

# Participatory Plant Breeding and Gender Analysis



*Cathy Rozel Farnworth and Janice Jiggins*



The Consultative Group on International Agricultural Research (CGIAR) works to promote food security, poverty eradication, and the sound management of natural resources throughout the developing world.

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**Cover photograph:**  
Malagasy women in the Fénerive area  
constructing a seasonal calendar showing  
intensity of work on paddy and other crops.  
(Photo by Cathy Rozel Farnworth.)





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PPB Monograph No. 4

*Cathy Rozel Farnworth and Janice Jiggins*

This One



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7. Asia.
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10. Investigación participativa.
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# 1. Introduction

Empirical enquiry and experience has shown that technology is not necessarily gender neutral, nor are knowledge and information. We know that women's roles in seed handling, agriculture production, food processing, trading and purchase are vital to food security and family well-being, and these roles and the knowledge on which they are based can be substantially and importantly different to that of men's. Yet although women acutely need income-generating, labour-saving and productivity-increasing technologies to enable them to fulfil their roles more easily, gender issues remain to be fully incorporated into technology development. The continuing failure of much technology R&D to recognise women's actual and potential contribution to technology development and use is not only detrimental to the economic security and social status of women and their families, but indeed also to the success of R&D in meeting national and regional objectives.

This paper has therefore been commissioned by the Participatory Research and Gender Analysis (PRGA) programme of the CGIAR to address these gaps with respect to plant breeding. Its purpose is:

- To provide an analysis of the methods and approaches currently used within participatory plant breeding (PPB) with respect to gender issues, the use of gender analysis (GA), and user involvement
- To draw out the implications of researchers' experience with GA and user involvement
- To analyse and discuss the outputs currently being generated by PPB from a user perspective, and
- To identify what more might be done, and how, in order to achieve broader impacts and to capitalise on what has been achieved to date.

In this introductory chapter we provide definitions of key words and concepts, followed by a preliminary discussion demonstrating the ways in which GA and PPB are finely intermeshed. The chapter concludes with Table 2 explaining the layout of the rest of the paper.

## Definitions of Key Words and Concepts

The following working definitions of key terms are used:

**Participatory Plant Breeding (PPB):** A range of actors including scientists, farmers, consumers, extension agents, vendors, processors and other industry stakeholders—as well as farmers' and community-based organisations and non-government organisations (NGOs)—are involved in plant breeding research and development. This activity is deemed 'participatory' when any mix of these actors, especially end users, have a significant research role in all major stages of the breeding and selection process.

**Formal-led Participatory Plant Breeding:** Farmers are asked to contribute to PPB activities which are basically controlled, managed, and executed by an International Agricultural Research Centre (IARC), National Agricultural Research System (NARS) or an NGO.

**Farmer-led Participatory Plant Breeding:** Researchers and/or development workers interact with farmer-controlled, managed and executed PPB activities, and build on farmers' own varietal development and seed systems.

**Participatory Varietal Selection (PVS):** Farmers and other stakeholders along the food chain are involved with researchers in the selection of varieties from formal and farmer-based collections and trials, to determine which are best suited to their own agro-ecosystems, needs, uses and preferences, and which should go ahead for finishing, wider release and dissemination. The information gathered may in turn be fed back into formal-led breeding programmes.

**Gender:** The socially or culturally established roles of women and men. As a social construct, women's and men's roles may differ from one place or culture to another, and change over time.

**Gender Analysis (GA):** The discovery through systematic enquiry of the gender roles in a particular place or location.

**Gender Sensitive:** Methods, analyses, policies, practices, behaviours, etc. that recognise gender issues as important and seek to institutionalise or mainstream attention to gender issues.

**Sex:** Biological differences between men and women.

**Women and Men:** Loosely differentiated categories within GA or as a focus of user involvement in PPB. Neither are homogenous categories: class, ethnicity, age and other socio-economic factors may create differences relevant to the process and outcomes of PPB.

### **Gender analysis**

Three sets of questions are central to GA, namely:

- (1) who does what, when and where? This covers crop-specific tasks and operations, farm enterprises and off-farm, non-farm and household maintenance activities that compete for, or complement, the management of in-crop and post-harvest seed, roots and tubers.
- (2) who has access to or control over plant genetic resources (PGR)? **Access** means that resources may be available, but without choice related to the timing or amount of use, or with some conditionalities attached. **Control** means having decision-making authority concerning a resource.
- (3) who benefits from each crop enterprise? what are the incentives and disincentives for managing crops and PGR? For making changes? The question of who benefits is closely related to roles and responsibilities, as well as to issues of access and control.

### **Participation**

The term 'participation' is an imprecise normative term that directs attention to **interacting relationships** rather than entities. It can usefully be broken down within a typology that characterises the structure and quality of interaction in terms of means and ends (see Table 1).

A common practical problem in R&D relationships that claim to be 'participatory' is that the espoused purpose, and the type of interaction chosen to achieve that purpose, are not consistent with each other. This leads to confusion at best and frustration, disappointment and conflict at worst. Another difficulty is that the type of participation practised, which may vary at different points in a breeding cycle, as well as with different sets of stakeholders, is usually not clearly specified in either project documentation or in published descriptions of what happens. This means that analytic comparisons across case studies are rarely possible at this stage.

### **Gender and PPB**

This section briefly introduces the following key areas of conceptual development and field experience: gender and seed management, gender and PPB, and gender as a flexible concept. They are explored more fully in later sections of this monograph; here we indicate, among other things, why emphasis needs to be given specifically to **women's** roles when exploring gender relations and their implications for PPB.

Table 1. Descriptive key: Participation means and ends.

Mode of participation	Type of participation	Outside control	Potential for sustaining local action and ownership	Research and action
Co-opted	Tokenism, manipulation; representatives are chosen but have no real input or power	High	None	On/For
Co-operation	Tasks are assigned with incentives; outsiders decide agenda and direct the process	High	Low	For
Consultation	Local opinions asked, outsiders analyse and decide on a course of action	High	Low	For/With
Collaboration	Local people work together with outsiders to determine priorities, responsibility remains with outsiders for directing the process	Medium		With
Co-learning	Local people and outsiders share their knowledge, to create new understanding. They work together to form action plans, typically with outsider facilitation	Medium	High	With/By
Collective action	Local people set their own agenda and mobilise to carry it out, in the absence of outside initiators and facilitators	None	High	By

SOURCE: Adapted from Biggs (1989); Pretty (1995); Cornwall (1998).



### **Gender and seed management**

In many cultures, women are responsible for seed management, whether for all crops, or for crops regarded as 'women's crops'. However, women's practices and techniques are quite diverse. Some women select next year's planting seed from the field prior to harvest, using mass selection or grid selection; sometimes they remove off-types and then select from the pooled harvest prior to storing the seed in a special container or a place apart from the main food supply and from the produce destined for the market, or they may select planting seed whilst sorting the beans, roots, tubers or grains prior to processing or food preparation. Women may conduct germination tests, or reserve part of the home garden for trying out interesting 'sports' or spontaneous crosses (Seshu and Dadlani 1989). They may actively seek out new acquisitions from the market, from neighbours, and from kin networks and friends in order to carry out multi-season, multi-location trials of these, thus exploring robustness in the varying soils and conditions of the farm. Children, too, can be the means of seed exchange, taking beans or grains to play with, losing these to others, or winning a larger handful that they may sell in the market for pocket money (Almekinders and Louwaars 1999, especially p.182-183). Some women, recognised as experts, carry out their own crosses, carefully isolating favoured varieties before manipulating pollen exchange (Song 1998) with the intention of refreshing preferred landraces and improved materials obtained from the formal system.

### **Gender and plant breeding**

Even where women's role in seed management is minimal, men and women may have quite distinct varietal preferences, and take different criteria into account when choosing varieties. One of the strong reasons why different men and women, and women of different backgrounds, have different preferences is because they relate to the **food chain** in different ways, and often at different times and places. The food chain concept emphasises the entire set of relationships that is needed to produce and move products to end users and consumers. Input suppliers, farmers, processors, traders, retailers, and consumers (with varying numbers and kinds of 'middlemen'—often in fact women—acting as intermediaries in the chain). The **resource-to-consumption** concept develops this further, to emphasise that access to material and biological resources, skills and knowledge is essential, and to bring out the reality that the chain represents a **gene flow**. Who controls the gene flow, and who determines which genetic qualities are valued, in which markets, for which purposes? The answers are strongly gendered and thus have strong implications for the design of PPB practice and process management

It is self-evident that men and women play different roles and responsibilities within households, in farming, and in society, yet the

**operational** implications are often obscured, not least by **gender bias**, however unwitting, on the part of plant breeders. The analysis of differentiated gender roles and responsibilities along the food chain and in gene flow management, can help plant breeders to avoid bias and accommodate diversity, and thereby make their work more relevant and effective. For example, in a farmer-participatory breeding project on pearl millet in the Jodhpur District of Rajasthan (India), women's main considerations in selection at the time of the study were found to be: grain yield, early availability of grain (related to their role as food managers), and the ease of hand-harvesting—lower panicle number and lower plant height (related to their role as harvesters). For the men, yield and quality were of greater concern (Weltzien et al. 1996). In another study of men's and women's roles and varietal preferences in villages in eastern India, where women are centrally involved in all aspects of rice production, the results drew attention to women's roles as the primary end-users of rice biomass and by-products. This related to women's responsibility for feeding and tending livestock, leading them to give higher value than men to these non-grain characteristics (Paris et al. 2001). Characteristics such as hulling and milling quality can also be important such that variety evaluation and selection takes place only once the post-harvest characteristics have been observed. Paris et al. (2001), for example, found a strong consumer preference for white-grained over red-grained rice because it saves women in the household time in milling. Plant breeders thus need to take into account a wider set of gender-related preferences to include non-target and post-harvest considerations.

### ***Gender, a mutable concept***

It is crucial to appreciate that gender preferences are not fixed. They can change over relatively short periods of time, as new social and technological opportunities open up. Johannessen (1982) records how women's preference for dent-type maize in one part of Malawi was formed by the relative ease of hand-grinding and the shorter cooking time of the softer grains. Men were responsible for storage, and thus favoured the harder grain quality of the flint-type. The introduction of local diesel-powered grinding mills reduced women's resistance to the hardness of the flint maize.

Women's practices and interests may also vary significantly between women, depending on differences in social status, household composition, wealth status or income source, livelihood, ethnicity, geographic location, and numerous other variables. For example, poor urban women making a living from selling snack food such as puffed rice may have very different varietal preferences and preference criteria from poor rural women anxious to meet the family's main staple food needs. Careful analysis of the differences between men and women, among women, and among the various actors along the whole

length of the food chain can not only reveal opportunity but also help avoid the waste of scarce scientific resources in plant breeding.

### **PPB and GA: The Opportunity**

PPB, both as a science and as a process, can help meet the challenge of gendering technology development and use. It offers a key to differentiating user categories, and to identifying each category's distinctive needs for planting materials and food products that work in context, thus enabling a wide range of user objectives to be met. Given the recent decision by the CG Technical Advisory Committee (TAC) that PPB should be adopted as a core element in CG Centre breeding programmes, it is timely to reflect on the PPB experience to date with the aim of drawing out guidelines that can support and enhance the quality and effectiveness of science.

GA can strengthen the professionalism of PPB by helping to ensure that scarce and valuable scientific resources are directed toward the development of safe, productive and sustainable agricultural and food sectors that strengthen poor people's livelihoods throughout the food chain, from seed handling right through to consumption. It also permits a way of analysing field data that can assist station-based breeders to develop formal-led breeding that takes account of differentiated users and user needs. Used in the context of farmer-led breeding, GA can help to empower women through strengthening their economic security and social status, as well as contributing to the well-being of their families. An essential dimension of such professionalism in the realm of PPB is the development of operational capacity to work with gender-differentiated categories of users<sup>1</sup>.

- 
1. The neglect of GA can impose a considerable opportunity cost on PPB activity. In an otherwise excellent analysis of a formal-led PPB project focussed on maize/millet inter-cropping with trees, in the middle hills of Nepal (Tiwari 2001), it was decided to take 'the household' as the unit of participation and of analysis. Glimpses of the 'gender reality' behind this decision are revealed throughout the account: the hiring at a late stage of a female researcher to contact women farmers; hints in the text that men and women might have different preferences and decision criteria; a suggestion that as the field activities got under way the researchers found that the women farmers were more conscientious than the men, and more knowledgeable about post-harvest characteristics; the acknowledgement that interviews by the female researcher with women farmers were more effective if men were not present; evidence that women farmers were more receptive to focus group discussion (a method used in evaluation) and contributed quality responses. Finally, among the recommendations for future work is listed the need to encourage women from the outset to participate "since most of the field and post-harvest operations including food processing are performed by women" (p.148).

## Organisational Opportunities

Recent changes in public sector Research, Development & Extension, and in the role of the market have many implications for PPB. Within the flux of changing organisational relationships there is a wide scope for deliberate choice of organisational partnerships that recognise the different ways in which men and women relate to food and farming. This is an important factor in the impact and in the potential for 'scaling up' localised PPB.

## Layout of the Paper

The remainder of this paper builds upon the preliminary discussion presented here. The main focus is upon the way in which GA can strengthen PPB, but some of the discussion pertains specifically to PVS. The authors have chosen case studies from around the world to help highlight particular points, provide inspiration and to show how lessons can be drawn from practice. These are presented in tables, boxes, and within the text itself.

Rather than summarise the findings of each chapter, the authors have chosen to conclude particular chapters, if appropriate, with a section entitled 'Gaps and Opportunities' that attempts to draw out the lessons of the material presented and discussed. The final chapter brings together the lessons of preceding chapters, with the aim of providing pointers to future work. Table 2 summarises the content of each chapter.

Table 2. Layout of the paper.

Chapter 2: User Differentiation	Discusses the strengths and limitations of GA in differentiating between, and under standing, users. It argues for gender-sensitive differentiation along the food chain. The effectiveness of gender-sensitive methods, alone and in combination with other tools, is examined, as is the question of who might carry out GA in the PPB situation.
Chapter 3: Diagnosis	Emphasises the importance of not subsuming particular user interests within broad-brush analytic categories like 'household'. Methods to diagnose the interests of particular user categories are presented, including stakeholder analysis and SWOT. Since such methods have poor predictive capacity, approaches to help predict future decision-making patterns and to deal with situations of rapid change are presented.

(Continued)

Table 2. (Continued.)

<p><b>Chapter 4: User Involvement in the R&amp;D Process</b></p>	<p>Highlights how women can be located and involved in PPB. Ways of opening up spaces for user involvement through institutional development are presented. User involvement across the plant breeding cycle (crossing, screening and testing, evaluation) is examined, followed by a section on approaches to capacity building in order to strengthen user involvement.</p>
<p><b>Chapter 5: User Involvement in Dissemination and Communication</b></p>	<p>Argues that the manifold spaces opened up by the worldwide devolvement of service provision to local government and non-public actors has created opportunities to involve multiple actors and to institute co-learning. The ways in which seed is being multiplied and disseminated is examined, as is the diffusion of experimental capacity and breeding capacity among users. The issue of quality maintenance during the scaling up process is addressed.</p>
<p><b>Chapter 6: Evidence for, and Assessment of, Gender-Differentiated Impacts</b></p>	<p>Argues that the literature on impact studies in PPB is inadequate with respect to providing a gendered understanding. It assesses the contribution some conventional impact studies have made and examines the role of PPB in innovation. User participation in the provision of impact data is discussed. The impact of PPB processes on social dynamics is examined.</p>
<p><b>Chapter 7: Forward-Looking Summary</b></p>	<p>The conclusions that may be drawn from each chapter are elaborated here. Further action steps which can be taken are presented.</p>

## 2. User Differentiation

This chapter studies the contribution of GA to differentiating users and in so doing draws attention to the narrow way in which the term 'user' tends to be confined to producers, whether women or men. However, processors, vendors and consumers are also 'users' of genetic materials and can therefore usefully be drawn into the PPB process. Since men and women tend to be positioned differently with respect to processing tasks and technologies, markets, and consumption, gender-sensitive user differentiation is required along the whole food chain.

The ways in which formal-led PPB and farmer-led PPB are currently differentiating users are outlined below. The insights gained highlight the contribution that GA can make to the understanding of other aspects of user preferences and use.

These reflections in turn raise the more pragmatic question of 'how much user differentiation' is needed.

### **Gender-Sensitive Methods**

#### ***Why gender-sensitive methods?***

Methods entitled 'gender sensitive' are those that allow discrimination among variables on the basis of gender differences, or that deliver insights into gender relationships. By focussing on the three main sets of questions—(1) *who does what, when and where*, (2) *who has access to and control over resources* and (3) *who benefits?*—GA forces implicit assumptions about the users to be made explicit and to be tested in context. It brings to the fore the realisation that intervention by PPB in the gene flow may have significant consequences for existing user interests. Through expanding understanding of potential users and their interests GA may therefore bring into the portfolio of target crops and crop varieties those who might otherwise be overlooked or undervalued.

#### ***GA across the food chain***

The literature on PPB indicates that GA is increasingly perceived as good practice, if not yet incorporated into standard practice. However, where it has been used to identify users, its application has been

confined in by far the majority of cases to producer populations. There is considerable missed opportunity in extending GA to other segments of the food chain, such as multinational supermarket chains, industrial processors and product industries, local retailers, informal traders, vendors and processors, to consumers in different socio-economic categories (see sections on Stakeholder Analysis in the next chapter).

### **GA tools and other methods**

Because of critical differences among women themselves in their relationships with men, and because gender is a cross-cutting variable in dynamic interaction with other variables, gender sensitive tools are often combined with other tools to permit maximum insights to be gained.

Preliminary bean research in Malawi and Rwanda, for example, pinpointed women farmers as the key producers of beans, as the custodians of bean seeds and seed selection, and as the most knowledgeable about the target crop and associated agro-ecosystems (Ferguson 1992; Sperling et al. 1993). But household surveys across a regional transect, and tools such as wealth ranking, revealed important regional and socio-economic differences among different categories of women with respect to preferences and selection criteria. These complementary data helped in the selection of locations, communities and household types from which individual women 'bean experts' could be selected as research collaborators.

The above example highlights one of the difficulties in the way methods are categorised: many of the standard field research tools in use such as questionnaires could be adapted to become 'gender sensitive', but are often blocked from becoming so because assumptions are built into their design or application. A common assumption, for instance, is that farms are headed by male decision makers (so the questionnaire is administered only to the male farmer). Another is that all female-headed households are poor (so no effort is made to discriminate among different types of female-headed household or those of different wealth status).

It is often further assumed that women's interests in improved genetic material relate solely to the domestic needs of the household, rather than to characteristics of interest to commercial markets (even in areas where women are self-evidently the main traders in informal markets and have substantial interests in processing crops for formal market sale). It is therefore preferable to treat all assumptions as hypotheses to be tested rather than as pre-given 'facts', as Box 1 shows.

There are many tools that allow the questions posed by GA to be pursued with rigour, either in 'objective' research as in questionnaire

**Box 1**

**Testing the gap between the ideal and the actual**

One of the ways in which GA can lead to deeper understanding is by testing for the gaps that may exist between the 'ideal' and the 'actual', between what people say and what they actually do. For example, a survey of Karamajong male household heads in a semi-nomadic pastoral area in Uganda, where pastoralist households also farm, suggested that only the women and girls worked in agriculture, whilst the men and boys looked after the cattle. Closer study of 'who does what', however, revealed that men accounted for 35% of the labour in planting sorghum, 50% of the labour in planting millet, a third of the labour in weeding millet fields, and over 50% of the labour during harvest.

**SOURCE:** Dyson-Hudson 1972.

surveys that are constructed around the three sets of questions italicised above, or in semi-structured interviews, focus groups, and in participatory appraisals that combine visual and numeric analysis. These techniques include cropping calendars, resource mapping, analysis of food chain participation and benefit analysis. The visual dimension of participatory appraisal allows data to be enriched with spatially correlated information. Numeric analyses can be enriched by meaning and metaphor.

***GA methods and the natural science tradition***

Yet it is precisely the mingling of 'pure' data with users' own interpretations that worries many who come from a natural science tradition, in which the power and right to give meaning to data through interpretation belongs to the scientist. It is not uncommon for research teams to seek to 'validate' the results of participatory GA by demanding they be cross-checked by statistical research. However this demand would seem to conflate the purposes for which each approach is most suited. Participatory GA can describe what a sub-population does, and can explain why the sub-population does what they do; statistical approaches to GA can describe what the whole population does and correlate associated behaviours in the whole population. Furthermore, the scope of participatory GA can be extended by iterating its application across a landscape or population that has been defined by statistical sampling techniques. Similarly, statistical approaches can pinpoint the areas, sub-populations, or issues that might warrant investment in participatory GA.

However one wishes to conduct GA, it is most usefully seen as a preliminary step taken to answer the key strategic question for PPB: who are the users? Close-focus analysis of user preferences and preference criteria can follow.



GA: Who/How

**Who?**

The literature and anecdotal reports of experience show that research teams have experimented with a range of approaches to guide their decisions on who carries out GA. These include hiring in university-based or consultant expertise (male or female) on a one-off basis, establishing continuing links with NGO partners, training women lab-based scientists in basic GA and field work skills, supporting local women professionals (such as teachers) who might be present in the research area to carry out GAs, and training male scientists. Each offers advantages and disadvantages as shown in Table 3.

Does the sex of the GA practitioner affect process or outcome? The answer would appear to be contextual: in some societies, it is absolutely not acceptable for women to be interviewed or otherwise interact with male 'outsiders'. In other circumstances the presence of a young boy as 'family chaperone', a shift in the interview setting from home to a more public place where women usually gather, or a switch in method from individual interviews to group interviews, can easily overcome constraints on contact between (male) researcher and women respondents. Budgetary considerations, as well as the availability and practicality of different options, might also be important factors in the choice of GA practitioner.

A desirable but not usually possible alternative is to appoint a social scientist, with GA as part of his or her terms of reference, as a full-time team member. Nonetheless, difficulties may arise in 'mainstreaming' GA into PPB work should the team experience general difficulties in integrating the social and biological sciences. This problem of cross-disciplinary integration is likely to be more profound if external assistance with GA is sought.

**How?**

Once the 'who' question is settled, there arises the question of 'how'. There is no single best practice guideline for gender analyses, as these may take many specific forms within the three-fold question framework already introduced. An important issue is, however, when and how often GA should be carried out. Here the best practice guidelines for **formal-led PPB** are clear:

- as an integral part of the overall design of PPB activity
- throughout the breeding cycle, and
- throughout the food chain.

An analysis of how different types of GA can strengthen the PPB process through the breeding cycle is shown in Table 4.

Table 3. The merits and constraints of different personnel for GA.

Who	Merits	Constraints
University-based socio-economic expertise	Well-informed theoretically Good analytic skills Good report writing skills	Methodological practice in GA can be weak Not all socio-economists have strong theoretical understanding of gender Not always available when needed Usually distant from field site
Consultant expertise	As above Can be selected for methodological and theoretical competence in GA	Expensive Limits to continuing linkages Quality control can be problematic if project team does not select or know the person
NGO partner	Strong background knowledge of context Established working relations with target communities Focussed on practical field experience	May lack women field workers or GA expertise May lack formal report writing and/or formal analytic skills May lack adequate technical understanding of PPB
Women lab-based scientists	Exposure to the field builds human capital within science establishment Have strong science background	May be reluctant to travel/work in field May lack sufficient in-depth understanding of social/gender relations and theory to provide adequate analysis Cannot assume women are interested in gender issues by virtue of their sex
Local women professionals	Strengthens local participation in PPB Builds human capital at local level May have special insights because of existing social/family links	May experience time constraints Own identity/position may make it difficult to address certain issues or involve particular groups Cannot assume women are interested in gender issues by virtue of their sex
Male PPB researchers	Strengthens socio-economic professionalism within PPB group	Training in GA may be required Training may be insufficient to remove gender bias

Table 4. Using different types of GA to strengthen the PPB process.

Stage in the breeding cycle	Examples how GA could be used	How GA might strengthen PPB
Setting goals	<p>M/W roles in seed management</p> <p>M/W roles in crop/food/product management through the food chain</p> <p>Preference ranking + criteria</p> <p>Decision trees</p> <p>Wealth ranking</p>	<p>Differentiating user needs and preferences</p> <p>Differentiating stakes and stakeholders</p> <p>Identifying opportunities</p>
Generating variability	<p>Identifying M/W's varieties and varietal management practices</p> <p>Identifying M/W's knowledge and skills in managing gene flow</p>	<p>Working with existing knowledge and skills in gene flow management</p> <p>Tying variability to uses and users along the whole food chain</p>
Selecting variety for experiment	<p>Identifying who to work with in experimentation</p> <p>Identifying procedures that suit both men's and women's work load, customs, etc.</p>	<p>Selection of relevant collaborators</p> <p>Effective and efficient protocols for collaboration</p>
Testing experimental varieties	<p>Procedures for farmer-scientist interaction during experimentation</p> <p>Identification of who participates in evaluation procedures</p> <p>Development of evaluation procedures with different stakeholders along the food chain</p>	<p>Effective and efficient farmer-scientist interaction, that take account of, for example, women's lower literacy levels</p> <p>Effective and efficient feedback from diverse interests and stakeholders</p> <p>Capture of relevant information, and user differentiated analysis of feedback</p>
Releasing and diffusing varieties	<p>M/W's communication channels and exchange networks</p> <p>Differentiating user demands for packaging, etc.</p>	<p>Faster, more effective dissemination</p> <p>Wider uptake within user categories (market segments)</p>

The guidelines for who should do what in GA within **farmer-led PPB** are less clear, partly because there are fewer published accounts that give sufficient detail on both women's and men's participation.

