

PROJECT COMPLETION SUMMARY SHEET

DATE: 28th Feb 2006.

TITLE OF PROJECT: Promotion of rainfed *rabi* cropping in rice fallows of eastern India and Nepal

R NUMBER: R8221

PROGRAMME: Plant Sciences Research Programme

PROGRAMME MANAGER (INSTITUTION): J.R. Witcombe, CAZS Natural Resources (CAZS-NR), University of Wales, UK

SUB-CONTRACTOR (if relevant):

PROGRAMME PURPOSE: Methods to optimise cropping systems by agronomic means developed and tested

PRODUCTION SYSTEM: Semi-arid production system

BENEFICIARIES: Resource poor farmers and their families in various *Terai* and foothill districts of Nepal and in remote, marginal upland areas of five states in eastern India; researchers, extension workers, traders, seed companies, small scale industries.

TARGET INSTITUTION: **Nepal:** NARC, DADOs, NGOs (FORWARD). **India:** Dept. of Agric., NGOs (Catholic Relief Services, Gramin Vikas Trust).

GEOGRAPHIC FOCUS: Areas of southern- and eastern Nepal and eastern India with large areas of rice-fallows.

	<u>Planned</u>	<u>Actual</u>
START DATE:	1st July 2003	1st July 2003
FINISH DATE:	31st January 2006	

1. Project Purpose

Methods to optimise cropping systems by agronomic means developed, tested, piloted and promoted in the SA production system.

2. Outputs:

This project followed a holistic approach to overcome the technical and social problems associated with rice-fallow systems through participatory action research and development activities. Drawing on the experiences and learning from the pilot phase of the project (R8098), approaches and activities differed in Nepal and in India because the incidence of, and attitudes towards, growing crops after rice were different.

1. Technical and social solutions to overcome constraints to rainfed rabi cropping in rice fallows tested, demonstrated and promoted.

Nepal

- Nearly 30,000 farmers were made aware of RRC technologies, far exceeding the original target of 500.
- One thousand one hundred farmers (including 380 women) were organized into 58 self-help groups, seven of which were organised into a cooperative to implement seed production for promising crop varieties identified during the project.

- Eight varieties of rice (Barkhe 1027, Barkhe 2014, Barkhe 3004, Sugandha-1, BG 1442, Panta Dhan 10, PR 101 and OR 367), eight varieties of chickpea (KPG 59, Awarodhi, Tara, GNG 469, Jhapa Local, ICC 37, ICCV 2 and KAK 2), four varieties of Mungbean (NM 94, VC 6372, VC 3960 and NM 92), two varieties of lentil (ILL 2580 and ILL 7723), one variety of pigeon pea (ICP 7035) were tested, selected and adopted by farmers.
- Two mungbean varieties-NM 94 (Kalyan) and VC 6372 (Prateeksha) have been officially released jointly with NGLRP and CAZS-NR and the release process of chickpea cultivar KPG 59 is ongoing.
- Six production units (one in Chitwan; four in Saptari; and one in Siraha) have been established for recycling the biopesticide HNPV at the local level.
- Six multipurpose tree nurseries have been established in Jhapa.
- Appropriate technologies, such as molybdenum loading through seed priming, use of urine sprays, IPM and IPNS approaches were demonstrated, verified and promoted among farmers.
- Fifty leader farmers were trained in marketing and processing of legume products.

India

- Package for growing a second crop (chickpea) on residual soil moisture after rice tested, adapted and adopted by farmers in representative rice fallow areas in Chattisgarh, Orissa, Jharkhand, West Bengal and Madhya Pradesh states.
- This package consists of: minimum tillage, early sowing, short duration chickpea cultivars (ICCV 2 + KAK 2 + JGK-1) and seed priming. Planting in large blocks, sometimes involving land sharing, allowed cost-effective protection of crops from free-grazing animals. Substantial changes in social organisation were sometimes necessary before RRC technology could be adopted.
- Analysis of more than 1000 soil samples from farmers' fields confirmed low levels of N, P, B, S, Mo and Zn and rhizobia.
- A positive response to added Mo was confirmed *in vitro* and in farmers' fields and provision during seed priming was validated and added to the RRC package. Molybdenum application increased chickpea grain yield by about 30 per cent and was as good as soil application in increasing yield. The main advantages of Mo application through seed priming are ease of application, uniform application and cost saving by about 30-fold.
- Although yields were invariably low for the first year that farmers tested the package, making their own mistakes proved to be a valuable learning experience and farmers were always enthusiastic about growing chickpea in subsequent years.
- In order to maximise the potential of the whole system, farmers tested two short-duration varieties of rice (Ashoka 200-F and Ashoka 228) against the traditional long duration cv.Swarna. Informal feedback and demands for more seed suggest that the two early varieties (bred under the auspices of another PSP-funded project) were preferred by farmers and allowed them to sow post-rice crops earlier. Eighty-eight trials of chickpea grown following harvest of either Ashoka or Swarna are ongoing.
- Since soil phosphorus is known to be limiting, 88 trials are underway to look at the effect of loading chickpea seeds with extra P during the seed priming process. This is a modification of work on priming seeds with P carried out under R7438.

