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PARTICIPATORY AGRICULTURAL RESEARCH PROCESSES
IN EASTERN AND CENTRAL ETHIOPIA:
USING FARMERS’ SOCIAL NETWORKS AS ENTRY POINTS

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PREFACE

The development of participatory research methods and support for their refinement and application by national research institutions has long been a key activity of the Centro Internacional de Agriculture Tropical (CIAT). This emphasis, in Africa as in Latin America, arose from the conviction that building a more effective and sustainable formal research sector depends upon establishing real partnerships with farmers. This paper examines, from both farmer and researcher perspectives, many of the processes surrounding the conceptualization and implementation of participatory research activities that are community based.

The study was carried out jointly by CIAT and the Melkassa Agricultural Research Center of the Ethiopian Agricultural Research Organization (EARO). We worked with communities in Central Ethiopia under the Participatory Research for Improved Agroecosystem Management (PRIAM) Project. A component study on the development of simple ox-drawn equipment for intensifying a monocropping system makes an excellent success story of participatory approaches. At the same time, the observations on social capital and the conclusions on strengths and potential pitfalls of working with farmer research groups will be startling for some, and deserve to be read by researchers, NGOs and development agencies across the region.

Disseminating results from significant research is an activity of the Pan-African Bean Research Alliance (PABRA) that serves to stimulate, focus and coordinate research efforts on common bean, the systems within which it is produced and the people who grow and consume it. PABRA is coordinated by CIAT in collaboration with two interdependent sub-regional networks of national programmes: the Eastern and Central Africa Bean Research Network (ECABREN) and the Southern Africa Bean Research Network (SABRN). Two other series complement this Occasional Publications Series: Workshop Proceedings and Reprints.

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We would like especially to thank the MARC scientists, Dr Habtu Assefa, Mr Melesse Temesgen and others, without whose collaboration this work would not have been possible. And very special thanks are due to Ms Hirut Abebe, whose skills in working with small farmers were indispensable in establishing and maintaining good relationships.

The farmers of Boffa and Wolechiti, and the chairpersons and members of the farmer research groups in both villages, are the centerpiece of this study. They shared so much of their agricultural experience and their insights into relationships that it is difficult to express adequately our appreciation for their patience. To Ato Sisay Tekleselasie, a special thank you!

CIAT and EARO also gratefully acknowledge the financial assistance of the International Development Research Centre (IDRC) that enabled this study to be carried out. For external support to the PRIAM project in Eastern Africa generally, we are grateful to the Rockefeller Foundation.

Financial support for regional bean networks, for this publication, and for contributions through PABRA to current collaboration between researchers and farmer groups in many countries, comes from the Canadian International Development Agency (CIDA), the Swiss Agency for Development and Cooperation (SDC) and the United States Agency for International Development (USAID).
Participatory Agricultural Research Processes in Eastern and Central Ethiopia: Using Farmers' Social Networks as Entry Points for PR Activities

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Introduction

Farmer participatory research (FPR) is an approach that enables and encourages farmers to take charge of the agricultural research process that is meant to improve and sustain their livelihoods. This paper examines, from both farmer and researcher perspectives, many of the processes surrounding the conceptualization and implementation of participatory research (PR) activities that are community based. In particular, I explore the issues involved in the formation of farmer research groups (FRGs) as a catalyst for community-based PR.

Findings from research conducted with the Participatory Research for Improved Agroecosystem Management (PRIAM) Project in Central Ethiopia suggest that Former should initiate the formation of FRGs based on local forms of social organization and not exclusively with "communities". Research agendas seeking to work exclusively with "communities" that demonstrate high levels of social capital may effectively marginalize the poorest and most vulnerable groups of rural people. In central Ethiopia, farmers are not organized according to community structures and institutions, but rather participate in multiple and overlapping social networks that cross many communities in a given geographical area. High levels of social trust and commitment typically characterize farmers' social networks, and through these social units farmers share knowledge, resources, and technologies. I argue that tapping into these local forms of social capital will enable researchers to build more effective linkages with local knowledge systems and enhance the meaningfulness of local peoples' participation in research. It will more effectively integrate different social categories of people into research and development initiatives, target the networks through which farmers disseminate technologies, and in the long-term sustain locally driven and relevant activities of research and development.

PRIAM

The International Center for Tropical Agriculture (CIAT) initiated the PRIAM Project in 1997 with financial support from the Rockefeller Foundation. The first phase (1997-1999) objectives were to:

1. Implement community-based PR projects in several countries in eastern Africa in collaboration with National Agricultural Research Systems (NARSSs), Ministries of Agriculture (MOAs), Departments of Extension, and nongovernmental organizations (NGOs);
2. Facilitate the institutionalization of PR approaches within collaborating NAROs, MOAs, Extension Departments, and NGOs; and
3. Refine and develop methods for different stages of the PR process, including Characterization and Diagnosis, Planning and Experimentation, Monitoring and Evaluation, Information and Technology Dissemination, and Analysis of Experience.

