |
| Dr V.P. Singh | GBPUA&T, Pantnagar, Uttranchal |
| Dr. U. P. Singh | Banaras Hindu University (BHU), Varanasi, UP |
| Dr. Mritunjay Kumar | Rajendra Agricultural University (RAU), Pusa, Samastipur, Bihar |
| Dr. R. N. Singh | Shram Bharti Krishi Vigyan Kendra, Jamui, Bihar |
| Dr. Debabrata Basu | Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal |
| Dr. Elahi Baksh | Agricultural Economist, Wheat Research Centre (WRC), Nashipur, Dinajpur |
| Dr. N.R. Sarkar | Senior Scientific Officer, Bangladesh Livestock Research Institute (BLRI), Dhaka |

## SLP Project purpose

- to better understand interactions & trade-offs in organic matter management in crop-livestock systems and implications for livelihood strategies and R&D programs.

## Objectives

- To understand crop-livestock integration & trade-offs farmers face in applying CA practices in RWL systems in the IGP
- To assess implications for development of CA/RWL systems
- To realign & focus R&D efforts addressing CA practices in these systems
  - to optimize benefits for rural livelihoods, poverty alleviation & environmental sustainability.

## Outputs

1. *Conceptual framework* to assess interactions and tradeoffs in organic matter management in crop-livestock systems and implications for livelihood strategies developed and applied;
2. *Quantitative information* on indicators and processes within this framework analyzed and synthesized, including identification of drivers and modifiers, cross-scale interactions and tradeoffs indicators
3. *Implications* for R & D programs assessed

## Proposed site selection

| Punjab | Haryana | UP | | Bihar | | West Bengal | Bangladesh |
|---|---|---|---|---|---|---|---|
| | | W | E | N | S | | |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |

Cluster I (North West) Transect 2 & 3 | Cluster II (East) Transect 4 | Cluster III (Far East) Transect 5

## Retained sites

- Punjab, Haryana, Uttarakhand — Cluster I: * Patiala, * Karnal, * US Nagar
- East UP, North Bihar, South Bihar — Cluster II: * Balia, * Samastipur, * Jamui/Luckkesarai
- West Bengal, Bangladesh — Cluster III: * Murshidabad, * Dinajpur, * Faridpur

## Study design

- 6 villages in selected district
  - Project villages/RCTs (4) & Control villages (2)
  - Half "near" & half "far"
- 120 Households in selected district
  - RCT & nRCT farms
  - Gradient of farm size & landless
- Crop and livestock enterprises
  - 3 repeated visits
    - ⟹ R ⟹ W ⟹
- Additional surveys: fodder markets, informal/qualitative

## Modular research approach

| | Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|---|
| 2006 | | PRA ** | | HH survey |
| 2007 | HH survey *(continued)* @ | | Enterprise Survey Market Survey | |
| 2008 | Enterprise Survey *(continued)* Market Survey *(continued)* # | | Analysis & write-up | |
| 2009 | Analysis & write-up *(cont.)* $ | | | |

** inception workshop, Apr 2006

@ progress review workshop, Fe 07 RWC Katmandu

# progress review workshop with IITA, Feb 08 WCCA, New Delhi

$ Final workshop


## PROGRAM

| Day | Mon 22/09/08 | Tue 23/09/08 | Wed 24/09/08 | Thu 25/09/08 |
|---|---|---|---|---|
| 09:00 - 10:30 | plenary presentations Punjab Haryana | plenary presentations West Bengal Dinajpur | plenary synthesis results (VS, HS) plenary training data handling | group meeting cluster III |
| 10:30 - 11:00 | tea | tea | tea | |
| 11:00 - 12:30 | plenary presentations Uttarakhand discussion on cluster | presentations Rajbari discussion on cluster intro cluster disc; planned reports | plenary training analysis, reporting wrap up | |
| 12:30 - 14:00 | lunch | lunch | lunch | |
| 14:00 - 15:30 | plenary presentations UP Bihar north | cluster discussion contrasts & similarities (based on presentations); implications (trade-offs, CA-feed links, R&D) | group meeting cluster I | |
| 15:30 - 15:45 | tea | tea | tea | |
| 15:45 - 17:00 | plenary presentations Bihar south discussion on cluster | plenary feedback from cluster discussions; synthesis results | group meeting cluster II | |
| | dinner | dinner | dinner | |

SLP Workshop on

CONSERVATION AGRICULTURE, LIVESTOCK AND LIVELIHOOD STRATEGIES IN IGP OF SOUTH ASIA : SYNERGIES AND TRADE OFFS

D.K. Grover
Director

Agro Economic Research Centre
Department of Economics & Sociology
Punjab Agricultural University
Ludhiana, Punjab - India

1

## BACKGROUND

- Rice-wheat cropping system is widely practiced covering around 65 % and 83% area in respective season.
- Livestock population plays an important role in the rice-wheat system. These crop-livestock systems support the livelihoods of majority of the families in the state.
- Integrating crop and livestock production has a number of advantages, including complementarities in terms of resource use and income and risk reduction.
- Lately, the rice-wheat cropping system is experiencing stagnant or declining grain yields, falling water tables and soil degradation.

2

- These threats are being addressed through research on RCTs, including zero-tillage, permanent beds, laser leveling etc) within the context of conservation agriculture.
- Applying conservation agriculture practices typically implies the need to retain crop residues on the soil surface, which reduces the availability of crop residue for livestock production.
- Thus, to adopt conservation agriculture practices, farmers face trade-offs between crop and livestock production.

3

➢Further, recent technological changes in the agricultural systems, e.g. mechanization, have had varying direct and indirect implications for the crop and livestock enterprises and their integration.

➢Not much is documented about crop-livestock interactions in the IGP. The present project is an attempt in this direction.

4

## Methodology and survey area

- Keeping in view the concentration of Resource Conservative Technology (RCT) activities, the study was focused in two blocks of Patiala districts i.e. Patiala and Rajpura.

➢ While selecting a sample of 6 villages, due care was accorded to various issues such as RCT and non-RCT activities, farness and nearness of the villages from market and population size of the village etc.

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➢In order to get overall view of the survey area, soil, irrigation, RCT activities and livestock population etc, the key informants including Village chief were interviewed.

➢ Thereafter the people were divided into three groups viz: Large farmers (> 8 acre), Small farmers (< 8 acre) and Landless of 8-10 persons each.

➢ The team members interviewed each group separately with key informants' information as a check.

6

**Partner institutions:**

**Punjab Agricultural University, Ludhiana**
**Krishi Vigyan Kender (KVK), Patiala**
**Farm Advisory Service Scheme, Patiala**

**In Collaboration with**

**CIMMYT, New Delhi**
**ILRI, New Delhi**

7

## Survey Team Members:

Dr D.K.Grover, Director, AERC, PAU, Ludhiana.
Dr Nils Teufel, Agricultural Economist, ILRI, New Delhi
Dr Kamal Paudyal, Agril Economist, CIMMYT, Nepal
Dr Gurpreet Kaur, D E S, FASS, Patiala
Dr DPS Brar, Asst Prof Ext Edu, KVK, Patiala
Dr P Singh, Asst Prof Animal Science, KVK, Patiala
Mr P Singh, SRI, AERC, PAU, Ludhiana.
Mr IP Singh, Deptt of Econ.& Soc, PAU, Ludhiana
Mr Prabjot Singh, Deptt of Econ.& Soc, PAU, Ludhiana

8

## Cropping pattern by village type, Patiala

(Percent area)

| | | *RCT villages (n=4)* | *NRCT villages (n=2)* | *Average (n=6)* |
|---|---|---|---|---|
| Kharif | Paddy, coarse | 68 | 82 | 72.67 |
| | Paddy, fine | 22 | 1 | 15.00 |
| | Fodder | 7 | 15 | 9.67 |
| | Vegetables | 1 | 2 | 1.33 |
| | Other | 2 | - | 1.33 |
| Rabi | wheat | 79 | 83 | 80.33 |
| | Fodder | 10 | 15 | 11.67 |
| | Vegetables | 9 | 2 | 6.67 |

9

## Crops grown by most/subset households in sampled villages, Patiala, Punjab.

| Season | Crops | Household growing (%) |
|---|---|---|
| Kharif | Paddy coarse | 100 |
| | Paddy fine | 33 |
| | Maize | 1.5 |
| | Vegetable | 15 |
| | Fodders | 100 |
| Rabi | Wheat | 100 |
| | Fodders | 100 |
| | Vegetables | 4 |
| Spring | Mungbean | 1 |
| | Sunflower | 4 |

10

## Important changes/trends in the surveyed area, Patiala, Punjab.

| *Particular* | *Crops* |
|---|---|
| Crops increased | Paddy, wheat, potato, floriculture |
| Reasons | Higher gross returns from wheat and paddy and efficient marketing |
| Crops decreased | Cotton, Sugarcane, Maize, rapeseed & mustard, Pulses |
| Reasons | Diseases and delayed payment and marketing problems |

11

## Livestock herd by village type, Patiala

[#/hh]

| *Particulars* | | *RCT villages (n=4)* | *NRCT villages (n=2)* | *Average (n=6)* |
|---|---|---|---|---|
| Dairy buffalo | (ad fem) | 2.012 | 5.300 | 3.110 |
| Desi dairy cattle | (ad fem) | 0.014 | - | 0.097 |
| Dairy cross-bred | (ad fem) | 0.169 | 0.981 | 0.446 |
| Draft buffalo | (ad male) | 0.021 | 0.007 | 0.017 |
| Draft bullocks | (ad male) | 0.212 | 0.400 | 0.247 |
| Goat | (adult) | 0.026 | - | 0.018 |

* Calculated as total village stock per type / total households

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## Livestock kept by most/subset households in sampled villages, Patiala, Punjab.

| Livestock species | Household keeping (%) |
|---|---|
| Dairy buffalo (ad fem) | 90 |
| Desi dairy cattle (ad fem) | 1.1 |
| Dairy cross bred | 23.2 |
| Draft buffalo | 1.9 |
| Draft bullock | 24.6 |
| Goat | 0.47 |

13

## Selected prices and market access indicators by remoteness, Patiala, Punjab.

| Particulars | | Near villages (n=3) | Far villages (n=3) | Average (n=6) |
|---|---|---|---|---|
| Irrigated upland, rent | [Rs/ac] | 16000 | 12000 | 14000 |
| Irrigated upland, purchase | [Rs/ac] | 2100000 | 2100000 | 2100000 |
| Daily wage (male) | [Rs/8h] | 108 | 111 | 109.5 |
| Daily wage (female) | [Rs/8h] | 61 | 66 | 63.5 |
| Wheat | [Rs/kg] | 7 | 7 | 7 |
| Paddy, coarse | [Rs/kg] | 6 | 7 | 6.5 |
| Paddy, fine | [Rs/kg] | 16 | 13 | 14.5 |
| Milk, buffalo | [Rs/l] | 13 | 15 | 14 |
| Milk, cattle | [Rs/l] | 11 | 10 | 10.5 |
| Dairy buffalo (ad fem) | [Rs/head] | 19333 | 17000 | 18166.5 |
| Desi dairy cattle (ad fem) | [Rs/head] | 6000 | 6000 | 6000 |
| Dairy cross-bred (ad fem) | [Rs/head] | 14000 | 10000 | 12000 |
| Goat (adult) | [Rs/head] | 1700 | 2000 | 1850 |

14

## Selected-marketing percentages by household group, Patiala, Punjab.

[%]

| | Large farmer (n=6) | Small farmer (n=6) | Landless (n=6) | Average (n=12 ) |
|---|---|---|---|---|
| Wheat | 61 | 84 | | 72.5 |
| Paddy, coarse | 99 | 99 | | 99 |
| Paddy, fine | 82 | 64 | | 73 |

15

## Income composition and distribution of main income by household groups, Patiala, Punjab.

Percent

| | Large farmer (n=6) | Small farmer (n=6) | Landless (n=6) | Average (n= 18) |
|---|---|---|---|---|
| Crops | 77 | 58 | | 45 |
| Livestock | 10 | 7 | 10 | 9 |
| Agril Lab | | 4 | 20 | 8 |
| Non- Agril Lab | 1 | 17 | 48 | 22 |
| Services | 7 | 4 | 12 | 8 |
| Business | 5 | 10 | 10 | 8 |

16

## RCT usages by village type, sample village, Patiala, Punjab, 2006

| Particulars | | Share of hh adopting [%] * | | Share of area used [%] ** | |
|---|---|---|---|---|---|
| RCT | Crop | RCT | N RCT | RCT | N RCT |
| Zero-tillage/ PTOS | Wheat | 15.3 | 1.91 | 15.52 | 1.2 |
| Direct dry seeded/PTOS | Rice | - | - | - | - |
| Direct wet seeded | Rice | - | - | - | - |
| Reduced tillage | Wheat | 24.83 | - | 34 | - |
| | Rice | - | 0.63 | - | 0.28 |

* Calculated as (No. of hh adopting) / (Total farm hh)
** Calculated as (Area used) / [(Total village area) * (Wheat or rice area share)]

17

## RCT/ agricultural machinery by village type, sample villages, Patiala, Punjab,

| | No of machines per farm hh* | | Usage price [Rs/ac] | |
|---|---|---|---|---|
| | RCT villages (n=4) | Non-RCT villages (n=2) | RCT village (n=4) | Non-RCT villages (n=2) |
| Tractor | 0.420 | 0.560 | 300 | 250 |
| Draught animal cultivation | - | - | - | - |
| Zero till (ZT) machine | 0.073 | 0.012 | 333 | 400 |
| Power tiller (PT) | - | - | - | - |
| PT operated seeder (PTOS) | - | - | - | - |
| Bed planter | | | | |
| Combine harvester | - | 0.083 | 516 | 450 |
| Chaff combine | 0.02 | 0.006 | 400 | 625 |
| Straw cutter | 0.01 | 0.07 | 350 | 150 |

* Calculated as (No. of machines in village) / (Total no. large farm hh + Total no. small farm hh)

18

Wheat straw use by village type, sample villages, Patiala, Punjab, 2006

(Percent)

| Wheat | Manual harvesting | | Combine harvesting | |
|---|---|---|---|---|
| | NRCT | RCT | NRCT | RCT |
| Left on field (soil mulch) | - | 0.33 | 19.16 | 25.60 |
| Burnt in the field | - | - | - | - |
| Sold | 5.00 | 11.60 | 10.14 | 28.34 |
| Collected by others (landless) | - | - | - | - |
| Fodder for own animals | 94.70 | 87.57 | 70.70 | 46.06 |
| Household fuel | - | - | - | - |
| Roofing/construction | 0.30 | 0.50 | - | - |
| Storage | - | - | - | - |
| Protection of Vegetables | - | - | - | - |

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Paddy straw use by village type, sample villages, Patiala, Punjab, 2006

(Percent)

| Paddy | Manual harvesting | | Combine harvesting | |
|---|---|---|---|---|
| | NRCT | RCT | NRCT | RCT |
| Left on field (soil mulch) | | 1.66 | 5.50 | 30.33 |
| Burnt in the field | | 1.66 | 73.01 | 69.12 |
| Sold | | 24.16 | 20.33 | |
| Collected by others (landless) | 22.00 | 2.50 | 0.83 | 0.33 |
| Fodder for own animals | 50.00 | 49.56 | | |
| Household fuel | | | | |
| Roofing/construction | 5.00 | | | |
| Storage | 20.00 | 16.30 | | |
| Protection of Vegetables | 3.00 | 4.16 | 0.33 | 0.22 |

20

Seasonal composition of feed rations for large ruminants in the sample villages, Patiala, Punjab

(%)

| Feed type/ Farmer group | Seasons | | | |
|---|---|---|---|---|
| | Winter | Wheat harvest | Monsoon | Paddy harvest |
| Berseem | 69.25 | 35.80 | - | 8.65 |
| Sorghum | - | 3.11 | 52.16 | 27.88 |
| Others | - | 4.72 | 26.49 | 20.16 |
| Wheat Straw | 24.37 | 53.32 | 20.77 | 35.32 |
| Paddy Straw | 6.38 | 3.05 | 0.58 | 7.99 |

21

Grazing practices for dairy animals on different farm groups in the sample villages ,Patiala, Punjab

(Hours/day)

| Group | Winter | Wheat harvest | Monsoon | Paddy harvest |
|---|---|---|---|---|
| Large | - | 0.66 | - | 0.66 |
| Small | 1.0 | - | 1 | - |
| Landless | 0.18 | 0.83 | 0.91 | 0.81 |
| Average | 0.39 | 0.50 | 0.64 | 0.49 |

22

Concentrate feeding practices for dairy animals on different farm groups in the sample villages ,Patiala

(Kg /animal/day)

| Group | Oilseed cake | Dairy meal | Grains | Total |
|---|---|---|---|---|
| Large | 1.41 | 0.66 | 1.08 | 3.15 |
| Small | 1.50 | 0.83 | 1.25 | 3.58 |
| Landless | 1.33 | 0.63 | 0.83 | 2.79 |
| Average | 1.41 | 0.71 | 1.05 | 3.17 |

23

## Major Observations from Village Survey

- ✓ The average holding size in RCT villages was found to be smaller (6.32 ac) as compared to 9.23 acres in Non-RCT villages.
- ✓ About 10 percent households were found to be without livestock in RCT villages whereas no household without livestock was there in Non-RCT villages.
- ✓ Dairy buffalo (adult female) / household was much lower (2.012) in RCT villages as compared to 5.3 Non RCT villages.

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✓It has been observed that RCT practices were being adopted in far villages with much more vigor. In far villages 17.5 percent households were adopting zero tillage and 34.1 percent reduced tillage. On the other hand, 4.21 per cent and 11.22 percent households adopted zero tillage and reduced tillage practices for wheat cultivation in near villages.

✓About 50% area under wheat in far villages was subject to RCT in the form of zero/reduced tillage whereas only 20% area was found under the RCT in near villages.

✓Due to poor germination and reduction in yield after 2-3 years, about 33% farmers disadopted zero tillage.

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## HOUSEHOLD SURVEY RESULTS

26

Preparation and seeding technology use by wheat/rice and RCT/non RCT

(Percent)

| Particulars | RCT | | | | N RCT | | | |
|---|---|---|---|---|---|---|---|---|
| | Wheat | | Rice | | Wheat | | Rice | |
| | Hh | Area | Hh | Area | Hh | Area | Hh | Area |
| Tractor use | 100 | 85 | 100 | 100 | 100 | 100 | 100 | 100 |
| Reduced tillage | 24 | 21 | - | - | - | - | - | |
| Reduced tillage (avg. no of passes) | 2 | - | - | - | - | - | - | |
| Zero tillage) | 12 | 15 | - | - | - | - | - | - |

27

Harvesting technology by wheat/rice and RCT /non RCT

Percent

| Particulars | RCT | | | | N RCT | | | |
|---|---|---|---|---|---|---|---|---|
| | Wheat | | Rice | | Wheat | | Rice | |
| | Hh | Area | Hh | Area | Hh | Area | Hh | Area |
| Combine harvester use | 27 | 23 | 100 | 83 | 88 | 71 | 96 | 76 |
| Bhusa reaper use | 0 | 0 | 0 | 0 | 24 | 21 | 0 | 0 |
| Using straw cutter | 2 | 2 | 8 | 8 | 0 | 0 | 4 | 3 |
| Burning straw | 2 | 2 | 88 | 71 | 0 | 0 | 87 | 69 |

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Straw management practices (%) by wheat/rice and manual/combine.

(Percent)

| Particulars | RCT | | | | N RCT | | | |
|---|---|---|---|---|---|---|---|---|
| | Wheat | | Rice | | Wheat | | Rice | |
| Manual/combine | M | C | M | C | M | C | M | C |
| Left in the field | 4.0 | 28.9 | 8 | | 1.7 | 27.8 | 7 | |
| Burnt in the field (burnt to ash) | - | - | 90 | 100 | - | - | 88 | 97.8 |
| Collected from field by others | - | - | - | - | - | - | - | - |
| Grazed on the field | - | - | - | - | - | - | - | - |
| Sold | 17.2 | 43.2 | - | - | 20.0 | 30.1 | - | 2.2 |
| Fodder for own animals | 75.1 | 26.2 | 2 | - | 78.1 | 42.8 | 5 | |
| Taken home as household fuel | 4.0 | 1.1 | - | - | 0.0 | 0.0 | | |

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Wheat crop residue (straw) use in the household level byRCT and non RCT

| Particulars | RCT | N RCT |
|---|---|---|
| Sold (%) | 25.45 | 25.04 |
| Storage (%) | 72.95 | 73.67 |
| Other (%) | 2.10 | 2.29 |
| Sold price (Rs) | 170.44 | 172.00 |
| Duration of storage (months) | 12 | 12 |

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## Characteristics of RCT/non RCT farms

| *Particulars* | *RCT* | *N RCT* |
|---|---|---|
| No of plot size | 3.21 | 2.11 |
| Average plot area (acre) | 3.28 | 2.17 |
| Operational area (acre) | 10.52 | 4.57 |
| Irrigated (%) | 99.83 | 98.85 |
| Canal irrigated (%) | 20.73 | 26.67 |
| Tubewell irrigated(%) | 92.89 | 95.68 |
| Rabi fodder area (acre) | 1.29 | 0.74 |
| Kharif fodder area (acre) | 1.29 | 0.74 |

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## Crop production by Wheat/rice and RCT/non RCT

(Percent)

| *Particulars* | *RCT* | | *N RCT* | |
|---|---|---|---|---|
| | *Wheat* | *Paddy* | *wheat* | *Paddy* |
| Yield /acre | 18.31 | 20.77 | 19.46 | 21.95 |
| Sold | 80.00 | 79.90 | 78.29 | 80.43 |
| Consumed | 4.85 | 10.00 | 13.18 | 17.00 |
| Paid in kind | 15.00 | 9.96 | 8.49 | 2.47 |

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## Livestock assets by RCT/ N RCT

(No/Hh)

| *Particulars* | *RCT* | *N RCT* | *Landless* |
|---|---|---|---|
| Buffalo | 4.67 | 5.24 | 2.67 |
| Cattle | 2.63 | 2.30 | 2.25 |

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## Milk production and use

| *Particulars* | *RCT* | *N RCT* | *Landless* |
|---|---|---|---|
| Milk l/d | 13.58 | 15.41 | 6.50 |
| Sold (%) | 48.41 | 44.03 | 19.80 |
| Consumed as liquid (%) | 39.91 | 41.51 | 59.37 |
| Processed (%) | 11.90 | 13.43 | 21.74 |
| Price buffalo milk (Rs) | 14.88 | 14.62 | 13.00 |
| Price cow milk (Rs) | 11.15 | 10.86 | 10.00 |

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## Main share of household fuel by RCT/ N RCT

(Percent)

| *Particulars* | *RCT* | *N RCT* | *Landless* |
|---|---|---|---|
| Wood | 14.58 | 18.57 | 18.54 |
| Dung cakes /sticks | 17.08 | 23.23 | 21.25 |
| LPG | 68.54 | 57.13 | 61.46 |

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## Average annual household income by RCT/N RCT

(Percent)

| *Particulars* | *RCT* | *N RCT* | *Landless* |
|---|---|---|---|
| Crop & livestock | 98.29 | 81.83 | 9.72 |
| Agril Lab | | 3.39 | 35.86 |
| Non Agril Lab | | 3.88 | 32.22 |
| Services | 1.12 | 7.57 | 12.12 |
| Business | 0.6 | 3.26 | 7.08 |

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## Major Observations from HH Survey

- Zero/reduced tillage is practiced on about 36% area under wheat and no such practice for rice.
- Average holding size was 10.52 & 4.57 acres on RCT & NRCT HH. This indicates that relatively larger farmers adopted RCT practices.
- About 75% wheat straw was stored, 23% sold and rest for other uses.

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- Around 87% HH burnt rice straw of 69% area in the fields and no such practice for wheat.
- Manually harvested wheat straw was (75-80%) used as fodder for own animals and combined harvested straw sold for fodder purpose.

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## Data Handling Progress

| | Village Survey | HH Survey | Enterprise Survey 1 | Enterprise Survey 2 | Enterprise Survey 3 |
|---|---|---|---|---|---|
| Data Collection | Finished | Finished | Finished | Finished | Under Progress |
| Data Entry | Finished | Finished | Waiting for the FORMAT | | |
| Data Cleaning | Finished & Report Submitted | Finished | | | |

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## Thanks for patient hearing

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# Conservation Agriculture, Livestock and livelihood Strategies in Indo – Gangetic Plains of South Asia

(Haryana Centre)

Raj Vir Singh
National Dairy Research Institute
KARNAL 132001 (Haryana)

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## Table 1.1 Selection of villages from Karnal District of Haryana

| Name of the village | Code No. | Had best No. | Block | RCT /Non RCT | Near/ Far | Distance from town / market |
|---|---|---|---|---|---|---|
| Pakhana | 209800 | 48 | Nilokheri | RCT | Near | 5 Kms from Taraori |
| Raison | 205500 | 12 | Nilokheri | RCT | Far | 14 Kms from Thanesar |
| Bairsal | 213000 | 27 | Nilokheri | Non - RCT | Near | 8 Kms from Nilokheri |
| Kailash | 231800 | 2 | Karnal | RCT | Near | 4 Kms from Karnal |
| Dadupur | 235600 | 43 | Karnal | RCT | Far | 10 Kms from Karnal |
| Nalwipar | 228200 | 83 | Karnal | Non-RCT | Far | 14 Kms from Karnal |

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## Table 1.2 Demographic features of Karnal District (Haryana) 2001

| Name of Tehsil | No. of Village | Density of population per sq. km. | Literacy rate % | Percent | | Workers % | |
|---|---|---|---|---|---|---|---|
| | | | | Rural | Urban | Total Main | Marginal |
| Karnal | 142 | 670.70 | 60.76 | 59.99 | 40.01 | 166367 (46.80) | 34319 (34.32) |
| Nilokheri | 76 | 461.29 | 56.82 | 79.02 | 20.98 | 46877 (13.19) | 21703 (21.71) |
| Indri | 108 | 420.38 | 57.33 | 89.91 | 10.09 | 38621 (10.86) | 10712 (10.71) |
| Gharaunda | 61 | 514.61 | 53.25 | 82.97 | 17.03 | 51571 (14.51) | 16234 (16.24) |
| Assandh | 47 | 330.55 | 52.20 | 87.84 | 12.16 | 52030 (14.64) | 17021 (17.02) |
| Total | 434 | 505.63 | 57.50 | 73.49 | 26.51 | 355466 (100) | 99989 (100) |

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## Table 1.3 Composition of various breeds and species of livestock in Karnal District of Haryana (00) 2003

| Particulars | District Karnal | Haryana State |
|---|---|---|
| Cattle Indigenous Male over 3 years | 46 (1.54) | 2990 |
| Female over 3 years | 150 (4.64) | 3233 |
| Crossbed Male over 2.5 years | 68 (13.41) | 507 |
| Crossbed Female over 2.5 years | 487 (15.32) | 3178 |
| Total cattle ( incl. Calves) | 1258 (8.17) | 15402 |
| Buffaloes Male | 255 (15.12) | 1687 |
| Female | 2193 (7.32) | 29947 |
| Total | 4468 (7.40) | 60348 |

count.