2. Expose other institutions to RRC technologies

Nepal.

- The project employed multi-stakeholders' initiatives in project planning, monitoring and evaluation. At least 20 institutions: 5 NGOs, 10 District Agriculture Development Offices (DADO), 5 CBOs have been made aware of various RRC technologies and some have already adopted the technologies in their own programmes.
- Over 100 professionals from governmental and non-governmental sectors participated in joint monitoring, trainings, exposure visits and workshops related to RRC project activities.
- Some farmers' groups were able to attract funds from district level line agencies, such as APPSP (Agriculture Perspective Plan Support Project), DADOs for scaling up of RRC technologies.
- The RRC technologies published in technical bulletins, proceedings, booklets etc were distributed to a wide range of professionals.

India

- The work in India was publicised at many meetings, etc (see Publications). In addition, many new implementing partners were recruited each year by CRS.
- Twenty four staff of CRS-India program and three senior staff of Orissa Dept. of Agriculture, were trained in RRC technologies.
- CRIDA staff, along with farmers of a selected village, were exposed to RRC technologies and also provided with chickpea seed/Rhizobium/other materials for planting chickpea after rice.
- Four in-service trainees from Mozambique and Malawi were trained in RRC technologies.

3. Income of participating farmers increased following adoption of rain fed rabi cropping technologies

Nepal.

- Livelihoods information was collected in 232 sample households.
- The overall benefits of cropping systems increased greatly after the adoption of RRC technologies in the project areas. Maximum benefits were obtained in legume-based cropping systems (up to \$1836 per hectare with B:C ratio of 2.1:1; against \$440 with B: C ratio 2.3:1 in rice fallow system).
- Increased availability of grain legumes and their by-products provided raw materials for local enterprises, and contributed to improved human and animal nutrition.

India

- A comprehensive impact analysis is underway.

4. Awareness of the opportunities for successful rainfed rabi cropping increased

Nepal.

- A wide range of stakeholders, from farmers at the grassroots level to planners at the centre are aware of opportunities of RRC technologies.
- In addition to the implementation of field activities in a participatory manner, the project also adopted some extension tools, such as folk song competitions, exposure visits, publications etc, to disseminate the successful technologies and learning to a wide range of stakeholders.
- Final community level workshops were organized in all the sites involving all concerned stakeholders.
- About 30,000 farmers across the Terai and foothills of Nepal have been made aware of various RRC technologies.

Contribution of Outputs to Project Goal

The project has increased the access of farmers to relevant information, appropriate crop varieties and other technologies directly relevant to marginal farm communities in the rice-fallow system. This has increased crop productivity as well as the technical capabilities and managerial skills of poor farm communities and hence income. Some of the outputs of the project have been institutionalised: two mungbean varieties have been officially released – the first time that varieties have been recognised in Nepal on the basis of participatory data collected and presented by NGOs - and one variety each of chickpea and pigeonpea are in the process of release. In India, CRS have adopted RRC technology as the central core of their plans to develop thousands of poor rural communities.