1 Current address: CIAT, AA 6713, Cali, Colombia
The PRIAM Project is currently working with national and regional agricultural research institutions in four communities in central and eastern Ethiopia (in addition to sites elsewhere in eastern Africa) and entering its fourth year with more diversified sources of funding through the Eastern and Central Africa Bean Research Network (ECABREN). The International Development Research Center (IDRC) of Canada provided funding for the supporting research activity reported here in order to analyze and document the research and extension experiences of participating communities and research institutions and to support continuing activities within the PRIAM Project in Ethiopia. This joint research activity with the Ethiopian Agricultural Research Organization (EARO) particularly emphasized understanding farmer response to the project, and farmer experimentation and diffusion of new technologies. The idea was to verify and demonstrate the utility of the PRIAM approach and to provide valuable information on farmer experimentation and diffusion mechanisms to several target groups—including PRIAM teams in six countries and a wider audience of researchers involved in community-based PR in Africa.

Research Objectives

The specific objectives of this supporting research activity were to:

1. Assess farmers' capacity to analyze their experiences with new technologies and processes connected with participatory technology development (PTD);
2. Investigate and analyze the multiple ways in which farmers experiment with and adapt new technologies, and assess how the PRIAM approach supports farmer experimentation;
3. Examine the factors that contribute to problems and successes in the functioning of farmer research groups (FRGs);
4. Analyze the implications of class and gender differences for participation in PR activities, farmer experimentation, and technology diffusion; and
5. Examine the social relations, networks, and institutions through which farmers donate, exchange, loan, and sell new technologies to other farmers within and across communities.

The research work focused primarily on the PRIAM sites at Boffa and Wolencheti managed by the Melkassa Agricultural Research Center (MARC). Field visits were also made to the PRIAM sites at Ararso managed by the Alemaya University (AU) and at Surakoyo managed by Awassa Regional Research Center, and to the PR site at Gununo managed by the Areka Regional Research Center under the auspices of the African Highlands Initiative (AHI).

Research Methodology

To explore the experiences of farmers and researchers with the PR process in the context of the PRIAM Project, the methodology involved a primarily qualitative approach. This drew upon a diversity of qualitative social science research methods as a way of examining a range of issues and themes associated with the process.

Focus group discussions provided an initial introduction to the participating farmers at the Boffa and Wolencheti sites and to their experiences within the PR process. Group discussions were organized to examine many of the social, cultural, and economic dimensions of the farming system, and household livelihoods. The discussions explored, in substantial depth, the dynamics and meaning of local social relations (such as gender, class, and kinship), both
within and across households and communities. They also explored how such relations shape the farming system, the ways in which farmers negotiate and secure access to productive resources (such as land and labor), and new agricultural technologies.

Semi-structured interviews with PRIAM farmers formed the basis of the qualitative research approach and were carried out at the Boffa and Wolencheti project sites, and to a lesser extent at Ararso (AU), Surakoyo (Awassa), and Gununo (Areka). These interviews were used to examine a diversity of issues including:

- Background to the on-farm experimentation process,
- Impact of new technologies on the farming system,
- Household livelihoods,
- Household and community relations,
- Social networks and institutions in which different farmers participate and invest, and
- How such relations provide local channels of information and technology diffusion.

Self-evaluations of FRGs were developed to enable farmers at Boffa and Wolencheti to analyze their own experiences as FRG members (and as participants in the PRIAM Project), and to evaluate the strengths and weaknesses they experienced within the PR process.

Wealth-ranking exercises were conducted to examine local concepts and categories of wealth. The same wealth-ranking method was later modified to assess the impact of the PRIAM approach (and new project technologies more specifically) on the wealth of participating farmers. This was assessed in relation to community members outside the formal PRIAM process over time and on the changing relations of power between rich and poor within participating communities in the PRIAM context.

In the latter stages of the research, a technology diffusion mapping exercise was organized to trace and map out the social relationships, networks, and institutions through which PRIAM farmers donate, exchange, loan, and sell new technologies to other farmers locally and within neighboring communities and woredas (districts).