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## Table 1.3 Composition of various breeds and species of livestock in Karnal District of Haryana (00) 2003

Count..

| Particulars | District Karnal | Haryana State |
|---|---|---|
| Indigenous | 135 (3.28) | 4111 |
| Crossbred | 21 (5.77) | 364 |
| Total Sheeps | 288 (3.52) | 8185 |
| Goats | 89 (1.93) | 4602 |
| Camels | 2 (0.40) | 500 |
| Pigs | 73 (6.09) | 1198 |
| Pou;try | 23353 (17.15) | 136189 |

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## Table 1.4 Basic Descriptors of aggregate surveys

| | Village type | | Village remoteness | | Overall average (n=6) |
|---|---|---|---|---|---|
| Village name | RCT villages (n=4) | Non-RCT villages (n=2) | Near villages (n=3) | Far villages (n=3) | |
| Total population | 15700 | 12900 | 14200 | 14400 | 4766.67 |
| Total hh | 2700 | 1790 | 2050 | 2440 | 750.00 |
| Large farm hh [%] | 14.07 | 14.45 | 22.20 | 7.58 | 14.25 |
| Small farm hh [%] | 34.08 | 7.50 | 16.83 | 29.10 | 23.50 |
| Landless hh [%] | 51.85 | 77.50 | 60.97 | 63.32 | 62.25 |
| Land per farm hh [ac] | 4.94 | 7.90 | 8.80 | 2.89 | 5.63 |
| Irrigated land [%] | 100 | 100 | 100 | 100 | 100 |
| Upland land [%] | 95.33 | 100 | 98.56 | 92.28 | 96.86 |
| Hh without livestock [%] | 11.67 | 9.72 | 8.05 | 13.32 | 10.91 |

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## Table 1.5 Distribution of Income

| | Large farmer (n=6) | Small farmer (n=6) | Landless (n=6) | Average (n=12 or 18) |
|---|---|---|---|---|
| Crops [%] | 75.83 | 69.17 | | 71.68 |
| Livestock[%] | 9.17 | 15.83 | 15.00 | 14.36 |
| Agricultural labour [%] | - | 5.00 | 38.33 | 25.04 |
| non-agricultural labour [%] | - | 3.00 | 35.00 | 22.49 |
| Services[%] | 4.17 | 5.00 | 10.00 | 7.99 |
| Business[%] | 7.50 | 2.00 | 1.67 | 2.58 |
| Others {%} | 3.33 | - | - | 0.01 |



## Table 1.6 Marketing of Agriculture Produce

| | Large farmer (n=6) | Small farmer (n=6) | Landless (n=6) | Average (n=12 or 18) |
|---|---|---|---|---|
| Wheat [%] | 93.75 | 81.67 | | 85.16 |
| Paddy, coarse [%] | 94.25 | 88.83 | | 91.54 |
| \Paddy, fine [%] | 85.00 | 81.00 | | 83.00 |
| Milk [%] | 57.50 | 67.50 | 71.17 | 65.38 |



## Table 1.7 Cropping pattern

| | RCT villages (n=4) | Non-RCT villages (n=2) | Average (n=6) |
|---|---|---|---|
| Kharif paddy, coarse [% area] | 85.65 | 70.19 | 80.51 |
| paddy, fine [% area] | 7.58 | 14.42 | 9.85 |
| Sugarcane [% area] | 1.99 | 5.77 | 3.25 |
| Fodder [% area] | 3.35 | 1.60 | 2.77 |
| Vegetables [% area] | 0.64 | 8.02 | 3.09 |
| Other [% area] | 0.79 | - | 0.53 |
| Rabi wheat [% area] | 93.23 | 84.07 | 90.21 |
| Sugarcane [% area] | 1.97 | 6.37 | 3.42 |
| Fodder [% area] | 3.62 | 8.92 | 5.37 |
| Vegetables [% area] | 1.18 | 0.64 | 1.00 |
| Spring/summer : Maize/Jowar/ Cash Crops[% area] | 1.59 | 7.20 | 3.40 |
| Pulse [% area] | 1.12 | - | 0.75 |
| Fodder [% area] | 1.59 | - | 1.06 |
| Fallow [% area] | 95.70 | 92.80 | 94.79 |



## Table 1.8 Livestock herd

| | RCT villages (n=4) | Non-RCT villages (n=2) | Average (n=6) |
|---|---|---|---|
| Dairy buffalo (ad fem) [#/hh] | 2.48 | 2.05 | 2.35 |
| Desi dairy cattle (ad fem)[#/hh] | 1.49 | 1.25 | 1.43 |
| Dairy cross-bred (ad fem) [#/hh] | 1.92 | 1.00 | 1.71 |
| Draft buffalo (ad male) [#/hh] | 1.00 | 1.00 | 1.00 |
| Draft bullocks (ad male) [#/hh] | 1.04 | 1.00 | 1.03 |
| Sheep (adult) [#/hh] | 63.82 | 10.0 | 18.97 |
| Goat (adult) [#/hh] | 23.82 | 4.12 | 7.40 |
| Pigs (adult) [#/hh] | 6.00 | 3.33 | 4.67 |



## Table 1.9 RCT Uses

| RCT | Crop | Share of hh adopting (%) | | Share of area used (%) | |
|---|---|---|---|---|---|
| | | Large farmer (n=6) | Small Farmer (n=6) | Large farmer (n=6) | Small Farmer (n=6) |
| Zero-tillage/PTOS | Wheat | 6.41 | 20.00 | 12.47 | 14.39 |
| Direct dry seeded /PTOS | Rice | 0 | 0 | 0 | 0 |
| Direct wet seeded | Rice | 0 | 0 | 0 | 0 |
| Reduced tillage | Wheat | 59.38 | 50.68 | 25.27 | 12.99 |
| | Rice | 59.38 | 50.68 | 25.27 | 12.99 |
| Bed planting | Wheat | 0 | 0 | 0 | 0 |
| | Rice | 0 | 0 | 0 | 0 |



## Table 1.10 Harvesting Practices

| | | Share of hh adopting [%] | | Share of area used [%] | |
|---|---|---|---|---|---|
| RCT | Crop | Large farmer (n=6) | Small farmer (n=6) | Large farmer (n=6) | Small farmer (n=6) |
| Combine harvester | Wheat | 81.4 | 90.17 | 60.17 | 57.5 |
| | Rice | 84.33 | 85.00 | 84.17 | 69.67 |
| Chaff combine | Wheat | 90.17 | 77.92 | 54.17 | 45.00 |
| | Rice | - | - | - | - |

## Table 1.11 Relative use of Wheat straw

| | Manual harvesting | | Combine harvesting | |
|---|---|---|---|---|
| | Large farmer (n=6) | Small farmer (n=6) | Large farmer (n=6) | Small farmer (n=6) |
| left on field (soil mulch) | 3.00 | 3.31 | 26.66 | 7.00 |
| Burnt in the field | - | - | 18.00 | 9.00 |
| Sold | 38.75 | 22.81 | 14.17 | 10.00 |
| collected by others (landless) | 5.00 | - | 4.17 | - |
| fodder for own animals | 51.25 | 74.38 | 40.00 | 66.00 |
| household fuel | - | - | - | - |
| roofing/construction | - | - | - | - |
| | 100% | 100% | 100% | 100% |

## Table 1.12 Relative use of Paddy straw

| | Manual harvesting | | Combine harvesting | |
|---|---|---|---|---|
| | Large farmer (n=6) | Small farmer (n=6) | Large farmer (n=6) | Small farmer (n=6) |
| left on field (soil mulch) | 8.33 | 2.50 | 30.36 | 13.33 |
| Burnt in the field | 1.67 | 1.67 | 62.96 | 64.33 |
| Sold | 60.00 | 13.33 | 0 | 5.00 |
| collected by others (landless) | 5.00 | - | 1.85 | 0.67 |
| fodder for own animals | 25.00 | 80.83 | 4.63 | 16.67 |
| household fuel | - | 1.67 | - | - |
| roofing/construction | - | - | - | - |
| | 100% | 100% | 100% | 100% |

## Table 2.0 Sample Design

| Village | Category I | Category II | Category III | Total |
|---|---|---|---|---|
| RCT | | | | |
| Kailash | 8 | 8 | 4 | 20 |
| Raison | 9 | 7 | 4 | 20 |
| Dadupur | 8 | 8 | 4 | 20 |
| Pakhana | 9 | 8 | 4 | 21 |
| Total | 34 | 31 | 16 | 81 |
| Non RCT | | | | |
| Nalwipar | 5 | 8 | 4 | 17 |
| Bairsal | 5 | 8 | 4 | 17 |
| Total | 10 | 16 | 8 | 34 |
| Grand Total | 44 | 47 | 24 | 115 |

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## Table 2.1 Characteristics of Farms

| Category of Households | No. of Plots | Average plot Size (Acre) | Irrigated area | Days average flooding | Source of Irrigation | Fodder area Rabi | Fodder area Kharif |
|---|---|---|---|---|---|---|---|
| RCT | | | | | | | |
| I | 2.15 | 6.97 | 6.97 | - | tube well | 0.90 | 0.90 |
| II | 2.00 | 4.48 | 4.48 | - | tube well | 0.50 | 0.60 |
| III | - | - | - | - | - | - | - |
| Non RCT | | | | | | | |
| I | 1.90 | 6.00 | 6.00 | - | tube well | 0.60 | 0.70 |
| II | 1.75 | 3.25 | 3.25 | - | tube well | 0.50 | 0.50 |
| III | - | - | - | - | - | - | - |

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## Table 2.2 Land Preparation & Seed Technology (Wheat)

| Category of Households | Tractor use | Power Tiller use | No. Passes | Zero Tillage | ZT drill/PTOS |
|---|---|---|---|---|---|
| | HH (%) | HH (%) | (Avg. No.) | HH (%) | HH (%) |
| RCT | | | | | |
| I | 100 | 100 | 3.62 | 100 | 100 |
| II | 100 | 100 | 3.94 | - | - |
| III | - | - | - | - | - |
| Non RCT | | | | | |
| I | 100 | 100 | 4.10 | - | - |
| II | 100 | 100 | 3.94 | - | - |
| III | - | - | - | - | - |

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## Table 2.3 Land Preparation & Seed Technology (Wheat)

| Category of Households | Tractor use | Power Tiller use | Reduced Tiller | No. of Passes | Zero Tillage | ZT drill/PTOS |
|---|---|---|---|---|---|---|
| | Area (%) | Area (%) | Area (%) | Average No. | Area (%) | Area (%) |
| RCT | | | | | | |
| I | 55.89 | 55.89 | 45.98 | 3.62 | 32.34 | 1.12 |
| II | 88.49 | 88.49 | 87.77 | 3.94 | - | - |
| III | - | - | - | - | - | - |
| Non RCT | | | | | | |
| I | 64.17 | 64.17 | 68.33 | 4.10 | 25.83 | 13.33 |
| II | 88.67 | 88.67 | 105 | 3.94 | - | - |
| III | - | - | - | - | - | - |

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## Table 2.4 Land Preparation & Seed Technology (Rice)

| Category of Households | Tractor use | Power Tiller use | No. of Passes | Zero Tillage | ZT drill/PTOS |
|---|---|---|---|---|---|
| | HH (%) | HH (%) | (Avg. No.) | | |
| RCT | | | | | |
| I | 100 | 100 | 3.82 | - | - |
| II | 100 | 100 | 3.74 | - | - |
| III | - | - | - | - | - |
| Non RCT | | | | | |
| I | 100 | 100 | 4.00 | - | - |
| II | 100 | 100 | 4.06 | - | - |
| III | - | - | - | - | - |



## Table 2.5 Land Preparation & Seed Technology (Rice)

| Category of Households | Tractor use | Power Tiller use | Reduced Tiller | No. of Passes | Zero Tillage | ZT drill/PTOS |
|---|---|---|---|---|---|---|
| | Area (%) | Area (%) | Area (%) | Area (Avg. No.) | Area (%) | Area (%) |
| RCT | | | | | | |
| I | 90.45 | 90.45 | 50.68 | 3.82 | - | - |
| II | 88.56 | 88.86 | 85.61 | 3.74 | - | - |
| III | - | - | - | - | - | - |
| Non RCT | | | | | | |
| I | 88.33 | 88.33 | 66.67 | 4.00 | - | - |
| II | 83.87 | 83.87 | 104.84 | 4.06 | - | - |
| III | - | - | - | - | - | - |



## Table 2.6 Harvesting Technology Wheat

| Category of Households | Combine Harvester | | Bhusa Reaper | | Straw Cutter | | Burning | |
|---|---|---|---|---|---|---|---|---|
| | HH (%) | Area (%) | HH (%) | Area (%) | HH (%) | Area (%) | HH (%) | Area (%) |
| RCT | | | | | | | | |
| I | 38.24 | 20.56 | 38.24 | 20.56 | 2.94 | 1.12 | 2.94 | 1.50 |
| II | 29.03 | 11.51 | 29.03 | 11.51 | 0.00 | 0.00 | 0.00 | 0.00 |
| III | - | - | - | - | - | - | - | - |
| Non RCT | | | | | | | | |
| I | 20.00 | 11.67 | 20.00 | 11.67 | 0.00 | 0.00 | 0.00 | 0.00 |
| II | 12.50 | 10.00 | 12.50 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| III | - | - | - | - | - | - | - | - |



## Table 2.7 Harvesting Technology Rice

| Category of Households | Combine Harvester | | Bhusa Reaper | | Straw Cutter | | Burring | |
|---|---|---|---|---|---|---|---|---|
| | HH (%) | Area (%) | HH (%) | Area (%) | HH (%) | Area (%) | HH (%) | Area (%) |
| RCT | | | | | | | | |
| I | 50.00 | 31.19 | 0.00 | 0.00 | 14.70 | 16.37 | 32.35 | 22.22 |
| II | 45.16 | 21.77 | 0.00 | 0.00 | 3.23 | 2.21 | 41.94 | 22.51 |
| III | - | - | - | - | - | - | - | - |
| Non RCT | | | | | | | | |
| I | 10.00 | 8.33 | 0.00 | 0.00 | 0.00 | 0.00 | 10.00 | 8.33 |
| II | 18.75 | 11.29 | 0.00 | 0.00 | 0.00 | 0.00 | 18.75 | 11.29 |
| III | - | - | - | - | - | - | - | - |



## Table 2.8 Straw Management Practices For Wheat Manual Harvesting (%)

| Category of Households | Left in the field | Burnt in the field | Collected from the field | Grazed on field | Sold | Taken home as fodder | Fuel | Roofing |
|---|---|---|---|---|---|---|---|---|
| RCT | | | | | | | | |
| I | 5.15 | 0.44 | 15.29 | - | 20.89 | 55.00 | 1.47 | 1.76 |
| II | 5.33 | 0.16 | 14.03 | - | 19.35 | 57.42 | 1.29 | 2.42 |
| III | - | - | - | - | - | - | - | - |
| Non RCT | | | | | | | | |
| I | 7.5 | - | 16.00 | - | 13.50 | 63.00 | - | - |
| II | 5.90 | - | 11.60 | - | 24.10 | 58.90 | - | - |
| III | - | - | - | - | - | - | - | - |



## Table 2.9 Straw Management Practices For Wheat Combine Harvesting (%)

| Category of Households | Left in the field | Burnt in the field | Collected from the field | Grazed on field | Sold | Taken home as fodder | Fuel | Roofing |
|---|---|---|---|---|---|---|---|---|
| RCT | | | | | | | | |
| I | 62.33 | 0.59 | 6.62 | 0.00 | 14.56 | 15.59 | 0.00 | 0.00 |
| II | 72.46 | 0.32 | 4.84 | 0.32 | 7.58 | 10.16 | 0.00 | 0.32 |
| III | - | - | - | - | - | - | - | - |
| Non RCT | | | | | | | | |
| I | 64.95 | 0.00 | 6.00 | 0.00 | 13.05 | 16.00 | 0.00 | 0.00 |
| II | 82.80 | 0.00 | 1.60 | 0.00 | 7.20 | 7.50 | 0.00 | 0.90 |
| III | - | - | - | - | - | - | - | - |

## Table 2.10 Straw Management Practices For Rice Manual Harvesting (%)

| Category of Households | Left in the field | Burnt in the field | Collected from the field | Grazed on field | Sold | Taken home as fodder | Fuel | Roofing |
|---|---|---|---|---|---|---|---|---|
| RCT | | | | | | | | |
| I | 9.56 | 0.88 | 18.09 | 0.29 | 11.47 | 40.59 | 1.18 | 17.94 |
| II | 9.68 | 0.81 | 15.97 | 0.00 | 16.13 | 42.09 | 0.00 | 15.32 |
| III | - | - | - | - | - | - | - | - |
| Non RCT | | | | | | | | |
| I | 10.00 | 0.00 | 17.50 | 0.00 | 9.50 | 45.00 | 0.00 | 18.00 |
| II | 9.70 | 0.00 | 15.00 | 0.00 | 18.80 | 42.50 | 0.00 | 14.00 |
| III | - | - | - | - | - | - | - | - |



## Table 2.11 Straw Management Practices For Rice Combine Harvesting (%)

| Category of Households | Left in the field | Burnt in the field | Collected from the field | Grazed on field | Sold | Taken home as fodder | Fuel | Roofing |
|---|---|---|---|---|---|---|---|---|
| RCT | | | | | | | | |
| I | 32.95 | 26.47 | 22.65 | 2.79 | 0.59 | 14.26 | 0.00 | 0.29 |
| II | 80.33 | 6.77 | 7.10 | 0.48 | 0.00 | 5.32 | 0.00 | 0.00 |
| III | - | - | - | - | - | - | - | - |
| Non RCT | | | | | | | | |
| I | 83.00 | 8.00 | 4.00 | 1.00 | 0.00 | 2.00 | 2.00 | 0.00 |
| II | 37.83 | 18.10 | 15.60 | 0.00 | 0.00 | 8.80 | 0.00 | 0.00 |
| III | - | - | - | - | - | - | - | - |



## Table 2.12 Crop Residue Use in Household - Wheat

| Category of Households | Sold (%) | Sold Price (Avg.) | Bought (%) | Bought Price (Avg.) | Stored (%) | Duration of Store age (Months) |
|---|---|---|---|---|---|---|
| RCT | | | | | | |
| I | 38.35 | 265.86 | 0.00 | 0.00 | 61.35 | 11.64 |
| II | 39.98 | 250.00 | 0.00 | 0.00 | 60.02 | 8.88 |
| III | 0.00 | 0.00 | 61.82 | 252.22 | 100.00 | 9.72 |
| Non RCT | | | | | | |
| I | 29.73 | 268.75 | 0.00 | 0.00 | 70.27 | 11.64 |
| II | 49.95 | 263.20 | 0.00 | 0.00 | 50.05 | 9.60 |
| III | 0.00 | 0.00 | 19.35 | 240.00 | 100.00 | 12.00 |



## Table 2.13 Crop Residue Use in Household - Rice

| Category of Households | Sold (%) | Sold Price (Avg.) | Bought (%) | Bought Price (Avg.) | Stored (%) | Duration of Store age (Mo.) |
|---|---|---|---|---|---|---|
| RCT | | | | | | |
| I | 22.80 | 93.41 | - | - | 70.20 | 5.88 |
| II | 40.05 | 101.74 | - | - | 59.95 | 4.97 |
| III | - | - | - | - | - | 2.94 |
| Non RCT | | | | | | |
| I | 23.65 | 86.25 | - | - | 76.35 | 9.32 |
| II | 47.40 | 96.90 | - | - | 52.60 | 4.50 |
| III | - | - | - | - | - | 5.10 |



## Table 2.14 Crop Production - Wheat

| Category of Households | Production (Avg.) | Sold (%) | Bought (%) | Consumed (%) | Other uses (%) | Paid in Kind (%) | Received in Kind (%) |
|---|---|---|---|---|---|---|---|
| RCT | | | | | | | |
| I | 129.88 | 72.21 | 0.00 | 17.38 | 2.81 | 7.60 | 0.00 |
| II | 81.00 | 67.18 | 0.00 | 24.04 | 2.50 | 6.28 | 0.00 |
| III | 0.00 | 0.00 | 61.82 | 100.00 | 0.00 | 0.00 | 38.18 |
| Non RCT | | | | | | | |
| I | 102.6 | 72.12 | 0.00 | 17.45 | 2.34 | 8.09 | 0.00 |
| II | 61.9 | 68.21 | 0.61 | 21.29 | 2.52 | 7.37 | 0.00 |
| III | 0.00 | 0.00 | 19.35 | 100.00 | 0.00 | 0.00 | 80.65 |



## Table 2.15 Crop Production - Rice

| Category of Households | Production (Avg.) | Sold (%) | Bought | Consumed (%) | Other uses (%) | Paid in Kind (%) | Received in Kind (%) |
|---|---|---|---|---|---|---|---|
| RCT | | | | | | | |
| I | 147.50 | 93.83 | 0.00 | 4.77 | 0.70 | 0.70 | 0.00 |
| II | 92.00 | 92.85 | 0.00 | 6.67 | 0.13 | 0.35 | 0.00 |
| III | 0.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 |
| Non RCT | | | | | | | |
| I | 116.00 | 94.48 | 0.00 | 5.34 | 0.00 | 8.09 | 0.00 |
| II | 70.10 | 93.15 | 0.00 | 6.56 | 0.00 | 0.29 | 0.00 |
| III | 0.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 100.00 |

## Table 2.16 Livestock Assets (Rs.)

| Category of Households | Buffalo | Cattle | Goats | Sheep | Total |
|---|---|---|---|---|---|
| RCT | | | | | |
| I | 44265 (2.88) | 10618 (0.79) | 0 | 0 | 15883 (3.67) |
| II | 26452 (1.7) | 9261 (0.8) | 00 | 0 | 35713 (2.50) |
| III | 17125 (1) | 1125 (0.2) | 6250 (3.8) | 1875 (0.6) | 18250 (1.20) |
| Non RCT | | | | | |
| I | 54100 (3) | 8250 (0.8) | 0 | 0 | 62350 (3.80) |
| II | 24125 (1.5) | 3625 (0.5) | 0 | 0 | 27750 (2.00) |
| III | 8125 (0.5) | 5938 (0.6) | 0 | 0 | 14063 (1.10) |

Note :- Figures in Parentheses indicate Number of animals

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## Table 2.17 Milk Production and Use

| Category of Households | Milk Litre / day | Sold (%) | Bought liquid Litre / day | Price buffalo milk (Rs./ Litre) | Price cow milk (Rs./ Litre | Consumed as liquid (%) | Processed (%) |
|---|---|---|---|---|---|---|---|
| RCT | | | | | | | |
| I | 10.62 | 43.49 | 0.59 | 12.24 | 10.44 | 23.55 | 32.96 |
| II | 7.00 | 51.29 | 0.00 | 12.00 | 10.00 | 23.28 | 25.43 |
| III | 2.50 | 50.00 | 0.50 | 12.81 | 9.88 | 39.29 | 10.71 |
| Non RCT | | | | | | | |
| I | 14.6 | 19.18 | 0.00 | 12.20 | 10.10 | 23.29 | 57.53 |
| II | 5.7 | 42.62 | 0.30 | 12.10 | 10.40 | 28.96 | 28.42 |
| III | 3.30 | 26.92 | 0.20 | 11.60 | 9.80 | 57.69 | 15.39 |

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## Table 2.18 Main Share of Household fuel

| Category of Households | Wood (%) | Straw (%) | Dung cakes (%) | LPG (%) |
|---|---|---|---|---|
| RCT | | | | |
| I | 24.87 | 0 | 39.84 | 34.65 |
| II | 28.06 | 0 | 44.52 | 27.42 |
| III | 34.68 | 0 | 57.19 | 8.13 |
| Non RCT | | | | |
| I | 31.0 | 0 | 44.00 | 25.00 |
| II | 29.06 | 0 | 42.50 | 28.44 |
| II | 32.50 | 2.50 | 51.25 | 13.75 |

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## Table 2.19 Average annual Household Income (Rs.)

| Category of Households | Farm (crop & livestock) | Agril. Labour | Non – agril. Labour | Services | Business | Pension | Total income |
|---|---|---|---|---|---|---|---|
| RCT | | | | | | | |
| I | 217500 (97.11) | 0.00 (0.00) | 588 (0.26) | 5882 (2.63) | 0.00 (0.00) | 0.00 (0.00) | 223970 (100.00) |
| II | 119032 (88.38) | 0.00 (0.00) | 1290 (0.96) | 11774 (8.74) | 2581 (1.92) | 0.00 (0.00) | 134677 (100.00) |
| III | 5250 (12.37) | 1250 (2.94) | 23000 (54.18) | 12500 (29.45) | 0.00 (0.00) | 450 (1.06) | 42450 (100.00) |
| Non RCT | | | | | | | |
| I | 1835 (83.98) | 0.00 (0.00) | 0.00 (0.00) | 10000 (4.58) | 25000 (11.44) | 0.00 (0.00) | 218500 (100.00) |
| II | 110313 (93.78) | 0.00 (0.00) | 2813 (2.39) | 0.00 (0.00) | 4500 (3.83) | 0.00 (0.00) | 117625 (100.00) |
| III | 313 (0.87) | 2250 (6.24) | 23500 (65.16) | 0.00 (0.00) | 10000 (27.73) | 0.00 (0.00) | 36063 (100.00) |

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## Table 3. Data Handling Progress

| | Village Survey | HH survey | Enterprises survey I | Enterprises survey II |
|---|---|---|---|---|
| Data records Collected | 24 | 115 | 115 | 115 |
| Data records entered | 24 | 115 | - | - |
| Data records cleaned | 24 | 115 | - | - |

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## Conservation Agriculture, Livestock and Livelihood Strategies in the Indo – Gangetic Plains of South Asia : Synergies and Tradeoffs

Presented by

B. Mohan Kumar, Professor & Head
Social Sciences

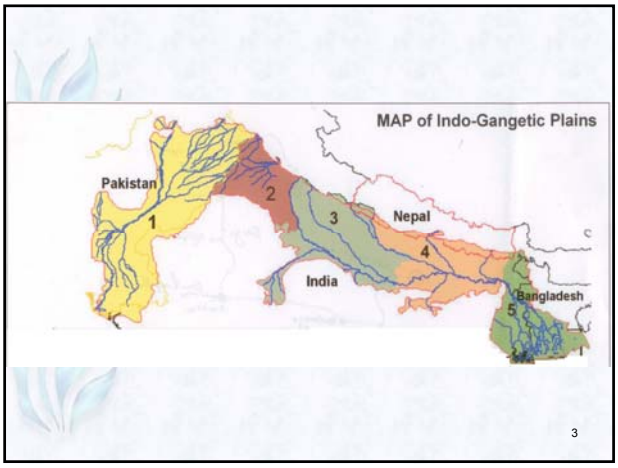
G. B. Pant University of Agriculture and Technology Pantnagar , Udham Singh Nagar
Uttarakhand - 263145

1

## Research Team

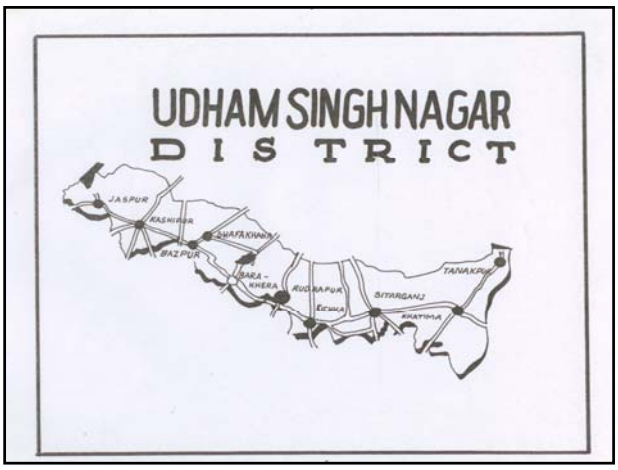
- Dr. V. Pratap Singh, Professor (Agronomy), College of Agriculture
- Dr. B. Mohan Kumar, Professor (Sociology), College of Basic Sciences and Humanities
- Dr. Brijesh Singh, Sr Research Officer (Animal Breeding), College of Veterinary and Animal Sciences

2

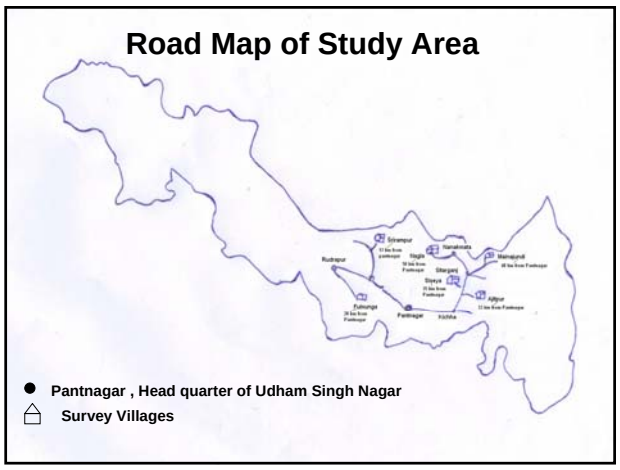



3

## Uttarakhand at Glance


## Road Map of Study Area



## Location of Survey Villages

| Names of villages | Category | Distance from town (km) | Tehsil |
|---|---|---|---|
| Mainajhundi | RCT | 10 | Sitarganj |
| Sisaiya | RCT | 07 | Sitarganj |
| Ajitpur | RCT | 15 | Kichchha |
| Fulsungha | RCT | 18 | Kichchha |
| Nagla | n-RCT | 16 | Sitarganj |
| Srirampur | n-RCT | 05 | Gadarpur |

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## Parameters of Selecting Study Area

- Distance from nearest town
- Access to market
- Prevalence of RCT

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## Village Survey at a Glance

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## Scientists visit during participatory appraisals

## Cropping pattern by village type

| | RCT villages (n=4) | Non-RCT villages (n=2) | Average (n=6) |
|---|---|---|---|
| *Kharif* paddy, coarse [% area] | 49.5 | 78.5 | 64.0 |
| paddy, fine [% area] | 7.0 | 9.0 | 8.0 |
| Sugarcane [% area] | 34.1 | 10.0 | 22.0 |
| Fodder [% area] | 5.8 | 2.5 | 4.2 |
| Vegetables [% area] | 0 | 0 | 0 |
| Other [% area] | 3.6 | 0 | 1.8 |
| Fallow [% area] | 0 | 0 | 0 |
| *Rabi* wheat [% area] | 50.5 | 48.5 | 49.5 |
| Sugarcane [% area] | 19.1 | 10.0 | 14.6 |
| Fodder [% area] | 5.8 | 1.5 | 3.7 |
| Vegetables [% area] | 3.6 | 0 | 1.8 |
| Other [% area] | 21.0 | 40.0 | 30.5 |
| Fallow [% area] | 0 | 0 | 0 |
| Spring/summerpaddy [% area] | 6.8 | 45.0 | 25.9 |

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## Livestock herd by village type

| | RCT villages (n=4) | Non-RCT villages (n=2) | Average (n=6) |
|---|---|---|---|
| Dairy buffalo (ad fem) [#/hh] | 1.9 | 1.7 | 1.8 |
| Desi dairy cattle (ad fem) [#/hh] | 1.6 | 1.0 | 1.3 |
| Dairy cross-bred (ad fem) [#/hh] | 7.5 | 1.6 | 4.5 |
| Draft buffalo (ad male) [#/hh] | 1.4 | 1.3 | 1.4 |
| Draft bullocks (ad male) [#/hh] | 2.5 | 2.0 | 2.3 |
| Sheep (adult) [#/hh] | 0 | 0 | 0 |
| Goat (adult) [#/hh] | 5.3 | 6.6 | 5.9 |
| Pigs (adult) [#/hh] | 10 | 0 | 5.0 |

