PROLINNOVA
PROmoting Local INNOVAtion
in ecologically-oriented agriculture and natural resource management

Farmer-led Joint Research

Experiences of PROLINNOVA Partners

compiled and edited by

Chesha Wettasinha and Ann Waters-Bayer

With contributions from partners in the PROLINNOVA Global Partnership Programme

A publication in the series on Promoting Local Innovation

Farmer-led Joint Research:

Experiences of PROLINNOVA partners

compiled and edited by

Chesha Wettasinha and Ann Waters-Bayer

A publication in the series on
PROmoting Local INNOVAtion (PROLINNOVA)

with contributions from partners in the PROLINNOVA Global Partnership Programme

PROLINNOVA International Secretariat
October 2010

First published October 2010 by
International Institute of Rural Reconstruction (IIRR)

Citation: Wettasinha, Chesha & Waters-Bayer, Ann (eds). *Farmer-led joint research: experiences of PROLINNOVA partners.* A booklet in the series on Promoting Local Innovation (PROLINNOVA). Silang, Cavite, Philippines: IIRR / Leusden: PROLINNOVA International Secretariat, ETC EcoCulture. October 2010.

ISBN: 1-930261-26-8

PROLINNOVA International Secretariat
ETC EcoCulture
POB 64, 3830 AB Leusden
The Netherlands
☎ +31 33 4326000
prolinnova@etcnl.nl

Design and layout by: Lilibeth T. Sulit - Villela, IIRR

Cover photo: Saraswathy Adhikari, farmer researcher from Begnas in Nepal, discussing her experiment on coffee breeding with the Director of LI-BIRD, the lead NGO of PROLINNOVA in Nepal (photo: Ann Waters-Bayer)

Printed in the Philippines by Twin A Printing Press, Caloocan City, Philippines

Contents

Annexes

List of acronyms

AARC	Awassa Agricultural Research Centre
ACDEP	Association of Church Development Projects
AFIRD	Agency for Integrated Rural Development
ARC	Agricultural Research Council
ARD	Agricultural Research and Development
ARI	Animal Research Institute
ASE	AgriService Ethiopia
BoARD	Bureau of Agriculture and Rural Development
CAP	Church Agricultural Project
CEDAC	Centre d'Etude et de Développement Agricole Cambodgien
CIP	International Potato Centre
CSIR	Council for Scientific and Industrial Research
DA	Development Agent
FAIR	Farmer Access to Innovation Resources
FARMER	Farmer Responsive Mechanisms in Research and Extension
FLG	Farmer Learner Group
FSG	Farmer Support Group
FTC	Farmers Training Centre
HAPID	HIV/AIDS and PID
IIRR	International Institute of Rural Reconstruction
IK	indigenous knowledge
ISD	Institute for Sustainable Development
IST	International Support Team
KZN	KwaZulu-Natal
LEISA	Low-External-Input and Sustainable Agriculture
MoFA	Ministry of Food and Agriculture
MoU	Memorandum of Understanding
NARP	National Agricultural Research Programme
NGLWG	Northern Ghana LEISA Working Group
NGO	non-governmental organisation
NRM	natural resource management
NSC	National Steering Committee
NTH	Northern Typical Highlands
OoARD	Office of Agriculture and Rural Development
PELUM	Participatory Ecological Land Use Management
PID	Participatory Innovation Development
PNSA	Prek Leap National School of Agriculture
POG	PROLINNOVA Oversight Group
PROFEIS	Promoting Farmer Experimentation and Innovation in the Sahel
PROFIEET	Promoting Farmer Innovation and Experimentation in Ethiopia
PROLINNOVA	Promoting Local Innovation in ecologically oriented agriculture and NRM
SSI	Smallholder Systems Innovation
UPWARD	Users' Perspectives Within Agricultural Research for Development
UWR	Upper West Region

Acknowledgements

This booklet carries stories of many men, women and communities who, through their own creative energies, started on the path of making new discoveries that could better their lives and improve their environments. The stories are also of "outsiders" – such as scientists, extensionists and development workers – who recognised these creative local people and supported them further on their journey of discovery. Working together has been enriching for all parties and changed the way they relate to and support each other. Not all of them are mentioned by name here, but we are grateful to them all for sharing their stories so that others can learn from them.

Among this group of people are also the authors of these stories from different PROLINNOVA country networks. We appreciate their efforts to write down – often in a language that is not their mother tongue – these stories. It has not been easy, but the authors have been very patient and responded to the many questions we posed to them in trying to draw out more details that would help the readers gain a better understanding of the process.

Our thanks are also due to the "backstoppers" (external advisors) to the different country networks who, in many ways, encouraged and supported the authors in writing these stories down.

A special word of thanks goes to Julian Gonsalves, who at very short notice and amidst many other engagements, reviewed the final draft and provided insightful comments.

Lilibeth Sulit-Villela of the International Institute of Rural Reconstruction (IIRR) deserves a special thank-you for designing the booklet and managing its printing. As always, she has done a great job.

Last, but not least, we acknowledge the generous support of the Directorate General for Development Cooperation (DGIS) of the Dutch Ministry of Foreign Affairs, which has enabled us to compile and print this booklet that draws attention to the positive and far-reaching impacts of farmer-led joint research.

We hope that this booklet will inspire practitioners and policymakers alike to recognise farmers as researchers in their own right and to join hands with them in pursuing common goals in agricultural research and development.

Chesha Wettasinha and Ann Waters-Bayer

Summary

Farmer-led joint research lies at the heart of the process that is called "Participatory Innovation Development" (PID) by the partners in the global learning network PROLINNOVA (Promoting Local Innovation in ecologically oriented agriculture and natural resource management). This network seeks to build on and scale up approaches to smallholder farming development that start with finding out how the farmers themselves work out new and better ways of using available resources to improve their livelihoods. The ultimate aim of the network is that PID becomes understood, accepted and integrated as part of the regular activities in agricultural research and development.

This is the third in a series of booklets that collect the experiences of PROLINNOVA partners from diverse countries in promoting participatory research and development in ways that enhance local innovation capacities. The previous booklet *Recognising Local Innovation* focused on how partners identified local innovation and documented it with farmers. This booklet is about how they used the local innovations as entry points to initiate processes of farmer-led joint research. This differs from farmers' informal research, which farmers initiate and carry out on their own, rather than together with other actors. It also differs from on-farm trials and other forms of participatory research that are initiated by formal research and extension services. Farmer-led joint research is a process whereby men and women farmers work together with scientists, extensionists, development agents and other actors on further developing and improving on local ideas and initiatives. The control of the process remains in the hand of the farmers, while all partners are encouraged to bring their own knowledge and experience into the joint learning and innovation process.

After a chapter devoted to the main principles and types of activities in farmer-led joint research, the nine cases in this booklet describe the real experiences of PROLINNOVA partners from various countries in trying to engage in farmer-led joint research. Some cases deal with joint experimentation based on local innovation, such as alternative low-external-input ways of growing potatoes, improving stall-feeding of goats, and combating disease in a staple crop. Some give more attention to scientific validation of local innovations, such as a mineral lick for livestock or a farmer-developed system for managing poultry. Others involve joint exploration by farmers and scientists of ways to improve a locally developed oven to smoke fish for the market, or to adaptation of a local innovation in water management to conditions on other farms. Another case highlights how facilitating visits by farmers to innovative farmers and other sources of new ideas has inspired participants to do their own experimentation; here, the main role of the "outsiders" – the development agents – is to create a stimulating environment for innovation. The various cases reveal that some PROLINNOVA partners are still in the early stages of experimenting with PID, while others have covered more ground. All of them are on a long and interesting journey, learning as they go along. In this sense, the cases provide a basis for drawing lessons that can be used for wider learning by others also beyond the PROLINNOVA network.

Though small in scale, the cases in this booklet show that substantial livelihood impacts can be achieved through farmer-led joint research. The challenge is to scale up the approach to involve and benefit many more smallholder farmers and communities. With a solid basis of evidence, good documentation and a focused communication strategy, PROLINNOVA partners would be in a strong position to mainstream the PID approach into agricultural research, extension and educational institutions as well as into farmer organisations at all levels.

Resumen

El “Desarrollo Participativo de Innovaciones” (DPI) consiste en una investigación dirigida por campesinos, implementada en conjunto con otros actores sociales. Este concepto forma una parte integral de la red global de aprendizaje PROLINNOVA (Promoviendo la Innovación Local en la agricultura ecológica y en el manejo de recursos naturales). Esta red procura fortalecer y ampliar el abordaje al desarrollo de que comienza cuando estos agricultores idean nuevas y diferentes formas para usar los recursos naturales para mejorar sus condiciones de vida. El objetivo final de esta red es que el DPI sea comprendido, aceptado e integrado como parte de la actividades normales de la investigación y el desarrollo en la agricultura.

Este es el tercer folleto de una serie que recoge las experiencias de los socios de PROLINNOVA de diversos países para promover la investigación y el desarrollo participativos de tal forma que se mejoran las capacidades locales de innovación. El folleto anterior, *Reconociendo la innovación local*, se enfocó sobre cómo los socios identificaron la innovación local y la documentaron con los agricultores. Este folleto aborda cómo usaron estas innovaciones locales como puntos de entrada para iniciar experimentos en DPI. Este difiere de la investigación informal de los agricultores, la cual es iniciada y llevada a cabo por los agricultores independientemente de otros actores. También difiere de ensayos en las granjas y otras formas de investigación participativa iniciada por servicios de investigación y extensión formales. El DPI es un proceso mediante el cual los agricultores trabajan junto con científicos, extensionistas, agentes de desarrollo y otros actores para favorecer el desarrollo y la mejora de ideas e iniciativas locales. El control del proceso lo llevan a cabo los agricultores, mientras que se incentiva al resto de los socios a introducir sus propios conocimientos y experiencia en el proceso conjunto de aprendizaje e innovación.

A continuación de un capítulo dedicado a los principios fundamentales y a los tipos de actividades del DPI, los nueve casos en este folleto describen las experiencias “reales” de los socios de PROLINNOVA de diversos países al intentar emplear el DPI. Algunos casos tratan de experimentación conjunta basada en la innovación local, como formas alternativas de crecer papas con bajos insumos externos, mejoras en la alimentación de cabras confinadas y cómo combatir enfermedades en un cultivo básico. Otros le dan más atención a la validación científica de las innovaciones locales, como un salegar mineral para ganado o un sistema desarrollado por agricultores para el manejo avícola. Otros aún abarcan la búsqueda conjunta por parte de agricultores y científicos de formas de mejorar un horno desarrollado localmente para ahumar pescado o la adaptación de una innovación local en el manejo de agua para condiciones en otras granjas. Otro caso destaca cómo el facilitar las visitas de agricultores a aquellos que son innovadores y a otras fuentes de nuevas ideas ha inspirado a los participantes a llevar a cabo sus propios experimentos; en este caso, el papel principal de los “actores externos” – los agentes del desarrollo – es crear un ambiente estimulante para la innovación. Los diversos casos revelan que algunos socios de PROLINNOVA todavía están en las primeras etapas de su

experimentación con DPI, mientras que otros ya han abarcado más terreno. Todos están en una larga e interesante travesía, aprendiendo sobre la marcha. En este sentido, los casos ofrecen una base para extraer lecciones que pueden usarse para un aprendizaje más amplio por otros más no involucrados en la red PROLINNOVA.

Aunque de pequeña escala, los casos en este folleto muestran que se pueden alcanzar mejoras sustanciales en las condiciones de vida a través del DPI. El desafío es ampliar el abordaje para involucrar y beneficiar muchos más campesinos y comunidades rurales. Con una base de evidencia sólida, buena documentación y una estrategia de comunicación enfocada, los socios de PROLINNOVA están en una posición fuerte para que el DPI se establezca como un abordaje a la investigación, la extensión y las instituciones educativas agrícolas, así como las organizaciones de agricultores a todo nivel.

Résumé

L'expérimentation paysanne conjointe est au cœur du processus appelé 'Développement Participatif de l'Innovation' (DPI) mené par les partenaires du réseau mondial d'apprentissage Prolinnova ('Promotion de l'Innovation Locale en Agriculture Ecologique et Gestion des Ressources Naturelles'). Ce réseau cherche à bâtir et à développer des approches pour le développement de l'agriculture avec de faibles ressources, qui débute par découvrir comment les paysans génèrent de nouvelles et meilleures façons d'utilisation des ressources disponibles afin d'améliorer leur moyens d'existence. L'objectif ultime du réseau est que le DPI soit compris, accepté et intégré dans les activités normales de développement et recherche agricole.

Ce document est le troisième d'une série de brochures qui assemblent les expériences des partenaires PROLINNOVA de divers pays en promotion de développement et recherche participatif selon des voies qui renforcent les capacités de l'innovation locale. La première brochure, *Reconnaissance de l'Innovation Locale*, se focalisait sur la manière dont les partenaires ont identifié l'innovation locale et l'on documentée avec les paysans. Cette brochure-ci porte sur la manière dont les partenaires ont utilisé les innovations locales comme points d'entrée pour initier des processus d'expérimentation paysanne conjointe. Cette dernière est différente de la recherche informelle paysanne que les paysans initient et mènent de leur propre grès plutôt que en collaboration avec d'autres acteurs. Elle est aussi différente des essais en milieu paysan ou autres formes de recherches participatives initiées par les services formels de recherche et vulgarisation. L'expérimentation paysanne conjointe est un processus par lequel les paysans (hommes et femmes) travaillent ensemble avec les scientifiques, conseillers agricoles, agents de développement et autres acteurs dans un but de développement et amélioration ultérieur des initiatives et idées locales. Le processus est laissé entre les mains des paysans tandis que tous les partenaires sont encouragés à apporter leurs propres connaissances et expériences dans le processus d'innovation et d'apprentissage conjoints.

Après le chapitre axé sur les principes clés et types d'activités en expérimentation paysanne conjointe, surviennent, dans cette brochure, neuf cas qui décrivent les expériences 'réelles' des partenaires PROLINNOVA de divers pays engagés dans l'expérimentation paysanne conjointe. Quelques cas portent sur l'expérimentation conjointe basée sur l'innovation locale, par exemples des façons alternatives de production de pommes de terre avec de faibles intrants externes, l'amélioration de mangeoires pour chèvres et la lutte contre une maladie d'une culture vivrière de base. D'autres cas offrent plus d'attention à la validation scientifique des innovations locales, par exemples pierres à lécher pour le bétail ou système avicole paysan. D'autres cas sont une exploration conjointe par les paysans et les scientifiques dans la recherche de moyens d'amélioration d'un four local pour fumer le poisson en vue du marché ou dans l'adaptation à d'autres exploitations paysannes d'une innovation locale sur la gestion de l'eau. Un autre cas montre comment la facilitation de visites de paysans à des paysans innovateurs et autres sources de nouvelles idées, a été une source d'inspiration

aux participants dans la réalisation de leur propre expérimentation. Dans ce cas-ci, le principal rôle des 'outsiders' (les agents de développement) est la création d'un environnement qui stimule l'innovation. Les divers cas révèlent que quelques partenaires PROLINNOVA sont encore aux premiers stades de l'expérimentation paysanne conjointe avec le DPI tandis que d'autres ont réellement pris de l'avance dans ce domaine. Tous sont sur un long et intéressant cheminement et ils apprennent au fur et à mesure. Dans ce sens, les cas offrent une base pour tirer des leçons à retenir pour un apprentissage plus large par d'autres et aussi au-delà du réseau PROLINNOVA.

Bien qu'étant à petite échelle, les cas de cette brochure montrent que des impacts réels sur les moyens d'existence peuvent être atteints à travers l'expérimentation paysanne conjointe. Le défit est d'accroître l'échelle de l'approche afin d'impliquer et de faire bénéficier beaucoup plus de paysans et communautés à faibles ressources. Avec une solide base d'évidences, une bonne documentation et une stratégie de communication ciblée, les partenaires PROLINNOVA pourraient être dans une bonne position pour insérer l'approche DPI dans le courant dominant des institutions de recherche agricole, de conseil agricole et de formation et aussi bien dans les organisations paysannes à tous les niveaux.

1 Introduction

Introducing this booklet

This booklet is the third in a series published by the PROLINNOVA network to share the rich diversity of experiences of its members working in several countries throughout the world. The first booklet, *Facilitating multi-stakeholder partnerships*, describes the challenges faced and lessons learned in building and maintaining partnerships within the network for promoting local innovation and farmer-led participatory research and development. The second booklet, *Recognising local innovation*, looks at how PROLINNOVA partners have identified, given recognition to, documented and shared local innovations as entry points to participatory innovation development (PID). This third booklet on farmer-led joint research focuses on the central process within PID. It presents cases of how PROLINNOVA partners have tried to bring different stakeholders together to support farmers in further improving and/or adapting innovations – both locally developed and introduced – in ways that combine local and scientific knowledge.

In this first chapter, a brief introduction to the PROLINNOVA network is followed by some explanations of concepts and terms used frequently within the network. The second chapter describes what could be considered as the "ideal" of farmer-led joint research – how it differs from farmers' informal research and from other forms of participatory research, why it requires attention, and some of the basic principles. These ideas have grown out of earlier experiences in facilitating farmer-led participatory research and development that have been documented in the literature listed in Annex 2.

The following nine chapters offer examples of how PROLINNOVA partners in different countries have tried to put the theory into practice – to initiate and facilitate farmer-led joint research. These are not "textbook" cases of PID. Instead, they document the efforts of the partners to move towards this – sometimes relatively successfully, sometimes less so, but always learning from mistakes and continuing to make progress.

The booklet concludes by drawing some important lessons from these experiences and outlining what still needs to be done so that farmers can take the driving seat in multi-stakeholder processes of agricultural research and development (ARD).

Introducing PROLINNOVA

PROLINNOVA is an international learning and advocacy network that promotes local innovativeness and joint processes of innovation development in ecologically oriented agriculture and natural resource management (NRM). It focuses on recognising the dynamics of indigenous knowledge and learning how to enhance the capacities of women and men farmers to adjust to changing conditions – to develop their own site-appropriate systems and institutions of resource management for food security, sustainable livelihoods and a sound environment. The essence of sustainability lies in the capacity to innovate and, thus, adapt.

PROLINNOVA's vision, mission and goal

Vision: *a world in which women and men farmers play decisive roles in agricultural research and development for sustainable livelihoods*

Mission: *to foster a culture of mutual learning and synergy in local innovation processes in agriculture and natural resource management*

Goal: *to develop and institutionalise partnerships and methodologies that promote processes of local innovation for environmentally-sound use of natural resources*

In particular, PROLINNOVA seeks to:

- demonstrate the effectiveness of user-led innovation for sustainable development
- build farmer-extension-researcher partnerships
- enhance capacities of farmers, researchers, extension workers and policymakers in participatory approaches
- pilot decentralised funding mechanisms to promote local innovation
- stimulate national and regional policy dialogue to favour local innovation
- set up platforms for reflection, analysis and learning about promoting local innovation
- integrate participatory approaches to farmer-led innovation and experimentation into research, extension and education institutions.

At this point in time, the international PROLINNOVA network is composed of smaller or larger networks of interested individuals and institutions in 18 countries: Bolivia, Burkina Faso, Cambodia, Ecuador, Ethiopia, Ghana, Kenya, Mali, Mozambique, Nepal, Niger, Nigeria, Peru, Senegal, South Africa, Sudan, Tanzania and Uganda. Some of these country-based networks have joined only very recently; others have a longer experience and some of these have given more attention than others to documenting their experiences.

In each country, it is generally a local non-governmental organisation (NGO) that convenes the major stakeholders in ARD. It serves as secretariat for a ***National Steering Committee (NSC)*** made up of people from government research, extension and education, other NGOs and – in some cases – farmer organisations or groups. The NSC defines the activities of its country programme, such as documenting local innovation, facilitating farmer-led joint research, engaging in policy dialogue etc. It gives strategic guidance, helps mobilise resources and is the apex structure for accountability. A smaller core team is responsible for coordinating implementation of the activities planned by the NSC.

The ***International Support Team (IST)*** within the PROLINNOVA network supports the country- and regional-level activities through capacity strengthening, web-based information management, international policy dialogue, networking, publishing and overall coordination. The IST comprises the International Institute of Rural Reconstruction (IIRR) in the Philippines, ETC EcoCulture and the Centre for

International Cooperation of the Vrije Universiteit Amsterdam in the Netherlands, and the coordinators of thematic subprogrammes such as HAPID (HIV/AIDS and Participatory Innovation Development) and PROFEIS (Promoting Farmer Experimentation and Innovation in the Sahel), who are based in South Africa and Senegal.

The ***PROLINNOVA Oversight Group (POG)*** serves as governance mechanism – or "board" – to ensure accountability at all levels within the network. It draws up policies and guidelines for the network and ensures that all members adhere to them. The POG is made up of four people elected from country-based networks in Africa (francophone and anglophone), Asia and Latin America, one from the IST and three independent persons elected by the network members to serve two-year terms.

Introducing key terms

Here, we explain how key terms frequently used in this booklet are understood within the PROLINNOVA network.

The term ***"farmers"*** refers to peasant or family farmers, pastoralists, fisherfolk, forest dwellers, artisans and processors who operate at a local level and are involved in activities related to agriculture and natural resource management. Our focus is on poor, marginalised and vulnerable groups of farmers, both women and men.

When we refer to ***"local innovation"*** (without an "s"), we mean the process by which women and men in a community develop new and better ways of doing things – using their own resources, on their own initiative and without stimulation or support from external service providers. Local innovation can be triggered by many factors. A farmer might explore new possibilities merely out of curiosity. More often, though, it is a way of responding and adapting to changes in the condition of natural resources, availability of assets, markets and other socio-economic and institutional contexts brought about by demographic trends, higher-level policies, disasters, climate change and other external influences, positive or negative. Local innovation often occurs in the face of new challenges or opportunities and involves informal experimentation by the resource users. Such locally specific innovation has been taking place across the world since time immemorial, but is generally given little or no attention in formal research and development interventions.