Publications:

Nepal

- Khanal, N.N., K.D Joshi, D. Harris and S.P Chand. 2004. Effect of micronutrient loading, soil application and foliar sprays of organic extracts on grain legumes and vegetable crops in marginal farmers' condition in Nepal' In P Anderson, J K Tuladhar, KB Karki and S L Maskey (Eds). *Micronutrients in south Asia and South East Asia*. Proceedings of an International Workshop, 8-10 September, Kathmandu, Nepal: International Centre for Integrated Mountain Development (ICIMOD) and Soil Science Division, Nepal Agricultural Research Council (NARC), pp 239
- Khanal, N.N., D. Harris, K.D Joshi, L. T Sherpa, S.Thapa and R. K Giri 2004. Potentiality of integrating Mungbean in cereal fallows in the low hills and terai of Nepal Proceedings of the 24th National Summer Crops Workshop (Grain Legumes). National Grain Legumes Research Program, Nepal Agriculture Research Council. pp 10.
- Khanal, N. N., K.D Joshi, D. Harris. 2004. Working with systems perspective: An innovative approach to improve overall systems productivity in Nepal Paper presented in the Sharing Workshop on Participatory Research Methodology for Improving the Access of Farmers to New Crop Germplasm and Enhancing Food Security in High Barind Tract of Bangladesh, 9-10 October 2004.
- Khanal, N.N., D. Harris, Lakpa T Sherpa, Ram K Giri and Krishna D Joshi. 2004. Testing and promotion of Mungbean in cereal fallows in the low hills and terai agroecosystems of Nepal. Paper presented in the Final Workshop and Planning Meeting, 27-30 May 2004 at Punjab Agricultural University, India.
- Khanal, N.P. and N.N. Khanal. 2005. Bridging the gap: Role responsibilities and approaches in scaling up of IPM of chickpea in Nepal. In S Pande, PC Stevenson, RK Neupane and D Grzywacz (Eds). *Policy and strategy for increasing income and food security through improved crop management of chickpea in rice fallows in Asia*. Proceedings of the national workshop on policy and strategy on promotion of IPM of chickpea in Nepal, 16-17 November 2004, Kathmandu, Nepal. Pathancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for Semi-arid Tropics (ICRISAT), 252 pp ,
- Khanal, N.N., K.D. Joshi and D. Harris. 2005. Rabi cropping and promoting winter legumes in rice fallows in Nepal. In S Pande, PC Stevenson, RK Neupane and D Grzywacz (Eds). *Policy and strategy for increasing income and food security through improved crop management of chickpea in rice fallows in Asia*. Proceedings of the national workshop on policy and strategy on promotion of IPM of chickpea in Nepal, 16-17 November 2004, Kathmandu, Nepal. Pathancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for Semi-arid Tropics (ICRISAT), pp 252

- Khanal, N.P., N.N. Khanal, K.D. Joshi, L.T. Sherpa, R.K. Giri and S. Thapa. 2004. Participatory varietal selection in rice: FORWARD's experiences on upland and medium water regimes of central and western terai of Nepal. Proceedings of National Summer Crop Workshop, Organized by Nepal Agriculture Research Council, Khumaltar Lalitpur Nepal from 28-30 June 2004.
- Khanal, N.P.; N.N. Khanal, G.B.Gurung, S.Thapa, K.P.Gupta, L.T.Sherpa, K.D. Joshi, D. Harris, JVDK Kumar Rao and R. Darai. 2005. Mungbean (*Vigna radiata* (L.) Wilczek) in cereal fallows: Experience of farmers' participatory research and development activities in foot hills and terai of Nepal. Proceedings of 4th International Food Legumes Research Conference (Abst.), 18-22 October 2005, New Delhi. (Accepted for publication).
- Khanal N P, Yadav N K, Khanal N N, Derai R, Joshi S, Neupane R K, Sherpa L T, Thapa S, Gupta K, Neupane R, Pokherel D N, Sah, R P, Adhikari B N, Joshi K D and Harris D (2006). A proposal for the release of Mungbean varieties NM 94 and VC6372 Jointly submitted by National Grain Legumes Research Programme (NGLRP), Rampur Chitwan, Nepal, Forum for Rural Welfare and Agricultural Reform for Development (FORWARD), Bharatpur, Chitwan, Nepal, and CAZS-Natural Resources, University of Wales, Bangor, UK. www.narc-nepal.org, forwardnepal.org, www.dfid-psp.org
- Khanal, N.P; N.N. Khanal, S.Thapa, K.P.Gupta, L.T.Sherpa, K.D. Joshi, D. Harris and JVDK Kumar Rao. Potential of Helicoverpa Nucleopolydovirus for the management of chickpea pod borer in Nepal. Paper presented in national workshop on food security and sustainable agriculture, 13-15 December 2005, Kathamandu, Nepal (In press).