Participatory Technology Development Put Into Practice

We can define PTD as activities of research and development that are aimed at, or result in, a change in an existing technology in a way that its users (in our case mainly farmers) consider desirable. These activities are carried out by networks in which the technology’s users play an active role. The PTD process interactively and collaboratively brings together the knowledge and research capacity of farmers and their communities with that of scientific research institutions to identify, generate, test, apply, and diffuse new technologies and practices (Engel et al. 1991:9). In PTD, unlike earlier PR paradigms (such as farming systems research), participation implies that farmers to a significant extent can identify and implement their own solutions to meet their specific needs. In PTD, research activities are chosen based on their relevance to, and the interest of, different farmers and build on their own knowledge of the farming system and experience with local technologies (Haverkort 1991:6). As such, the role of researchers within PTD is less that of directing or controlling the research agenda than of supporting farmer interests and initiatives. Thus the PTD goal is not only to develop locally adapted, improved technologies, but also to improve farmer experimental capacities and to empower social groups’ greater access to, and control over, resources and decision making within development research as a means of ensuring its sustainability.
The process of participatory technology development under PRIAM

The PTD process in the PRIAM communities around Nazareth began with the building of cooperative relationships between PRIAM researchers from MARC, district-level development agents (DAs), and farmers from participating communities as the core PTD network. At the initial stage of PRIAM work at MARC, the PRIAM research team consisted of several research scientists from the lowland pulses and maize commodity programs, and from the agricultural engineering, agronomy, pathology, and agricultural economics departments. Until very recently however, most PRIAM researchers at MARC have participated less over time with only the agricultural engineer continuing his work under PRIAM. The PRIAM teams at Awassa and Areka Research Centers and the AU have experienced greater success in forming and maintaining multi-disciplinary research teams under PRIAM.

At each project site, PRIAM researchers and DAs formed FRGs through which relationships were built between PRIAM farmers as a starting point in the PTD process. The FRG members were selected based on their interest and willingness to participate in on-farm research and, to a lesser extent, their ability to participate in terms of resource access (land, labor, etc.). At the time of FRG formation, no attempt was made to identify and include different categories of farmers - or user groups - (based on wealth and other social and economic axes of difference). The purpose of establishing FRGs within participating communities was to facilitate the PTD process at community level. The FRGs were and are expected to act as the focal point of on-farm experimentation, monitoring and evaluation of on-farm trials, and information and technology dissemination within the community. The formation of FRGs was also seen to have the potential of building farmer capacity to influence research agendas and act collectively through the development or consolidation of community networks.

The PRIAM project began, in 1997, with activities aimed at developing with farmers an agroecological profile of the project sites (including soil types, rainfall patterns, cropping system, and indigenous technical knowledge of local agroecology etc.). However, little effort was put into enhancing researcher understanding of the social and cultural dimensions of farmer livelihoods and community/social organization (because of a lack of social science experience and expertise at MARC). A series of discussions followed between PRIAM researchers and farmers to identify and prioritize farmers’ problems (Table 1) and research interests.
Table 1. Identified and prioritized problems of farmers participating in the Participatory Research for Improved Agroecosystem Management (PRIAM) Project, with potential innovations and technologies identified.

<table>
<thead>
<tr>
<th>Problems identified and prioritized</th>
<th>Potential innovations/technologies identified</th>
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<tbody>
<tr>
<td>1. Soil moisture stress</td>
<td>• improved farm implements for moisture conserving</td>
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<td></td>
<td>• short-cycle varieties</td>
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<td></td>
<td>• tillage practices that harvest moisture</td>
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<td>Poor availability of high-yielding and different-maturing classes of varieties</td>
<td>• testing of different varieties suited to local agroecological conditions</td>
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<td>2. Poor soil fertility</td>
<td>• crop rotation</td>
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<td></td>
<td>• farmyard manure and inorganic fertilizer</td>
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<td></td>
<td>• compost</td>
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<td>3. Weeds</td>
<td>• improved tillage practices</td>
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<td></td>
<td>• use of inter-row weeder</td>
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<td></td>
<td>• herbicides</td>
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<tr>
<td>4. Livestock health problems</td>
<td>• use of, and research into, indigenous herbal medicines</td>
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<td></td>
<td>• veterinary services</td>
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<td>5. Lack of portable water</td>
<td>• development of water resources such as deep wells and ponds</td>
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<td>6. Soil erosion</td>
<td>• contour plowing</td>
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<td></td>
<td>• tie ridging</td>
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<td></td>
<td>• terracing</td>
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<td></td>
<td>• afforestation</td>
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<td>7. Pests and diseases</td>
<td>• use of botanical plants that have pesticidal properties</td>
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<td></td>
<td>• storage hygiene</td>
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<tr>
<td></td>
<td>• mixing of other crops with teff</td>
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<td></td>
<td>• pesticide use</td>
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<tr>
<td>8. Shortage of cultivatable land</td>
<td>• renting land</td>
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<tr>
<td></td>
<td>• inter-cropping</td>
</tr>
<tr>
<td></td>
<td>• sharing available land (common lands)</td>
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<tr>
<td>9. Poor availability and high cost of pesticides</td>
<td>• subsidies</td>
</tr>
<tr>
<td></td>
<td>• use of botanicals</td>
</tr>
<tr>
<td></td>
<td>• crop rotation</td>
</tr>
<tr>
<td>10. Shortage of animal feed</td>
<td>• testing different forage legumes and multi-purpose fodder trees</td>
</tr>
</tbody>
</table>

SOURCE: Adapted from Adugna and Tesfaye (1999).
On-farm experimentation with new technologies under PRIAM

Farmers have engaged in a diversity of on-farm experimentation based on their identification and prioritization of researchable problems, and the technical expertise of PRIAM researchers. In this way they have tested (and continue to test) the performance of improved varieties, cropping methods, and agricultural implements against that of local counterpart technologies where the local ones acts as controls.