The outcomes or products of this innovation process are referred to as ***"local innovations"*** (with an "s"). These may be developed by individuals or groups of men and/or women or by entire communities. The innovations may involve new techniques for farming or using natural resources, new ways of organising farming (production, processing or distribution/ marketing aspects) or other resource-management activities, or changes in behaviour of the resource users. In other words, the innovations may be technical and socio-institutional, including policy change at local level, such as new bylaws for using natural resources.

The PROLINNOVA network gives attention to identifying, documenting and supporting local innovation processes and the innovations that result from them. This is done to increase awareness of the relevance of farmers' creativity for meeting the needs of farming families and communities and to encourage development agents and scientists to interact with and enhance the innovative capacity of farmers. Identifying local innovations offers development agents and scientists – as well as farmers – an entry point for identifying questions of mutual interest that they can explore jointly, so as to improve agriculture and NRM in an effective and sustainable way. Here, we call this process ***"farmer-led joint research"***, for which we often use the acronym PID (participatory innovation development). This is explained in some detail in the following chapter.

A concept central to this approach is that of ***"multi-stakeholder partnerships"***. In this context, "stakeholders" refers to all actors who have an interest in improving livelihoods through agriculture and NRM. In addition to the primary stakeholders – women and men farmers – these include scientists, extension workers, educators, policymakers, input suppliers, traders and other people from the private sector, as well as consumers. "Partnership" refers to the process whereby actors jointly plan and implement activities, in order to achieve a shared goal or objective. To be able to collaborate, these partners mobilise and share resources and agree on how to manage them. Multi-stakeholder partnerships can exist at different levels, from local to global, and may be set up for different purposes, ranging from joint experimentation to influencing the policies and practices of international institutions dealing with ARD.

2 Focus on farmer-led joint research

Ann Waters-Bayer, Chesha Wettasinha and Brigid Letty

In this series of booklets based on actual experiences of partners in the PROLINNOVA network, the previous one – *Recognising Local Innovation* – focused on how partners have identified local innovation and documented it, or helped farmers document it. That booklet gave examples of how PROLINNOVA partners fed information about local innovations and innovation processes into exchange among farmers and other actors in ARD in order to make them aware of the creativity of small-scale farmers. The current booklet focuses on another important way in which partners use the cases of local innovation they have discovered, namely, to gain entry into farmer-led joint research. This is a process in which men and women farmers, scientists, development agents and possibly also other actors explore and improve the local ideas in a way that encourages all partners to bring in their own knowledge and experience.

What is different about farmer-led joint research?

Farmer-led joint research is not the same as farmers' research, although it usually builds on this. It also differs from on-farm trials and other forms of participatory research that are initiated by formal research and extension services. To be able to understand and facilitate farmer-led joint research, we need to be clear about these differences.

Farmers' research. From its very nature, farming is a constant process of experimentation, adaptation and innovation to a greater or lesser extent – day by day and year by year. Long before there were formal research and extension services, men and women in rural areas were creating and testing possible ways of improving the way they farm. They have been carrying out their own investigations and experiments in order to accommodate changing situations or adjust to new environments. Worldwide, innovation by farmers has been central to their – and everyone's – survival.

Farmers' informal research continues to this day, also where they have access to findings from formal research. Scientists who develop technology packages for extension seldom realise how farmers are dealing with them. For example, if a package promoted by an extension service involves seed, fertiliser and certain sowing and crop-management practices, farmers may test one or two of the components with their local varieties. Moreover, farmers are often exploring possibilities to improve their farming that are largely or completely ignored by formal research. This is especially so in the case of crops, animals, processes and products that are important to women, such as backyard poultry-keeping, or to the "minor" crops of non-dominant ethnic groups, such as *enset* in southern Ethiopia.

Farmers' research is completely controlled by the farmers concerned: they decide what they want to explore, how they want to do it, what they want to observe and what is done with the findings. They cover the costs and they carry the risks themselves. Scientists and development agents play – at most – an indirect role, perhaps by providing new information or materials, which the farmers may use in quite different ways than the "outsiders" had originally intended.

Farmer innovator Kes Malede from Tigray in Ethiopia demonstrates another of his water lifting devices to researchers from Mekelle University (photo: Ann Waters-Bayer)

On-farm trials. In the last couple of decades, many agricultural scientists have moved beyond the walls of their laboratories or research stations. On-farm trials and similar methods of participatory research are now more widely applied. In these activities, the initiative usually comes from scientists, who are interested is validating "their" technologies within the real farming world. The degree of participation of the farmers in planning, implementing and analysing the on-farm trials can vary greatly, but the final decision about what is being explored or tested is made by the scientist or – when on-farm trials are part of an extension approach – by development agents trying to introduce new technologies. Most often, the farmers are given free inputs and may even be paid for carrying out the work – which can be justified, as they are doing this work primarily for outsiders and not for themselves. It is seldom that on-farm trials are set up to explore ideas raised by farmers.

However, this kind of interaction between farmers and scientists can contribute to increasing farmers' capacities to carry out their own research. Moreover, some farmers doubtless take up ideas from on-farm trials and explore them further in their own informal experimentation. By far the majority of on-farm trials involve technologies in crop production, less often technologies in livestock-keeping, tree management or food processing – largely the domain of women. On-farm trials do not lend themselves to exploring social or economic innovations, such as a new system for agricultural credit or for marketing.

Farmer-led joint research differs from both farmers' research and on-farm trials in that it is conceived and controlled by farmers who carry out the research in

collaboration with other (non-farmer) partners. Research that is led by farmers aims at exploring new possibilities – already recognised by the farmers – to solve local problems or capture new opportunities. The farmers are therefore driven by their motivation to find out what will work better.

The partners in the joint research need not be research scientists. They may be fieldworkers in governmental or non-governmental development organisations. They may be specialists or widely recognised experts – also farmer experts from other areas. They may be people from the private sector involved, for example, in agricultural input supply or marketing. The other partners in the joint research are often, like the farmers, driven by their curiosity whether and how new things work in the farming system, but they could also be motivated because their organisations encourage and reward their giving support to forms of research and development led by farmers. Partners from the private sector may be motivated by the possibility to expand their business or open up a new business, if the innovation works out.

In joint research, at least two – sometimes more – different types of actors are involved in a combined effort to improve local innovations or to develop new ones. In this collaboration, farmers play a leading role or, at least, a role equal to the other (non-farmer) actors in planning and implementing the research and in evaluating the research process and results. The process starts with what farmers are already trying out or ideas they already have about how to improve their farming. Over time, as the relationship between the partners develops, the exchange between them can stimulate still more ideas, new ideas may be brought in from outside sources or new partners may join, but the ultimate control over the process remains in the farmers' hands.

Why should farmer-led joint research be encouraged?

There are several reasons why more efforts must be made to integrate farmer-led joint research into mainstream approaches to ARD. Despite evidence over decades of small-scale farmers' ability to experiment and innovate, most agricultural scientists continue to do research on behalf of farmers rather than in ways that stimulate and strengthen the capacity of farmers – linked with other actors – to adapt to changing conditions. In many cases, small-scale farmers do not adopt technologies developed by scientists and disseminated through extension, because the technologies do not meet the farmers' needs or suit their conditions. This may be because the introduced technologies do not focus on farmers' top priorities, or because the results of formal research were assessed on the basis of criteria that are not relevant to the family members that were meant to adopt the technologies. This is especially the case when new technologies are introduced to men but the people who do the related work are the women and girls, such as in livestock care and feeding.

Moreover, although funders and managers of agricultural research often talk at high-level meetings about the need to involve resource-poor farmers in defining

the research agenda, there are few initiatives to capacitate the farmers – both men and women – to play this role. Promoting farmer-led joint research can make an important contribution to this.

What activities does farmer-led joint research encompass?

Farmer-led joint research can encompass a wide variety of activities. It could be an experiment conducted together with development agents and possibly a nearby scientist, for example, to determine which botanical substances are most effective in controlling diseases in crops or livestock. It could be collaboration with a mechanic or engineer in improving a piece of equipment so that it is easier to use or works more efficiently, such as trying out different materials for or making adjustments to the design of a plough. It could involve working with private enterprises or consumer organisations in exploring processing and marketing procedures to see how benefits along the value chain between production by the farmers and consumption by the end buyer can be more fairly divided. It could involve working with communication experts in developing or trying out new ways of sharing information about farming practices. Thus, the focus could be on "hard" (technologies) or "soft" innovations (changes in institutions or methods) that farmers have chosen to investigate and for which they draw in other expertise to support them in these investigations.

Farmer researcher Adhikari from Begnas in Nepal (seated) takes the lead in a discussion with development workers and researchers from PROLINNOVA Nepal (photo: Ann Waters-Bayer)

By no means should farmer-led joint research be the only approach that is promoted in ARD. But it has an important role to play in the repertoire of participatory approaches. Indeed, it is probably more an approach to development than it is to formal research. Most cases of farmer-led joint research involve development agents who are encouraging farmers to experiment with new ideas, from whatever sources, rather than trying to convince the farmers to adopt technologies that have not been tested locally. However, some involvement of scientists in or at least their exposure to this joint research should, over time, influence the way formal agricultural research is conducted and the topics on which it focuses. And the involvement of men and women farmers in a leading role should strengthen their capacities to exert direct influence on formal research.

Why use local innovation as an entry point?

Using local innovation as an entry point to joint research provides openings for integrating farmers' and outsiders' knowledge and ideas when seeking answers to farmers' questions. Identifying local innovation helps the non-farmer partners learn to understand and value what farmers are already trying to do to improve their situation. The partners thus gain greater appreciation of local capacities. Also the farmers start to regard themselves differently: although poor in terms of financial resources and often also in level of formal education, they realise that they are rich in terms of knowledge, ideas and skills. Starting with local innovation builds mutual respect and lays a sound basis for a true partnership, in which the different contributions of the partners are equally valued.

Starting with local innovation also provides a point of departure for joint exploration and learning that is firmly embedded in local realities and is driven by farmers' keen interest. It is where the energy lies. This approach focuses on the positive – on local creativity and achievements, on the farmers' strengths. It explores particular opportunities open to the farmers that they are already trying to pursue, rather than dwelling on their problems and weaknesses. It is quite the opposite approach to starting with a problem analysis, which leaves farmers with a feeling that they have to rely on help from outside.

What are basic features of farmer-led joint research?

Although many different types of activities can be involved in farmer-led joint research, there are some basic features that characterise the process. It starts with seeking local innovators and innovations and finding out where the local energies are with respect to trying to solve problems or exploring new opportunities. A farming community or common-interest group, supported by development agents, screens new ideas according to criteria important to the men and women in the community or group. Such criteria are likely to involve some aspects of cost effectiveness, accessibility of inputs, priority given to this topic or problem, and whether some local farmers are prepared to experiment with the idea on behalf of the community or group.

The next step is to decide what aspects of the new idea are going to be investigated, how this will be done and by whom, what kind of results are expected and how long it should take to obtain them. The partners in the joint research need to decide what they will observe and record, and how and by whom, so that they will have documented results that they can analyse together. The process of facilitating this research planning is meant to strengthen the capacity of farmers and the other partners to engage in systematic investigation of new possibilities. The farmers who actually conduct the research on behalf of the larger group often include local innovators who had earlier been working on these questions on their own.

Staff members from government extension services or local NGOs are sometimes able to give the farmer-researchers some basic training in defining research objectives, selecting appropriate sites, laying out trials, including control treatments (where appropriate and possible), measuring changes, keeping records and analysing the results. In some cases, the services of scientists may be needed to provide this training and to assist in setting up the experiments, but it is important that the research is designed in a way that the farmers retain the ownership. It should start simple, addressing first the major factor that the farmers want to investigate. The methods need to make sense to the farmers, lead to visible results and be reliable enough to produce results that the farmers can use.

It is usually staff from government extension or NGOs but conceivably also staff from farmer associations who follow up on the activities, helping the farmers monitor the research at the agreed times, document the results and share these with other interested parties. These are most commonly other farmers and development agents who visit the experimenting farmers, but may also include scientists, managers of research or development agencies, local government officials and higher-level policymakers.

The process of monitoring and evaluation starts already when the research is designed: when the criteria to assess the results are formulated. Discussions by the farmers and other partners during the course of the research may lead to some changes in how this is done. At the end of the research period, all the results are analysed – often in small workshops involving the experimenting farmers, the other partners and possibly other interested people. The group then decides whether it has found answers to its questions and can share the results (whether positive or negative), or whether it needs to repeat the experiment to be sure of the results, or whether it needs to try things out again in a different way.

Scientists can seldom be intensively involved throughout the whole process, but they can play important advisory roles in helping design the research so that it lays a firm basis for farmers to decide on next steps. They can help explain the reasons behind certain findings, so that farmers understand some of the less visible factors that could have influenced the outcomes. They can also assist in generating “hard data” to validate farmers’ findings in conventional scientific terms, so that other scientists, policymakers and donor agencies are convinced about the results of the farmer-led joint research.

Farmers and development workers from Kampong Speau in Cambodia evaluating a joint experiment (photo: Fanos Birke)

How to encourage this approach?

An important way in which development agents can support farmer-led joint research is by supporting related learning processes: helping communities organise farmer tours (cross-visits), meetings of experimenters, field-days and farmer-to-farmer training. Likewise, they can develop booklets and/or audiovisuals such as posters or films or radio broadcasts to share information about the process and the results of farmer-led joint research.

They can help to sustain and scale out the process of farmer-led joint research by facilitating the establishment of farmer fora managed by organisations at community or district level. Higher-level management staff in agricultural research and extension – often through key champions within the organisations – can help integrate the approach into the extension system, and link farmer experimenter groups and farmer fora with district, provincial or national fora for ARD.

How can farmers keep control?

What has been described in this chapter is the ideal form of farmer-led joint research that PROLINNOVA partners are trying to promote. However – as pointed out in the case from Uganda – this is, in itself, an experiment with a new way of working that is not familiar to the partners involved, including the farmers. Past experience has led to certain habits and expectations in the interactions between farmers and other people involved in ARD. There is a need for a great deal of "trial and error", reflection and honest assessment of what actually happened until

people learn to interact as genuine partners in ARD – especially until farmers with less formal education gain the skills and confidence to be able to assert themselves when collaborating with relatively highly educated specialists and scientists.

One key way in which to assure that the control remains in the hands of the farmers is to give them access to resources for funding the research they regard as important. Pilots are now underway with so-called Local Innovation Support Funds that are managed or co-managed by local grassroots organisations and are used to buy materials for farmer-led research, to pay for the services of supporting specialists such as technicians or scientists, or to obtain information from other farmers or specialists, for example, by visiting them, observing and asking questions directly. Farmer-led local steering committees issue a call for proposals and, based on criteria developed by the community, select applications from individual farmers or farmer groups whose work is supported out of the fund (Waters-Bayer *et al* 2005, Veldhuizen *et al* 2008). It will be a sign that farmer-led joint research is truly mainstreamed when at least a small portion of the government budget for ARD is allocated to such farmer-managed innovation funds.

References

Letty B. 2010. Introduction to local innovation and joint experimentation. PowerPoint presentation prepared for training workshop in Pietermaritzburg, KwaZulu-Natal. Pietermaritzburg: PROLINNOVA–South Africa (http://www.prolinnova.net/South_Africa/index.php)

Veldhuizen, L van, Waters-Bayer A & Wettasinha C. 2005. Participatory Technology Development where there is no researcher. In: Gonsalves J *et al* (eds), *Sourcebook on Participatory Research and Development for Sustainable Agriculture and Natural Resource Management* (Los Banos: CIP-UPWARD), Vol.1, pp165–171.

Veldhuizen L van, Krone A, Wongtschowski M & Waters-Bayer A. 2008. FAIR – Farmer Access to Innovation Resources. *Rural Development News* 2/2008: 47–52.

Waters-Bayer A, Veldhuizen L van, Wongtschowski M & Killough S. 2005. Innovation support funds for farmer-led research and development. *IK Notes* 85. Washington DC: World Bank.

3 Farmer's own and joint research on alternative ways to grow potatoes in South Africa

Michael Malinga, Thabane Madondo, Erna Kruger and Brigid Letty

This case shows how formal researchers and development workers can join up with famer innovators who are continuously seeking ways of improving their farming practices. The farmer innovator was already in the process of trying out a method of growing potatoes under mulch, suggested to him by a visitor to his farm. He showed this to a development worker, who then encouraged him to become involved in a joint experiment together with an agricultural scientist and two other farmer innovators interested in trying out mulching. The farmer experimenter was in control throughout the duration of the joint experiment, supported by the scientist and the development worker. It is a good example of how farmer-led experimentation can spark the interest of other people to join in.

Mr Madondo is a farmer innovator in Potshini, a village in Ukhahlamba District of KwaZulu-Natal, South Africa. He is married, with six children, and has just obtained a Certificate in Participatory Community Development through the Centre for Adult Education at the University of KwaZulu-Natal. He is a fulltime farmer, growing crops and keeping some cattle, goats and chickens. He likes trying out new things to improve his farming. He had been one of several farmers involved in on-farm research, together with scientists from the Agricultural Research Council (ARC), into minimum-tillage methods for growing potatoes. He then started to experiment on his own with an alternative method: growing potatoes under a layer of mulch.

Mr Madondo heard about the idea from a pastor from Lesotho who runs an organisation that assists smallholder farmers. The pastor was visiting Potshini with some farmers from Lesotho to see Mr Madondo's minimum-tillage trials. These involved opening a furrow and planting the potatoes by hand, then ridging, weeding etc. The pastor suggested trying to grow potatoes without disturbing the soil at all. Mr Madondo saw the opportunity this would offer to reduce labour in potato production. The pastor had explained only that one could place the potatoes in rows on the soil surface and cover them with mulch. Mr Madondo had to decide for himself how deep to make the mulch as well as the type of material to use.

First attempt to grow potatoes under mulch

Before sharing his ideas with other farmers and researchers working in Potshini, Mr Madondo tried the new method out for one season on a small portion of his field (5x5m) that he had not been using. During the first season (2006), Mr Madondo tried a spacing of 30cm between the potatoes in the row and 90cm between rows. The following year (2007), he reduced the spacing between the potatoes in a row to 20cm and increased the size of his experiment to an area of 15x5m.

From his little experiment, Mr Madondo found out that the system worked but he also saw a need for improvement. The material he first used for the mulch was

waste grass left over from making thatch bundles for roofing, but the mulch layer was too shallow and he could harvest only 3–4 small potatoes (or one very big one) per plant. He did, however, note the reduced labour requirement, as he needed to work only at planting time. The next time, he increased the depth of the mulch layer to 30cm. He had the impression that he obtained a very good yield, similar to that when using the conventional method of ploughing and ridging. He had not, however, weighed the potatoes, and he left them under the mulch, harvesting some only when needed in the house.

Encouraging joint experimentation

At this point in time, Mr Madondo was collaborating with the Farmer Support Group (FSG) – the outreach arm of the Centre for Environment, Agriculture and Development at the University of KwaZulu-Natal – on the Smallholder Systems Innovation (SSI) Project. This is a multidisciplinary programme of applied research aimed at improving rainfed farming within the context of watershed and river-basin management. He was working in particular with Mr Michael Malinga, a field worker with FSG. Up until this point, their work had been focused mainly on homestead vegetable production.

Mr Madondo told Mr Malinga about the new mulching method that he had tried out. Mr Malinga was also interested in this, and asked many questions regarding the yields obtained compared with the conventional method and the specifics of the method. He wanted to know more exactly how Mr Madondo was growing the potatoes under mulch and why Mr Madondo thought it was better than the conventional method.

Mr Malinga also encouraged Mr Madondo to share his findings with other farmers in the area. Mr Madondo explained that, during the previous season, he had already tried to share the outcomes of his experiment with other farmers, but that year the natural grassland had all been burnt and there was no grass available for mulching, so the others could not try it out for themselves. With encouragement from Mr Malinga, Mr Madondo shared his findings at a meeting of a Farmer Learner Group (FLG) that FSG had initiated and was supporting in order to have a way to call farmers together to share the outcomes of the SSI project, without having an open community meeting but also without setting up a formally registered legal entity. Mr Madondo also shared his findings with farmers from the broader area at the Sivusimpilo Farmers' Forum, another platform initiated by FSG, which involves four communities from Ukhahlamba District.

When PROLINNOVA-South Africa circulated a call for proposals for joint experimentation to be funded in 2008, Ms Erna Kruger – a development practitioner and researcher working in Potshini with FSG and Mr Madondo – offered to assist him in writing a proposal, designing the experiment and reporting on the experimentation process. Initially, Mr Madondo prepared a draft experimental layout and shared it with Mr Malinga and Ms Kruger. They discussed it further and, together, they finalised the layout for the experiment. In addition, two other farmers who had learned of the technology at the FLG meeting, Mrs Kethiwe Hlongwane and Mrs Sizakele Mduba, also wanted to take part in the experimentation process.

Embarking on a joint experiment

Since there were delays with the process of accessing the PROLINNOVA funds, Mr Madondo went ahead in August 2008 on his own and planted a portion of his field using the mulching method. This time, he used a layer of bean residue as mulch. As with his previous trials, he did not add any form of fertilizer.

The formal joint experiment funded by PROLINNOVA–South Africa started in October 2008. For the main experiment, eight experimental plots, each 5x5m in size, were established in order to compare not only mulching with ploughing and ridging, but also to compare the use of manure with the use of inorganic fertilizer. The conventional practice of ploughing the soil and using inorganic fertilizer was used as the control for the experiment. A total of 96 tubers were planted per plot (see Figure 1).

The spacing used in the formal experiment was 30cm within rows and 75cm between rows; this was less than Mr Madondo had been using. A combination of maize stover, bean residue and thatch grass was used as mulch. Mr Madondo proposed that the potatoes from the different plots be weighed so that the yields could be compared. Ms Kruger suggested that plant counts also be made to be able to assess germination rates. Yields of the August and October mulched plantings were also compared to see the impact of timing.