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## Income composition and distribution of main income by household groups

| | Large farmer (n=6) | Small farmer (n=6) | Landless (n=6) | Average (n=12 or 18) |
|---|---|---|---|---|
| Crops [%] | 75.7 | 60 | | 67.8 |
| Livestock[%] | 9.5 | 14.7 | 17.5 | 13.9 |
| Agricultural labour [%] | 0.8 | 16 | 74.2 | 30.3 |
| non-agricultural labour [%] | 1.7 | 1.8 | 8.3 | 3.9 |
| Services[%] | 8.7 | 5.8 | 0 | 4.8 |
| Business[%] | 4.0 | 1.7 | 0 | 1.9 |

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## Selected prices in market access by remoteness

| | Near villages (n=3) | Far villages (n=3) | Average (n=6) |
|---|---|---|---|
| irrigated upland, rent[Rs/ac] | 9000 | 7383 | 8192 |
| irrigated upland, purchase [*Rs/ac] | 39.8 | 6.5 | 23.15 |
| irrigated lowland, rent [Rs/ac] | 10000 | 0 | |
| irrigated lowland, purchase [Rs/ac] | - | - | - |
| Daily wage (male)[Rs/8h] | 77 | 67 | 71.7 |
| Daily wage (female )[Rs/8h] | 73 | 67 | 70.0 |
| Wheat [Rs/kg] | 7.0 | 7.65 | 7.35 |
| Paddy, coarse [Rs/kg] | 5.35 | 5.75 | 5.55 |
| Paddy, fine [Rs/kg] | 6.65 | 7.50 | 7.07 |
| Milk, buffalo [Rs/l] | 12.00 | 12.00 | 12.00 |
| Milk, cattle [Rs/l] | 11.00 | 10.33 | 10.66 |
| Dairy buffalo (ad fem) [Rs/head] | 16500 | 13333 | 14916 |
| Desi dairy cattle (ad fem) [Rs/head] | 11500 | 4000 | 7750 |
| Dairy cross-bred (ad fem) [Rs/head] | 14500 | 13750 | 14125 |
| Goat (adult) [Rs/head] | 2500 | 1666 | 2083 |

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## RCT usage by household group

| | | Share of hh adopting [%] | | Share of area used [%] | |
|---|---|---|---|---|---|
| RCT | Crop | Large farmer (n=6) | Small farmer (n=6) | Large farmer (n=6) | Small farmer (n=6) |
| zero-tillage | Wheat | 40.6 | 29.4 | 44.5 | 21.1 |
| direct dry seeded | Rice | 1.7 | 0 | 0.45 | 0 |
| Direct wet seeded | Rice | 0.0 | 0 | 0 | 0 |
| reduced tillage | Wheat | 17.3 | 50.8 | 8.7 | 36.9 |
| | Rice | 8.3 | 0 | 5.6 | 0 |
| bed-planting | Wheat | 0 | 0 | 0 | 0 |
| | Rice | 0 | 0 | 0 | 0 |

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## Agricultural machinery by village type

| | No of machines per farm hh | | Usage price [Rs/ac] | |
|---|---|---|---|---|
| | RCT village (n=4) | Non-RCT villages (n=2) | RCT village (n=4) | Non-RCT villages (n=2) |
| Tractor (price for cultivation) | 16.8 | 12.5 | 280 | 250 |
| Draught animal cultivation | – | – | 125 | 400 |
| Zero till (ZT) machine | 1.8 | 1.0 | 260 | 150 |
| Power tiller (PT) | – | – | – | – |
| PT operated seeder (PTOS) | – | – | – | – |
| Bed planter | – | – | – | – |
| Combine harvester | 1.0 | – | 562 | 550 |
| Chaff combine | 1.3 | – | 613 | 1400 |
| Straw cutter | – | – | – | – |

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## Relative use of wheat straw (%) by mode of harvesting and household group

| | Manual harvesting | | Combine harvesting | |
|---|---|---|---|---|
| | Large farmer (n=6) | Small farmer (n=6) | Large farmer (n=6) | Small farmer (n=6) |
| Left on field (soil mulch) | 4.2 | 0 | 7.5 | 0 |
| Burnt in the field | 2.5 | 0 | 38.3 | 3.3 |
| Sold | 22.5 | 0 | 10.8 | 0 |
| Collected by others (landless) | 2.5 | 0 | 0 | 0 |
| Fodder for own animals | 66.7 | 100 | 40.0 | 30.0 |
| Household fuel | 1.7 | 0 | 1.7 | 0 |

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## Relative use of paddy straw by mode of harvesting and household group

| | Manual harvesting | | Combine harvesting | |
|---|---|---|---|---|
| | Large farmer (n=6) | Small farmer (n=6) | Large farmer (n=6) | Small farmer (n=6) |
| Left on field (soil mulch) | 1.7 | 0 | 36.6 | 10.0 |
| Burnt in the field | 19.2 | 0 | 50.8 | 45.0 |
| Sold | 7.5 | 4.2 | 0 | 0 |
| Collected by others (landless) | 4.2 | 1.7 | 5.8 | 0 |
| Fodder for own animals | 63.3 | 70 | 5.0 | 8.3 |
| Household fuel | 1.7 | 5.8 | 1.7 | 3.3 |
| Roofing / Construction | 0 | 0 | 0 | 0 |
| Heating purpose | 1.7 | 1.7 | 0 | 0 |

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# Household Survey at a Glance

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## Introduction

The information on rural livelihoods in terms of assets, strategies and outcomes were collected through household survey. Households were selected using stratified random sampling. Operational land holding and RCTs were the major criteria for stratification.

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## Household survey

## Land preparation and seeding technology use by wheat / rice and RCT / non-RCT

| HhGroup | RCT | | | | nonRCT | | | |
|---|---|---|---|---|---|---|---|---|
| Crop | wheat | | paddy | | wheat | | paddy | |
| TechUsed | Hh% | Area% | Hh% | Area% | Hh% | Area% | Hh% | Area% |
| Tillage with tractor | 90.48 | 70.94 | 80.95 | 65.17 | 75.61 | 62.48 | 82.93 | 75.57 |
| Tillage with power-tiller | 0.00 | 0.00 | 2.38 | 2.38 | 0.00 | 0.00 | 0.00 | 0.00 |
| Reduced tillage (3 pass) | 21.43 | 18.39 | 11.90 | 7.62 | 7.32 | 5.44 | 19.51 | 16.96 |
| Reduced tillage (2 pass) | 28.57 | 21.91 | 33.33 | 29.37 | 17.07 | 18.43 | 12.20 | 18.17 |
| Reduced tillage (1 pass) | 0.00 | 0.00 | 7.14 | 8.73 | 2.44 | 3.00 | 2.44 | 1.05 |
| Zero tillage | 26.19 | 12.85 | 0.00 | 0.00 | 2.44 | 0.44 | 0.00 | 0.00 |
| Seeding wheat with ZT drill | 21.43 | 15.48 | 0.00 | 0.00 | 9.76 | 5.57 | 0.00 | 0.00 |

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## Harvesting technology by wheat / rice and RCT / non-RCT

| Household Group | RCT | | | | Non-RCT | | | |
|---|---|---|---|---|---|---|---|---|
| Crop | Wheat | | Paddy | | Wheat | | Paddy | |
| Technology Used | HH% | Area% | HH% | Area% | HH% | Area% | HH% | Area% |
| Bhusa reaper | - | - | - | - | - | - | 16.78 | 11.48 |
| Combine Harvester | - | - | - | - | 46.23 | 35.88 | - | - |
| Straw burnt in Field | - | - | 36.61 | 28.53 | - | - | - | - |
| Straw cutter | 43.04 | 66.65 | - | - | - | - | - | - |

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## Straw management practices (%) by wheat / rice and manual / combine

| Crop | Wheat | | Paddy | |
|---|---|---|---|---|
| Harvest Type | Combine | Manual | Combine | Manual |
| Left in Field [%] | 16.84 | 10.25 | 19.54 | 13.1 |
| Burnt in Field [%] | 29.34 | 0.3 | 53.41 | 8.87 |
| Collected from Field [%] | 1.82 | 0.19 | 0 | 1.16 |
| Grazed in Field [%] | 0 | 0 | 0 | 0 |
| Sold from Field [%] | 0 | 10.43 | 0 | 2.89 |
| Taken Own Fodder [%] | 51.65 | 51.65 | 18.06 | 54.38 |
| Taken Hh Fuel [%] | 0.34 | 1.22 | 4.38 | 9.64 |
| Taken Roofing [%] | 0 | 0 | 4.61 | 8.18 |
| Taken Construction [%] | 0 | 0 | 0 | 0 |

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## Straw Survey

## Crop residue use in the household level by wheat / rice and RCT / non RCT

| House Hold Group | RCT | | | Non-RCT | | |
|---|---|---|---|---|---|---|
| | Wheat straw | Paddy (rabi/boro) straw | Paddy (kharif) straw | Wheat straw | Paddy (rabi/boro) straw | Paddy (kharif) straw |
| Sold [%] | 9.48 | 0.00 | 2.84 | 13.10 | 7.81 | 8.33 |
| Sold Price | 137.50 | | 30.00 | 236.00 | 190.00 | 80.00 |
| Bought [%] | 19.50 | | 5.00 | 14.75 | 30.00 | 9.33 |
| Bought Price | 187.50 | | 100.00 | 132.50 | 40.00 | |
| Storing [%] | 95.16 | 100.00 | 98.67 | 88.57 | 92.19 | 91.67 |
| Storing Duration | 11.60 | 4.75 | 5.63 | 11.64 | 5.00 | 5.22 |

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## Characteristics of RCT and non RCT farms

| HhGroup | RCT | NonRCT |
|---|---|---|
| No. of Plots | 3.93 | 3.96 |
| Plot Area (Acre) | 2.56 | 1.48 |
| Rainfed / Irrigated (Acre) | 97.54 | 79.76 |
| Days average Flooding | 8.47 | 5.25 |
| Fodder Rabi Area (Acre) | 0.78 | 0.46 |
| Fodder Kharif Area (Acre) | 0.88 | 0.51 |
| Source of Irrigation | | |
| Canal% | 24.06 | 27 |
| Electric Tubewell [%] | 37.68 | 17.39 |
| Electric Submersible Pump [%] | 1.4 | 6.85 |
| Diesel Tubewell [%] | 26.73 | 35.1 |

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## Crop production by wheat / rice and RCT / nonRCT

| HhGroup | RCT | | Non-RCT | |
|---|---|---|---|---|
| Crop | Wheat | Paddy | Wheat | Paddy |
| Yield | 14.77 | 16.42 | 12.32 | 15.32 |
| Sold [%] | 65.72 | 77.66 | 57.66 | 56.71 |
| Bought [%] | | 10 | 6 | 65.72 |
| Consumed [%] | 27.08 | 17.97 | 39.41 | 38.58 |
| Other Use [%] | 2.34 | 1.01 | 2.83 | 1.03 |
| Paid in Kind [%] | 4.86 | 4.08 | 0 | 1.11 |
| Receive in Kind [%] | | | | |

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## Livestock assets by RCT and nonRCT

| House Hold Group | RCT | Non-RCT | Landlesss |
|---|---|---|---|
| Buffalo | 24 | 22 | 8 |
| Cattle | 26 | 24 | 8 |
| Goat | 0 | 0 | 3 |
| Sheep | 0 | 0 | 0 |
| Pig | 0 | 0 | 0 |
| Poultry | 0 | 0 | 0 |

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## Milk production and use

| House Hold Group | RCT | Non-RCT | Land less |
|---|---|---|---|
| Milk l/d | 9.07 | 6.14 | 2.75 |
| Sold [%] | 26.49 | 21.81 | 16.88 |
| Price Buffalo Milk [Rs/l] | 13.89 | 12.5 | 13 |
| Price Milk Cattle [Rs/l] | 11.63 | 10.67 | 11 |
| Consumed [%] | 53.84 | 50.6 | 73.13 |
| Processed [%] | 19.68 | 26.07 | 10 |

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## Main share of household fuel by RCT/ Non-RCT

| House Hold Group | RCT | Non-RCT | Landless |
|---|---|---|---|
| Wood [%] | 39.40 | 48.93 | 49.58 |
| Straw [%] | 2.14 | 4.17 | 7.92 |
| Dung [%] | 24.40 | 30.00 | 35.42 |
| LPG [%] | 32.62 | 15.48 | 7.08 |
| Other [%] | 2.62 | 1.43 | 0.00 |

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## Average annual household income by RCT / Non-RCT

| House Hold Group | RCT | Non-RCT | Landless |
|---|---|---|---|
| Income Source | | | |
| Farm (crop & livestock) | 69.75 | 51.52 | 2.29 |
| Agricultural Labour | 3.22 | 8.90 | 26.77 |
| Non-Agricultural Labour | 5.22 | 5.92 | 29.14 |
| Services | 13.91 | 20.63 | 19.73 |
| Business | 6.56 | 10.04 | 21.06 |
| Pensions | 0.74 | 0.82 | 0.00 |

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## Data Handling Progress

| | Village Survey | House Hold Survey | Enterprise Survey 1 | Enterprise Survey 2 | Enterprise Survey 3 |
|---|---|---|---|---|---|
| Data records collected | 06 | 120 | Yes | In progress | Not Yet |
| Data records entered | Yes | Yes | In Progress | Not Yet | Not Yet |
| Data records cleaned | Yes | Yes | Not Yet | Not Yet | Not Yet |

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## Initial Conclusions

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## Prevalence of RCT practices

- More use of tractor & combine harvester
- Followed by use of Zero Tillage (ZT) machine & reduced tillage

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## Constraints in RCT machine use

- Low risk taking capacity
- Scarce investable money to spare
- High unaffordable cost of many machine

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## Livestock

- Little if any difference in RCT & Non-RCT villages
- Declining number of livestock due to
  - Mechanization
  - Preference for high yield animal
- Fodder resource were straw (70%), green fodder (25%), concentrate (5%)

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## Use of RCT & its impact

- Reduced tillage and zero tillage practices were observed higher in case of wheat in RCT villages than in non-RCT one
- Farmers using RCT tend to produce more cereal and consume less

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## Use...cont

- Area under fodder, no. of animals, milk production and consumption were observed higher in RCT households
- Income from crop and livestock is higher in RCT household
- RCT households were observed to use more LPG as fuel

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## Overview status

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## Village Survey

- Initiation of project in October 2006
- Sampling of RCT (4) & Non-RCT (2) by November 2006
- Collection & Analysis of data in December
- First report submission in February 2007

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## Household Survey

- Initiation in May 2007
- Sampling of 120 households
- Collection of data by April 2008
- Analysis / Interpretation / completion by August 2008

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## Enterprise Survey Round1

- Initiation in February 2008
- Data collection in progress
- To be completed following harvesting

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## Enterprise Survey

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## Enterprise Survey Round2

- Initiation of data collection in May 2008
- Data collection in progress

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## Thanks

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Conservation Agriculture , livestock and livelihood in the Indo Gangetic Plains of South Asia :Synergies and Tradeoffs - SLP/CIMMYT Supported Project

## PROGRESS AND ACCOMPLISHMENTS

U. P. Singh, H. P. Singh & Y. Singh
Institute of Agricultural Sciences
B.H.U., Varanasi, U.P. (India)

## Site: Ballia

- **Project Coordinator:**
  **Dr. Olaf Erenstein**
- **Site Coordinator:**
  **Dr. U. P. Singh**
- **Project Team:**
  **H. P. Singh, Y. Singh, D.K. Singh, A. Kumar, B. Prakash, P. Shukla, Balwant Singh, J. Mishra, Vivekanand Singh, Ajeet Kumar, S.R. Singh, Nils Teufels, A. Samaddar**

## Baseline Site Characterization


- Located at the border of Eastern U.P. & Bihar in alluvial plains between the Ganges and Ghagara river systems, covers 329023 ha
- **Latitude –** 25°33' to 26°11' N
  **Longitude –** 83°40' to 84°38' E

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## Farmers' Status

| | |
|---|---|
| **High Population Density:** | **923/km²** |
| **Low Literacy Rate :** | |
| **Overall** | **59%** |
| **Female** | **44%** |
| **Farmers below poverty line:** | **35%** |
| **Land holding:** | |
| **Small and marginal (< 2 ha)** | **85%** |
| **Medium (2-4 ha)** | **10%** |
| **Large (> 4 ha)** | **5%** |

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## Classification of the selected villages

| Village Type | Village title | Location | HH(#) |
|---|---|---|---|
| RCT far | Gharmalpur | 7km from Ratsar | 800 |
| RCT near | Pahrajpur | 3km from Ratsar | 100 |
| Non-RCT far | Bankata | 10km Sikandarpur | 132 |
| RCT far | Rustampur | 9km from Sahatwar | 225 |
| RCT Near | Baro Bandh | 4km Ratsar | 80 |
| Non-RCT near | Raghunathpur | 5km from Sahatwar | 55 |

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## Description of selected villages

- The land of these villages is upland/lowland and irrigated. The major source of irrigation is canal followed by electric & Tube wells.
- Rice is the major *kharif* crop, occupies about 65 percent of the cropped area.
- Wheat crop alone occupies about 75 percent of the total cropped area.
- The other crops, though grown over minor areas are vegetables, pulses, oilseeds and maize etc.
- Most of the households keep animals like buffalos and cows.

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## Cont.

- All the villages are electrified and enjoy partially telephonic and transport connectivity.
- The main occupation of the people is farming, yet they have some subsidiary occupations like dairy, poultry, custom hiring on the size of operational holding.
- The income of the farmers , primarily depends on the size of operational holding.

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## Village Characteristics

- The total population of surveyed villages varied from 500 heads (100 households) to 2500 heads (225 households) with an overall average of 350 heads (55 households).
- Landless households, on the whole constituted 27% of the total households.
- The proportion of large and small holdinsngs in these sample villages were 7.3 and 65.4%.
- The average size of holding is estimated as 0.75 acres.
- Livestock was found as major subsidiary enterprise in the villages.

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## Cont.

- 91% households are keeping livestock on their farms for meeting their own milk requirements.
- Village located far the towns housed more number of people (6300 heads and 1157 families) as compared to the villages located near the town (1850 heads and 235 families).
- The ratio of large farms to small farms was high (1:3.69) in RCT villages as compared to 1:9.75 in non RCT village.
- Landless households comprised of 25 and 14 percent of total households in RCT and non-RCT villages, respectively.

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## Cont.

- The average holding size in RCT villages was found to be small (1.27 acre) as compared to 1.44 acres in non RCT villages.
- The total land per household owned by large and small farmers was 2.32 and 0.95 acres respectively.
- The total number of buffalos (adult female) per household owned by large farmers, small farmers and landless representative group in the surveyed area were 0.57, 0.46 and 0.60.
- Small ruminants were found more with small farm households (0.87) and landless households (0.86) as against large household (0.12).

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## Cont.

- Assets by HH groups, on the whole only about 8.37% were found to be without livestock in the surveyed area (1.97% large farmers, 6.93% small farmers and 16.29% landless).
- Of the total milk production in the study area, 38.3% was marketed (38% on large farms, 41.7% on small farms and 35% on landless households).
- The major source of irrigation was diesel tubewell (55%), followed by canal (50%) and electric tube well (25%).

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## Cont.

- Canal irrigated land was highest in RCT villages (60% as compared to Non RCT villages (20%).
- Electric tube well accounted for 25% source of irrigation in RCT village.

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## Farming System

### Crops

- The major crops, grown in the surveyed area were rice in *kharif* and wheat in *rabi* season.
- The next important crops were sugarcane, pigeon pea, vegetables, oilseed, pulses sorghum, oat, berseem et.
- Rice and wheat were grown by most of the households.
- Sugarcane, pulses, fodder, maize, oilseed were grown by some households.

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## Cont.

- The surveyed area was dominated by rice in *kharif* and wheat in *rabi* season covering about 77 and 75% of total cultivated area in a particular season.
- In RCT villages, rice constituted 83% (78% coarse + 4.5% fine) of the total cultivated area during *kharif* season .
- In case of Non RCT villages, only coarse rice is grown which accounted for 61.6% of total cultivated area.
- Fodder crops covered 6% of the total cultivated area during *kharif* season in RCT villages whereas no area was found in non-RCT villages.

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## Cont.

- The fallow land was 30% in RCTs and 3% in Non RCTs with an average of 16.5%.
- The area under rice, wheat, potato, maize, vegetable and fodder has shown an increasing trend on large farms.
- The small farmers also increased area under rice, wheat, barley, fodder and potato in the study area.

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## Cont.

- On the other hand the crops like pulses, oilseed, sugarcane, and rapeseed & mustard has declined over the last 10 years on large farms.
- The small farmers have also cut their area under sugarcane, maize and pulses due to excess moisture, insect problem and inefficient marketing system.

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## Livestock

- Dairy buffalo (adult female)/household were higher (1.62) in RCTs villages as compared to 0.88 in Non RCT village.
- Dairy cross-bred adult female were 0.30/ household in RCTs village and 0.07/household in Non RCTs village with in average of 0.27/ household.
- Mules, pigs and donkeys were found in a very small number.

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## Cont.

- An average HH in the surveyed area possessed 0.36 adult female buffalo, 0.27 adults cross-bred female cow, 0.25 desi dairy cattle (adult female), 0.004 adult male draft bullocks and 0.88 adult goats.
- The population of buffaloes and cross-bread cows has increased, replacing the Desi cow irrespective of farm size groups.

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## Livelihood

- In case of large farmers group, 36% income was contributed by crops followed by services (32%), livestock (12.3%) and business(8%) whereas no income from non-agriculture labour.
- In case of small farmers 35% of their total income was contributed by crops.

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## Cont.

- Livestock was the next best contributor (25%) to the income of small group farmers, followed by service (15%), business (13.66%), non-agricultural labour (13%) and agriculture labour (6.6).
- Agricultural labour was found to be the major source of income for the landless household group in the surveyed area, constituting 55% towards their income, followed by non-agricultural labour component (22.5%), livestock (21.6%) and service (8%).

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## Markets

- The purchase price of irrigated land was Rs. 2,60,000/acre for near villages and Rs. 3,25,000/acre for far villages.
- The prevailing rent for such land was observed higher in near villages (Rs. 7000/acre) as compared to only Rs. 4500/acre in far villages with an overall ongoing rent/acre of Rs. 6166 in the study area.
- About 26.6% of total wheat production was marketed in the study area.
- The large farmers sold 38.3% and small farmers marketed about 15% of total wheat produced at their farms.

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## Cont.

- The sale of milk to nearby local market has increased as they pay more remunerative price to the farmers as compared to the conventional milk men.
- The average price of oilseed cake and dairy meals was found to be Rs. 9.74 per kg and Rs. 7.83 per kg respectively.
- By remoteness the price variation in oil seed cakes was found almost the same whereas in case of dairy meals, the price was higher in far villages as compared to near villages.

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## Marketed Surplus by household group

- Marketed surplus (% of total production)
- For Wheat
  - Average – 26.6%
  - Large farmers – 38.3%
  - small farmers – 15%
- For coarse paddy
  - Average – 33.3%
  - Large farmers – 45.8%
  - Small farmers – 20.8%
- For milk
  - Average – 38.3%
  - Large farmers – 38%
  - Small farmer – 41.7%
  - Landless household – 35%

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## Technology Used

### RCT-ZT

- Reduced tillage practice in wheat was more common among the large group farmers, whereas, in case of rice, participation of small farmers is higher towards this RCTs option as compared to large farmers.
- In RCT villages, 7.4% and 10.4% households adopted zero tillage and reduced tillage, respectively for wheat cultivation.

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## Cont.

- In RCT village 1.30% and 10.8% households were adopting direct seeded rice/zero tillage rice and reduce tillage, respectively for rice cultivation in RCTs villages.
- Some of the RCTs practices were being adopted in far villages with much more vigor. In far villages 7.06% households were adopting zero tillage and 10.35% reduced tillage.
- About 21% area under both wheat and rice in far villages was under zero or reduced tillage, whereas, 19% area (wheat and rice combined area) was found under the RCTs in near villages.

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## Cont.

- The general agricultural machines i.e tractor was found more in numbers/household in Non-RCT villages as compared to RCT village, whereas combine harvester was found more in RCTs village as compared to non-RCT villages.

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## Crop Residue Management

- Mechanical harvesting in recent time particularly of wheat and rice has increased in some of the sampled villages.
- However, use of combines created problem for sufficient availability of straw for livestock feeding.

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## Cont.

- 11% large farmers practiced harvester combines for wheat harvest on about 23.4% of total wheat area.
- For rice harvesting 9.3% large farmers used combine harvester.
- The use of chaff combine was not in sampled villages.
- The practice of using combine harvester for rice and wheat was comparatively more common among the small farmers.

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## Cont.

- The total wheat straw under manual harvesting mode, about 72.17 and 88% was used for fodder for owned animals by large and small farm categories.
- Only 20.67% such wheat straw was sold out by large farmers.
- Among the small farmers, this selling practice was found to be nominal (1.67%).
- The wheat straw produced by combine harvesting was partly left in the field and partly burnt in the field.

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## Cont.

- A big chunk of such wheat straw was left on fields for mulching purposes.
- The share of wheat straw used for mulching purposes was found to be 13 and 72.5% by large and small farmers, respectively.
- Whereas the share of wheat straw burnt in the field was found to be 85.75 and 27.5 percent by large and small farmers, respectively.
- Large and small farmers mainly used rice straw obtained through manual harvesting mode as fodder for owned animals i.e. 89.17 % and 87.5% respectively.

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## Cont.

- Large and small farmers sold about 6.17 and 0.5 % rice straw in the market.
- Other uses of such rice straw were noted as for roofing/construction, mulching, collection by other farmers, household fuel etc. The rice straw by combine harvest mode was mostly burnt in the field by large farmers whereas small farmers used it as mulch.
- About 60 and 40% of such rice straw was burnt and used as mulch by large farmers, whereas, small farmers, 100% used it as left such straw on the field for soil mulching.

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## Cont.

- Whereas in far villages 33.33% was burnt in the field.
- Out of the total wheat straw under manual harvesting mode, 69.66 and 90.50% was used as fodder for owned animals in near and far villages.
- A big chunk of combine harvested wheat straw was left on field for mulching purpose. It was 66.67% in near and 32.33% in far villages.

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## Cont.

- Rice straw obtained from manual harvesting mode was used as fodder for own animals to the tune of 69.75% in near villages and 89.33% in far villages.
- In near villages, 14.25% rice straw was sold, whereas, in far village only 6.33% rice straw was sold.
- Whereas in far villages 33.33% was burnt in the field.

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## Cont.

- Rice straw obtained from manual harvesting mode was used as fodder for own animals to the tune of 69.75% in near villages and 89.33% in far villages.
- In near villages, 14.25% rice straw was sold, whereas, in far village only 6.33% rice straw was sold.
- In far villages 33.33% rice straw was burnt in the field.

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## Cont.

- Out of total wheat straw under manual harvesting mode, 78.50 and 80.63 % was used as fodder for own animals in Non-RCT and RCT villages, respectively.
- A big amount of wheat straw was burnt in the field harvested by combine.
- This accounted for 98 and 40% in Non-RCT and RCT villages, respectively.

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## Cont.

- The total rice straw under manual harvesting mode, 93.33% was used as fodder followed by 4.33% as roofing/ construction, 1.0% was sold and 0.33% for other/storage purpose in Non-RCT villages.
- The RCT villages were found with positive balance of wheat straw to the tune of 20% whereas non-RCT village was associated with negative balance of 5%.

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## Cont.

- The large household group used 14, 100 and 8% dung as manure during summer, monsoon and winter season, respectively.
- The small households used comparatively more dung as fuel as compared to large farms.
- In case of landless group, the uses of dung for fuel purposes was found to be much higher as compared to large and small farm groups.
- Landless group used the left over quantity of dung either as a sold or manure.

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## Feeding

- During winter, share of berseem was more whereas during wheat harvest share of wheat straw is more.
- Similarly during rice harvest share of rice straw is more in their feeding.
- Especially in landless and small farmers groups, proportion of grasses was high in feeding during monsoon season.
- The various concentrates fed to dairy animals were oilseed cakes, dairy meals and grains.
- The most common concentrate among the sample farmers was found to be the oilseed cakes followed by grains and dairy meals.

