

**CGIAR Systemwide Livestock Programme
Concept Note for Research Grants 2005**

1. Project title

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

2. Lead centre

CIMMYT

3. Collaborating institutions (IARC, NARS, ARI, others)

Rice Wheat Consortium for the Indo-Gangetic Plains (RWC)

International Livestock Research Institute (ILRI)

International Rice Research Institute (IRRI)

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

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6. Cost of the Research Grant ('000 USD, funds requested from the SLP)

	2005/06	2006/07	2006/07	Total
Salaries	30	30	30	90
Services	10	5	5	20
Supplies	5	3	2	10
General expenses	35	65	10	110
Workshops	10		10	20
Training	10			10
Equipment	10			10
Travel	15	10	10	35
Overheads	19	17	10	46
Total	144	130	77	351

7. Matching funds ('000 USD by source)

	CIMMYT	RWC	ILRI	IRRI	ICRISAT	NARS	Total
Salaries	60	30	30	15	15	36	186
Services							0
Supplies							0
General expenses							0
Workshops							0
Training							0
Equipment							0
Travel							0
Overheads	9	4.5	4.5	2.25	2.25	5.4	18
Total	69	34.5	34.5	17.25	17.25	41.4	138

8. Background (Max. 300 words)

In the Indo-Gangetic Plains (IGP) rice-wheat systems dominate crop agriculture. They cover some 13.5 million ha and typically include a significant ruminant livestock component. These crop-livestock systems sit at the core of the livelihood strategies of millions of families on the IGP – 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. Rice-wheat cropping 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 research by the Rice-Wheat Consortium (RWC) on resource-conservation 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. To adopt conservation agriculture practices, farmers face trade-offs between crop and livestock production. It is proposed 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 programmes in support of improved livelihoods and NRM in the IGP.

9. Project purpose (Max. 200 words)

a) State project purpose simply and directly.

- To better understand crop-livestock interactions (CLI) and the 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 general;
- To use this understanding to realign and focus current and future R&D efforts addressing conservation agriculture practices in rice-wheat-livestock systems so as to optimize their benefits for rural livelihoods, poverty alleviation and environmental sustainability.

10. Need/demand for the proposed research

a) State results of any previous consultations (workshop, interviews, surveys, etc) that show that the proposed work responds to a demand by beneficiaries and users of project outputs. If evidence of the demand for the project is not available indicate what activities will be undertaken to ensure that the proposed work is demand-led.

There has been a strong program of research and promotion of RCTs to improve crop productivity in the rice-wheat systems of the IGP (RWC, 2005; Sangar et al., 2005). While the results have been focused on and are very encouraging for improving crop productivity, the external review of the RWC (Seth et al., 2003) emphasized the need to assess RCTs from a system perspective. Consistent with that, recent RWC and regional conferences have highlighted the importance of assessing the impacts of RCTs more holistically, by including the livestock component and considering other livelihood strategies in the evaluation of their impacts on the resource poor, including, e.g., landless livestock keepers (RWC, 2005; Sangar et al., 2005). Applying conservation agriculture practices (zero-tillage, permanent beds and mulching) typically implies the need to retain crop residues on the soil surface. Although the adoption of zero 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 (Sidhu et al., 1998). Another important factor appears to be that crop residues are an important source of fodder.

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. For three reasons the need for a systems and livelihoods approach is particularly critical in the case of crop-livestock interactions in the IGP:

1. **Complexity:** Although conceptually simple and often idealized, disentangling crop-livestock interactions typically proves more complex in practice (e.g. Sumberg, 2003);
2. **Dynamics:** Recent technological and institutional changes in the agricultural systems in the IGP, e.g. mechanization, have had varying direct and indirect implications for the crop and livestock enterprises and their integration and/or separation; and,
3. **Diversity:** The significant diversity of the agricultural systems in the vast IGPs means that the type and extent of crop-livestock interactions are considerable and that their influences on technological change cannot be ignored nor generalized. The significant divergences between, for example, the Western and Eastern IGP – be it in agricultural systems; land use productivity and intensity; poverty; or, traditions (Narang and Virmani, 2001), demands a clear understanding of the factors which drive crop-livestock interactions and how their effects should be addressed by research, extension and policy changes.