1 Conventional / Manure	3 Conventional / Inorganic fertilizer CONTROL PLOT	5 Conventional / Inorganic fertilizer CONTROL PLOT	7 Conventional / Manure
2 Mulched / Manure	4 Mulched / Inorganic fertilizer	6 Mulched / Manure	8 Mulched / Inorganic fertilizer

Figure 1: Layout of the experiment

Yields were measured using a weighing scale for the different plots, while general plant growth was assessed quantitatively. Plant counts were made weekly to monitor how the potatoes were emerging from the mulch. In a notebook, Mr Madondo documented this information from his experiment. Ms Kruger assisted him by entering the data into a spreadsheet and doing some basic calculations of averages, percentages etc. She also prepared the progress reports that were submitted to PROLINNOVA-South Africa.

When the potatoes started flowering, Mr Madondo assumed that no more potatoes were likely to emerge and he opened up the mulch to see what had taken place beneath it. He found that some potatoes had sprouted but some pest had eaten through the stalks and the original potatoes had since rotted.

At the sites of Mrs Hlongwane and Mrs Mduba, these farmers took no measurements and made only a visual assessment, together with Mr Madondo. He had hoped that they would record the potato yield, but the households had already started harvesting and consuming the potatoes when he discussed this with the two women.

After harvest, Mr Madondo gave information about the results of the joint experiment to the other farmers in the FLGs and to still more farmers at a meeting of the Farmers' Forum.

FLG members discuss findings of the mulching experiment (photo: Erna Kruger)

Outcomes from the joint research

Germination and survival rates. Plant counts for the potatoes planted under mulched and conventional conditions at Mr Madondo's farm were recorded in November and then a month later in December 2008 in order to assess the germination rate (Tables 1 and 2). In November 2008, the average number of potatoes that had emerged in the plots with conventional treatment was 65%. When the number of plants surviving was assessed again in December, the average survival rate in these plots was 53%. The average germination and survival rates in the mulched plots in November and December were 35% and 38%, respectively. From this, it can be seen that the germination of potatoes on the mulched plots increased between November and December, meaning that they were germinating and growing with some delay. These potatoes were still emerging from the mulch, while those in non-mulched plots were already flowering.

There was a marked decrease in the number of plants between November and December in the conventional (non-mulched) plots – a rather unexpected result. However, as mentioned above, Mr Madondo had found evidence that pests had eaten some plants in the mulched plots. The conventional plots may have been damaged in the same way; this could explain the decrease.

Overall, the mulching method produced disappointing results, but Mr Madondo believes that this was due to the choice of material used for mulching, which made it difficult for the potato plants to emerge. He claimed that his previous experiments had led to better results; however, he did not have the data to support his claim.

Yields. In January 2009, the research team weighed the potatoes harvested from a certain area in the formal experiment (October planting). This yield was compared with that of potatoes harvested at the same time from an equivalent area in the mulched field that Mr Madondo had planted in August, where the potatoes had grown very well. The weighing allowed not only a comparison of the mulching method in August and October but also a comparison of yields of the mulched and conventional method from the October planting.

Table 1: Germination rates (percentage of plants emerged) as of 20 November 2008

Inorganic fertilizer plots		Manure plots	
PLOT 3 – Conventional	66%	PLOT 1 – Conventional	45%
PLOT 4 – Mulched	25%	PLOT 2 – Mulched	52%
PLOT 5 – Conventional	72%	PLOT 7 – Conventional	76%
PLOT 8 – Mulched	27%	PLOT 6 – Mulched	34%

Table 2: Percentage of the potatoes emerged as of 10 December 2008

Inorganic fertilizer plots		Manure plots	
PLOT 3 – Conventional	50%	PLOT 1 – Conventional	30%
PLOT 4 – Mulched	32%	PLOT 2 – Mulched	35%
PLOT 5 – Conventional	68%	PLOT 7 – Conventional	64.5%
PLOT 8 – Mulched	26%	PLOT 6 – Mulched	57%

Six areas, each 1 m^2 in size, were marked off randomly in each of the treatments being compared. The number of plants found in each selected area was counted and the potatoes harvested from these plants were weighed (see Tables 3 and 4).

The mulched plot planted in August clearly yielded better (58 kg) than the mulched plot planted in late October (28 kg). Some possible reasons for this are that: i) Mr Madondo watered the August plot; ii) the bean straw used as mulch perhaps made germination of the potatoes easier, as it is less dense and more easily wetted than the thatch grass and maize stalks used in the October plantings; and iii) rain only came in November, so the October planting remained dry for a period and then received unusually heavy rain.

Tables 3 and 4 clearly show that the conventionally ploughed and ridged plot yielded more than did either of the mulched plots. It can also be seen that the plots planted with commercial fertilizer yielded more in each case than the equivalent plot planted with manure. The reason for this was that the mulching method generally resulted in patchy potato germination and growth. It appeared that some plants had to struggle to emerge from the thick grass and maize stover mulch that was used.

Table 3: Comparison of mulched plantings (August and October 2008) with conventional planting (October 2008)

August planting: mulched		**October planting: conventional**		**Manure plots**	
No. of plants	Weight of potatoes harvested (kg)	No. of plants	Weight of potatoes harvested (kg)	No. of plants	Weight of potatoes harvested (kg)
11	8.6	8	15	4	3
12	6.8	6	11	6	5.5
12	10	8	13	4	5.5
14	8.5	8	10.5	3	5
14	13.5	4	7	4	4
11	11	4	6	6	5
74	**58kg**	**38**	**62kg**	**27**	**28kg**

Table 4: Yield comparison between conventional and mulched potatoes, using either inorganic fertilizer or manure

October planting: conventional (quantity harvested in kg)		**October planting: mulched (quantity harvested in kg)**	
Inorganic fertilizer plot	62.5 kg	Inorganic fertilizer plot	76 kg*
Manure plot	61.7 kg	Manure plot	33.4 kg
Inorganic fertilizer plot	63.4 kg	Inorganic fertilizer plot	47.2 kg
Manure plot	42.2 kg	Manure plot	28 kg
TOTAL	**252 kg**	**TOTAL**	**184.6 kg**

* Volunteer potatoes from the previous season came up in this particular plot and thus made interpretation of these results difficult.

Other benefits of mulching. Mr Madondo found that the layer of mulch decomposed over the season and formed compost, thus seemingly improving the soil conditions. He also found that the weed challenge in the mulched area was markedly reduced the following season compared with the weeds in non-mulched areas.

Results obtained by the other two farmer experimenters. The experiments undertaken by the other two farmers produced variable results. Mrs Mduba was happy with the results, but her children started to harvest the potatoes before they could be weighed. She said she would repeat the experiment the following year.

Mrs Mduba with her potato experiment (photo: Erna Kruger)

Mrs Hlongwane was also happy with the results, especially in terms of the ease of harvesting the crop, but later found that the mulch was providing a haven for snakes. Mr Madondo had planned to ask them to measure yields by volume, since they were not interested in weighing the potatoes, but he was too late in asking them and much of their potato plots had already been harvested by then. The women said that the children had started harvesting in the portion of the field with the mulching experiment, because it was much easier to harvest the potatoes under mulch than those under the soil.

Formal on-station experimentation

During the same season (2008–09), researchers from the KwaZulu-Natal Department of Agriculture and Environmental Affairs made a field visit to Potshini. The researchers who made this visit came back later with other horticulturalists to show them Mr Madondo's trial. They were interested in this new practice and replicated the experiment at the Cedara Research Station under more controlled conditions. They found that the plants did not germinate well, as they struggled to emerge through the mulch, which was a very dense and compacted layer of grass. The researchers indicated that they wanted to repeat the experiment using a different material as mulch.

Further joint experimentation activities planned

Despite the disappointing results obtained from the joint experiment, Mr Madondo plans to repeat the trial and has applied for support through another PROLINNOVA initiative known as Farmer Access to Innovation Resources (FAIR). This is a pilot project to test the functioning of locally managed funds to which individual and groups of farmers can apply for support to their own experimentation and innovation. Mr Madondo believes that the choice of material used for mulching was largely responsible for the poor performance of the mulching method in the initial joint experiment and plans to repeat the trial using bean stover, which is what he had used in his August 2008 planting.

While the yields of the first season of the formal joint experiment were not good, many farmers who became aware of the mulching method regarded it as a promising way to reduce the labour inputs for planting and harvesting potatoes. Some of these farmers plan to continue experimenting with this new method. For example, Mr Mbhele – a farmer from Obonjaneni, also in Ukhahlamba District, who learnt of the technology when Mr Madondo presented it at the Sivusimpilo Farmers' Forum – started to experiment with ways of using the mulching material more efficiently.

Lessons learnt from joint experimentation at Potshini

The experimentation undertaken at Potshini has been a learning opportunity for all involved. The need to have a thorough record-keeping system in place became obvious, as farmers need sound information on which to base their decisions, rather than relying only on their impressions. Farmers noticed that they could not bring evidence of improvement if they had not recorded the results in some way.

Another lesson learnt was that the number of factors being compared must be reduced in order to ensure that the results can be clearly understood and interpreted by the formal researchers and the farmers.

It was also apparent that, when the community members want farmers to conduct experiments on their behalf, they need to identify farmers who are committed to the concept of experimentation.

Putting principles of farmer-led joint research into practice

For an experimentation process to be truly farmer-led, farmers need to be actively involved in planning, managing and evaluating the process and results of the experiment. The mulching experiment described here clearly reflects a number of key aspects of farmer-led joint research, namely:

- The experimentation was motivated by what a farmer innovator had already started;
- The farmer innovator prepared the draft experimental design (including the choice of treatments) and shared it with the other team members, who then suggested how it could be improved;
- The farmer innovator was actively involved in managing and monitoring the trial, including the collection and recording of data and the preparation of field reports;
- The farmer innovators as well as other farmers in the area were actively involved in assessing the outcomes of the research, which included finding possible explanations for the results obtained;
- The involvement of other farmers in the experimentation and the active sharing of the process and results through the FLGs and Farmers' Forum have allowed other farmers to learn about the technologies being tested and adapted.

Benefits of farmer-led joint research

The experimentation process has made the farmers in the FLGs and Farmers' Forum more aware of the benefits of objectively comparing different technologies. It has also made all partners more aware of the different skills and knowledge that they can bring together through a farmer-led joint experimentation process.

The efforts of the partners have been focused on something that smallholder farmers regard as a priority. They have been testing and further developing a labour-saving technology to see if it can bring yields comparable with those obtained using conventional tillage methods.

While the technical outcomes of the experiment were not very positive (i.e. the mulching method did not perform as well as expected), the process has provided all parties with an opportunity to understand better the factors that need to be considered when planning and conducting an experiment. This will inform the next phase of experimentation to be carried out in Potshini.

4 Jointly comparing local innovations to combat *enset* bacterial wilt in Ethiopia

Demekech Gera and Tesfahun Fenta

The NGO that coordinates the PROLINNOVA network in Ethiopia discovered that several smallholders in the south of the country are innovating and experimenting with ways to control bacterial wilt, a major problem in the staple crop in the area. Government researchers and extension agents joined the NGO in supporting farmer-led experimentation to compare the different potential solutions that farmers had developed. The challenges involved in this new type of interaction in agricultural research and development are openly discussed.

Enset (*Enset ventricosum*), or "false banana", is the main crop of a traditional farming system in southern Ethiopia. This perennial crop is grown primarily for the large quantity of carbohydrate-rich food found in the false stem (pseudostem) and underground bulb (corm). About 15 million people – more than 20% of the Ethiopian population – depend on *enset* for foodstuff, fibre, feed, construction materials and medicines. The Southern Nations, Nationalities and Peoples Regional State of Ethiopia, referred to hereafter as the Southern Region, is especially well known for its high production and utilisation of *enset*, which is a staple food in the region.

An Integrated Food Security Programme of AgriService Ethiopia (ASE), the NGO that coordinates PROLINNOVA–Ethiopia, is operating in Amaro Special *Woreda* (District) in the Southern Region. In 2000, to start up its development programme there, ASE conducted a Participatory Rural Appraisal (PRA) exercise. During this exercise, the smallholder farmers indicated that bacterial wilt is the major problem in their *enset* plots. The disease, which is caused by the bacteria *Xanthomonas campestris* pv. *musacearum*, attacks the vascular bundle of the plant and causes wilting. The symptoms of the disease are difficult to detect in its early stages. It sometimes completely damages the crop. ASE took up contact with the Agricultural Research Centre in Awassa, the capital of the Southern Region, and found out that – although bacterial wilt in *enset* is a priority on the regional research agenda – the scientists had not yet developed reliable control measures or treatments that could be recommended to the farmers.

ASE has a research component that uses recognition and documentation of indigenous knowledge (IK) and local innovation as a major strategy. In 2002–03, the Amaro Programme Office staff made an inventory of IK and local innovations through focus-group discussions on local coping mechanisms and strategies, in order to screen options and select best-bet solutions to local problems. During this inventory, the ASE staff found some promising practices carried out by individual farmers on their *enset* plots to protect the plant from bacterial wilt. The staff then organised a gathering of these farmers and other community members, facilitated discussion on the issues around *enset* and made these local solutions more widely known. Here, we describe the process of planning and implementing farmer-led participatory experimentation on these local innovations and the challenges encountered during the process.

Farmer innovations to combat bacterial wilt

The livelihood of the family of Mr Behailu, a farmer in one of the communities where ASE operates in Amaro District, depends on *enset*. Many years ago, long before ASE started working there, his *enset* plants became highly affected by bacterial wilt. He was very worried because he lost so many *enset* plants that he was afraid he could no longer support his family. This livelihood-threatening problem motivated him to innovate. He remembered that the generation of his grandfather used to plant euphorbia cactus around the *enset* plants. He hypothesised that the cactus must have a controlling effect on some enemies of *enset*. He decided to do his own experimentation with the thick milky liquid extracted from this cactus to see if it could control bacterial wilt. He squeezed the cactus plant to extract the latex, which he collected in a bowl, and then applied the latex to the plants – in some cases to the damaged surface of the *enset* leaves, in other cases to the stem of the *enset* plant at its base. He found both methods to be effective.

Innovator farmer Behailu observing the reaction of enset plants to bacterial wilt after applying his botanical treatment (photo: Tesfahun Fenta)

Besides Mr Behailu, ASE staff identified two other farmers who had done their own informal experimentation and innovation to protect their *enset* plants from bacteria wilt: Mr Somali, who applied *Aloe vera* (called *errate* in Amharic) and Mr Dereso, who used wood ash.

Planning and implementing joint experimentation

In 2002, the Amaro Programme Office set up a district-level Research Coordination Forum made up of innovative farmers, other community members, researchers

from Awassa Agricultural Research Centre (AARC), specialists from the District Office of Agriculture and Rural Development (OoARD) and ASE staff. The Forum identifies different researchable issues, prioritises and plans joint research, and discusses research progress and results. It also organises review workshops periodically, usually annually.

In 2003, members of the Research Coordination Forum met in ASE's Amaro Programme Office to plan joint experimentation on *enset* to investigate the effect of local practices and botanicals in preventing bacterial wilt. The meeting was attended by innovator farmers identified by ASE, other men and women smallholder farmers from the local community, a plant pathologist from AARC, an agricultural advisor from the OoARD, two ASE project officers and two ASE development agents (DAs). Together, they identified 45 clones of *enset* in Amaro District alone. They selected one of these clones (locally called Shena) for the experiment, because it is particularly susceptible to bacterial wilt but is favoured by local people because of the colour and cooking characteristics of the traditional food products (*bulla*, *kocho* and *amicho*) made from this clone.

The Forum participants planned an experiment with four treatments – euphorbia cactus, *errate*, ash and *fanfo* – to be compared with a control. Dr Fikre Handaro, the pathologist from AARC, had suggested that *fanfo* (*Pychnostachis abyssinica* (Fresen)) be included as a treatment, because some farmers in other parts of the Southern Region use this herbal extract to protect *enset* from bacterial wilt (Kidist Bobosha 2003).

Based on their readiness to be involved in this activity, six farmers (five men and one woman) – including one of the local innovators – were initially assigned by the Forum to conduct the experiment. These were Mr Behailu, Mrs Meselech, Mr Mohamed, Mr Sebsibe, Mr Solomon and Mr Teklu. The other two originally identified farmer innovators could not take active part in the experiment because they lived too far away.

Near their homes, the farmer experimenters multiplied *enset* seedlings from the selected clone and in 2005, a year later, transplanted them into their individual *enset* plots. The farmers applied the treatments at the time of planting the seedlings, as they had observed that *enset* tends to be infected before it is two years old. They scratched the fleshy stem of euphorbia cactus plants, collected the latex that oozed out, soaked the sucker roots in a mixture of this latex with water for about ten minutes and then planted the suckers. Similarly, they scratched or cut into the fleshy leaves of *errate* and rubbed the jelly-like substance that came out onto the sucker roots when planting them. The farmers followed the same procedure in preparing and applying *fanfo* extracts. In the fourth treatment, they put ash into the holes in which the suckers were planted.

In the 2007 rainy season, two years after the four treatments had been applied to the *enset* plants, the researcher from AARC taught the farmer how to inoculate the seedlings with the bacteria, using a hypodermic needle. Three farmer experimenters – Mrs Meselech, Mr Solomon and Mr Teklu – thus artificially infected two *enset* plants in each treatment. The other three farmers had lost interest,

because they thought it would take too long to see any results from experimenting with *enset*, a perennial plant. Fifteen days after inoculation, the researcher and the three farmer experimenters assessed how much the disease had spread. The plant pathologist recorded signs of resistance, tolerance and susceptibility to bacterial wilt in all the plants in the three experimental plots. By checking for the presence of the disease in these ways, the partners in experimentation had a basis for assessing the efficacy of the treatments, so that they could identify the best solution to the problem of bacterial wilt.

Innovator farmer Behailu and scientist discussing the effect of botanicals on development of enset bacterial wilt (photo: Tesfahun Fenta)

Roles of the different actors

AARC gave technical backstopping by advising the experimenting farmers, the OoARD and ASE staff with regard to experimental design, data collection, monitoring and follow-up to the experiment. The researcher came to work with the farmers in the field three times during the experiment: i) when the seedlings were treated and transplanted; ii) when the plants were inoculated with bacteria; and iii) when the spread of the disease was scored 15 days after inoculation. The ASE Programme Office staff, together with government DAs working at village level, facilitated the process of learning from the joint experimentation by organising workshops for farmers and other stakeholders at the Amaro Programme Office and field days on the farms of the local experimenters. The farmers carried out the experiments on their own land and monitored what was happening through observations during the course of their regular work, as the *enset* plots were close to their homes. In addition, the farmer experimenters and the plant pathologist collected quantitative data from the three experimental plots. Other farmers in the

community and neighbouring villages provided motivation for the experimenting farmers by coming to visit their experimental plots, and some also started to try out the same practices informally on their own farms.

Results of the joint experimentation

The bacteria were evident in all the treatments, but there was variation in the level of infection. The *enset* plants treated with euphorbia cactus extract fared better that the plants in the other treatments, although farmers' assessment varied because of different performance at different sites. At Forum meetings, at the ASE annual review meeting in Ambo in 2008 and during field days organised by the OoARD, Mrs Meselech, Mr Solomon and Mr Teklu informed participants about their local research experience. They stressed how bacterial wilt in *enset* can be managed effectively by integrating the use of euphorbia cactus extract with plant sanitary measures such as removing infected plants and burying or burning them, cleaning or disinfecting farm tools, and not carrying out other farming operations with tools that had been used in infected fields.

Challenges encountered during the process

Some challenges were encountered in the process of joint experimentation. Firstly, the farmers found the experimentation to be time consuming: they had to devote precious time to this, which could have been spent on other activities to secure their livelihoods more immediately. Some of the farmers may initially have had a hidden motivation to volunteer to carry out the experiments, expecting more incentives than only the moral satisfaction of being called a "local innovator" or "farmer researcher" or for being known more widely beyond their villages. They expected payments from ASE, such as *per diem* allowances for taking part in the meetings. PROLINNOVA in general and ASE in particular believe that paying *per diem* erodes ownership of local development. However, three of the farmers did continue with the experiment, even though they gained no immediate material benefits from it. The *enset* experimenters were part of a group of 22 members that had formed a Farmer Field School in 2004. They meet frequently to discuss their research results and other issues, and do not receive *per diem* payments for these meetings.

Secondly, it is a huge challenge to involve different actors in joint experimentation and, above all, to deepen and institutionalise the concept and practices of participatory innovation development (PID) among all the stakeholders in rural development. Most of the stakeholders – particularly the researchers, but also DAs and new ASE staff – did not assume full ownership of the PID activities. They did not always make themselves available to the farmers when needed. This brought about delays in the activities and ultimately had a negative effect on the quality of the data gathered, as well as on timely utilisation of research results. In the long term, smallholder farmers can expect that the PID activities will benefit them by increasing production and productivity; this is an important source of motivation. Informal discussions with research and development staff in government and NGOs revealed that opportunities to take part in national or international workshops, short-term training and higher education might motivate

them to become involved in PID. Moreover, formal researchers need to be able to produce peer-reviewed publications so as to have a chance for promotion in their professions.

A major challenge is frequent staff turnover in all the stakeholder organisations involved, including ASE. When people who had been part of the PID process left an organisation, no institutional memory remained. This was especially the case in the OoARD in Amaro. The Ethiopian civil service does not allow flexibility in the use of time by research and extension staff, nor is it open to new concepts. Thus far, farmers have not left their community-based organisations, but some members became more occupied with other activities, because they were assigned by local authorities to be involved in political activities of the government at the *kebele* level (the lowest level in the administrative structure in Ethiopia). This happened to Mr Behailu, who then had less time to devote to experimentation and sharing of results.

Nevertheless, despite these many challenges, the experimentation is continuing at the local level in Amaro, as a few research-minded individuals among the farmers and other stakeholders try to find answers to their questions.