## Selecting Organised and Non-Organised Partners

Poorer people often do not belong to farmers' clubs because the requirements and expectations of membership can be too high. The explicit and hidden costs of membership may include fees, the need to provide food if members visit the farm, or the shame of poor quality clothing. Such people never see extension workers on their farms and indeed extension workers might not even know they exist. A choice to work on PPB with organised groups and clubs, or through extension workers' contacts, can therefore be exclusionary on grounds of both poverty and gender, for instance in a locality where women farming alone without resident male help are among the poorer categories of farmers.

It can also be difficult to identify important stakeholders in the food chain, such as urban housewives, who are rarely members of the kinds of organised groups with whom scientists might work. One way of addressing this problem is to include the community in the

### Box 2

#### Choosing organisational partners. Chivi District, Zimbabwe

In Ward 21 of Chivi District, Zimbabwe, there are a large number of varied local organisations. These include groups associated with traditional leaders, churches, village community workers and co-ordinators, extension workers, farmers' clubs, garden groups, village development committees, and ward development committees. What could be the basis of deciding whom the researchers would work with as organisational partners in varietal selection and seed management?

It was agreed in discussion between the researchers and community members that important criteria were: the organisation engaged in activities related to food production; that these activities did not conflict with local customs; that the leadership was democratic and representative of the membership; that women were active participants (also in decision-making) and that the marginalised or particular ethnic groups were not excluded.

At a community assembly, the community itself identified the farmers' clubs and the gardening groups as best meeting the criteria. The farmers' clubs had a mostly (but not exclusively) male membership and leadership, and poorer farmers also had their own clubs. However the gardening groups' membership and leadership consisted mostly (though not exclusively) of women, including significant numbers of female household heads. These were acknowledged to be among the poor in this particular Ward.

SOURCE: Win 1996.

identification of partner organisations and individuals. This can help ensure an explicit and balanced choice, as the example in Box 2 illustrates.

## **Gendering Standard Tools**

### ***Questionnaire and ranking in Eastern India***

Studies conducted in the context of IRRI's eastern India participatory rice breeding programme demonstrate the value of systematic application of a standard tool: socio-economic surveys. The researchers added value by constructing a gender sensitive questionnaire that was applied across a range of target agro-ecosystems, and across the top-10 sequence of individual farms, enabling them to spatially locate gender preferences by land type (Paris et al. 2001). The gender differentiation was captured by (a) purposive sampling of both men and women farmers, (b) extending the scope of the survey to include different user needs for food, livestock fodder, thatching and cash, and (c) extending the scope of the survey to include post-harvest considerations, including taste, ease of milling, recovery rate, storability, and market premium. The results of the studies pointed breeders firmly in the direction of developing baskets of choices for both men and women farmers, rather than unique varieties.

The researchers also conducted a sample survey of 75 rice farming households in three villages of Raipur District, Madhya Pradesh. A participatory weighted ranking method was used to elicit male and female farmers' criteria for selecting rice varieties according to land elevation (related to hydrology and soils), and to determine the trade-offs they made between traits. First, basic information was collected from male and female heads of rice farming households (name, age, sex, caste, size of landholding, elevation of rice plots, etc.). Twenty cards were prepared, each showing a rice varietal trait. The cards were presented and explained to the farmers, who were then asked to select the cards/traits that he or she considered when selecting a variety for a particular land elevation. The cards not considered important were discarded. The farmer was then asked how much weight he or she would give to each of the remaining cards/traits, out of 16 *ana* (16 *ana* = 100 *paise*, 100 *paise* = 1 *rupee*). An average weight was then computed, by dividing the sum of all the values assigned per trait by the number of respondents, and then calculating the proportion of each trait to all traits.

This method was powerful in documenting gender differentiated user preferences by land type, related to the different basket of tasks and responsibilities men and women have with respect to each land type. However, the prepared cards limited the range of traits that could be considered. Open-ended interviews revealed, for example, the importance of a purple-coloured variety as a strategy to identify and

eradicate wild rice at an early stage of crop growth in specific cultural conditions, but this was not included in the card set and was not mentioned by the respondents during the exercise. Further, the interviews disclosed a preference for late to medium varieties designed to provide rice for gift-giving during the important *Diwali* festival—but this kind of social motivation for trait preference also did not emerge in the card exercise. Thus the researchers conclude that the card method needs to be combined with a prior round of open-ended enquiry.

### **Socio-economic survey in India**

The researchers in a formal-led rice PPB programme in Madhya Pradesh, India, extended their understanding of differentiated user needs by extending their socio-economic surveys of preferred varieties and traits to include other user groups than farmers: millers, traders, and labourers (Sahu et al. 2000). They found some significant differences. For example, the modern varieties *Swarna* and *Mahamaya* were found both to have the positive qualities favoured by farmers in traditional irrigated rice varieties—including high demand by traders and drought tolerance. *Swarna*, an earlier release, has spread fast and is preferred by consuming households for *bast* (rice left over from dinner, dipped in water and a little salt and eaten for the following breakfast or lunch). Poor farmers and agricultural labourers (many of whom are women and among the poorest of the poor) are paid in rice yet none the less prefer *Mahamaya* because they feel that its bold and coarse grains 'last longer in the stomach'. Millers and traders also prefer *Mahamaya*, but specifically for making beaten rice and puffed rice. The research showed that while there can be significant convergence across user categories, the reasons for their preference can be markedly different.

### **Other Methods**

Other methods demonstrating promise include the combined use of Geographic Information Systems (GIS) and Remote Sensing (RS). These methods are increasingly being used in agricultural R&D to elaborate system hierarchies, to develop correlated information on nested systems, and to enable researchers to 'zoom in' and 'zoom out' across scales of interaction (Miranda 2000). For example, they allow spatialisation at varying hierarchical levels of productivity variables, of farm system typology parameters, and of a system's environmental impact on a given resource. They also permit area, perimeter and volume calculations, and offer a series of basic operations for the quantification of these. Fortunately, the improving spatial resolution of imagery allows smaller grids for sampling designs, an especially important contribution where census and land ownership maps are lacking, or where agricultural 'frontiers' are frequently expanding or contracting. Improving temporal resolution is expanding the use of

these tools where understanding is sought of within season and cross season dynamics, and in impact assessment.

The discriminatory power of RS is greatly superior to the human eye and improving radiometric or spectral resolution is opening up new potentials. For example, several vegetative stages—phytomass and productivity levels—now can be identified, and different soya bean varieties have been distinguished in orbital images (due to differences in height and the insertion angle of the leaves). Radar sensors allow imaging during night time and under all weather conditions, thus greatly enhancing the utility of RS in the humid tropics.

The use of participatory R&D tools **in combination with GIS** is under experimentation (González 2000; Powell 1998). Others are working with forms of **diversity analysis** across geographic scales of resource management, that likewise build on the complementarities among traditional and participatory research methods (McDougall and Braun 2002). However, their specific application in the context of PPB and in relation to GA has yet to be tested.

### **Complementing GA: Social and Organisational Analyses**

So far this chapter has shown that GA, or the adaptation of standard research tools to become gender sensitive, can shed light on the interaction of gender relationships, roles and responsibilities, and the spatial and functional characteristics of user preferences. It has also pointed to the value of combining GA with other methods.

Two dimensions of enquiry complement GA particularly well, (1) **social analyses** that pick up socio-cultural motivations for varietal preferences and concretise the specific ways in which gender interacts with other social variables (such as age, or ethnic identity); and (2) **organisational analyses** which document the ways in which organisations include or exclude stakeholders from access to varieties, potential co-operation with plant breeders, and opportunity to use new releases. These points are discussed further here.

#### **Social analyses**

Social analyses can be particularly valuable in picking up the cultural values underlying varietal preferences as well as the retention of minor crops which formal surveys and other exercises, such as the card game described above, are not good at revealing. The importance of understanding such values has been stressed by a number of researchers (such as Gurung and Gurung 2001). The study of values may have power in revealing the 'gendered spaces' in agriculture that may be embedded in strongly-held mythic and religious belief systems. Participatory techniques such as focussed discussion around

'generative themes', such as PGR management, are proving particularly valuable. Prompt cards, pictures, photographs, songs, role plays or folk theatre traditions, which 'encode' the theme in a way that is meaningful to the participants, may be used to stimulate and focus the discussion.

### ***Institutional and organisational analyses***

Organisational analyses are complicated by the confusion in everyday speech between 'organisations' and 'institutions'. A classic (but by no means the only) definition offered by institutional economists is that institutions are:

The humanly devised constraints that shape human interaction. They are made up of formal constraints (rules, laws, constitutions), informal constraints (norms of behaviour, conventions, self-imposed codes of conduct) and their enforcement characteristics (North 1990, p.27).

In this sense, GA is a form of **institutional** analysis. The important consideration for PPB is that institutions offer different potentials for co-operation in plant breeding and for a programme's ability to operationalise gender sensitive programming (see Chapter 5 for more discussion on this point).

If institutions can be thought of as the 'rules of the game', organisations are the material form in which the rules are embedded. Thus, a research station is an organisation where the basic rule is 'the practice of science'. One approach to institutional analysis, which has been used by a farmer-led participatory technology development programme (that includes PPB) in southern India, is RAAKS—Rapid Appraisal of Agricultural Knowledge Systems (Naidu and van Walsum 2001). RAAKS methodology invites stakeholders to map agricultural knowledge systems by tracing functional interactions among the stakeholders, and to inventories their differing perspectives on what is at stake. Important steps in the mapping process include analysis of what binds and what separates stakeholders, and the development of strategies to overcome communication blocks (for more detail on RAAKS, see Engel and Salomon 1997).

Although the method is not specifically gender-sensitive, PPB practitioners can make it so by explicitly identifying women's organisations as one of the key stakeholders. Yiching Song and her team in southwest China are using a partial RAAKS analysis to map 'actor networks' among members of formal organisations and between these and different users, paying particular attention to the gaps and barriers between (categories of) women users and others (Song and Jiggins 2002). The analysis has helped researchers to decide they



should be working with two existing local networks, one an informal network of women farmer groups, and the other, among extension stations in the formal organisational sector.

### **GA and Children**

An area for which GA is not especially suited is the investigation of the role of children in farming, trading and the dissemination of breeding materials. Yet children are often important in seed management, by exchanging seeds with others in games, helping their mothers to clean and select seeds for planting, or, as another instance, in collecting left over grains at the end of a market day as a contribution to a (poor) household's food supply. The potential role of child-focussed organisations, such as schools, as partners in PPB, and as social vehicles for the spread of understanding of PPB principles and skills, has in general been neglected.

### **Barriers to Gender-Sensitive User Differentiation**

There are a number of important and common barriers to wider adoption of gender sensitive user differentiation. They can be summarised under the three headings of Functional, Conceptual and Strategic Barriers.

#### ***Functional barriers***

- The complexity of gender relations may require extensive formal study. Many teams cannot to do this or do not have the expertise.
- Frequently there is a failure to check at the outset of the PPB/PVS process if there are significant and relevant gender differences.
- There is a lack of clarity in the research objectives with respect to gender research.
- There is a lack of—or poor testing of—explicit gender-related hypotheses.
- The competence to carry out good quality participatory research and GA is lacking. Poor design or execution lowers the quality of the scientific research with which it is associated.

This last point can be further elaborated. The innovative 'Mother and Baby' trials in Zimbabwe were set up in part to test for any differences in varietal preference among men and women cultivators in the same household, female heads of household, and households of different socio-economic status. Farmers replicated formal trial designs in their own fields in order to try out their preferred varietal selections under their own management. Although the trials were in some respects successful, they resulted also in what those involved humorously call lost, abandoned, illegitimate and delinquent trials (Appendix 1: 52), from which very little can be learned. This and other examples seem to share certain characteristics:

- a. elaborate, complex overall research designs, with multiple, possibly conflicting, research objectives
- b. inadequate or unmanageable data capture so that systematic monitoring and feedback is not feasible
- c. insistence on statistical sampling under scientific controls at a point where a more naturalistic method would better foster the joint learning process; a failure to observe discipline in the application of a participatory method (participatory does not mean slapdash), and insufficient creativity in thinking through what tools and instruments would allow joint learning.

Indeed, nagging doubts would appear to persist among some PPB researchers concerning the validity and rigour of participatory methods in general. As an example, the justification of rankings in matrix and preference ranking seems to be poorly understood by some, particularly in comparison with statistical approaches. These doubts suggest that participatory research methods have been **transferred** to biological scientists without adequate explanation of the research principles within which each method is lodged, or of the disciplinary histories from which the participatory methodological tool-kit was put together. In this particular instance, the method of matrix ranking is drawn from the tool kit of psychology and from **repertory grid** analysis (Kelly 1955). A recent tool for **logistic** preference ranking for evaluating technology options is now available as a user manual for Microsoft Excel 7.0 applications. The software consists of a matrix in Excel for Windows 7.0. The user only needs to input field data into a file containing the frequency of each technology and its ranking order. When the user has finished this process, the software conducts the analysis automatically<sup>2</sup>.

### **Conceptual barriers**

There can be a lack of understanding of how the design principles of 'PRGA' research differ from those of positivist-realist research, that is, there is confusion concerning the philosophic principles underpinning a given research practice, and thus doubts over the **claims to have established valid knowledge**. This leads to:

- disputed rather than purposeful selection of the relevant approach to use for the context and problem,
- uncertainty regarding effective mixing of research approaches/ methods,
- doubt as to the value (rigour) of the research output,
- inconsistency of the focus of the research and/or scale of analysis with the problem and/or the technology need and/or potential and

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2. Available from Luis Alfredo Hernández Romero, CIAT Publication no. 319, IPRA CIAT Project.

- differences in objectives among research team members, and between researchers and farmers.

### **Strategic barriers**

- Participatory research and GA are used cynically to gain access to funding.
- GA is treated as an 'add-on' in the design of a research study.
- GA outputs have no influence over what is done, or how it is done, i.e., the lessons learnt are not mainstreamed into the PPB/PVS process.

Although separated here for the sake of clarity, the three are closely related, and when present together form are highly resistant to change.

### **Gaps and Opportunities**

It is not immediately obvious how such functional, conceptual and strategic problems and barriers might be overcome. Professional GA and participatory research training of a few days' or weeks' duration has been given throughout the CGIAR institutes and in many NARS over the last 3 decades. While this has opened up space for understanding it has not yet institutionalised competence on any significant scale.

A longer term agenda involves the incorporation of GA and participatory research into core scientific training at university level. In the more immediate term, since researchers (like farmers) seem to learn most effectively from their peers, and through experiential learning, the incorporation of PRGA into standard practice would suggest a programme of field-based peer-to-peer learning. Jacqueline Ashby (Appendix 1: 56) has made explicit the often 'hidden' principles of PPB/PVS research, and it might be helpful to reflect on them here. She explains that:

- Farmers, other actors and researchers share **joint responsibility** for the research process and its results.
- They **share the risks** of research: there is no advance guarantee that a method, process, or experiment will 'work' as anticipated.
- No experiment, method, or process is a failure as long as there is explicit commitment to, and mechanisms for, **shared and systematic learning from the experience**.

In addition, greater attention to gender issues, and the quality of participatory processes, in impact assessments (see Chapter 6) would help to legitimate gender-sensitive user differentiation as standard practice in PPB.

### 3. Diagnosis

This chapter takes further the discussion of user differentiation initiated in Chapter 2. An important early step in PPB is to diagnose the interests of potential partners and collaborators in particular varieties. Trade-offs among interests are probably inevitable, but it is critical that scientists do not bias outcomes by assuming *a priori* homogeneity of interests within or between households, through subsuming women's interests in those of men's, or through conflating the interests of producers with those of other stakeholders in the food chain. Box 3 shows why gender differentiation in diagnostic studies is critical to the effectiveness and relevance of PPB.

It is thus crucial that researchers and their partners debate and make any trade-off explicitly when determining priorities and selecting varietal characteristics within breeding programmes. It is also important that there are compensating measures for those whose

#### Box 3

##### Women's glutinous rice in the Philippines

The example of women's glutinous rice in the Philippines is instructive. The task of processing rice by hand was laborious and time-consuming for the women. The raw material was limited since the glutinous rice varieties the women were growing were low yielding and little land was devoted to glutinous rice cultivation. The sale of glutinous rice contributed only marginally to household income. Glutinous rice did not appear to be a high priority for the plant breeders. However after talking with women farmers, the WIRFS project (Women in Rice Farming Systems) developed a study that included both formal surveys and household- and market-based action learning with women and men farmers. The results demonstrated the importance of the rice when sold in its processed form as a speciality product. It provided a high percentage of the women's income, enabling them to fulfil their responsibilities for key household inputs and food management. As a result of this study a new, early-maturing, higher yield variety was developed that compared favourably in terms of taste and eating qualities with local varieties. At the same time de-hulling machinery was developed in collaboration with the women processors. This led to improvements in labour efficiency and reduced the drudgery involved in hand pounding. The value-added gross returns were 70% (Paris 1989; Paris 2000 in Kaaria and Ashby 2001, p.29).

interests lose out as a result of the choices made. In the sections that follow, four diagnostic areas are discussed:

- Stakeholder analysis (SA) is one tool that is widely used in development projects and commercial marketing as a diagnostic tool in order to distinguish among different stakeholders' core interests (their 'stakes' in PPB). SA may also be used to initiate contacts that form the basis of subsequent operational partnerships.
- Another key diagnostic tool focuses directly on different stakeholders' preferred characteristics. Typically, stakeholders, including consumers as the end-users, are themselves making trade-offs among desired traits for any single variety, among components in mixes, and among the portfolio of varieties held in the household, community or trading network. Researchers can greatly amplify their impact by learning about and working with the full range of stakeholder preferences.
- A third diagnostic area of considerable importance is the exploration of **heuristics**, or decision-making rules, that can assist researchers to predict the trade-offs likely to be acceptable to any given stakeholder category.
- In the absence of rigorous stakeholder diagnosis, much can be achieved by even minimal record-keeping within a decentralised varietal selection process. Gaps and challenges remain though, and these are elaborated in the final section.

## **Stakeholder Analysis**

### ***Stakeholder analysis: what and why***

SA has been developed in recognition that descriptors such as family, men, women, community, farmers of a particular crop and other categorisations aggregate or hide the different interests, resource stakes and conflicts that typically exist within such categories (Guijt and Shah 1998). SA therefore identifies a project's 'stakeholders', assesses their interests (their 'stakes'), and the ways in which these interests affect preferences, relationships or outcomes. The key terms in SA are defined as follows:

- **Stakeholders** are persons, groups or institutions with core interests in an activity;
- **Primary stakeholders** are those who are directly affected by project activities, either positively or negatively, whether through inclusion or exclusion. In systems language, they are often referred to as customers—those who are the victims or beneficiaries of transforming actions;
- **Intermediate stakeholders** are intermediaries in the delivery or execution of project resource flows and activities. In systems language, they are often referred to as actors—those who carry out the transforming actions;

- **Key stakeholders** are those with the power or influence to 'kill' or delay a project. In systems language, these are often referred to as owners—those who could stop the transforming actions.

Stakeholders are sometimes divided into 'direct' and 'indirect' stakeholders. This has the virtue of simplicity but the distinction conceals information that it might be more important to reveal. For example, the primary stakeholders, as customers, are those to whom project teams are directly accountable, and for whom they are providing a service. The designation of a stakeholder or sub-set of stakeholders as customers might usefully prompt a research team to reflect on how 'accountability' is to be achieved in practice. On the other hand, if the intermediate stakeholders, or actors, are not included in the 'mental maps' and project designs of research teams, project activities will rarely move beyond the project without additional effort at the end of the research pipeline. By involving intermediate actors in PPB activity from the very start, project teams create opportunities for initiating 'scaling up' processes that are institutionalised within existing social processes and organisational responsibilities. It is the intermediate actors who can transform project activities into living reality, who bring 'futures possible' into being. For their part, key stakeholders, or owners, are key precisely because they have the power to bring 'futures possible' to a halt or turn opportunity in an unintended direction.

The findings of a SA typically are used:

- a. in making more precise the initial selection of who might be invited to participate;
- b. to reveal the precise location of the stakeholder to the target holder to the target activity. This can be assessed when SA is used in a participatory research context with different stakeholder groups;
- c. in identifying relationships or interests that might be seen as problematic. These may require conflict negotiation or resolution;
- d. as a preliminary to thinking through how to design interactions, i.e., what kinds of interaction are sought, with whom, at what stages of the cycle of activities, and within the whole food system;
- e. as a diagnostic template during impact assessment, e.g. for subsequently positioning those with whom PPB researchers end up working with most closely, or for assessing the characteristics of the finished seed upon different stakeholders.

### **Stakeholder analysis: who does it?**

SA is usually done by researchers, as part of their preliminary inventory of the situation and context. They might well discover that a stakeholder, or sub-set of stakeholders, plays a role in more than one category.

### **Stakeholder analysis: how is it done?**

The basic steps in SA are:

- (1) Draw up a table of those you consider to be primary, intermediate, and key stakeholders, on the basis of information presently available to you.

Notes: Identify and list all potential stakeholders. Identify explicit and hidden interests in relation to the situation addressed. Briefly assess the likely impact of project activities and design choices on each of the identified interests. Indicate the relative priority that the project presently gives to each stakeholder in meeting their interests. Check if there are 'invisible' stakeholders (e.g., women in farm households who carry out a key task with respect to the target crop, but who are not considered primary decision makers or other vulnerable groups). Note if you think it likely that 'emergent' stakeholders will appear at later stages of the project.

- (2) Assess each stakeholder's importance with regard to the situation/problem, and their relative power or influence.

Notes: Key stakeholders hold relatively greater power, or are in a stronger position to influence preferences, relationships, or outcomes. Legal hierarchies, leadership authority, control of strategic resources, possession of specialist knowledge, negotiating position, and explicit social, economic or political status, including gender relationships, are all useful indicators in making the assessment. However, informal relations of power and influence may be of equal or greater importance, and should be noted where these are known or suspected. The 'exit' power of the seemingly powerless (e.g., by refusal to co-operate), should also be considered. In terms of method, **influence** and **importance** may be calibrated in a matrix diagram, for example to show where women might have low influence, but be of high importance for achieving PPB objectives. This might be because of their specialist roles/knowledge within the household or in relation to an agricultural or nature management task, or in post-harvest activities.

- (3) Identify assumptions about how stakeholders might affect relationships, outcomes or the viability of activities.

Notes: Key stakeholders whose interests are not met may be able to 'kill' a PPB project or delay its activities beyond the funding available. This step attempts to assess what roles such stakeholders are being asked to play in the course of a project (and whether such roles are realistic), and also any negative responses that might be anticipated. It also attempts to assess the realism of key assumptions about causality, i.e., IF such and such is to happen, THEN x and y must occur.

### **Stakeholder analysis: a case study**

An elaboration of SA has been reported by Ravnborg and Westermann in relation to natural resource management (Ravnborg and Westermann 2000). An aspect of their practice relevant to PPB is the way in which stakeholders were identified by **peer referral**. After preliminary identification of the target area and resource users (using GIS and secondary information), the researchers undertook a series of individual and group interviews. Individuals were selected on the basis of researcher convenience. After exploring that person's involvement in the target resource, based on a semi-structured interview guided by a check list, the researcher concluded by asking the respondent to identify those who had **similar interests**, and those who had dissimilar interests, in the target resource. By systematically contacting those identified, each time concluding the interview with the same question, it proved possible to develop in a timely and cost-effective manner an inventory and contextualisation of interests, and for researchers to identify and analyse the primary, intermediate, and key stakeholders. The process was continued until no new names or interests emerged.

### **Multiple advantages of stakeholder analysis**

By extending SA through the food system, to include not only producers of the target crop but also seed managers, processors, traders and end users, researchers may avoid the bias that occurs if **only** men, or if **only** farmers are contacted in the diagnostic phase, or if community leaders or heads of farmers' organisations are asked to identify and select project collaborators. An analysis by Susan Hecht (1999) of farmer selection criteria documented a number of PVS programmes found that over half (52%) related to the cultural dimensions of the crop rather than production features. Yet it is precisely these cultural dimensions that tend not to be incorporated into either classic breeding programmes or PPB. Further, typically researchers do not, for example, consider characteristics such as processing, storage, and cooking quality as determinant values, except where a crop or a substantial part of it enters the commercial food chain. This is perhaps because post-harvest activities often take place within the homestead or community and often are managed by women.

Another advantage of SA is that it can help researchers avoid being taken by surprise or enable them to more rapidly discover the unexpected. For example, in parts of sub-Saharan Africa, it has been found that poor men and women are choosing varieties that help them to cope with rapidly changing socio-economic conditions (for examples from Sierra Leone, see the technical report, phase 1, Sierra Leone, posted on the Community-Based Development and Conservation web site [www.cbdcprogram.org](http://www.cbdcprogram.org)). The reasons for varietal choices may be surprising, as Box 4 illustrates.