The PRIAM researchers and farmers have worked together to plan, design, and implement on-farm trials and monitoring and evaluation protocols that would meet the needs and interests of both parties. The PRIAM farmers typically experiment with a new technology over multiple seasons to analyze its performance under changing (or variable) climatic conditions.

Over the last 4 years, experimenting farmers at PRIAM sites in central and eastern Ethiopia have implemented variety trials on teff, maize, beans, sorghum, wheat, barley, and sweet potato. After 3 years of variety trials, and based on their own criteria, farmers have selected varieties with various characteristics including early maturity, drought and/or heavy rain tolerance, high yield, pest resistance, and a desirable appearance and taste. Selected varieties are now being multiplied by some PRIAM farmers at the project sites and shared with farmers within the community and neighboring villages.

In addition to variety trials, PRIAM farmers in the Ararso Peasant Association (with AU) are implementing on-farm experiments to address:

- Soil fertility management issues (e.g., composting, use of farmyard manure, intercropping with nitrogen-fixing legumes, multipurpose forage and pasture crops, and multipurpose trees);
- Crop protection/pest management (e.g., testing Lantana, Datura, carbofuran insecticide, and pepper tree to control sorghum stalk borer);
- Livestock health (e.g., veterinary services and livestock monitoring, and multipurpose forage and pasture crops to improve quality of livestock feeds); and
- Reforestation (e.g., dissemination of *Leucaena leucocephala*, *Sesbania sesban*, and *Eucalyptus saligna* seedlings).

Compared to other PRIAM sites in Ethiopia, the AU has experienced the greatest success in implementing an integrated approach to PR despite the lack of a functioning multidisciplinary team.

**Implement technology**

One of the most impressive series of on-farm experiments is that designed to test the performance of improved agricultural implements developed by researchers from the National Agricultural Mechanization Research Center (NAMREC) at MARC in collaboration with farmers from the two participating communities near Nazreth. Since 1996, farmers at the two Nazreth project sites have performed on-farm trials to test and compare the performance of five different agricultural implements with the indigenous *maresha* or ox-drawn wooden plow in this farming system based on animal traction. Examples are given below.

**The moldboard plow**

This is designed to cut deeper into and invert the soil. Farmers find that it improves water infiltration into the soil, enables deeper root penetration and nutrient uptake, controls weeds,
and incorporates crop residues into the soil thereby dramatically increasing soil fertility. Through on-farm experimentation, use of the moldboard plow was found to increase grain yield by 50% to 100%.

The winged plow
This is designed to plow a farmer’s field without inverting the soil and thus reduces soil moisture loss to evaporation. Farmers in dry areas have found this implement useful for moisture conservation through Nish Kebera (an indigenous water harvesting technique).

The inter-row weeder
Compared to manual weeding, this tool dramatically reduces the time and labor required for regular weeding activities, provided that row planting is also practiced (the traditional system is broadcast seeding). Given that women to varying degrees play a role in weeding planted fields, the introduction of the weeder may have long-term impacts on the gender division of farm labor. In turn, this may impact on the extent to which women play a role in decision making in farm management and can claim a portion of farm income in return for the contribution of their labor. A great benefit of both the winged plow and the inter-row weeder is that they require significantly less draft power and can be pulled by a single ox or a pair of donkeys. This is an incredibly valuable feature given that the shortage of oxen and oxen feed are major production constraints in the area.

The tie-ridger
This tool forms a series of basins to check run-off and improve rainfall infiltration in cultivated fields thereby increasing soil moisture and reducing soil erosion and nutrient loss.

The row planter
According to experimenting farmers, this tool saves time and labor, more evenly distributes and conserves seed and fertilizer, and has been found to be exceptionally useful in the intercropping of beans or forage crops in maize or sorghum fields. Using the row planter, farmers in participating communities have also been experimenting with the comparative benefits of open and closed furrow planting under different rainfall conditions. Farmers have opted to experiment with different implements depending on the types of crops grown, the local soil type, the specific production constraints experienced, and the specific practices, preferences, and interests of individual farmers.

Variations on the maresha plow
On-farm experimentation of new agricultural implements has met with remarkable success in participating communities largely because the implements were developed and designed as attachments to the indigenous maresha plow used by farmers throughout Ethiopia for centuries. The experience of farmers and researchers alike has been that the development of the new implements derived from indigenous farm implements and practices simplifies the training required by farmers to operate and test the implements on-farm. It makes possible the dissemination of new information, skills, and maresha-based technologies from farmer to farmer. Farmers more readily accept and adopt these technologies because they are familiar, have a relatively low cost, save labor time, conserve seed, and dramatically improve farmers’ yields.