Conclusions on farmer participatory research

The most widely used modality of participatory research in Ethiopia is led by scientists or agricultural experts in government offices or NGOs. This gives farmers a chance to make decisions on some of the issues in the research process. However, it may not reflect the real needs of the farmers or truly incorporate the farmers' knowledge, because the research questions are usually set by the scientists or "experts".

ASE and other members of PROLINNOVA–Ethiopia regard innovations by small-scale farmers as entry points into PID that will guarantee that the participatory research process is mainly controlled by the farmers and also that the farmers will have more confidence to influence the research carried out by scientists. Re-orienting farmer participatory research in this way will not only find answers to farmers' questions – such as in the case of *enset* bacterial wilt, where appropriate and sustainable technologies could not be provided by Science alone – but will also empower the farmers in a real sense.

Reference

Kidist Bobosha. 2003. Characterization of *Xanthomonas campestris* pv. *musacearum* isolates: causal agent of *enset* bacterial wilt disease. MSc thesis, Addis Ababa University, Ethiopia.

5 Research to promote local innovation: *siella* mineral lick for livestock in Ghana

Naaminong Karbo

This case from Ghana shows how animal scientists as well as farmers have been conducting research – each in their own way – to develop and improve mineral lick blocks for livestock. The scientists have been conducting on-station as well as on-farm research and providing farmers with some of the research findings as extension messages. Farmers have used this information to complement their own experiments. The local innovation and adaptation by farmers has stimulated researchers to join hands with them in research to further enhance the development of lick blocks for improved livestock production.

Farmers in northern Ghana take pride in their livestock as one of their important resources apart from the land, the various crops cultivated, the rivers, streams, trees, hills and sacred groves. Livestock fit well into the management of natural resources for food and nutrition security in the zone. The animals are sold for cash to buy farm inputs, to pay medical and school fees, and to buy grain when the barns are empty before the next harvest.

Therefore, much research and extension interaction with farmers has been on improved management of animal feeding so as to derive more benefits from the existing crop-livestock system. Farmers commonly use locally available resources for feed, such as natural pastures, crop residues and byproducts from agricultural processing, whether in the home or in local agro-industries. Supplementary mineral sources to improve animal production are brought into the resource flows from outside the system when farmers buy common salt and mineral lick blocks from the market.

In most rural areas in northern Ghana, however, these commercial products are not available and, even where they may be found in the towns, the price is often prohibitive. Farmers, researchers and extension workers wanting to promote "endogenous development" (i.e. development from within based primarily on local resources) therefore sought local alternatives. One of these is *siella*, a clay-like material commonly licked by domestic and wild animals on the range in lowland areas. In international literature, this is sometimes referred to as "geophagy" or earth-eating (Mills 2005).

There was already some documentation of the indigenous knowledge (IK) on *siella* and its role in the farming systems of northern Ghana (mentioned in Karbo *et al* 1999a). Since then, there was a growing interest and attention of livestock-keepers, scientists and development workers in developing this material for improved management of livestock. Some livestock-keepers began to make lick blocks out of the material to feed to their animals at home.

Scientists learning from farmers

It was in the mid-90s, when prices of mineral licks were out of reach of most small-scale farmers, that some scientists raised the research questions as to what *siella* consists of, whether and how it benefits livestock, and the IK systems

surrounding it in northern Ghana. As a boy herding cattle in the period immediately after Ghana's independence, I had observed cattle licking *siella*. Now, as a research scientist seeking to address – with farmers – the problems of mineral nutrition of livestock in the sedentary crop-livestock systems of the Northern Guinea Savannah Zone of Ghana, I saw this as an opportunity to begin to work on this phenomenon.

In 1992, I developed a proposal for this research, which received funding under the National Agricultural Research Programme (NARP). A multidisciplinary study team with a farming systems background – involving an agronomist, a horticulturist and a social scientist – visited rural communities to interact with individuals and farmer groups in order to gain a better understanding of the IK related to *siella* and its uses in the local farming systems.

Before going to the field to discuss this with rural people, we designed a checklist as a guideline. Staff of the Ministry of Food and Agriculture (MoFA) known to the communities in the various locations we had selected for the visits helped us gain entry into these communities. We held group discussions with the local people – men, women and children – to explore their perception and uses of *siella*. We made key-informant interviews with cattle-herders to gain more in-depth knowledge on the topic. Local people led us to sites where *siella* is found and helped us collect soil samples for laboratory analysis. During our joint walks, they described the approximate grazing pattern and use of *siella* by cattle.

Exploring how farmers regard and use *siella*

Farmers in northern Ghana know *siella* well, by different local names according to the dialect spoken. They believe that the material plays a vital role in the health and productivity of both animals and humans. Cows that lick *siella* give more and "sweeter" milk and produce bigger calves than do cows without access to *siella*. Pregnant women who take *siella* will give birth to fat and healthy babies. However, farmers in some locations had not considered it worthwhile to fetch *siella* home for their animals, because they thought it might lose some of its quality. Others felt that the resource was there where it was found, and that animals could go to it themselves, as the quantities required will make it difficult to transport it from there to the animals in the homesteads.

However, there were exceptions. A centenarian, Mr Maama from Dandaprugu in Upper West Region (UWR), told us that, until the early 20th century, lick blocks or balls of *siella* were made and kept at home to ensure that the animals always returned home from grazing. Shortly after we started the discussions in the rural communities, another farmer in UWR, Mallam Seidu, reported that he carried *siella* home and that his cattle relished it.

Mineral analysis in the laboratory revealed that over 90% of *siella* sampled was alkaline on the pH scale. Macro-mineral concentrations such as sodium and potassium were 10–15 times higher than those in ordinary adjacent soils in the zone. Farmers observed that crops do not grow well on *siella* spots because of the high salt concentration; this agreed with findings from the chemical analysis.

Further facilitation from research and extension

In on-station trials, scientists proceeded to test the feeding of *siella* to local rabbits and observed significant differences in growth rates compared with those of the control rabbits. During the same period, scientists from the Animal Research Institute (ARI) and development workers from the Association of Church Development Projects (ACDEP) and MoFA jointly conducted on-farm trials with a mineral lick made from bone ash and salt. At community meetings, farmers evaluated the results as being useful for their sheep and goats, thus confirming the findings from the on-station trials. Farmers observed that using the lick at home made it easier to manage the animals, as they returned to the pens early to receive the lick. Twinning was high and the lambs and kids born were heavier. In this case, similar to animals licking *siella*, the sheep and goats also had a glossier coat, which is a sign of good health. The results of this on-farm evaluation were shared in the *Savannah Farmer* magazine (Karbo *et al* 1999b).

ARI exhibited the two types of mineral licks to the public at annual National Farmers' Day celebrations organised by MoFA at district and regional levels in northern Ghana. Similarly, ARI and others in the scientific community in northern Ghana organised exhibitions of the mineral licks on the African Scientific Renaissance Day held annually in northern Ghana. One such exhibit was also made in the Saboba-Chereponi District in the Northern Region.

Farmers' path to innovation

In the Wapuli and Chegbani communities in Saboba-Chereponi District, the use of *siella* or *likpeen* (in the local Likpakpa language) by livestock and wildlife when grazing the range is common knowledge. The idea of fabricating it into lick blocks for animals came up during discussions at farmer meetings organised by NGO and government extension services. A farmer in one of the community-level discussion groups said: "During a farmers' training by MoFA, we were told to always buy the commercial or imported mineral blocks for our animals, but I decided to try *likpeen* at home and my sheep and goats accepted it". At the community meeting where this information was shared, his fellow farmers said they thought he was wasting his time, because the animals at home will not accept it. Later, however, they themselves observed the animals indeed liked *siella* when it was offered to them at home, and that it made it easier to manage the animals because they voluntarily returned to the compound, unlike before.

Similarly, in Wapuli, during our discussions with community members, they identified an extension worker in the Evangelical Presbyterian Agriculture and Rural Development Project Saboba-Chereponi – a member of ACDEP – who had suggested to them that *siella* mixed with crushed oyster shell and salt could be used to make lick blocks. Being a group of bullock farmers, they were quick to try this out and made a sample to show to him. In the meantime, however, the extension worker had been transferred out of the district. The innovation process apparently slowed down at that point, because the interaction with outsiders by way of follow-up and encouragement had been interrupted.

Rekindling local interest in farmer innovation

In Chegbani in Saboba-Chereponi District, ARI has a cattle-breeding station and is keen to work with local communities with a view to integrating the West African shorthorn cattle breed into the farming systems. Managing bullocks for traction was important for the integration process, and ARI occasionally trained some farmers in the Chegbani area in this. ARI's presence in the Wapuli area was enhanced through collaboration with two initiatives, namely, "Farmer Responsive Mechanisms in Research and Extension" (FARMER) in partnership with MoFA, the Council for Scientific and Industrial Research (CSIR) and the Canadian International Development Agency; and "Promoting Local Innovation" (PROLINNOVA) in partnership with ACDEP, NGLWG (Northern Ghana LEISA Working Group) and ETC EcoCulture in the Netherlands. The former addresses issues of housing and managing feed for draught bullocks, while the latter seeks to identify and promote local innovation processes. In terms of philosophy, however, the two initiatives have in common a farmer-first approach and a respect for IK.

In 2005, during training on bullock-feeding management with a group of bullock-keepers in Wapuli, the farmers and scientists discussed the need to feed salt blocks to the animals for good health and efficient work output. The farmers shared their earlier experiences of having fabricated a lick block for this purpose. However, the lick blocks they had made were brittle and crumbled easily because there was no binder. Therefore, we – the farmers and the scientists – experimented with adding cassava or maize flour and observed that using cassava flour as a binder gives a better product.

Wapuli group members demonstrating process of making *siella* lick blocks (photo: Naaminong Karbo)

Initially, the farmers had been making the blocks on an individual basis for their animals at home but, when the FARMER project introduced group learning and sharing on bullock housing and feeding management, they decided to work together and to produce lick blocks not only for themselves but also for the local market. This was also because farmers who were not in the group had expressed interest in the product. The main buyers are Fulani herders hired to take care of local farmers' animals in the communities, in consultation with the kraal (livestock enclosure) owners, who pay for the lick block. Settled Fulani herders who have their own kraals also buy the lick block for their animals. A local block of about 5 kg sells for the equivalent of USD 2.20, which is far cheaper than imported commercial lick blocks of similar weight on the local market.

Farmer innovation engages researchers

For me as a scientist, it was gladdening to discover that farmers – acting on information provided through extension – took the lead to use *siella* as a constituent component of a locally-produced lick block. The research on *siella* that we scientists had initiated earlier had been intended to further explore its inclusion in lick blocks for feeding to livestock, but had not materialised because of funding constraints after NARP – which had favoured participatory on-farm systems research – ended in 1999.

The lick block that had been developed by farmers and was being used by community members called for further engagement by research and extension services. Development partners in the PROLINNOVA–Ghana network facilitated documentation by participatory video so that the local people could tell their own story about *siella* and share their experiences with others (Bruce 2008). The participatory video work had an important spinoff in terms of gender issues. The original Wapuli group had emerged as an interest group of farmers owning or working in the field with bullocks; here, women played a limited role. When the video films made by different communities in northern Ghana were shared, the Wapuli community saw a video from the Chegbani community, where women were active in the local experimentation related to making *siella* lick blocks. The men in the Wapuli group realised that, also in their own households, women are involved in preparing and giving feed to livestock, especially when local resources are being used, whereas men play a larger role when it comes to procuring external inputs such as commercial licks and concentrates. After the participatory video sessions, the men in the Wapuli group invited several women to join their experimenting group.

We as scientists saw a research question emerging that was relevant from our viewpoint: what are the mineral concentration levels in the fabricated lick block in order to characterise the product appropriately? The Wapuli group, led by its chairman Pastor Tuobi, also had a question: what would be the economic benefits of using their local lick block compared to the existing commercial products? Scientists in PROLINNOVA–Ghana did not shy away from this challenge. Together with the Wapuli group, we planned and implemented further research at the Nyankpala Animal Research Station (using sheep), in the research laboratory and in farmers' livestock holdings in order to explore these questions (Avornyo *et al* 2009).

Wapuli farmer group member with *siella* lick block (photo: Naaminong Karbo)

ARI and the Wapuli group jointly entered their work for the Science and Technology Innovation Competition organised in 2009 on the occasion of CSIR's fiftieth anniversary. Innovations from throughout Ghana were judged according to their innovativeness, their economic and commercial viability, their environmental friendliness and the feasibility of their adoption by end-users. The *siella* innovation developed jointly by farmers and scientists came among the top ten selected for public presentation and was given recognition in the form of a certificate and a cash award. This was in addition to the personal satisfaction of the partners in the joint research that we had enhanced development of affordable mineral licks that improved livestock production and the livelihoods of small-scale farmers.

Acknowledgements

I am grateful to Ann Waters-Bayer for the interest she showed in this case and for finding precious time to comment on the drafts; the queries and suggestions were very useful. I thank all NGLWG members and the ACDEP secretariat in Tamale for encouraging me to write this paper for the purpose of sharing experiences. And I thank the rural communities for their readiness to discuss with our study team and to engage in joint research with us.

References

Avornyo FK, Karbo N, Alenyorge B & Abudu JR. 2009. The effect of a locally produced mineral lick on the performance of growing West African dwarf sheep. In: Okai BD, Boateng M & Antwi C (eds), Improving the animal industry in Ghana in the face of the current global economic crisis: proceedings of the 16th biennial conference. Ghana Society of Animal Production, Kwame Nkrumah University of Science and Technology, Kumasi, 5–8 August 2009.

Bruce J. 2008. Participatory video to document farmer innovation in north Ghana. In: Wettasinha C, Wongtschowski M & Waters-Bayer A (eds), *Recognising local innovation* (Silang, Cavité: International Institute of Rural Reconstruction / Leusden: PROLINNOVA International Secretariat, ETC EcoCulture), pp 33–34.

Karbo N, Bruce J, Langyintuo A, Dittoh S & Yidana J. 1999a. Indigenous knowledge on '*siella*' and its role in the farming systems of northern Ghana. *Ghana Journal of Agricultural Science* 32: 59–67.

Karbo N, Bruce J & Alebekiya M. 1999b. Scientists and farmers evaluate a local salt lick block fed to indigenous rural sheep in northern Ghana. *The Savannah Farmer* 1: 22–23.

Mills A. 2005. Cornflakes, elephants and kangaroos. http://www.saasta.ac.za/sciencewrters/winners/2005/mills_a.pdf

6 Joint experiment to improve a local fish-smoking oven in Niger

Saidou Magagi, Jean-Marie Diop, Adam Toudou, Sabo Seini and Abdou Mamane

Partners in PROLINNOVA–Niger initiated a process of joint experimentation that led to considerable changes in a locally developed oven for smoking fish. Although the fish-smokers had noted some problems with this oven, they had not continued to improve the design because of the additional costs involved in trying out potential improvements. The situation changed, however, when a team of scientists and extension workers in PROLINNOVA–Niger discussed the possibility of setting up and co-funding a joint experiment with the fish-smokers. The description of the process reveals the pro-active role played by the local experimenters and others in the community. It also brings an example of how one successful experiment can lead to further socio-economic changes within a community, with local people taking the lead.

National systems of agricultural research in the Sahel, although they increasingly refer to participatory approaches, are still predominantly characterised by a transfer-of-technology approach. Researchers are expected to generate technologies to be passed on by extension agents to farmers. This approach does not foster farmers' creativity nor does it encourage their own initiatives to develop technologies. It also ignores the considerable agro-ecological variability in the Sahel, and therefore sometimes leads to development of technologies that are inappropriate, especially for small-scale farmers. A key lesson is that "one-size-fits-all" does not apply in the Sahel. Local agro-ecological variability means that local solutions always need to be sought. The identification of local innovations and initiatives can be used as entry points for planning farmer-led participatory research and development (Wettasinha *et al* 2006). PROLINNOVA supports such a process in which different stakeholders, such as extension workers and scientists, support small-scale farmers in further developing their local innovations through participatory innovation development (PID).

Discovering local innovation

As part of the PROLINNOVA–Niger activities, an interdisciplinary team composed of two researchers, two government extension workers and a development agent from a local NGO made an inventory of local innovations. It organised a national workshop to share the results and to select local innovations as entry points for PID. One of the innovations that the workshop participants found particularly interesting was the *banda*, a locally developed oven for smoking fish. The team had identified this in the village of Boumba Kaïna, Department of Boboye, Dosso Region in southwestern Niger, 300 km from the capital city Niamey. The oven appeared to bring benefits to both men and women in the community and could be easily reproduced by other farmers, but also had potential for improvement. The local people mentioned several problems they were still trying to solve.

The locally developed *banda* is a clay oven, open at the top, specifically made to smoke fish. It had been developed over time as an improvement to the three-stone open-fire stove still used in many other villages for this purpose. Fish

smoking is a typical task of village women, although some men also do it, whereas fishing on the River Niger is an activity reserved only for men. Some of the smoked fish is consumed by the family or given to other families as gifts, while the rest is sold by both women and men on local markets. Many villagers of Boumba Kaïna were using this innovation – some using larger ovens and some using smaller ones – but they mentioned the following limitations to the team that was making the inventory of innovations: limited smoking capacity; high consumption of wood; time-consuming process; poor quality of smoked fish; not usable in rainy and windy weather; spoilage of smoked products because of contaminants such as dust; need for continuous supervision during the entire smoking process to keep away stray dogs, rodents and birds; and frequent cases of burns suffered by small children who are with their mothers during the fish-smoking process. In addition, because the ovens are made of clay and are open to the elements, they are not durable and have to be replaced every few years.

Agreeing on an improved design to test

During a general village assembly attended by both women and men, the team discussed the possibility of improving the design of the oven to overcome some of the limitations that had been mentioned. The villagers were enthusiastic about this idea and, together with the team, came up with suggestions to improve the design. It was agreed that large and small improved versions of the *banda* would be compared with the existing ovens in a process of joint experimentation.

Villagers discussing possible improvements to the local *banda* (photo: Jean-Marie Diop)

Based on the suggestions during this meeting, the researchers came up with a design for an improved *banda* that incorporated the following features: a more durable structure made of brick and cement in a rectangular shape; a taller structure with two shelves to increase capacity to smoke fish; a roof to prevent damage from rain and wind; and two windows fitted with shutters to keep out dust and to prevent animals from getting at the fish.

Trying it out together

Four farmers (two men and two women) chosen by the community agreed to conduct the experiment in their own compounds. The other families in the village had access to these four compounds to be able to observe the experiments.

Four types of ovens were tested: i) large locally developed *banda*; ii) large improved *banda*; iii) small locally developed *banda*; and iv) small improved *banda*. In total, four improved *banda* were built in the village (two large and two small ones) to compare with locally developed large and small *banda*. Each improved oven was built in the homestead of a volunteer farmer experimenter, who already had a local oven in his/her compound. The size of the improved *banda* corresponded to the size of the existing local *banda* in the compound.

Each farmer experimenter compared the two ovens in his/her compound, based on criteria in line with the above-mentioned limitations. These criteria, suggested by the farmers and the research team, were used in jointly designing monitoring sheets for recording data. Since many villagers are not literate, the farmers selected a literate farmer from their midst to keep records at the four experimental sites related to smoking and marketing. This farmer-monitor visited the sites whenever the farmer experimenters smoked fish and noted down the following:

- Weight of fresh and smoked fish per batch;
- Type and quantity of wood used for smoking the batch;
- Duration of smoking the batch of fish;
- Buying price of fresh fish;
- Selling price of smoked fish;
- Use made of the smoked fish (home consumption, gift, sold);
- Where the smoked fish was sold.

The development agents and researchers in the PROLINNOVA–Niger team visited the sites regularly to advise the experimenters, to support the farmer-monitor and the experimenting farmers in filling in the recording sheets, and to do some additional monitoring.

Roles in the joint experimentation

The individuals involved in the joint experimentation played different roles. The villagers supplied local resources (bricks, water and wood) and free labour, including masonry to build the ovens. Fish for smoking was supplied both by the experimenting farmers as well as by the other villagers. The fact that all villagers who so wished could smoke their fish in the improved *banda* under the control of the farmer experimenters meant that it was possible to obtain feedback from a larger number of farmers and to stimulate their interest in the experiment. Ten other farmers (five women, five men) at the market in Boumba also took part by assessing the colour, smell, texture, taste and acceptability of the smoked fish.

The development agents provided technical support and guidance in building the improved *banda*. They also helped the men and women who smoke fish to organise themselves into a cooperative of 20 members called *Banda Guiyara Rayuwa Ka* and to set up a community savings-and-credit system that could be used to finance the building of still more improved ovens. The agricultural development service in Gaya Department provided free use of a vehicle for field trips.

Researchers in INRAN (National Institute for Agricultural Research in Niger) contributed ideas for improved design of the ovens, and documented the agreement among the partners in the joint experiment as well as the process and results. Before the experiment began, the researchers conducted a workshop on PID for all participants, including the farmer experimenters and farmer monitor (Magagi *et al* 2007).

The PROLINNOVA–Niger programme provided the materials for the improved *banda* that were not available locally (cement, metal grids, barrels, metal doors) and scales for weighing the fuelwood and the fish. It also provided material and financial resources for PID training, field visits and monitoring and evaluation (M&E) of the joint experimentation.

The PROLINNOVA–Niger team involved in the experiment coordinated the M&E, including the tasting panel on the local market. In order to enrich the M&E and stimulate interest in sustaining the PID process, it helped organise visits of other villagers to the farmer experimenters and mentored the women and men fish-smokers in the cooperative to promote the improved *banda* and to facilitate the supply of materials for the *banda* that had to be brought in from elsewhere. The data recorded by the farmer-monitor and the researchers were used for a final evaluation of the experiment during a village meeting.