#### Box 4

### Why do poor women plant bitter cassava in Malawi?

Linley Chiwona-Karlton and her colleagues have been studying the role that certain crops play for destitute women, or women who are single, divorced, outcast or *de jure* wives, in Malawi. In areas where there is a lack of security in general, problems of animal predation and fast-moving socio-economic change, people have been forced to adopt livelihood strategies that they would not normally consider. Weaker or less powerful members of the community are particularly vulnerable to food theft, leading farmers to adopt specific strategies to counter stealing.

One woman said: 'If you only or mostly plant non-bitter cassava in your field, the chances are high that you encounter a lot of stealing. If you complain you will be subjected to name calling. Especially the young men, youth, they think it is their right to harvest the fruits of our labour.' Another said, 'As a single woman, with no husband or man to protect me—if I complain about my cassava being stolen they say "wali na pamulomo" literally—she has a big mouth—or "ba kuweleweta"—she is just rambling on'.

However if a woman has a liaison with a powerful man her fields and her well-being are assured. Men with low social status in the community also grow bitter cassava to prevent theft. In situations like these a careful stakeholder analysis would reveal that it is not currently in the interests of either poor men or poor women to grow sweet cassava. Bitter cassava requires a lot of time-consuming preparation to render it non-toxic but it is precisely this quality that deters thieves and guarantees food security to poor households. Aiming to produce improved non-bitter cassava strains in this situation would not benefit the poor.

SOURCE: Chiwona-Karlton et al. (1998).

### Increasing User Participation in SA

SA can be done in a participatory fashion, with sub-sets of those whom researchers initially identify—on the basis of the secondary information available—as the primary, intermediate and key stakeholders. A categorising and sorting method called Wealth Ranking (Grandin 1988) can then be used for further differentiation within and between the stakeholder categories by bringing together small groups (3-5) within each of these categories. Individuals are selected on the basis of their willingness to participate. In addition to categorising and sorting, the wealth analysis method generates contextualised information on the asset structure that characterises each identified category, linked to explanatory variables. It can be further adapted for the purposes of PPB, by basing the analysis on local concepts of **expertise** (rather than **wealth**) in relation to the target crop, and by relating expertise to interests along the whole food system. Although participatory in its application and reliant on richly textured local knowledge, this method generates accurate statistical data, as well as qualitative information, that can be entered into spatially-referenced GIS applications. It can also be correlated with other types of statistical data.

One of the advantages of a systematic SA which includes participatory elements is that it can help determine the 'representativeness' of the interests of different stakeholders, in circumstances where 'representativeness' has interacting socio-economic, production system, and agro-ecological dimensions, as Box 5 shows. A different approach has been taken by INIAP with the aim of obtaining sufficient information for the characterisation of **ideotypes** matched to the interests of different stakeholder categories, as Box 6 indicates.

### Box 5

#### **Systematic capture and analysis of stakeholder knowledge and decision-making, CORPOICA, Colombia**

CORPOICA has been exploring PVS since 1986, and PPB since the end of the 1990s. Its data base has increased to the point where it sees potential for creating genotypes that have pan-tropical relevance, by fitting them to a diverse range of production systems, farmer types and stakeholder needs across a range of environments.

In a 4-year Ph.D. study using both statistical and participatory methods, Antonio López characterised three production systems and five farmer types. The participatory methods included community mapping, cassava/maize workshops and focus groups on soil use. In each case, he worked initially with 5-10 men and women farmers identified as highly knowledgeable with respect to the focus of his inquiry (a purposive sample) by the community and by key informants such as extension agents. The farmers' knowledge was coded and entered into computer software—WIN-AKT\*—that allows rapid and systematic clustering and handling of cognitive information. Thereafter the information was validated and tested for knowledge representativeness in statistical samples of eight farmers (four men four women) for each production system and environment. Knowledge was also elicited from other stakeholders (middlemen, wholesalers, extensionists) on the basis of voluntary selection. The knowledge of scientists was ascertained through purposive sampling. Gender and age differentiated knowledge was recorded with respect to pest management, soil fertility and genetic resources in cassava and maize. The results will be used for ecological modelling of plant genotypes x the study variables, and for building an analytic model of decision-making.

CORPOICA researchers place considerable hope in the results (in preparation). However, a number of questions arise, such as:

- Is there a simpler way to capture and model this information?
- Is the information stable?
- If farmers' and other stakeholders' knowledge is self-renewing in response to changes in their own preferences and in their context, how easy and cost-effective is it to update the models?
- How reliable is the assumption that what farmers and other stakeholders know correlates with what they actually do at any given time and context?

\* Available through: [www.safs.bangor.ac.uk/afforum](http://www.safs.bangor.ac.uk/afforum) or by e-mail: [WINAKT@bangor.ac.uk](mailto:WINAKT@bangor.ac.uk)

SOURCE: Appendix 1: 10, 72.

### Box 6

#### **Incorporating user channels in germplasm management, INIAP, Ecuador**

INIAP researchers are seeking to improve the process and the quality of R&D by including other actors—not only farmers—in the food chain and in PVS/PPB. Stakeholders identified include food quality standards authorities, merchants, rural and urban consumers and processing industries. During 1996-98 INIAP selected 600 potato landraces and improved clones for evaluation by these stakeholders. The results were analysed using Kite diagrams to identify preference commonalities both *within* stakeholder categories and *among* stakeholder categories, per locality, county, sub-region and region. Further discrimination has revealed some gender preferences within these spatial and stakeholder categories. The results are being used to select and develop ideotypes, a process that has shortened the varietal release time from 10 to 5 years. The *national* ideotype for Ecuador has been characterised by this process as: red skin, floury, a white or yellow flesh and with taste quality similar to that of the preferred landraces.

The selection of evaluators has been governed by pragmatic considerations as well as principle. The farmers included a group with whom the researchers had already been working for 9 years, as well as existing women's groups. The criteria were that they should be volunteers recognised as 'potato enthusiasts' by their peers and willing to collaborate. The traders were selected from the principal markets using the same criteria. Consumers included invited members of tasting panels as well as random samples of housewives buying in the markets. The proportion of women participants varied from site to site, depending on their roles in that locality in the potato food chain.

The Institute scientists, on the basis of this experience, are becoming confident that:

- Improved feedback from potato food chain stakeholders makes their work easier, because breeding specifications are more now focussed and relevant. Thus their work is also more cost-effective.
- The process of eliciting feedback is manageable.
- It is helpful to work with a process that allows scientists to 'zoom in' or 'zoom out' to different levels of aggregation and discrimination among preferences.
- The process complements, rather than substitutes for, local PVS and PPB activities.
- The information is also valuable for agro-industry, traders and commercial processors as well as for market-oriented farmers.

However, technical problems remain in assigning values and weights to preferences and stakeholders, and in the management of trade-offs. If researchers' knowledge is the basis for fixing these, and if researchers fail to adjust values and weights to changing preferences, then the relevance and validity of the process will be weakened.

The INIAP researchers are in addition beginning to see the management of PVS/PPB in terms of the *management of knowledge sharing and information flows among stakeholders*.

SOURCE: Appendix 1: 15, 55, 59.

## Other Diagnostic Tools for Identifying Stakeholders

The processes by which stakeholders have been identified within stakeholder categories, such as processors, vendors or consumers, are poorly described in the literature. In general, researchers seem to rely on a combination of convenience (a local Home Economics Institute that can convene a consumer taste panel, for instance), the obvious (only two supermarket chains processing and locally selling or exporting potato chips), and various forms of peer referral.

### **SWOT analysis**

In response to this, the International Potato Center is developing improved practice by using the **SWOT technique** (an analysis of Strengths, Weaknesses, Opportunities and Threats). Graham Thiele explains:

“Our project Papa Andina has been helping organise meetings of food chain actors in Bolivia, Peru and Ecuador. The strengths and weaknesses, opportunities and threats posed by other stakeholders are discussed by the participants. Once the existing linkages and stakeholder interests along the whole chain are clearly understood, representatives of each segment come together to discuss how to improve the links and preference criteria of each stakeholder. So far workshops with actors have been held in each country, follow up actions are planned and underway, including the setting up of new organisational forms to bring different actors together. Ensuring that small farmers are effectively included in this is perhaps the hardest challenge. Most processors would prefer to work with a small number of large farmers to reduce their transaction costs. As demand for processed potatoes takes off in Andean countries the equity cost of not helping small farmers to enter this market will increase.” (Appendix 1: 2).

The ‘food chain actors’ and stakeholder representatives came together because of their interest in a **specific food product in the food chain, at a specific location**, such as around *tunta*, a dried potato product of the Puno area in southern Peru. Typically a group of local institutions begin the initiative together with farmers’ organisations and a wholesaler or exporter. Ideally informal vendors and processors (many of whom are likely to be poor women, selling to poor urban consumers), would be included but this is harder to organise and so far has not been the focus of effort (Graham Thiele, pers. com. 2001).

### ***Taste panels***

Rice taste panels, composed of men, women, the better-off and poor people, have been used to assess new inter-specific rice hybrids (both as unhusked seed and rice). The criteria which have emerged so far focus on domestic processing, palatability and willingness to pay (WARDA). Potato taste panels have included women in the household, backyard processors and street sellers (CIP). Cassava researchers in Malawi have established through combined use of taste panels (of mixed male and female membership, as well as single-sex membership), DNA fingerprinting, and laboratory analysis that farmers can discriminate among 'bitter' and 'cool' cassava cultivars, with an accuracy that is predictive of cyanogenic glucoside levels (Chiwona-Karlton 2001). Farmers' cultivar classifications thus can be used reliably in participatory cassava selection, breeding, and dissemination.

### ***Cooking tests***

Cooking tests have been conducted 3 months after harvest, by which time the rice seeds have 'rested' and are at their maximum quality<sup>3</sup>. These are performed by women selected by the communities participating in varietal assessment (WARDA). With respect to beans, tests have been carried out by rural women in fuel-short and fuel-abundant households regarding cooking time as well as taste (Butler 1993).

### ***Impact study information can lead to new stakeholder partnerships***

In a combined farmer-led and formal-led PPB project in southwest China, stakeholder identification has proceeded step-wise from the 'back end' of conventional breeding, that is, an impact study (Song 1998). The in-depth study of the spread and impact of improved modern maize varieties, and of women farmers' efforts to refresh and improve their own landraces by crossing with the modern varieties, provided initial data for identification of key organisations who might be involved in a PPB project, as well as on the potential village coverage, agro-ecosystems, and stakeholders' interests. The impact study also provided deep insight into the different seed management systems in use among farmers, and in the formal seed system. This information enabled researchers subsequently to identify 'farmer plant breeding villages' representative of the two major agro-ecological systems in the southwest, while offering contrasting socio-economic

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3. The convergence of women's and researchers' perceptions of the optimal time in itself has been an interesting discovery and recognition of each other's knowledge.

contexts. In two of these villages, women farmers are the maize breeders, and the key seed managers in the informal seed system. Within each village, researchers have identified enthusiasts by peer referral, with whom to work on a more intensive basis (Song and Jiggins 2002).

### **Decision-making Rules**

Many PPB researchers are concerned that while GA, SA and other methods are excellent for analysing 'what is and why', they are not strongly oriented toward **predicting** the uptake of new materials or emergent preferences.

In general, the limitations to predictability centre on the open nature of social systems in interaction with a changing environment. Surprise is an irreducible characteristic. It is increasingly recognised that this poses limits to social engineering approaches that rely on designed interventions to achieve predictable outcomes. A more tractable challenge addresses the difficulty in generalising or extrapolating deeply contextual socio-economic data over large geographic areas.

Farmers' decisions about what varieties to grow appear to be more stable (less subject to non-predicted change) in relation to slow growing plants (such as shrubs and trees), a characteristic that Christine Gladwin is putting to good use in her investigation of the decision rule-base in Zambia, as indicated in Box 7.

There are greater difficulties in generalisation or extrapolation where decisions change rapidly over time, because of the rate of change in varietal diversity. The fairly rapid rate of turn-over in varieties grown or used that is sometimes observable at household level however may appear less rapid if researchers focus on the stock of materials available at community levels. An important point to note, however, is that men's and women's networks of exchange and transfer are typically different, and both need to be operating effectively for the conservation of seed biodiversity at community

#### **Box 7**

##### **Using decision trees in Zambia**

Christine Gladwin has developed the formal instrument of the Decision Tree in order to help researchers predict the adoption behaviour of different categories of farmers within a given agro-ecology, and to test whether or not gender difference is a relevant consideration in selection of materials. She has been testing this instrument in Zambia. Early results suggest that decision trees can be predictive of differentiated user selections within a specified environment.

SOURCE: Appendix 1: 48, 65.

levels. However, the **underlying** decision making rules governing varietal selections nonetheless may remain quite stable as the following case study shows.

### **Decision-making rules: A case study**

Researchers in Nepal have developed a diagnostic approach that combines 'rapid biodiversity appraisal', i.e., the tools of rapid rural appraisal adapted to biodiversity assessment in an agro-ecosystem, and 'intensive data plots' (IDPs) (Rana et al. 2000) in order to test the idea that decision-making rules may not change much over time. IDPs were originally designed to understand farm economics and farm management decisions. Adapted for application in a biodiversity use and conservation project in Nepal, IDP involves the participatory recording and analysis of on-farm activities related to one farmer-named variety per plot/land (which for practical reasons reduces to one landrace per plot, with the selected landraces chosen by the farmer). The main objectives are to:

- make an inventory of landraces and varietal diversity on a specific plot at household level
- document indigenous knowledge systems associated with the selected landraces
- calculate the costs of production and returns of the selected landraces and varieties
- record farmers' management practices in relation to the selected landraces/varieties
- diagnose farmers' problems and constraints and explore opportunities for improvement.

All natural, socio-economic and human-managed factors of the cultivated plots and the household are measured and related to the existing crop biology. This information is recorded by the farmer in a diary. Researchers visit the farm household once a week to transfer the data to a main register. All family members, together with the researchers, participate in the analysis and interpretation of the data. Plant samples are analysed in a laboratory and the results are likewise shared with the participants. While the extent of women's participation as an IDP farmer is not clear from the authors' presentation (Rana et al. 2000), if due care is taken to involve both men and women participatory IDP would appear to offer a useful approach to improving predictability of PGR management decisions.

### **Decision support systems**

Both decision trees and the IDP approach are researcher-intensive, and require replication across socio-economic categories within each agro-ecosystem. By focussing on decisions at the farm level, they also lose sight of the dynamic interaction of producers and other

stakeholders in the food chain. An interesting approach that attempts to address the challenge of predicting decision-making across larger spatial scales and multiple stakeholder interactions is that of decision support systems (DSS). Typically—but not necessarily—computer-mediated, DSS attempt to model decision heuristics using, in the simplest case, linear progression, but including a range of more complicated software based, for example, on Monte Carlo modelling. Crop-based decision modelling, such as that developed by the ASPRU team (Dept. of Primary Industries/CSIRO, Queensland, Australia), combine crop growth, soil moisture, crop management, and (a limited number of) economic algorithms. When farmers enter their own rainfall and soil data, the model allows interrogation of a range of 'what if' scenarios that can help guide farmers' decisions, such as whether or not to plant an inter-season crop to take advantage of residual soil moisture.

There is a huge literature critiquing the merits and demerits of these approaches, from a technical, theoretical and 'user' viewpoint. The controversies are unresolved but early optimism has given rise to a more realistic appreciation of when, where, and how DSS might assist. At present, DSS appear to be finding their greatest application among scientists and for special user applications (such as an aid to a bank's review of its farm lending portfolio). So far as the present authors can discover, the literature does not report a single case of DSS specifically developed or adapted for GA in agriculture and food systems. A more recent range of experimental testing of where DSS can make its greatest contribution to PPB focuses on combining specialist use of DSS, with GIS, and participatory research on the ground.

### **Gaps and Challenges**

A challenge that is only just beginning to be addressed is the question of the speed of change—in stakeholder categories, in the nature of what is at 'stake', or in user preferences. In areas under severe pressure, such as areas of civil unrest and involuntary migration, rapid environmental change and deep socio-economic hardship brought about by, for instance, the HIV/AIDS pandemic, the instability of analytic boundaries and stakeholder interests is anecdotally reported to be high. During Malawi's famine crisis in 2002, for example, in southern areas where mainly 'sweet' cassava is grown, the theft of roots from fields of standing cassava as well as premature harvesting as a pre-emptive move against future theft, reduced the availability in local markets of a range of short duration and late-maturing varieties that had been grown in small patches for specific purposes. A less favoured but high starch, short duration variety became much more widespread. Both men's and women's small cassava-related enterprises, based on specific varietal types,



suffered, women's management of household diets became highly constrained, but women traders benefited, if they could get hold of supplies, because the price increased of particularly 'sweet' varieties favoured as a hunger-stilling snack food. There were further and more surprising consequences: the combination of thieving and premature harvesting reduced the availability of planting material for the late-maturing varieties, because the stems were not ripe enough when the roots were lifted, to use for stem cuttings at the next rains, some 3 months' later. In difficult situations such as these individual men and women—or even whole communities—over short periods of time may lose their entire stock of genetic resources and preferred crop varieties, and acquire new stocks haphazardly, or they may switch the focus of their livelihoods in order to cope with changing conditions.

The drop-out rate among members of stakeholder panels and collaborating groups in areas of severe stress can also be high. In such cases, or indeed wherever research resources are very modest, researchers may have to forego rigorous diagnostic data and centralised planning in order to work directly with those selected by NGOs, extensionists, communities, women's groups and farmers' organisations.

The experience of WARDA in decentralising rice varietal selection is quite positive in this regard, with minimal record-keeping at maximum tillering, maturity, and post-harvest of men's and women's choices, seemingly providing sufficient feedback to guide researchers' decisions effectively (see Box 8). In this case, researchers are more or less 'going with the flow' rather than attempting to steer selection toward specific commercial ends. Possibly this simply reflects the lesser degree of formal market organisation in West Africa compared to much of south and east Asia, and the less direct pressures to integrate domestic production into global trade than are being experienced elsewhere.

### Box 8

#### Decentralising rice varietal selection

The West Africa Rice Development Association (WARDA) has developed under the NERICA (New Rices for Africa) programme a PVS process to support the development and introduction of interspecific rice that combines the productive potential of Asian rice with the stress resistance of African rice.

Limited resources and structural adjustment programmes demand innovative partnerships between different stakeholders. Extremely heterogeneous micro-environments—both biophysically and socio-economically—and very limited researcher capacity demand a decentralised adaptive approach.

(Continued)

**Box 8.** (Continued.)

The WARDA approach encompasses a 3-year research programme aimed at identifying promising varieties for further evaluation. This involves a partnership between WARDA, scientists in national agricultural research institutions, NGOs, community groups, extension agents and farmers. The participatory approach has provided primary information to channel back into the varietal development programme. This approach to PVS has proved instrumental in ensuring rapid adoption of NERICAs in Côte d'Ivoire and Guinea and is currently being implemented in 17 countries.

Farmer rice enthusiasts are selected by community groups, extensionists and NGOs, guided by a four-fold classification of 'better-off, poor, male, female'; approximately a third to a half of those chosen are women. The farmers visit the rice station three times during the first growing season: at emergence, tasselling and harvest. They observe promising selections of the new interspecifics, exotics and regional landraces. Their selection criteria, preferred traits and priorities are recorded at each of the three stages. After statistical analysis of the recorded data, seeds of the preferred varieties are given to collaborator farmer for assessment in their own fields during the second year. The farmers are invited, as before, onto the station to study their own and researchers' selections at maximum tillering, maturity, and post-harvest. Their preferences are again recorded. In the third year they may buy, at low cost, a quantity of planting seed for their final selections. They are required to bulk up this for community-based seed multiplication and dissemination as well as for their own use.

The lessons of the first 3-year cycle include: *'Farmers selected on average three varieties; usually five or six varieties are very popular across the group, and another 10-15 varieties are selected by only a handful of farmers for particular 'niches'.* Men's and women's choices differ statistically. *'In general, men and women selected the interspecifics about equally—but different interspecifics'.* Other differences have also been noted. For example, women's post-harvest selections may favour the 'bold' grain of *Oryza sativa* varieties, while men may favour a smaller grain type and varieties that perform well without fertiliser (WARDA 2000). Differences between the 'better-off and poor- households, by gender, have yet to be analysed.

SOURCE: WARDA 2000\*.

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\* A similar approach is provided by a one-off exercise carried out in Tanzania in 1994. Sixteen pre-release varieties were issued in sets of four to Extension Assistants in four Districts, who distributed them to 160 randomly selected farmers. Each Assistant had a motorbike and make visits twice in the season to collect simple farmer assessment and acceptance data. The total cost of the exercise was \$500 (Appendix 1: 44). No information is available as to the sex of the EAs, or the farmers, nor about their preferences.

## 4. User Involvement in the R&D Process

This chapter examines how researchers choose whom to work with and outlines the practical and cultural barriers that might constrain collaboration with women. The question of whether it is first necessary to develop capacity to participate effectively in PPB is considered, as well as the kinds of support that might make such participation more effective. Some specific ways in which users are involved through the breeding cycle are then explored, followed by a review of user involvement in evaluation, and a summary of gaps and opportunities for increasing user involvement or improving the quality of the interaction between breeders and users.

### **Choosing Whom to Work With**

An important consideration is to determine the relative need for, and advantages of, working with 'experts' rather than 'representatives'. Representatives selected from, or proposed by, an existing social group or organisation can exclude from PPB those who are already excluded by virtue of the dominance in office or leadership of, for instance, a class, a gender, an age set or ethnic identity.

#### ***Experts at field level***

The examples given in Boxes 9 and 10 demonstrate how researchers can counteract this difficulty of 'representatives' by identifying and selecting 'expert' collaborators at field level. The first case uses a combination of community-identified primary stakeholders and personal characteristics as the basis for selection.

The second example reports researcher-determined 'expertise' as the criterion for selection, as revealed through interactions at a diversity fair.

#### ***Which criteria to use?***

The criteria used for selecting experts and enthusiasts at farm level have consequences for the impact of PPB as the following examples show.

### Box 9

#### Identifying women bean experts in Rwanda

Beans are a 'woman's crop' in Rwanda but only a few women are considered 'expert' in bean growing. After initial efforts to find effective farmer collaborators—based on discussions with male community leaders—had proved disappointing, researchers evolved the following procedure:

1. Existing community groups were asked to nominate local candidates who had had considerable success in growing beans and who were known to be able to select for diverse, even adverse, conditions.
2. Researchers then visited the recommended women's fields, looking for evidence of both good field maintenance and of innovation.
3. Women who were reflective, spoke clearly and appeared not to be intimidated by the presence of men were preferred as collaborator farmers.
4. If a candidate expressed a strong interest in helping evaluate varieties, her husband's permission was sought by the researchers to formally enable her to participate.

SOURCE: Sperling and Scheidegger 1996.

### Box 10

#### Identifying experts through seed fairs

Sorghum farmers in eastern Ethiopia have an established folk taxonomy. To classify and label their landraces they use botanical, use, agro-ecological and adaptive traits. The actual name given depends on the characteristics of the variety, the place of introduction and the name of the introducing farmer. However, tremendous ecotype differentiation occurs on genotypes meaning that some varieties have a range of names. Also, in the course of exchange of names, original names tend not to be maintained. However the main botanical criteria used by farmers include seed colour, panicle type and stalk sweetness. These are commonly unaffected by genotype x environment interaction and so provide relatively consistent data.

Farmers were asked to bring all the varieties of sorghum they grow to a researcher-organised Diversity Fair. They were asked to explain the characteristics of each variety, its history, where they got it from and its name. The Diversity Fair enabled the researcher to inventorise men's and women's varieties, document the farmers' indigenous knowledge and to promote spontaneous exchange of varieties among farmers (because the farmers themselves found out a lot about what other farmers were growing and asked to have some seed, etc). The Fair also allowed the researcher to collect gender-disaggregated data on the most popular varieties, the most disease resistant ones, etc. The data analysed so far shows men's indigenous knowledge of sorghum to be wider ranging than women's, but this impression remains to be confirmed by more data collection. Finally, the Fair helped the researcher to identify men and women farmer 'experts' with whom to initiate collaboration.

SOURCE: Appendix 1: 17. See Appendix 3 for Farmer Sorghum Diversity Tree.

In a PROINPA project in Bolivia, the male researchers chose to work with farmer enthusiasts, but initially they did so on the basis of farmer self-selection. At the start, all the self-identified enthusiasts were men but as collaboration progressed the researchers began to appreciate the **functional** necessity of also including women farmers when questions came to the fore related to the handling of true potato seed in the small plots near the house. These are traditionally managed by women. A female researcher was hired and she facilitated the development of collaboration with the women farmers (Appendix 1: 82). Without such corrective measures, self-selection can institutionalise gender bias.