Over the course of the experimentation process, the implement technologies in particular have gone through several stages of development based on farmers’ experiences with their use and on the feedback given to PRIAM researchers of how they may be improved to better
meet farmers' needs and interests. The indigenous knowledge of PRIAM farmers related to the local climate, the nature and characteristics of their soils, the growth behavior of locally used crops, and the indigenous *maresha* plow has made important contributions to the development of the implements. More specifically, it has contributed to how they are used (i.e., farming practices) on-farm. The next section presents the development of the row planter as a detailed case study in order to examine in-depth the “process” of PTD.

**Case study in participatory technology development: The row planter**

To understand why farmers do, or do not, accept and adopt technologies we must examine the processes through which they are developed. Often, agricultural scientists develop technologies on-station, with little consideration of the agroecological, economic, social, and cultural realities of the end-users (in our case, small-scale farmers), and little, if any, farmer participation in the process. The result, in many cases, is the development of technologies that do not address farmer needs and interests and which, for the most part, are not readily adopted. This case study shows how important farmer participation is in all dimensions of the technology development process. Farmer participation improves not only the acceptability and adoption of technologies, but also builds the capacity of farmers’ networks and institutions to develop and sustain their own research and development agendas.

In 1995, engineers from NAMREC at MARC designed the first row planter as an attachment to the indigenous *maresha* plow to enable farmers to plow and plant crops in rows (as opposed to broadcasting). Although the row planter had been tested extensively on-station, the PRIAM Project gave researchers the opportunity and support to collaborate with farmers in the area to test and further develop the technology under farmers' field conditions and livelihood constraints.

The original row planter was first brought to the field in 1996 after a farmer from the Wolencheti Peasant Association had expressed interest in testing the technology after he had visited MARC to observe the new technologies being developed. Because the original row planter was designed for local sorghum and maize varieties (each crop has its own seed distribution plate based on seed size and application rate), the farmer began by experimenting with the tool to sow local sorghum and maize that season. Throughout the crop season researchers spent considerable time with him observing and evaluating the tool’s performance in his field. At the end of the first season, the experimenting farmer gave considerable feedback to researchers including the request that researchers develop a new seed distribution plate for *fandisha*, a “popcorn” variety of maize. (The seed size of *fandisha* is smaller than local maize and larger than local sorghum and thus required a new seed plate for optimum seed distribution.) In the same season, researchers developed a seed distribution plate for *fandisha* that farmers quickly tested and approved.

In the same season, the experimenting farmer experienced a serious problem in the operation of the row planter that would demand researcher attention. The seed distribution outlets were positioned at the back and the fertilizer distribution outlets at the front of the planter in order to distribute fertilizer ahead of seed. During the planting of both sorghum and maize, the farmer reported that the fertilizer distribution outlets were becoming clogged with mud as the planter moved forward through the soil. In 1997, most PRIAM farmers confirmed this finding that caused the release and application of fertilizer below optimal levels and thereby affected overall crop quality and yield. In 1997, PRIAM farmers recommended modification of the planter’s design to overcome this shortcoming. In the same year, and in response to
farmers’ feedback, PRIAM researchers redesigned the row planter. On the original implement, two fertilizer distribution outlets were located at the front and two seed distribution outlets at the rear. To reduce mud clogging, researchers modified the planter by having only one outlet each for seed and fertilizer distribution and moving the fertilizer outlet from the front to a position beside the seed distribution outlet at the back of the planter (Figure 1).

![Figure 1](image)

**A. Original row planter**
Fertilizer distribution outlet at the front of the row planter (arrowed).

**B. Adaptation of row planter**
Fertilizer distribution outlet moved to the back - behind the plow and alongside the seed distribution outlet.

In 1997, the modified row planter was taken back to PRIAM farmers for continued experimentation. All reported that the modifications made by researchers dramatically reduced mud clogging in the distribution outlets of the planter, allowing optimal distribution of both seed and fertilizer on the farm. It is crucial to note that during on-station testing of the row planter, researchers had not encountered problems associated with mud clogging within the fertilizer distribution outlets. This was because they were testing the planter on sandy soil types with properties very different from the heavy “shakete” clay soils found in the Wolencheti area. Moreover, researchers were using a modified version of the indigenous maresha plow (unlike that used by farmers in the area) to test the row planter on-station that, again, accounted for results unlike those experienced in farmers’ fields. According to the PRIAM researcher responsible for the row planter’s development, farmer participation in the technology development process has produced new adaptations of the implement that make it more locally appropriate than its predecessor.