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## Results of Household Survey

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## Land preparation and seeding technology used by wheat/rice and RCT/non-RCT

| Technology used | RCT | | | | Non RCT | | | |
|---|---|---|---|---|---|---|---|---|
| | Wheat | | Rice | | Wheat | | Rice | |
| | HH % | Area % | HH % | Area % | HH % | Area % | HH % | Area % |
| Tillage with tractor | 65.22 | 44.79 | 84.78 | 64.95 | 76.00 | 69.06 | 70.00 | 63.67 |
| Tillage with power-tiller | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Reduced tillage (3pass) | 4.35 | 3.72 | 8.70 | 8.70 | 20.00 | 20.00 | 24.00 | 20.57 |
| Reduced tillage (2pass) | 2.17 | 2.17 | 10.87 | 12.71 | 0.00 | 0.00 | 0.00 | 0.00 |
| Reduced tillage (1pass) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

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## Cont.

| Technology used | RCT | | | | Non RCT | | | |
|---|---|---|---|---|---|---|---|---|
| | Wheat | | Rice | | Wheat | | Rice | |
| | HH % | Area % | HH % | Area % | HH % | Area % | HH % | Area % |
| Zero tillage | 34.78 | 28.34 | 0.00 | 0.00 | 4.00 | 4.00 | 0.00 | 0.00 |
| Seeding wheat with ZT drill | 6.52 | 3.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Seeding with PTOS | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Seeding rice direct dry | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Seeding rice direct wet | 0.00 | 0.00 | 2.17 | 2.17 | 0.00 | 0.00 | 0.00 | 0.00 |

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## Harvesting technology by wheat/rice and RCT/non RCT

| Technology used | RCT | | | | Non RCT | | | |
|---|---|---|---|---|---|---|---|---|
| | Wheat | | Rice | | Wheat | | Rice | |
| | HH % | Area % | HH % | Area % | HH % | Area % | HH % | Area % |
| Combine harvester | 2.17 | 2.17 | 2.17 | 2.17 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bhusa reaper | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Straw cutter | 2.17 | 2.17 | 2.17 | 2.17 | 0.00 | 0.00 | 0.00 | 0.00 |
| Straw burnt in field | 2.17 | 2.17 | 4.35 | 2.72 | 0.00 | 0.00 | 0.00 | 0.00 |

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## Straw management practice (%) by wheat/rice and manual/combine

| Technology used | RCT | | | | Non RCT | | | |
|---|---|---|---|---|---|---|---|---|
| | Wheat | | Rice | | Wheat | | Rice | |
| | Man-ual | Comb-ine | Man-ual | Com-bine | Man-ual | Com-bine | Man-ual | Com-bine |
| Left in the field | 6.21 | 0.00 | 5.92 | 0.00 | 7.48 | 0.00 | 7.80 | 0.00 |
| Burnt in the field | 0.74 | 60.00 | 0.94 | 0.00 | 0.31 | 0.00 | 0.11 | 0.00 |
| Collected from field by other | 4.47 | 40.00 | 9.38 | 0.00 | 7.71 | 0.00 | 5.44 | 0.00 |
| Grazed on the field | 0.36 | 0.00 | 0.90 | 0.00 | 2.04 | 0.00 | 2.44 | 0.00 |
| Sold | 20.32 | 0.00 | 18.33 | 0.00 | 15.52 | 0.00 | 17.56 | 0.00 |

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## Cont.

| Technology used | RCT | | | | Non RCT | | | |
|---|---|---|---|---|---|---|---|---|
| | Wheat | | Rice | | Wheat | | Rice | |
| | Man-ual | Comb-ine | Man-ual | Com-bine | Man-ual | Com-bine | Man-ual | Com-bine |
| Taken home as fodder for own animals | 54.47 | 0.00 | 43.92 | 0.00 | 56.52 | 0.00 | 50.87 | 0.00 |
| Taken home as household fuel | 2.83 | 0.00 | 5.42 | 0.00 | 8.75 | 0.00 | 14.00 | 0.00 |
| Taken home for roofing/ construction | 0.49/ 0.00 | 0.00/ 0.00 | 1.35/ 0.00 | 0.00/ 0.00 | 0.83/ 0.00 | 0.00/ 0.00 | 1.33/ 0.00 | 0.00/ 0.00 |

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## Crop residue use in the household level by wheat/rice and RCT/non RCT

| Technology used | RCT | | | Non RCT | | |
|---|---|---|---|---|---|---|
| | Wheat straw | Rice (rabi/ boro) | Rice (kharif) | Wheat straw | Rice (rabi/ boro) | Rice (kharif) |
| Sold (%) | 29.72 | 59.50 | 52.19 | 171.25 | 0.00 | 19.38 |
| Sold price | 105.81 | 133.00 | 51.88 | 39.71 | 0.00 | 40.81 |
| Bought (Qtl) | 1.84 | 0.00 | 0.44 | 4.36 | 0.00 | 4.94 |
| Bought price | 372.92 | 0.00 | 116.75 | 460.00 | 0.00 | 560.00 |
| Stored (%) | 140.14 | 80.50 | 80.42 | 167.94 | 0.00 | 68.85 |
| Duration of storage (mo) | 8.33 | 5.75 | 3.40 | 8.04 | 0.00 | 10.00 |

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## Characteristics of RCT/non RCT farms

| Technology used | RCT | Non RCT |
|---|---|---|
| Average no. of plots | 5.00 | 3.00 |
| Average plot size (acre) | 0.83 | 0.52 |
| Irrigated area % | 100.00 | 100.00 |
| Days average flooding | 9.38 | 0.00 |
| Source of irrigation (Tubewell) | 50.00 | 100.00 |
| Fodder area rabi | 0.05 | 0.04 |
| Fodder area kharif | 0.05 | 0.04 |

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## Crop production by wheat/rice and RCT/non RCT

| Technology used | RCT | | Non RCT | |
|---|---|---|---|---|
| | Wheat | Rice | Wheat | Rice |
| Production (qtl) | 20.53 | 27.65 | 7.33 | 6.40 |
| Sold (%) | 18.95 | 16.78 | 6.40 | 12.92 |
| Paid in kind (%) | 81.90 | 61.72 | 110.50 | 163.22 |
| Consumed (%) | 93.80 | 87.85 | 119.52 | 114.72 |
| Other uses (%) | 25.04 | 24.50 | 73.66 | 35.59 |
| Bought (qtl) | 0.77 | 0.63 | 2.27 | 1.76 |
| Received in kind (qtl) | 1.76 | 0.00 | 1.11 | 0.12 |

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## Livestock assets by RCT/non RCT/ landless HH group

| Technology used | RCT | Non RCT | Landless |
|---|---|---|---|
| Buffalo (no./Hh) | 0.62 | 0.71 | 0.77 |
| Cattle (no./Hh) | 1.00 | 0.71 | 0.55 |
| Goats (no./Hh) | 0.07 | 0.22 | 0.95 |
| Sheep | 0.00 | 0.00 | 0.00 |
| Pigs | 0.00 | 0.00 | 0.00 |
| Poultry | 0.00 | 0.00 | 0.00 |

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## Milk production and use by RCT/non RCT/landless

| Technology used | RCT | Non RCT | Landless |
|---|---|---|---|
| Milk l/d | 4.25 | 2.31 | 2.53 |
| Sold (%) | 19.79 | 10.94 | 3.64 |
| Price buffalo milk | 9.00 | 10.81 | 7.80 |
| Price cow milk | 8.33 | 7.56 | 3.80 |
| Consumed as liquid (%) | 110.95 | 477.66 | 562.82 |
| Processed (%) | 10.24 | 31.77 | 13.55 |

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## Main share of household fuel by RCT/non RCT/ landless

| Technology used | RCT | Non RCT | Landless |
|---|---|---|---|
| Wood (%) | 32.45 | 26.56 | 34.17 |
| Straw (%) | 11.49 | 23.85 | 12.08 |
| Dung cakes/sticks (%) | 34.68 | 43.96 | 50.83 |
| LPG (%) | 20.74 | 4.69 | 1.04 |
| Other | 0.74 | 0.00 | 0.00 |

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## Average annual household income by RCT/ non RCT/landless HH group

| Technology used | RCT | Non RCT | Landless |
|---|---|---|---|
| Farm (crop & livestock)(%) | 36.45 | 27.69 | 8.15 |
| Agricultural labour (%) | 1.34 | 2.74 | 9.70 |
| Non-agricultural labour (%) | 18.94 | 34.32 | 41.06 |
| Service (%) | 25.14 | 15.38 | 20.86 |
| Business (%) | 8.80 | 13.01 | 15.03 |
| Pensions (%) | 4.78 | 4.51 | 1.77 |

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## Data handling progress

| | Village survey | Hh survey | Entrp srvy 1 | Entrp srvy 2 | Entrp srvy 3 |
|---|---|---|---|---|---|
| Data records collected | 06 | 119 | 119 | 119 | 119 |
| Data records entered | 06 | 119 | 0 | 0 | 0 |
| Data records cleaned/checked | 06 | 119 | 80 | 80 | 80 |

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## General outlook on crop and livestock production

- Average farm size will further reduce due to sub division of land in the eastern U.P.
- The monoculture of rice-wheat cultivation will continue in some cases.
- However, in some locations the area under vegetables, high value crops will increase in the coming years.
- RCTs area may expand by awareness, timely irrigation water availability and mechanization.

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## Cont.

- There are possibilities of soil fertility depletion, water shortage and increased production costs.
- The use of herbicides has increased for weed control in almost all the crops.
- The complain of adulterated chemicals has been also reported by the farmers which has less effect on controlling the weeds..

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## Conclusions

- Unawareness regarding RCTs, imprecise land leveling and lack of timely irrigation water availability are the limiting factors for faster adoption of these technologies.
- Adequate availability and appropriate machines for excessive residue situation are crucial issues for spread and faster adoption of these technologies.
- Integration of crops and livestock would be helpful in sustaining crops yield, increasing income and improving soil health by efficient utilization and recycling of the resources.

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## Cont.

- Farmers should be encouraged by assuring the availability of zero till drills/bed planters/laser levelors at subsidized rates at initial stage by the co-operatives/ Agriculture department.
- Appropriate management practice should be evolved, evaluated and matched in the context of new RCTs options and emerging cropping systems.
- On- farm trials should be conducted for further refinement and evaluation of the technologies after the users' feedback.

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## Cont.

- Farmers' participatory research and effective extension services are essential for accelerating RCTs/CA adoption.
- Effective management of crop residue is required for appropriate soil cover/health and livestock feeding.

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# SYSTEM WIDE LIVESTOCK PROGRAMME

Project Cite - Rajendra Agricultural University
Pusa, Samastipur
North Bihar

1

## DESCRIPTION OF SELECTED VILLAGES OF SAMASTIPUR DISTRICT

| Village Title | Village Type | Location | Total Population | Total HH | % Large HH | % of small HH | % of Landless HH | Avg. land per farm | Irrigated percentage |
|---|---|---|---|---|---|---|---|---|---|
| Pratappur | RCT (far) | 5 km from Kalyanpur block | 3000 | 600 | 4.16 | 50.0 | 46.0 | NA | 100 |
| Mirzapur | RCT (far) | Kalyanpur block | 1800 | 200 | 22.5 | 35.0 | 25.0 | 1.43 | 100 |
| Bisanpur Bathna | RCT (near) | Pusa block | 5000 | 425 | 23.52 | 53.0 | 23.52 | 0.71 | 100 |
| Mohamad-pur Birauli | RCT (near) | 15 km from Samastipur | 2000 | 325 | 38.46 | 23.0 | 38.5 | 1.23 | 100 |
| Patepur Gopinath | Non RCT (near) | 13 km from Samastipur | 2000 | 400 | 25.00 | 50.0 | 25.0 | 1.02 | 100 |
| Ghornagar | Non-RCT (far) | 18 km from Samastipur | 1500 | 250 | 3.2 | 48.0 | 20.0 | 1.74 | 100 |

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## MAIN CHARACTERISTICS OF THE SITE

**A. Strength of the site**

- Fertile soils
- Rich water resources
- Suitable climate for intensive cropping
- Good number of livestocks

**B. Constraints of the site**

- Subsitence nature of farming
- Small & fragmented farm
- Resource poor
- Flood affected
- Low literacy rate

3

## PROJECT TEAM

**A. SITE COORDINATORS**

1. **DR. MIRTUNJAY KUMAR**
   Sr. Scientist-cum-Associate Professor (Agronomy)
2. **DR. AMALENDU KUMAR**
   Jr. Scientist-cum-Asstt. Professor (Agricultural Economics)
3. **DR. C.B.SINGH**
4. Asstt. Professor (Animal Husbandry)

**B. ENUMERATORS**

1. Mr. Ranjan Kumar
2. Mr. Narendra Kumar
3. Mr. Manoj Kumar

**C. COMPUTER DATA ENTRY ENUMERATOR**

1. Mr. Jay Prakash

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## Farming Systems:

### A. Crops

**Cropping Pattern of Selected Village (2006)**

(Area in %)

| Season/Crops | RCT Villages | Non-RCT Villages | Average |
|---|---|---|---|
| **Kharif** | | | |
| Paddy Coarse | 16.80 | 16.40 | 16.60 |
| Paddy fine | 0.70 | - | 0.40 |
| Fodder | 4.20 | 2.70 | 3.50 |
| Vegetables | 9.70 | 16.40 | 13.30 |
| Tobacco | 5.60 | 4.80 | 5.20 |
| Others | 9.40 | 12.20 | 10.80 |

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*Contd….*

| Season/Crops | RCT Villages | Non-RCT Villages | Average |
|---|---|---|---|
| **Rabi** | | | |
| Wheat | 22.70 | 14.40 | 18.60 |
| Sugarcane | 0.70 | 2.40 | 1.60 |
| Fodder | 0.60 | 0.50 | 0.60 |
| Maize | 17.50 | 8.00 | 12.8 |
| Vegetables | 0.60 | 04.20 | 2.40 |
| Others | 7.30 | 12.20 | 9.80 |
| **Spring/Summer** | | | |
| Vegetables | 1.40 | 11.20 | 6.30 |
| Mung bean | 5.20 | 8.30 | 6.80 |
| Fallow | - | - | - |

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## B. Livestock

Livestock population and per household of selected village (2006)

| Particulars | RCT Villages | Non-RCT Villages | Total |
|---|---|---|---|
| Dairy buffaloes | 560 | 350 | 910 |
| Average per HH | 1.63 | 1.37 | 1.50 |
| Desi Dairy Cattle | 35 | - | 35 |
| Average per HH | 1.25 | - | 1.25 |
| Dairy Cross-bred | 695 | 65 | 760 |
| Average per HH | 1.34 | 1.85 | 1.38 |
| Draft bullocks | 120 | 100 | 220 |
| Average per HH | 2.0 | 2.0 | 2.0 |
| Sheep (Adult) | 50 | - | 50 |
| Average per HH | - | - | - |
| Goat (Adult) | 1200 | 250 | 1450 |
| Average per HH | 2.18 | 2.77 | 2.26 |
| Pigs | Nil | Nil | Nil |
| Draft buffaloes | Nil | Nil | Nil |

## Household keeping various species of livestock (2006)

| Livestock | Household Keeping |
|---|---|
| Dairy buffalo | 27.5 |
| Desi dairy Cattle | 1.20 |
| Dairy Cross bred | 25.0 |
| Draft buffalo | Nil |
| Draft bullock | 5.2 |
| Sheep | 0.2 |
| Goat | 29.1 |
| Pig | Nil |

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## C. Markets

**The prices of selected inputs and major output with market access**

| Indicators | RCT Villages | Non-RCT Villages | Average |
|---|---|---|---|
| Irrigated upland Rent (Rs./acre) | 9500 | 6000 | 7750 |
| Irrigated upland Purchase Price (Rs./acre) | 480000 | 1050000 | 765000 |
| Irrigated lowland rent (Rs./acre) | 4500 | 5000 | 4750 |
| Irrigated lowland purchase price (Rs./acre) | 110000 | 53333 | 108333 |
| Daily wage (male) for 8 hrs. (Rs.) | 57 | 58 | 57.50 |
| Daily wage (female) for 8 hrs. (Rs.) | 32 | 42 | 37.00 |
| Wheat price (Rs./Kg) | 11.0 | 11.0 | 11.0 |
| Paddy Coarse (Rs./Kg) | 5.50 | 6.0 | 5.75 |
| Paddy fine (Rs./Kg) | 7.50 | 7.50 | 7.50 |

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## Contd....

| Indicators | RCT Villages | Non-RCT Villages | Average |
|---|---|---|---|
| Milk buffalo (Rs./ltr.) | 10.0 | 11.0 | 10.50 |
| Milk Cattle (Rs./ltr.) | 12.0 | 12.0 | 12.0 |
| Desi dairy cattle (Rs./cattle) | 8000 | 8000 | 8000 |
| Dairy buffalo (Rs./buffalo) | 10000 | 10000 | 10000 |
| Dairy Cross-bred (Rs./bred) | 12000 | 10000 | 11000 |
| Goat adult (Rs./goat) | 1200 | 1300 | 1250 |
| Travel cost to nearest urban centre (Rs.) | 5 | 7 | 6 |
| Travel cost to agril. Market (Rs.) | 10 | 15 | 13 |

10

## Marketing of major products by different farm categories in the sampled areas

(In %)

| Major products | Large farmer | Small farmer | Landless | Average |
|---|---|---|---|---|
| Wheat | 60 | 70 | - | 48.33 |
| Paddy Coarse | 70 | 65 | - | 45.00 |
| Paddy fine | 75 | 65 | - | 46.00 |
| Milk | 40 | 50 | 60 | 50.00 |

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## D. Livelihood

**Source of income by household in selected villages on different farm categories**

| Particulars | Large farmers | Small farmers | Landless | Average |
|---|---|---|---|---|
| Crop | 58.33 | 43.33 | - | 34.0 |
| Livestock | 16.66 | 17.50 | 7.50 | 14.0 |
| Agricultural labour | - | 14.16 | 64.0 | 25.0 |
| Non-Agricultural labour | - | 16.0 | 18.0 | 12.0 |
| Services | 12.50 | 5.83 | 1.00 | 6.33 |
| Business | 7.50 | 2.50 | 6.66 | 5.55 |

12

## Technology use (Village type)
### RCT Usages by village type

| RCT | Crop | Share of HH. adopting ( %) * | | Share of area used (%) ** | |
|---|---|---|---|---|---|
| | | RCT | Non-RCT | RCT | Non-RCT |
| ZT | Wheat | 0.9 | 0.09 | 0.012 | 0.0015 |
| Direct dry seeded | - | - | - | - | - |
| Direct wet seeded | - | - | - | - | - |
| Reduced tillage | Wheat | - | - | - | - |
| | Rice | - | - | - | - |

** Calculated as out of total farm HH, No. of HH adopting*
*** Calculated as total Cultivated Village area out of if share of Wheat & Rice area.*

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## RCT Usage in Sampled Villages according to remoteness

| RCT | Crop | Share of HH. adopting (%) * | | Share of area used ( %) ** | |
|---|---|---|---|---|---|
| | | Near Village | Far Village | Near Village | Far Village |
| ZT | Wheat | 0.93 | 0.046 | 1.0 | 0.05 |
| Direct dry seeded | Rice | - | - | - | - |
| Direct wet seeded | Rice | - | - | - | - |
| Reduced tillage | Wheat | - | - | - | - |
| | Rice | - | - | - | - |
| Bed Planting | Wheat | - | - | - | - |
| | Rice | - | - | - | - |

** Calculated as out of total farm HH, No. of HH adopting*
*** Calculated as out of total Cultivated Village area used, share of Wheat & Rice area.*

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## Resource Conserving Technology ($RCT_s$) used by different Categories of households

| Particulars | Crop | Share of the adopting | | Share of area used | |
|---|---|---|---|---|---|
| - | - | Large farmer | Small farmer | Large farmer | Small farmer |
| Zero tillage (In %) | Wheat | 11.0 | 8.0 | 9.0 | 8.0 |
| Direct dry Seeded | Rice | - | - | - | - |
| Direct Wet seeded | Rice | - | - | - | - |
| Reduced tillage | Wheat | - | - | - | - |
| Reduced tillage | Rice | - | - | - | - |
| Bed Planting | Wheat | - | - | - | - |
| Bed Planting | Rice | - | - | - | - |

## Crop Residues
### Crop residues of *Paddy Straw* used by household group

In %

| Particulars | Manual Harvesting | | Combine Harvesting | |
|---|---|---|---|---|
| | Large farmer | Small farmer | Large farmer | Small farmer |
| Left on field | 0.0 | 0.0 | - | - |
| Burnt in the field | 16.0 | 0.0 | - | - |
| Landless Collected by other | 0.0 | 0.0 | - | - |
| Fodder for own animals | 66.0 | 73.0 | - | - |
| Household fuel | 0.0 | 0.0 | - | - |
| Roofing/Construction | 0.5 | 5.0 | - | - |
| Storage (Bhusahuk) | 2.5 | 10.0 | - | - |
| Used as protection of vegetables | 1.0 | 8.0 | - | - |

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## Crop residues of *Wheat straw* used by HH group

| Particulars | Manual Harvesting | | Combine Harvesting | |
|---|---|---|---|---|
| | Large farmer | Small farmer | Large farmer | Small farmer |
| Left on field (Soil mulch) | 0.16 | 17.0 | - | - |
| Burnt in the field | 0.00 | 0.0 | - | - |
| Sold | 17.00 | 23.0 | - | - |
| Landless Collected by others | 01.66 | 0.0 | - | - |
| Fodder for own animals | 81.18 | 58.0 | - | - |
| Household fuel | 0.0 | 0.0 | - | - |
| Roofing/Construction | 0.0 | 2.0 | - | - |
| Storage | 0.0 | 0.0 | - | - |
| Protection of vegetables | 0.0 | 0.0 | - | - |

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## MANAGEMENT
### Variation in *Wheat Straw* use by remoteness

| Particulars | Manual Harvesting | | Combine Harvesting | |
|---|---|---|---|---|
| | Near | Far | Near | Far |
| Left on field (Soil mulch) | 12.30 | 0.20 | 0.0 | - |
| Burnt in the field | 0.00 | 0.00 | 0.0 | - |
| Sold | 11.10 | 13.00 | - | - |
| Collected by others (Landless) | 0.00 | 0.00 | - | - |
| Fodder for own animals | 40.00 | 24.10 | - | - |
| Household fuel | 0.00 | 0.0 | - | - |
| Roofing / Construction | 0.40 | 0.0 | - | - |
| Other use | 3.20 | 0.0 | - | - |

## Variation in *wheat straw* use

| Particulars | Manual Harvesting | | Combine Harvesting | |
|---|---|---|---|---|
| | Non-RCT | RCT | Non-RCT | RCT |
| Left on field (Soil mulch) | 0.0 | 0.0 | - | - |
| Burnt in the field | 0.0 | 0.0 | - | - |
| Sold | 0.5 | 4.20 | - | - |
| Collected by others (Landless) | 0.0 | 0.50 | - | - |
| Fodder for own animals | 21.30 | 9.40 | - | - |
| Household fuel | 0.0 | 0.0 | - | - |
| Roofing / Construction | 0.0 | 0.0 | - | - |
| Protection of vegetables | 0.0 | 0.0 | - | - |

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## Feedings

**Seasonal composition of feed in different farming group**

| Feed type | Seasons | | | |
|---|---|---|---|---|
| | Winter | Wheat Harvest | Monsoon | Paddy Harvest |
| | LARGE GROUP | | | |
| Green fodder | - | - | - | - |
| Berseem | 11.30 | - | - | 4.5 |
| Oat | 16.50 | 20.0 | 55.0 | - |
| Maize | - | 30.0 | - | - |
| Wheat Straw | 55.0 | - | 34.0 | 48.6 |
| Paddy | 31.0 | - | - | 39.0 |
| Others | - | 30.0 | - | 15.0 |

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## *Contd....*

| Feed type | Seasons | | | |
|---|---|---|---|---|
| | Winter | Wheat Harvest | Monsoon | Paddy Harvest |
| | SMALL GROUP | | | |
| Green fodder | - | - | - | - |
| Berseem | 10.0 | - | - | - |
| Oat | - | 5.6 | 50.0 | 7.5 |
| Maize | 22.0 | - | - | - |
| Wheat Straw | 44.50 | - | 50.0 | 47.4 |
| Paddy | 21.2 | - | - | - |
| Others | - | 26.0 | - | 10.0 |

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## *Contd....*

| Feed type | Seasons | | | |
|---|---|---|---|---|
| | Winter | Wheat harvest | Monsoon | Paddy harvest |
| | LANDLESS GROUP | | | |
| Green fodder | - | - | - | - |
| Oat | 4.20 | - | - | - |
| Sorghum | 12.50 | - | 36.70 | - |
| Tree leaves | 5.50 | - | - | - |
| Wheat Straw | 64.70 | - | 56.00 | 37.2 |
| Paddy | 33.30 | - | - | 33.3 |
| Others | 0.0 | 28.33 | - | 31.7 |

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# HOUSEHOLD SURVEY

23

## TECHNOLOGY USE

### Land preparation and seeding

| RCT (Y/N) | Crop | TechUsed | HH % | Area % |
|---|---|---|---|---|
| Yes | Wheat | Tillage with tractor | 72.00 | 39.04 |
| Yes | Wheat | Tillage with power-tiller | 0.00 | 0.00 |
| Yes | Wheat | Reduced tillage (3 pass) | 76.00 | 38.33 |
| Yes | Wheat | Reduced tillage (2 pass) | 0.00 | 0.00 |
| Yes | Wheat | Reduced tillage (1 pass) | 0.00 | 0.00 |
| Yes | Wheat | Zero tillage | 24.00 | 5.40 |
| Yes | Wheat | Seeding wheat with ZT drill | 4.00 | 2.40 |
| Yes | Wheat | Seeding with $PTO_S$ | 0.00 | 0.00 |
| Yes | Wheat | Seeding rice direct dry | 0.00 | 0.00 |
| Yes | Wheat | Seeding rice direct wet | 0.00 | 0.00 |

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## Contd....

| | | | | |
|---|---|---|---|---|
| Yes | Paddy (all kharif) | Tillage with tractor | 88.00 | 63.05 |
| Yes | Paddy (all kharif) | Tillage with power-tiller | 0.00 | 0.00 |
| Yes | Paddy (all kharif) | Reduced tillage (3 pass) | 44.00 | 33.57 |
| Yes | Paddy (all kharif) | Reduced tillage (2 pass) | 0.00 | 0.00 |
| Yes | Paddy (all kharif) | Reduced tillage (1 pass) | 0.00 | 0.00 |
| Yes | Paddy (all kharif) | Zero tillage | 0.00 | 0.00 |
| Yes | Paddy (all kharif) | Seeding wheat with ZT drill | 0.00 | 0.00 |
| Yes | Paddy (all kharif) | Seeding with $PTO_s$ | 0.00 | 0.00 |
| Yes | Paddy (all kharif) | Seeding rice direct dry | 0.00 | 0.00 |
| Yes | Paddy (all kharif) | Seeding rice direct wet | 0.00 | 0.00 |

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## Contd....

| | | | | |
|---|---|---|---|---|
| No | Wheat | Tillage with tractor | 91.55 | 54.18 |
| No | Wheat | Tillage with power-tiller | 0.00 | 0.00 |
| No | Wheat | Reduced tillage (3 pass) | 0.00 | 0.00 |
| No | Wheat | Reduced tillage (2 pass) | 0.00 | 0.00 |
| No | Wheat | Reduced tillage (1 pass) | 0.00 | 0.00 |
| No | Wheat | Zero tillage | 0.00 | 0.00 |
| No | Wheat | Seeding wheat with ZT drill | 0.00 | 0.00 |
| No | Wheat | Seeding with PTOS | 0.00 | 0.00 |
| No | Wheat | Seeding rice direct dry | 0.00 | 0.00 |
| No | Wheat | Seeding rice direct wet | 0.00 | 0.00 |

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## Contd....

| | | | | |
|---|---|---|---|---|
| No | Paddy (all kharif) | Tillage with tractor | 88.73 | 70.51 |
| No | Paddy (all kharif) | Tillage with power-tiller | 0.00 | 0.00 |
| No | Paddy (all kharif) | Reduced tillage (3 pass) | 0.00 | 0.00 |
| No | Paddy (all kharif) | Reduced tillage (2 pass) | 0.00 | 0.00 |
| No | Paddy (all kharif) | Reduced tillage (1 pass) | 0.00 | 0.00 |
| No | Paddy (all kharif) | Zero tillage | 0.00 | 0.00 |
| No | Paddy (all kharif) | Seeding wheat with ZT drill | 0.00 | 0.00 |
| No | Paddy (all kharif) | Seeding with PTOS | 0.00 | 0.00 |
| No | Paddy (all kharif) | Seeding rice direct dry | 0.00 | 0.00 |

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## Harvesting Technology Use

| RCT_YN | Crop | TechUsed | Hh% | Area% |
|---|---|---|---|---|
| Yes | Wheat | Combine harvester | 0.00 | 0.00 |
| Yes | Wheat | Bhusa reaper | 0.00 | 0.00 |
| Yes | Wheat | Straw cutter | 0.00 | 0.00 |
| Yes | Wheat | Straw burnt in field | 4.00 | 3.64 |
| Yes | Paddy (all kharif) | Combine harvester | 0.00 | 0.00 |
| Yes | Paddy (all kharif) | Bhusa reaper | 0.00 | 0.00 |
| Yes | Paddy (all kharif) | Straw cutter | 0.00 | 0.00 |
| Yes | Paddy (all kharif) | Straw burnt in field | 0.00 | 0.00 |
| No | Wheat | Combine harvester | 0.00 | 0.00 |
| No | Wheat | Bhusa reaper | 0.00 | 0.00 |
| No | Wheat | Straw cutter | 0.00 | 0.00 |
| No | Wheat | Straw burnt in field | 0.00 | 0.00 |
| No | Paddy (all kharif) | Combine harvester | 0.00 | 0.00 |
| No | Paddy (all kharif) | Bhusa reaper | 0.00 | 0.00 |
| No | Paddy (all kharif) | Straw cutter | 0.00 | 0.00 |
| No | Paddy (all kharif) | Straw burnt in field | 0.00 | 0.00 |