The AME Foundation and its partner NGOs in southern India work with farmer enthusiasts in farmer-led PPB. Their experience has led them to a deeper formulation, however, of what motivates an 'enthusiast'. They look for farmers who, beyond a committed interest in farming and its development, display the characteristics of what AME staff call **connected farmers**. An AME farmer team member explains the term thus:

Land is the Mother. We depend on the land and therefore respect her. This respect is the basis of meaningful experiments. If there is respect, farmers learn many things. If the respect is not there, but only the desire to see immediate results, there won't be any learning" (Naidu and van Walsum 2001, p.16).

However, they insist that the connected farmer-collaborator must also be a member of an existing village level organisation, so that there is potential for building effective strategies for dissemination and increasing the numbers of those learning the skills to carry out farmer-led PPB. Two complementary types of village level organisation have been identified: formal structures of village governance, dominated by men; informal self-help groups (SHGs), mostly single sex, and popular with both men and women. The involvement of the formal male leadership is important in sanctioning and legitimating women's involvement through the SHGs. Most of the SHGs have been formed for purposes other than that of agricultural technology development. Nonetheless they are proving excellent partners, in association with NGOs. Many SHGs are beginning to federate to district or regional level, bringing together several thousands of farmers at a time into larger, more formal organisations that are taking on a wider range of self-directed development activity. AME terms this the 'convergence between social organisation and knowledge empowerment.'

### ***Using GA to identify partners***

Another approach to the identification of people to work with is to use GA to help understand local roles and responsibilities in seed management. Most formal-led PPB projects still opt for formal release and expect official agencies, such as parastatals, to move the improved

seed out to stockists or directly to farmers. However alternative models of seed release and dissemination (see Chapter 5) may offer opportunities for greater impact on the poor. In this case it would make sense for formal breeders to select partners also from among the stakeholders in alternative seed flow systems.

Indeed Trygve Berg (1992) reports an interesting example of a situation that turned sour because of lack of understanding of gender roles in seed management. During a germplasm collection trip to Sudan, the team asked permission from bystanders if they could collect a sorghum head from a nearby field. As they picked the head, a woman came rushing over to them, very angry and "shouting wildly at us". It turned out that as the mother of the house, she was responsible for seed selection. It was forbidden for anyone else to start harvesting sorghum heads before she had walked through the fields and made her selection. Viewed in a positive light, the anecdote suggests that a GA of seed management can help identify the category of 'seed experts' with whom formal breeders could work.

### **Ways to Specifically Ensure Women's Involvement**

PPB researchers may experience a mix of practical constraints to involving stakeholders, even when their diagnostic studies suggest that it is essential to secure their participation. The short case studies given here show how researchers adapted their approaches accordingly.

In an ICRISAT project in Rajasthan, India, the staff had specific instructions to locate equal numbers of male and female participants. A woman investigator joined the team, to help locate interested women farmers. In year one, a pick-up jeep was sent out to transport the interested farmers but returned with only male farmers—women farmers felt unable to enter the jeep in the presence of strange men. In subsequent years women were transported in women-only jeeps. The same project learned that if their researchers were to be able talk to people of any caste they had to be of an appropriate caste themselves—either of higher caste or somewhat outside the caste system by virtue of education (Appendix 1: 28).

In a PPB barley project in the Yemen a systematic procedure toward selection of farmer collaborators was used (Ceccarelli et al. 2000). This procedure combined researcher-controlled 'representative' and community-controlled 'enthusiast' selection. A step-wise process was followed, first through selecting by agro-climatic area, then through selecting among communities along the rainfall gradient by household income and education of household heads. The final choice of farmers recognised by their peers to be enthusiasts was left to the community. However, so long as the researchers had enough seed, in practice any farmer could join the experiments. In the first round

wives did not come forward, although in fact they carried out much of the field work. However a male Yemini researcher heard in the course of an informal social discussion with his kinsmen that women were interested in joining in more directly. The researchers asked the local teacher, a woman, to help them form a women's group in each of the six participating villages.

Thereafter, it was the fact that the women selected one lentil variety and two barley varieties that no one else had selected that stimulated the interest of the national scientists in further assisting the women to participate. The very positive experience over the first year of collaboration with the women led the researchers to allocate funding to hire a female social scientist to work with the women's groups. While the breeders' selections over the first two years were different to both men's and women's selections, women's selections have turned out to be more similar to the breeders' than the men's. It is the marked gender pattern in selections that continues to engage the interest of the breeders, even in this male-dominated and culturally conservative social environment (Appendix 1: 41, 60).

The following example in Box 11 further reinforces the idea that the mediation of female staff, or of professional women located in the

### **Box 11**

#### **Locating innovative women farmers in India with the help of women extensionists**

The Indian Institute of Management (IIM) project supports farmer-led PPB and hence prioritises links with farmer innovators. After several years it became clear to project staff that they had identified very few women innovators, leading them to examine their process of identifying farmer innovators. They realised that they tended to work with only male student volunteers, who received one-day gender sensitisation training but no training in GA. When the male students asked who was responsible for a particular innovation, women's innovations typically would be claimed by—or assigned to—the husband or other male family members. Although a few women students were involved, most faced constraints to working in the field. These included the difficulty of finding safe overnight stops and chaperoned use of public transport, and the requirement to travel to a block\* other than their own in order to avoid bias.

Practical changes were made: arrangements were made for women students to stay in a village with families known to the IIM team; they were permitted to work in their own block, and travel was arranged so that they could be accompanied by another family member. The result was that more women innovators were located, raising the proportion of women to male innovations documented to 20:80.

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\* Administration Unit.

SOURCE: Appendix 1: 5.

community, may be necessary to enable the male-dominated world of formal plant breeding develop effective working relations with women farmers.

Another consideration may be the need to limit and focus the experimental agenda. The AME Foundation reports on the basis of its experience with farmer-led PPB in southern India that substantial pressure from both farmer-collaborators and partner-NGOs is needed to avoid open-ended experimentation (Naidu and van Walsum 2001). The male and female farmers it works with on the Deccan Plateau, in adverse socio-economic and agro-ecological conditions, are anxious not to lose time, since there is a high opportunity cost in a context where labouring—if they can get it—offers them a secure daily wage comparable to and sometimes better than the returns to farming. The NGOs for their part are mostly based in social improvement activities and often lack a clear motivation and resources to continue with experimental processes once a farmer-proven technology, or improved variety that can offered to other farmers, emerges from the experimental programme.

A comparable experience is recorded for a cassava breeding project in northeast Brazil (Fukuda and Saad 2001). The project began with a small number of individual male farmers interacting directly with the breeders and extensionists. Activities expanded to cover larger numbers of individual farmers; some women and more marginal farmers were included but the programme remained largely focussed on somewhat better off male farmers. In the last phases of project expansion, practically whole communities were involved. At this time, women, children and marginal farmers had a better chance to be included. However, the scale of interaction proved unmanageable and the quality of the work began to suffer. Currently, the project has returned to working with small numbers of carefully selected individual (mostly male) farmers, and the provision of guidance and training to them on the requirement to share materials and knowledge with others in their community.

### **Opening Up Spaces through Institutional Development**

The ways in which socio-cultural behaviours interact with institutional norms and rules may lead to women's interests and priorities being excluded from the PPB research programme, even when women are members of a collaborating organisation. As the example in Box 12 suggests, the solution may be to create new organisations that allow women a leadership role and a space for direct collaboration with PPB teams.



**Box 12**

**Developing women-only groups for PPB in Colombia**

When CIAT started working with PPB in Colombia, the membership of the community-based agricultural research groups, CIALs, was as follows: men-only 56%, women-only 7%; remainder mixed. CIAT worked with all three types of CIALs by carrying out a joint diagnosis and then prioritising themes for research. In the mixed groups, CIAT researchers noticed that men were almost always the office holders and thus also the information holders. It became clear after a while that the themes chosen were those that men had prioritised. This led to discussions with the women members, who said that they felt excluded and wanted their own CIALs. In many communities today there is one CIAL for men and another for women.

SOURCE: Appendix 1: 11.

The experience of researchers of working with some 40 farmer research groups<sup>4</sup> in Kabale District in Uganda is similar (Sanginga et al. 2002). Some groups had both men and women members and others had men-only or women-only membership. At the beginning of the project, the researchers received information about the gender experience of the CIALs in South America but they were unsure as to whether such principles could be implemented successfully in Uganda. They observed, however, that "*when men talk about gender it is taken seriously*". The researchers first discussed the potential opportunity for research collaboration with a community that they knew from previous interactions. It was decided that the community itself would select individuals to work with the research team, within the guideline that both men and women known for their enthusiasm as 'knowledgeable experimenters' should be selected. They chose to let the idea and reality of a research **group** evolve (or not) at its own pace. Following the first positive experience, more groups were set up but around half failed within 2-3 years.

An analysis of the factors that have nurtured the surviving active groups shows that the women-only groups in this area are the more cost-effective, because:

- Men often take the profit and spend it on drink.
- Women are more reliable in turning up for group meetings and carrying out the agreed work.
- Women are keen seekers of knowledge and skills (whereas men tend to demand handouts and inputs).
- Women in this area have a tradition of collective labour groups, and of sharing information within the group and with their female kin.

4. International Center for Tropical Agriculture (CIAT) and PRGA Programme-Africa Highlands Initiative (AHI).

Other factors were also found to be important, such as group size (small groups of 6-10 members were found to work best), cohesive social capital (high degree of homogeneity among group members), and the opportunity and willingness to help the group "go beyond agricultural research". Interestingly this last point is also stressed in the experience of the Colombian FIDAR team working on low cost *in vitro* cassava propagation. The training of community-selected women propagators in the hygiene management required in the propagation chamber has led the women to take up simple health work in their community, whilst the literacy and numeracy training provided to them similarly spilled over into informal education activities.

The importance of group development, or more broadly, local institutional capacity, might need to be complemented by the provision of training support to stakeholder collaborators. This idea has been explored and systematically tested in Bolivia, as outlined in Box 13.

### Box 13

#### Training as part of organisational capacity building in Bolivia

PPB researchers working with CIALs in Bolivia since January 1999 have been testing the cost-effectiveness of working with different kinds of organisation—syndicates, traditional organisations, NGOs, FFS and CIALs. Earlier experience under PROINPA with PVS was positive, but researchers noted the following points: (1) relatively few farmers were involved and benefits did not spread widely, (2) late blight resistance broke down in farmers' fields and (3) specific characteristics adapted to niche environments (social and agro-ecological) could not be accommodated in the formal breeding program. PROINPA and collaborating NGOs are now placing more emphasis on stakeholder training in PPB. The training methodology emphasises group-based *discovery learning* through the crop cycle. This focuses on strengthening stakeholders' understanding of the *principles* of genetic resource management and breeding—not merely on skills development. For example, the training seeks to help farmers understand, observe and test different kinds of resistance. The training design also addresses practical issues such as when and where to hold the field sessions, so that both women and men are free to attend. Community-based workshops are used to share and disseminate the learning more widely.

SOURCE: Appendix 1: 1, 66.

#### User Involvement in the Plant Breeding Cycle

There are numerous published accounts and theses studies of user involvement in the plant breeding cycle. They often provide in-depth information on the steps involved in the context of participatory breeding or varietal selection, whether formal-led or farmer-led, what is observed, recorded, and analysed, and how this is done and by

whom. There is, in addition, often information on the location, the socio-economic context, farm household characteristics, and usually male farmers' preference criteria (and less frequently, women farmers' criteria). However, there are very few accounts that systematically state the gender of those involved in each step or the specific activities of female and male users through the cycle of interaction. Since these kinds of data are not usually recorded by practitioners, follow-up enquiry produces impressionistic feedback that is hard to analyse. The examples presented in this section thus bring together a number of insights that point the way to further systematic study. Where the literature permits, a distinction is made between user involvement in farmer-led and formal led PPB.

### ***Local crop improvement***

Mass selection by farmers, as a low-cost, widely used method of local crop improvement, has been documented in Nepal and Mexico (Sthapit et al. 2000). Often farmers have developed the capacity also to cross their selections, and this section begins with an example from southwest China of the skills farmers use when carrying out their own crosses. Where such competence and experience already exists, it can be linked in powerful ways to formal breeding capacity, and the example is extended in order to describe in some detail how this might be done in order to provide a systematic comparison of user involvement in farmer-led and formal-led PPB. A formal-led PPB programme in Syria is then discussed. It is followed by a case study from the Philippines that illustrates how training can be offered to farmers to enable them to develop farmer-led PPB activities. Another case study from Nepal tracks the process there. This overview of crossing concludes with examples of user involvement in the development of hybrids and OPVs in formal-led PPB in Vietnam and Tanzania.

#### ***Case study 1: China***

The unusual example of a maize breeding programme in southwest China deals with a combined programme of formal-led and farmer-led research (Song and Jiggins 2002), which has its origins in the study of women farmers' indigenous maize hybridisation activities (Song 1998). The background to the project, and the design of the trials, is given in some detail below, because it shows how careful design will allow analytic comparison to be made among different forms of user involvement. Tables 5 and 6 are taken from the same source. However, the example begins by presenting the traditional hybridisation skills of women farmers in one of the collaborating villages, Wenteng (ibid.).

Table 5. Comparison of user involvement in field trials with different breeding approaches and foci.

Comparative items	GMRI Trial (1)	GMRI Trial (2)	Wenteng Trial	Zhichen Trial (1)	Zhichen Trial (2)	Zhurou Trial	Niantan Trial	Lonhua Trial
Breeding approach followed	Conventional scientific breeding	Formal-led PPB	Women farmer-led PVS	Farmer-led PVS	Farmer-led PPB	Farmer-led PVS	Women farmer-led-PPB	Traditional farmer selection
Organization form	Centralized working through top-down system	Decentralized Working with some farmers	Decentralized Working with women farmers	Decentralized Working with farmers	Decentralized Working mainly by farmers	Decentralized Working with farmers	Decentralized Working mainly by women farmers	Decentralized Working totally by farmers
Germplasm on trials	Pop 961, 966	Pop 961-966, Tuxperho 1 foram and farmer landraces	Pop 961, 963	Pop 961, 963	F wax, L wax	Pop 961, 963	F white, L white	Pop 961, 963
Technological objectives	Productivity increase	Productivity increase Biodiversity enhancement Local adaptation of germplasm	Local adaptation of germplasm for OPV improvement	Local adaptation of germplasm for OPV improvement	Biodiversity enhancement Crop improvement	Local adaptation of exotic germplasm for OPV improvement	Biodiversity enhancement Crop improvement	Local adaptation of exotic germplasm
Social/institutional objectives	For trial comparison	Better understanding of farmers' system Farmer skill building Increase farmers' participation	Farmer skill building Farmer seed system enhancement Women empowerment	Farmer skill building Farmer seed system enhancement Women empowerment	Farmer skill building through PPB PPB testing	Farmer skill building Farmer seed system enhancement Women empowerment	Farmer skill building Farmer seed system enhancement Women empowerment	For trial comparison
Seed production and diffusion	Formal	Formal and farmer's system	Farmer's system	Farmer's system	Farmer's system	Farmer's system	Farmer's system	Farmer's system

Table 6. Decision making and division of labour between farmers (F), breeders (B) and project researchers (R) in the different trial models.

Comparative items	GMRI Trial (1)	GMRI Trial (2)	Wenteng Trial	Zhichen Trial (1)	Zhichen Trial (2)	Zhurou Trial	Niantan	Huaguang
	Conventional scientific breeding	Formal-led PPB	Women farmer-led PVS	Farmer-led PVS	Farmer-led PPB	Farmer-led PVS	Farmer-led PPB	Traditional farmer selection
<b>Main deciders</b>								
Setting breeding goals	B, R	B, F, R	F, B, R	F, B, R	F, B, R	F, B, R	F, B, R	F, R
Defining the plant type for PPB and PVS trials	B	B, F	F, B	F, B	F, B	F, B	F, B	F
Defining breeding and selection materials	B	B, F	F, B	F, B	F, B	F, B	F, B	F
Defining breeding/selection methods	B	B, F	F, B	F, B	F, B	F, B	F, B	F
Setting selection criteria	B	B, F	F, B	F, B	F, B	F, B	F, B	F
Selecting parent materials and making crosses	B	B, F	F, B	F, B	F, B	F, B	F, B	F
<b>Main conductors</b>								
Selecting land for the trials	B	B	F	F	F, B	F	F, B	F
Adaptive testing on-station and in field	B	B, F	F, B	F, B	F, B	F, B	F, B	F
Evaluating experimental varieties	B	B, F	F, B	F, B	F, B	F, B	F, B	F
Producing seed	B	B	F	F	F	F	F	F
Releasing and populising new Vs	B	B, F	F	F	F	F	F	F

Women known in the village as expert maize breeders skilfully control the breeding process, from field design to seed selection and through to pollination. For generations, the women claim they have maintained their landraces (traditional varieties) through separating in space and time the planting of each landrace. The next year's planting seed is harvested based on a three-step process of mass selection. Step one is to select from the middle of the field the best plants, that is, healthy, vigorous plants with big ears of maize. Step two is to select the best ears, based on cob size, length and the number of seed rows. Step three is to select the best grains from the middle portion of each ear, based on kernel size, shape, quality and colour. New crosses are made using manual and mechanical methods to remove tassels from the seed plants before they shed pollen, and to collect the pollen from male plants for artificial pollination. In this way, the women manage to maintain the vigour of an OPV, Tuxpeño 1, released by the formal seed system in the early 1980s but subsequently ignored by the formal system as new hybrids came on stream. One women farmer breeder had not only maintained the variety's vigour, but had improved its qualities to be better adapted to local conditions. By 1998, more than 80% of Wenteng's maize growing area was planted to the woman's improved Tuxpeño 1 and it was spreading rapidly to neighbouring villages through informal seed exchanges.

The project team built on such experiences to design a programme of user involvement in parallel farmer-led and formal-led PPB activities (Box 14 and Tables 5 and 6).

### ***Case study 2: Syria***

Another example of systematic testing of user involvement in the breeding cycle is given by a formal-led PPB project for barley in Syria (Ceccarelli et al. 2000). The researchers began by designing four types of trials: by farmers in their fields, with farmers on-station, by breeders in farmers' fields, and by breeders on-station. Their experience of the rigour, reliability, and comparative costs and benefits of the four led them to concentrate on testing and selection by farmers in their own fields, complemented by seed multiplication on-station.

### ***Case study 3: Philippines***

Whereas in the China case presented on page 47, the project team was able to build on existing farmer competence in hybridisation, other projects may find that such skills have been lost or have not developed. The MASIPAG programme in the Philippines was among the first to demonstrate in a systematic way that farmers could learn to handle the procedures involved in making their own crosses if appropriate training was offered (Medina 1988). MASIPAG stands for

### Box 14

#### The design of user involvement in PPB in southwest China

**Background:** The PPB field experiments have been designed as pilot research using both a formal-led and a farmer-led approach, with different research focuses in each trial for comparison. The priorities of the PPB pilot project are to look at the standards and methods of both farmers and breeders, with three objectives: (1) to bring the best farmer knowledge and the best scientific knowledge together in realising the overall goal of crop improvement and biodiversity enhancement, (2) to establish direct communication and feed-back between the two systems and enhance local capability, equity and gender balance, and (3) to compare different breeding approaches, i.e., PPB, PVS, conventional formal and farmer traditional, through trials. The main methods used are comparative field trials, field visits and field days, in-depth case-studies and participant observation. The project is working in five villages, two of which are designated 'in-depth' study villages (including Wenteng).

As a result of a series of discussions among farmers and formal plant breeders jointly and separately, it was decided that the PPB and PVS field experiments would target four types of varieties, i.e., exotic populations (CIMMYT populations), farmer "creolised" varieties, farmer maintained landraces and formally conserved landraces. More than 20 varieties were identified as target varieties for PPB and PVS on-station and on-farm trials. The characteristics of the four types of varieties and purpose of the trials are as follows:

- *Exotic populations* (CIMMYT populations). Six populations, i.e., Tuxpeño 961, 962, 963, 964, 965 and 966, introduced by the Chinese Academy of Agricultural Science (CAAS) from CIMMYT in 1996, were identified as starting points for improving OPVs. They were planted for field experiment and regional adaptation and selection at Guangxi Maize Research Institute (GMRI) in the first cropping season of 2000 (there are two maize cropping seasons per year in the research area, the first lasts from February until the end of June, the second from July to November). During the pre-harvest season the first field day was facilitated by the mixed gender team with the participation of farmers (80% of them were women) from the five villages, formal sector plant breeders, extensionists and public seed company managers. Based on the results of the field trials, joint discussions and ranking-by-voting, two varieties (961 and 963) were selected by both formal plant breeders and farmers, and then agreed by other participants, for moving into farmers' fields in the following cropping season for farmer-led PVS trials.
- *Farmer "creolised" varieties*. These are materials delivered by formal breeders and then improved and locally adapted by farmers. One popular variety, Tuxpeño 1, was included in the on-station trial for the purposes of analysis, breeding and comparison, to be followed by farmer-led PVS trials.
- *Farmer maintained landraces*. Eight landraces currently used by farmers in the five trial villages were collected and included in the on-station trials for purposes of analysis, breeding and comparison, also to be followed by farmer-led PVS and PPB trials. This work is based on a conventional formal breeding

(Continued)

**Box 14.** (Continued.)

project conducted by GMRI from 1995 to 1997. The original objective was to test and analyse the genetic features of these landraces for population improvement. One hundred landraces were tested, together with four standard testers, i.e., M17, 330, Bass (Reid) and Lancaster.

- *Formally conserved landraces.* Four landraces from the on-station trials were selected by farmers during the first field day held at GMRI, for use in farmer-led PPB trials in the two in-depth case-study villages, to be crossed by farmers with the landraces they are currently using. This they have been doing during the first and second cropping seasons of 2001.

**User Involvement:** Baseline data, the varieties collected and the discussions among farmers and formal-sector breeders were used to design the field trials of the four types of varieties described above. The trials first were conducted in the two in-depth case-study villages. In the following cropping season, i.e., in the second year of the project, the trials were scaled up to include all five villages. Each trial site has its own focus for PPB and PVS comparison (see Table 5). Decision making roles and the division of labour between farmers and breeders differ depending on the type of trial (Table 6).

Farmer-Scientist Partnership for Rural Development. The programme involved at its launch 44 farmer organisations, a support group composed of scientists from the University of the Philippines, Los Baños (UPLB), and a nine-member Board composed of five farmers (who elected the chairman), members of two NGOs, and two scientists. The NGOs worked with the farmer organisations to help local communities select farmer-trainees. MASIPAG trained two UPLB staff to undertake rice hybridisation from F1 up to uniform lines, and in the selection of parents. The staff then became the project technicians and they began by giving an intensive week-long training to four farmers in the same skills at UPLB's experimental farm. These four farmers in turn trained members of their own communities. As the programme developed, farmer-to-farmer training became the main mechanism for spreading the skills of what became a very large farmer-led PPB movement, with the project technicians providing back-up in the field and liaison between the farmers and the support group.

**Case study 4: Nepal**

A formal-led PPB project carried out by the Lumle Agricultural Research Centre (LARC) in Nepal invited farmer participation in the development of improved rice varieties from F<sub>3</sub> bulks onwards (Sthapit et al. 1996). In a parallel breeder-led scheme, the best materials from the farmer participatory project were taken into formal trials and purified by progeny row selection for certified seed production in order to satisfy formal release requirements. However if part of the problem is that the poor or other marginalised people do not have ready access



to formal seed releases, then feeding the outputs of PPB into the formal seed system may not achieve the impacts desired. Site selection was based on the incidence of spikelet sterility (induced by cold irrigation water), socio-economic conditions and the incidence of bacterial sheath brown rot disease. PRAs had established that farmers wanted to improve the milled grain colour of local varieties. The objective of the PPB activity was therefore defined as the development of a 'white grain' that was more cold water tolerant and disease resistant than the existing varieties. Expert farmers were identified by their peers in the selected communities as knowledgeable and skilled, and those who were willing to work with the breeders were invited to join the team. The expert group's understanding of selection and inheritance were discussed and they were invited to visit each other's fields, and LARC's station trials. They received training in the following principles: that the traits of offspring from two contrasting parent plants would vary; selection within the variable traits should be done for 2 to 3 years until the trait varied no longer; and that some traits, such as grain colour, were 'strongly' inherited and thus good targets for selection.

In the first season, the expert farmers were invited to grow the bulks anywhere they chose in their own fields, using their normal practices, except that the test entries had to be planted and stored separately. Sign boards were placed alongside the trial plots to attract the attention of other farmers. The expert farmers used their own criteria to assess and select plants and planting seed for the next season, with women participating particularly in post-harvest assessment of traits. The methods and criteria that farmers used were monitored and recorded by field technicians. The farmers were asked to return half the selected seed to LARC after harvest. Farm walks were made jointly by the breeders and the expert farmers in order to monitor all trial farms in the first season; in the second and third seasons, harvest yield and grain yield after threshing were systematically sampled, as well as plant height at harvest and straw yield. The on-farm and on-station trial plots also were monitored jointly in farm walks by expert and other farmers, the breeders, a socio-economist, and other researchers. The farmers then were asked individually to rank varieties on a scale of 1 (excellent) to 7 (worst), and to list any positive and negative characteristics that they had experienced. The extent of agreement of the preference rankings of individuals among male, among female, and among all farmers were analysed assessed using the Kendall coefficient of concordance  $W$  (Sthapit et al. 1996), a measure of the agreement among a group of judges. "The extent of agreement between two groups of judges, such as breeders and farmers, was measured using the overall orders of each group and Spearman's rank order correlation coefficient" (Sthapit et al. 1996).