It is evident that the interactions between crops and livestock in the IGP is complex, dynamic and diverse – and our knowledge only partial; hence the urgent need to update our knowledge base and to assess the implications for agricultural R&D – particularly with the advent of, and strong advocacy for, conservation farming and RCTs. This proposal addresses that need.

11. Beneficiaries

a) Identify the beneficiaries of the project.

The ultimate beneficiaries of this research-for-development project are the resource poor farmers in the IGP and their peers (e.g. landless livestock keepers) faced with the same challenges, which are to increase crop and livestock productivity while efficiently managing scarce natural resources.

The immediate beneficiaries are researchers, development agents and policy makers working in the domains of rural development, crop and livestock production and conservation agriculture.

b) Explain how the project beneficiaries have been or will be targeted.

The project intends to target the beneficiaries' directly through two ways:

- **Consultation:** The stakeholder group within the RWC will become more inclusive through partnering livestock keepers and the livestock R&D community. The

enlarged group will be consulted through a systematic process of interactive dialogues, participatory approaches and structured surveys. The consultative process with stakeholders will include both immediate and ultimate project beneficiaries at various levels, beginning with farmers, landless livestock keepers, other villagers and market agents/service providers. The extensive RWC network, which has been built on strong participation by national, state, district, NGO and private- sector partners, will facilitate the process.

- *Feedback and Dissemination:* Through: the iterative participatory R&D process with landed and landless families; regular site workshops for R&D staff; end of project workshop; dissemination of results through RWC (including www.rwc.cgiar.org); and, scientific publications (book, project reports, papers) and policy briefs.

The ultimate project beneficiaries (beyond the project sites) will be targeted indirectly by benefiting from the more relevant R&D efforts.

12. Location

a) Indicate the countries in which the proposed project will be implemented.

India, Bangladesh

b) Explain the criteria used to select countries and project sites.

- Rice-wheat systems have high annual biomass production – suggesting ‘surplus’ residual biomass and scope for conservation agriculture practices (Erenstein, 2003).
- The Rice-Wheat Consortium (RWC) emphasizes the research and promotion of Resource Conserving Technologies (RCTs) / Conservation Agriculture in the Indo-Gangetic Plains.
- RWC works in four countries in South Asia (India, Bangladesh, Nepal, Pakistan). To prevent dilution of study resources, the proposed research will target two of the countries (Bangladesh and India), while the results will be shared by the RWC with the other two countries and more broadly as appropriate.
- Most success so far with adoption of RCTs (particularly zero-tillage) in the region has been in India. Size and diversity of Indian IGP allow for a number of potentially relevant contrasts.
- Bangladesh offers a number of additional potentially relevant contrasts with India – including the status/role of cattle and being the most densely populated sizeable country in the world. Bangladesh also has started making advances with another RCT (bed planting).
- Favorable logistics for working simultaneously in both India and Bangladesh (e.g. in terms of border crossing, IARC offices, capability and interest NARS partners).

13. Outputs

a) List the outputs that will be delivered by the project.

1. Accessible *knowledge* of the linkages between conservation agriculture, livestock and livelihood strategies in the IGP. This includes:
 - a. A comprehensive scientific knowledge base and documentation (including 1 book, 5 supporting project module reports and at least 1 peer reviewed journal article), encompassing:
 - Description, typology and quantification of rice-wheat-livestock systems in the IGP, including an assessment of underlying drivers and modifiers and interactions that influence choice and mix of farm enterprises;
 - Assessment of trade-offs resulting from the adoption of conservation agriculture practices, particularly in terms of stability, productivity and profitability of crop and livestock enterprises and impacts on livelihoods and environmental sustainability;
 - b. Policy briefs synthesizing major findings in accessible format;
 - c. Shared awareness and understanding of major implications amongst stakeholders.