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## CROP RESIDUE USE

Straw Management Practices

| RCT (Y/N) | Crop | Harvest Type | Left In Field % | Burnt In Field% | Collected From Field % | Grazed In Field % | SoldFrom Field % | TakenOwn Fodder % | TakenHh Fuel % | Taken Roofing % | Taken Construction % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Yes | Wheat | manual | 9.80 | 0.00 | 0.00 | 0.00 | 28.00 | 58.80 | 3.40 | 0.00 | 0.00 |
| Yes | paddy (all kharif) | manual | 9.76 | 0.00 | 0.00 | 0.00 | 52.62 | 33.33 | 0.95 | 2.86 | 1.43 |
| Yes | paddy (all kharif) | combine | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 90.00 | 0.00 | 0.00 | 0.00 |
| No | Wheat | manual | 9.44 | 0.00 | 0.00 | 0.00 | 21.27 | 51.48 | 17.75 | 0.00 | 0.00 |
| No | paddy (all kharif) | manual | 9.24 | 0.00 | 0.00 | 0.00 | 28.81 | 37.54 | 9.24 | 15.17 | 0.00 |

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## Crop residue use in the household level

| RCT (Y/N) | Straw Type | Sold % | Sold Price | Bought (qtl) | Bought Price | Storing% | Storing Duration |
|---|---|---|---|---|---|---|---|
| Yes | Wheat straw | 27.42 | 260.00 | 0.00 | | 72.58 | 10.44 |
| Yes | Paddy (kharif) straw | 56.30 | 374.00 | 0.00 | | 43.70 | 8.08 |
| No | Wheat straw | 22.98 | 140.76 | 3.05 | 520.97 | 218.12 | 7.25 |
| No | Paddy (kharif) straw | 39.95 | 165.93 | 1.06 | 655.42 | 95.25 | 5.29 |

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## FACTORS AFFECTS

### Characteristics of Farms

| RCT (Y/N) | Avg Plot No | Avg Plot Area (acre) | Irrigated Area (acre) | Irrigated % | Days Flooding | IrrDslTubew% | Fodder Rabi Area_ac | Fodder Kharif Area_ac |
|---|---|---|---|---|---|---|---|---|
| Yes | 6.21 | 0.33 | 2.33 | 100.00 | 5.80 | 100.00 | 1.69 | 1.81 |
| No | 4.08 | 0.18 | 0.89 | 98.46 | 1.01 | 93.59 | 0.14 | 0.16 |

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## Crop production of farm

| RCT (Y/N) | Crop | Production( qtl) | Sold % | Paid In Kind% | Consumed % | Other Use% | Received In Kind (qtl) | Bought (qtl) |
|---|---|---|---|---|---|---|---|---|
| Yes | Wheat | 33.12 | 58.08 | 13.21 | 22.39 | 6.96 | 0.00 | 0.00 |
| Yes | Paddy (all kharif) | 53.92 | 27.75 | 12.66 | 23.65 | 35.93 | 0.00 | 0.00 |
| No | Wheat | 9.92 | 27.60 | 6.98 | 112.25 | 6.62 | 0.01 | 0.48 |
| No | Paddy (all kharif) | 16.95 | 31.02 | 11.16 | 87.52 | 6.86 | 0.05 | 0.41 |

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## Position of Livestock assets

| HhGroup | BuffNo/Hh | CatlNo/Hh | GoatNo/Hh | SheepNo/Hh | PigNo/Hh |
|---|---|---|---|---|---|
| RCT | 0.32 | 2.28 | 0.00 | 0.00 | 0.00 |
| Non RCT | 0.84 | 0.79 | 0.03 | 0.00 | 0.00 |
| Landls | 0.43 | 0.48 | 0.58 | 0.00 | 0.00 |

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## Milk Production and Use

| Hh Group | MilkTotal l/d | Sold % | Consumed % | Processed % | Price Buff Rs/l | PriceMilk Catl Rs/l |
|---|---|---|---|---|---|---|
| RCT | 6.26 | 24.93 | 76.05 | 3.73 | 1.59 | 6.59 |
| Non RCT | 5.50 | 46.11 | 49.91 | 6.76 | 7.83 | 3.30 |
| Landls | 4.00 | 57.00 | 43.00 | 0.00 | 9.00 | 2.80 |

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## Share of Household Fuel

| HhGroup | Wood% | Straw% | Dung% | LPG% |
|---|---|---|---|---|
| RCT | 16.80 | 9.00 | 67.60 | 6.60 |
| Non RCT | 23.94 | 15.77 | 58.17 | 1.69 |
| Landls | 40.83 | 10.00 | 39.17 | 0.00 |

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## Average Annual Household Income

| Hh Group | Hh No | Income Code | Income Type | Income % |
|---|---|---|---|---|
| RCT | 24 | 2001 | Farm (Crop & Livestock) | 68.75 |
| RCT | 24 | 2002 | Agricultural Labour | 0.12 |
| RCT | 24 | 2003 | Non-Agricultural Labour | 1.60 |
| RCT | 24 | 2004 | Services | 22.58 |
| RCT | 24 | 2005 | Business | 1.69 |
| RCT | 24 | 2006 | Pensions | 5.25 |

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***Contd....***

| | | | | |
|---|---|---|---|---|
| Non RCT | 70 | 2001 | Farm (Crop & Livestock) | 51.17 |
| Non RCT | 70 | 2002 | Agricultural Labour | 5.28 |
| Non RCT | 70 | 2003 | Non-Agricultural Labour | 19.13 |
| Non RCT | 70 | 2004 | Services | 17.57 |
| Non RCT | 70 | 2005 | Business | 5.42 |
| Non RCT | 70 | 2006 | Pensions | 0.00 |
| Landls | 23 | 2001 | Farm (Crop & Livestock) | 9.25 |
| Landls | 23 | 2002 | Agricultural Labour | 41.80 |
| Landls | 23 | 2003 | Non-Agricultural Labour | 40.14 |
| Landls | 23 | 2004 | Services | 4.47 |
| Landls | 23 | 2005 | Business | 4.35 |
| Landls | 23 | 2006 | Pensions | 0.00 |

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## DATA HANDLING PROGRESS

| | Village Survey | HH Survey | Entrp1 Survey | Entrp 2 Survey | Entrp 3 Survey |
|---|---|---|---|---|---|
| Data Records Collected | Finished | Finished | Finished | Progress | - |
| Data Records Entered | Finished | Finished | Progress | - | - |
| Data Records Cleaned | Finished | Finished | - | - | - |

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39

SLP on *"Conservation Agriculture Livestock and livelihood strategies in the Indo Gangetic plains of south Asia: Synergies and tradeoffs"*

Welcome

Krishi Vigyan Kendra,Jamui,Bihar (India)

**Site- Jamui**

*[Part of middle Gangetic plains of central cluster]*

Dr. Raj Narain Singh
Programme coordinator & CCPI

1

## Introduction

- Promotion of conservation Agriculture in SE Bihar is being done by KVK, state govt. & NGOs
- Zero/ Minimum tillage in wheat, pulse and other crops is spreading fast. Farmers often do so with or without retaining significant amount of crop residues as mulch.
- Share croppers are mostly marginal or landless families and more dependant upon crop residue to sustain their livestock as most important sustaining enterprises.
- Recycle of crop residue to land through FYM is less than 50% due to its major use in fuel.

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The farming system of the Jamui site having sound combination of cropping system, livestock & piggery etc.

| | | |
|---|---|---|
| RCTs village | : | Lakra, Raipura in Jamui<br>Sondhi, Patner in Lakhisarai |
| Non-RCT village | : | Mangochapari in Jamui<br>Billo in Lakhisarai |
| Soil | : | Alluvial, clay, sandy, acidic to slight alkaline |
| Crops in kharif | : | Paddy Coarse, Paddy fine, Sugarcane, Fodder and vegetable etc. |
| Crops in rabi | : | Wheat, Sugarcane and fodder etc. |

3

## The research assessment was focused on

- The trade offs affecting crop and livestock production and natural resource management.
- The impact of the trade offs on the livelihood for the poor household.
- Their implication in designing research and extension programmes in support of improved livelihood and natural resource management in Indo-gangetic plains.

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## Objective of the research

- To understand the Crop Livestock Interaction & trade offs farmer face in applying conservation Agriculture practices in rice-wheat-livestock system of SE Bihar.
- To assess the implication of the Crop Livestock Interaction & the trade offs for the development of conservation Agriculture in particular and of rice-wheat-livestock system in general.
- To use this understanding to realize and focus current and future R&D efforts addressing conservation Agriculture practices in rice-wheat-livestock system to optimize their benefits for rural livelihood, poverty alleviation and environmental sustainability.

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## Expected outputs of the research

- conceptual framework to assess interaction and trade offs in organic matter management in crop-livestock system and implication for livelihood strategies developed and applied.
- Quantitative information on indicators and process within this framework analyzed and synthesized including the idntification of drivers and modifiers, cross scale interaction and trade offs indicators.
- Implication for R&D programmes.

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## Expected beneficiaries of the research

- The ultimate beneficiaries are resource poor farmers and their peers (e.g. landless livestock keepers) faced with the same challenges to increase crop & livestock productivity while efficiently managing natural resources.
- The immediate beneficiaries are researchers, development agents and policy makers working with the domains of rural developments, crop and livestock production and conservation Agriculture.
- The beneficiaries beyond the sites will be targeted by benefiting from the more relevant R& D efforts.

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## Livestock status

| Livestock | Large | Small | Landless | Average |
|---|---|---|---|---|
| Buffalo | 703 | 470 | 030 | 401.0 |
| Cattle | 690 | 650 | 147 | 495.6 |
| Small ruminants | 620 | 708 | 236 | 521.3 |
| hh without livestock (%) | 14.3 | 20.2 | 66.4 | 33.6 |

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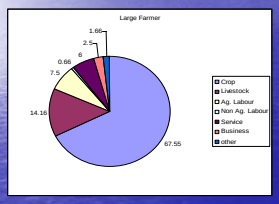
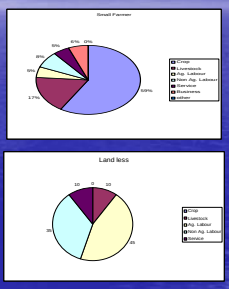
## Income Inflow (%)

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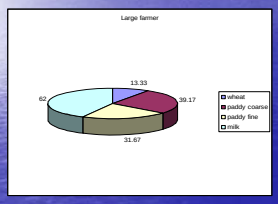
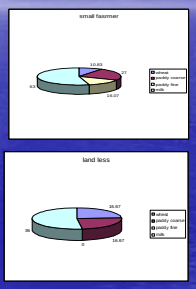
## Marketing status (%)

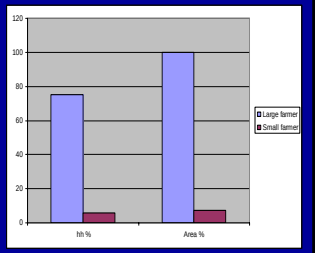



10

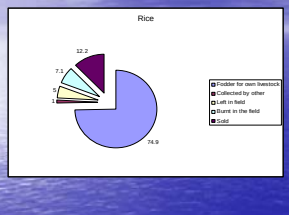
## Technology use

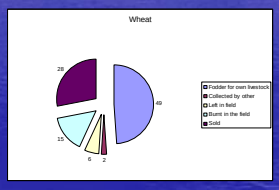
- Conservation Agriculture package-Wheat, Residue management & Diversification
- ZT-Wheat, Lentil
- Large farmers use combine harvester *(in 100% area)* so that they left more amount of residue in comparison to small *(in 7.27% area)* & landless farmer.




11

## Straw management (%)




12

KRISHI VIGYAN KENDRA
JAMUI, BIHAR

**RESULTS OF HOUSE HOLD SURVEY**

13

## Land preparation and seeding technology use by wheat/rice in RCT/Non-RCT

| Technology/Practice used | RCT | | | | Non-RCT | | | |
|---|---|---|---|---|---|---|---|---|
| | Wheat | | Rice | | Wheat | | Rice | |
| | % hh | % area | % hh | % area | % hh | % area | % hh | % area |
| Tractor use | 22.92 | 20.62 | 27.08 | 26.04 | 8.51 | 6.31 | 8.51 | 7.16 |
| Power tiller use | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced tillage | 2.08 | 1.67 | 0 | 0 | 0 | 0 | 0 | 0 |
| Zero tillage | 4.17 | 3.47 | 0 | 0 | 0 | 0 | 0 | 0 |
| Zero tillage drill/PTOS for seeding | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | (Average no. of passes) | | | | | | | |
| Reduced tillage | -- | | | | | | | |

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## Harvesting technology by wheat/rice and RCT/Non-RCT

| Technology/Practice used | RCT | | NON-RCT | |
|---|---|---|---|---|
| | % hh | % area | % hh | % area |
| Combine harvester use | 0 | 0 | 0 | 0 |
| Bhusa reaper use | 0 | 0 | 0 | 0 |
| Using straw cutter | 0 | 0 | 0 | 0 |
| Burning straw | 2.08 | 1.12 | 0 | 0 |

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| | RCT | | Non RCT | |
|---|---|---|---|---|
| | Wheat | Rice | Wheat | Rice |
| Left in the field | 5.10 | 5.00 | 5.19 | 5.11 |
| Burnt in the field (burnt to ash) | 0.00 | 0.11 | 0.00 | 0.00 |
| Collected from field by others | 0.00 | 0.00 | 0.27 | 0.22 |
| Grazed on the field | 0.10 | 0.00 | 1.08 | 0.00 |
| Sold | 45.52 | 34.57 | 22.06 | 19.46 |
| Taken home as fodder for own animals | 49.06 | 34.89 | 55.10 | 36.85 |
| Taken home as household fuel | 1.15 | 18.09 | 11.98 | 14.57 |
| Taken home for roofing | 0.00 | 4.26 | 1.98 | 26.20 |
| Taken home for construction | 0.00 | 3.09 | 0.00 | 4.24 |

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## Straw management practices (%) by wheat/rice (manual)

| Technology/Practice used | RCT | | Non-RCT | |
|---|---|---|---|---|
| | Wheat | Rice | Wheat | Rice |
| Left in the field | 5.10 | 5.00 | 5.19 | 5.11 |
| Burnt in the field (burnt to ash) | 0.00 | 0.11 | 0.00 | 0.00 |
| Collected from field by others | 0.00 | 0.00 | 0.27 | 0.22 |
| Grazed on the field | 0.10 | 0.00 | 1.08 | 0.00 |
| Sold | 45.52 | 34.57 | 22.06 | 19.46 |
| Taken home as fodder for own animals | 49.06 | 34.89 | 55.10 | 36.85 |
| Taken home as household fuel | 1.15 | 18.09 | 11.98 | 14.57 |
| Taken home for roofing | 0.00 | 4.26 | 1.98 | 26.20 |
| Taken home for construction | 0.00 | 3.09 | 0.00 | 4.24 |

## Crop residue use in the household level by wheat/rice and RCT/Non-RCT

| Practice used | RCT | | NON-RCT | |
|---|---|---|---|---|
| | Wheat | Rice | Wheat | Rice |
| Sold (%) | 48.95 | 33.75 | 37.22 | 26.47 |
| Sold price (Rs.) | 112.58 | 0.50 | 22.73 | 49.07 |
| Bought (%) | 0 | 0 | 222.20 | 222.20 |
| Bought price (Rs.) | 0 | 0 | 9999.00 | 9999.00 |
| Stored (%) | 50.38 | 59.26 | 65.71 | 68.00 |
| Duration of storage (mo) | 29 | 38 | 35 | 38 |

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## Characteristics of RCT/Non-RCT farms

| | RCT | NON-RCT |
|---|---|---|
| Average No. of plots | 1.98 | 3.02 |
| Average plot size (ac) | 2.86 | 0.88 |
| Irrigated area (ac) | 3.44 | 1.82 |
| Days average flooding | 0 | 0.33 |
| Source of irrigation | Canal (59.27%) Pump(0.00%) | Canal (38.65%) Pump(0.81%) |
| Fodder area rabi (ac) | 0.05 | 0.44 |
| Fodder area khairf (ac) | 0.05 | 0.22 |

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## Crop production by wheat/rice and RCT/Non-RCT

| Particulars | RCT | | NON-RCT | |
|---|---|---|---|---|
| | Rice | Wheat | Rice | Wheat |
| Yield qtl | 32.77 | 47.89 | 15.70 | 34.31 |
| Sold % | 52.95 | 50.25 | 24.51 | 31.58 |
| Bought % | 0.04 | 0.02 | 1.32 | 1.02 |
| Consumed % | 30.88 | 33.94 | 136.07 | 85.51 |
| Other use % | 9.08 | 7.97 | 7.82 | 6.06 |
| Paid in kind % | 7.26 | 6.67 | 4.65 | 5.63 |
| Received in kind % | 0.00 | 0.00 | 0.00 | 0.00 |

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## Livestock assets by RCT/NON-RCT4

| Live stock | RCT | NON-RCT |
|---|---|---|
| Buffalo/hh | 0.69 | 0.46 |
| Cattle/hh | 0.96 | 1.04 |
| Goats/hh | 0.60 | 0.69 |
| Sheep/hh | 0 | 0 |
| Pigs/hh | 0 | 0 |
| Poultry /hh | 0 | 0 |

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## Milk production and use

| Particulars | RCT | | NON-RCT | | LANDLESS | |
|---|---|---|---|---|---|---|
| | % | l\d | % | l\d | % | l\d |
| Milk | -- | 3.09 | -- | 4.18 | -- | 3.00 |
| Sold | 46.27 | -- | 40.30 | -- | 50.00 | -- |
| Processed | 0.0 | -- | 7.12 | -- | 0.0 | -- |
| Price buffalo milk Rs\ l | 16.00 | | 16.00 | | -- | |
| Price cow milk Rs\l | 17.67 | | 18.00 | | 18.00 | |

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## Main share of household fuel by RCT/Non-RCT

| Particulars | RCT | NON-RCT | Landless |
|---|---|---|---|
| Wood (%) | 30.42 | 19.27 | 15.63 |
| Straw(%) | 35.52 | 23.96 | 27.29 |
| Dung cake(%) | 28.65 | 52.29 | 51.88 |
| LPG(%) | 5.42 | 5.42 | 1.04 |

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| Particulars | RCT | Non-RCT | LANDLESS |
|---|---|---|---|
| Farm (Crop & livestock) | 73.50 | 49.77 | 10.90 |
| Agricultural labour | 2.21 | 10.77 | 47.63 |
| Non-agricultural labour | 1.67 | 9.88 | 23.71 |
| Services | 17.69 | 18.10 | 11.32 |
| Business | 5.38 | 8.18 | 6.44 |
| Pensions | 0.0 | 2.26 | 0.0 |

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System Wide Livestock Programme
Research on Conservation agriculture Livestock and Livelihood Strategies in Indo Gangetic Plains of South Asia: Synergies and Tradeoffs

Lower Gangetic plain
West Bengal

Dr. Debabrata Basu
Co PI, BCKV

1

## Some Background Information

- West Bengal: India's most densely populated state
- Characterized by rural livelihood based on rice-cattle farming system
- Intensification and diversification are the main pathways of agricultural growth
- Densely stocked state in India in terms of livestock population
- Rice-wheat system is relatively limited

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## Geographical location of Murshidabad district and its head quarters

| Latitude | | Longitude | | Name of district HQ | Latitude | Longitude |
|---|---|---|---|---|---|---|
| North | South | East | West | | | |
| $24^0 50'20''N$ | $23^0 43'30''N$ | $88^0 46'00''E$ | $87^0 49'17''E$ | Berhampore | $24^0 08'N$ | $88^0 16' E$ |

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## Basic Profile of Murshidabad District

| Sl No | Features | Number |
|---|---|---|
| 1 | **Area** | 5324.00 sq km |
| 2 | **Population** | 5866569 |
| 3 | **Density (per sqkm)** | 1102 |
| 4 | **Net area Sown** | 404300 ha |
| 5 | **Permanent pasture** | 600 ha |
| 6 | **Normal Rainfall** | 1377 mm |

Source: District Statistical Handbook 2005. Bureau of Applied Economics & Statistics, Government of India

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Area, Production and Productivity of Major Crops of Murshidabad District (2004-05)

| Sl No | Crop | Area (,00ha) | Production (,00MT) | Yield (Kg/ha) |
|---|---|---|---|---|
| 1 | Autumn rice | 38.1 | 85.8 | 2252 |
| 2 | Winter rice | 232.2 | 585.2 | 2563 |
| 3 | Summer rice | 140.4 | 513.2 | 3658 |
| 4 | Jute | 131.6 | 1963.2 | 14.9 Bale |
| 5 | Barley | 0.6 | 0.5 | 870 |
| 6 | Wheat | 130.4 | 251.8 | 1931 |
| 7 | Potato | 10.3 | 245.6 | 23767 |
| 8 | Rape & Mustard | 76.1 | 64.5 | 848 |
| 9 | Gram | 11.6 | 10.2 | 1108 |

1 Bale =180 kg
Source: District Statistical Handbook 2005. Bureau of Applied Economics & Statistics, Government of India

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## Basic Profile of Berhampur Block

| Sl No | Feature | Number |
|---|---|---|
| 1 | **No of Moujas** | **130** |
| 2 | **Fertiliser Depot** | **119** |
| 3 | **Seed Depot** | **3** |
| 4 | **No. of Gram Panchayat** | **13** |
| 5 | **Bargadars** | **4909** |
| 6 | **Patta holders** | **7434** |
| 7 | **Small Farmers** | **3445** |
| 8 | **Marginal Farmers** | **201676** |
| 9 | **Agricultural Labour** | **38660** |

Source: District Statistical Handbook 2005. Bureau of Applied Economics & Statistics, Government of India

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## Area, Production and Productivity of Major Crops of Berhampur Block (2004-05)

| Sl No | Crop | Area (,00ha) | Production (,00MT) | Yield (Kg/ha) |
|---|---|---|---|---|
| 1 | Autumn rice | 18.4 | 44.4 | 2411 |
| 2 | Winter rice | 159.2 | 4224 | 2653 |
| 3 | Summer rice | 141.0 | 533.1 | 3780 |
| 4 | Jute | 105.4 | 1538.3 Bales | 14.6 Bales |
| 5 | Barley | 0.3 | 0.3 | 931 |
| 6 | Wheat | 97.6 | 236.9 | 2427 |
| 7 | Potato | 2.4 | 47.7 | 20289 |
| 8 | Lentil | 15.0 | 7.8 | 520 |
| 9 | Black gram | 0.5 | 0.4 | 810 |
| 10 | Pigeon pea | 2.7 | 1.5 | 546 |
| 11 | Sesame | 6.8 | 6.8 | 992 |
| 12 | Mustard | 43.5 | 44.1 | 1012 |
| 13 | Linseed | 0.6 | 0.4 | 707 |
| 14 | Gram | 11.3 | 5.6 | 496 |

1 Bale = 180 kg

Source: District Statistical Handbook 2005. Bureau of Applied Economics & Statistics, Government of India

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## Livestock Population (2003 Livestock Census)

| Block | Cattle | Buffalo | Goat | Poultry |
|---|---|---|---|---|
| Berhampur | 70243 | 4168 | 72308 | 257811 |

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## Irrigation potential of Berhampur Block

| Sl No | Source | Number | Area (ha) |
|---|---|---|---|
| 1 | Tank | 27 | 27 |
| 2 | RLI | 37 | 1886 |
| 3 | DTW | 51 | 1551 |
| 4 | STW (Govt.) | 30 | 145 |
| 5 | Others (Pvt. STW) | 6078 | 11012 |
| | Total | 6223 | 14621 |

Source: District Statistical Handbook 2005. Bureau of Applied Economics & Statistics, Government of India

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## Basic descriptors of individual survey villages

| Village name | Kadamati | Kumradaha | Sundalpur | Daulatabad | Bahara | Dabkai-Arwa |
|---|---|---|---|---|---|---|
| Village code | 920100 | 920220 | 926200 | 924600 | 913600 | 916000 |
| Village type (RCT or non RCT) * | RCT | RCT | non RCT | RCT | non RCT | RCT |
| Village remoteness (Near or far) * | Near | Near | Far | Far | Near | Far |
| Total population | 2500 | 2100 | 1250 | 4500 | 1800 | 2016 |
| Total hh | 545 | 300 | 250 | 900 | 350 | 436 |
| Large farm hh [%] | 16.52 | 16.67 | 48 | 12.22 | 14.28 | 1.61 |
| Small farm hh [%] | 55.96 | 28.33 | 32 | 37.78 | 42.86 | 52.41 |
| Landless hh [%] | 27.52 | 55 | 20 | 50 | 42.86 | 45.98 |
| Land per farm hh [ac] ** | 1.01 | 1.98 | 2.33 | 1.33 | 1 | 0.9 |
| Irrigated land [%] | 100 | 100 | 100 | 100 | 100 | 92.5 |
| Upland land [%] | 75.00 | 87.50 | 64.29 | 97.22 | 16.67 | 42.50 |
| Hh without livestock [%] | 5.50 | 16.67 | 10.00 | 19.44 | 8.57 | 34.40 |

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## Basic descriptors of aggregate survey villages

| Features | Village type | | Village remoteness | | Overall average (n=6) |
|---|---|---|---|---|---|
| | RCT villages (n=4) | Non-RCT villages (n=2) | Near villages (n=3) | Far villages (n=3) | |
| Total population | 11116 | 3050 | 6400 | 7766 | 14166 |
| Total hh | 2181 | 600 | 1195 | 1586 | 2781 |
| Large farm hh [%] | 11.78 | 28.33 | 15.90 | 14.94 | 15.35 |
| Small farm hh [%] | 43.24 | 38.33 | 45.19 | 39.91 | 42.18 |
| Landless hh [%] | 44.98 | 33.34 | 38.91 | 45.15 | 42.43 |
| Land per farm hh [ac] | 1.22 | 1.67 | 1.19 | 1.46 | 1.33 |
| Irrigated land [%] | 98.98 | 100 | 100 | 98.82 | 99.30 |
| Upland land [%] | 82.95 | 50 | 65.38 | 77.63 | 72.66 |
| Hh without livestock [%] | 3.64 | 1.80 | 1.72 | 4.51 | 3.25 |

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## Asset levels by household groups

| | Large farmer (n=6) | Small farmer (n=6) | Landless (n=6) | Average (n=12 or 18) |
|---|---|---|---|---|
| Total land [ac] | 1246.67 | 961.67 | | 1104.17 |
| irrigated land [%] | 97.16 | 97.54 | | 97.3 |
| buffalo (ad fem) [#] | 20 | 75 | 0 | 31.67 |
| cattle (ad fem) [#] | 541 | 893 | 134 | 522.67 |
| small ruminants [#] | 869 | 2065 | 1100 | 1344.67 |
| hh without livestock [%] | 7.24 | 20.22 | 32.77 | 20.08 |

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## Income composition and distribution of main income by household groups

| | Large farmer (n=6) | Small farmer (n=6) | Landless (n=6) | Average (n=12or 18) |
|---|---|---|---|---|
| Crops [%] | 68.67 | 52.17 | ---------- | 60.42 |
| Livestock [%] | 13.83 | 16.17 | 11.67 | 13.89 |
| Agricultural labour [%] | 0 | 13.5 | 56.33 | 23.28 |
| non-agricultural labour [%] | 1.67 | 11.67 | 31.17 | 14.83 |
| Services [%] | 5.67 | 0.50 | 0 | 2.05 |
| Business [%] | 9 | 6 | 0.83 | 5.28 |
| Others (Fishery) | 1.17 | 0 | 0 | 0.39 |

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## Selected prices and market access indicators by remoteness

| | Near villages (n=3) | Far villages (n=3) | Average (n=6) |
|---|---|---|---|
| Irrigated upland, rent[Rs/ac] | 10200 | 8400 | 9600 |
| Irrigated upland, purchase [Rs/ac] | 200000 | 217500 | 207000 |
| Irrigated lowland, rent[Rs/ac] | 4500 | | 4500 |
| Irrigated lowland, purchase[Rs/ac] | 110000 | 105000 | 108750 |
| Daily wage (male) [Rs/8h] | 64.4 | 59.11 | 61.22 |
| Daily wage (female)[Rs/8h] | 58.67 | 52.8 | 56.71 |
| Wheat [Rs/kg] | 9.33 | 8 | 8.5 |
| Paddy, coarse [Rs/kg] | 6 | 6 | 6 |
| Paddy, fine [Rs/kg] | - | - | - |
| Milk, buffalo [Rs/l] | 10 | 10 | 10 |
| Milk, cattle [Rs/l] | 11.17 | 8.88 | 10.25 |
| Dairy buffalo (ad fem) [Rs/head] | 12500 | | 12500 |
| Desi dairy cattle (ad fem) [Rs/head] | 5333.33 | 4500 | 5200 |
| Dairy cross-bred (ad fem) [Rs/head] | 9000 | 9000 | 9000 |
| Goat (adult) [Rs/head] | 1133.33 | 866.67 | 900 |
| Travel cost to nearest urban centre [Rs] | 4 | 8.67 | 6.33 |
| Travel cost to agricultural market [Rs] | 3.5 | 4.5 | 4 |