The expert farmers carried out some interesting experiments, planting and selecting for traits that enabled plants to perform better than the local controls, for example, in the coldest water, low sunlight or extremes of fertility, i.e., they wanted to test for risk in conditions where local varieties performed badly. They used a variety of (more or less successful) methods in their selection practices, as well as applying a wide range of criteria in their assessments; the most common criteria used were grain colour, yield, plant height and maturity relative to local varieties. Women farmers then assessed those varieties that had performed best in the field in terms of their post-harvest characteristics, using criteria such as milling per cent, broken grains, water absorption, elongation whilst cooking, aroma, dryness, stickiness, taste and ability to fill the stomach before feeling hungry again. The amount of time and care taken by the farmers was found to increase over the 3 years, as farmers began to appreciate the value and see the results of systematic observation and selection.

#### ***Case study 5: Vietnam***

The next example comes from Nan, Vietnam. Although small in scale, it shows how experience initially with PVS can then lead into PPB activities as breeders, NGOs and farmers start to gain confidence in working together. In 1997 three villages in contrasting agro-ecosystems were selected in lowland, upland and highland areas. Four or five farmer-collaborators were identified in each village, on the basis of their interest and engagement in full-time rice farming. Two yield trials were established in each village, one managed by the project and one by the farmers. The results were jointly evaluated. On the basis of this initial experience, one farmer was invited from each of the three villages to join in further collaboration in more intensive researcher-managed trials and in PPB. In the researcher-managed trials, in addition to hosting and jointly evaluating the trial plots, the farmers made cross-visits to monitor each other's experimental plots, assisted the researchers in carrying out field surveys of rice diversity, and took part in focus group discussions of varietal preferences and rice development strategies. They were also assisted to visit the Philippines to learn from the experience of farmers working with NGOs in PPB, and to receive training in making their own crosses. On their return, they all selected parent material, though two of the farmers could not proceed immediately because of the local non-availability of their preferred varieties. One of the farmers made successful crosses and by 1999 had brought the process through to F<sub>2</sub> populations for further selection ([www.cbdcprogram.org](http://www.cbdcprogram.org)).

#### ***Case study 6: Tanzania***

The final example comes from a Bean CRSP (Collaborative Research Support Programme) project based at Sokoine University of Agriculture and Ilonga Research Station, Tanzania (Butler 1993). The

participatory bean breeding process was based on the genetic variation existing in farmers' fields, plus new regional and exotic varieties released at the  $F_6$  stage, that were allowed to self-pollinate and undergo selection for 5 to 6 generations (purposive recombination) in farmer-managed and station-based trials. Men and women farmers were invited to evaluate the progeny in successive generations at podding and harvest and make selections, on farm and on-station, throughout the successive generations. A simple ranking and scoring process was used at each evaluation, based on a scale of 1 (very poor) to 4 (excellent). Extension workers recorded the scores and the criteria used by each farmer in making his or her assessment. The farmers were found to be using nine major preference criteria, compared to the breeders' five (plant habit, disease resistance, yield, cookability, quality). The additional criteria used by farmers addressed the appearance of the pod, leaf and seed (and not just plant habit), tolerance of rain or drought, taste, and storability. They also distinguished between the seed colours preferred for home consumption and those favoured by the market. The breeders meanwhile also made their own selections. The preferred selections of the combined farmer and breeder evaluations were fed back into the formal breeding process. One interesting lesson was that the initial selection of farmer collaborators has important consequences for the outcome. The original selection by the research team of the farmer experts proved biased in terms of smallholders' interests so in subsequent years the criteria were changed to include better-targeted socio-economic and attitudinal factors, the individual's enthusiasm for collaboration, as well as women's associations. Their initial experience also prompted the researchers to set up a community-based consumer evaluation study, guided by a food technologist, social scientist and breeder.

### **Screening and testing**

This section looks at examples that shed light on different aspects of farmers' roles in screening and testing. The first sketches farmer-breeder collaboration in the rehabilitation of kola nut farms in Nigeria. The second, from Sierra Leone, looks at how successive years of interactive screening and testing can widen impacts and increase the robustness of selections. The third example, from Zimbabwe, suggests a role for farmer groups and demonstration plots.

#### **Case study 1: Nigeria**

A very early experience in participatory varietal selection that involved farmers in screening and testing is provided by the *kola nut* improvement project initiated in Ito, Ilaro and Otta, Ogun State, Nigeria, in 1966 (van Eijnatten 1977). The basis of the project was to work with farmers known by their peers to have high-yielding trees that produced good quality nuts. In this area, men farmers own the

trees but women trade the nuts, so both were involved in selection of 'mother trees'. Without the farmers' and traders' experience, the project team would have had to conduct costly long time-series observations. The selected farmers identified best-performing individual trees and these were observed jointly by the farmers and researchers through four consecutive harvests. The farmers acted as the recorders, and made fortnightly visits to the selected trees. It became clear through their observations that there were in fact two distinct types of trees in cultivation, with different growth characteristics and producing nuts of different quality. After 4 years, the lowest-yielding and poorer quality trees, as assessed jointly by farmers, traders, and researchers, were eliminated from the experiment and root cuttings were taken from the remaining 'mother trees' and placed in rooting bins. Rooting ability and time from cutting to root strike were recorded jointly by the farmers and project team, before the successful cuttings were hardened off. Unfortunately, the most successful clones proved to be those taken from the mother trees during the flowering and fruiting stage, but the farmers objected to any larger scale removal of cuttings from their own mother trees during this period. So the project team and farmers decided to plant a nursery for the propagation of mother trees that could serve as a source of clonal material. Together they laid out a nursery orchard design that incorporated a number of features that the farmers wanted to test, as closely replicating the range of planting opportunities on their own farms, as well as various establishment and management practices. They also set up 'clonal fields' that could serve as a source for the sale of rooted cuttings. Farmers from the neighbouring communities were invited in to observe the nursery orchard and clonal fields, as well as to make study tours to observe the farmer collaborators' own trees. The clonal trees raised yield by five to nine times over the average for Ogun. Unfortunately no long term cost and revenue data are available but at least the orchard and clonal fields had the potential to become a major revenue centre and to successfully rehabilitate Ogun State's kola farms.

### ***Case study 2: Sierra Leone***

The PVS, FAMPAR trials and Garden trials in Sierra Leone provide insight into how impact can be increased by spinning the outputs from one set of trials into another, and from participatory research back into formal breeding programs and seed releases ([www.cbdcprogram.org](http://www.cbdcprogram.org)). Following on from initial seed surveys, PRAs and farmer-breeder workshops, PVS rice trials of hybrids and inter-specifics were initiated in 1998 in Kambia District together with WARDA. In 1999, the five best varieties selected by the PVS farmers in Kambia District were given to 48 farmers (50% women) for cultivation on their own farms, in four villages in Lokomassama chiefdom, Loko District. Each farmer received at random 500 grams of seed of one of the five varieties, and all grew ROK3 as the best local variety. Farmers'

perceptions of agronomic yield were recorded through a formal questionnaire. Farmers' preference criteria were elicited during farm walks in September 1999, at crop maturity. The farmers then individually ranked their own preferences for all the plots. They then scored their preferences in terms of three classes: better than the check (local variety), the same as the check, and worse than the check. Men's and women's rankings and scores were recorded separately. The 13 varieties that came top in the FAMPAR trials, together with three local varieties, were then taken in 1999 into garden trials in six additional villages; 120 farmers (50% women) planted the selected varieties in their own gardens, allowing free visiting by other farmers throughout the growing season. At maturity, a Field Evaluation Day was held together with the researchers. Overall, farmers used 21 selection criteria but significant gender differences were revealed. The men concentrated on yield parameters while the women gave more attention to grain quality traits. In making their assessments, the women used their fingers to de-husk the grain so as to observe the grain colour, hardness and taste on the tongue. They preferred white to red grain colour, as saving milling time, and they perceived that long slender grains had a good taste after cooking. Large soft grains that expand during cooking were also favoured, as being able to feed more people. Two of WARDA's inter-specific crosses survived among the top rankings throughout the three successive 'screening and testing' trials, and were taken up for wider dissemination.

### **Case study 3: Zimbabwe**

The final example in this section is taken from the experience of the Community Technology Development Trust (CTDT), in Zimbabwe ([www.cbdcprogram.org](http://www.cbdcprogram.org)). On the basis of formal socio-economic surveys in of Tsholothso, UMP and Chiredzi Districts, potential farmer-collaborators with adequate resources, willingness and experience in sorghum and millet farming were invited by the CTDT to submit themselves for final selection by the local Farmer Groups (one for men, one for women and one mixed). Three farmers in each of three wards in Tsholothso, two farmers in each Ward in UMP, and two farmers in each Ward in Chiredzi, were finally selected. Each was given five improved OPVs of sorghum and pearl millet. They were invited to grow these together with their own varieties and to select the preferred progeny. Land was also set aside by the Farmer Groups for farmer demonstration plots, to grow two replications of each of the improved OPVs in separate plots, for observation and comparison with the plants growing (and evolving) in their own fields. Field Days were held two times a year, at mid-season and at harvest, in each District, at which systematic farmer evaluations were carried out jointly by the CTDT and Farmer Groups, and the farmers' preference criteria and selections recorded. The selections that came top in the farmer rankings were released through farmer networks at community-based

and cross-District Seed Fairs. This example represents perhaps a rather looser degree of researcher control than in some of the other cases presented in this chapter, and appears to be something of a hybrid between on-farm testing of cultivars and farmer-managed mass selection. However, it may highlight the value of working with existing local institutions and seed systems in screening and testing.

### **Evaluation**

This section teases out some of the ways in which farmers are invited to participate in evaluation, based on examples from China and India.

#### **Case study 1: China**

The evaluation procedures described in Box 15 are being used in the southwest China maize breeding project. The two approaches used, combining naturalistic and objective methods, are frequently mentioned in the literature.

#### **Case study 2: Uttar Pradesh, India**

In a participatory rice varietal selection project in eastern Uttar Pradesh, India (Paris et al. 2001), farmers themselves have been invited to carry out a systematic evaluation. Two farmers from each of two villages were selected by the research team to test a range of genotypes designed to provide a basket of choices, and match the

### **Box 15**

#### **Evaluation procedures, Southwest China Maize Breeding Project**

**Field day:** At each harvest formal-sector breeders and other professionals, including farmers from the trial villages and other areas, are invited to evaluate and "vote" on the materials resulting from the farmers' field trials and the on-station trials. Both male and female farmers and formal-sector breeders suggest, discuss and agree on relevant indicators to assess the impacts PPB and PVS on crop characteristics, productivity and genetic diversity.

**Farmer survey and in-depth case study:** Other indicators concerning attitudinal change, influence on formal system, local capacity building, farmer empowerment, equity enhancement, etc. are decided through an intensive farmer-scientist communication and discussion process. It includes focus group discussion, i.e., women farmers, men farmers, formal sector breeder, and extensionists, and joint discussion of all the groups. Then relevant data are collected by the team through a survey of 200 different farm households, including trial, non-trial, adopted and non-adopted, woman-led and man-led households, in the trial villages during the last harvesting season of the project. In-depth case studies of the two initial PPB/PVS trial villages and GMRI also are being conducted to assess the impact at community and institution levels during the process.

preference criteria previously elicited. An additional 10 farmers (five men and five women) were invited to visit the individual plots and to rank the genotypes at past-maturity stage on a scale from 1 (excellent) to 16 (worst) on the basis of visual assessment. The rankings generated an  $n \times k$  matrix where  $n$  equals the lines being evaluated and  $k$  equals the farmers evaluating the crop performance. Kendall's Coefficient of Concordance ( $W$ ) was used to measure the agreement in rankings among male farmers and among female farmers, and the correlation between male and female farmers' rankings. High and significant correlation values indicate close agreement on the ranking of the rice genotypes by men and women in the sample. In this case, the agreement between male and female farmers, and between farmers and breeders was close. The approach serves as a check on how closely trial genotypes in any season really do meet differentiated user preferences.

### **Case study 3: Southern India**

A different approach has been taken in the farmer-led experiments supported by NGO partners of the AME Foundation in southern India (Naidu and van Walsum 2001). Here the emphasis is placed on monitoring the process of interaction, as much as on specific trial results. Monitoring takes place at four levels: individual farmer, SHG, NGO and the Foundation itself.

- **Farmers:** they are provided with notebooks during training in which they record crop performance, rainfall, labour requirements, and simple cost-benefit data. Those who cannot read or write are trained to use a few key functional words, and to enter their observations using symbols and icons.
- **SHGs:** the farmers' observations are presented, discussed and analysed at weekly or two-weekly meetings. The members also discuss issues of group dynamics, such as leadership and attendance discipline. Minutes are taken and sent on to the relevant NGO partner.
- **NGOs:** NGO personnel monitor on a two-weekly or monthly basis crop performance, the extent of farmers' involvement in the experiments, and the social interaction among farmers, including drop out rates and gender dynamics. Training, counselling or other specific support is given wherever there are problems. Monthly or quarterly reports are sent onto AME.
- **AME Foundation:** AME staff integrate feedback from the other levels, and submits to the NGOs and SHGs an annual audited statement that addresses the technical, socio-economic, gender and process aspects of the process, and an audit account of the SHG's revolving fund.

In addition, end-of-season farmers' meetings are held at local, district and increasingly also at regional levels. In the case of groundnut, a number of cross-regional meetings have been held, at which farmers from three states have met to review and share their learning. At these meetings, farmers are asked to prepare explicit accounts of their results, and the indicators they are using to assess the results of an experiment. This process reveals numerous complexities. For example, "a farmer may hardly harvest any groundnut crop because of erratic rainfall, still she considers her experiment successful because the loss in terms of investments made is less than that on the control plot" (Naidu and van Walsum 2001, p.32). Or farmers might harvest a trial variety after 116 days instead of the recommended 90 days, because of weather-related labour constraints, but still obtain a groundnut crop considered acceptable in farmers' eyes.

The evaluative process and outcome of these meetings become inputs to the crop-based working groups (groundnut and cotton). It is instructive to see how this feedback is beginning to change perception and understanding within the working groups. In the case of the late-harvested groundnut variety, the breeder responsible for providing that genotype strongly argued that it should be considered a 'failed experiment' and that if farmers were not capable of sticking to recommended practice, then there was no point in involving them in breeding work. His peers in the working group, however, argued that scientists had to provide genotypes for trial that matched farmers' reality, and used peer pressure to encourage him to work more closely with farmers in the field (Box 12: E. van Walsum, pers. com. 2001).

### ***Farmer capacity building***

From the material reviewed in the preparation of this chapter, it is clear that PPB encompasses in practice a range of farmer involvement, from visual evaluation of cultivars in on-station trials, through on-farm screening and testing of cultivars, to farmer-controlled crossing or mass selection. There are clearly also positive effects of PPB that are broader than merely those of success in breeding cultivars that are better performing in terms of users' desired traits.

However, the continuum of practice would seem to have implications for what can be expected in strict breeding terms from the degree of user involvement. PPB that permits replicated evaluation of genotypes within and across sites appears likely to allow long term gains. Those based on mass selection are likely to see diminishing returns for any one cultivar because of uncontrollable environmental variations (cultivar x site, cultivar x year, cultivar x site x year, etc.), but to the extent that PPB creates enduring capacity among farmers to



carry out crosses and perform systematic mass selections, then the gains are likely to be much more substantial. PPB that incorporates measurement and replicated testing is more likely to be able to make genetic gains for polygenic, environmentally influenced traits after the first two or three breeding cycles.

### **Farmer training workshops**

The PROINPA (Bolivia), MASIPAG (Philippines) and Nan (Vietnam) cases already presented in this paper show that the effectiveness of PPB can be enhanced by farmer training.

Further evidence is provided by the case of a Farmer Breeder Workshop in 2001 that was organised by the project 'Participatory Plant Breeding with Women Small Farmers in Africa and Latin America' (see PRGA Program Synthesis [www.prgaprogram.org](http://www.prgaprogram.org) \ progress). The 13 farmers (6 women) from the north coast region of Colombia, who had considerable experience in breeding animals and in varietal selection for a number of open pollinated crops, discovered much that was new to them in the workshop modules on cassava plant reproduction, basic genetics, botanical seed and seedlings, variability and segregation, making crosses and handling early generations, varietal evaluation and selection. As a result of the workshop, the participants could implement a full cassava breeding cycle, understanding phenotype, genotype, dominant and recessive traits, variability and segregation. They could identify feminine and masculine cassava flowers (and their main organs), and knew when they were ready for crossing, how to make a cross, protect a pollinated flower, and harvest and plant botanical seeds. They developed Action Plans for follow-up activity in their own communities, including measures for sharing their new knowledge and skills with others.

### **Training manuals**

There are an increasing number of training manuals that aim to strengthen farmers' and field workers' plant breeding skills, for instance the manual developed by breeders together with Nepali maize farmers: 'Mass Selection: A Simple Technique for Community Level Variety Improvement and Seed Selection in Maize. Training Manual for Farmers'<sup>5</sup>.

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5. Compiled by M. Subedi, S. Sunwar and R. Gautam, Li-Bird, and obtainable from Li-Bird, PO Box 324, Mahendrapool, Pokhara, Nepal. Telephone/Fax: 00 97 61 26834. E-mail: [libird@mos.com.np](mailto:libird@mos.com.np)

## Gaps and Opportunities

### **Points at which user involvement occur**

There are a number of common features that stand out in the continuum of practice. User involvement in PPB typically would appear to occur at one or more of the following points (with the steps sometimes executed in parallel):

- Preliminary participatory and formal appraisals of (i) the local materials growing in farmers' fields, as well as regional and exotic materials; (ii) farmers; and (iii) agro-ecosystems;
- Development of criteria for selection of sites and farmer collaborators;
- Development and implementation of processes for the selection of farmer collaborators in each site;
- Identification of suitable local and improved materials, to expand the basket of choices included in the trials;
- Training of farmers in inheritance and selection, where relevant;
- Crossing, testing (sometimes replicated, sometimes not) and screening of the selected materials, on-farm and on-station (with or without measurement and data recording by farmers, extension workers or others);
- Elicitation of men and women farmers' and breeders' pre- and post-harvest assessment criteria (and perhaps also of others in the food chain);
- Assessment by ranking and scoring of the tested materials, on-farm, in producer households and communities, and on-station;
- Selection of varieties for seed release through formal or informal channels.

As yet, there are very few cases where a wider range of stakeholders have been invited into the early stages of the process so that their criteria and preferences can be fed into the selection of materials to be tested, and complementary tests can be carried out, for example, of acceptability in differentiated trading markets and among differentiated consumers. There would also appear to be relatively few examples of systematic attention being paid to the design of the **process** of selection of farmer collaborators.

### **Understanding farmer decision-making**

There is also relatively little discussion in published accounts of formal-led or farmer-led PPB and PVS regarding the implications of the trade-offs that farmers might be prepared to make, such as trading off yield for earliness, tolerance to conditions in otherwise unusable plots, or market acceptability, or market acceptability for cultural value. While there is increasingly abundant information on

farmers' preferences and preference criteria, there is virtually none on the deeper reasoning that might inform a final choice. The impression is generated that many potentially viable materials to meet specific user needs and niche markets are still falling by the wayside in formal systems, though perhaps less so in farmer-led PPB where the process of eliminating varieties that receive lower overall scores is much less controlled (Sperling et al. 2001a). However, this comment is currently hard to substantiate because of the general lack within PPB projects of formal studies of spread and adoption.

### **Opportunities**

There are also tantalising suggestions that the **potential** for wider impacts can be achieved by:

- Working with established farmer and SHGs;
- Devolving more of the power to select farmer collaborators to communities and/or farmer groups;
- Exploiting traditional systems of seed exchange.

However, much of the evidence for this point remains anecdotal and requires further systematic analysis. Among published analyses, useful sources are: Sthapit and Subedi (1997); Smith et al. (2001); Sperling et al. (1993, 2001b); PRGA (2001); Atlin et al. (2001).

The present authors are left with the strong impression that far more is 'known' by practitioners about user involvement in the details of breeding work than is appearing in either the published literature or project documentation. It seems that research teams do not themselves appreciate the importance of their tacit knowledge of process, which is being developed through experience, in improving the design of future participatory interaction. It might therefore be useful to commission a series of case studies of existing projects focussed on this topic, so as to place this information in the public domain. It would also be useful to support more examples of explicit comparison of design options (as in the southwest China case).

## **5. User Involvement in Dissemination and Communication**

The challenge to disseminate, diffuse and communicate the results of research, from scientists to extension agents to farmers, and from farmer to farmer, has rested in the public sector domain for many years in developing countries. Publicly-funded research and extension agencies have been responsible for service delivery. A smaller role has been played by training institutes and universities.

Today the situation is changing rapidly. In many countries responsibility for organising services has been devolved from central bureaucracies to local governments and a range of non-public actors have been invited to participate in service provision. These include NGOs, consultancy and advisory firms, commercial input suppliers, commercial food processors and retailers, community-based and farmer organisations. Numerous cost-sharing arrangements are under experimentation. Researchers are being encouraged to make direct contact with food system stakeholders, and to invest in collaborative, experience-based learning of 'what works, where'. At the same time, there is greater recognition and understanding of the processes involved in farmer to farmer extension, communication and training—and active encouragement to work with these processes.

The emphasis on multiple actors, local adaptation and on co-learning is a response in part to the deep contextuality and dynamism of biological processes, even in the relatively controlled environments of irrigated rice or wheat. It is also a recognition that in difficult micro-environments and for the remote, the resource-poor, the vulnerable, and the 'hard-to-deal-with' problems, a focussed approach and a portfolio of opportunity are required, rather than a standardised response.

However, there are contrary forces at work as well. Grades and standards are being set in the modern commercial sector, driven by the concerns of processors, wholesalers and retailers. Grades and standards in export markets are being determined by the environmental and fair trade concerns and the preferences of rich-world governments and consumers. Farmers are being pushed to 'produce to specification' if they wish to enter the global trade in food and farm products.

These changes have opened up a huge diversity of ways in which differentiated users can become involved in dissemination and communication. There is as yet no authoritative global analysis of what works where, and why, but preliminary study is beginning to tease out some guidelines. In this chapter, experiences with seed dissemination, seed multiplication, and the diffusion of experimental capacity and breeding insights are outlined. The chapter concludes with an assessment of the prospects for scaling-up.

## Seed Dissemination

### *The problem*

The simplest way to think about seed dissemination is through direct farmer-to-farmer exchange. Relatively few PPB studies have looked in detail at direct farmer-to-farmer seed exchange, but among these, the importance of kinship, marriage networks, ethnicity and economic factors stand out in influencing dissemination (see Sperling and Loevinsohn 1993 for a Rwandan example).

The implications of such studies are that access to seed is not always an equitable or open process. Poor farmers who do not have a surplus from which to save their own seed until the next season's planting, farmers who are not in regular contact with extension workers, or women farming alone who are not part of male information and seed exchange networks, can all be excluded from access to, or information about, improved seeds (Mheen Sluijter 1996; Commutec 1996; Ferguson and Mkandawire 1993). More recent Trade-related Intellectual Property Rights legislation, patenting and court judgements suggest that the emerging seed regulatory frameworks will become more, not less hostile to the informal seed systems on which the majority of the world's smallholder farmers continue to rely, notwithstanding on-going efforts to introduce seed regulatory reforms that are supportive of informal seed systems (Tripp 1995; Tripp et al. 1997; ECAPAPA 2001).

If, as appears to be the case, most formal-led PPB projects opt to release improved materials through official channels, then the **development** impacts sought by PPB may well turn out to be disappointing. Formal-led PPB projects that continue to insist on collecting yield data in order to satisfy release committees may be doing a disservice to users. Joshi and Witcombe (1996) provide an example of farmers balancing earliness and market price against the lack of increased yield in their (positive) evaluation of a chickpea variety trial. Here, the yield data would not have provided the necessary data for a release proposal and a variety of value to farmers would have been eliminated. The remainder of this section presents a number of alternatives to official release that might be worth bringing into wider use.

## **Some solutions**

### **Case study 1: Sangams in Andhra Pradesh, India**

Development organisations can help expand farmer-to-farmer dissemination networks by considering what the focal points for seed dissemination could be. For instance, in the Medak District of Andhra Pradesh the Deccan Development Society is working with some 3,600 families in 75 villages on seed diversity, varietal selection, seed banking and seed exchange. The aim is to provide a basis for the development of a form of permaculture that is embedded in local traditions of biodiversity management. The men and women are organised into 'sangams', that is, gender-specific groups. Through the sangams marginalised Dalit tribal women are learning new skills in their traditional areas of responsibility. In 1998 they participated in recording what plants were grown and why, on nearly 500 farms and also in analysis of the initial results. Some 32 key crop varieties were ranked that year, by gender, agroecosystem and wealth status of the farm household. Furthermore, the women's sangams are growing, hand-picking and distributing selected seeds. They are repaid by the men and women who receive the seed in the form of fresh seed the following season. The development of the sangams is seen as a purposive way to expand the dissemination of seeds beyond individual family and community networks (P.V. Sateesh, pers. com. 1999).