At the end of 1997, PRIAM farmers expressed an interest in testing the row planter with crop varieties under experimentation within PRIAM. Farmers advised researchers that in order to use the implement with new maize and bean varieties (such as Awassa 511 and Katumani maize varieties, and Awash 1 bean variety) they would require new seed distribution plates for each. By the beginning of the 1998 maher season, researchers had developed and distributed new seed distribution plates for multiple improved maize and bean varieties.
During field discussions between researchers and farmers it was decided, however, that the entire seed distribution mechanism of the row planter would need to be redesigned to enable farmers to use the implement for bean planting. According to experimenting farmers, the hopper, or seed compartment, of the row planter was too small for bean seed, given that the rate of bean seed application was much higher than that of maize and sorghum. As a result, farmers expressed concern that the seed compartment would become exhausted too quickly—and so would require greater labor in refilling—during the planting of bean. In response to these concerns and recommendations, PRIAM researchers redesigned the seed distribution mechanism in the row planter to make it adaptable to bean (and other kinds of seed with different seed application rates) by developing adjustable seed/fertilizer distribution compartments. Today, farmers can manually adjust the size of the distribution compartments to accommodate a diversity of crops and varieties (Figure 2). The ability to plant beans in rows has recently led to increased interest and experimenting with the intercropping of bean with maize, a system not formerly known in this area.

Figure 2. Modifications made to the row planter: Adjustable seed compartments to enable farmers to plant different crops and varieties.
Based on these and other on-farm experiences and recommendations by PRIAM farmers, each of the improved agricultural implements has gone through several stages of development over the last 4 project years. Farmers and researchers continue to work collaboratively to adapt and improve the row planter and other implements to meet farmers’ specific needs and interests.

Once again, according to PRIAM researchers, had the experiences and indigenous knowledge of farmers not been identified and integrated into research, such technological improvements to the row planter would not have been realized. The PTD at the Nazreth sites has been an iterative process that has depended upon a strong sense of collaboration and exchange of ideas and expertise between researcher and farmer. The PTD process, according to researchers and farmers alike, demonstrates that the best solutions in technology development often come from farmers who have first-hand experience with the field operation and maintenance of implements. This process has, in turn, resulted in the development of technologies that are more appropriate and adaptive to local agroecological and production systems, and hence more sustainable than the standardized, and highly mechanized, farming technologies.

**The impact of new technologies on farmers’ livelihoods**

Interviews with PRIAM farmers revealed some economic and social impacts of involvement in the PR process and, more specifically, access to and experimentation with new technologies. Wealth-ranking exercises in September and October 1999 provided considerable quantitative information regarding the impact of the PR process on the wealth and livelihoods of PRIAM farmers. During wealth ranking exercises in Worka (Wolenchetti Peasant Association) and Kachachule (Boffa Peasant Association) villages, respondents were asked to rank all village members into locally defined categories of wealth. Once the rankings were completed, respondents were instructed to locate all PRIAM farmers within each wealth category. Respondents were then asked to rank PRIAM farmers again, this time based on their position within local wealth categories in 1996 – before the introduction of the PRIAM Project (and new project technologies). According to the results of the wealth-ranking exercises, between the years 1996 and 1999 most PRIAM farmers have jumped, on the average, two wealth categories out of five. In Worka village, for example, 83% of PRIAM farmers shifted at least one wealth category with 67% of those jumping two or more wealth groupings in only three seasons (see Appendices 1a and 1b). Both participating and non-participating farmers report that, as a result of on-farm experimentation with new technologies, PRIAM farmers were able to dramatically increase crop yields and seasonal incomes. With this additional farm income, they have been able to purchase more oxen, increase their landholdings, increase their level of investment in farm production (purchase of inputs etc.), and improve household food security and overall household livelihoods. The new wealth and status of PRIAM farmers has resulted in new categories and concepts of wealth defined on the basis of participation and access to technology under PRIAM, and in growing disparities between rich and poor within the community. The PRIAM farmers share a distinct social and economic status vis-a-vis other community members not only because they are now wealthier than most of their neighbors, but also because as a group they have strong relationships with PRIAM researchers, local extension agents, and NGOs active in the community. This situation elevates the social and political status of PRIAM farmers setting them apart from the body of their community.
The often-dramatic increases in household wealth created by new project technology raises several questions about the impact of new income levels on domestic budgeting arrangements and intra-household social/gender relations. During an interview with the wife of a PRIAM farmer in Wolenchetti, it was clear that higher farm incomes under PRIAM did not have a wholly positive impact on the household. In households in Wolenchetti and Boffa, women, as wives, do not have the power to control or allocate farm income and in most cases do not generate an income of their own. Instead, their husbands give them small allowances from farm income or permit them to take and sell small amounts of grain to purchase food and supplies for the household. Increases in farm incomes have led to wives making new demands for greater amounts of money to meet household needs. In most cases, women request only the same percentage of farm income that they had received in the past. However, in some cases such requests can produce conflict between husbands and wives. One wife, for example, claims that her husband refuses to increase her household allowance despite the dramatic increase in his farm income and increased investment in farm production over the last three seasons. In reaction to her husband’s refusal, she regularly pilfers grain from the household silos and sells it at local markets to secure the money needed to improve household food security and livelihoods. In some cases, greater farm income may give rise to a renegotiation of gender resource rights and responsibilities within the household. In others, more negatively, they may increase conjugal conflict over domestic budgeting arrangements.