Farmer experimenter building an improved *banda* on his compound to compare with the local *banda* (photo: Jean-Marie Diop)

Technical results with the improved design

Data related to different technical aspects of fish smoking for the four types of *banda* are shown in Table 1. Analysis of these data revealed that the improved ovens, both large and small, allowed a larger output of smoked fish within a given time and used less firewood to smoke the same quantity of fish, compared to the locally developed ovens. This will have a positive environmental effect, as less wood is consumed and less smoke given off to the surroundings.

Table 1: Comparison of smoking capacity in the four types of *banda*

Types of *banda*	Holding capacity of oven (kg)	Quantity of smoked fish per kg firewood (kg/kg)	Quantity of firewood used per ton smoked fish (kg/t)	Quantity of smoked fish per hour (kg/h)	Output (smoked fish) (kg/ 24hrs)
Locally developed large *banda*	80	1	1000	2	48
Improved large *banda*	350	6	167	9	216
Locally developed small *banda*	50	2	500	3	72
Improved small *banda*	250	10	100	12	288

The quantity of fish smoked per hour in the improved ovens was much higher than in the locally developed ovens. The smoking time for a batch of fish was reduced, thus saving time for women to do other things. The small improved oven was more efficient in this respect than was the large improved one. This may be because the ovens with larger dimensions lose more heat than do the smaller ones.

Other benefits identified by villagers

During the discussions involving experimenting farmers and other farmers in the village, the following additional advantages of the improved oven were also mentioned:

- Less tiring work, probably on account of less heat stress, reduced smoke in the eyes, and not having to be around all the time to keep animals away and to make sure that young children do not burn themselves;
- No need for constant supervision, meaning that other tasks can be done while the fish is being smoked;
- Reduced risks of theft, accidental fire etc;
- Fish can be smoked even during rainy and windy periods;
- Reduced contamination by dust, birds etc, leading to a better-quality product;
- Better appearance, smell and taste of fish, and a longer shelf life.

The villagers also reported that the better quality of the fish smoked in the improved *banda* led to a better price and more demand for the product on the local market. They said that the reputation of the Boumba fish-smokers had spread in the region through traders from Benin and Nigeria who buy up the product.

Socio-economic impacts of improved oven design

The increased demand for the smoked fish led to further developments within Boumba. Several more families replaced their clay ovens with the improved version without external support. Those who had built improved ovens started to rent them out to others in the village, who re-smoke their fish to improve the quality and thus the price of the product. Some men in the village have even started to buy up fish smoked in the local clay ovens and re-smoke them in the improved ovens, instead of going out to catch fresh fish.

The families use the increased income for various purposes such as home improvement, buying additional food, fulfilling social obligations, buying livestock etc.

Women in Boumba are able to get better prices for fish smoked in the improved oven (photo: Manori Wijesekera)

An important spinoff has been the increased interest of people involved in the joint experimentation in learning how to read and write. Wanting to be able to document the experimentation and keep the records themselves, both women and men in the cooperative requested literacy training. Initially, this was given by the farmer monitor, one of the few people in the village who could read and write. Interested by PROLINNOVA–Niger's approach of applying literacy training to rural development, the Department of Non-Formal Education in Boboye started to offer a literacy course, and a community library was opened in Boumba Kaïna. A farmer trained in literacy who learned from booklets about improved techniques of planting

rice said that this helped him increase his yields. He also expressed satisfaction that he can now read the expiry dates of medicines he buys for his family.

Members of households with an improved oven mentioned more harmonious relations between men and women within the home. Smoking fish using the clay ovens often led to conflicts. If a batch of fish that was smoking was damaged or depleted in some way – e.g. because it became wet or a stray animal took some of it – the men would blame the women for being negligent. As smoked fish is an important source of income, such conflicts were unavoidable. With the improved ovens, women can put in a batch of fish and then proceed to other activities, being confident that damage to the fish will be minimal.

Sharing results at all levels

Farmer-to-farmer visits, field days, fairs and events for testing the smoked fish were organised by PROLINNOVA–Niger partners at the sites where joint experimentation on fish smoking took place. These events provided an opportunity for other community members, consumers, wholesale fish traders, extension staff and other staff of PROLINNOVA partner organisations to learn more about the joint experiment and to give feedback on the quality of the fish smoked in the improved *banda.*

Results of the joint experimentation were also shared within the PROLINNOVA–Niger network at meetings of the National Steering Committee, meetings of the two subgroups of PROLINNOVA–Niger – "Poles" East and West – and at a workshop on institutionalising PID in Niger. The process and results of the experiment were documented in written and visual form through reports, PowerPoint presentations, photos, brochures and video films. They were also broadcast through radio and television, thus achieving broader national coverage.

Still more broadly in West Africa, this experience was shared in Burkina Faso, Mali and Senegal during PID training in the framework of the PROFEIS (Promoting Farmer Experimentation and Innovation in the Sahel) programme. This is a sister programme of PROLINNOVA in these other francophone countries. The case was also presented at several international meetings such as the International PROLINNOVA Workshop in Ghana (Magagi *et al* 2008), the APPRI (Learning, Producing and Sharing Innovations) workshop in Burkina Faso (Magagi *et al* 2008), a regional workshop hosted by CIRDES/CIRAD in Burkina Faso (Magagi *et al* 2009) and an international symposium hosted by the Institute of Development Studies (IDS) in the UK (Salomon 2009).

New issues and challenges

This case of joint experimentation has demonstrated that the improved ovens are superior in many ways to the ones that farmers had developed on their own in the village. But the process of experimentation should continue in discussion with the community, so that new issues that arise can also be tackled. With respect to the improved ovens, questions that still need attention include: more efficient

combustion to further reduce wood consumption, identifying varieties of fish that smoke better and faster, investigating quality of the smoked fish in relation to the type of wood used etc. The PROLINNOVA–Niger team observed that local women were doing their own informal experimentation with different types of woody matter used as fuel so as to improve the smell, taste and thus the price of the smoked fish. This would be another topic for joint experimentation. Also other non-technical innovations could be explored, such as in marketing the smoked fish.

This joint experimentation in fish smoking demonstrates how the combination of local knowledge and scientific knowledge leads to the development of innovations that are relevant for small-scale farmers and fisherfolk. Although this has been a success, it remains an isolated case of joint experimentation in Dosso Region. Thus, the challenge remains: how to scale up the PID approach throughout the country? This calls for the different stakeholders in agricultural research and development – government extensionists, NGO development agents, researchers etc – to recognise the creativity and innovativeness of farmers and to work together with them in developing better ways of doing things. This requires a change in the attitude and behaviour of the major actors in agricultural research and development, including the farmers. The Dosso example can provide a source of inspiration for this.

The joint experiment was conducted in the framework of the PROLINNOVA–Niger programme funded partly by the partners in Niger and partly by the Netherlands Ministry of Foreign Affairs to the end of 2010. It will be necessary to set up mechanisms to ensure continued support to the process of farmer-led joint experimentation in Niger and to scale it up.

References

Magagi S, Haoua S, Dan Lamso N & Katkore A. 2007. Training workshop report on "Understanding participatory joint experimentation approaches and PID process". Niamey: PROLINNOVA–Niger.

Magagi S, Haoua S, Toudou A, Diop JM, Arzika I & Boumba Kaïna farmer innovators/experimenters. 2008. PID and joint experimentation on fish smoking in Niger. PROLINNOVA International Partners Meeting, 31 March–4 April, Tamale, Ghana.

Magagi S, Toudou A, Seyni H & Maidaria G. 2008. Joint experimentation of women's innovation on fish smoking in *banda*, Niger. APPRI Workshop on Co-Learning, Producing and Sharing Innovations for Agriculture in Dryland Africa, 21–24 October, Ouagadougou, Burkina Faso.

Magagi S, Toudou A, Diop JM, Seyni H & Mamane A. 2009. Amélioration du fumage du poisson par une approche participative et la prise en compte d'une innovation locale à Boumba Kaïna au Niger. Centre International de Recherche-Développement sur l'Elevage en zone Subhumide, Burkina Faso (CIRDES)/Centre de la Recherche Agronomique pour le Développement, France (CIRAD) Atelier Régional "Méthodes et Indicateurs d'Évaluation d'Impact des Innovations

dans les Systèmes de Production et les Territoires Agropastoraux de l'Afrique de l'Ouest", 1–4 décembre, Ouagadougou, Burkina Faso.

Salomon M. 2009. PROLINNOVA: global networking for local innovativeness. Symposium on Innovation, Sustainability and Development: A New Manifesto, 24 September, STEPS Centre, Institute of Development Studies, Brighton, UK.

Wettasinha C, Wongtschowski M & Waters-Bayer A (eds). 2008. *Recognising local innovation.* Silang, Cavite, Philippines: International Institute for Rural Reconstruction / Leusden: PROLINNOVA International Secretariat, ETC EcoCulture; revised version.

7 Farmer-led adaptation of local water-management innovation in Ethiopia

Hailu Araya, Kiflay Tebari, Leul HaileSelassie and Abadi Redehay

Farmer-led joint research can encompass many different types of activities – not only field trials on experimental plots. In the case of an underground water-harvesting system developed by a farmer innovator in northern Ethiopia, the innovation cannot simply be copied. Moreover, it is not possible to compare treatment and control, as each plot of land differs. The principles behind the innovation have to be applied under different conditions with respect to soils, slopes and the general lie of the land. The roles of other actors – in this case, extension agents from the government and a local NGO – are primarily to draw other farmers' attention to the principles behind the local innovation, encourage them to adapt the components to suit the characteristics of their own fields and support them in assessing the results of their efforts. The main advisor in this process of joint exploration and adaptation is the farmer innovator, a grassroots expert in water management.

The multi-stakeholder Northern Typical Highlands (NTH) platform of PROLINNOVA–Ethiopia has identified numerous local innovations developed by smallholder farmers. One of the innovations is an intricate system of draining and harvesting water from waterlogged land so that it can be cultivated throughout the wet season and the stored water can be used for irrigation in the dry season. This innovation was developed by Abadi Redehay, a 45-year-old man who lives with his wife and four children in Mai Berazio village of Tahtai Maichew District, near the historical town of Axum in the Central Zone of Tigray Region in northern Ethiopia. It was recognised by district specialists and development agents (DAs) in the Bureau of Agriculture and Rural Development (BoARD), after local farmers drew their attention to it.

Abadi's innovation

Abadi was trying to sustain his family on less than 0.5 ha of cropland on reddish and clay soils. He had to be innovative to solve the waterlogging problem on his sloping land and to increase crop production. When he was visiting Axum, he saw a sewage canal under construction. He was inspired when he realised that the sewage system was draining water away so that it did not stay on the soil surface, as was happening on his farm. He decided to try to use a drainage system like this on his own land.

Completely on his own, Abadi dug deep and long channels diagonally across the slope and placed long and flat stones on both sides of each channel so that the water would flow easily. However, the channels created a problem in working in the field and, having little land, he wanted to use the land they occupied. He therefore decided to cover them with flat stones and put soil on top to make underground canals. These lie at depths varying between 40 and 180 cm below the soil surface. During the rains, they capture excess runoff water as well as water coming up from deeper levels through capillary action. They lead the water

to two collection points where two or more canals join. The water is stored in these excavated ponds. Water that exceeds the capacity of the ponds overflows to a nearby stream.

Farmer innovator Abadi Redehay showing how he drains water from his field (photo: Tesfahun Fenta)

During the dry season, Abadi draws water from the ponds, using a treadle pump, and irrigates crops sown in the plots below the ponds. He bought the pump with his own money after he had been successful in collecting and using water in this way and thus increasing his income. Over time, still working on his own, he gradually expanded the drainage system throughout his farm, connecting the canals and leading the water to three collection points.

Before he started this innovation, he grew mainly *teff*, a local cereal that can be sown late in the wet season, and sometimes chickpea, a crop than can be sown in September after the rain stops. Now, because he can sow the land earlier in the wet season, he has more options and, because he can also irrigate the land, he can even grow vegetables in the dry season. He now obtains up to three harvests per year from the same piece of land.

The waterlogged land had been used part of the year for free-range grazing but, now that the land has been drained and is cultivated year-round, the total output of the crops plus the crop residues for livestock is worth more than simply the grass that used to be grazed there. In addition, Abadi can harvest more and better-quality forage from his farm boundaries as well as around the water reservoirs

year-round. As a result of his innovation in water management, he was able to buy and feed more animals. Abadi and his wife now have two oxen, one cow, one donkey, six goats and several chickens. Before starting his innovation, they did not even have a pair of oxen to plough their land. Abadi had to go to town to find wage labour, but now he can devote himself entirely to farming, and his neighbours regard him as having become relatively well-off.

Starting up Participatory Innovation Development

In April 2005, the NTH platform organised a workshop for farmers, local DAs, specialists from the District Office for Regional Agricultural and Rural Development and BoARD, Wukro District Agricultural and Technical College, Mekelle University and the local NGO Institute for Sustainable Development (ISD). The workshop was held in Axum, as NTH partners from the BoARD and ISD had identified several innovations near there. It introduced the concepts of local innovation and Participatory Innovation Development (PID). The participants examined some examples of local innovation, which the farmer innovators presented themselves, and then considered what should be done with the innovations: whether 1) to disseminate them more widely; 2) to explore questions about the innovations in a PID process; or 3) to see them as useful only for the specific circumstances of the local innovators.

The workshop participants visited several farms, including Abadi's farm, and were particularly impressed with how – using his drainage technology – he so skilfully managed the water flows to gain benefits in both the wet and the dry season. Many farmers experience the same problems as Abadi did: temporary waterlogging in one season and insufficient moisture in another season on the same piece of land. Because they cannot plough the waterlogged fields during the main rains, they cannot use these fields until late in the season. This limits the type and yields of crops they can grow there. While on Abadi's farm and inspired by his innovation, the farmers and DAs discussed what they could try out together. Back at the workshop venue, they presented their observations and suggestions to the other participants.

The BoARD, in collaboration with some NGOs (including ISD) and farmers, had already been trying to help farmers deal with problems of waterlogging and seasonal moisture deficiency. It had been promoting standardised technologies that did not suit the varied conditions of the smallholder farmers. But then the BoARD had started to look at what solutions the farmers themselves were developing. At the Axum workshop, the participants discussed the water-harvesting and drainage interventions promoted by the BoARD and the locally developed water-management innovations, as well as other new technologies coming from outside and inside the farming communities, e.g. in beekeeping. Then, the farmers in the workshop selected three local innovations that they wanted to explore further and possibly improve in PID processes.

One of these innovations was Abadi's system of subsurface drainage and subsequent irrigation with the harvested water. Farmers wanted to try this out on

other farmers' plots and see if it worked or could be adapted to other conditions. The farmers pointed to specific aspects of Abadi's innovation that would need to be investigated, such as the appropriate capacity and the durability of the water-collection ponds. The DAs and different specialists listened to the farmers and posed questions, but did not decide which innovations to explore in PID. The farmers made these decisions.

A second workshop was held in May 2006 to launch the PID activities supported by the NTH team in Tigray Region. In preparation for this workshop, the NTH asked Abadi and the Tahtai Maichew District agricultural specialists to suggest three volunteer farmers to try out his innovation. Abadi proposed three farmers who live very close to him and to each other in Tahtai Maichew District, who faced waterlogging problems on their farms, who were keen to do the experiment together on their adjoining plots, who were on good relations with each other and who were open to sharing their experiences with other farmers. After the launching workshop, the three farmers and Abadi – assisted by BoARD staff – applied to PROLINNOVA–Ethiopia for some funds to carry out their PID activities.

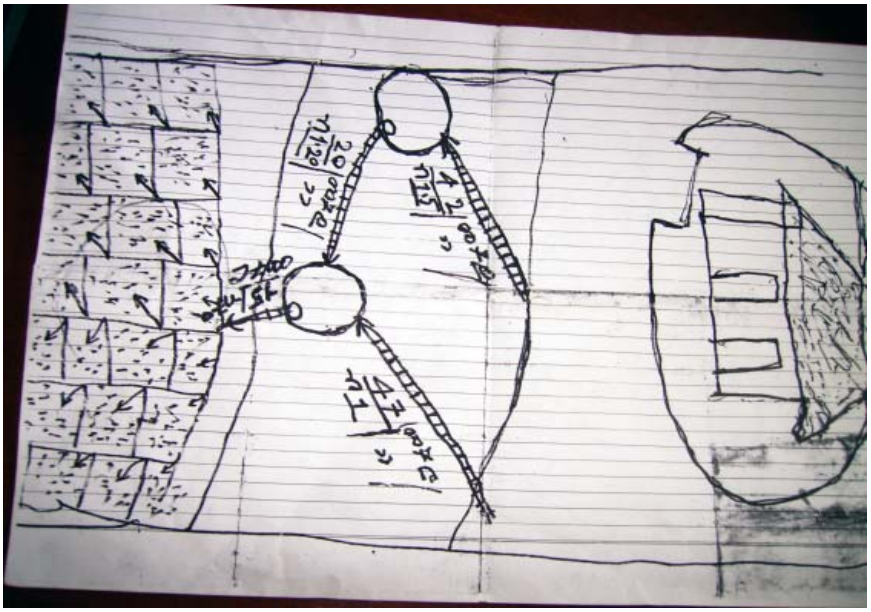
Adapting in the process of trying out

After the main wet season in 2006, when the PROLINNOVA–Ethiopia coordinating office in Addis Ababa released the funds for PID, the experimenting farmers started digging the canals and water-collection pits. They used the funds to buy materials such as sledge hammer, shovel, cart, etc for breaking and transporting stones, and a notebook, camera and films to document their work and the results.

The farmers could not experiment with the water-management innovation in a conventional scientific way with treatment and control, as the characteristics of the land of each farmer differs. They had to figure out how to apply the principles behind Abadi's work on their own land. As a group, under Abadi's guidance in assessing slopes and water flows, they dug canals draining water from different directions and connected the canals at five points, where they excavated small water reservoirs. Contrary to recommendations from outsiders, the farmers decided not to use cement to reinforce the canals, because the soil has enough clay content to hold the water. Indeed, the clayey nature of the soil was causing the drainage problem. They decided to line the larger reservoirs with stone only, because using cement would reduce water collection. Water enters the reservoirs not only through the canals.

The three farmers dug canals leading from the smaller water reservoirs to a lower area where they made a larger water reservoir. This is on a piece of land that was useless for cropping because of very severe waterlogging. Excess water from the farm and the smaller water reservoirs flows to this main reservoir and from there to a nearby stream. Thus far, there are no signs of erosion damage caused by overflowing water, because the stream banks are covered with hardy grasses.

The three experimenting farmers made their water reservoirs smaller and shallower than those made by Abadi, partly because their land is rockier. They adjusted things as they went along, depending on what they found. At one point exactly where they wanted to dig a pond, they found a huge rock, and had to use fire and a hammer and chisel to break it down.



Abadi's sketch plan for water drainage and harvesting in small ponds (photo: Tesfahun Fenta)

In the main wet season in 2007, the farmers sowed their drained land with cereals. In the dry season, they grew vegetables on the land below the reservoirs, just as Abadi had done on his farm, using the water from the reservoirs for irrigation. They drew out the water using customary devices, such as clay pots, cans or plastic containers, and sometimes Abadi's treadle pump, which he loaned to them free of charge.

While trying to set up the new system of joint water management across the plots of the three farmers, they and Abadi met 2–3 times per month to work together and to observe the water flows. They looked at how well the land was drained and whether and where they needed to build additional canals. They looked at the labour they had to invest, the inputs they had to buy, and the level of water that collected in the ponds. They could not quantify the amount of water collected because the ponds are irregular in shape. The farmers regulated the height of the water in the ponds by plugging and unplugging the below-surface outlets to the canals. Thus, they monitored and evaluated their work continuously, and discussed next steps.

In an area like Tigray Region, where many activities in agriculture and natural resource management (NRM) are supported through food-for-work or cash-for-work schemes, it is noteworthy that the experimenting farmers did not receive any food or cash for their work on land improvement. They received only some advice from BoARD and ISD staff, and the PID funds that allowed them to buy tools and other things they needed for the experimentation.

The role of different actors in the PID process

Even though the experimenting farmers already knew about Abadi's innovation from their own observations, he played an important role in the PID process by explaining his experience and guiding the joint work. Most of the problems in the trial-and-error process and the costs of initial mistakes had been faced by Abadi while he was developing his innovation. With his help, the farmers could avoid making the same mistakes. That is why they valued his presence so highly.

Their main partners in the PID process were DAs and specialists from BoARD at village and district level and staff from ISD. Only later were contacts made with formal researchers, when the Dean of Agriculture at the newly established Axum University and Head of Axum Agricultural Research Centre visited the PID site in late 2007. Tahtai Maichew District is too far away (about 280 km) from Mekelle University for people from there to take part in the regular meetings of the experimenting farmers. Some staff members from Mekelle University who are interested in PID made occasional visits, although the funds made available through PROLINNOVA–Ethiopia to support PID were not enough to cover their travel costs.

About once a month, someone from ISD visited the experimenting farmers. In between, ISD staff in Addis Ababa and Mekelle kept in touch by telephone with the district specialists for agriculture and NRM, who maintain frequent contact with the DAs in the field. The DAs joined the meetings of the experimenting farmers about twice a month, and occasionally the district specialists also came. The main tasks of ISD and extension staff were to help the farmers monitor their work and its effects. It had been agreed from the outset of the PID activities that the farmers themselves would do most of the monitoring.

During the PID launching workshop, the experimenting farmers had been given a still-photo camera and two films so that they could document their experiment visually. Abadi himself took the photographs and paid for film development and prints. He gave some of the prints to the three experimenting farmers and put the others in an album that he purchased himself and that he keeps in his house. He shows the photographs to visiting farmers so that they can follow each stage of the work, e.g. when the farmers were digging the canals, which can now no longer be seen because they are underground. There is no suitable site nearby where the farmers could display the photographs for others to see whenever they want.

Abadi also keeps written records. In a large notebook, he wrote down all the activities done by the farmers when testing the innovation in their adjoining plots. Similarly, the DAs and district specialists noted down their observations during their meetings with the farmers, including detailed records on the length and width of the canals and the depth and diameter of the water reservoirs. They put these records on file in the district agricultural office and referred to them when reporting to their colleagues and superiors.