### **Case study 2: Determining seed flows in Uganda and Ethiopia**

The second example deals with an innovative research design that was constructed in order to study seed dissemination and exchange networks in Uganda and Ethiopia, emphasising the importance of examining the impact of the source through which improved seeds are released (David and Kasozi 2001). The aim was to gain insight into who is benefiting from new PVS seed releases. Small packets of seed were sold through different channels: women's groups, maternal and child health clinics (overwhelmingly female clients), NGOs, extension agents (male, female) and market traders. Seed sales through these channels were recorded. People of all wealth categories were found to buy seed (contrary to expectation), and networks of kin relations rather than administrative and geographic boundaries were found to be determinant in the pattern of seed flow, with marked but not wholly segregated gender patterning in the communication links (Appendix 1: 43).

### **Case study 3: Seed fairs in Andhra Pradesh, India**

A **Seed Fair**, at which cooking and tasting panels are also held, is another strategy, introduced for example by the Deccan Development

Society in the Medak District, India. The Seed Fair is not only a place at which seeds are presented, compared and exchanged—it also provides a forum for cross-community and cross-gender communication about seeds, seed networks, performance characteristics and impacts. **Seed calendars**, written and illustrated in local vernaculars, are also becoming popular means of communicating information on seeds and varietal characteristics as well as basic information about varietal selection and improvement procedures.

#### ***Case study 4: The role of local custom in seed management in Bangalore, India***

Other organisations are examining the role of local customs and rituals in seed management. For example, the GREEN Foundation, based in Bangalore in southern India, has been working with male farmers on a varietal selection process for upland rice, wetland rice and ragi, taking into account the characteristics of tillering capacity, pest and disease resistance, and leaf area. The methods used include stratified mass selection (grid selection or selection from each part of a field), and negative mass selection (removal of off-types). As a complementary initiative, Green Foundation staff are working with researchers from the National Institute for Advanced Studies to document the ways in which local seed management practices are embedded in ritual. For example, the ritual of germinating seeds from nine different crops during the *negilu puje* at the start of a new season could be seen as a germination test, and thus an important aspect in the local maintenance of the quality of farmer-improved seed. **Neighbourhood seed certification** schemes attached to PVS or PPB projects would serve a similar purpose in identifying 'farmer certified seed' with some assurance of quality.

### **Seed Multiplication**

Seed multiplication offers opportunities for men and women farmers to become involved in new types of economic enterprise and service.

#### ***Case study 1: Private producer sellers in Colombia***

Options include the development of private producer sellers (sellers of farmer-improved seed), as in a CIAL project in Cauca, Colombia. Six of the pioneer CIALs had by 1994 successfully moved locally-adapted crop varieties into seed production enterprises. These varieties had emerged from six varietal trials (23 replications) that were scaled-up into commercial plots over 3 years. The CIAL agronomist provided additional training in production, processing and quality control. After a site visit the national agency responsible for seed certification approved the sale of the seed as 'farmer-improved seed' within the state. Up to 1994, some 20,000 additional labour days had been

created, and women had become major suppliers of the 1-5 kg sacks in which the seeds were packed. Two of the enterprises had become farmer-managed and financially independent of the CIALs (the others continued to use the CIAL fund), and all returned a percentage of gross sales income back to the CIALs (Ashby and Sperling 1995).

### **Case study 2: Bulking up cassava in Uganda**

Another approach has been taken in Uganda with the aim of making disease-free cassava stems more widely available. The main features of the programme are described in Box 16. In Soroti District, women as well as men plant cassava but it is mainly women who carry out the processing, cooking and brewing of cassava. Men are more frequently engaged in trading the roots. Both men and women farmers are involved in bulking up the improved stems, but there are some marked gender differences. Typically, bulking up is an individual enterprise for the larger farmers among the men, providing them with

#### **Box 16**

#### **Multiplication of mosaic resistant cassava in Uganda**

Agricultural technology dissemination in Uganda has traditionally followed an expert-led, top-down approach. There has also been a lack of effective linkages and co-ordination between stakeholders, leading to poor supervision, monitoring and evaluation by district and sub-county leaders. Technical staff have not been held accountable to their clients, the farmers.

To address these organisational difficulties the National Network of Cassava Workers (NANEC) was set up to disseminate mosaic control technologies. NANEC is a research managed extension methodology which links all key cassava stakeholders (contact farmers, extensionists, NGOs, researchers, administrators and policy makers) and manages them to achieve a desired outcome. Each team is responsible for training extension staff, farmers and NGOs, for conducting on-farm trials and for the multiplication and distribution of stems of improved varieties. This work is monitored by scientists from the cassava programme.

Most NGOs now use the NANEC approach or a modified version: Vision Teruda, for example, implemented a cassava multiplication programme following training in NANEC. They work by first organising farmers into communities of 30-40 households and conducting initial awareness meetings. A representative of the community (community agricultural worker) is trained, along with some other members of the community, by Vision Teruda's community extension workers. These people then train other members of the community. Community gardens are also set up for the purposes of monitoring performance and training.

The successes of Vision Teruda are attributed to: close collaboration with researchers, a strong community spirit, provision of the appropriate technologies, an effective technology transfer and information system and finally an effective and efficient monitoring and evaluation system.



a source of income or enabling them to provide a status-enhancing service (or, bestow an obligation) to the community. However, women do the bulking up either as members of a women's group—thus providing a service to members and their female friends, kin or neighbours—on the commercial plot of an Integrated Pest Management club<sup>6</sup> as an income source for the club, and for the club members.

Specialisation on the basis of gender, household or community identity are other possibilities: Bangladesh provides examples of a women's seed network; volunteer households establishing Seed Huts as a central point for the surrounding villages, handling both men's and women's seeds; and Seed Wealth Centres established as a community initiative to service a larger catchment area (Friis-Hansen and Sthapit 2000).

### **Scaling Up the Process**

It is useful to think of scaling up the PPB process as having two dimensions: a qualitative dimension, that seeks to strengthen and expand organisational capacity, and a quantitative dimension, that seeks to ensure that larger numbers of breeders and other researchers become involved. A gender lens on this issue would add a third, **gender mainstreaming**. Each of these three dimensions is considered in turn, with the aid of case studies.

#### ***Scaling up: Expanding organisational capacity***

The AME Foundation, India, has analysed its own scaling processes as a co-evolutionary trajectory (Naidu and van Walsum 2001). It began working with simple entry point activities and crops and a limited number of male and female farmers, NGOs and government agencies. Three concentration themes were identified (including groundnut improvement, within which the groundnut PPB activity is incorporated). Initial 'successes' were developed that, weather permitting, gave farmers a clear benefit over existing materials and practices. The AME's participatory technology development process was then linked to work of the Department of Agriculture (DoA) and an increasing number of research institutes, while the partner NGOs and farmers themselves began taking the process to others, expanding both the process, and access to the emergent technologies, within their own networks.

Within the groundnut programme, AME first convened crop-season experiment **review meetings** with its NGO partners, and organised **field days** for other villages, journalists, NGOs researchers and DoA

6. Pers. field notes, Jiggins 2000. Appraisal mission. National Agricultural Advisory Service programme development.

functionaries, in order to share and evaluate experimental findings. **Village level evaluation** meetings led to **district and regional farmers' meetings** that began to take responsibility for planning, shaping and extending the experimental programme. The next step was to form a **regional crop-based working group** as a **platform** for shared learning among scientists and farmers, and for the development of concerted action among an expanded range of stakeholders, including bank managers and input suppliers. Simultaneously, a **National level Steering Committee** was constituted and three **district level working committees** with representatives from the Ministry of Agriculture, State Department of Agriculture, research institutions, partner organisations, farmers and bank managers.

The scale of inter-organisational capacity building is impressive. To take the Groundnut Working Group as an example, in 2000 it co-ordinated activity in five districts in two states (Karnataka and Tamil Nadu), involving 21 NGOs (one of them an women's NGO), two international research centres, three national research programmes, five state universities, two extension and training organisations, banks and input suppliers. Some 614 farmer-led experiments were conducted by SHGs (in one case, 90% of the experiments were conducted by women farmers), and a further 1419 'extension' farmers and 10 NGOs were directly involved in dissemination.

### ***Increasing researchers' involvement***

If the number of published articles and conference papers can be said to be a good indicator, the last 20 years especially have witnessed an increase in the number of researchers involved in PPB or PVS. More NGOs appear to be developing relevant technical skills in participatory agricultural development in general and, in fewer instances, in PPB. Umbrella programmes, such as the former US AID-funded Co-operative Research Support Program, the Community-Based Biodiversity Development and Conservation programme, and the Systemwide Program on Participatory Research and Gender Analysis of the CGIAR, also have had an evident impact in so far as they have legitimated and encouraged especially formal sector breeders to engage with participatory process, in both developing and industrial countries.

More generally, inter-active Research and Development has gained credibility and acceptance within some influential European and American agricultural science universities (such as Wageningen University Research, the Netherlands; Oregon, Iowa, Minnesota and Michigan State Universities, USA), and more peer-reviewed science journals have opened their pages to participatory research reports. Consistent, if relatively modest, funding support has been offered by a number of foundations, bilateral and international agencies—but PPB

remains to a worrying degree dependent on project-related external funding rather than the regular budgetary support of national agricultural research organisations and universities.

The attractions of working with the new genetic sciences may be exercising a strong pull away from PPB. A strategic opportunity not yet greatly exploited may exist for collaboration between PPB and the new bio-technical scientists (for an example of the use of molecular markers in participatory cassava breeding, see Chiwona-Karlton 2001). None the less, taking all factors together, it would be fair to say that the opportunity and need for PPB and PVS far outstrip the numbers of those prepared or able to engage in it. A surer grip on (i) the up-front costs involved compared to conventional breeding; (ii) the cost-effectiveness of PPB and PVS; (iii) criteria for the identification of the generic situations for which PPB and PVS have clear advantages; and (iv) effects and impacts, might help substantiate and motivate further investment and effort by a larger number of breeders and organisations.

### ***Gender mainstreaming***

The major public organisations and most NGOs remain male dominated. On the whole they have not become more gender aware. Indeed, some of their members regard the increasing participation of women with complacency rather than as evidence of the structural changes in farming that are leading to more work and greater stress for the women left behind on the farm.

#### ***Case study 1: Developing and maintaining a gender focus in India***

However the AME Foundation realises that increasing the number of women participants in organised activity is not the same as gender mainstreaming (E. van Walsum, pers. com. 2001). AME's own records show that women's participation has increased from some 30% in 1996 to 65% by year 2000. As the numbers have increased, the need to consult women as to the practical details of programming, such as the timing of and venue for meetings, has increased. AME tries to maintain the gender focus by its evaluation processes. For example, the participation of men and women at meetings is recorded, dropout rates compared, and the reasons for any gender-differentiated pattern are analysed. It also seeks to show the potential for working with women as well as men by publicising cases such as that summarised in Box 17.

Initial training in GA, participatory research processes, and specific participatory research methods, for farmers, NGOs, researchers, and government functionaries has been assessed as essential by participants in helping them to:

### Box 17

#### **Kadiri Women's Federation and groundnut development**

Kadiri is located in the largest groundnut-producing district in India (Anantapur District, Andhra Pradesh). About 85% of the drought-prone dryland is planted to groundnut and through continuous cropping, the crop has become susceptible to pests, disease, and declining yields. In 1997 the women's self-help groups (SHGs) formed a federation, Pragati Mahila Samakya (PMS), with 2250 members, assisted by the United Nations Development Fund and MYRADA, an NGO. In the same year, AME began participatory technology development (PTD) with one of the federation's constituent SHGs. In the first season, the women had good results from experiments on three improved groundnut management technologies: gypsum application, rhizobium and farm yard manure. They were so convinced of the value of their results that they took the initiative to share them with the whole Samakya. Subsequently, the PMS has become a platform for the dissemination of improved groundnut varieties emerging from the PPB activities and associated cultural practices, has requested and received training from AME on PTD and low external input sustainable agriculture, and formed its own training team to share PTD skills with all the 45 SHGs in the federation.

SOURCE: Naidu and van Walsum 2001 (Box 9, p.27).

- break out of old ways of thinking,
- to get activities started along new lines, and
- to train their own trainers so that activities can expand—a 'lesson of experience' duplicated also in Yiching Song's experience in southwest China.

In AME Foundation's experience, it is necessary nonetheless to 'have patience' with the time it takes for men and women at all levels to become accustomed to the interaction between 'gender' and 'participation'. Some of its partner NGOs work only with a single sex, such as male agricultural labourers organised into unions, some with both sexes (variously organised), and others only with women's SHGs. Each form of organisation offers particular opportunities for dissemination and scaling up of the participatory research process, because of the particular ways in which men and women relate to the wider society, and because of the different constraints and way of acting each form of organisation offers. Through sharing experiences, those involved in the programme have become more acutely aware of the functional benefits to the programme as a whole of involving both men and women, and of the need to ensure that information gaps between men and women within households or communities do not block the participation of one or other household member (van Walsum and Devi Kolli 1999).

#### **Case study 2: Mainstreaming gender in Uganda**

A related point has been made by researchers working on participatory bean varietal selection in Kibale, Uganda. While many

researchers in Uganda have no difficulty with the concepts that lie behind GA, regardless of their own gender, and no practical difficulty with applying GA tools and methods, GA activity has to be fully integrated into the functional tasks that the scientist or extension worker is focussed on—else it just does not happen on any significant scale. In this respect, the **mentoring** role played by experienced individuals, or by organisations such as the AME Foundation, has proved critical to gender mainstreaming.

### **Diffusion of Experimental Capacity and Breeding Insights**

As research effort has moved toward co-learning, an important task has been to understand the extent to which experimental capacity and breeding skills diffuse (that is, move spontaneously through existing social networks and communication processes) beyond the groups with whom researchers are directly working.

General lessons seem to be that **principles**—rather than specific 'technical packages' or discrete bits of knowledge—diffuse, provided there is an appropriate **organisational** vehicle to carry the diffusion process, and that there are ways in which farmers themselves can recoup the transaction costs of **farmer-to-farmer** learning. A key question then becomes: when should one build on existing organisations and when if it is worthwhile to develop new fora for learning and collective action. This point is elaborated in Box 18.

#### **Box 18**

##### **Analysing returns to educational investment in Ghana, Zanzibar and Tanzania**

A review by Kevin Gallagher of participatory technology development FFS in Zanzibar, Ghana and Tanzania has generated interesting indicative data on the organisational costs and benefits of FFS when viewed as an educational investment. The benefit-cost ratios seem to be the higher value of the crop. That is, the investment returns from FFS are not primarily in the subsistence sector. Where market opportunities are buoyant, as for bananas in parts of Tanzania, cost recovery is possible.

Other aspects of the returns to this form of organisational investment are that, where participatory research is on the agenda of a research institute, FFS members may begin to influence, for example, priority-setting within the institute. They may also influence the design of experimental plots. Data so far shows farmers favour a 'commercial size' group plot, so as to test the real feasibility of management returns and risks. Another noteworthy feature is the adoption of the FFS label by a range of existing groups, formed for other purposes, which now wish to conduct 'seed to seed' R&D. The FFS label is also being loosened as more and more communities establish study clubs in order to carry out R&D on the basis of experiential learning.

SOURCE: Appendix 1: 84.

As the example of MASIPAG<sup>7</sup> in the Philippines (sketched on p.40), and of LI-BIRD in Nepal illustrate (Box 19), experiential (discovery) learning and training appear to be important, perhaps essential, in supporting the institutionalisation of farmer-to-farmer capacity in farmer-led PPB.

### **Case study 1: SHGs in India**

Others, however, have found that working with existing men's and women's organisations is the best way forward, even if the organisations are rather loosely constituted and barely recognised by the formal sector. Turning again to the AME Foundation's experience, over time it saw that an increasing proportion of the participating SHGs in the farmer-led process were women's groups, reflecting the increasing trend for men to seek work away from the farm. AME provides two kinds of support to the SHGs: training, and revolving funds to support experimentation. The support has both practical and strategic objectives.

The **training** given to each organisation is specific, but in principle is experiential, field based, and participatory, and includes:

- Season-long training in PTD in year 1, continuing as required in years 2 and 3
- Strategic workshops for farmer collaborators and NGO functionaries, from year 1
- Season-long training of NGO Trainers and Farmer Trainers, who after 3 years take over the management and implementation of the PTD process, beginning in year 2.

That is, the training seeks to provide systematic procedural training in the PTD process for the immediate purposes of experimentation, but also seeks to capacitate farmers and NGOs to spread the principles of PTD<sup>8</sup>.

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7. MASIPAG, established in 1986 as a partnership of farmers, NGOs, and scientists, comprising 21 'people's organisations', 10 NGOs, 3 national farmers' movements, and scientists from three educational institutions. The group collects local rice varieties, carries out participatory research on stakeholder preferences and preference criteria, and teaches men and women selected by their representative organisations to perform hybridisation and subsequent seed selection and multiplication (Medina 1988).
  8. It is interesting that in the combined farmer-led and formal-led PPB project in southwest China, Yiching Song and her colleagues have identified capacity-building in PRA methods as important to help women farmers spread their PPB/PVS skills systematically with others, while PTD and GA skills training has been initiated for researchers and extensionists (Song and Jiggins 2002).

### Box 19

#### Consolidating farmers' knowledge in farmer-led participatory maize breeding in Nepal

A lack of access to modern varieties of maize and low productivity were the starting points of the research agenda of LI-BIRD, an NGO, and the National Maize Research Institute. They began work in the Gulmi District of Nepal where informal dialogue with users, in combination with a formal GA, led to a change in the research objectives, away from production and towards quality criteria. It became clear that farmers wished to maintain the *Thulo Pinyalo* variety of maize due to its high yield potential, good culinary traits, higher grit recovery, insect and disease tolerance, fodder quality and palatability and its adaptation to local management practices. Unfortunately, this variety is prone to lodging due to its height (5 or more metres).

Since farmers selected large and long cobs from the harvest, and not from standing plants, they were unwittingly contributing toward the selection of taller plants. Farmers were not aware of the possibilities of crossing *Thulo Pinyalo* with exotic varieties grown locally.

The programme aimed to transfer knowledge and techniques to the farmers on how to improve the local landrace with the aim of achieving reduced height. GA had revealed that women were major decision makers in maize production. Therefore representation of women was maintained at over 50% throughout all stages of the project. Of particular importance to women and poor farmers was maize of high nutritional quality and plentiful fodder. These user categories also wanted to be able to intercrop maize with legumes. Their objectives were included in the project's aims.

After one year of training and guidance, the farmers initiated their own breeding programme. During a farm walk farmers had observed the field performance of *Rampur Composite* and wanted to incorporate certain of its traits into *Thulo Pinyalo*. The farmer research committee selected 200 farmers (50% women) as farmer-breeders, requesting *Rampur Composite* seed and training from the project. They planted *Rampur Composite* seed in *Thulo Pinyalo* plots to facilitate spontaneous crossing. The farmers chose the parents and decided the design of the breeding plots. They were trained in de-tasseling and mass selection techniques by the programme.

Within 2 years the farmers had developed their own maize population which they have called *Resunga composite*. They are continuing to select for homogeneity.

SOURCE: Appendix 1: 32, 81; Sunwar, S. 2000. Copies of overheads presented at PRGA Programme Small Grants Workshop, Nairobi, 9-11 November.

The **revolving funds** reach the SHGs via the NGO partners but the SHGs are responsible for managing the funds, to enable their members to procure the macro inputs required for their chosen experiment. A more strategic purpose is to enable the farmers to prove to the formal sector banks that any of the farmer-developed technologies that are evaluated positively by farmers are economically viable and thus worth considering for a regular loan (Naidu and van Walsum 2001).

### **Case study 2: Training support in Latin America**

Another approach, more common in formal-led PPB, is to invest in the development of training materials for organisations as well as individual farmers. Project support to the CIALs in Latin America, for example, has included considerable investment in training materials for the project staff involved in formal-led PPB, as well as in handbooks for farmers and community leaders. Both the illustrations and the text bring out the importance of GA and the involvement of both women and men.

In Bolivia, concerted effort is being made to diffuse capacity more widely through offering training support to different types of organisation, as explained in Box 20.

#### **Box 20**

##### **Training as part of organisational capacity building in Bolivia**

PPB researchers working with CIALs in Bolivia since January 1999 have been testing the cost-effectiveness of working with different kinds of organisation—syndicates, traditional organisations, NGOs, FFS and CIALs. Earlier experience under PROINPA with PVS was positive, but researchers noted that: relatively few farmers were involved and benefits did not spread widely; late blight resistance broke down in farmers' fields; and the specific characteristics adapted to niche environments (social and agro-ecological) could not be accommodated. PROINPA and collaborating NGOs today are giving more emphasis to training in PPB. The training methodology is based on group-based *discovery learning* through the crop cycle. It focuses on strengthening farmers understanding of the *principles* of genetic resource management and breeding, and not merely on skills development. For example, the training seeks to help farmers understand, observe and test different kinds of resistance. The training design also addresses practical issues such as when and where to hold the field sessions, so that both women and men are free to attend. Community-based workshops are used to share and disseminate the learning more widely.

SOURCE: Appendix 1, 66; Ashby et al. 2000.

### **Case study 3: Establishing new organisational relationships in southwest China**

What happens though when there are bottlenecks in organisational relationships? An interesting situation is under study by Yiching Song (Appendix 1: 33; Song 1998). In southwest China, the primary stakeholder in the plant breeding process until the end of year 2000 had been the Ministry of Agriculture, to which were linked extension agents, farmers, breeders and seed companies. Formerly, tensions existed for a number of reasons among all these stakeholders, but the government is moving to ease the situation by liberalising and privatising certain roles and functions.



One approach adopted to further this liberalisation is the establishment of pilot schemes under the Seed Law newly approved by the People's Congress (8 July, 2000, effective from 1 Dec. 2000). The Guangxi Maize Research Institute (GMRI) in southwest China is now able independently to sign contracts with a 'seed production base' (e.g., a village or farmers' organisation). A seed production base must be ready to multiply the seed that GMRI has developed and to sell it back to the GMRI for distribution to other areas. The villagers benefit by receiving twice the normal price for the new seed than for unimproved maize. Yet since this price is still lower than the price of the seed on the free market, conflict has developed between the GMRI and other stakeholders. Farmers have challenged the GMRI's monopoly:

- A women farmers' group in Wenteng village is producing and selling a locally favoured OPV that is their creolisation of CIMMYT-derived Tuxpeño 1;
- A farmers' organisation in Ganao village, that holds the parent lines, is experimenting with breeding and selling a range of hybrids independently of the GMRI breeders;
- The Heci prefecture and Zenda seed company are collaborating on the production and sale of improved hybrids;
- The GMRI and the provincial government's seed company are collaborating in seed production and sale.

In addition, the Laizhou Academy of Agricultural Sciences is conducting an in-depth case study of the emergence and development of a private maize breeding institute in North China.

## **Maintaining Quality during Scaling Up of the Process**

### ***Maintaining quality organisation-wide***

Jürgen Hagmann and Edward Chuma have considered the general case of how to maintain quality in participatory R&D as organisational capacity expands<sup>9</sup>. They stress the need for systematic intervention at different organisational levels and a need for a process orientation, in order to provide flexibility and adaptability in the emerging organisational system. Through enhancing the adaptive management capacity of the users, significant moves towards empowerment can be made that ripple through the entire set of organisational relationships. However, as Baur and Kradi (2001) caution, "success" in institutionalising participatory R&D is neither a simple, nor mechanistic process.

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9. They draw upon experience in natural resource management but the lessons drawn seem relevant to PPB also.

The authors note a few of the dangers inherent in a participatory process of capacity-building, including: 'participation' is often used as an excuse for ineffective project management; organisations are often unwilling to engage explicitly in promoting learning processes due to a lack of conceptual understanding; the lack of systems for performance and quality control interrupt or prevent feedback between different organisational levels. Therefore, the seven quality criteria presented in Box 21 have 'self-learning and self-accountability' as their goal.