2. Well founded *recommendations* developed to realign and focus current and future R&D efforts addressing conservation agriculture practices in rice-wheat-livestock systems so as to optimize their benefits for rural livelihoods, poverty alleviation and environmental sustainability. This includes:
 - a. Policy and institutional recommendations that are both supportive of holistic analyses of rice-wheat-livestock systems and of outcomes resulting in improved livelihoods and sustainable agricultural practices; and,
 - b. Technical recommendations for targeted R&D programs in rice-wheat-livestock systems addressing issues of natural resource and farm productivity, environmental sustainability and improved livelihoods.

14. Research approach and proposed research activities in relation to outputs

(Max. 300 words)

The research will draw on existing datasets, methodologies and literature (e.g. Baltenweck et al., 2003), complemented by significant primary data collection. The data will be collected at selected geographic clusters within the main agro-ecologies and agricultural systems, further stratified in terms of market access, population density and their exposure to RCTs.

Data collection will target:

- *Four system levels*: regional, local/community, farm/household and enterprise.
- *Multiple stakeholders*, including farmers with diverging rural livelihood strategies, landless keepers of ruminant livestock, service providers, market agents and community leaders.

The analysis will assess trade-offs resulting from the adoption of conservation agriculture practices, particularly in terms of stability, productivity and profitability of crop and livestock enterprises, and their impacts on livelihoods, NRM and environmental sustainability.

In order to learn and to extrapolate from site-specific findings, particular attention will be paid to: (i) adhering to a shared research methodology across sites; and, (ii) understanding the underlying system drivers and modifiers that influence choice and mix of farm enterprises. To assess changes over time extensive use will be made of: (i) a retrospective perspective per site, and (ii) contrasting cases at different stages of adoption and maturity of conservation agriculture on farms. These, together with the understanding of system drivers, will allow for prospective assessments from which to derive the implications and develop the policy, institutional and technical recommendations. To assess spatial components, spatial analysis tools (including geo-referencing) will be applied.

Six modules will be implemented:

- 1 Stocktaking (Inception workshop; Data/literature review; Stakeholder consultation; Institutional/policy review).
- 2 Participatory appraisal (Informal surveys).
- 3 Livelihood/Household module (Formal surveys).
- 4 Enterprise module (detailed formal survey crop/livestock production).
- 5 Market module (Survey/assessment of selected markets).
- 6 Feedback/Dissemination module (Analysis and write-up; R&D recommendations; final workshop)

Modules 1-5 feed into the sixth, which delivers the two project outputs (also see Table 1 and Annex 1).

Table 1 Modular research approach of project

Module	Level				Time					
	Regional	Local/- community	Farm/- household	Enterprise	S1	S2	S3	S4	S5	S6
1 Stocktaking	X				X					
2 PRA		X			X					
3 Livelihood/Household survey			X			X				
4 Enterprise survey				X			X	X		
5 Market survey	X	X					X	X		
6 Feedback									X	X

Note: S: Semester, S1: October 2005-March 06,... S6:April 08-September 08

15. Expected impact on beneficiaries (poverty reduction, food security, environmental protection – Max 250 words)

a) State, preferably in quantitative terms, what development impact might be achieved in the short or medium term.

The ultimate beneficiaries (resource-poor families in the IGP and beyond) benefit from more relevant R&D efforts with favorable implications for poverty reduction, food security and environmental protection.

The immediate beneficiaries (R&D agents and policy makers) benefit depending whether they work in the domains of conservation agriculture and livestock in isolation or in cross-cutting fashion. In the case of disciplinary or single commodity work, the results

and recommendations coming from this study should help guide and realign their priorities. In case of cross-cutting work, the results and recommendations should strengthen their arguments. In both cases, the results are expected to enhance the impact of current and future R&D work and thereby help to better target increasingly scarce R&D resources.

b) State what indicators will be used to demonstrate impact.