## Selected marketing percentages by household group

| | Large farmer (n=6) | Small farmer (n=6) | Landless (n=6) | Average (n=12 or 18) |
|---|---|---|---|---|
| Wheat [%] | 30 | 22 | | 26 |
| Paddy, coarse[%] | 49.17 | 27.67 | | 38.42 |
| Paddy, fine[%] | - | - | | - |
| Milk [%] | 79.17 | 83.33 | 84 | 82.06 |

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## Irrigation source by village type

| | RCT villages (n=4) | Non-RCT villages (n=2) | Average (n=6) |
|---|---|---|---|
| Canal [%] | 0 | 0 | 0 |
| electric tubewell [%] | 31 | 10 | 24 |
| diesel tubewell [%] | 43.25 | 77.5 | 54.67 |
| river lift with diesel [%] | 23.25 | 0 | 15.50 |
| pond using diesel pump [%] | 0 | 12.5 | 4.17 |

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## Livestock herd by village type

| | RCT villages (n=4) | Non-RCT villages (n=2) | Average (n=6) |
|---|---|---|---|
| Dairy buffalo (ad fem) [#/hh] | 0.01 | 0.00 | 0.008 |
| Desi dairy cattle (ad fem) [#/hh] | 0.41 | 0.28 | 0.38 |
| Dairy cross-bred (ad fem) [#/hh] | 0.23 | 0.30 | 0.25 |
| Draft buffalo (ad male) [#/hh] | 0.03 | 0.07 | 0.04 |
| Draft bullocks (ad male) [#/hh] | 0.15 | 0.32 | 0.09 |
| Sheep (adult) [#/hh] | 0.04 | 0.00 | 0.03 |
| Goat (adult) [#/hh] | 1.57 | 1.5 | 1.56 |
| Pigs (adult) [#/hh] | 0.07 | 0.00 | 0.056 |

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## Existing Cropping Sequence in the Study Villages

| Name of the village | Existing cropping system | |
|---|---|---|
| | Upland | Lowland |
| Kadamati | Jute - Aman rice - Wheat<br>Jute - Aman rice - Mustard | Fallow - Aman Rice - Boro Rice<br>Fallow -Aman Rice – Wheat<br>Fallow - Fallow - Boro Rice<br>Jute - Aman Rice - Boro Rice<br>Jute - Aman Rice - Wheat |

| Name of the village | Existing cropping system | |
|---|---|---|
| | Upland | Lowland |
| Kumradaha | Aus rice - Aman rice - Boro rice<br>Jute - Aman rice -Boro rice<br>Jute - Aman rice -Potato<br>Jute - Aman rice - Wheat<br>Jute - Aman rice - Mustard<br>Jute - Aman rice - Vegetables<br>Jute - Aman rice -Pulses | Aman rice - Boro rice<br>Fallow - Boro rice |

## Existing Cropping Sequence in the Study Villages

| Name of the village | Existing cropping system | |
|---|---|---|
| | Upland | Lowland |
| Daulatabad | **For Sandy Upland**<br>Vegetable-Pulse-Fodder<br>**For Sandy loam**<br>Jute- Aman rice - Wheat<br>Jute- Fallow - Mustard<br>Jute- Aman rice - Mustard | Jute- Fallow- Boro rice<br>Jute- Aman rice- Boro rice |

| Name of the village | Existing cropping system | |
|---|---|---|
| | Upland | Lowland |
| Sundalpur | **For Sandy Upland**<br>Jute -Pulse-Mustard<br>Jute -Pulse- Pulse<br>Jute-Pulse- Wheat<br>Vegetable-Pulse-Mustard<br>Vegetable-Pulse- Wheat<br>**For Sandy loam**<br>Fallow- Aman rice- Boro rice<br>Jute - Aman rice- Boro rice<br>Jute - Aman rice- Wheat<br>Jute - Aman rice- Mustard<br>Jute - Aman rice- Potato | Jute- Fallow-Fallow<br>Fallow-Fallow- Boro rice |

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## Existing Cropping Sequence in the Study Villages

| Name of the village | Existing cropping system | |
|---|---|---|
| | Upland | Lowland |
| Bahara | Vegetable- Potato - Sesame<br>Vegetable - Vegetable - Sesame<br>Vegetable - Mustard- Sesame | Jute - Aman rice - Wheat<br>Jute - Aman rice - Boro rice<br>Fallow - Aman rice - Boro rice<br>Fallow - Fallow - Wheat<br>Fallow - Aman rice – Wheat |

| Name of the village | Existing cropping system | |
|---|---|---|
| | Upland | Lowland |
| Arwa | **Rainfed**<br>Fallow- Aman rice- Fallow<br>**Irrigated**<br>Fallow- Aman rice- Boro rice | **Less flood prone**<br>Jute- Aman rice- Wheat<br>Jute- Aman rice- Mustard<br>Jute- Aman rice- Pulse<br>Jute- Fallow – Wheat<br>**Flood prone**<br>Fallow-Fallow- Boro rice<br>Fallow-Fallow- Wheat |

## Cropping pattern by village type

| | | RCT villages (n=4) | Non-RCT villages (n=2) | Average (n=6) |
|---|---|---|---|---|
| Kharif | paddy, coarse[% area] | 77.27 | 44 | 66.87313 |
| | paddy, fine[% area] | 0 | 0 | 0 |
| | Sugarcane [% area] | 2.27 | 0 | 1.560625 |
| | Fodder[% area] | 5 | 2 | 4.0625 |
| | Vegetables[% area] | 6.59 | 9 | 7.343125 |
| | Other [% area] | 2.61 | 0 | 1.794375 |
| | Fallow [% area] | 6.24 | 45 | 18.36625 |
| Rabi | wheat [% area] | 25 | 9 | 20 |
| | Sugarcane[% area] | 2.27 | 0 | 1.560625 |
| | Fodder[% area] | 1.81 | 1 | 1.556875 |
| | Vegetables[% area] | 6.82 | 11.5 | 8.2825 |
| | Other [% area] | 37.5 | 25.65 | 33.79688 |
| | Fallow [% area] | 26.6 | 52.85 | 34.80313 |
| Spring/summer | Paddy, boro [% area] | 35.3 | 42.5 | 37.55 |
| | Jute [% area] | 47.25 | 37.5 | 44.20313 |
| | Other [% area] | 17.45 | 4 | 13.24688 |
| | Fallow [% area] | 0 | 16 | 5 |

## Changes in crops by household group

| | Large farmer (n=6) | Small farmer (n=6) |
|---|---|---|
| Crops increased | Mustard<br>Aman rice<br>Jute<br>maize (introduced)<br>pulses<br>sunflower<br>boro rice<br>Vegetables | Winter Rice<br>Jute<br>Mustard<br>Vegetables |
| Reasons | Mustard-High price, Less cost of cultivation<br>Winter rice-Irrigation facilities. Low cost of cultivation.<br>Jute- lower labour requirement and price of jute<br>Low cost of production and remunerative<br>Maize-training & extension activities<br>Pulses &sunflower-technology available.<br>Boro rice-Irrigation facility<br>Vegetables-remunerative & grown on fallow lands where aman paddy can't be grown | Rice &jute- Available low land suitable for Rice and Jute cultivation<br>Mustard & veg.-More profitable |

## Changes in crops by household group

| | | |
|---|---|---|
| Crops decreased | Wheat<br>Brinjal<br>Sugarcane<br>Autumn rice ceased<br>Chick pea<br>Pigeon pea<br>Pointed gourd | Sunflower<br>Potato<br>Wheat<br>Cucurbits<br>Pulses<br>Boro rice<br>Pointed Gourd<br>Sugar Cane |
| Reasons | Wheat- Less yield. Labour problem for threshing; short winter & rain during harvest<br>Brinjal -high pest attack<br>sugarcane -being stolen from the field; pest attack & low yield<br>Chick pea and pigeon pea - flood problem<br>Pointed gourd- less profit due disease problem | Sunflower-poor yield.<br>potato -unavailability of quality seed<br>Pulses are not so profitable.<br>Low yield & less market access for wheat<br>Boro rice-Less profit lack of water, high price of diesel<br>sugarcane -being stolen from the field |

## Feed rations, in % (especially importance of straw)

| Feed | Winter | Wheat harvest | Monsoon | Paddy harvest |
|---|---|---|---|---|
| Paddy straw | 65.71 | 66.86 | 40.87 | 74.79 |
| Wheat straw | 0 | 8.44 | 4.71 | 0.59 |
| Green grass & Green fodder | 32.19 | 21.22 | 52.66 | 21.35 |
| Maize | 2.10 | 3.48 | 1.76 | 3.27 |

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## Available average Grazing hours in different seasons

| | Large | Small | Landless |
|---|---|---|---|
| Winter | 0.5 | 2.0 | 1.5 |
| Wheat harvest | 2.7 | 3.0 | 3.1 |
| Monsoon | 1.0 | 1.4 | 1.5 |
| Paddy harvest | 0.3 | 2.0 | 1.5 |

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## Changing Trends of livestock population over the Years

| | Large farmer (n=6) | Small farmer (n=6) | Landless (n=6) |
|---|---|---|---|
| Species Increased | crossbred cow, goat (in Kadamati and Kumradaha) | crossbred & deshi cow, goat (in Kadamati and Bahara) | crossbred cow, goat (in Kadamati and Sundalpur) |
| Reasons | Cow: profit assured by co-op-society Higher milk yield, availability of AI from co-operative<br>Goat less input, more income | Cow: more production & generating extra income assured marketing through dairy co-operative Deshi cow: compatible with the farming system<br>Goat less input, more income | Cow: higher milk yield.<br>Goat: very little cost feeding is much easier & cheap |

## Changing Trends of livestock population over the Years

| | Large farmer (n=6) | Small farmer (n=6) | Landless (n=6) |
|---|---|---|---|
| Species decreased | Buffalo, deshi cow, draft bullock, sheep, goat | buffalo, draft bullock sheep, cow, goat | Deshi cow, Goat, Sheep |
| Reasons | Buffalo: requires more labour Deshi cow: low yield of milk Draft bullock: mechanization in agriculture Sheep & Goat: shortage of grazing land and time | Buffalo: requires more labour Deshi cow: low yield of milk Draft bullock: mechanization in agriculture Sheep: not profitable. Less demand of meat. Goat: shortage of grazing land and time. High mortality rate | Deshi cow: low yield of milk Sheep & Goat: shortage of grazing land and time, health problem |

## Changes in feeding technique/ milk marketing

- Less grazing
- Increase in use of concentrates
- Cultivation of green fodder mainly by the large farmers
- Introduction of dairy by Bhagirathy Dairy Co-Operatives
- Milk marketing through co-op
- Vaccination, and A.I. increased
- Natural mating decreased

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## RCT usage by household group

| RCT | Crop | Share of hh adopting [%]* Large farmer (n=6) | Small farmer (n=6) | Share of area used [%]** Large farmer (n=6) | Small farmer (n=6) |
|---|---|---|---|---|---|
| zero-tillage/ PTOS | Wheat | 3.74 | 0.25 | 1.44 | 0.21 |
| direct dry seeded/PTOS | Rice | 0.70 | | 0.27 | |
| Direct wet seeded | Rice | | | | |
| reduced tillage | Wheat | | | | |
| | Rice | 11.68 | | 10.70 | |
| bed-planting | Wheat | | | | |
| | Rice | | | | |

* Calculated as (No. of hh adopting) / (Total no. large farm hh +s. Total no. small farm hh)
** Calculated as (Area used) / (Total village area)

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## Agricultural machinery by village type

| | No of machines per farm hh* RCT village (n=4) | Non-RCT villages (n=2) | Usage price [Rs/ac] RCT village (n=4) | Non-RCT villages (n=2) |
|---|---|---|---|---|
| Tractor (price for cultivation) | 0.003 | 0.008 | 280 | 255 |
| Draught animal cultivation | 0 | 0 | 300 | 300 |
| Zero till (ZT) machine | 0 | 0 | 300 | 0 |
| Power tiller (PT) | 0.001 | 0 | 300 | 0 |
| PT operated seeder (PTOS) | 0 | 0 | 0 | 0 |
| Bed planter | 0 | 0 | 0 | 0 |
| Combine harvester | 0 | 0 | 0 | 0 |
| Chaff combine | 0 | 0 | 0 | 0 |
| Straw cutter | 0 | 0 | 0 | 0 |

* Calculated as (No. of machines in village) / (Total no. large farm hh + Total no. small farm hh)
Agriculture machinery in general is not much prominent in this area excepting tractor, power tiller possession of which belongs to few rich households, they provided the service on rent as indicated in the table, Zero tillage machines are available with the Government Farm under CIMMYT project or supplied Central institute of Agril Implements, Bhopal.

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## Harvest practices by household group

| RCT | Crop | Share of hh adopting [%] * | | Share of area used [%] ** | |
|---|---|---|---|---|---|
| | | Large farmer (n=6) | Small farmer (n=6) | Large farmer (n=6) | Small farmer (n=6) |
| Combine harvester | Wheat | N.A. | N.A. | N.A. | N.A. |
| | Rice | N.A. | N.A. | N.A. | N.A. |
| Chaff combine | Wheat | N.A. | N.A. | N.A. | N.A. |
| | Rice | N.A. | N.A. | N.A. | N.A. |

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## Use of wheat straw by household group

| | Large farmer (n=6) | Small farmer (n=6) |
|---|---|---|
| left on field (soil mulch) | 0 | 0.83 |
| Burnt in the field | 23.83 | 10.83 |
| Sold | 0 | 5 |
| collected by others (landless) | 7.17 | 2.5 |
| fodder for own animals | 35.33 | 32.84 |
| household fuel | 15.83 | 30.5 |
| roofing/construction | 17.84 | 12.5 |
| | 100% | 100% |

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## Use of paddy straw by household group

| | Large farmer (n=6) | Small farmer (n=6) |
|---|---|---|
| left on field (soil mulch) | 0 | 0.83 |
| Burnt in the field | 0 | 0 |
| Sold | 4.67 | 21.33 |
| collected by others (landless) | 0 | 0 |
| fodder for own animals | 95.33 | 76.17 |
| household fuel | 0 | 0 |
| roofing/construction | 0 | 0 |
| other use | 0 | 1.67 |
| | 100% | 100% |

## Straw prices and straw balance by village type

| | RCT villages (n=4) | Non-RCT villages (n=2) | Average (n=6) |
|---|---|---|---|
| Wheat straw normal price [Rs/ kg] | 0 | 0.33 | |
| peak price [Rs/kg] | 0 | 0.33 | |
| Village balance [%] | 0 | 0 | 0 |
| Paddy straw normal price [Rs/ kg] | 0.85 | 0.90 | 0.87 |
| peak price [Rs/kg] | 1.00 | 1.00 | 1.00 |
| Village balance [%] | 0 | -40 | -16 |

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## Dung & fuel management

| | Large farmer (n=6) | | | Small farmer (n=6) | | | Landless (n=6) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Sum. | Mon. | Win. | Sum. | Mon. | Win. | Sum. | Mon. | Win. |
| used as fuel | 38.33 | | 44.17 | 81.67 | 8.33 | 80.83 | 60 | 32 | 80 |
| used as manure | 57.5 | 100 | 51.67 | 15 | 87.5 | 15 | | | |
| Sold as cow dung cake | 4.17 | | 4.17 | 3.33 | 4.17 | 4.17 | 20 | 8 | |
| not used/ wasted | | | | | | | 20 | 60 | 20 |
| | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % |

Sum.: Summer; Mon.: Monsoon; Win.: Winter

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## Household survey

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## Land preparation and seeding technology used by wheat/rice and RCT /non-RCT

| RCT_YN | Crop | TechUsed | Hh% | Area% |
|---|---|---|---|---|
| yes | Wheat | Tillage with tractor | 39.58 | 13.89 |
| yes | Wheat | Tillage with power-tiller | 20.83 | 11.77 |
| yes | Wheat | Reduced tillage (3 pass) | 2.08 | 0.69 |
| yes | Wheat | Reduced tillage (2 pass) | 12.50 | 3.92 |
| yes | Wheat | Reduced tillage (1 pass) | 0.00 | 0.00 |
| yes | Wheat | Seeding wheat with ZT drill | 31.25 | 9.75 |
| yes | Wheat | Seeding with PTOS | 0.00 | 0.00 |
| yes | Wheat | Seeding rice direct dry | 0.00 | 0.00 |
| yes | Wheat | Seeding rice direct wet | 0.00 | 0.00 |
| yes | Paddy (all kharif) | Tillage with tractor | 60.42 | 36.01 |
| yes | Paddy (all kharif) | Tillage with power-tiller | 35.42 | 24.43 |
| yes | Paddy (all kharif) | Reduced tillage (3 pass) | 0.00 | 0.00 |
| yes | Paddy (all kharif) | Reduced tillage (2 pass) | 0.00 | 0.00 |
| yes | Paddy (all kharif) | Reduced tillage (1 pass) | 0.00 | 0.00 |
| yes | Paddy (all kharif) | Zero tillage | 0.00 | 0.00 |
| yes | Paddy (all kharif) | Seeding wheat with ZT drill | 0.00 | 0.00 |
| yes | Paddy (all kharif) | Seeding with PTOS | 0.00 | 0.00 |
| yes | Paddy (all kharif) | Seeding rice direct dry | 0.00 | 0.00 |
| yes | Paddy (all kharif) | Seeding rice direct wet | 0.00 | 0.00 |

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## Land preparation and seeding technology used by wheat/rice and RCT /non-RCT

| RCT_YN | Crop | TechUsed | Hh% | Area% |
|---|---|---|---|---|
| no | Wheat | Tillage with tractor | 42.86 | 20.78 |
| no | Wheat | Tillage with power-tiller | 35.71 | 16.48 |
| no | Wheat | Reduced tillage (3 pass) | 1.79 | 0.45 |
| no | Wheat | Reduced tillage (2 pass) | 3.57 | 2.08 |
| no | Wheat | Reduced tillage (1 pass) | 0.00 | 0.00 |
| no | Wheat | Seeding wheat with ZT drill | 1.79 | 0.89 |
| no | Wheat | Seeding with PTOS | 0.00 | 0.00 |
| no | Wheat | Seeding rice direct dry | 0.00 | 0.00 |
| no | Wheat | Seeding rice direct wet | 0.00 | 0.00 |
| no | Paddy (all kharif) | Tillage with tractor | 66.07 | 43.65 |
| no | Paddy (all kharif) | Tillage with power-tiller | 25.00 | 15.90 |
| no | Paddy (all kharif) | Reduced tillage (3 pass) | 0.00 | 0.00 |
| no | Paddy (all kharif) | Reduced tillage (2 pass) | 1.79 | 1.67 |
| no | Paddy (all kharif) | Reduced tillage (1 pass) | 0.00 | 0.00 |
| no | Paddy (all kharif) | Zero tillage | 0.00 | 0.00 |
| no | Paddy (all kharif) | Seeding wheat with ZT drill | 0.00 | 0.00 |
| no | Paddy (all kharif) | Seeding with PTOS | 0.00 | 0.00 |
| no | Paddy (all kharif) | Seeding rice direct dry | 0.00 | 0.00 |
| no | Paddy (all kharif) | Seeding rice direct wet | 0.00 | 0.00 |

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## Harvesting technology by wheat/rice and RCT / non RCT

| | Wheat | | | | Paddy | | | |
|---|---|---|---|---|---|---|---|---|
| | RCT | | Non-RCT | | RCT | | Non-RCT | |
| | % hh | % area | % hh | % area | % hh | % area | % hh | % area |
| Combine harvester use | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bhusa reaper use | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Using straw cutter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Burning straw | 0 | 0 | 1.79 | 0.89 | 0 | 0 | 0 | 0 |

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## Straw management practices (%) by wheat/rice

| | wheat | | paddy | |
|---|---|---|---|---|
| | RCT | Non-RCT | RCT | Non-RCT |
| Left In Field% | 6.89 | 6.33 | 10.00 | 9.74 |
| Burnt In Field% | 26.33 | 22.65 | 0.00 | 0.79 |
| Collected From Field% | 3.11 | 2.86 | 0.00 | 0.00 |
| Grazed In Field% | 4.00 | 1.02 | 0.00 | 0.00 |
| Sold From Field% | 10.44 | 10.82 | 22.67 | 44.74 |
| Taken Own Fodder% | 23.44 | 14.80 | 67.33 | 38.95 |
| Taken Hh Fuel% | 22.00 | 35.20 | 0.00 | 4.74 |
| Taken Roofing% | 3.78 | 4.49 | 0.00 | 0.00 |
| Taken Construction% | 0.00 | 1.84 | 0.00 | 0.00 |

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## Crop residue use in the household level by wheat/rice and RCT / non RCT

| Harvest type: Manual | RCT | | | Non-RCT | | |
|---|---|---|---|---|---|---|
| | Paddy (Kharif) | Paddy (Boro) | Wheat | Paddy (Kharif) | Paddy (Boro) | Wheat |
| Sold | 29.03 | 35.83 | 21.54 | 61.01 | 42.86 | 19.15 |
| Sold price (Rs./q) | 81.33 | 74.82 | 34.70 | 72.00 | 74.58 | 38.89 |
| Brought (qtl) | 11.38 | 3.00 | 0 | 10.18 | 10.29 | 5.00 |
| Brought price | 81.00 | 75.00 | 0 | 85.31 | 75.43 | 30.00 |
| Stored (%) | 65.75 | 69.55 | 78.79 | 77.15 | 96.73 | 86.52 |
| Duration of storage (mo) | 7.79 | 4.75 | 4.50 | 8.09 | 5.94 | 3.54 |

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## Characteristics of RCT /non RCT farms

| | RCT farm | Non-RCT farm |
|---|---|---|
| No of plots | 9 | 8 |
| Average plot size (average of hh) | 0.57 | 0.42 |
| Irrigated area % (average of hh) | 100 | 100 |
| Days average flooding | 78 | 59 |
| Source of irrigation | STW (electric), STW (diesel), DTW | STW (diesel) |
| Fodder area rabi | 1.33 | 2.68 |
| Fodder area kharif | 1.33 | 2.68 |

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## Crop production by wheat/rice and RCT/nonRCT

| | RCT | | Non-RCT | |
|---|---|---|---|---|
| | Wheat | Paddy | Wheat | Paddy |
| Production_qtl | 5.67 | 17.20 | 3.13 | 10.32 |
| Sold% | 42 | 36 | 34 | 17 |
| PaidInKind% | 0 | 0.41 | 1.46 | 0 |
| Consumed% | 58 | 68 | 66 | 87 |
| OtherUse% | 0 | 0 | 0 | 0 |
| ReceivedInKind | 0 | 0 | 0 | 0 |
| Bought | 0.75 | 5.17 | 1.33 | 3.60 |

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## Livestock assets by RCT / non RCT / landless

| (In Number/ hh) | RCT | Non-RCT | Landless |
|---|---|---|---|
| Buffalo | 0 | 2.00 | 0 |
| Cattle | 2.5 | 2.2 | 2.1 |
| Goats | 2 | 2.4 | 1 |
| Sheep | 4 | 1 | 0 |
| Pigs | 0 | 0 | 0 |

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## Milk production and use by RCT / non RCT / landless

| | RCT | Non-RCT | Landless |
|---|---|---|---|
| Milk l/d | 3 | 3.83 | 3.43 |
| Sold (%) | 50 | 66 | 78 |
| Price cow milk | 11.08 | 10.33 | 10.50 |
| Consumed as liquid (%) | 89 | 34 | 22 |
| Processed (%) | 14 | 0 | 5 |

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## Main share of household fuel by RCT / non RCT / landless

| HhGroup | RCT | Non-RCT | Landless |
|---|---|---|---|
| Wood% | 9.58 | 11.63 | 24.58 |
| Straw% | 8.23 | 10.00 | 17.08 |
| Dung% | 74.69 | 71.03 | 52.92 |
| LPG% | 3.13 | 4.50 | 2.50 |
| Other% | 3.96 | 0.82 | 1.67 |

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## Average annual household income by RCT / non RCT / landless

| HhGroup | IncomeType | Income% |
|---|---|---|
| RCT | farm (crop & livestock) | 66.93 |
| | agricultural labour | 3.37 |
| | non-agricultural labour | 7.21 |
| | services | 13.56 |
| | business | 8.93 |
| | pensions | 0.00 |
| nonRCT | farm (crop & livestock) | 52.15 |
| | agricultural labour | 14.18 |
| | non-agricultural labour | 12.26 |
| | services | 11.61 |
| | business | 9.79 |
| | pensions | 0.00 |
| Landless | farm (crop & livestock) | 23.37 |
| | agricultural labour | 27.77 |
| | non-agricultural labour | 20.28 |
| | services | 8.53 |
| | business | 18.67 |
| | pensions | 0.00 |

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## Crop profile: RCT & Non RCT Wheat

| | RCT plot | Non-RCT plot |
|---|---|---|
| Tillage cost* | 150.00 | 480.00 |
| Cost of seed | 210.00 (15 kg/bigha**) | 280.00 (20 kg/bigha) |
| Fertilizer cost | 270.00 | 350.00 |
| Irrigation | 150.00 | 200.00 |
| Weeding | 400.00 | 200.00 |
| Pesticide | 50.00 | 50.00 |
| Harvest cost | 500.00 | 550.00 |
| Threshing | 230.00 | 180.00 |
| Total | **1960.00** | **2290.00** |
| Production | **5 qtl** | **4 qtl** |
| Gross return | **4570.00** | **3650.00** |
| Net return | **2610.00** | **1360.00** |

* ZT in case of RCT, ** 1 bigha= 0.33 acre

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## General outlook on crop & livestock production

- Farmers normally resist changes and it may assume that changes in cropping pattern in the coming days will be relatively slow, rather they will resort relatively profitable practices if available keeping the main crops constant.
- Livestock sustains their livelihood across all the classes and it is the market and policy that determines their impetus for carrying out husbandry at the local level by choosing breed (deshi or cross breed), maintenance of herd size
- The profit margins in different crops are reducing with the increase in input price. And farmers are trying for reduction in vulnerability along with income augmentation from their enterprises and they always quest for appropriate technology in this regard. If such technology is promoted farmers are ready to change if they are convinced.

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## Conclusions

- Zero tillage wheat and direct seeded rice along with minimal tillage have high potential as it reduces cost of cultivation, saves time, and protects the plant from lodging etc. as perceived by many of the farmers. But inadequate promotional support by extension agencies, poor access to tillage and seeding implements stand as barrier for further scaling up and often for discontinuance although the farmers are willing.
- Some farmers are asking for local proto types for bullock drawn zero tillage machines for their farm which will make them independent and others are specific that dry seeded rice is has potential in early winter rice after sesame not after jute which is harvested late. The technologists have to think for appropriate weed management strategies for this crop in this area where direct seeded crop suffers heavy weed problem

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## Progress of Data handling

| | Village survey | Hh survey | Entrp survey 1 | Entrp survey 2 | Entrp survey 3 |
|---|---|---|---|---|---|
| Data records collected | Completed | Completed | Completed | Nearly Completed | ---------- |
| Data records entered | Completed | Completed | ---------- | ---------- | ---------- |
| Data records cleaned | Completed | Completed | ---------- | ---------- | ---------- |

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## Thanks. . .

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## Welcome to Bangladesh

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## Welcome to WRC

## SLP Conservation agriculture & crop-livestock interactions:

### Findings from WRC Dinajpur Site

**Presented**

**By**

**Dr. Elahi Baksh, SSO**
**WRC, Dinajpur**
**Bangladesh**

## Some Basic Information

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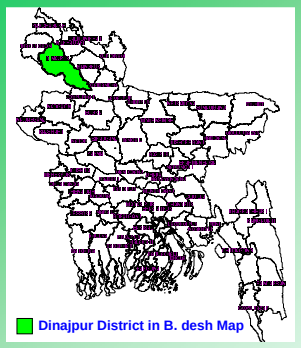
## Site Locations





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## RCTs in the site

Power Tiller (PT)

- In 1970 1st introduce by importing 569 PT by BADC for reducing draft power shortage
- The no. of active PT was 1,23867 in 2002

## RCTs in Dinajpur

Power Tiller Operated Seeder (PTOS)

- In 1996 1st introduced by CIMMYT/ WRC
- Presently about 256 active PTOS is working in Bangldesh
- The PTOS performs three functions at a time i.e. ploughing, seeding in rows and laddering.
- Eliminates delay planting by reducing turn around time.
- Saves seed (20%) and reduces production cost (25%).


## RCTs in Dinajpur

Power Tiller Operated Seeder (PTOS)

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- Eliminates delay planting by reducing turn around time.
- Saves seed (20%) and reduces production cost (25%).