### **Box 21**

#### **Quality aspects in the management and facilitation of learning processes**

##### **Quality Criteria 1: Vision, Strategy and Impact Orientation**

- Internalisation and articulation of the development vision of the intervening agents
- Clarity regarding the research questions
- Clarity with respect to clients, services and accountability
- Knowledge about the institutional arrangements in the innovation system
- Consider the question 'who would do what differently if the intervention were successful'
- Consistent strategy with respect to achieving impact or influence
- Clarity with respect to core products required to achieve impact

##### **Quality Criteria 2: Process Design at Farmer Level—Guiding Principles**

- Intervention based on building self-reliance upon local organisations as far as is possible
- Facilitation of access/linkages to outside information sources/networks
- Use of monetary resources based upon the principle of 'demonstrated capacity before resource input'
- Intervention process to value and respect the whole community, not just particular interest groups
- To follow the concept that 'form follows function' in planning and organisational development

##### **Quality Criteria 3: Process Facilitation at Farmer Level**

- Internalisation of vision and process steps by facilitators
- Culture of enquiry
- Empathy and creativity of facilitators
- Reflective facilitation to create self-insight and self-exploration
- Focus of facilitation upon learning and understanding the consequences of behaviour
- Facilitation of how different perspectives/realities are constructed
- Facilitation to unlock energy blocks, e.g., a culture of silence, victim culture
- Conflict management skills
- Facilitation of leadership skills
- Building upon the farmers' agenda

##### **Quality Criteria 4: Process Management**

- Consistent but flexible planning
- Systematic process monitoring and self-evaluation
- Systematic process documentation

(Continued)

**Box 21.** (Continued.)

Quality Criteria 5: Scaling Up/Out Strategy

- Have a scaling up orientation right from the start of the pilot activity
- Use organisational models for scaling up/out
- Gain knowledge about organisational structures, cultures, procedures
- Focus upon mainstreaming efforts, lessons and activities

Quality Criteria 6: Development of Competencies

- Develop a broad strategy, e.g., learning groups
- On the job coaching and peer learning
- Performance management
- Motivate field staff
- Put together interdisciplinary teams

Quality Criteria 7: Strategic Partnerships and Networking

- Deepen knowledge about key stakeholders and actor networks
- Work on values and strategies for partnership development
- Develop learning mechanisms between partners

**SOURCE:** Juergen Hagmann and Edward Chuma, presentation at the III International Seminar and Small Grants Workshop 'Uniting Science and Participation in Research', 6-11 November 2000 in Nairobi, Kenya.

We see these principles as good generic guidelines but they lack a 'gender dimension' that takes account of the differentials in social power and status among men and women, and the different ways in which they may participate in organisations throughout the food chain. Further analysis would seem appropriate to ensure that gender issues are mainstreamed as quality criteria.

***Maintaining quality through establishing accountability***

***Case study 1: Accountability in six Asian countries***

The SEARICE experience draws particular attention to a key aspect of quality, the issue of accountability (see Quality Criteria 1 and 7 in Box 21). As a network organisation with its origins in social justice movements, SEARICE seeks to internalise the concerns and values of its members. Previous advocacy and activism in PGR conservation has led to an understanding that ecosystems and markets are key factors in sustaining agriculture. Three countries were selected from a six-country study, to reflect a spectrum of ecosystems and degree of market integration in the development of PVS and PPB activities with FFS. The organisational relations that are developing take different forms in each case as indicated in Box 22.

It is not clear as yet whether special measures might be needed to ensure that organisations that are mainly led by men remain

**Box 22**

**SEARICE—Enhancing organisational accountability through training**

In *Laos*<sup>10</sup>, SEARICE has brokered new working relations among the following institutional partners: National IPM Programme, Oxfam Solidarity (Belgium-Laos) (an NGO), Dept. of Agriculture, Environment Agency, National Agricultural Research Council, CIDSE (an NGO), Global IPM Facility, and in one municipality, an Agricultural School and secondary schools. In *Vietnam*, the following are involved: National Integrated Pest Management Programme, Plant Protection Dept., Mekong Delta Farming Systems Research Institute, Can Tho University, Agricultural Research Institute, Seed Save (an NGO), and the Global IPM Facility. Unusually, the already existing Integrated Pest Management Clubs in the selected project sites have been involved in identifying the institutional partners, drafting proposals, and designing activities. Both women and men are club members (though women are in the minority).

In both cases, the aim is to conserve local rice diversity and increase production by involving farmers in early selection (from F3) of parent material and, in *Vietnam*, also in carrying out the crosses. The country programmes also provide the partners with access to a wider range of rice genetic resources. Through training and capacity building throughout the emerging organisational web, it is anticipated that the clubs will move toward local PGR management and will evolve over time into community-based Renewable Natural Resource Centres under the Ministry of Agriculture. SEARICE stresses the ethos of *service* to the local clubs, and the accountability of technicians and trainers to club members in its training.

SOURCE: Appendix 1: 37, 78.

accountable also to women stakeholders along the food chain as the programme develops, given that women tend:

- less often to be members of public and formal organisations
- to be involved in organisational leadership and decision-making roles less frequently than men, especially in formal and public sector organisations
- to be less articulate in public and formal discussion fora and meetings
- have different working hours and workloads, and thus are available for meetings at different times and places than men.

**Case study 2: Accountability in Latin America**

CIALs in Latin America, for example, have found it necessary as the movement expands to experiment with:

10. SEARICE is also supporting within the same programme PPB/PVS activities in Bhutan (not reported here).

1. Women-only and men-only CIAs in the same community. This happened because it was found that participatory diagnosis, preference ranking and priority-setting—exercises that faithfully captured differentiated user needs—did not necessarily translate into research activity that reflected also women's priorities, since the male community leaders in mixed CIAs decided the agenda in their own favour;
2. CIA members that developed confidence in their breeding ability and produced successful varieties that began to earn them a market return, did not necessarily share their success with other community members, but rather tended to 'privatise' the results for their own benefit. A new requirement has been introduced into the CIA contract (for accessing community research funding) which requires the CIA members to schedule community-wide learning and sharing events.

***Maintaining quality through improving extension agent—Farmer links***

Related aspects of quality maintenance during up-scaling have been identified by Fukuda and Saad (2001). From 1993 to 2000, the work team in the north eastern Brazil cassava breeding project experienced a 3000% increment in the number of participatory trials. The scale effects mean that the latent impact "is immense", both on farmers and, through feedback processes, on the work of the researchers. However, the research team noticed during the expansion a reduction in the quality of information obtained and used, inadequacies in the training and coordination of the work team, and the lack of a strategy for information management. The greater numbers of extension agents involved, and the delegation of key tasks to them such as farmer selection and data recording, opened up the potential for loss of quality throughout the breeding and dissemination process. It proved necessary also to expand the work team and, with this expansion, to devise strategies to help them catch on to and catch up with the tacit, experiential understanding that had been acquired by the initial team members. In addition, the sheer volume of information made it necessary to develop a special computerised data base, complemented by visits by the breeders to participating communities to do a 'reality check' on the input data and to discuss their analyses of the data with the farmers.

## 6. Evidence for, and Assessment of, Gender Differentiated Impacts

The literature on impacts is inadequate for the purposes of this paper, for a number of reasons:

- There is a rapidly growing literature on the impacts of PPB on **farmers**. However, this is not further differentiated by sex.
- There is an immense literature on the impacts of new seed, production, harvesting, storage, processing, and cooking technology on women in farm households, women farmers, and on women in general. Yet there are few systematic studies of the impacts of PPB on women in any category, either in terms of the effects of being a participant in a PPB process, or in terms of the impact of the new materials generated.
- There is practically no literature that examines the effects of PPB—either as process or in terms of the impacts of the emergent materials—on **gender relations** at the household, community or any other relevant social or geographic scale along the food chain.
- Although there are preliminary suggestions of how PPB is changing modes of interaction, collaboration, and communication among organisational stakeholders, altering the direction of formal breeding programmes, and changing the views of policy-makers, the gender dimension is so far lacking (Song and Jiggins 2002; Fukuda and Saad 2001).
- There are some intriguing anecdotal hints here and there of localised spill-over effects. For example, it is reported that the 'successful' groups in Kibale, Uganda, who worked with scientists on improving bean varieties, were led by men or women who had the opportunity and willingness to help the group "go beyond agricultural research" (Pascal Singanga, pers. com.). This has also been stressed in the experience of the Columbian FIDAR team working on low cost in vitro cassava propagation. The training offered to the women participants in the hygiene management procedures required in the propagation chamber led them to take up simple health work in their community, while the literacy and numeracy training provided to the facility's operators similarly spilled over into informal education activities with their neighbours.

This chapter thus draws together some of the partial evidence and points to areas where more focussed work needs to be done. It is organised into six sections. The first looks at the use, strengths and limitations of conventional impact study methodologies in relation to PPB. The second looks more closely at PPB's impact on innovation processes, while the third highlights the need for caution in the interpretation of impact data. Sections four and five look at stakeholder involvement in impact assessment and a number of alternative methodologies. The chapter concludes with some thoughts about how to develop methods, skills and practice in this area.

## **Conventional Impact Study Methodologies**

One of the main impacts that researchers, science managers and funding agencies seek to understand is the rate of adoption and diffusion of a single technology or baskets of technologies. There is a huge literature on, and a long tradition of, adoption and diffusion research, with a well-established suite of accompanying methodologies and specific methods to choose from (see Rogers 1962, 1983, 1995; Rogers and Shoemaker 1971). A standard approach is to use a quasi-experimental design based on **before and after** and **with and without** comparisons. Although they have the advantage of producing statistical data that allow generalisation across populations and areas, they are of only limited use for prediction.

### ***Conventional impact studies***

#### ***Case study 1: Conventional impact study in India***

What kinds of insight can be generated through conventional studies? An impact study conducted in Raichur, India, on behalf of the AME Foundation found that the extent of spread of a selected number of technologies and materials that had been generated through participatory research varied by crop (groundnut, cotton and paddy rice). The spread of groundnut is quite slow and limited (a ratio of 1 to 3 other farmers). This crop is widely grown by poorer, risk-averse farmers, many of them women because of structural changes related to male migration. By contrast, in cotton there is a strong and widely perceived need for change, in particular motivation to try out alternatives to chemical-dependent production is high. The spread is fast and, within participating villages, with a ratio of 1 to 7 (and from participating villages to others, around 1 to 3). In paddy, grown mostly by small but not necessarily poor farmers, the spread is about 1 to 10.

The AME study found that the speed and scale of spread is hugely increased once farmers have developed the confidence to organise at higher levels, and that such flows of information and materials generally take place most effectively within single sex federations. The

extent to which this finding can be generalised to other contexts needs further study and/or testing.

Another conventional way to monitor the spread of the outputs from PPB is by tracing exchanges of a selected variety along farmer-to-farmer networks, that are conditioned by friendship (Sthapit et al. 1996), marriage, ethnic identity (and so on). Cromwell (1990) provides a more general review of the lessons from Asia, Latin America and Africa concerning seed dissemination.

### ***Critique of conventional impact studies***

Conventional adoption and diffusion studies tend to misrepresent important aspects of actual innovation processes. They also prove inadequate wherever it is important to understand people's **reasons and explanations** for acting as they do (Röling 1998). Indeed, conventional approaches are not particularly well suited to the study of the outcomes, effects and impacts of the added value of participatory processes, among other reasons because:

- They have limited ability to pick up the deeper, multi-causal dynamics within the participatory process that might shape locally significant adoption (and non-adoption) rates;
- The more subtle (but arguably more important) social effects of participation, and longer term impacts, are not amenable to statistical study. This is because (among other reasons) of the irreducible importance of confounding factors, difficulties in the attribution of causality, time lags, and the weakness of the relationship between knowledge, attitudes and practices;
- They fail to capture empowerment effects.

However, the alternatives presently available may fail to satisfy, because:

- PPB practitioners are unfamiliar with them;
- Their results are not considered sufficiently rigorous to those schooled in the traditions of natural science, even if expressed in statistics;
- The alternative tool kit is not yet fully developed: adaptation and creativity is called for.

The remaining sections thus focus on (i) the alternatives, precisely because the conventional approaches are well known and accessibly documented, and the alternatives need further development (Guijt 1998; Estrella et al. 2001); and (ii) challenging issues that are specific to the effects and impacts of **participatory** plant breeding (Lilja et al. 2000).



## PPB and the Innovation Process

In a position paper presented in 1997, Sthapit and Subedi provide evidence that PPB compared to conventional breeding:

- Better meets the needs of farmers in less favourable areas. [Others have noted the superior advantage of PPB with respect to: farmers over-looked by centralised breeding and official seed systems, niche opportunities for production, and niche markets (Atlin et al. 2001; Smith et al. 2001)];
- Reduces the time required from the start of the breeding cycle to the release of improved materials;
- May increase bio-diversity under nearly all circumstances (but this requires further investigation);
- Aids the assessment by breeders and farmers of local genetic resources and the value of their continued conservation *in situ*;
- Leads to more realistic assessment of the spread and adoption rate of PPB products (because farmers might take an improved variety into use whilst also appreciating its disadvantages);
- Brings other stakeholders, such as NGOs, into the seed supply system, hence increasing the institutional availability of improved seed;
- Brings other stakeholders into the institutional effort required to maintain and develop food security and livelihoods along the whole food chain;
- Increases seed diffusion by increasing the number of distribution points (in so far as seed outflows decline as the distance from the source increases). Careful consideration seed release points and channels can reduce the risk that particular users (women, lower castes, lower status ethnic groups, young unmarried farmers, etc.) are excluded from access;
- Spreads among civil society improved knowledge and skills about breeding and varietal selection (increases scientific literacy at the grass roots);
- Provides an enabling environment for farmers, farmer organisations and other stakeholders along the food chain, to control their own development ('empowerment');
- Is more responsive to food cultures embedded in deeply held belief systems;
- May have positive effects on the attitudes and practices of conventional breeders and research institutions;
- Brings in additional funding streams (e.g., from farmer organisations and individual farmers, NGOs, market organisations, etc.) to the plant breeding and innovation process.

Other authors might add:

- Offers greater possibility that gender issues are treated seriously within normal PPB professionalism (Sperling et al. 2001b).

This is a formidable and persuasive list of advantages. However, almost every point is disputed. More systematic examination is needed to test each of these points and to refine the circumstances within which the findings might prove robust. Preliminary efforts to synthesise the experience to date along these lines are provided in the special 2001 issue of *Euphytica* on participatory plant breeding (volume 122, number 3). Although the authors concentrate on experiences from the tropics, it should be noted that the highly commercialised Dutch potato breeding industry maintains a long-established tradition of reliance on farmer-breeders for the identification of promising new materials and collaborates with them through the breeding cycle. Particularly needed is an ecological economics analysis, that includes environmental and bio-diversity values, of the comparative cost effectiveness of PPB in selected (marginal and commercial) environments.

### Interpretation of Impact Data

#### *Case study 1: Difficulties in interpreting impact data in Brazil*

Fukuda and Saad (2001) raise an important point when they query how impact data are to be interpreted. They highlight the case of a farmer who did **not** participate in cassava trials in the northeast Brazil project but who picked up discarded clones and incorporated them into his own system. Fukuda and Saad offer two contrasting explanations, the first to do with farmer motivation and the second to do with programme failure:

Either

- He was short of planting material and took advantage of the discarded material, or
- He wanted to boost his production that year by increasing his plantings, or
- He preferred to test them on his own, or
- The discarded materials displayed characteristics that were import uniquely to him;

OR:

- There is a segment of the community that “for one reason or another is not being represented in the evaluations”, and “thus the participatory research is serving and responding to the needs and desires of only part of the community” (Fukuda and Saad 2001).

Their query points to the need for impact studies to explore the **reasons** why some farmers (and other stakeholders) are **not** participating, and not just focus on those who do, or who are targeted.

It also challenges the 'standard' assumption that the adoption success of new plant material can be best measured in terms of geographic spread and speed of adoption. While the products of a PPB process can spread widely, and fast, they also are intended (a) to meet **specific** needs, in **specific** agro-environments and food markets, and (b) to add useful items to the **portfolio** of products handled along the food chain. An important effect to measure would thus be the contribution of PPB to the maintenance or enrichment of local biodiversity and food cultures. It could be argued further that PPB, by pulling multiple stakeholder interests into the process, adds to market diversity, and this also requires further elucidation.

### ***Case study 2: Willingness to pay as a proxy measure in West Africa***

A simpler proxy measure of impact is provided by WARDA's experiences with farmer-involvement in varietal selection in West Africa. In the final round of testing and selection, farmers are asked about their willingness to pay for 5 kg of planting seed of the preferred rice varieties. Purchase of the improved seed or planting material that survives successive rounds of testing and selection by breeders and farmers is certainly a good indicator of monetised demand, and a useful proxy for spread and adoption, but it is a demand that possibly the poorer members of the community are unable to make.

### **Contribution of Farmers and Other Stakeholders to Impact Studies**

Another important point is the extent to which farmers as individuals and groups can make meaningful contributions to formal impact analysis. Farmers, as well as other local actors, hold knowledge and understanding that is rich in context. That is, they have specific interpretative knowledge, but may lack tools for expressing this in formal analysis. This knowledge can be especially important for registering impacts not susceptible to straightforward numerical enumeration. An important role of the researcher then, is to seek or devise such tools.

### ***Case study 1: An empowerment index in Latin America***

Researchers and selected members of CIALs in Latin America together have devised an instrument for analysing 'empowerment', defined as capacity for self-management, that is not dependent on literacy, and whose results can be converted to numbers for statistical analysis (Appendix 1: 56). It is based on monitoring and recording progress against agreed indicators. The indicator set is drawn up jointly. The set contains elements common to all CIALs but the items in the set can be modified or expanded to incorporate indicators of specific local relevance. Respondents place appropriately coloured stickers in the

cells of the grid. The scores can reflect gender patterns, as in the following illustrative example for CIALs of mixed (male/female) membership, and varying degrees of maturity (see Table 7).

Similarly, the following instrument is being used to define and analyse criteria for ranking research topics in the annual agenda-setting meetings as Table 8 shows.

Instruments such as these would seem to offer one way to deal with the conceptual problem of how to nest questions of variability and diversity within context-rich interpretation.

Table 7. Empowerment grid.

Indicator	New CIAL	Intermediate CIAL	Mature CIAL
Frequency of meeting, etc.	red* (female) green (male)	green* (male) yellow (female)	yellow* (male and female)

Key: red\* stickers = poor/seldom; green\* stickers = few/occasional;  
yellow\* stickers = good/frequent.

Table 8. Criteria for ranking research topics.

Crop/animal	Cost	How risky?	How many benefit?	Who benefits?			
				Rich men	Rich women	Poor men	Poor women
Matze, traditional	.	..	.....			....	...
Matze, hybrid	..	.	...	.....	..		
Beans	..	...	....		...	..	...
Tomato	.....	....	..	.....	..	...	..

### Assessing the Impact on Social Dynamics

Participatory instruments also can be used to capture changes in social dynamics, as Table 9 illustrates.

In all three cases, the interventions are changing the social dynamic and flow of communication, for 'better' or 'worse'. Gender differences may or may not be an important factor. For example, there is little evidence that women are more ready than men to share competitive information—supplied as a public good—with the wider community in situations in which both men and women as individuals have access to profitable market opportunities (see Box 23). The CIALs are seeking therefore to develop mechanisms and procedures that will encourage CIAL members to continue to share information, skills, and

DR | ...

Table 9. Working with CIALs: How PPB/PVS interventions can change the social dynamic.

	Ecuador	Colombia	Honduras
Crop focus	Market-oriented	Vegetables and potatoes, fruits	Subsistence crops
Farmer goals	High added value	High added value	Community and household food security
Target farmers	Risk takers participating farmers	Risk takers participating farmers	Poor
Dynamic	Privatise results	Privatise results	Better-endowed farmers seeking advice from poor farmers

### Box 23

#### The relationship between gender identity and maize technology adoption in Ghana

*Statistical tests:* Cheryl Doss and Michael Morriss have used statistical survey data to analyse whether or not gender identities affect maize technology adoption in Ghana, and concluded that, once the sample was controlled for access to resources and inputs such as credit, there were no significant gender differences, i.e., they concluded that it is the *positionality* of women in the family and society, rather than their gender as such, that brings about differential outcomes (Doss and Morriss, 2001). However, since women's position is strongly conditioned by their gender, this might seem a somewhat circular argument.

technologies with their community in these situations. On the other hand, there is ample evidence from other development experience that information rarely trickles down from the richer to the poorer. Conversely, where poor farmers can become the holders of valued information, the social dynamic can move in their favour.

#### Gaps and Opportunities

The material presented in this chapter suggests that more effort is needed to:

- Expand the toolkit currently used for the analysis of effects and impacts in PPB, by drawing on others' experience in using participatory monitoring and evaluation tools, and by experimenting with how best, and when, formal surveys and participatory methods can be combined;
- Develop the toolkit by experimenting with methods for capturing and interpreting empowerment and changes in gender dynamics;

- Investigate further how farmers and other stakeholders can contribute to analysis of GIS data and satellite images (see Powell 1998; González 2000), and how GIS and remote sensing can contribute to analysis of PPB's effects and impact;
- Synthesise the lessons of experience, in order to indicate more precisely the situations in which PPB has a comparative advantage in terms of the effectiveness of plant breeding;
- Develop measures for capturing the effects and impacts on local agro-biodiversity, food cultures, and markets;
- Carry out an ecological economics study of the cost-effectiveness of PPB and genetic resource flow management in selected marginal and commercial environments;
- Carry out focussed studies on the effects and impacts on institutional capacity-building along the food chain.

## 7. Forward-Looking Summary

This paper began by stating that empirical enquiry and experience has shown that the need for, and the impact of, technology is not necessarily gender neutral, nor are knowledge, skills and information. Women's roles in seed handling, agricultural production, food processing, trading and purchase are known to be vital to food security and family well-being, but their positions and interests can be substantially and importantly different to that of men's.

The paper thus had the following aims: (1) to analyse the methods and approaches currently used within PPB with respect to gender issues, the use of GA, and user involvement; (2) to draw out the implications of researchers' experiences with GA and user involvement; (3) to analyse and discuss the outputs currently being generated by PPB from a user perspective; and (4) to identify what more might be done, and how, in order to achieve broader impacts and to capitalise on what has been achieved to date. What conclusions may now be drawn?

This final chapter begins by summarising what is already current 'best practice', under the headings of Gender Analysis, Stakeholder Analysis and Complementary Research, Participatory Plant Breeding, Communication and Dissemination and finally Assessing Effects and Impacts. The various suggestions made in the text under the heading Gaps and Opportunities are then clustered and presented. The chapter concludes with a broad-brush outline of further strategic research and analysis.

### **A Summary of Current Best Practice**

#### ***The contribution of gender analysis***

1. GA is contributing significant insights into user needs through the length of the production to consumption chain. By focussing on the three main sets of questions, (1) who does what, when and where, (2) who has access to and control over resources and (3) who benefits, GA forces implicit assumptions about who the users are to be made explicit, and for these to be tested in context.

2. Anyone can learn how to do GA, but who does a GA may have implications for how the results are incorporated into practice. If GA is not done by PPB researchers themselves, then they need to be aware of the implications of the type of expertise they call on to do the GA and gender research.
3. The findings of GA assist in the design of criteria and process for the identification and selection of who to work with.
4. The decisions made about whom to work with are consequential for the outcomes of PPB.
5. If women's involvement is considered necessary, because of the roles that women play in agro-food systems, then consideration must be given to the removal of any practical constraints to their participation.
6. It might be necessary in specific contexts to hire in women to work with women.
7. GA brings to the fore the realisation that intervention by PPB in the gene flow may have significant consequences for existing user interests and for gender relationships throughout the food chain.
8. Off-setting measures may be needed to counter any negative consequences for (particular categories of) women or men which are revealed by the analysis.
9. High quality GA and participatory research help to maintain standards in PPB science, but in order for this to happen, GA needs to become part of normal professionalism.
10. GA is not sufficient to permit full understanding of user interests, since gender is a cross-cutting variable in dynamic interaction with other variables. It needs therefore to be complemented by a range of other tools.
11. GA offers a firm, but not sufficient, foundation for developing activities to meet the empowerment goals of participatory research.

### ***Stakeholder analysis and complementary diagnostic research***

1. Stakeholder analysis (SA) is an important tool in revealing to researchers the wider set of stakes and needs of actors in the flow of genetic materials throughout the food chain.
2. SA can assist also in identifying with whom PPB teams could or should be working beyond the production environment, on the basis of mutual or divergent stakes.
3. The findings of SA can provide a firm foundation for initiating the linkages with the institutional actors who will carry an innovation into practice.
4. Flexibility and pluralism in the choice of diagnostic research methods is essential.
  - a. Social situations are constantly changing, gender roles are in flux, user needs do not remain constant, and researchers need to be alert to such changes.
  - b. The combined use of participatory methods, formal surveys, and statistical analyses have been shown to be strongly



complementary in the type of understanding each provides; together, they help to build a 'richer picture' than any one approach alone can generate.

5. Institutional and cultural analyses can deepen insight into the reasons for behaviour, preferences, and decisions among a sub-set of a larger population, allowing extrapolation (with caution) to the larger population.
6. Decision support systems and other heuristic instruments may sharpen researchers' ability to spot and work with specific user needs and opportunities.
7. GIS and remote sensing can extend and deepen the spatialisation of information and data sets, and may have a specific role as a diagnostic tool in the identification of like-areas of opportunity, especially if combined with community-based studies and stakeholder needs identification. Farmers and other stakeholders have shown they are able to assist in the assessment and interpretation of GIS and remote sensing data.

### ***Participatory plant breeding***

1. Stakeholder and GA, and participatory research tools such as preference ranking, can help make explicit the choices and trade-offs which are made by breeders among breeding objectives. Such choices and trade-offs also can be made through a process of stakeholder negotiation.
2. Some farmers in some communities already possess skills in breeding, through mass (or grid) selection and through hybridisation. These skills can be strengthened by researchers, or taught over short intensive periods, by either trainers or trained farmers, to new sets of farmers.
3. Users from the length of the food chain can be involved effectively in formal-led PPB. There are no examples found of stakeholders from the length of the breeding chain being involved in farmer-led PPB.
4. User involvement can occur with benefit at all or a combination of stages of the PPB cycle; it is essential in the early stages of setting the research agenda and in selection of varieties for further testing or release.
5. Both the degree and the quality of user participation are likely to vary through the breeding cycle.
6. Systematic negotiation of roles and degrees and quality of participation is necessary to avoid confusion and disappointment. Re-negotiation may be necessary as participants jointly learn 'what works for them, for their own purpose, in their context'.
7. PPB researchers can work effectively with individuals, or with already existing groups, or stimulate the formation of new groups of users. The choice is a contextual one, but will have consequences for effects and impacts.