- Increased relevancy of R&D activities by immediate beneficiaries
- Increased reference to system and livelihood implications by immediate beneficiaries
- Increased adoption of selected conservation agriculture practices by ultimate beneficiaries
- Number of visits to project page on RWC website (www.rwc.cgiar.org)
- Number of downloaded project documents from project page on RWC website (www.rwc.cgiar.org)

c) State what activities will be undertaken during the project's life to assess potential impact either ex-ante or ex-post.

The study is itself a kind of impact assessment of conservation agriculture practices in rice-wheat-livestock systems. It is both ex ante in areas without significant adoption of RCTs and ex post in areas with more significant adoption (like NW India).

In terms of specific activities that will be undertaken:

- Research results and proposals presented at the next RWC planning meeting (spring 2007) will be screened for relevancy and related references.
- Project page on RWC website (www.rwc.cgiar.org) will be monitored for visits and downloads.
- The survey data will be systematically organized and documented and forwarded to CIMMYT headquarters for storage with the socioeconomic data sets.

16. Scaling out strategy (Max. 150 words)

a) Describe the strategy, processes and institutional alliances that can or will be used to upscale findings and ensure that outputs are made available to targeted beneficiaries.

The feedback/dissemination module specifically addresses the scaling out strategy and includes:

- Feedback to the R&D community through scientific publications (book, project reports, papers) and policy briefs; end of project workshop; dissemination of project results through RWC and at regional and international conferences.
- Results from the project will be uploaded on the RWC website (www.rwc.cgiar.org) - with a direct link to the SLP website.

In addition the consultation, dialogue and collaboration with immediate beneficiaries during project implementation will expose them to system-level and livelihood implications.

17. Risks and assumptions associated with output delivery (Max. 200 words)

The project foresees the recruitment of a regional project scientist of good caliber for the duration of the project. It is expected that the person can be timely identified and participate without staff turnover.

The project implementation assumes research field activities to get under way quickly and to be more or less completed within the first two years of the project along with the delivery of interim outputs – allowing the third year for finalizing data analysis, reporting, book publishing and the final workshop.

For successful project outcomes, it assumes that disciplinary/commodity-based researchers and development agents will adopt and effectively apply an holistic systems perspective to their understanding of the objectives of landed and landless families and related environmental issues and to the development of technological and policy interventions.

18. Systemwide nature of proposed project

a) State why this is a systemwide activity and why the SLP is the appropriate mechanism for collaboration and funding

The research clearly cuts across the boundaries of any individual CG centre – involving various commodities (livestock, rice, wheat, other crops), systems (irrigated and rain-fed), natural resource management and livelihoods. Although eco-regional in focus the project will generate lessons applicable to other eco-regions. The SLP is the most appropriate mechanism for collaboration and funding for this research proposal in view of the focus on food-feed crops within the context of sustainable use of land, water and soil nutrients in crop-livestock systems. Furthermore, the proposed research neatly fits the subject matter of the research grants for 2005: targeting the strategic interface between the demand for feed resources and the sustainability of conservation agriculture strategies.

b) State what inter-center synergies are expected

The RWC, CIMMYT and IRRI have made significant advances at the crop/plot level. The proposed research would actively incorporate ILRI and ICRISAT and move beyond a pure crop perspective to a genuine system and livelihood perspective.

19. Specific capabilities and roles of partner institutions and key staff (Max.300 words)

Olaf Erenstein (CIMMYT): System perspective; system drivers and modifiers; interdisciplinary (agro-economist & agronomist); conservation agriculture; crop-livestock interactions.

W. Thorpe (ILRI): livestock (particularly dairy) enterprises in smallholder crop-livestock systems; production-to-consumption market chain approach; crop-livestock interactions; research and development linkages.

Raj K. Gupta (CIMMYT/RWC): agronomy; conservation agriculture; natural resource management; rice-wheat systems; facilitation & networking.