## Basic characteristics of respective upazila belongs to selected village

| Characteristics | Name of Upazila | | | | |
|---|---|---|---|---|---|
| | Birgonj | Kaharol | Fulbari | Dinajpur Sader | Biral |
| Distance from district HQ (km) | 29 | 24 | 40 | 0 | 10 |
| Area (sq. km) | 413 | 206 | 229 | 354 | 352 |
| Population density (per sq. km) | 560 | 575 | 565 | 796 (1981) | 472 (1981) |
| Area/ head (ha) | 0.18 | 0.17 | 0.18 | 0.13 (1981) | 0.21 (1981) |
| Latitude (range) | 25°48/ - 26°04/ N | 25°44/ - 25°53/ N | 25°23/ - 23°34/ N | 25°28/ - 25°47/ N | 25°30/ - 25°46/ N |
| Longitude (range) | 88°26/ - 88°40/ E | 88°30/ - 88°44/ E | 88°49/ - 89°00/ E | 88°34/ - 88°47/ E | 88°27/ - 88°39/ E |

•Source: MOA,1991

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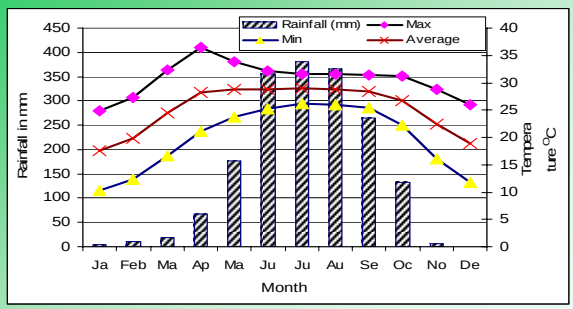
## Rain fall (in mm), maximum, minimum and average temperature (in °C) in Dinajpur

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## Findings from community survey, 2006



## Team members involved in the survey

- Dr. Md. Elahi Baksh — Team leader
  Senior Scientific Officer, WRC, BARI, Dinajpur
- Dr. A Z Sarker — Team member
  Senior Scientific Officer, WRC, BARI, Dinajpur
- M. Jahangir Kabir — Team member
  Scientific Officer, WRC, BARI, Dinajpur
- M. Shajedul Karim Sarker — Team member
  Scientific Officer, Regional Station, BLRI, Serajgonj
- Dr. Kamal Paudyal, CIMMYT, India — Team member
- Dr. Nils Teufel, ILRI India — Team member

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## Basic descriptors of aggregate survey villages

| Items | RCT villages (n=4) | Non-RCT villages (n=2) | Overall average (n=6) |
|---|---|---|---|
| Total population | 1926 | 694 | 437 |
| Total hh per village | 391 | 173 | 94 |
| Large farm hh [%] | 24 | 38 | 28 |
| Small farm hh [%] | 45 | 16 | 36 |
| Landless hh [%] | 31 | 46 | 36 |
| Land per farm hh [ac] | 2.37 | 3.02 | 2.59 |
| Irrigated land [%] | 99.60 | 100 | 99.64 |
| Upland land [%] | 94 | 100 | 95 |
| Hh without livestock [%] | 1.75 | 11.5 | 5 |

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## Asset levels by household groups

| Items | Large farmer | Small farmer | Landless | Average (n=12 or 18) |
|---|---|---|---|---|
| Average land per hh [ac] | 4.41 | 0.92 | 0 | 2.59 (n = 12) |
| Irrigated land [%] | 99 | 100 | 0 | 99.55 (n = 12) |
| Buffalo (ad fem [#] | 0.01 | 0 | 0 | 0.003 (n = 12) |
| Cattle (ad fem) [#] | 1.53 | 0.97 | 0.83 | 0.97 (n = 18) |
| Small ruminants [#] | 3.41 | 1.71 | 1.13 | 1.95 (n = 18) |
| Hh without livestock [%] | 3.66 | 4.94 | 6.83 | 5 (n = 18) |

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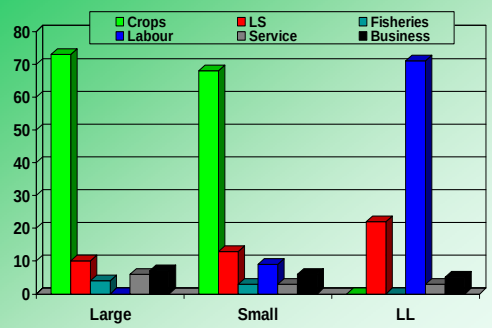
## Sources of income by HH groups

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## Selected marketing percentages by household group

| Product | Large (n=6) | Small farmer (n=6) | Landless (n=6) | Average (n=12 or 18) |
|---|---|---|---|---|
| Wheat [%] | 88 | 87 | 0 | 87 |
| Paddy, coarse [%] | 73 | 41 | 0 | 57 |
| Paddy, fine[%] | 74 | 79 | 0 | 77 |
| Maize [%] | 99 | 96 | 0 | 97 |
| Milk [%] | 47 | 67 | 83 | 65 |

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## Cropping by village type

| Rabi season | | | |
|---|---|---|---|
| Crops | RCT villages (n=4) | Non-RCT villages (n=2) | Average (n=6) |
| Wheat [% area] | 30 | 5 | 17.5 |
| Sugarcane[% area] | 2 | 5 | 3.5 |
| Maize [% area] | 8 | 29 | 18.5 |
| Vegetables[% area] | 4 | 7 | 5.5 |
| Boro rice [% area] | 44 | 14 | 29 |
| Potato [% area] | 7 | 27 | 17 |
| Banana[% area] | 2 | 2.5 | 2.25 |
| Other [% area] | 2 | 4.5 | 3.25 |
| Fallow [% area] | 1 | 6 | 3.5 |
| All [% area] | 100 | 100 | 100 |

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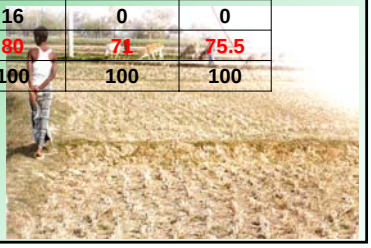
## Cropping by village type

| Summer/Spring | | | |
|---|---|---|---|
| Crop | RCT villages (n=4) | Non-RCT villages (n=2) | Average (n=6) |
| Maize [% area] | 4 | 0 | 2 |
| T. Aus rice[% area] | 0 | 29 | 14.5 |
| Other [% area] | 16 | 0 | 0 |
| Fallow [% area] | 80 | 71 | 75.5 |
| All [% area] | 100 | 100 | 100 |



## Cropping by village type

| Kharif season | | | |
|---|---|---|---|
| Crop | RCT villages (n=4) | Non-RCT villages (n=2) | Average (n=6) |
| Paddy, coarse[% area] | 66 | 67.5 | 66.75 |
| Paddy, fine [% area] | 18 | 15 | 16.5 |
| Sugarcane [% area] | 2 | 5 | 3.5 |
| Maize [% area] | 0 | 2.5 | 1.25 |
| Vegetables [% area] | 6 | 1.5 | 3.75 |
| Banana [% area] | 2 | 0 | 1 |
| Other [% area] | 0 | 2.5 | 1.5 |
| Fallow [% area] | 6 | 6 | 6 |
| All [% area] | 100 | 100 | 100 |

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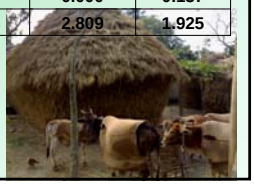
## Livestock herd by village type

| Items | RCT villages (n=4) | Non-RCT villages (n=2) | Average (n=6) |
|---|---|---|---|
| Dairy buffalo (ad fem) [#/hh] | 0.005 | 0.000 | 0.003 |
| Desi dairy cattle (ad fem) [#/hh] | 0.926 | 1.873 | 1.242 |
| Dairy cross-breed (ad fem)[#/hh] | 0.488 | 0.145 | 0.374 |
| Draft buffalo (ad male) [#/hh] | 0.036 | 0.035 | 0.036 |
| Draft bullocks (ad male) [#/hh] | 0.148 | 0.301 | 0.199 |
| Sheep (adult) [#/hh] | 0.205 | 0.000 | 0.137 |
| Goat (adult) [#/hh] | 1.483 | 2.809 | 1.925 |

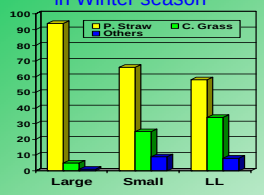
## Concentrate feeding by farm size

| Items | Rice bran (kg/day) | Wheat bran (gr/day) | Other (gr/day) |
|---|---|---|---|
| Large (n=6) | 1.26 | 267 | 190 |
| Small (n=6) | 1.01 | 200 | 42 |
| Landless (n=6) | 0.95 | 0 | 120 |

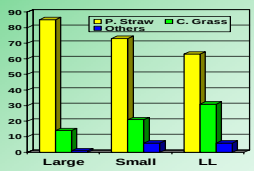
Others= Pulses bran, Molasses, Maize etc

## Feed Rations

in Winter season



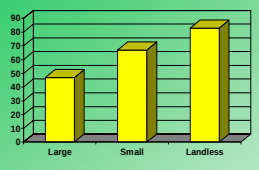

in Monsoon season



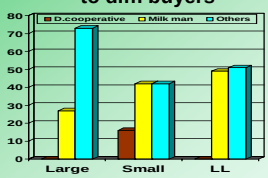



## % of Milk Marketed

% of milk marketed




to diff. buyers





## RCT usage by village type

| Village | Crop | Share of hh adopting [%] | | Share of area used [%] | |
|---|---|---|---|---|---|
| | | Large farmer | Small farmer | Large farmer | Small farmer |
| All village | Wheat | 41 | 35 | 34 | 25 |
| RCT village | Wheat | 70 | 41 | 48 | 30 |

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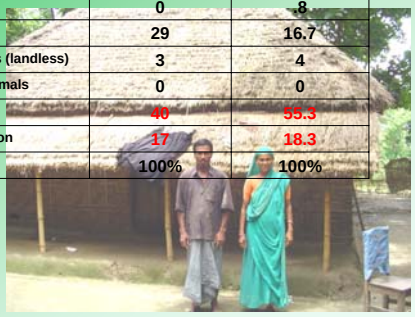
## Agricultural machinery by village type

| Items | No of machines & animal in villages | | Usage price [Tk/ac/plow] | |
|---|---|---|---|---|
| | RCT village (n=4) | Non-RCT villages (n=2) | RCT village (n=4) | Non-RCT villages (n=2) |
| Tractor | 1(268)* | 1(94)* | 600 | 500 |
| Draught animal (pair) | 35(268)* | 26(94)* | 300 | 300 |
| Power tiller (PT) | 18(268)* | 1(94)* | 300 | 250 |
| PTOS | 3(268)* | 0(94)* | 600 | NA |

Calculated as (No. of machines in village) / (Total no. large farm hh + Total no. small farm hh)

## Relative use of wheat straw

| Items | % of total straw use | |
|---|---|---|
| | Large farmer (n=6) | Small farmer (n=6) |
| Left on field (soil mulch) | 11 | 4.8 |
| Burnt in the field | 0 | 8 |
| Sold | 29 | 16.7 |
| Collected by others (landless) | 3 | 4 |
| Fodder for own animals | 0 | 0 |
| Household fuel | 40 | 55.3 |
| Roofing/construction | 17 | 18.3 |
| | 100% | 100% |

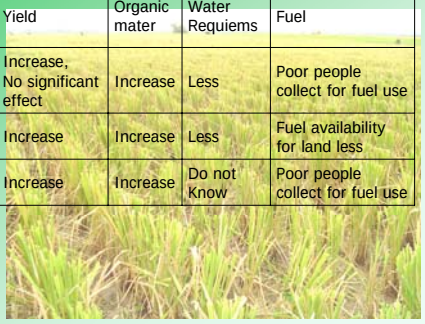


## Relative use of rice straw

| Items | T. Aman rice | | Boro rice | |
|---|---|---|---|---|
| | Large farmer (n=6) | Small farmer (n=6) | Large farmer (n=6) | Small farmer (n=6) |
| Left on field (soil mulch) | 13 | 7 | 48 | 47 |
| Burnt in the field | 0 | 0 | 0 | 0 |
| Sold | 17 | 16 | 0 | 0 |
| Collected by others | 8 | 5 | 3 | 0 |
| Fodder for own animals | 41 | 46 | 22 | 20 |
| Household fuel | 9 | 14 | 13 | 18 |
| Roofing/construction | 12 | 10 | 0 | 0 |
| Other use | 0 | 2 | 14 | 15 |

## Farmers' perception of leaving more straw in the field

| Farm category | Weeds | Yield | Organic mater | Water Requiems | Fuel |
|---|---|---|---|---|---|
| Large | Less infestation | Increase, No significant effect | Increase | Less | Poor people collect for fuel use |
| Small | Less weed | Increase | Increase | Less | Fuel availability for land less |
| Landless | Less weed | Increase | Increase | Do not Know | Poor people collect for fuel use |



## Relative use of dung by season and household group

| Category | Large farmer | | | Small farmer | | | Landless | | |
|---|---|---|---|---|---|---|---|---|---|
| | Sum. | Mon. | Win. | Sum. | Mon. | Win | Sum. | Mon. | Win. |
| Fuel | 13 | 0 | 2 | 23 | 3 | 19 | 56 | 2 | 69 |
| Manure | 83 | 100 | 97 | 73 | 98 | 73 | 3 | 0 | 5 |
| Sold | 0 | | 2 | 5 | 0 | 8 | 42 | 98 | 26 |
| Other | 4 | 6 | 0 | 0 | 0 | | 0 | 0 | |
| | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Cowdung cake making, drying and storage for future use scenario

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## General outlook on crop & livestock production

- Area under maize, potato, banana, tomato were increasing in both villages due to higher yield and profit.
- May be due to marketing facilities more 'near village' farmers have been cultivating vegetable than 'far village' farmers.
- Farmers are now following reduced tillage by using PT and PTOS (where PTOS is available).

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## General outlook (cont.)

- No. of draft animals are decreasing, but diary cattle, beef fattening young stock, and goat rearing have been increasing.
- Farmers reared all of these kinds of species for earning additional profit.
- In RCT villages cross diary cow was increasing.
- Concentrated feeding practice was also increasing.

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## General outlook (cont.)

- Farmers have positive conception about straw leaving in the field. They opined it reduces weed infestation, increase soil fertility, organic matter and yields of the next crop.
- Majority of the farmers used a remarkable portion of rice - wheat straw and dung as fuel. This ultimately limits the farm yard manure use in the soil; reduce organic matter content and soil fertility.

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## Findings from HH Survey

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Rice land preparation and seeding technology use in RCT and non-RCT farm

| Technology | RCT farm | | non-RCT farm | |
|---|---|---|---|---|
| | % of HH | % of area | % of HH | % of area |
| Tractor | 2 | 1 | 6 | 4 |
| Power-tiller | 98 | 99 | 94 | 96 |

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Wheat land preparation and seeding technology use in RCT and non-RCT farm

| Technology | RCT farm | | NRCT farm | |
|---|---|---|---|---|
| | % of HH | % of area | % of HH | % of area |
| Tractor | 3 | 2 | 0 | 0 |
| Power-tiller | 67 | 78 | 100 | 100 |
| Seeding with PTOS | 30 | 20 | 0 | 0 |

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Rice and wheat straw management practices of manual harvest

| Items | % of total | | | |
|---|---|---|---|---|
| | Rice | | Wheat | |
| | RCT farm | non-RCT farm | RCT farm | non-RCT farm |
| Left in the field | 16 | 16 | 12 | 14 |
| Burnt in the field | 0 | 0 | 3 | 1 |
| Collected others from field | 1 | 1 | 1 | 0 |
| Taken for sold | 12 | 9 | 12 | 8 |
| Taken for own fodder | 43 | 44 | 0 | 0 |
| Taken for Hh fuel | 20 | 19 | 45 | 34 |
| Taken for roofing | 8 | 11 | 27 | 43 |
| All | 100 | 100 | 100 | 100 |

## Rice and wheat residue use in the household level in RCT and non-RCT farm

| Items | RCT | | | NRCT | | |
|---|---|---|---|---|---|---|
| | Paddy kharif | Paddy rabi | Wheat | Paddy kharif | Paddy rabi | Wheat |
| Sold (%) | 12 | 0 | 12 | 9 | 2 | 8 |
| Sold price (Tk/kg) | 1.21 | 0 | 0.4 | 1.33 | 0 | 0.5 |
| Bought (kg) | 56 | 200 | 83 | 54 | 120 | 0 |
| Bought price (Tk/kg) | 1.5 | 1.8 | 1 | 1.53 | 1.8 | 1 |
| Stored (%) | 84 | 91 | 80 | 92 | 85 | 83 |
| Duration of storage (mo) | 7 | 4 | 4 | 6 | 4 | 3 |

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## Characteristics of RCT and non-RCT farms

| Items | RCT | NRCT |
|---|---|---|
| No of plots | 5 | 4 |
| Average plot size (dec) | 57 | 48 |
| Irrigated area % | 97 | 96 |
| Days average flooding | 4 | 1 |
| Source of irrigation (%):Canal | 0 | 0 |
| Electric tube well | 9 | 19 |
| DTW | 22 | 8 |
| STW | 69 | 73 |
| Fodder area Rabi | 0 | 0 |
| Fodder area kharif | 0 | 0 |

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## Rice and wheat production & utilization by RCT and non-RCT farm

| Items | Rice | | Wheat | |
|---|---|---|---|---|
| | RCT farm | non-RCT farm | RCT farm | non-RCT farm |
| Production (kg/ac) | 1400 | 1320 | 1230 | 1140 |
| Sold (%) | 44 | 43 | 86 | 80 |
| Bought (%) | 0.5 | 0.5 | 0 | 0 |
| Consumed (%) | 46.5 | 44 | 7 | 9 |
| Other uses (%) | 0 | 0 | 0 | 0 |
| Paid in kind (%) | 7 | 10 | 6 | 10 |
| Received in kind (%) | 2 | 2.5 | 1 | 1 |

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## Livestock assets (number) in RCT and non RCT farm

| Items | Per household number of livestock | | | | |
|---|---|---|---|---|---|
| | Buffalo | Cattle | Goats | Sheep | Pigs |
| RCT farm | 0.0 | 2.8 | 1.9 | 0.2 | 0.8 |
| non-RCT farm | 0.1 | 3.4 | 2.3 | 0.0 | 0.0 |
| Landless | 0.0 | 1.5 | 1.5 | 0.3 | 0.0 |

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## Milk production and use

| Items | RCT | NRCT | Landless |
|---|---|---|---|
| Milk (l/d) | 1.5 | 1.5 | 1.2 |
| Sold (%) | 32 | 52 | 74 |
| Bought (l/d) | 0 | 0 | 0 |
| Price cow milk (Tk/l) | 16 | 16 | 15 |
| Consumed as liquid (%) | 68 | 48 | 26 |
| Processed (%) | 0 | 0 | 0 |

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## Main share of household fuel in RCT and non-RCT farm

| Household group | % of total | | | | |
|---|---|---|---|---|---|
| | Wood | Straw | Dung | LPG | Other |
| RCT | 18 | 44 | 7 | 0 | 30 |
| Non-RCT | 17 | 43 | 11 | 0 | 29 |
| Landless | 10 | 25 | 18 | 0 | 47 |

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**Average annual household income of RCT, non-RCT farm and land less**

| Income type | Income% | | |
|---|---|---|---|
| | RCT | Non-RCT | Landless |
| Farm (crop & livestock) | 70 | 66 | 20 |
| Agricultural labour | 8 | 13 | 32 |
| Non-agricultural labour | 4 | 8 | 28 |
| Services | 9 | 4 | 8 |
| Business | 9 | 9 | 12 |
| All | 100 | 100 | 100 |

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## Data handling progress

| | village srvy | hh srvy | entrp srvy 1 | entrpr srvy 2 | entrpr srvy 3 |
|---|---|---|---|---|---|
| data records collected | 6 village | 121 | 121 | 121 | Not yet |
| data records entered | comple ted | 121 | Not yet | Not yet | Not yet |
| data records cleaned | comple ted | 121 | Not yet | Not yet | Not yet |

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## Thanks to all

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**Conservation of Agriculture, Livestock & livelihood Strategies in the Indo-gangetic Plains of South Asia: Synergies and Tradeoffs**

Rajbari, BANGLADESH

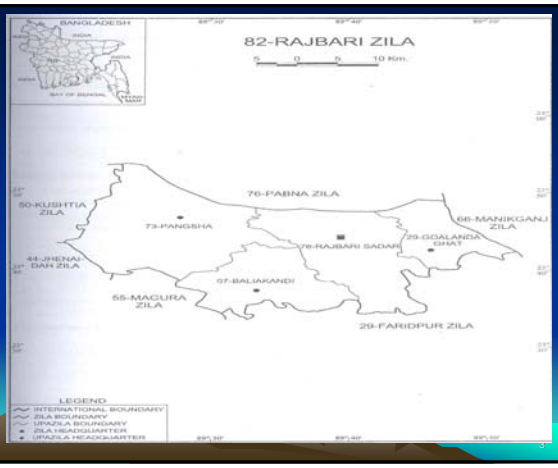
Presented by
Dr. N.R. Sarker

1

## Objectives

- To better understand crop-livestock interactions and trade-offs farmers face in applying conservation agriculture practices in rice-wheat-livestock systems.
- To assess the implications of the CLI and the trade-offs for the development of conservation agriculture in particular and of rice –wheat- livestock systems in generals;
- To use this understanding to realign and focus current and future R &D efforts addressing conservation agriculture practices in rice-wheat-livestock systems and optimize their benefit for rural livelihoods, poverty alleviation and environmental sustainability.

2

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## Situation of Rajbari district

23°33‘ and 23°55‘ North Latitude and between 89°19‘ and 89°5‘ East Longitude

Agro-ecological zone: 12 ( lower Gangetic Flood Plains)

The Padma, Jamuna, Garai and Kumar are the main rivers flow over the district.

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## General description

High land- 21.44%
Medium high land- 37.06%
Medium low land-24.75%
Low land- 5.53%
Others -11.27%
Area- 1118.80 sq. km
Baliakandhi – 243.53 sq. km

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## Methodology

**Selection of survey area**:
In the Inception workshop, the detailed methodologies of the project activities was discussed and finalized the project sites in upper and lower Gangetic plains.

In lower Gangetic plain of Bangladesh, two districts were selected one is Rajbari and another is Dinajpur.

.

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## Selection of village

Before, finalize the village selection, a preliminary visit was made by BLRI scientist and Dr. Elamulai Kannan, CIMMYT, India, the team made an visit to Faridpur district.

We discussed with:

Deputy Director, DAE

DLO, SSO, BARI and we visited a nearby village where RCTs was prevailing earlier.

## Cont.

Finally, information was collected on using RCTs from different villages of Baliakandhi uapzilla under Rajbari district through discussion with farmers and local leaders of union council.

Based on the list of RCTs villages, six villages were randomly selected by using GRS reading.

## Name of the villages selected for data collection

| Village name | Village 1 | Village 2 | Village 3 | Village 4 | Village 5 | Village 6 |
|---|---|---|---|---|---|---|
| Village code | 1001 | 1004 | 1008 | 1009 | 1013 | 3001 |
| Village type (RCT or non-RCT) | RCT | RCT | RCT | RCT | Non-RCT | Non-RCT |
| Village remoteness | 3 | 8 | 4.5 | 5 | 9 | 14 |
| Near or Far | Near | Far | Near | Far | Near | Far |

## Survey Team

| SL No. | Name of Team Member | Position | Institution |
|---|---|---|---|
| 1. | Dr. N.R. Sarker | SSO | BLRI |
| 2. | Dr. N.C. Roy | DLO (Faridpur) | DLS |
| 3. | Dr. S. K. Biswas | V.S. (Baliakandhi) | DLS |
| 4. | Dr. Nils Tuefel | Agricultural Economist | CIMMYT, India |
| 5. | Dr. K.K. Paudal | Agricultural Economist | CIMMYT, India |
| 6. | Mr. Ziaur Rahman | Team Member | BLRI |
| 7. | Mr. Babul Akter | Team Member | BLRI |
| | | | |

## Data collection procedures

PRA team collected information from the farmers through FGD .

Focused groups were divided into four such as:

1. Key informant group
2. Three farmers group discussions (one large farmers group> 2 acres of cultivated land, one small farmer group <2 acres of cultivated land and one having no cultivated land).

## Salient findings

**Basic Description of the villages**

| Village Name | Village Name | | Village Remoteness | | Overall (n=6) |
|---|---|---|---|---|---|
| | RCT (n=4) | Non-RCT (n=2) | Near (n=3) | Far (n=3) | |
| Total Population | 5900 | 1100 | 2800 | 4200 | 7000 |
| Total hh | 790 | 242 | 500 | 532 | 1032 |
| Large farm hh (%) | 39.24 | 21.49 | 18.00 | 51.13 | 35.08 |
| Small farm hh (%) | 44.05 | 35.95 | 56.00 | 28.57 | 42.15 |
| Landless farm hh (%) | 16.71 | 42.56 | 25.40 | 20.30 | 22.77 |
| Land per farm hh (acre) | 1.69 | 1.22 | 1.69 | 1.47 | 1.58 |
| Irrigated land (%) | 96.49 | 100.00 | 100.00 | 94.03 | 97.13 |
| Upland (%) | 54.22 | 52.70 | 59.84 | 47.58 | 53.94 |
| Hh without livestock (%) | 8.23 | 17.36 | 11.00 | 9.77 | 10.39 |

## Assets level by household groups

| Parameters | Large farmers (n=6) | Small farmers (n=6) | Landless farmer (n=6) | Overall (n=18) |
|---|---|---|---|---|
| Land hh (acre) | 5.73 | 1.24 | 0 | 2.66 |
| Irrigated land (%) | 96.53 | 85.16 | 0 | 94.18 |
| Buffalo /hh | 0 | 0 | 0.03 | 0..006 |
| Cattle (ad fem/hh) | 0.90 | 1.30 | 0.32 | 0.32 |
| Small ruminants/hh | 2.72 | 2.12 | 1.48 | 2.18 |
| Hh without livestock | 5.52 | 10.34 | 38.72 | 15.12 |

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## Income composition and distribution of income by household

| Parameters | Large farmers (n=6) | Small farmers (n=6) | Landless farmer (n=6) | Overall (n=18) |
|---|---|---|---|---|
| Crops (%) | 80.17 | 67.17 | 16.00 | 54.45 |
| Livestock (%) | 9.00 | 10.33 | 0.00 | 6.44 |
| Agricultural labour (%) | 0.00 | 5.00 | 67.17 | 24.06 |
| Non-agril. Labour (%) | 0.00 | 3.33 | 12.50 | 5.27 |
| Services (%) | 2.33 | 4.67 | 0.00 | 2.33 |
| Business (%) | 4.67 | 6.17 | 1.83 | 4.22 |
| Others (%) | 3.83 | 3.33 | 2.5 | 3.22 |
| Total | 100 | 100 | 100 | 100 |

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## Selected Prices and market access indicators by remoteness

| Parameters | Unit | Near Village (n=3) | Far village (n=3) | Overall (n=6) |
|---|---|---|---|---|
| Irrigated upland, rent | (Rs/acre) | 13500 | 16564 | 15,032 |
| Irrigated upland, purchase | (Rs/acre) | 275000 | 357666 | 316333 |
| Irrigated lowland, rent | (Rs/acre) | 15166 | 9283 | 12,225 |
| Irrigated lowland, purchase | (Rs/acre) | 203333 | 273333 | 2,38,333 |
| Daily wage (male) | (Rs/8h) | 106 | 100 | 103 |
| Wheat | (Rs/kg) | 14.17 | 14 | 14.29 |
| Paddy coarse | (Rs/kg) | 10.33 | 10.17 | 10.25 |
| Paddy fine | (Rs/kg) | 11.50 | 11.50 | 11.29 |
| Milk, cattle | (Rs/L) | 19.17 | 20 | 19.58 |
| Desi dairy cattle | (Rs/h) | 15833 | 14000 | 14916 |
| Dairy cross-bred | (Rs/h) | 34000 | 33333 | 33,666 |
| Goat | (Rs/h) | 1750 | 2000 | 1825 |
| Travel cost to nearest urban centre | (Rs) | 6.33 | 9.33 | 7.83 |
| Travel cost to | (Rs) | 6.33 | 7.67 | 7.00 |

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## Selected marketing percentages by household group

| Items | Large farmer (n=6) | Small farmer (n=6) | Landless (n=6) | Overall (n=18) |
|---|---|---|---|---|
| Wheat | 40.00 | 16.67 | 0.00 | 18.89 |
| Paddy, coarse | 0.84 | 13.34 | 0.00 | 4.73 |
| Paddy, fine | 8.34 | 0.834 | 0.00 | 3.05 |
| Milk | 29.17 | 50.50 | 52.50 | 44.05 |

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## Cropping pattern by village type

| Season | Crop type | RCT village (n=4) | Non-RCT village (n=2) | Overall (n=6) |
|---|---|---|---|---|
| Kharif | Paddy, coarse (% area) | 57 | 38 | 50 |
| | Paddy, fine (% area) | 41 | 48 | 43 |
| | Fallow ( % area) | 2.0 | 10 | 4 |
| Rabi | Wheat (% area) | 11.0 | 9.0 | 11 |
| | Vegetables (% area) | 71 | 39 | 60 |
| | Other (% area) | 18 | 52 | 29 |
| Spring/Summer | Jute (% area) | 72 | 45 | 63 |
| | Aus (% area) | 24 | 0.00 | 16 |
| | Sesame (% area) | 1.0 | 0.5 | 0.98 |
| | Fallow (%area) | 3.0 | 11 | 6 |