8. Minimum data sets that are collectable and usable for the purpose of process management and shared learning (and not only scientific purposes) are desirable. More systematic comparison is needed to determine guidelines regarding who might best, or should, collect and analyse the data for monitoring purposes. Stakeholder-based monitoring, analysis and interpretation is possible and offers advantages for programme management and shared learning.
9. Gender variables, user participation, preference criteria, and selection choices are essential elements in the minimum data set.
10. Changes in the macro policy environment, the devolution of budgetary and planning authority to local governments, the privatisation of public sector services, and the opening up of economic participation to local commercial, non-government and other civil society actors, present PPB researchers with unprecedented opportunities for direct contact with stakeholders and new opportunities for collaborative co-learning beyond the farm level.
11. The reasons for choosing to develop particular partnerships should be made explicit, and serve to advance the breeding, production and empowerment goals embraced by PPB.
12. Systematic selection and development of partnerships can lead to a rapid and wide increase in PPB effort, and an impressive scaling up in the numbers of farmers and other stakeholders involved.
13. Training, and training manuals, for farmers, support organisations, and breeders, also materially assist in the deepening and widening of effort. Farmers and other stakeholders can be brought effectively into the process of developing such training materials.

### ***Communication and dissemination***

1. Breeding for specific adaptation brings local institutional and informal networks, and systems of plant or seed multiplication, sale and exchange, into the foreground as channels for communication and dissemination.
2. The decentralisation and privatisation of public sector service agencies opens up opportunities for new participants in communication, multiplication and dissemination, including the development of farmer-to-farmer movements and local organisational partnerships.
3. If formal seed (plant) systems in practice exclude certain users or other stakeholders from access, then PPB projects must consider the consequences of offering their products (only) to formal seed multiplication and seed release programmes.
4. Local regulatory frameworks may need to be created in order to ensure the quality of local seed releases.
5. Schools, clinics, seed fairs, religious festivals, etc. offer a range of alternative options for communication, seed multiplication and dissemination. Further creative experimentation is warranted.

6. Incentives for farmers to share materials and breeding skills with others can be provided but more insight is needed into how to structure such incentives effectively.

### ***Assessing effects and impacts***

1. Systematic monitoring and assessment of the effects and impacts of PPB in practice is still in its infancy.
2. Case study evidence indicates that user involvement in PPB does increase confidence and knowledge among participants and may lead to significant spill-over effects of wider benefit to the community.
3. PPB may have additional positive effects—on bio-diversity, agro-ecosystems, food security and local livelihoods—but such effects need to be better documented and interpreted.
4. PPB may also have a positive impact on the efficiency of breeding, by reducing the duration of the breeding-to-release time and making more effective use of genetic materials in terms of user needs and opportunities.
5. Monitoring data need to be able to pick up specific adaptation and innovation processes; standard adoption and diffusion research methods may not be applicable or may need to be complemented by other research approaches.
6. The impact of PPB on gender relationships, social dynamics at community and higher levels, and stakeholder livelihoods along the food chain, need to be better assessed.
7. The tools of geographical information systems (GIS) and remote sensing may offer new ways, in combination with gender-sensitive field tools, to identify a range of effects and impacts linked to production and ecosystem characterisation, at varying scales of aggregation.

### **Gaps and Opportunities**

This section summarises the various 'gaps and opportunities' revealed by the analyses presented in this paper. They are clustered under the headings of Developing and Strengthening Practice, Supporting Breeders and Other Researchers, Methods and Materials Development and Expanding the Agenda.

#### ***Developing and strengthening practice***

It would be useful to document and analyse in depth the existing experience with regard to:

- Systematic comparison of the design of user involvement in formal-led and in farmer-led PPB processes, from a gender perspective;

- Systematic comparison of working with individuals, existing groups, and newly-formed groups of various kinds, using a SWOT analysis (strengths, weaknesses, opportunities threats), from a gender perspective;
- The degree and quality of women's involvement in selected formal- and farmer-led PPB cases, from a food chain perspective;
- The costs and cost-effectiveness of selected formal-led and farmer-led PPB cases compared to conventional breeding, from both a cost-benefit and a broader ecological economics perspective.

It would be good to experiment further with:

- Involvement of local schools in PPB and the introduction of breeding skills into rural school curricula;
- Farmer-to-farmer training, with or without FFS, in breeding skills and seed system management;
- Systematic involvement of a wider set of food chain stakeholders, through to end consumers, in farmer-led and formal-led PPB;
- The development of partnerships with a wider range of stakeholder institutions;
- Alternative communication, multiplication and dissemination channels, and the reform of official seed regulatory frameworks;
- User involvement in impact assessment, especially in 'hard to measure' assessments of empowerment, participation, and improvements to livelihoods.

### ***Supporting breeders and other researchers***

It would be useful to further develop

- Field-based peer-to-peer learning between PPB teams about their GA and user involvement experience;
- 'Best practice' incentives, for example in the form of competitive awards for peer-reviewed articles that document and analyse PPB teams' methodological and process experiences;
- Small grant schemes, to reduce innovation risk for PPB teams and lower the threshold for experimentation.

It would be helpful to support PPB teams to:

- Consider the implications of whom they choose to work with through the breeding cycle, and of their choice of institutional partners, for bringing the outputs of PPB into stakeholder practice;
- Develop an appreciation of measures of 'success' that are relevant for specific adaptation, niche markets, and specific user needs.

### **Methods and materials development**

It would be useful to support the further development and dissemination of:

- The use of social, stakeholder, and food chain analyses, to complement GA;
- Decision support and other heuristic tools, and the (participatory) applications of GIS and remote sensing;
- Cost-effective tools which provide insight into the cultural (religious, mythic) dimensions of varietal preferences;
- Organisational analysis tools, to support effective, gender-sensitive, choice in the development of partnerships;
- Gender-sensitive procedures for the routine documentation and analysis of user involvement in the detailed processes of breeding;
- Gender-sensitive criteria for assessing the quality of the scaling-up processes;
- Usable and cost-effective tools for:
  - monitoring and evaluating adoption and diffusion relevant to: specific adaptation, niche markets, and specific user needs
  - the gender dimensions of innovation processes throughout the food chain
  - impacts on social dynamics and gender relationships
- Training and communication materials, developed with stakeholders.

### **Expanding the agenda**

Two items have not surfaced in the material presented in this paper. However, they have figured in conversations with researchers during the preparation of this paper and so are introduced briefly.

1. The new tools and insights provided by genetic research and gene technologies would appear to offer a number of opportunities in the context of PPB. Possible applications would include the use of molecular markers to characterise and track the flow of genetic diversity in existing and introduced varieties; and improved techniques for local production of disease-free materials and propagation of vegetatively-propagated plants.
2. The focus, by far, of the majority of PPB effort has been on the improvement of the production performance of varieties for local use, with some attention paid to cooking, storage, and processing quality in household or community environments, and also to performance in extreme climatic or growing conditions. As stakeholder interests along the food chain come into play, however, other qualities may come to the fore, such

as robustness in transport to markets, pest and disease resistance in bulk storage facilities, a wider range of 'market appeal' criteria in differentiated trading and market circuits, commercial processing needs, and a more diverse set of end consumer taste (storage, cooking, processing) preferences and products. It is not yet clear (1) how, or who, will negotiate the trade-off among preference criteria that such engagement implies, and (2) how PPB capacity can be expanded to maintain a response to the expanding diversity of need and opportunity.

## **A Forward-Looking Strategy**

1. **Bringing other stakeholders into PPB:** PPB so far has been carried into wider practice through support from the international donor community, and the dedication of national and international scientists, NGOs and farmers. As experience and confidence in working with users along the food chain grows, there is both a need and an opportunity to bring other actors into PPB. It would be timely to explore, for example:
  - The interest of traders, market managers, and associations of marketers in contributing equity to PPB-supported market development and 'back contracting' with local producer groups.
  - The interest of national or international commercial processors (e.g., of cassava or potato products) in supporting PPB in order to help farmer groups to 'produce to specification' and conversely, to bring their preferred local varieties and associated products to commercial markets.
  - Linking up with stakeholders in the Integrated Pest Management Farmer Field Schools, organic farming movement, and farmers' organisations and processors wishing to export to markets with in effect 'zero tolerance' of pesticide residues. Together, they offer stronger potential for bringing into practice on a wide scale a productive agriculture that supports local livelihoods, safe food and a sustainable environment.
  - In the European area, the new Water Framework Directive and Natura 2000, that respectively require integrated management of whole river systems, and the designation of extensive ecosystems as areas to be managed in ways that conserve specified species of birds and other threatened wildlife, both bring new stakeholders into play. Similar policy frameworks, though perhaps of more restricted scope, are being put in place in many developing countries. They imply, and require, a rapid transition to new forms of agriculture, meeting new standards of pollution control, pest and disease management throughout the food chain. PPB surely can have an important role in working with such 'non-farming,

non-food' stakeholders in meeting the demands that societies are now placing on the management of agro-ecosystems that now occupy the larger part of the world's 'green spaces'.

- The interest of emergent local governments enjoying wider powers under decentralisation and privatisation policies, in working with PPB and local farmer and community groups to develop market-oriented agriculture.
- The interest of mature farmers' organisations in working with PPB for the farmer-led development of niche markets, for example in beer brewing, snack foods or foods prepared for special public occasions.

Each option carries some risks, but offers also advantages for the expansion of PPB's contribution, and for varying degrees of cost-sharing or even cost-recovery.

- 2. Specialisation of Farmer Trainers and Farmer Breeders:** A lesson might be drawn from the Asian experience in Integrated Pest Management, where graduates of FFS over time have become 'farmer experts', training other farmers in Field Schools, and spearheading the development of 'community IPM' (a movement managing district-wide agricultural experiments and a larger set of development actions). Farmers and other users involved with PPB teams can be supported to become 'farmer experts', training others in breeding skills, and/or becoming specialised crop breeders working on a longer term basis with researchers (as specialised potato farmers in the Netherlands, and soft fruit producers in England do).
- 3. Apprenticeships in User Involvement and PPB:** The Systemwide Program on PRGA could be supported to offer a number of apprenticeship training positions to the next generation of formal and informal breeders, placing them with PPB teams working in national and international research institutes, and also those in NGOs and farmer-led PPB communities. The experience gained could be amplified by ensuring regular exchange of experience among the apprentices, many of whom could be expected to develop strategies for further expansion of PPB in their home context.
- 4. Mentoring Programmes and Further Development of the PPB Profession:** As researchers step beyond normal professionalism, they often express a wish to access a 'dialogue partner' to talk through how to respond to a challenge, design and manage a particular step, or develop an emerging opportunity. Internet-based information and resource guides, e-mail conversations, and periodic seminars and training opportunities, all assist individuals to move toward current best practice. However, PPB practitioners could be supported also to act as peer mentors, by establishing peer-to-peer study visits to sites in order to learn from each

other's own field practices with respect to a suite of user involvement variables such as the use of GA and SA, selection of collaborators, involvement of food chain stakeholders, etc.

PPB practitioners, including farmers running farmer-led PPB, could be supported to 'normalise' PPB within the breeding profession, by organising PPB sessions at relevant scientific congresses.

University-courses that teach PPB, covering both its scientific and its user involvement dimensions, could be listed and promoted on relevant Internet sites; additional courses and course specialisations could be developed. Of special interest would be those that involve non-university stakeholders in teaching and/or course assessment, and the opportunity for site visits. The potential for reaching large numbers of students through internet-mediated learning (as in the Open University's undergraduate and Masters-level programmes), should also be explored.



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## **Web Sites**

**www.cbdcprogram.org** This contains technical reports from field projects, as well as information on the Community Biodiversity Development and Conservation programme.

**www.prgaprogram.org** This contains information on the Systemwide Program on Participatory Research and Gender Analysis, publications, seminar or workshop reports, inventories and searchable databases on participatory research methods used in the fields of Natural Resource Management and Participatory Plant Breeding and Gender, a Toolbox with participatory research, gender analysis and social analysis tools and methods, and resources for gender-related research and training.



## Appendix 1. Interviews, Focus Groups, and Presentations

The authors participated in the following interactions at the 3rd International Seminar and Small Grants Workshop 'Uniting Science and Participation in Research', 6-11 November 2000 in Nairobi, Kenya, in order to capture more of practitioners' first hand experiences and personal views, and deeper insight into the details of practice than formal publication of results allows.

### **Informal Open-ended Individual Discussions and Interviews**

#### ***Bolivia***

1. Edson Gerardo Gandarillas M. (Fundación PROINPA)
2. Graham Thiele (CIP)

#### ***Cameroon***

3. James Gockowski (IITA—Humid Forest Ecoregional Centre)

#### ***Canada***

4. Sally Humphries (University of Guelph; Zamorano Project in Honduras)
5. Kiritkumar Patel (University of Guelph)
6. Awegechew Teshome (University of Ottawa)

#### ***Colombia***

7. Roosevelt Escobar (CIAT)
8. Luis Alfredo Hernández (CIAT)
9. Susan Kaaria (CIAT)
10. Antonio José López (CORPOICA)
11. Carlos Arturo Quirós (CIAT)
12. José María Restrepo (FIDAR)
13. Nadine Saad (CIAT)
14. Joe Tohme (CIAT)

#### ***Ecuador***

15. Héctor Andrade (INIAP)
16. Carmen Isabel Castillo (INIAP)

#### ***Ethiopia***

17. Frew Mekbib (Alemaya University)

**Germany**

18. Andreas Oswald (Institute of Crop Science, University of Kassel)

**Honduras**

19. Juan Carlos Rosas (EAP/Zamorano—Programa de Frijol)

**Italy**

20. Marina Puccioni (Istituto Agronomico per l'Oltremare)

**Ivory Coast**

21. Monty Patrick Jones (WARDA)

**Kenya**

22. Richard Coe (CIMMYT)  
23. Steve Franzel (ICRAF)  
24. Mikkel Grum (IPGRI)  
25. Felister Makini (KARI)

**Madagascar**

26. Bodo Rabary (Center for Applied Research and Rural Development or Centre Nationale de Recherche Appliquée au Développement Rural/Participatory Research for Improved Agroecosystems Management)

**Malaysia**

27. Ahmed Mahfuz (ICLARM)

**Mali**

28. Eva Weltzien-Rattunde (ICRISAT)

**Mexico**

29. Mauricio Rafael Bellon (CIMMYT)

**Nepal**

30. Shibesh Chandra Regmi (New ERA)  
31. Camille Richard (ICIMOD)  
32. Sharmila Sunwar (LI-BIRD)

**Netherlands**

33. Yiching Song (Wageningen Agricultural University)

**Peru**

34. Rebecca Nelson (CIP)  
35. Oscar Ortiz (CIP)

**Philippines**

- 36. Thelma Paris (IRRI)
- 37. Wilhelmina Pelegrina (SEARICE)
- 38. Ralph Roothaert (c/o IRRI)

**Sweden**

- 39. Linley Chiwona-Karlton (IHCAR)

**Syria**

- 40. Aden A. Aw-Hassan (ICARDA)
- 41. Salvatore Ceccarelli (ICARDA)

**Tanzania**

- 42. Ursula Verena Hollenweger (CIAT)

**Uganda**

- 43. Sonila David (CIAT)
- 44. Roger Kirkby (CIAT Regional Programme on Beans in Eastern Africa)
- 45. Pascal Cigoho Sanginga (CIAT)

**United Kingdom**

- 46. Ritu Verma (IDRC and SOAS)

**USA**

- 47. Cheryl Renee Doss (Yale Centre for International and Area Studies)
- 48. Christine Gladwin (University of Florida)
- 49. Kathleen Schroeder (Appalachian State University)

**Zimbabwe**

- 50. Edward Chuma (University of Zimbabwe)
- 51. Julien De Meyer (CIMMYT)
- 52. David D. Rohrbach (ICRISAT)

**Focus Groups**

- 53. Women and Technology Development 1: 9.11.00
  - Jacqueline Ashby (CIAT)
  - Linley Chiwona-Karlton (SLU)
  - Robert Delve (TSBF/CIAT)
  - Cheryl Doss (Yale)
  - Janice Jiggins (SLU)
  - Susan Kaaria (CIAT)
  - Adrienne Martin (NRI)
  - Felister Makini (KARI)
  - Jennifer Ngui, graduate student
  - Bernard Ogola, Nairobi friends Club International
  - Thelma Paris (IRRI)
  - Ritu Verma (IDRC/SOAS)

54. Women and Technology Development 2: 9.11.00  
Linley Chiwona-Karlton (SLU)  
Cheryl Doss (Yale)  
Christine Gladwin (University of Florida)  
Susan Kaaria (CIAT)  
Janice Jiggins (SLU)  
Felister Makini (KARI)  
Jennifer Ngui, graduate student  
Nasambu Okoko (KARI-Kisii)  
Thelma Paris (IRRI)  
Mary Young (National Veterinary Research Institute)  
Sharmila Sunwar (LI-BIRD)

**Authors' Notes on Plenary and Small Group Presentations  
and Discussions**

55. Héctor Andrade (INIAP)  
56. Jacqueline Ashby (CIAT)  
57. Aden Aw-Hassan (ICARDA)  
58. Mauricio Bellon (CIMMYT)  
59. Carmina Castillo (INIAP)  
60. Salvatore Ceccarelli (ICARDA)  
61. Richard Coe (ICRAF)  
62. Roosevelt Escobar (FIDAR/CIAT)  
63. Steve Franzel (ICRAF)  
64. Frew Mekbib (Alemaya University)  
65. Christine Gladwin (University of Florida)  
66. Gerardo Gandarillas (PROINPA)  
67. Mikel Grum (IPGRI)  
68. Luis Hernández (CIAT)  
69. Sally Humphries (University of Guelph)  
70. Monty Jones (WARDA)  
71. Roger Kirkby (CIAT)  
72. Antonio José López (CORPOICA)  
73. John Lynam (Rockefeller Foundation)  
74. Felister Makini (KARI)  
75. Rebecca Nelson, (CIP)  
76. Oscar Ortiz (CIP)  
77. Thelma Paris (IRRI)  
78. Wilhelmina Pelagrina (SEARICE)  
79. Juan Carlos Rosas (EAP/Zamorano)  
80. Nadine Saad (CIAT)  
81. Sharmilla Sunwar (LI-BIRD)  
82. Graham Thiele (CIP)  
83. Joe Tohme (CIAT)  
84. Kevin Gallagher (Global IPM Facility, FAO)

## Appendix 2. An Analysis of the Organisation of the Breeding Continuum in Relation to the Location of Women Professionals and Women Farmers' Access and Participation

The following chart is based on the categorisation of the breeding continuum suggested by Weltzien et al. (2003); the inventory of gender-related research and training in the CGIAR Centres (1996-1998) compiled by Hilary Sims Feldstein (2000); gender-disaggregated data on the staffing of agricultural research and extension services compiled by FAO and ISNAR (various reports), and FAO data on the coverage of selected national extension services.

Organisation of breeding/ Research continuum	Location of women professionals	Women farmers' access/Participation
Conventional pipeline, centralised location		xx
Conventional pipeline, decentralised location	x	
Conventional pipeline, decentralised location, devolution of on-farm selection to farmers	x	x
Client participation, centralised location	xx	
Client participation, decentralised location	x	x
Client participation, decentralised location, devolution of on-farm selection to farmers	x	xx

## Appendix 3. Farmer Sorghum Diversity Tree in Alemaya Area in Ethiopia

### Bishinga

Afukanni	Cherchero	Chiquere	Danga
Seed colour: white, red	Seed colour: white, red	Seed colour: red	Seed colour: dark red
Panicle: semi-compact	Panicle: semi-compact	Panicle: semi-compact, lax	Panicle: semi-compact
Stalk sweetness: sweet, insipid	Stalk sweetness: sweet, insipid	Stalk sweetness: insipid	Stalk sweetness: sweet
Fendisha	Keyla	Muvra	Nanno
Seed colour: red, light red, white	Seed colour: red	Seed colour: red, white, yellow	Seed colour: white, red
Panicle: semi-compact, insipid	Panicle: semi-compact, lax	Panicle: semi-compact, compact	Panicle: nanno type (very lax)
Stalk sweetness: sweet, insipid	Stalk sweetness: insipid	Stalk sweetness: sweet, insipid	Stalk sweetness: sweet, insipid
Tomma	Wegere		
Seed colour: dark red, red	Seed colour: white, red		
Panicle: compact	Panicle: semi-compact		
Stalk sweetness: sweet, insipid	Stalk sweetness: sweet, insipid		

### Legend

Folk Generic Level

Folk Species Level

Folk Variety Level

SOURCE: Mekbib and Farley (2000).

## Appendix 4. List of Acronyms and Abbreviations Used in the Text

### **Acronyms**

<b>AME</b>	Foundation Agriculture, Man and Ecology Foundation
<b>ASPRU</b>	Agricultural Production Systems and Research Unit
<b>CAAS</b>	Chinese Academy of Agricultural Science
<b>CGIAR</b>	Consultative Group on International Agricultural Research
<b>CIAL</b>	Comité de Investigación Agrícola Local (CIAT, Colombia)
<b>CIAT</b>	Centro Internacional de Agricultura Tropical (Colombia)
<b>CIMMYT</b>	Centro Internacional de Mejoramiento de Maíz y Trigo (Mexico)
<b>CIP</b>	Centro Internacional de la Papa (Peru)
<b>COMMUTEC</b>	Community Technology Development Association
<b>CORPOICA</b>	Corporación Colombiana de Investigación Agropecuaria
<b>CPAC</b>	Centro de Pesquisa Agropecuária dos Cerrados (Brazil)
<b>CRSP</b>	Collaborative Research Support Programme
<b>CSIRO</b>	Commonwealth Scientific Industrial Research Organisation
<b>CTDT</b>	Community Technology Development Trust
<b>DDS</b>	Deccan Development Society (India)
<b>FAO</b>	Food and Agriculture Organization
<b>FIDAR</b>	Fundación para la Investigación y el Desarrollo de la Agroindustria Rural (Colombia)
<b>GMRI</b>	Guangxi Maize Research Institute (China)
<b>IARC</b>	International Agricultural Research Centre
<b>ICARDA</b>	International Center for Agricultural Research in the Dry Areas (Syria)
<b>ICIMOD</b>	International Centre for Integrated Mountain Development
<b>ICLARM</b>	International Center for Living Aquatic Resources Management (Malaysia)
<b>ICRAF</b>	International Centre for Research in Agroforestry (Kenya)
<b>ICRISAT</b>	International Crops Research Institute for the Semi-Arid Tropics (India)
<b>IDRC</b>	International Development Research Centre (Canada)
<b>IHCAR</b>	Department of Public Health Sciences, Division of International Health
<b>IIM</b>	Indian Institute of Management (India)
<b>INIAP</b>	Instituto Nacional de Investigaciones Agropecuarias (Ecuador)
<b>IPRA</b>	Participatory Research in Agriculture
<b>IRRI</b>	International Rice Research Institute (the Philippines)
<b>KARI</b>	Kenya Agricultural Research Institute
<b>LARC</b>	Lumle Agricultural Research Centre

LI-BIRD	Local Initiatives for Biodiversity, Research and Development (Nepal)
MASIPAG	Farmer-Scientist Partnership in Rural Development
NANEC	National Network of Cassava Workers (Uganda)
NARS	National Agricultural Research System
NERICA	New Rices for Africa Programme
NRI	Natural Resources Institute
PMS	Pragati Mahila Samakya (India)
PRGA	Participatory Research and Gender Analysis Program (CIAT)
PROINPA	Fundación Promoción e Investigación de Productos Andinos (Bolivia)
SEARICE	South East Asia Regional Institute for Community Education
SLU	Swedish University of Agricultural Sciences
SOAS	School of Oriental and African Studies
TAC	Technical Advisory Committee (CGIAR)
UPLB	University of the Philippines-Los Baños
WARDA	West Africa Rice Development Association (Ivory Coast)
WIRFS	Women in Rice Farming Systems

### **Abbreviations**

DoA	Department of Agriculture
DSS	Decision support systems
FFS	Farmer Field Schools
GA	Gender analysis
GIS	Geographical Information Systems
IDP	Intensive data plots
IPM	Integrated pest management
NARS	National Agricultural Research Systems
NGO	Non-governmental organisation
OPV	Open-pollinated variety
PGR	Plant genetic resource
PM&E	Participatory monitoring and evaluation
PPB	Participatory plant breeding
PR	Participatory research
PRA	Participatory rural appraisal
PRGA	Participatory Research and Gender Analysis
PTD	Participatory technology development
PVS	Participatory variety selection
R&D	Research and development
RAAKS	Rapid Appraisal of Agricultural Knowledge systems
RS	Remote sensing
SA	Stakeholder analysis
SHG	Self-help group