Determining the extent to which this is likely to be a trend within PRIAM communities in Ethiopia is difficult. In Wolenchetti and Boffa, husbands are typically present during interviews with women. Thus difficulties ensue in discussing issues related to household income and domestic budgeting, and relationships between husbands and wives. In such situations, women commonly refer to social norms rather than the specific experiences of their households and will not speak negatively about their husbands. When sensitive questions are asked, husbands tend to take over the interview process and redirect the discussion. This certainly reflects the way in which gender relations of power shape the interview process and the kinds of results documented.

Household budgetary responsibilities can be, for example, how decisions about income allocation are made, how additional income is used, and who has the right to access and control such income.) How husbands and wives struggle over and renegotiate these responsibilities may have particular implications for communities (and PRIAM sites) where both women and men are actively engaged in agriculture. This is the case in Kenya and Uganda, but in marked contrast to most of Ethiopia. Researchers need to examine such potential impacts during local monitoring and evaluation activities, although considerable time must be given toward developing trust and familiarity between researchers, farmers, and other household members.

**Farmer Research Groups in the Participatory Research Process**

Farmer research groups were formed in 1997 under PRIAM to coordinate the PR activities in participating communities and to act as a linkage between PRIAM researchers and the community (inspired by the Local Agricultural Research Committees [CIAL] approach in Latin America, see Ashby et al. [1995]). According to researchers and farmers, the objectives of the FRGs are to:

- Conduct on-farm research with new technologies,
- Facilitate researcher/farmer contacts,
- Monitor and evaluate on-farm trials and report the results of on-farm experimentation to PRIAM researchers on the basis of consensus,
- Disseminate information and skills (through farmer-to-farmer training) to community members outside the formal research process,
- Disseminate project technologies to community members outside the formal research process (distributing the benefits of research to the community), and
- Catalyze community development initiatives.

Essentially, the FRGs are the center or focal point of PRIAM research activities at village level. As members of the groups, participating farmers are responsible not only for on-farm experimentation, but also for a range of social/community-based activities (such as dissemination of information and technologies) where the FRG is seen as a crucial linkage between PRIAM researchers and the whole community. As such, PRIAM researchers were interested to analyze, with PRIAM farmers, the functioning and performance of the FRGs in terms of their ability to meet group objectives, group leadership, cohesiveness, and problem-solving capacities, and their relationship with the formal research system and their community. Using a participatory evaluation tool (see Appendices 2a and 2b), FRG members conducted a self-evaluation of their group. To ensure that community members had a voice in this process, community members also participated in an evaluation of the FRG. It was hoped that information obtained through FRG self-evaluations would illustrate their effectiveness in, and contribution to, PR processes and would provide lessons to other PRIAM Project sites in the region working within and through FRGs.

The FRG evaluation exercises proved a crucial research activity not only to identify the strengths and achievements of the groups, but also to recognize the difficulties encountered in their day-to-day activities and management and the opportunities they present within the PR process.

Achievements of farmer research groups

The findings of the FRG self-evaluations at the Boffa and Wolencheti PRIAM sites reveal several key strengths related to the performance of each farmer group. The strengths identified include the:

- Development of a collaborative and productive relationship with PRIAM researchers and extension personnel;
- Design and implementation of on-farm variety and implements trials producing high quality research results;
- Organization of monitoring and evaluation activities (e.g., Farmer Field Days that enable group members to work collectively to identify and solve problems in trial design and implementation, improve experimentation practices, monitor and evaluate trials of all PRIAM farmers, and decide, as a group, new research directions);
- Dissemination of improved technologies across many communities in their district; and
- Collective pursuit of new research and development opportunities (e.g., local seed enterprises).

The findings indicate that strong FRG leadership is crucial to forming and maintaining a cohesive farmer's group with consistent and creative objectives and that is energetic in realizing these goals. According to FRG members, the organization of farmers into groups (whether locally or externally initiated) has greatly enhanced the relationship and degree of
maps constituted a source of pride in their achievements as project participants and because many of them wished to continue tracking their own technology dissemination activities in the future.

The TDM exercise may constitute an efficient and effective participatory monitoring and evaluation tool that farmers can use to document, analyze, and report information related to the diffusion of new technologies over time and space. Because farmers are most familiar with their own social networks and dissemination activities it would be easier and far less resource-intensive for farmers, rather than researchers, to take responsibility for such diffusion studies provided that farmers have the interest, commitment, and capacity to organize and implement such a research activity.