India

- Harris, D., Breese, W.A., and Kumar Rao, J.V.D.K. (2005). The improvement of crop yield in marginal environments using 'on-farm' seed priming: nodulation, nitrogen fixation and disease resistance. *Australian Journal of Agricultural Research* 56 (11): 1211-1218
- Kumar Rao, J.V.D.K., Harris, D., Joshi, K.D., Khanal, N., Johansen, C. and Musa, A.M. 2005. Promotion of rainfed rabi cropping in rice fallows of eastern India, Bangladesh, and Nepal: An overview. Pages 64-75 in Pande, S., Stevenson, P.C., Neupane, R.K. and Grzywacz, D.(eds.). "Policy and strategy for increasing income and food security through improved crop management of chickpea in rice fallows in Asia". Summary of a NARC-ICRISAT-NRI Workshop, 17-18 November 2004, Kathmandu, Nepal. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 252 pp.
- Kumar Rao, J.V.D.K. and Harris, D. 2005. Role of legumes in N economy/N use in cropping systems/soil health. Proceedings of Brainstorming Session on Policy Options for Efficient Nitrogen Use – Sponsored by National Academy of Agricultural Sciences at NASC Complex, DPS Marg, New Delhi, 4-5 October 2005. (www.ipu.nic.in/scon/nitrogen.html) (http://www.ipu.nic.in/scon/conservation_of_nature/Kumar%20Rao.pdf)
- Kumar Rao, J.V.D.K., Harris, D., Mahesh, K. and Gupta, B. 2005. Promotion of rainfed rabi cropping of chickpea (*Cicer arietinum* L.) in rice fallows of eastern India. Pages 98-99, in Abstracts – '4th International Food Legumes Research Conference – Food Legumes for Nutritional Security and Sustainable Agriculture' held at New Delhi, India, 18-22 October 2005. (Editor: Kharkwal, M.C.).
- Siddique, K.H.M., Johansen, C., Kumar Rao, J.V.D.K. and Ali, M. 2005. Role of legumes in sustainable cropping systems. Page 31, in Abstracts – '4th International Food Legumes Research Conference – Food Legumes for Nutritional Security and Sustainable Agriculture' held at New Delhi, India, 18-22 October 2005. (Editor: Kharkwal, M.C.).
- Johansen, C., Musa, A.M., Kumar Rao, J.V.D.K., Harris, D. and Shahidullah, A.K.M. 2005. Alleviating molybdenum deficiency and inadequate nitrogen fixation of chickpea in acid soils of Bangladesh. Page 68, in Abstracts – '4th International Food Legumes Research Conference – Food Legumes for Nutritional Security and Sustainable Agriculture' held at New Delhi, India, 18-22 October 2005. (Editor: Kharkwal, M.C.).
- Padma Parvathi, K. 2004. Enumeration of native chickpea rhizobial populations with reference to growing chickpea in rice-fallows. Dissertation work submitted, in partial fulfillment for the award of degree of M.Sc (Environmental Biotechnology), to the Centre for Environment, Institute of Science & Technology, Jawaharlal Nehru Technological University, Hyderabad, A.P., India. 77 pp.
- Kumar Rao JVDK, D Harris, AM Musa, C Johansen, KD Joshi, N Khanal, JS Gangwar and K Bhattacharyya. (2003). Promotion of rainfed rabi cropping of chickpea in rice fallows of South Asia. Pages 83-84 in Abstracts: International Chickpea Conference (editors: R.N.Sharma, M.Yasin, S.L.Swami, M.A.Khan and Ajit J. William). January 20-22, 2003. Indira Gandhi Agricultural University, Raipur, Chattisgarh, India.
- Kumar Rao, JVDK. 2003. Utilizing rice-fallows in South Asia: a potential for legumes. Pages 249-251 in RWC-CIMMYT. (2003). Addressing Resource Conservation Issues in Rice-Wheat Systems of South Asia: A Resource Book. Rice-Wheat Consortium for the Indo-Gangetic Plains - International Maize and Wheat Improvement Center. New Delhi, India. 305 pp.
- Gaur, P.M., Jagdish Kumar., Kumar Rao, J.V.D.K., Rao, B.V. and Sandhu, J.S. 2003. Short duration chickpea varieties for crop diversification opportunities. Pages 41-42, in Abstracts - National Symposium on Pulses for crop diversification and natural resource management held at Indian Institute of Pulses Research, Kanpur-208024, U.P., India, during 20-22 December 2003. (edited by Shiv Kumar, Basu, P.S., Singh, K.K., Naimuddin and Brahma Prakash).
- Kumar Rao, J V D K., Harris, D., Johansen, C. and Musa, A M. 2004. Low-cost provision of molybdenum (Mo) to chickpeas grown in acid soils. Abstracts: in CD of IFA International Symposium on Micronutrients, 23-25 Feb 2004, New Delhi, India (International Fertilizer Industry Association – publications@fertilizer.org – www.fertilizer.org).
- Johansen, C., Musa, A M., Kumar Rao, J V D K., Harris, D., Ali, M Y., and Lauren, J G. 2004. Molybdenum response of chickpea in the High Barind Tract of Bangladesh and in Eastern India. Pages 52-54, in Book of Abstracts – "Micronutrients in South and South East Asia" An International Workshop on "Agricultural Strategies to Reduce Micronutrient Problems in Mountains and Other Marginal Areas in South and South East Asia" held at Kathmandu, Nepal, during 8-10 September 2004 (Eds. Tuladhar, J.K., Karki, K.B., Anderson, P., and Maskey, S.L.)

