

## Examples of what can be achieved through PPB

### Improved seed system dynamics

- Enhanced effectiveness of breeding by sharing knowledge, resources and skills between farmers and breeders
- More rapid uptake, dissemination and use of new varieties by farmers
- Regulations for release and seed certification may be adapted based on collaborative experiences

### Enhanced conservation and use of biodiversity

- Varieties developed that provide new options for farmers to diversify production systems
- Specific farmers' varieties enhanced or used as breeding parents

### Strengthening livelihoods and resilience

- Increase farmers' options to adapt to challenges like climate change, seize opportunities such as new market demands
- Create opportunities for income generation in rural areas through seed production and sales
- Attract support and engagement from others to address goals such as improved nutrition, inclusion/equity, etc.

### Supporting social organization and culture

- Farmer organizations' and their members' capacities to work together, respecting and building on cultural norms concerning seed
- Capacities to engage in partnerships with researchers, traders and other actors

# Participatory Plant Breeding: Opportunities for collaboration between farmers and National Plant Breeding Programs

This practice guide is meant to:

- Explain what Participatory Plant Breeding (PPB) is
- Give guidance on how it can be organized in practice
- Promote awareness of what can be achieved through PPB

## What is Participatory Plant Breeding (PPB)?

The idea behind PPB is that through collaboration, farmers and breeders can accomplish more together than each group could achieve alone. An important prerequisite for PPB is complementary knowledge, skills and resources of the partners. Farmers' and breeders' recognition of what each can contribute is a key to successful PPB.

Farmers have long experience with their crops and fields in their social and environmental context. Farmers, with their specific observation and selection skills, have developed locally well adapted varieties appropriate for multiple uses. Plant breeders, in contrast, have expertise for variety testing across environments for optimizing selection progress for traits that can't be effectively observed in single environments, like yield and many types of resistance. Breeders may also access plant genetic resources from across the world. By combining their different capabilities, breeding progress can be enhanced to create new varieties that are adapted to the farmers' conditions and needs in view of diverse challenges, such as increasing climate variability.

▼ Farmers select in a trial grown in their village.



## What is a (new) variety?

It is useful to clarify what the term 'variety' may mean to different participants. For example, farmers may associate 'varieties' with certain types of plants, locations, uses or people who donated the seed. Farmers may manage their seed lots without keeping varieties separate. It is important for plant breeders to understand farmers' concepts of varieties and ways of managing seed lots when planning PPB. Plant breeders consider a variety to be a specific type of plant, identifiably different from others, with a certain expected level of diversity within. Breeders always manage individual varieties as separate seed lots so that each variety can be reproduced.

## How can PPB be organized in practice?

PPB is an approach to jointly identify problems and opportunities and share responsibilities for variety development. This includes planning, decision making and practical activities.

Decisions made at each stage of the plant breeding process determine the characteristics of the varieties that may become available for use. Planning practical activities on-farm or on-station involves distributing tasks in an efficient manner based on specific knowledge or interests of specific participants. To realize the power of collaboration, it is thus important to consider the ways in which farmers and plant breeders can collaborate at each stage of the breeding process.

### Further information on PPB

<http://participatory-plant-breeding.cirad.fr/>

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### 1 | Setting goals and priorities

Breeding programs need clear priorities regarding their overall goals and specific objectives. Goals such as enhancing nutrition, diversity and livelihoods, for which types of farmers in which agroecologies, need to be agreed on. Based on these goals, characteristics of potential new varieties need to be identified that offer new opportunities beyond what is already available. To work towards agreeing on goals and priorities, farmers and breeders, possibly with support from others, can engage in participatory activities such as:

- Understanding roles and responsibilities for crop production, post-harvest processing and use, including from a gender perspective
- Diagnosing cropping system constraints and how farmers try to address them
- Studying the characteristics of varieties currently used by farmers, including their specific strengths and weaknesses for addressing those constraints
- Jointly identifying an initial set of priorities, for example the type(s) of varieties to be developed, traits to be considered, etc.
- Conducting regular planning and feedback meetings to ensure transparency, sharing of information and reflecting on agreed goals and priorities.

### 2 | Assembling and generating diversity

Breeding programs generate new diversity by assembling and crossing existing varieties to combine desirable traits for selection. The performance and extent of diversity of this newly created material determines the potential success of subsequent selection activities. Farmers and breeders can contribute to generating new diversity with their complementary expertise by, for example:

- Jointly identifying interesting ‘off type’ plants in farmers’ fields to use in breeding
- Farmers proposing their own varieties as parents for crossing
- Breeders contributing materials from genebanks, universities or international public breeding programs
- Farmers and breeders jointly plan crosses
- Facilitating crossing at large scale by sowing selected ‘parents’ side-by-side in farmers’ fields

### 3 | Selecting plants and progenies

The diversity created needs to be funneled towards the targeted trait combinations. Selection between plants and progenies continues over several generations until experimental varieties with identifiable differences are obtained. The growing conditions under



▲ Visual inspection of grain quality by women farmers in Mali.

which this selection is practiced strongly influences the adaptation of these experimental varieties. Farmers and breeders can share responsibilities in this process by:

- Jointly deciding on the field management of selection plots and nurseries
- Conducting selection in specific generations on-farm, benefitting from farmers’ selection skills
- Involving farmer experts who select for specific traits, e.g. experienced women farmers select among progenies for grain processing quality traits on-station
- Breeders selecting for traits requiring controlled conditions for effective observation

### 4 | Evaluating experimental varieties

The performance of new experimental varieties needs to be evaluated for their usefulness regarding the agreed goals and objectives. Progress for yield can only be made at this stage. This requires testing many experimental varieties at several sites and years. This activity demands the most resources of all the stages and is difficult for farmers or breeders to do alone. Farmers and breeders can join forces, resources and expertise in this stage by:

- Conducting initial and advanced trials in farmers’ fields using agreed and effective trial designs provided by breeders
- Evaluating trials with large numbers of farmers representing the diverse groups of users
- Evaluating experimental varieties for processing qualities for local consumption and, where relevant, other uses
- Sharing decisions on variety advancement based on discussions of analyzed trial data and farmers’ observations

### Decentralized seed production – a bundle of opportunities in West Africa

Seed production and dissemination can be developed with a view toward the common good – and farmers’ organizations can play a central role in this. Farmer organization members, including women and youth, can engage in seed production, processing, packaging and local distribution. Farmer organizations provide trusted information and seed of new varieties to their members and community by building on culturally acceptable practices. Access to new seed by members and their community can be improved by farmer organizations’ options for pricing and credit. The capacities and cohesion of farmer organizations themselves can grow through their members’ engagement in seed production and distribution.

Farmer organization engagement in seed production and distribution respects and builds on farmer’s cultural norms for sourcing seed. This leads to more rapid uptake of new varieties. Multiple farmer organizations, each pursuing their members’ interests, can contribute to increasing varietal diversity within a region.

### 5 | Producing and disseminating seed

Any success of the breeding process can only reach farmers if seed of the newly developed varieties becomes accessible at sufficiently large scale, and in a sustainable manner. Farmers and breeders can take on various responsibilities in this process, such as:

- Interested seed producers or their organizations choose which new varieties to produce based on local interests and variety performance information
- Farmer organizations engage in locally decentralized seed production and dissemination
- Farmers and breeders collaborate in building up seed production of chosen new varieties
- Farmers and breeders jointly design and implement culturally effective information campaigns about the new varieties
- Farmers and breeders adapt responsibilities for early generation seed production based on growing demand for seed
- Breeders and farmers agree on procedures for maintaining co-developed varieties

### Stages of a plant breeding program