J.K. Ladha (IRRI): soil science; conservation agriculture; natural resource management; rice-wheat systems; facilitation & networking.

Parthasarathy Rao (ICRISAT): livestock production systems; crop-livestock interactions.

20. Contribution to CGIAR goals

- | | |
|---------------------------------|---|
| a) Germplasm enhancement | Yes (indirectly, by highlighting implications for...) |
| b) Natural resources management | Yes |
| c) Policy analysis | Yes |
| d) NARS institutional capacity | Yes |

21. References

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Annex 1 - Research modules

1	Stocktaking module
	<ul style="list-style-type: none">- Inception workshop: Gathering of main project partners and selected stakeholders to plan and implement project.- Review of existing information, including published and grey literature and data sets.- Stakeholder consultation: Identification and consultation of main stakeholders at federal, state and intrastate levels, including public sector, non-governmental organizations and private sector. Includes their assessment of constraints and opportunities and research needs.- Institutional and policy review: Assessment of (dis)incentives for conservation agriculture and ruminant livestock and the identification of promising policy adjustments.
2	Participatory appraisal module
	<ul style="list-style-type: none">- Informal survey using participatory appraisal (PA) techniques to identify key issues at community level in relation to conservation agriculture, livestock and livelihoods. Emphasis on institutions, drivers and modifiers.- Appraisal will be targeted at contrasting bio-physical and socio-economic settings in the IGP, building on the on-going ILRI-CIMMYT crop-livestock interaction scoping study in India. Appraisal will assist in identifying key issues and key sites for subsequent formal surveys.
3	Livelihood/Household module
	<ul style="list-style-type: none">- Formal rural household survey to assess livelihoods (assets, strategies, outcomes) and role/implications of conservation agriculture and livestock in selected areas.- Encompasses diverging livelihood strategies, including crop-based, mixed and livestock-based systems and different levels and types of reliance on non-agricultural sector.
4	Enterprise module
	<ul style="list-style-type: none">- Detailed formal survey to generate input-output figures and enterprise budgets for main summer crop [rice, other], winter crop [wheat, other], ruminant livestock [dairy cattle, buffalo, oxen] and fodder crops.- Subset/sample of households covered in livelihood survey, with data collected during multiple visits (at least seasonally).
5	Market module
	<ul style="list-style-type: none">- Targeted survey of selected markets – particularly crop residues, green fodder, manure and selected agricultural service providers (zero-tillage, combining). Focus on agents, roles, transactions, spatial flows and dynamics.

- Rapid assessment of selected markets and their imperfections, and implications for conservation agriculture and livestock, including capital (risk); labor (mechanization); land (incentives for conservation); livestock products.

6 Feedback/dissemination module

- Analysis and write-up: This encompasses (i) project reports documenting project modules; (ii) final comprehensive book; (iii) policy briefs; and (iv) synthesis paper in peer reviewed journal.
- Research & development recommendations: Will be included in project publications, synthesized in policy briefs and actively disseminated in networks.
- End of project workshop: Gathering of main project partners and selected stakeholders – including policy makers and advisers - to present and discuss results of project. Will also identify follow-up activities and strategy to implement recommendations.

Annex 2 – Qualifications and experience project scientist

To implement the project under the leadership and guidance of the principal investigators, a regional project scientist will be contracted for the duration of the project.

The qualifications and experience of the ideal candidate for this position include:

- Recent PhD in agricultural economics or related field;
- Young, dynamic, flexible, mobile and ability to work in both field and office;
- Conversant in major language groups of the IGP (Hindi, Bangla, ...);
- Good social skills and team worker;
- Preferably experience with, but at least exposure to, interest in and knowledge of several of the following:
 - o Systems perspective, livelihoods, poverty alleviation, gender issues,
 - o Rural surveys,
 - o Participatory approaches,
 - o Statistical analysis,
 - o Spatial analysis,
- Good writing and synthesizing skills;
- Good computer skills.

In case of equal merit, female candidates will be preferred to facilitate interaction with female target group.