Results and outcomes of the PID

The experimenting farmers showed that Abadi's innovation could indeed be applied elsewhere. Moreover, the materials that he originally used for building the pits and canals were strong enough: the earthen walls of the smaller reservoirs and the stone-lined walls of the larger ones held up well and needed no further reinforcement. The farmers did not find any cracking or other damage in the walls, but still monitor this. In a way, their experiment never really ended, as they continue to seek ways to improve how they manage the water, adding each year more canals to improve the drainage in the fields.

Other interested farmers in the neighbourhood occasionally joined the working meetings of the farmers involved in the PID, to work with and learn from them. Although women head over a quarter of the households in the area, almost exclusively men came to the meetings. The innovation involves strenuous work in digging and moving stones, the kind of work that usually only men do. Four of the neighbours have started digging their own pits and canals, and still more are planning to do this. One of the four neighbours is a woman household head, who dug some pits on her own but found that it is beyond her capacity to make the drainage canals. She hopes that, by irrigating dry-season vegetables with the water harvested in the pits she has already made, she can earn enough money to be able to hire a man to make the underground canals.

The experimenting and other neighbouring farmers have recognised that Abadi's original water-management system cannot be replicated with exactly the same dimensions. (They therefore saw no need to make exact measurements, as the extension staff had done.) The innovation can provide only an indication to other farmers, who have to make adjustments depending on their particular situation. Some fields will need more canals and pits, some less. Other farmers who try out Abadi's idea may even develop it beyond what he has done.

Making the PID process and results more widely known

The experimenting farmers disseminated their results when other farmers joined their regular working meetings, during visits to the PID site on farmers' days organised by the Agricultural Office and the District Administration, and through informal communication among farmers. This happens, for example, when

attending church, when gathering to celebrate a saint's day, at market places, at coffee or funeral gatherings or during neighbourhood meetings for other purposes. Except in the church, the men and women sit together on such occasions and both take part in these informal discussions.

The Agricultural Office has organised visits of farmer groups to Abadi's farm 3–4 times a year in the last couple of years. It has brought farmers from other areas that suffer from waterlogging in order to see how Abadi has dealt with the problem and to see the PID work on water drainage and irrigation. The Agricultural Office has also brought people from the village and district administration to see the PID work, so that they would understand this approach to agricultural development. The experimenting farmers were also visited by farmers and DAs from three other districts in Central and Western Tigray. Abadi keeps a record of all visitors to both his own farm and the PID site, and has counted more than 1000 visitors during a year. The visitors expressed appreciation for what Abadi and his neighbours have accomplished, and many of the farmers said they would try it out on their own fields. However, neither Abadi nor the Agricultural Office knows how many farmers have actually done so. The DAs working in Mai Atsmi Farmers Training Centre (FTC) have applied the drainage technique in the land around the FTC, firstly because the land needed to be drained and secondly to serve as demonstration to farmers in that area.

Abadi readily provides technical advice to other farmers. The Agricultural Office has found that farmers trust what Abadi shows and tells them much more than they trust what the agricultural specialists tell them. According to Abadi, the visits do not take too much of his time, as he merely shows and explains the principles to other farmers and then they have to do the work themselves. He does not benefit in terms of money, but he receives recognition, small things like notebooks and t-shirts, and ideas and suggestions from visitors for improving what he is doing. Moreover, the PROLINNOVA partners invite him to attend farmer fairs and workshops about agricultural development in other areas, where he can likewise pick up new ideas.

Communication and dissemination for agricultural improvement is greatly constrained by the frequent turnover of extension staff in Tigray. The handover from one DA to the next is not well done, so it is difficult for the new DAs to learn about the local innovations and PID processes. In most cases, they just find a pile of unordered papers on the desk or in the drawers or cupboards. By writing this and other articles in English (Hailu Araya 2007, Hailu Araya *et al* 2008), we have shared the experience beyond Tigray, but these articles also need to be published in Tigrigna for distribution to the DAs and literate farmers in the region. Most DAs do not have access to international publications, even if these are posted on a website, because most extension staff – even the subject-matter specialists – do not have access to the Web.

It has proved quite useful for information dissemination to have posters in the District Agricultural Office about outstanding farmer innovators and to have their work featured in catalogues of local innovations (e.g. PROFIEET 2006). More

posters will need to be made so that all DAs and subject-matter specialists and the farmers themselves have copies they can display, and also so that the posters can contribute to learning in the FTCs, agricultural and technical colleges and universities in Tigray. PROLINNOVA–Ethiopia has printed posters on local drip irrigation and water-lifting innovations in Tigray but not yet one devoted to Abadi's innovation in water management. This was included, however, as part of a general poster on local innovation presented at the anniversary celebrations of Tigray's Liberation, held in 2008 in Western Tigray. Abadi's work was also featured in the second catalogue of local innovations, published with support of the Relief Society of Tigray.

In the end, however, the most effective way to disseminate the innovative ideas to other farmers will continue to be through farmer-to-farmer communication, both in the fields of the innovating and experimenting farmers and at agricultural fairs where these farmers present their work.

References

Hailu Araya. 2007. The story of a smart water harvester in Tigray Region, Ethiopia. In: *Smart water harvesting solutions for rain, fog, run-off water and groundwater* (Netherlands Water Partnership), pp 36–39.

Hailu Araya, Kiflay Tebari, Leul HaileSelassie & Guesh WoldeSelassie. 2008. Participatory innovation development in water management in Tigray, Ethiopia. *Rural Development News* 2/2008: 53–57.

PROFIEET (Promoting Farmer Innovation and Experimentation in Ethiopia). 2006. *Catalogue of farmer innovations,* Vol. 1. Addis Ababa: ASE.

8 Improving the *jhalkari* – a local innovation to reduce fodder wastage in Nepal

Basanta Rana Bhat and Rajan Ghimire

In this case, the ideas for experimenting to improve the local innovation – a net for stall-feeding livestock – came from the community itself. The supporting NGO facilitated the process and provided some of the material required for the experiment. It is a very simple innovation that, through an equally simple process of joint experimentation, has delivered a product that meets a widespread need of the community and reduces the work burden of women in feeding livestock. The innovation has thus been readily adopted and adapted by other farmers. It is a case that shows the potential benefits of stimulating even the simplest of farmer-led experiments that can deliver great impact.

The Tharu ethnic community has lived for at least 600 years in Chitwan, the tropical plains of Nepal. Rich in ethno-cultural knowledge, this community's livelihood has been closely connected to the local natural resources and these, in turn, have shaped their culture and traditions (Ghimire & Rana Bhat 2003). Several development-related changes in the area impacted on the traditional lifestyle of the Tharu. With the eradication of malaria in the plains, people from various parts of the country migrated to Chitwan and took advantage of the agricultural policies that favoured the more educated and rich migrant farmers. Establishment of the Chitwan National Park further marginalised the Tharu, who were deprived of using the forest-based natural resources. Although a buffer zone management policy introduced a few years later allowed them limited access to the national park to harvest herbs, grasses, wood etc, the Tharu were forced to innovate and come up with coping strategies to adjust to these changing conditions. For example, to cope with the reduced availability of forage, they reduced the number of livestock they kept. They also modified their farming practices by adopting various agroforestry systems.

Uttam's innovation

The 56-year-old farmer Mr Uttam Chaudhary is a member of the Tharu community who lives with his nine family members in Divyanagar, a village in Sissai, Chitwan. Uttam keeps animals – sheep, goats and buffaloes – on his farm. The animal manure is used to fertilise his fields; meat and milk are used for home consumption and are sold on the local market; wool is used for weaving cloth and making quilts for the cold season. During the dry season, the animals are grazed around the farm or are given fodder collected in the area, mostly by his wives and daughters. In the wet season, the sheep and goats are kept and fed indoors, out of the cold and rain. With entry into the forest restricted and wood for building feeding troughs scarce, farmers simply put the cut fodder in a heap on the stall floor for the animals to eat. In the dry season, when the stall floor is dry, the amount of fodder wasted is minimal. However, in the wet season when the floor is damp, much of the cut fodder is wasted because the animals trample it.

This problem got Uttam thinking. He wanted to find a way to reduce the drudgery of his wives and daughters in collecting fodder that then went to waste. So, instead

of putting the fodder on the floor, he decided to hang up a bundle of fodder with a rope in the stall where the animals were kept. This was a slight improvement but, once the animals began to tug at the fodder, much of it ended up on the ground and was trampled. So he pondered on it further.

Uttam Chaudhary's initial innovation (photo: Ecoscentre)

As a big river runs past the village, Uttam and the men in his village are often out fishing. Nets are used for catching fish, so Uttam is skilled in weaving nets. He came upon the idea of making a bag out of fish net, into which he could put the fodder and then hang it up. Hanging up the net bag with fodder was far better than just hanging up a bundle of fodder on a rope. The spillage was limited even when the animals pulled out what they wanted to eat from the bag. Gradually, Uttam modified the shape, size and weave of the net bag to make a fodder-holding bag, which is called a *jhalkari.* This simple innovation proved to be a very good solution to a problem faced by most farmers who stall-feed their animals in the wet season. Several of Uttam's neighbours borrowed this idea and started using a *jhalkari* for feeding their animals.

Joint experimentation to improve the *jhalkari*

Ecoscentre, a partner organisation of PROLINNOVA–Nepal, is an NGO that is based in Chitwan. The *jhalkari* was one of the nearly 50 innovations identified and documented by Ecoscentre staff in 2006. Some of the local innovations identified were further improved through a process of joint experimentation.

In May 2006, field staff of Ecoscentre's Seeds for Survival Programme organised and facilitated a village-level workshop in Sissai for farmers from villages in the area and staff of local line agencies. At this workshop, Ecoscentre introduced the

concepts of local innovation and Participatory Innovation Development (PID) to the participants. Several farmer innovators who were invited to the workshop presented their innovations. Uttam was one of them. He described how he came up with the idea and developed the *jhalkari,* a bag made out of fish net to hold animal fodder. As part of the workshop programme, field visits were made to the farms of several innovators. The participants were particularly impressed with Uttam's innovation and how it had helped him to reduce wastage when feeding his animals.

Later, the participants engaged in a short-listing and preference-ranking exercise to select four innovations that could be improved through a process of joint experimentation. Some of the criteria used for ranking were: benefit to the community, use of local resources, no damage to the environment, easy to handle, and inexpensive solution for a pressing problem. Uttam's innovation was one among the selected four, as it met all of these criteria. The workshop participants were asked to give their suggestions on how each of the selected innovations could be further improved and/or disseminated. A key observation regarding the *jhalkari* was the difficulty to refill it: the bag had to be taken off its perch and the freshly cut fodder had to be pushed in through the narrow neck of the bag. Some modifications to the design would make this task easier.

In October 2006, Ecoscentre organised a follow-up workshop at village level to launch joint experimentation activities. Most of the participants in the first workshop came to this second event. The purpose was to discuss how the experiments would be undertaken for the four selected innovations. Uttam presented some ideas he had thought of for improving the *jhalkari,* based on suggestions made at the first workshop and feedback from his wives and daughters who were using the *jhalkari*. He wanted to change the shape of the bag's opening to find out which shape would make refilling easier. The workshop participants from his community selected two of Uttam's neighbours to join him in the process of experimentation. The roles of Ecoscentre staff were to give technical inputs in the different designs, to help in documentation and to provide financial support for buying the necessary materials. These included iron rings, frames etc and nylon rope for the experiments, plus notebooks, pens and a camera for keeping records.

During a period of two months, the three farmers – with Uttam taking the lead – tested and compared three different designs: a) the original narrow opening; b) a rectangular opening made with a metal frame; c) a round opening made by inserting an iron ring. They discussed each of the designs together but tried them out independently and kept records including photographs. Each model was tried out for three weeks. The farmers also took note of feedback on each model given by their family members, mostly the women and girls involved in collecting the fodder and feeding the animals. Members of the community visited the three experimenting farmers and observed what they were doing. Ecoscentre staff visited the experimental site regularly and discussed the progress.

At the end of the experimental period, based on their records, the three experimenting farmers concluded that the most efficient design in terms of handling, feeding of animals and deposition of fodder was the *jhalkari* with an

iron ring inserted to create a round opening. This design was preferred for several reasons: the round opening made it easy to refill; if hung at a convenient height, it could be refilled even when it was still hanging; it moved flexibly even when the animals would pull at the fodder; this design led to the least amount of spillage and wastage of fodder.

Spreading the news

Within Uttam's village, word got around fast and many of the families began to use the improved *jhalkari.* Ecoscentre staff spread the news about this innovation to neighbouring communities and organised field trips for people to visit Uttam's community. Uttam, his family and neighbours were more than happy to share information about their innovation with visitors. The innovation was publicised at a biodiversity fair organised by Ecoscentre and the Nepal Permaculture Group in Chitwan, which was attended by staff of various government agencies, NGOs, community-based organisations, university students and people from other villages in the Chitwan area. Uttam's innovation was also given coverage on local FM radio through Ecoscentre's facilitation.

Farmer innovator Uttam describing how he developed the *jhalkari* (photo: Ecoscentre)

Ecoscentre shared Uttam's innovation with other partners of PROLINNOVA–Nepal, who then spread the word around to communities in their working areas. A group of students and teachers of the Institute of Agriculture and Animal Sciences based in Chitwan – also a PROLINNOVA–Nepal partner – visited Uttam's farm when the experiment was being carried out and collected information that was later used in class to discuss the topic of local innovation and its importance in agricultural research and development.

In May 2009, Uttam was invited to present his innovation at the National Farmer Innovators Fair in Kathmandu, organised by PROLINNOVA–Nepal. This fair was open to the public for three days and drew large crowds. A local TV station – Kanthipur Television – gave live coverage of the innovators' fair throughout Nepal. Also participants from several other Asian countries attending the Innovation Asia-Pacific Symposium – co-organised by PROLINNOVA in Kathmandu – had a chance to visit Uttam's and other local innovations displayed at the fair.

Simply a greatly useful result

The *jhalkari* has proven to be a simple yet successful innovation that is being readily taken up by many farming families who stall-feed their animals in the wet season. Most families in Uttam's village are now using the *jhalkari*. Some of them have even adapted it to suit their own purposes by changing the size, using different material for making the net etc. Uttam himself has been trying out further adaptations to the design. He also has been receiving orders from nearby villages and has made and sold several *jhalkari*. Uttam emphasises that he does not want to make a lot of money out of this endeavour but he wishes to support fellow farmers with his innovation. The *jhalkari* has also been taken up and is used regularly by farmers beyond Uttam's village, as was confirmed by Ecoscentre staff during visits to various villages in Chitwan.

Reference

Ghimire M & Rana Bhat B. 2003. Empowerment of Tharu indigenous knowledge. *In*: Haverkort B, van Hooft K & Hiemstra W (eds), *Ancient roots, new shoots: endogenous development in practice* (Leusden: ETC Compas / London: Zed Books), pp 70–73.

9 Exploring alternatives to commercial feed for pigs in Cambodia

Chhut Socthaun and Sam Vitou

This is an early case of joint experimentation in Cambodia, where the researchers were trying to move beyond conventional on-farm research, giving farmers more room in all aspects of the experimentation process. The farmers were involved in looking for and deciding on options for the experiment, as well as in carrying it out and keeping records. The researchers played a supportive role, especially in designing recording sheets, analysing results etc. Although the case contain relatively little information on the process of experimentation, it does show that a simple experiment in which farmers take responsibility and ownership can lead to useful results not only for those engaged in the experiment, but also for others in their communities.

PROLINNOVA–Cambodia, set up in March 2004, seeks to work with various governmental and non-governmental organisations to integrate participatory approaches into research, development and education for promoting local innovation in ecologically oriented agriculture and natural resource management. The multi-stakeholder platform within the country has over 25 member institutions and is coordinated by the Centre d'Etude et de Développement Agricole Cambodgien (CEDAC).

Every year, PROLINNOVA–Cambodia supports proposals for experiments implemented by the network members. The experiments have focused, amongst others, on the ecological System of Rice Intensification (SRI), ecological chicken-raising, efficiency of botanical pesticides in vegetable growing, and ecological pig-raising. In 2006, more than 200 farmers in 15 farmer groups were supported in doing experiments. These farmer-led experiments are facilitated by three educational institutions (Royal University of Agriculture, Prek Leap National School of Agriculture and Kampong Cham National School of Agriculture), one farmer organisation (Farmer and Nature Net) and 11 government institutions concerned with agricultural development. During the annual national planning workshop of PROLINNOVA–Cambodia in December 2006, farmers and staff of several partner institutions presented the results of their experimentation.

The workshop participants were particularly interested in the experiment that farmers conducted together with the staff of Prek Leap National School of Agriculture (PNSA) on the production and use of water-hyacinth silage for pig feeding.

Identifying options for experimentation

PNSA works with farmers in Seb Commune, Kampong Tralach District, Kampong Chhnang Province in central Cambodia. PNSA had initiated the setting up of a pig-farmers' association in 2005 to give pig farmers an opportunity to work together in improving pig husbandry and to save money through bulk purchases of pig feed. In recent years, the price of pig feed had risen sharply, while the price of locally produced pork had decreased because of competition from pork imported from Thailand and Vietnam. As a result, many pig farmers in Cambodia have been forced to abandon this enterprise.

In June 2006, a research team from PNSA studied alternatives in pig feeding in Seb Commune. The team met with 15 farmers in the pig-farmers' association as well as with staff of the Office of Animal Production and Veterinary Services, staff of the Agricultural Office in Kampong Tralach District, members of the commune's council and the district governor. During these discussions, the participants came up with several different ideas for pig feed such as banana stems, water hyacinth (*Eichomia crassipes)* and water convolvulus (*Ipomoea aquatic),* apart from the commercial feed available on the market. The idea of water hyacinth came from a staff member in the Office of Animal Production who suggested that using it could make the Cambodian pig farmers more competitive with those in Thailand and Vietnam. One of the farmers in the group who brewed rice wine suggested using rice-wine residue as an alternative feed. After discussing the pros and cons of these alternatives, the pig farmers and the PNSA research team decided to experiment with water hyacinth, because it grew abundantly in the area as a prolific "weed" and could be harvested for free. This they thought could bring down the production costs. They also wanted to try out rice-wine residue in the experiment not only because it was available locally, but also because it was a way of recycling waste from local rice-wine making.

Experimenting with alternative feeds for pigs

Fifteen pig farmers and the research team decided to compare three options – commercial feed bought by farmers, water hyacinth and rice-wine residue – over a period of ten weeks. They divided up the tasks and responsibilities. The farmers agreed to give their pigs the three different types of feed and to collect the basic data for comparison, such as the weight of feed given to pigs (recorded daily) and

Members of the research team training farmers in making water-hyacinth silage (photo: Chhut Socthaun)

the weight of the pigs (recorded once a week). The research team designed a simple format that could be used by the farmers to record these data and gave each experimenting farmer a record book. The equipment used for the experimentation belonged to the pig-farmers' association, including the implements to cut water hyacinth, containers and weighing scales. The researchers agreed to visit the farmers once every two weeks to monitor the records and the general progress of the experiment together with the farmers.

Before starting the experiment, the pig farmers asked the research team to train them in preparing silage from water hyacinth. They were given the following guidelines.

Preparing silage from water hyacinth

Requirements:

- Fresh, preferably young water hyacinth
- Palm sugar
- Salt
- Knife for cutting water hyacinth
- Plastic container to hold the silage (size depends on amount of water hyacinth)
- Can or tub to mix palm sugar, water and salt

Preparation:

- Chop water hyacinth into small pieces 1–2 cm long.
- Mix palm sugar and salt with water and then mix well with the chopped water hyacinth.
- Put the mixed material into the plastic container and compress firmly.
- Leave the mixture for 8–10 days (8 days are enough if the water hyacinth is young); it is not necessary to cover the container but it needs to be protected from rain and water.
- The mixture is then ready to be used for pig feed.

Recommended quantities:

10 kg water hyacinth, 400 g palm sugar, 100 g salt and 1.6 litres of water

For feeding the pigs, the research team advised the farmers to take only the wet yellow part of the water hyacinth out of the container and to press down the rest of the mixture firmly so that it can continue to ferment. The water-hyacinth silage produced in this way was to be stored for about 30 days. The researchers told the pig farmers to prepare only 10 kg of water-hyacinth silage at a time, so that it could be used before its quality deteriorated. The water-hyacinth silage was to be fed to the pigs mixed with an equal quantity of rice bran.

In the experiment, the farmers used three treatments (three types of feed) with five replications:

Treatment 1: Commercial feed (bought by the farmers)
Treatment 2: Rice-wine residue and commercial feed in a ratio of 1:1
Treatment 3: Water-hyacinth silage and rice bran in a ratio of 1:1.

Researcher from PNSA discussing pig measurements with farmer experimenter (photo: Chhut Socthaun)

Results of the experiment

At the end of the experiment, the farmers and the PNSA research team brought all records together and calculated the average weight gain of the pigs and the expenditure on the different feed treatments. The researchers helped the farmers convert the recorded feed weights into monetary equivalents. The results of the experiment showed that the commercial feed (Treatment 1) led to higher weight gains than did the other two treatments: an increase of over 40 kg per pig within ten weeks compared to about 36 kg with the second and third treatments. However, the expenditure was lowest in the case of the water-hyacinth silage option.

The farmers and researchers involved in the experiment presented their findings to other farmers in the commune.