Technology diffusion mapping as a diagnostic tool: Social capital assessment

TDM may also be used as a diagnostic or rapid appraisal technique to identify and analyze the social relationships, networks, and institutions to which different people belong and the function that each performs in terms of local resource sharing and other forms of mutual aid and coordinating collective action. In this way, the TDM exercise can be used as a type of social capital assessment tool to identify local networks and institutions that may provide strategic entry points for different kinds of participatory research and development activities.
Appendix 3b. Technology Diffusion / Social Network Mapping: Simplified Sample from Worka Village

MAP LEGEND
Methods of Seed Dissemination
- Gift (3kg or less)
- Gift (3kg or more)
- Exchange
- Sale
- Neighboring Village

DENGORE

MERKO

WOLENCHETI

MONE

DONI

Wife's father

Brother

Sister's husband

Mekanajo/Mhaber

Mekanajo/Mhaber

7 km

6 km

10 km

75 km

4 km
## Appendix 3c. Farmers’ Social Networks in Central Ethiopia.

<table>
<thead>
<tr>
<th>Social network</th>
<th>Membership</th>
<th>Function / Role</th>
<th>Reach</th>
<th>Contribution to dissemination*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinship</td>
<td>Immediate and extended family members across many villages and districts.</td>
<td>Extended family is the basis of most forms of social support and mutual aid among rural people. The members, as part of a complex web of rights, responsibilities, and obligations, share resources such as labor, land, oxen, and money, and provide other kinds of social and material support.</td>
<td>Membership crosses many villages. Geographical coverage of kin relations often exceeds 30 km.</td>
<td>✖✖✖✖ Sharing of resources, including information and technologies, is extremely common among extended family members. All PRIAM farmers indicated that they prioritized these relations above all others in terms of sharing of technologies.</td>
</tr>
<tr>
<td>Iddir</td>
<td>An institution of about 100-200 adult men (heads of households) from many neighboring villages. Members are typically connected socially either through extended family or close friendships. Membership is consistent over time.</td>
<td>A social/cultural institution of men responsible for the preparation and burial of the deceased during funeral ceremonies. Each member household contributes an annual amount of money. In exchange, the Iddir provides families with the necessary material support to cover funeral costs and to ensure the household’s security in the short term.</td>
<td>Membership in Iddir, although localized around one or two communities often includes several neighboring villages.</td>
<td>✖ Iddir members share technologies among themselves. However, Iddir membership overlaps with other social networks and technologies are typically diffused through these smaller networks.</td>
</tr>
<tr>
<td>Baltina</td>
<td>Women (wives of Iddir members).</td>
<td>A social/cultural institution of women responsible for preparing food and drink during funeral ceremonies. Also an important source of social and material support/mutual aid among women (e.g., widows).</td>
<td>Same as Iddir.</td>
<td>✖ Women’s social networks are an important source of information dissemination on the performance and benefits of new technologies. Information is then passed on to husbands and other male family members.</td>
</tr>
<tr>
<td>Mhaber</td>
<td>People who share close friendships. Men and women participate in separate (gender-specific) Mhaber networks.</td>
<td>During the religious holidays of each month, Mhaber members meet at one another’s homes for food and drink. This is an important and symbolically significant network.</td>
<td>Friendship networks cross multiple neighboring communities.</td>
<td>✖✖✖ An important source of information dissemination during holiday gatherings, and technologies shared extensively among the closest of these members.</td>
</tr>
<tr>
<td>Jiggi / Dabo</td>
<td>6-10 male relatives and close friends. Group membership is typically consistent across seasons.</td>
<td>Exchange labor or group labor networks. At critical times in farm season, one man initiates a labor group by calling his closest friends and male kin. This group works together on each other’s farms for the remainder of the season.</td>
<td>Labor groups made up of farmers from 2-3 local communities whose farms are neighboring.</td>
<td>✖✖✖✖ Common means of information and technology diffusion during on-farm work. Members gain information on the use and benefits of technologies first hand and are able to monitor their progress over the course of a farm season. Technologies shared upon request.</td>
</tr>
<tr>
<td>Mekanajo</td>
<td>Two male relatives or close friends. Membership tends to be relatively consistent over time.</td>
<td>Oxen-sharing relationship typically between two men who each own only one ox. Sharing enables participants to plow their fields.</td>
<td>Individually each such group has poor reach because consists of only two farmers.</td>
<td>✖✖✖ Common means of information and technology diffusion (especially for improved implements) during on-farm work.</td>
</tr>
<tr>
<td>Equb</td>
<td>Small group of 3-5 (or more) family or close friends. Membership changes over time.</td>
<td>Rotating credit and savings groups.</td>
<td>Typically localized around one or two neighboring villages.</td>
<td>Have little or no role in the dissemination of technologies.</td>
</tr>
</tbody>
</table>

a. Contribution to dissemination ✒ = little to ✖✖✖✖ = a lot.