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## Changes in crops by household group

| | Large Farm (n=6) | Small Farm (n=6) | Status |
|---|---|---|---|
| Crops increased | Onion/garlic, wheat, rabi & spring crops, Jute, Wheat, boro | Onion/garlic, Wheat, Jute, boro | ↑ |
| Reasons | Less irrigation, higher productivity | Higher yield compared to competitive crops | |
| Crops decreased | Potato & vegetables, aman rice | Wheat, pulses, sugarcane, aus paddy, oil seed | |
| Reasons | Less competitiveness to onion and garlic | Low yield, higher cost of production, changes in cropping pattern and less competitiveness to onion and garlic | ↓ |

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## Livestock herd by village type

| Item | Unit (No./hh) | RCT | Non-RCT | Overall |
|---|---|---|---|---|
| Deshi dairy cattle (ad female) | /hh | 1.12 | 0.25 | 0.91 |
| Dairy cross-bred (ad female) | /hh | 0.13 | 0.049 | 0.108 |
| Draft bullocks | /hh | 0.038 | 0.074 | 0.046 |
| Sheep (ad) | /hh | 0.00 | 0.033 | 0.007 |
| Goat (ad) | /hh | 2.88 | 1.98 | 2.67 |

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## RCT usage by household group

| RCT | Crop | Share of hh adopting (%) | | Share of area used (%) | |
|---|---|---|---|---|---|
| | | Large farmer (n=6) | Small farmer (n=6) | Large farmer (n=6) | Small farmer (n=6) |
| PTOS | Wheat | 23.33 | 37.00 | 20.33 | 32.00 |
| Reduced tillage | Rice | 0.00 | 17.00 | 0.00 | 0.00 |

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## Relative use of wheat straw by mode of harvesting and household group

| | Manual harvesting | |
|---|---|---|
| | Large farmer (n=6) | Small farmer (n=6) |
| Left on filed (soil mulch) | 3.33 | 0.66 |
| Feed for own animals | 0.83 | 0.00 |
| Household fuel | 79.66 | 85.00 |
| Roofing/construction | 1.66 | 3.33 |
| Other use | 14.5 | 11.00 |
| Total | 100% | 100% |

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## Relative use of paddy straw by mode of harvesting and household group

| | Manual harvesting | |
|---|---|---|
| | Large farmer (n=6) | Small farmer (n=6) |
| Left on filed (soil mulch) | 6.17 | 2.33 |
| Burnt in the field | 3.67 | 0.00 |
| Sold | 19.17 | 0.00 |
| Feed for own animals | 67.17 | 96.00 |
| Household fuel | 2.5 | 1.67 |
| Roofing/construction | 0.00 | 0.00 |
| Other use | 1.67 | 0.00 |
| Total | 100% | 100% |

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## Relative use of dung by season and household group

| | Large farmer (n=6) | | | Small farmer (n=6) | | | Landless (n=6) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Sum | Mon | Win | Sum | Mon | Win | Sum | Mon | Win |
| Used as fuel | 20.83 | 0.00 | 68.33 | 42.5 | 0.00 | 64.17 | 62.50 | 0.00 | 52.63 |
| Used as manure | 75.00 | 66.67 | 31.67 | 57.5 | 100 | 35.83 | 0.00 | 0.00 | 0.00 |
| Sold | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.17 | 33.33 | 25.33 |
| Not used/wasted | 4.17 | 33.33 | 0.00 | 0.00 | 0.00 | 0.00 | 33.33 | 67.67 | 22.04 |
| Total | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % |

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## General overview

- Crop production is the major source of income in large and small farmers both RCTs and non-RCTs villages.
- Livestock is playing a secondary role in addition to main source of income.
- Landless farmers carried out their livelihood by giving agricultural labour.
- Cultivation of paddy still dominating but onion and garlic have been increased very recently.
- Wheat and sugarcane were decreased but the areas of jute was increased due to higher price.
- In RCT villages cultivation of coarse paddy is dominating followed by fine paddy, whereas, in Non-RCTs coverage of fine paddy was increased followed by coarse paddy.
- Vegetables production was increased both in RCTs and Non-RCTs

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## Presentation on Household Survey

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Table 1. Land preparation and seeding Technology used by wheat/rice and RCT/Non-RCT

| Type of Crop | RCT | | Non-RCT | |
|---|---|---|---|---|
| Wheat: | % hh | % Area | % hh | % Area |
| Power tiller use | 32.00 | 6.00 | 75.00 | 33.00 |
| PTOS | 64.00 | 22.00 | - | - |
| | | | | |
| Paddy: | | | | |
| Power tiller use | 93.00 | 68.00 | 79.00 | 76.00 |

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Table 3. Straw Management Practices (%) by wheat/ rice and manual

| Type of crop | RCT | Non-RCT |
|---|---|---|
| Wheat | Manual | Manual |
| Left in field | 5.00 | 3.00 |
| Burn in the field | 2.00 | 5.0 |
| Collection from field by others | 3.0 | 2.0 |
| Taken as household fuel | 85 | 80 |
| Roofing | 3.0 | 6.0 |

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**Cont.**

| Type of crop | RCT | Non-RCT |
|---|---|---|
| Paddy: | Manual | Manual |
| Left in field | 27 | 35 |
| Burn in the field | 3.00 | 7.0 |
| Sold | 0.75 | 1.0 |
| Taken as for feeds | 68.00 | 52.0 |
| Taken as household fuel | 2.0 | 1.0 |

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Table 4. Crop residue use in the household levels

| Type of crop residue | RCT | Non RCT |
|---|---|---|
| Rice straw (Kharif) | | |
| Sold (%) | 9.75 | 33.74 |
| Sold price (Tk /Qtl) | 2230 | 3080 |
| Bought (Qtl) | 1.48 | 0.41 |
| Bought price Tk/(Qtl | 2250 | 2152 |
| Stored (%) | 121 (?) | 102.60 (?) |
| Duration of storage (month) | 11.43 | 6.25 |
| Rice straw (Rabi/boro) | | |
| Sold (%) | 33.33 | 0.00 |
| Sold price (/Qtl) | 600 | - |
| Bought (Qtl) | 1.06 | 0.6 |
| Bought price (TK. /Qtl) | 1100 | 1000 |
| Stored (%) | 101.67 (?) | 130 (?) |

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## Cont.

| Type of crop residue | RCT | Non RCT |
|---|---|---|
| Wheat straw : | | |
| Sold (%) | 2.43 | 4.75 |
| Stored (%) | 97.95 | 95.0 |
| Duration of storage (month) | 4.17 | 2.23 |

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Table 5. Characteristics of RCT/Non RCT Farms

| Items | RCT | Non RCT |
|---|---|---|
| No. of Plots | 13.62 | 8.20 |
| Average Plots size (acre) | 0.20 | 0.14 |
| Irrigated | 99.55 | 99.38 |
| Average days of Flooding | 43.55 | 39.42 |

Table 6. Crop production by wheat/rice and RCT/Non RCT

| Type of crop | RCT | Non RCT |
|---|---|---|
| Wheat : | | |
| Yield/ ha | 2.26 | 1.90 |
| Sold (%) | - | 63 |
| Consumed (%) | 78 | 37 |
| Others use (%) | 22 | (?) |
| Paddy: | | |
| Yield/ha | 5.0 (?) | 5.0(?) |
| Sold (%) | 20 | 25 |
| Consumption (%) | 235 (?) | 313 (?) |
| Other use (%) | 83 (?) | 20 (?) |

Table 7. Livestock assets by different farm categories

| Type of livestock | RCT | Non-RCT | Landless |
|---|---|---|---|
| Cattle (No. /hh) | 2.52 | 1.72 | 1.18 |
| Goat (No./hh) | 2.09 | 1.78 | 1.55 |
| Sheep | 0.14 | 0.00 | 0.00 |

Table 8. Milk production and use by different farm categories

| | RCT | Non-RCT | Landless |
|---|---|---|---|
| Total yield (l/d) | 1.25 | 1.17 | 0.85 |
| Sold (%) | 15.48 | 18.06 | 40.00 |
| Consumption as liquid (%) | 64.29 | 69.44 | 60.00 |
| Processed (%) | 5.95 | 4.17 | 0.00 |
| Price of milk (Taka/L) | 15.71 | 12.27 | 13.00 |

Table 9. Main share of households fuel by different farm categories

| | RCT | Non-RCT | Landless |
|---|---|---|---|
| Wood (%) | 4.0 | 2.0 | 3.0 |
| Straw (%) | 16 | 20.0 | 22 |
| Dung (%) | 50 | 58 | 62 |
| LPG (%) | 0.00 | 0.22 | 0.00 |
| Others | 31 | 19 | 13 |

Table 10. Average household income by RCT/non RCT/ Landless

| | RCT | Non-RCT | Landless |
|---|---|---|---|
| Farm (crop & livestock) (%) | 76 | 54 | 27 |
| Agricultural labour (%) | 7.0 | 17 | 37 |
| Non-Agricultrural labour(%) | 0.00 | 2.0 | 10 |
| Service (%) | 10 | 11 | 4 |
| Business (%) | 7 | 12 | 21 |

## Own observation

- Crop and livestock are the major sources of income in large and small farmers both RCTs and non-RCTs villages.
- Landless farmers carried out their livelihood by giving agricultural labour and small business.
- Cultivation of paddy still dominating followed by wheat .
- RCT villages use of PTOS is significant whereas, in Non-RCTs use power tiller for cultivation of paddy is increased.
- In both RCTs and non RCTs paddy straw is generally used as cattle feeds and wheat straw for household fuel source.

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## Data handling progress

| | Village survey | hh survey | Enterprise 1 | Enterprise 2 | Enterprise 3 |
|---|---|---|---|---|---|
| Data records collected | Finish | Finish | Finish | Finish | Not yet started |
| Data records entered | Finish | Finish | Not yet done | Not yet done | Not yet done |
| Data records cleaned | Finish | Finish | Not yet done | Not yet done | Not yet done |

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Conservation agriculture, livestock & livelihood strategies in the Indo-Gangetic Plains of South Asia: Synergies and tradeoffs

**Cross cutting issues & reporting**

Presented by
Olaf Erenstein (CIMMYT India)

***SLP Project Progress workshop, New Delhi, September 22-25, 2006***

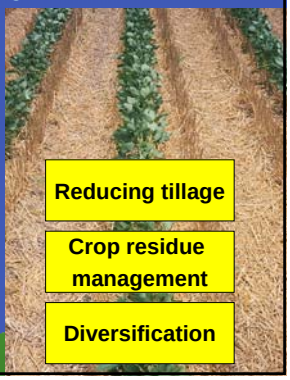
## Outline

- Cross cutting issues
- Planned reports
- Guidelines for cluster discussion

## Resource conserving technologies & Conservation agriculture

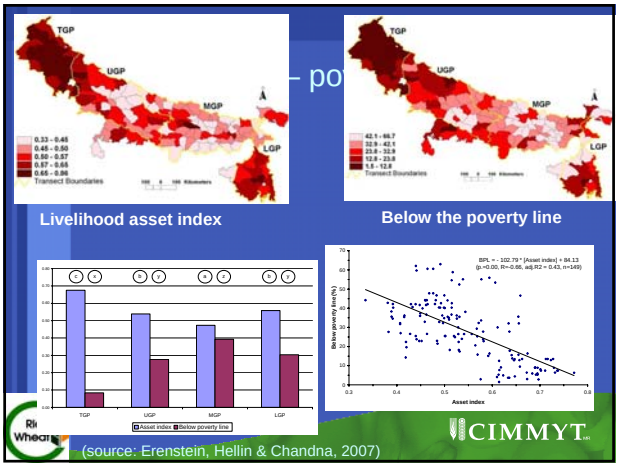
Resource conserving technology (RCT):
enhance resource/input use efficiency

Conservation agriculture:
1. Minimum level of soil movement
2. Maintain soil cover, particularly retention of crop residues
3. Use of sensible, profitable crop rotations




## Equity implications & poverty alleviation

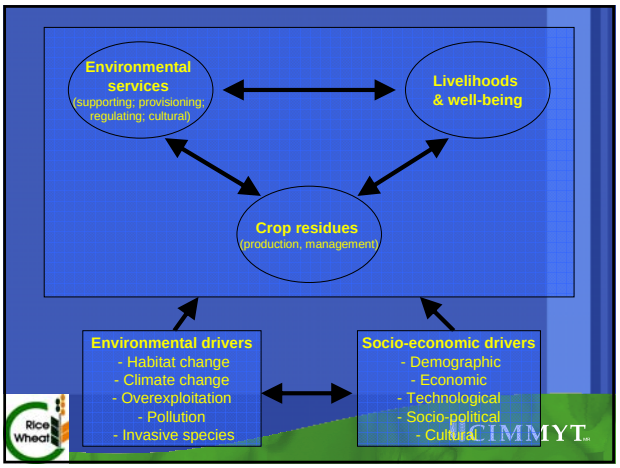
- Spatial diversity IGP
  - NW comparable to middle income countries
  - E poverty pocket
    - » 500 million people, >30% below poverty line, >2/3 <$2/day
- Farm diversity
  - NW 19-42% farms < 1ha, av.farm size 2.1-3.8 ha
  - E 75-80% farms < 1ha , av.farm size 0.8-0.9 ha
- ZT primarily benefited NW and larger farmers




(source: Erenstein, Hellin & Chandna, 2007)

## IGP: Some of the gradients

| | TGP (NW) | LGP (E) |
|---|---|---|
| Farm size | ← | |
| Herd size | ← | |
| Crop yield | ← | |
| Poverty | | → |
| Food/feed | | |
| -Wheat | ← | |
| -Rice | | → |
| Institutional environment | ← | |
| Popn. Density | | → |




## Planned reports


## Project reports/working papers

| | Title | Content | Responsibility | Deadline |
|---|---|---|---|---|
| 1. | Village survey report (9x) | VS | Each site team | Done (9 drafts) |
| 2. | Hh survey report (9x) | HHS/ES123 Min 10 pages + annex tables | Each site team | Mid Nov 08 |
| 3. | Working paper qualitative survey | 20 pager by cluster | Arindam et al | Mid Nov 08 |
| 4. | Working paper residue markets | 20 pager by cluster | Arindam et al | Mid Nov 08 |
| 5. | Working Paper HHS | 10 pager by cluster + annex tables | Nils et al | Mid Jan 09 |
| 6. | Working Paper ES123 | 20 pager by cluster + annex tables | Nils et al | Mid Jan 09 |

## Published reports (1-4)

| | Title | Content | Responsibility | Deadline |
|---|---|---|---|---|
| 1. | Village survey synthesis | 1.Intro<br>2.Methodology<br>3.Cluster I<br>4.Cluster II<br>5.Cluster III<br>6.Cross-cluster analysis & synthesis<br>7.Conclusion | SLP coordination team (Nils et al) | Full draft: Mid Oct. 08<br>Printed: end March 09 |
| 2.-4. | Cluster report I (same for II and III) | 1.Intro<br>2.Methodology<br>3.Site 1 (20 page synthesis VS/HHS/ES123 following similar format)<br>4.Site 2<br>5.Site 3<br>6.Cross-site analysis & synthesis<br>7.Conclusion | Editors: SLP coordination team<br>Authors site chapters: site coordinators + collaborators<br>(+ 1 cluster editor - if possible) | draft site chapters: mid Jan 09<br>Full draft: end Feb 09 |

## Published reports (5)

| | Title | Content | Responsibility | Deadline |
|---|---|---|---|---|
| 5. | Overall synthesis | 1.Intro<br>2.Methodology<br>3.Cluster I<br>4.Cluster II<br>5.Cluster III<br>6.Cross-cluster analysis & synthesis<br>7.Conclusion | SLP coordination team | Full draft: end Mar 09 |


## Working groups on cross-cutting cluster issues: Contrasts, similarities & implications

## Indicators from the inception workshop

- Crop
- Livestock
- Asset indicators


## Most striking contrasts & similarities

| | | | CLUSTER ….. | |
|---|---|---|---|---|
| Category | Indicator | Site 1 | Site 2 | Site 3 |
| Crops | | | | |
| Livestock | | | | |
| Crop-livestock interactions | | | | |
| RCTs/CA | | | | |
| Livelihoods | | | | |
| Environment | | | | |
| Drivers of change | | | | |
| Modifiers | | | | |

## Implications

| | | | CLUSTER ….. | |
|---|---|---|---|---|
| Category | Indicator | Site 1 | Site 2 | Site 3 |
| rice-wheat-livestock systems | Stability | | | |
| | productivity | | | |
| | profitability | | | |
| CA-feed links | | | | |
| CA trade-offs livelihoods | | | | |
| CA trade-offs poverty | | | | |
| CA trade-offs environment | | | | |
| RCTs/CA adoption | | | | |
| RCTs/CA adaptation | | | | |
| R&D | | | | |
| Gaps & needs | | | | |

## Guidelines

- Break into 3 cluster groups
- Agree on moderator/chairperson
- Address discussion points for each session within allotted time
- Report back to plenary

**Conservation agriculture, livestock & livelihood strategies in the Indo-Gangetic Plains of South Asia: Synergies and tradeoffs**

## Qualitative Round of SLP

Presented by
Arindam Samaddar (CIMMYT India)

*SLP Project Progress workshop,*
*New Delhi, September 22-25, 2006*

1

## Study Objective - 1

Understanding Farmers perceptions

- Tilling, Different Tilling Implements
- Seeding/Planting
- Harvesting & Post harvesting practices
- Importance of retaining residue
- Importance of Straw
- Livestock
- Major changes in the villages

2

## Study Objective - 2

Straw market survey

- Market characterization
- Product differentiation
- Who are the sellers?
- Who are the buyers?
- Volume traded
- Trends and variations
- Outlook and perceptions on Residue marketing

3

## Methodology

Farmers perception
- One RCT and nonRCT village
- Focus group discussion

Straw market study
- Straw traders from village level
- Straw traders from near by town/district town
- Straw market in Dhaka, Kolkata, Patna, Varanasi, Delhi, Ludhiana

4

## Major Findings

Tilling
- Tilling makes the land fertile – common perception in all the clusters
- Soil type, crop, cropping pattern, season – determine nature of tilling and tilling implements
- No of passes – Depends on the ownership of machineries

5

## ZT Adoptions

- ZT adoption depends on how it was introduced – learning and unlearning experiences
- Less cost is the main driving force for adoption
- RT is the adaptation – high fuel cost

6

## Residue Retention & Straw Use

- Clean harvested field – Traditional thinking, feel good, aesthetic sense
- Residue retention is good for soil – Common perception
- Residue retention – Rice is preferred over wheat
- Residue retention – no conscious effort in ZT/RT adopted farmers
- Tradition of wheat & Rice – Dictates the straw preference as feed
- Harvesting technology – determines availability and quality of straw

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## Livestock

- Cross breed is increasing except in Dinajpur
- Herd size is reducing, milk production is less
- Productivity of milk, selling of milk increased – market feed, milk cooperative, high milk price
- Priority of milk selling – higher in small and landless farmers
- Livestock keeping – tradition and showcase of status

8

## Major Changes

- More population – less farming land
- More area under cultivation
- Production stagnation
- High input cost – Farming is not profitable option
- Young generation – looking for other income options

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## Straw market findings

Quality of Wheat bhusa

- Particle length
- Threshing mode
- Colour
- Moisture content
- Region of origin

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## Quality of Rice Straw

- Base colour
- Length of the straw
- Thickness of the straw
- Colour
- Softness
- Season of growing
- Type of variety

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## Selling and Buying

- NW – Only wheat straw
- Central – mainly wheat, both rice and wheat in Bihar
- East – Mainly rice straw
- Selling and buying through commission agent in the market
- In city – bought by the dairy mainly
- Price rises before the crop harvest & during monsoon
- Natural calamity(eg.) flooding – high demand and prices

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# Observations on data processing and results

Conservation agriculture, livestock and livelihood strategies in the Indo-Gangetic plains of South Asia: Synergies and tradeoffs

Workshop on project progress
22-24/09/2008
Nils Teufel

1

## What is coming now?

- Technical issues related with data entry, data correction, initial analysis
- Data entry form Enterprise Survey
- Examples of synthesis results
- Outlook on data analysis

2

## Technical issues on data entry, data correction and initial analysis 1

- 0 versus null (" ") entries
  - e.g. amounts, prices
  - placeholders
    - example: milk prices Ballia
- Units
  - weights
    - used: quintal [standard], maund (40kg), kg, bag (50kg)
  - area
    - used: acre [standard], bigha, katha (0.05 bigha), decimal, dhur (0.05 katha), pakhi (excluded)
    - conversion table on village level
    - replacement of database object - example

3

## Technical issues on initial results

- decimals presented
  - usually no decimals required with % values
- additional information to means
  - n
  - se

4

## Technical issues on data collection

- gps data
  - collection?
  - data entry?
  - format used: N dd.ddd° E dd.ddd°
    - e.g. N 28.627044° E 77.161339°
  - format often set: N dd° mm.mmm' E dd.ddd°
    - example
    - gps settings
- residue measurements
  - collected?
  - timing?

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## Technical issues on data analysis

- So far, Access queries
  - advantages: flexible, direct link to data
  - disadvantages: only descriptives, no table design
- Further analysis by statistical package
  - e.g. SPSS
  - temporarily extract data from database for analysis
  - syntax is easy to generate, share and store
  - example

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## Examples of synthesis results (VS) village characteristics

| | | | TGP | UGP | LGP |
|---|---|---|---|---|---|
| village population | RCT | n | 12 | 12 | 12 |
| | nonRCT | n | 6 | 6 | 6 |
| no. of households | RCT | mean | 353 | 355 | 280 |
| | nonRCT | mean | 434 | 310 | 169 |
| large farm hh % | RCT | mean | 18 | 20 | 25 |
| | nonRCT | mean | 22 | 19 | 30 |
| small farm hh % | RCT | mean | 35 | 48 | 43 |
| | nonRCT | mean | 22 | 61 | 29 |
| landless hh % | RCT | mean | 46 | 31 | 32 |
| | nonRCT | mean | 55 | 20 | 41 |
| land per hh [ac] | RCT | mean | 2.99 | 1.23 | 1.12 |
| | nonRCT | mean | 3.13 | 1.21 | 1.36 |
| hh without livestock % | RCT | mean | 29 | 12 | 9 |
| | nonRCT | mean | 16 | 21 | 13 |

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## Examples of synthesis results (VS) assets

| | | TGP | UGP | LGP |
|---|---|---|---|---|
| | n | 54 | 54 | 54 |
| land/hh [ac] | mean | 5.90 | 1.58 | 1.43 |
| irrigated land % | mean | 95 | 88 | 88 |
| ad fem buff/hh | mean | 2.17 | 0.47 | 0.03 |
| ad fem catl/hh | mean | 0.59 | 0.66 | 0.86 |
| small rum/hh | mean | 0.31 | 0.57 | 2.02 |
| hh without livestock % | mean | 17 | 19 | 14 |

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## Examples of synthesis results (VS) income shares

| | | TGP | UGP | LGP |
|---|---|---|---|---|
| | n | 54 | 54 | 54 |
| inc crops % | mean | 47 | 33 | 46 |
| inc livestock % | mean | 13 | 16 | 13 |
| inc ag labour % | mean | 18 | 22 | 22 |
| inc non-ag labour % | mean | 13 | 14 | 9 |

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## Study aims

- Revisit research objectives
- Formulate them into real issues

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## What do we want to learn?

- Who is using ZT?
  - Mainly household survey, VS cluster comparison
- Why, how does it help them?
  - Hypotheses from VS (harvesting, labour price)
- What is the role of straw?
  - Overview VS
- Who is using straw, how?
  - Some VS, mainly ES
- Is straw available for RCT?
  - Burning?

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## How do we want to answer these questions?

- Descriptives highlighting cluster differences
- Econometric analysis of household decisions
  - ZT adoption, straw use, livestock feeding ..
- Household modelling of technology impacts
  - ZT, straw management, livestock production

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## What will we do with the results?

- Reports
- Congress presentations
- But will this be enough?
- Where can we spread the message?
- Where will it make a difference?

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## Possible future steps

- In Delhi we put together all data, once available, to develop overall analysis
- At cluster or site level further analysis is also actively encouraged
  - we cannot lead this analysis
  - but we can provide support (e.g. SPSS syntax)
- We can also share complete survey database
- Coordinate contributions to World Congress
- Coordination at cluster level on collaboration

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## Back to basics

- Data entry of Enterprise Survey
  - builds on household survey data
  - all three enterprise surveys integrated
- Components a bit more complex that queries
  - will be installed in Delhi
- Still (!) not quite complete
  - this exercise will highlight weaknesses

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Conservation agriculture, livestock & livelihood strategies in the Indo-Gangetic Plains of South Asia: Synergies and tradeoffs

**Data analysis issues**

*SLP Project Progress workshop, New Delhi, September 22-25, 2006*

## Significant figures

| | significant figure | | | |
|---|---|---|---|---|
| Original | 1 | 2 | 3 | 4 |
| 123456 | 100000 | 120000 | 123000 | 123500 |
| 12345.6 | 10000 | 12000 | 12300 | 12350 |
| 1234.56 | 1000 | 1200 | 1230 | 1235 |
| 123.456 | 100 | 120 | 123 | 123.5 |
| 12.3456 | 10 | 12 | 12.3 | 12.35 |
| 1.23456 | 1 | 1.2 | 1.23 | 1.235 |

## Example: Relative use of dung by season and household group (4 significant figures)

| | Large farmer (n=6) | | | Small farmer (n=6) | | | Landless (n=6) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Sum | Mon | Win | Sum | Mon | Win | Sum | Mon | Win |
| Used as fuel | 20.83 | 0.00 | 68.33 | 42.5 | 0.00 | 64.17 | 62.50 | 0.00 | 52.63 |
| Used as manure | 75.00 | 66.67 | 31.67 | 57.5 | 100 | 35.83 | 0.00 | 0.00 | 0.00 |
| Sold | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.17 | 33.33 | 25.33 |
| Not used/-wasted | 4.17 | 33.33 | 0.00 | 0.00 | 0.00 | 0.00 | 33.33 | 67.67 | 22.04 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

## Example: Relative use of dung by season and household group (2 significant figures)

| | Large farmer (n=6) | | | Small farmer (n=6) | | | Landless (n=6) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Sum | Mon | Win | Sum | Mon | Win | Sum | Mon | Win |
| Used as fuel | 21 | 0 | 68 | 43 | 0 | 64 | 63 | 0 | 53 |
| Used as manure | 75 | 67 | 32 | 58 | 100 | 36 | 0 | 0 | 0 |
| Sold | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 33 | 25 |
| Not used/-wasted | 4 | 33 | 0 | 0 | 0 | 0 | 33 | 68 | 22 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 101 | 100 |

## Example magnitude/relevance of differences

| | RCT | Non-RCT | Landless |
|---|---|---|---|
| Farm (crop & livestock) (%) | 76 | 54 | 27 |
| Agricultural labour (%) | 7 | 17 | 37 |
| Non-Agricultrural labour(%) | 0 | 2 | 10 |
| Service (%) | 10 | 11 | 4 |
| Business (%) | 7 | 10 | 21 |
| | 100 | 94 | 99 |

## Handling of zero's

| | | Incl zero | | Excl zero | |
|---|---|---|---|---|---|
| | | Large | Landless | Large | Landless |
| Farm | 1 | 70 | 17 | 70 | 17 |
| | 2 | 85 | 0 | 85 | |
| | 3 | 100 | 10 | 100 | 10 |
| Non Farm | 1 | 30 | 83 | 30 | 83 |
| | 2 | 15 | 100 | 15 | 100 |
| | 3 | 0 | 90 | | 90 |
| Average | | | | | |
| Farm | | 85 | 9 | 85 | 13.5 |
| Non Farm | | 15 | 91 | 22.5 | 91 |
| | | 100 | 100 | 107.5 | 104.5 |

## Example: Income composition and distribution of main income by household groups (4 significant figures)

| | Large farmer (n=6) | Small farmer (n=6) | Landless (n=6) | Average (n=12or 18) |
|---|---|---|---|---|
| Crops [%] | 68.67 | 52.17 | ---------- | 60.42 |
| Livestock [%] | 13.83 | 16.17 | 11.67 | 13.89 |
| Agricultural labour [%] | 0.00 | 13.5 | 56.33 | 23.28 |
| non-agricultural labour [%] | 1.67 | 11.67 | 31.17 | 14.83 |
| Services [%] | 5.67 | 0.50 | 00.00 | 2.05 |
| Business[%] | 9.00 | 6.00 | 0.83 | 5.28 |
| Others (%) | 1.17 | 0.00 | 00.00 | 0.39 |

## Example: Relative use of dung by season and household group (2 significant figures)

| | Large farmer (n=6) | Small farmer (n=6) | Landless (n=6) | Average (n=12or 18) |
|---|---|---|---|---|
| Crops [%] | 69 | 52 | ---------- | 60/40 |
| Livestock [%] | 14 | 16 | 12 | 14 |
| Agricultural labour [%] | 0 | 14 | 56 | 23 |
| non-agricultural labour [%] | 2 | 12 | 31 | 15 |
| Services [%] | 6 | 1 | 0 | 2 |
| Business [%] | 9 | 6 | 1 | 5 |
| Others (%) | 1 | 0 | 0 | 0 |
| | 100 | 100 | 100 | 120/100 |