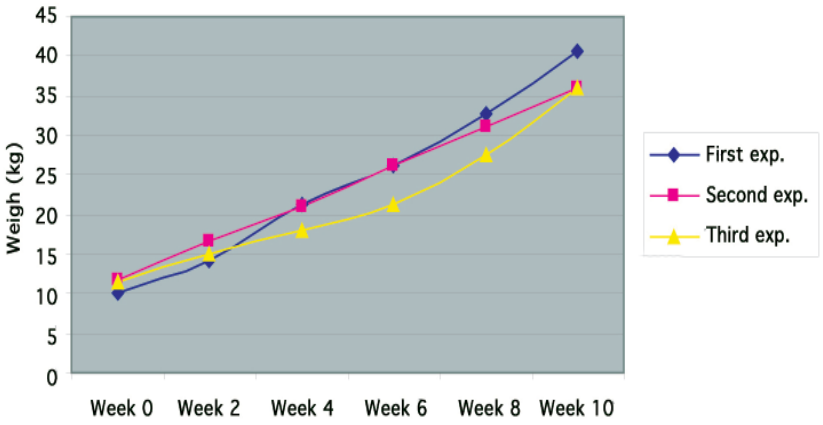


Figure 1: Accumulation of pig weight

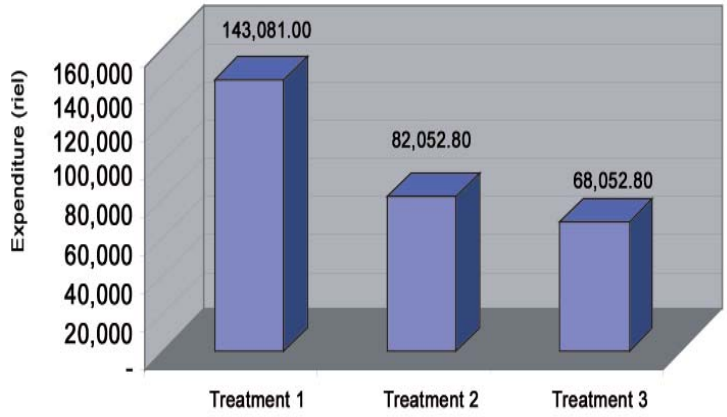


Figure 2: Comparison of pig feeding expenditure

Lessons and conclusion

The farmers and the PNSA research team regarded the use of water-hyacinth silage as pig feed to be an attractive option, as it was less expensive than other feeds, even though the weight gain of the pigs was not as high as with the use of commercial feed. Using rice-wine residue was also cheaper than commercial feed, even though it was not as freely available as water hyacinth. By identifying and using locally available resources to supplement commercial feed, farmers could bring down their expenses and thus compete with the prices of pork imported from Vietnam and Thailand.

The experiment was successful in revealing to farmers the relative benefits of different types of feed. Farmers could analyse these benefits themselves, as they were involved in the entire process of experimentation – from planning to evaluation. They found that the water-hyacinth silage brought overall benefits compared with the other treatments. The farmers who experimented with the silage have continued this practice, using the mixture as made during the experiments. Indeed, around 30% of farmers who had given up raising pigs went back to it when they saw the benefit of using water-hyacinth silage.

In continuing the process of experimentation, the pig farmers and researchers have been looking at other local resources to use as pig feed. They now plan to try out water-convolvulus silage for feeding pigs, as it is richer in minerals than is water-hyacinth silage.

10 Trying out joint experimentation in poultry farming in Uganda: an experiment in itself

Ronald Lutalo, Tomusange Nvule, Gerald Kirembe, Donald Kugonza, Stella Lutalo and William Critchley

This case highlights a key challenge in trying to promote farmer-led joint experimentation: making sure that farmers take and keep the lead. As PROLINNOVA partners seek to learn from both successes and failures, we include this case to show the danger that farmers lose control in joint experimentation and end up simply being labourers and observers of scientist-led on-farm trials. It is an example of a joint experiment undertaken by several partners of PROLINNOVA–Uganda – one of their first attempts along these lines – which did not succeed as had been hoped, but certainly yielded some useful lessons.

Joint experimentation involves specialists from outside the farming community working alongside farmers to add value to local innovation and to strengthen farmers' motivation and capacity to try out and further develop new ideas. The partners in the PROLINNOVA–Uganda network defined joint experimentation as the process in which farmer innovators, formal researchers and extension agents work together in jointly validating or improving farmers' innovations. Theoretically, it is the farmers who set the agenda of the process: they decide what they want to test or improve, based on their original innovation (or ongoing experiment). This makes joint experimentation clearly different from conventional research – also on-farm – that is conceived, designed and conducted by scientists.

Looking for local innovations

Two people from PROLINNOVA–Uganda took part in the international "Training of Facilitators in Participatory Innovation Development" that was held in 2004 on the International Institute of Rural Reconstruction's (IIRR) campus in the Philippines. After this training, these and several other PROLINNOVA–Uganda partners embarked on identifying and documenting local innovations in the fields of agriculture (crop and livestock management, fishery, beekeeping etc), energy and natural resource management. A team of subject-matter specialists drawn from the PROLINNOVA–Uganda partners reviewed the first round of "potential innovations", as they were termed, and selected the five most promising ones to be supported through processes of joint experimentation. The criteria for selection of innovations were: high potential for improvement through formal research, high potential to spread and have an impact in small-scale farming, and originality of the innovation.

The team of specialists that had selected local innovations as candidates for joint experimentation informed the network partners who had identified these innovations. These partners were asked to contact the farmer innovators concerned and, together with them, to identify formal researchers to support them in undertaking the joint experimentation.

Mr Tomusange's innovation

One of the farmers whose innovation was selected by the team of specialists was Mr Tomusange Nvule, who lives in Mabanda Village in Namayumba Sub-County

of Wakiso District. This is very close to Kampala, Uganda's capital city. Mr Tomusange was trying out better ways of rearing local chickens as an alternative to the conventional way of rearing "improved" breeds that was being recommended by the extension services. His experience was that "improved" chickens were more vulnerable to disease and more expensive to feed. Mr Tomusange described how he started to innovate:

''Indigenous poultry works everything out … you just wait to harvest… In the early 1980s, I employed up to 45 labourers on my farm. All this changed as a result of the 1981–86 liberation war, which led to the destruction of my farm and its infrastructure. In the process of re-establishing my farm, I decided to take up indigenous poultry keeping as one of my enterprises, after discovering that it could be a viable way of generating income. After getting some training on commercial poultry farming, I became even more passionate about the enterprise to the extent that I made it a full-time job. As I continued carrying it out, I noted that conventional poultry management for improved breeds was characterised by low hatchability of eggs, small clutch size and high chick mortality. In 2003, I decided to modify the conventional poultry-farming methods that I was using on my farm."

Mr Tomusange experimented on his own to find an innovative system of managing poultry (photo: William Critchley)

Through trial and error, Mr Tomusange came up with the following innovative system of managing poultry:

a) Creating communal laying nests – putting all fertile eggs into one nest – to encourage longer laying periods (hence more eggs), to reduce egg spoilage and to facilitate monitoring of eggs;

b) Isolating broody hens in wooden boxes with two sections fitted with wire mesh floor and an open roof covered by a mat (woven from tree branches) to improve hatching rates;
c) Making a creep hole in the partition of the brooding box through which chicks could access highly nutritive feed in the adjoining section and move back to the mother hen for brooding, thus reducing costs of feeding;
d) Weaning chicks at four weeks of age and keeping them in group housing for another four weeks, then setting the chicks free to range in an area of about 0.3 ha fenced with living thornbushes or chainlink wire;
e) Growing different plants in the fenced free-range area to be able to provide the birds with forage, insects, worms and exercise and to monitor the birds on a daily basis.

Process of joint experimentation

When informed that his innovation was selected for joint experimentation for the purpose of scientific validation, Mr Tomusange willingly accepted the offer. The process began with meetings held between the PROLINNOVA–Uganda core-team partner the PELUM (Participatory Ecological Land Use Management) network in Uganda, a local non-governmental organisation called the Agency for Integrated Rural Development (AFIRD) and Mr Tomusange in order to agree on how to do the joint experimentation. The innovator had confidence in his innovation and was interested in validating it together with scientists. The process of validation in the form of joint experimentation thus began to take shape. For PROLINNOVA–Uganda, this way of working was in itself an experiment.

After the initial discussions to agree on the purpose and focus of the research, the next step was to identify a suitable scientist from a research organisation to work together with Mr Tomusange. One person from PELUM, one from AFIRD and the innovator – with support from the network coordinator – identified an animal scientist in the Faculty of Agriculture at Makerere University in Kampala. Then, the representatives of AFIRD and PELUM met to discuss the terms of reference for the scientist, which – mainly for financial reasons – had to conform to a Memorandum of Understanding (MoU) signed between the core-team partner (PELUM–Uganda) and Environmental Alert as the NGO that serves as secretariat for PROLINNOVA–Uganda.

The four partners in the joint experimentation (from AFIRD, PELUM, Makerere University and Environmental Alert) then visited Mr Tomusange to see his innovation. Immediately after this field visit, the farmer innovator, the animal scientist and the two people from AFIRD and PELUM met to discuss the research in more detail. They agreed that the scientist would make a background literature review, write up the methodology to be used throughout the trial and the analysis, and produce an inception report. The literature review and inception report were important primarily for the scientist and his colleagues at the university rather than for the farmer innovator and his colleagues in the village.

The animal scientist drafted a workplan and budget for the entire process of joint experimentation, including all costs and expenses, how much the farmer would

cover himself and what was requested as support from PROLINNOVA–Uganda. The total budget came to 2,120,000 Ugandan shillings (USh), which was about US$ 1000 at that time. However, the PROLINNOVA–Uganda Steering Committee had set a ceiling for the financial support that could be provided from the network, and this was only USh 1,500,000. The network secretariat at Environmental Alert agreed to disburse this maximum sum in tranches (75% of the amount on signing the contract and 25% on submitting the final report on the joint experiment). The MoU in the required format was prepared and signed. This MoU was meant to guide all the partners involved by spelling out their respective roles in the process. The farmer's role was to manage the experiment, while the animal scientist was expected to provide technical support, and the extension workers with AFIRD were to serve as facilitating links between the farmer innovator and the scientist. The experiment went over a period of five months from April to August 2005.

According to Mr Tomusange, this is how the process worked out: *''Before starting the process, we met and discussed about the way forward and agreed on what would be done by me (the farmer), the researcher and AFIRD plus PROLINNOVA. We also came up with a workplan for doing the joint experiment and a budget for the same. My research objective was to increase the number of chicks hatched, to increase the number of birds reared by reducing chick mortality and to increase saleable egg production".*

Brooding box with two compartments is part of Mr Tomusange's innovation (photo: William Critchley)

The idea proposed by the animal scientist in setting up the experiment was that Mr Tomusange's innovation – combining the five components described above – would be compared with two "controls". These were two other farmers in the same village, who lived relatively far from the farmer innovator and had not been involved in the earlier discussions about the experiment. They would simply

continue their normal system of free-ranging (scavenging) poultry. The basic idea was to test whether the local innovation was better in technical and economic terms than the conventional system practised by most poultry-keepers in the neighbourhood. The animal scientist visited the field regularly, together with Dr Kirembe from AFIRD, to record the weight of the chickens, to calculate mortality rates and to monitor the general progress of the experiment. The experimenting farmer and the other two "control" farmers did not keep any records themselves.

Jointly evaluating the results

The people involved in assessing the results were Mr Tomusange and his wife and children, the animal scientist, a farmer trainer from AFIRD, the PELUM–Uganda Country Desk Coordinator and the PROLINNOVA–Uganda coordinator. They gathered at Mr Tomusange's farm and discussed what came out of the experiment. The other two farmers who were included in the experiment as "control" cases were not involved in this discussion.

The results of the experiment validated at least part of Mr Tomusange's innovation by establishing that:

- There was an obvious difference between the crossbred hens under the "Tomusange system" and those that were free-ranging in terms of hatchability of eggs: 94% versus 79%, while the local hens that were confined had a hatchability rate of 96%.
- The innovative brooding box worked well because of the natural broodiness of the local chickens, which are better mothers than are the "improved" crossbred chickens; free-ranging crossbred hens abandoned their chicks after one week.
- The use of the brooding box led to lower weight losses of hens during brooding than in the case of free-ranging hens.
- It also led to much higher chick survival rates, largely because confined brooding effectively cut out the loss of chicks to predators.

The scientist concluded that Mr Tomusange's innovation should be popularised among smallholder poultry farmers who keep less than 50 mature hens.

The PROLINNOVA International Support Team member (William Critchley) from the Netherlands – the "backstopper" in PROLINNOVA parlance – visited Mr Tomusange in 2006, after the joint experiment was over. The farmer said he appreciated the assistance from PROLINNOVA–Uganda and had learnt something from the results, but he expressed the opinion that the experiment had slipped out of his control and left him merely as a bystander. He did not even have the opportunity to see the animal scientist's report on the experiment.

Disseminating the results

A spinoff of the joint experimentation process was that the PROLINNOVA–Uganda network asked Mr Tomusange, together with a woman innovator identified by network partners, to exhibit their innovations and share their experiences in joint

experimentation at the African Science Exhibition that was held in Entebbe in June 2005 during the General Assembly of the Forum on Agriculture Research in Africa (FARA). PROLINNOVA–Uganda also included Mr Tomusange in a national "sharing event" that it organised later in 2005, where various farmer innovators, formal researchers and extension agents who had been involved in joint experimentation processes could share their experiences. Other than these two events, there were no deliberate attempts to facilitate sharing of the process or findings within the farming community concerned or with other farmers.

Lessons learnt from the joint experimentation

To find out what could be learnt from this early attempt to facilitate farmer-led joint experimentation, the PROLINNOVA–Uganda coordinator and backstopper discussed this with other members of the network and came to the following conclusions and lessons:

- The "joint experiment" had basically become an on-farm trial run by the formal researcher.
- In future experiments of this kind, all treatments should be conducted on the same site and also the farmers managing the control treatments should be involved in the learning process.
- The team facilitating the joint experimentation needs to study the local situation and interventions already in place in more detail before starting the experiment.
- The opportunity to use the experiment for joint learning had been largely lost: in future, any separate research report should be given to the farmer experimenters immediately after completion of the experiment.
- There is a need to develop a practical way of doing participatory monitoring and evaluation during the joint experimentation process – and not just to rely on criteria developed by scientists.

Final comments

This case of a "joint experiment" to validate a local innovation did not work out as well as it should have done. It turned out to be more of an "on-farm trial" managed by the scientist, while the farmer innovator was more or less carrying out instructions and was hardly involved in the monitoring or evaluation. Joint experimentation is an attractive concept, but more easily described in theoretical terms than put into practice. It is no simple matter to define clearly who does what and who decides what. Furthermore, if conducted on a sub-contract basis with a research institution, it can prove to be very expensive and thus not easily replicable. In many cases, it may be a better idea to invite scientists or other specialists to visit innovators in the company of extension workers in order to advise them on their joint experiments. Of course, there will be occasions where laboratory work is necessary, but keeping the experimentation process simple, cheap and replicable is essential.

11 Cross-visits to stimulate farmer-led experimentation in Msinga, South Africa

Rauri Alcock and Brigid Letty

PROLINNOVA partners in South Africa have been using cross-visits for different purposes. This case describes how cross-visits were organised within communities so that experimenting farmers could share their experiences with others. It also shows how farmers and NGO fieldworkers from one location have been stimulated to experiment by visiting farmers in other locations. All in all, the cross-visits have resulted in several positive developments: the number of farmers who have become involved in trying out new things has increased; more options for experimenting have been identified; the experiences of experimenting farmers have been shared with a larger audience; a space for farmers and fieldworkers to interact more closely has been created; and fieldworkers have been able to gain better insights into what farmers expect from experimentation.

Msinga is a very hot and dry rural area in KwaZulu-Natal (KZN) Province in South Africa. Most men of a working age are absent for much of the time, as they migrate to other areas as labourers, and come back only two or three times a year for short visits. The area is well known for its gun running and marijuana farming. The NGO known as Church Agricultural Project (CAP) has been working in Msinga since 1975 and is involved with land reform, dryland and irrigated agriculture, and welfare activities. CAP is a partner in the PROLINNOVA–South Africa multi-stakeholder platform. It currently runs a programme in Msinga called the Mdukutshani Land Reform Project, funded by Misereor (Germany), that provides support around livelihoods and farming (livestock-keeping and dryland cropping) to land-reform beneficiaries.

One of CAP's activities involves supporting rural community members who keep indigenous (local) chickens. CAP staff initially started working with cattle farmers, mainly men, but then started working on poultry-keeping because they wanted to be able to involve also women. This project looked at ways to increase poultry productivity and reduce bird mortalities. In a baseline study of farmers in the area, predation was identified as the biggest cause of losses. Numerous young chicks are taken by predators, especially hawks; only two or three chicks from a clutch of 12 survive to adulthood. CAP therefore started working with farmer groups on preventing losses to hawks and other predators by providing shelter for the chickens.

The development approach taken by CAP is to identify and strengthen local ideas / innovations as well as to find external ideas that are broadly relevant to the Msinga farmers' situation and then see whether any of the local farmers want to experiment with or try out and adapt what they have seen or heard.

Testing and adapting new ideas

Farmers in Msinga have investigated numerous ways to address the problem of predation of chickens. One idea suggested by CAP was the use of small structures

known as A-frames to house hens with young chicks. The concept (sometimes called “chicken tractors”) has also been promoted by other NGOs operating in KZN.

Some 30 farmers (all women except one man) advised by CAP tried out the A-frames but were not satisfied with them, and only one woman continues to use them. The structures need to be small and lightweight if they are to be moved regularly to areas where there is some greenery available for the chickens to eat. Since the structures being tried out were too heavy to do this easily, they were generally not moved regularly. The confined chicks became malnourished because the farmers did not provide enough additional feed, especially greenery. Another problem was that it was not possible to keep more than one hen and her chicks in an A-frame, as one hen would attack and kill the chicks of another hen.

Because the A-frames did not seem to address the problem of chicken predation satisfactorily, the CAP fieldworkers asked the farmers to think of what else they had heard of or previously tried on their own to solve this problem. Two more ideas emerged. One idea was to tie pieces of plastic packet to the backs of chicks to prevent predation by hawks, while the other was to tie a plastic packet to a tree so that it rustles and chases predators away.

Tying pieces of plastic packet to the chicks appears to confuse the hawks by changing the shape and colour of the chicks. This practice is not entirely new to the area, as people had heard of it being used previously in nearby places. However, it was adapted by Mr Bekwa Majozi, who developed his own way of tying the pieces of coloured plastic onto the backs of the chicks and also investigated which colour of plastic is most effective. While people previously made holes in a piece of plastic and tied it around the chick with the wings protruding through the holes, Mr Majozi ties the piece of plastic over each wing in such a way that it puffs up above the chick. He also found that bright green plastic is most effective. Four other farmers (one man, three women) have taken the original practice and, like Mr Majozi, have adapted it in attempts to make it more effective.

Msinga farmers had heard their older relatives talk of the practice of tying a plastic packet to a tree so that it rustles at night and chases away predators such as mongoose or genets, but had not tried it out themselves. With encouragement from CAP, four women farmers started to experiment with this on behalf of the groups. (The men were not as interested because they generally have dogs that chase away predators.) Assisted by the CAP fieldworker, the women kept records of chick losses on a monthly basis, to be able to measure any real, as opposed to perceived, reduction in losses. Together with CAP staff and other chicken-keepers, they assessed the effectiveness of the practice at a farmers’ day in October 2008. All four women were unanimous in their opinion that it led to reduced chick mortality.

Pieces of plastic attached to chicks to ward off hawks (photo: Rauri Alcock)

Cross-visits to find new ideas to test

CAP has found that an effective way to find or stimulate new ideas is to arrange for farmers and fieldworkers to visit projects of other organisations that are working in similar situations. CAP promotes local farmer cross-visits, where farmers with whom they are working visit other farmers or farmer groups that are also involved in the programme, so as to share experiences and findings. It works with a range of different farmers involved in other agricultural activities, and all are invited to take part in the cross-visits and farmers' days. For example, farmers involved in CAP's Nguni cattle-breeding project might also participate in a cross-visit to a group involved in the chicken project.

Cross-visits to other areas are arranged with either government fieldworkers or other NGOs. CAP has helped establish farmer groups, each with a group coordinator, in an effort to scale up the chicken-raising activities. Fieldworkers meet with the groups at the homes of the group coordinators to discuss and share experiences and to vaccinate chickens. When cross-visits are being arranged, each group decides who will represent them on the visit. CAP fieldworkers talk with the groups about what is to be seen as well as how they will report back from the process to the other farmers.

Following a cross-visit, CAP fieldworkers and farmers agree on what things they have seen that are interesting enough for testing and evaluating. Once the ideas have been selected, farmers and staff identify who will be involved in the experiment. Together, they agree how the experiment will be carried out and how they will see

the results (i.e. what will show whether it has been successful). These are verbal plans. There are, however, written agreements between CAP and the group coordinators to keep records, share information and experiences, and arrange meetings.

The farmers try out different things, with some inputs from CAP (technical advice from chicken experts, rather than cash or materials). Through discussions with the farmers, the fieldworkers try to gain some idea of what outcomes the farmers expect from their informal experiments. Of the things that the farmers try out, those that have some level of success (or at least some successful elements) are used as topics for farmers' days and cross-visits. To prepare for assessing the effectiveness of what they intend to try out, the farmers describe what they regard as success and how it will be measured. For instance, because they are looking at ways to reduce predation, they decided to count how many chicks that have had plastic tied to them are being lost, compared with other chicks in the flock.

As one example, in November 2005, CAP organised a cross-visit from Msinga to a farmer in another part of KZN. Managers from CAP and from the organisation hosting the visit (Mariannhill Diocese Development Project), three CAP fieldworkers, two Mariannhill fieldworkers, 15 Msinga farmers (mostly women), a similar number of farmers from Mariannhill (again, mostly women) and field staff from the KZN Department of Agriculture and Environmental Affairs were involved in the cross-visit. The group visited the home of Mr Ephraim Mtshali, a farmer who lives at St Bernards Mission, some 300 km away from Msinga, close to the small town of Richmond. CAP made contact with Mr Mtshali through one of the fieldworkers who was working for the Mariannhill Diocese project, an initiative also funded by Misereor.