1. Internal Reports:

Technical bulletins

- i. On-farm seed priming for enhancing crop productivity in rainfed cropping systems
- ii. Increasing nitrogen use efficiency in rice based cropping systems
- iii. Participatory research and development process: An experience of RRC
- iv. Appropriate technology for growing chickpea in rice fallows
- v. Use of cattle urine for increasing productivity of crops
- vi. Role of biogas technology for maintaining soil productivity
- vii. Mungbean: A potential crop for Terai and Foot Hills
- viii. Chickpea production technology
- ix. Technology for local recycling of HNPV (Helicoverpa Nuclear Polyhedrovirus) for the management of chickpea pod borer
- x. Integrated management of chickpea disease
- xi. Integrated management of rice diseases

Poster:

"Burn biogas, not the dung cakes; increase crop productivity by utilizing animal wastes".

"Promotion of Mungbean in cereal fallows in the low hills and terai agroecosystems of Nepal" has been sent to AVRDC for the publication in the proceedings of the Final Workshop and Planning Meeting to be held during 26-30 May 2004 at Punjab Agricultural University, India.

Other reports

Khanal, N.N. 2002. Intensifying Rice Fallows through Rainfed Winter Cropping: Results of Chickpea, Field pea and Buckwheat Trials in the Eastern Terai of Nepal. *FORWARD Working Paper No. 1 & P.*

Khanal, N.N., S. Thapa, R. K. Giri, L.T. Sherpa, K. Thapa, S. Chaudhari, B. Rayamajh. 2003. Promotion of Rainfed *Rabi* Cropping in Rice Fallows of Nepal: Review of achievements from July 2002-June 2003. *FORWARD Working Paper No.*

Kumar Rao, J.V.D.K., and Harris, D. 2005. Growing chickpea in rice fallows. 4 pp.

2. Other Dissemination of Results:

Kumar Rao, J V D K. 2004. A quick – growing crop for the winter season. Radio interview on the topic given for BBC Radio (AGFAX).WREN media-
<http://www.agfax.net/> December 2004.

Harris, D., and Kumar Rao, J V D K. 2004. Rainfed rabi cropping in rice fallows – Chickpea in Eastern India. A Development brief prepared by the Centre for Arid Zone Studies, University of Wales, UK; Catholic Relief Services, India; Gramin Vikas Trust, India; ICRISAT, India. 7 pages.

6. Follow-up indicated / planned:

The information and technologies generated by the project in Nepal are being scaled up through various projects implemented by FORWARD in various districts. Some researchable constraints, such as standardization of priming duration in chickpea and mungbean, and determination of population density in maize mungbean inter/mixed cropping systems are being evaluated in the National Grain Legumes Research Program. Variety release proposals for other crop varieties are being prepared. In India, the package (short duration rice followed by short duration chickpea as described above) has been adopted by CRS at the centre of their drive to promote crop-related prosperity in rural communities. Their stated aim (with appropriate technical backup) is to scale up the RRC approaches eventually in 8,000 villages.

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