Mr Mtshali engages in a range of farming activities including raising indigenous and "improved" chickens (he has over 100 birds). He keeps them fairly intensively, using a hut for raising chicks and outside wire enclosures with a tin roof to separate birds of different ages so that he can provide them with different diets. After a formal presentation, Mr Mtshali took the visitors around his yard and showed them the various enclosures and facilities and explained the purpose of each. While people were looking at this, he answered their questions. The farmers from Msinga also had an opportunity to talk about their own activities and interests. The CAP fieldworkers provided, when needed, additional information to help the farmers inform the people from other areas about the work that CAP is doing and the things that the project is interested in.

Before the visit, none of the Msinga farmers had built shelters for their chickens, which generally just roosted in trees at night. Mr Mtshali's enclosures were also much bigger than anything the Msinga farmers had seen before. Feeding the chickens and separating chickens of different ages were also new concepts for them.

Four of the farmers who saw the enclosures during the visit to Mr Mtshali have tried out similar things back at their homes, adapting what they saw during the cross-visit. Two of the women, Mrs Nyoni Mchunu and Mam Yengwa, have had

some success with their efforts to make chicken huts and have also seen increased chick survival. They took the ideas of separating the chickens of different ages and feeding the chicks separately from the mothers. They also took the idea of the hut that Mr Mtshali was using to raise chicks. Instead of allocating one of their existing huts to chickens, as Mr Mtshali had done, they constructed smaller mud-walled, thatch-roofed structures for their chickens, because they were already using all their existing huts. The structures they built are made mainly of local natural resources, except for the wire used for the front of the hut. While using the huts, they have introduced other elements, such as tying the hens with a leg tether to different corners of the hut in order to prevent them from fighting or attacking chicks of other hens.

CAP also encourages other organisations (and the farmers they work with) to visit the farmers with whom it is working in Msinga, thus ensuring a two-way sharing of ideas, processes etc. These visits involve also other stakeholders such as staff from the Provincial Department of Agriculture and other NGOs.

Local cross-visits to share experiences and generate ideas

A number of cross-visits have been arranged within Msinga to facilitate sharing of experiences and identification of more options to improve backyard chicken production. To date, these have focused mainly on structures for housing chickens and methods of feeding them. Each cross-visit normally involves about 30 farmers, most of them women.

In response to questions from other farmers in Msinga about how to go about building enclosures for their chickens, CAP arranged cross-visits by representatives of the farmer groups to the households of Mrs Mchunu and Mam Yengwa so that these women could share their experiences. During the cross-visits, the other farmers had the opportunity to see the structures and hear what factors the women had considered when designing and building them (cost, accessibility, number of compartments etc). Since seeing the structures built by Mrs Mchunu and Mam Yengwa, four other women farmers in the area have started building houses for their chickens. CAP continues to arrange such visits in the hope that the visitors who see the structures will go home and adapt what they have seen so that, in this way, a wide range of options for building shelters for chickens will be developed.

The type of structure that farmers in Msinga are building is a hybrid of what was originally seen at Mr Mtshali's home, namely the enclosures for birds of different ages and the hut for raising chicks. Generally, the farmers build a mud hut that is half the height of a traditional hut used for human habitation. They leave the front of the hut open (i.e. without a mud wall) and then close it with chicken netting and, using locally cut saplings, they build perches for the chickens to roost on. The hut is high enough for an adult person to go inside to clean it. One disadvantage of the structures is that the chickens kept inside have to be fed instead of scavenging for their own feed around the home. Some other difficulties are being experienced with the houses, such as goats rubbing against them and damaging them. The farmers have had limited success in trying to keep the goats away.

A visit to Mrs Mchunu, who built a chicken hut (in the background) after a cross-visit to Mr Mtshali's home (photo: Rauri Alcock)

Ideas from outside to stimulate mutual learning

In October 2007, nominated representatives of the farmer groups (about 40 people, mostly women) from a number of communities in Msinga visited three chicken-keepers who were deliberately feeding their chickens instead of only letting them scavenge for their food. The cross-visit was arranged because farmers had been putting pressure on the CAP fieldworkers to give information about options for feeding chickens. There had been numerous discussions about using commercially available products, but this was a meeting to look at alternatives. In addition to seeing what people were already experimenting with, the cross-visit was also used as an opportunity to introduce some new ideas from outside.

At the final household that was visited, the CAP fieldworkers facilitated an information-sharing session around chicken feed and feeding. CAP asked Brigid Letty, who is the coordinator of PROLINNOVA–South Africa and an animal scientist, to do some research and to share with the farmers a number of options for feeding chickens. The aim was to expose the farmers to some new ideas that they could try out and adapt.

The content of the session was based on issues that the farmers had identified previously, such as the problem of egg-eating by chickens. It also covered the basics of poultry nutrition: the different types of nutrients and feedstuffs required for healthy, productive chickens. Brigid presented a number of different ideas she had encountered for growing or gathering different feedstuffs such as grasses,

legumes, insects etc. This formed the basis for farmer discussions. The farmers strongly disliked some of the ideas presented, such as producing fly maggots to feed to chickens, while they showed interest in some other ideas such as using limestone grit, gathering termites, and planting grains and legumes. CAP provided a small quantity of different seeds for the farmers to see and for some to try out at their homes.

Since the visit, a number of farmers have tried out some of the ideas that had been presented and discussed and there has even been some dissemination to other farmers. For example, Mam Yengwa tried out a new method of gathering live termites from a termite mound (a method that Brigid encountered when researching the topic). Local people in Msinga have experience with using termites to feed chickens, but normally destroy the mound when harvesting the termites. This new method is less destructive: a clay pot is filled with damp grass and placed over a hole in the termite mound and a colony forms in the pot. When CAP fieldworkers visited Mam Yengwa, they found that this new technique had proved to be very effective. They arranged a cross-visit in late October 2008, when other women farmers had a chance to see what Mam Yengwa was doing and could try it out for themselves at their own homes. Already that summer, one of these farmers, MaMchunu MaDlamini, successfully applied this termite-feeding practice with her own chickens.

Another farmer in Msinga, MaChoncho Dlamini, started to investigate an alternative way of feeding her chicks. She gives them unhatched eggs and dead chicks cooked and then ground up with mealie meal (coarse maize flour) as a feed supplement throughout the winter, making effective use of this source of protein. In addition, she collects all eggs laid during winter, except for one clutch, and cooks and feeds them to the chicks that hatch from the selected clutch. She says that normally all the chicks hatched in winter die, so she would rather sacrifice the majority of the eggs for the one clutch that will then survive.

These are examples of how CAP introduces new concepts to the farmers with whom it is working. Often, the farmers adapt these ideas to make them more relevant to the local situation. After farmers have tried out and possibly adapted the ideas that they saw or discussed during the visit, they share their experiences and learn from each other. CAP arranges structured sharing opportunities for the farmers and provides transport and lunch for them.

Creating a stimulating environment

In these ways, CAP is creating an environment that allows for learning and sharing by farmers. Cross-visits have proved to be useful for generating ideas that farmers can test and adapt to their own situations. The involvement of other PROLINNOVA–South Africa partners in field trips to Msinga, hosted by CAP, has also allowed for wider sharing and learning. The reciprocation of such visits is an essential component of the process. By exposing other stakeholders to the concepts of local innovation and farmer-led joint investigation through field trips and cross-visits, these development processes can be promoted.

MaChoncho Dlamini grinding up cooked eggs to supplement her chicks' diet during winter (photo: Rauri Alcock)

The cross-visits undertaken by the chicken-keepers have not only looked at structures or shelters for the chickens, but have also allowed for sharing of experiences in feeding chickens. Some of the things that farmers are working on are new concepts or ideas – both their own and from outside – and some are adaptations of local practices. In general, at least one farmer from each of the 19 farmer groups advised by CAP started experimenting with something they have seen on a cross-visit. Around 30 chicken-keepers have continued with experimentation. CAP seeks to stimulate and support the evaluation and adaptation of ideas from whatever source, so that the outcomes will be appropriate for the local situations of small-scale farmers.

12 Extending the reach of farmer-led joint research

Chesha Wettasinha and Ann Waters-Bayer

PROLINNOVA partners in different countries have started to facilitate farmer-led joint research. The cases presented in this booklet have documented some of these experiences. They provide a basis for drawing out observations and lessons that could be used for wider learning within the network and beyond.

How farmers view local research

Farmers view local research – on their own or together with others – as an activity that continues until they find something that really works for them. In the joint research in South Africa described in Chapter 3, the first potato-mulching experiment was technically a failure. The innovation in the form it was tested was not superior to the conventional way of growing potatoes. However, not only the original experimenting farmer but also other farmers in the neighbourhood are continuing to explore the possibilities, trying out other materials as mulch to see if they bring better results. They are convinced that, if they find the right materials, the innovation will greatly reduce the labour requirements in growing potatoes. The continuing research by these farmers is a process that need not be closely followed by a scientist but should be supported by local development agents and farmer organisations, as the local research results could benefit many farm families in the area.

Small improvements can make a big difference

Nearly all the cases show that simple improvements brought about through farmer-led joint research are often taken up easily and quickly by other farmers in the area. For example, the fodder net in Nepal (Chapter 8) is now being used by many families within and beyond the innovator's village, as they found it to be a practical and affordable solution to a high-priority problem. In other situations, as in the Niger example (Chapter 6), the improved oven for smoking fish came at a higher cost than the original local innovation, but was adopted by others who figured out that the benefits of the improved oven far outweighed the initial investment in construction. In yet other situations, as in the case from southern Ethiopia (Chapter 4), farmer-led research dealt with *enset* – an important crop for millions of farmers in the region but given relatively little attention by formal research. Farmers were at long last learning about solutions to one of their major problems on growing *enset* – solutions based on techniques developed by some particularly inquisitive local farmers using locally available resources and validated in farmer-led joint research.

Keeping experimental designs simple

Simplicity of experimental design and visual assessment are characteristic of farmers' own research. Farmers who experiment are interested in seeing whether the experiment brings about tangible change that can be of use to them. All of the cases described in this booklet show the need to maintain simplicity also in farmer-led joint research, even though scientists and other outsiders may prefer more complex designs and assessment techniques.

Development workers of CEDAC and farmers assessing harvest in their rice experiment in Kampong Speau, Cambodia (photo: Fanos Birke)

More complex research designs are important, but are better suited to researcher-managed trials conducted parallel to farmer-led research, such as the formal on-station experiments with growing potatoes under mulch in South Africa (Chapter 3) and the on-station research into the nutritional value of locally developed mineral lick blocks for livestock in Ghana (Chapter 5). In the farmer-led joint research in the farming communities, the research design has to make sense to the local people and directly address the key questions they pose. Nevertheless, if farmers are to be convinced about the results of the parallel research led by scientists, the latter still need to explain what they were doing in understandable terms.

Farmer exchange visits for sharing

Farmer-to-farmer exchange is highlighted in all the cases as an integral and important aspect of farmer-led joint research. In the first place, farmer exchange visits have been organised around ongoing experiments to share the technologies been tested or explored with larger groups of farmers. But, as discussed in the case from Msinga in South Africa (Chapter 11), cross-visits can have a further-reaching aim than merely transferring (locally developed) technologies. Here, the NGO has used cross-visits to stimulate interaction among farmers and development workers, to generate more ideas for experimentation, and to stimulate development workers to think about what farmers could and want to gain out of farmer-led experimentation.

Involving women in the process

In the above-mentioned case from South Africa, most of the farmers involved were women, as they play the major role in smallholder farming in the area. In other cases, where most farm households are headed by men, particular attention is needed to ensure that the farmer-led joint research and the farmer-to-farmer exchange are organised in such a way that not only men but also women can take part. This is especially important if the local experimentation concerns activities in which women play a major role, such as sowing and weeding, livestock care, food processing and marketing. For example, in the case of Ghana (Chapter 5), it was only after the male group of farmer experimenters saw a video made by a mixed-gender group in another village that they (and the supporting NGO) became aware they were experimenting in a women's realm – livestock feeding – and that also women should be involved in the joint research and sharing.

Communication among research partners

Communication between farmers and other partners in the joint research is obviously one area that calls for more attention. Communication is a key to developing an open and transparent mode of operation among all actors involved. Scientists, on the one hand, need to learn how to explain concepts and principles to farmers in a way that is accessible to them. Scientists also need to find appropriate ways of feeding back results of their research that is meant to support farmers' efforts. Farmers, on the other, need to become more articulate in conveying to other actors what they wish to do and what kind of research support they need. Extension agents, who have been used to transmitting messages from scientists to farmers, have to look for more interactive forms of communication that support lateral spreading of information. Many of the cases in this booklet describe how farmers and other actors have begun to communicate with each other on much more open and equal terms.

From local sharing to scaling out

Farmer-to-farmer sharing and communication between partners in farmer-led joint research involve more than just exchanging research results. If well facilitated, these communication processes can take on a much wider dimension – initiating a culture of experimentation within farming communities. Starting with a handful of local innovators and other farmers willing to try out new ways of doing things, farmer-led joint research gradually attracts more and more farmers and development agents. Some farmers start by repeating or adapting a particular experiment they were exposed to, others continue with related aspects of the same experiment, and still others start experimenting on entirely new topics. In Niger (Chapter 6), the initial joint experiment with the fish-smoking ovens led several other women to continue experimenting with other aspects related to fish smoking, such as the burning efficiency of different types of wood and the varieties of fish best suited for smoking.

Wider impacts and spinoffs

Farmers' innovation may often seem very simple to scientists and development agents, or so site-specific that the outcomes of a joint innovation process would have limited application in geographic terms. This could even deter these actors from becoming involved in joint research on topics and questions determined by farmers. However, as the cases in this booklet reveal, such research can have substantial impacts not only in terms of the innovation itself but also in terms of other spinoffs generated in the process. Farmers increase their capacity to experiment more systematically and gain confidence in their own capabilities. They interact with others in planning and analysing research, build rapport with formal researchers and show greater openness to ideas coming from other sources. At the same time, scientists and development agents are exposed to the farmers' reality and creativity; this can help put their own work into perspective.

The sense of empowerment gained by farmers and the realisation of their potentials also led to wider development impacts beyond research and development in agriculture and NRM. For example, the women in Niger (Chapter 6) who could not be involved in monitoring the experiment on fish-smoking ovens because they could not read or write wanted to learn how to do so. This led to the organisation of literacy training in the village, through the involvement of the Department of Non-Formal Education.

Funding as a catalyst for experimentation

Finding seed funding is often a barrier for farmers to engage in their own research. Most farmers are prudent in investing their limited resources in trying out something new, which generally comes with an element of risk. The example of the fish-smoking oven in Niger is a case in point.

It is often difficult to distinguish between seed funding for local research and start-up funds for investing in a new way of doing things. For example, the farmers involved in adapting the local innovation to drain and save water in northern Ethiopia (Chapter 7) would probably not have started to explore this so quickly, had there not been seed funding and encouragement from the PROLINNOVA platform in Tigray. It is only a pity that this seed funding went to male household heads, while a woman without the strength to do the heavy work involved has to irrigate dry-season vegetables with the water harvested in the pits she dug herself until she can earn enough money to be able to hire a man to make the underground canals. It is obvious that, in the further development process, more attention needs to be given to seed funding for women in this part of Ethiopia where almost a third of the households are headed by women.

The initial injection of small amounts of funding made by PROLINNOVA partners for farmer-led joint research can stimulate local people to seek different ways of continuing to fund their research – by providing in-kind contributions, by co-financing, by setting up community funds etc. This will be addressed in more detail in the next booklet in the series, which will focus on managing local innovation support funds and ensuring their sustainability.

Gradual process with changing roles

The cases presented in this booklet by no means meet all the criteria of an "ideal" form of farmer-led joint research as described in Chapter 2. Moving away from a system of research and development that is controlled by scientists and development interventionists to a system in which farmers have a strong say does not happen overnight. It is a gradual process and one that calls for changes in the attitudes, behaviour and roles of all the actors involved. Scientists and development projects that are used to deciding on all aspects of research and "demonstration" of new technologies have to learn to step back and take a supporting role. Farmers, on the other hand, have to become more assertive and manage many aspects of processes with which they are not familiar.

In Cambodia (Chapter 9), at an early stage when PID was just being introduced as an approach to ARD, the scientists still played a fairly prominent role in the joint experimentation. Although this process was not truly farmer-led, it allowed for good interaction between farmers and scientists, giving farmers sufficient responsibility to be attracted to this new approach. In the case from Nepal about the net for goat fodder (Chapter 8) and the case from South Africa about growing potatoes under mulch (Chapter 3), the process was further advanced toward PID. Here, the farmer innovators remained in control of the experiment, while the formal researchers played a less prominent but supportive role, bringing in inputs that add value to the process.

The degree of involvement of scientists in farmer-led joint research needs further reflection. It has often proven difficult to draw scientists into supporting farmer-led research on a regular and intensive basis. It may be more realistic to consider seeking the support of scientists only occasionally in an advisory capacity. In this way, scientists would still stay abreast of farmers' research needs and ideas, while farmers would gain access to external comments and suggestions as well as new information from formal research. It would also reduce the danger that scientists take over the experimentation process – a lesson drawn in Chapter 10. Such an arrangement – provision of occasional advisory support by scientists – would call for flexibility within the research system to allow scientists some space to respond to farmers' requests for support, without having to draw up formal agreements between farmers and the research organisation about conducting joint research.

The most important place for farmer-led joint research is within approaches to development in agriculture and NRM. As this is scaled up, fieldworkers and subject-matter specialists in advisory services, development projects and farmer associations will probably be the main "outsiders" working together with farmers in jointly exploring paths to development.

Ways forward

The cases in this booklet provide evidence of the growing experience of PROLINNOVA partners in promoting an approach to research in development that builds on farmers' own initiatives and creativity. Though small in scale, the cases show that substantial livelihood impacts can be achieved through farmer-led joint research. The challenge is to scale up these activities to involve and benefit many more farmers in the countries concerned. Meeting this challenge means finding ways to make farmer-led joint research an integral part of the extension approach of development organisations, projects, NGOs, farmer associations etc.

How then do we stimulate the interest and commitment of others within the ARD community to follow this approach? Firstly, we have to communicate what we are doing to others – at all levels – in an effective and convincing manner. This requires a communication strategy that is differentiated according to the target groups and uses the most appropriate media. Secondly, we have to build up a sufficiently large body of evidence to substantiate the message we are trying to communicate. These data need to be not only qualitative but also quantitative, providing "hard" evidence about the wider impact on rural people's lives brought about through promoting local innovation and farmer-led joint research. With a solid base of evidence, clear and attractive documentation and a focused communication strategy in place, PROLINNOVA partners would be in a stronger position to mainstream the approach into institutions of agricultural and NRM research, extension and education and into farmer organisations at all levels.

Annex 1: Contributors to this booklet

Mr Abadi Redehay, farmer innovator, Mai Berazio Village, Tigray Region, Ethiopia

Mr Abdou Mamane, farmer innovator, Boumba Kaïna, Boboye, Niger

Mr Adam Toudou, Université Abdou Mounmouni, Niamey, Niger (toudouadam@yahoo.fr)

Mr Amanuel Assefa, AgriService Ethiopia (ASE), Addis Ababa, Ethiopia (kidus_aman@yahoo.com)

Ms Ann Waters-Bayer, PROLINNOVA International, ETC EcoCulture, Leusden, Netherlands (ann.waters-bayer@etcnl.nl)

Mr Basanta Rana Bhat, Ecoscentre, Chitwan, Nepal (ecoscentre@wlink.com.np)

Ms Brigid Letty, Institute of Natural Resources, Scottsville, KwaZulu-Natal, South Africa (bletty@inr.org.za)

Ms Chesha Wettasinha, PROLINNOVA International, ETC EcoCulture, Leusden, Netherlands (c.wettasinha@etcnl.nl)

Mr Chhut Socthaun, Prek Leap National School of Agriculture, Prek Leap, Cambodia (socthaun36@yahoo.com)

Ms Demekech Gera, ASE, Addis Ababa, Ethiopia (worku10@yahoo.com)

Mr Donald Kugonza, Makerere University, Kampala, Uganda

Ms Erna Kruger, Mahlathini Organics, Richmond, KwaZulu-Natal, South Africa (erna@gracenet.co.za)

Mr Gerald Kirembe, Agency for Integrated Rural Development (AFIRD), Kampala, Uganda (kirembe@yaoo.com)

Mr Hailu Araya, Institute for Sustainable Development, Addis Ababa, Ethiopia (hailuara@yahoo.com)

Mr Jean-Marie Diop, PROLINNOVA International, ETC EcoCulture, Leusden, Netherlands (jm.diop@etcnl.nl)

Mr Kifle Tebari, Tahtai Maichew District Agriculture and Rural Development Office, Wukro Marai, Tigray Region, Ethiopia

About the series on Promoting Local Innovation (PROLINNOVA)

PROLINNOVA is a multi-stakeholder partnership programme under the umbrella of the Global Forum on Agricultural Research (GFAR). It was initiated by non-governmental organisations (NGOs) to promote recognition of local initiatives and strengthening of local peoples' capacities to adjust to changing conditions, in collaboration with other stakeholders - in other words, how to enhance local innovation systems in agriculture and natural resource management. It seeks to integrate participatory approaches to research and development into the regular work of research, extension and education institutions in Africa, Asia, the Pacific region and Latin America.

This is one in a series of booklets based on actual experiences of partners in the PROLINNOVA programme. The series covers, among others, the following topics:

- Facilitating multi-stakeholder partnerships
- Recognising local innovation
- Farmer-led joint research
- Managing local innovation funds
- Farmer-led documentation and sharing
- Stimulating institutional and policy change.

Printed versions of the booklets are available from IIRR, YC James Yen Center, Silang, Cavite, Philippines, and PDF files can be downloaded from the PROLINNOVA website (www.prolinnova.net).

PROLINNOVA
PROmoting Local INNOVAtion
in ecologically-oriented agriculture and natural resource management

IIRR