

Table 3. Participation of Farmers and Researchers in Setting Breeding Objectives

Specific breeding objectives	Breeding objectives set by	How breeding objectives are set (degree of participation)	Stage of involvement
<ul style="list-style-type: none"> • Developing of varieties for low water regime • Improving Masuli rice for disease tolerance and yield • Eliminating awns and increasing height in Pusa basmati rice • Improving grain quality of IR44595 • Improving CH-45 for disease tolerance, increased seed dormancy in yield 	<p>Researchers and Farmers</p>	<p>Experience from PCI research activities along with farmers' information on pests and diseases</p>	<p>Crop monitoring of PVS activities</p> <p>Market survey</p>
<ul style="list-style-type: none"> • On-farm conservation of rice landraces through value addition • Improvement for locally important traits in common landraces in Kaski, Bara, and Jumla sites 	<p>Farmers and Breeders</p>	<p>Farmers compared traits of different landraces, identified, prioritized the traits to be improved and conserved, followed by selection of specific landraces as parents while researchers selected which MVs to be used as male parents for addressing the desired traits</p>	<p>PPB field-level planning of activities</p>
<ul style="list-style-type: none"> • Drought tolerance in upland rice (Ghalya) in tar condition • Diversity deployment 	<p>Farmers and Researchers</p>	<p>PRA exercises</p>	<p>Pre-project period during diagnostic stage</p>
<ul style="list-style-type: none"> • Addressing lodging problem on Thulo piyanlo landrace of maize • Diversity deployment 	<p>Farmers</p>	<p>Initial objective set by researchers for cultivar deployment and introduction during the project design was changed by farmers after field activities were initiated, particularly during goal-setting exercise</p>	<p>Initial stage of project implementation</p>
<ul style="list-style-type: none"> • Addressing shattering problem in PPB product (M-3 rice) • Developing cold-tolerant, farmer-accepted variety 	<p>Farmers</p>	<p>Feedback from farmers who adopted the variety and experienced shattering problem</p>	<p>Monitoring of varietal spread</p>

set to improve M-3 using mutation breeding. Similarly, consultative participation involving mill owners as the users (reaffirmed by farmers in Chitwan) led to breeding work to improve Pusa basmati rice⁴ for awn reduction, and other varieties for market purposes (e.g., taste and price).

The breeding of high-altitude rice in Chhomrong demonstrated that women farmers were the main goal setters for the development of white-colored rice from the red peri-carped Chhomrong dhan (Sthapit, Joshi, and Witcombe 1996). Farmers of in situ sites at Kaski and Bara actively collaborated in setting breeding objectives and identifying landrace parents (table 3). Women and men

4. Adoption of Pusa basmati was low despite its high market price. A market survey indicated that mill owners did not want to mill Pusa basmati because of its long awn, which needs special adjustment of the milling device. The need for an awnless Pusa basmati with good flavor and aroma was thus realized.

farmers were instrumental in redefining the breeding objectives for maize in Gulmi (table 3), while in certain other cases, however, breeders had more say in setting breeding objectives, which were later verified with the farming communities (e.g., *chaite* and main-season rice in HPPS).

These examples indicate that the participation of farmers and researchers in different circumstances and stages is important if the right opportunity to influence breeding is to be captured. This requires continuous collaboration and commitment from those involved.

Diverse production environments within HPPS

LI-BIRD's experience shows that diverse, niche environments and different user choices do exist in the HPPS. For example, the Chitwan valley (150–250 m) of Nepal is considered a high-potential production system. However, through a series of PVS and IRD⁵ activities in a participatory crop-improvement project in Chitwan valley, it was found that Chitwan has different production environments for rice: low-lying swampy, rain-fed, partially irrigated, and well-irrigated areas. Variations in soil fertility and farmers' preferences also exist in these areas. Different technologies are needed for these conditions. In such circumstances, participatory crop improvement approaches have also been effective (DTZ Peida 1999), justifying the belief that PPB should not be limited to marginal production systems only (Witcombe 1999).

Diversity through PPB

As formal breeding systems aim for wider adaptability and uniform varieties, the promotion of uniform varietal technologies may reduce diversity. In HPPS, where a modern variety is widely grown (e.g., CH-45, a variety of *Chaite* rice grown in 98% of the project area), PPB has the potential to increase biodiversity (Joshi et al. 1998; Witcombe et al. 2000). Hence, PPB creates diversity, and this would help create sustainable production systems.

Participation

The breeding process involves the participation of farmers (women and men) and researchers at different stages of PPB for different purposes. Depending on the objective and nature of the work, the mode of participation may vary from one stage to another in the same PPB project (table 3). For quality participation, it is also important to establish and agree upon the roles and responsibilities of different actors/partners. LI-BIRD has experienced that having such an arrangement, even with grassroots organizations, actually enhances the participation of all those involved. Annex 'A' shows an agreement on various tasks between LI-BIRD and two community-based organizations, while annex 'B' shows those agreements between farmers and researchers (the Nepal Agricultural Research Council and LI-BIRD). An analysis of the strengths and weaknesses of the participating institutions also helps identify areas for capacity or skill building for the respective institutions, researchers, and farmers. Such kinds of partnership are increasingly becoming important in the context of developing a critical mass of researchers and sharing resources for PPB.

5. Informal research and development (IRD) is an informal and simple method of testing, choosing, and multiplying seeds of choice for development (Joshi and Sthapit 1990). IRD, first used at Lumle Agricultural Research Centre in Nepal, is now increasingly being used for variety testing and dissemination in marginal and high-potential environments in Nepal and India (Joshi et al. 1998).

Concerns about the institutionalization of PPB

Participatory plant breeding is considered to be parallel to the formal breeding system and is also viewed as competing for the same resources. Most formal-sector researchers/breeders have yet to realize PPB's importance and its potential for addressing food security. These may be some of the concerns limiting the institutionalization of the approach. For the institutionalization of PPB and its wider use as a complementary approach, it is necessary for PPB practitioners and advocates to make greater efforts to influence policymakers in the national research system and funding agencies. This may also require more collaborative PPB projects for different environments and crops. Exposing researchers to participatory approaches to crop improvement will also be necessary.

Concerns about the seed regulatory framework

It is not likely that all the PPB materials will satisfy the distinct (D), uniformity (U), and stability (S) requirements, which is essential for formal release.⁶ There are concerns that the seed regulatory system must be flexible to allow PPB products, such as farmers' varieties or landraces, to be recognized for further dissemination. However, in the context of a poor seed-supply system in the formal sector (less than 10% of the national seed demand is met by the formal system) and with farmers depending mainly on their own seed systems (i.e., informal seed-supply systems), the question may be asked whether it is necessary for PPB products to go through the seed regulatory framework, and also whether it would be commercially feasible to deal with a large number of varietal requirements for location-specific PPB products.

Concerns about pests and diseases

A general criticism of PPB materials is that they are prone to pests and diseases because they are not put through a disease-screening process as materials in conventional breeding programs are. It is, of course, important that care should be taken for any new material to be tested under any breeding program. But it may not hold true that only PPB products are subject to such problems. Experience has shown that even formally released varieties that have passed through a rigorous screening process may also succumb to pests and diseases within a short period after release. Instead, it can be argued that as PPB creates diversity and the products are locally adapted, the problem of pests and diseases in PPB products may be less serious than in a pure-line variety developed by conventional breeding. In modern farming, a single-crop variety is usually grown alone. In contrast, the genetic heterogeneity created by PPB may provide greater disease suppression when used over large areas. Zhou et al. (2000) demonstrated significant reduction of blast disease due to diversification of rice varieties in China. Nevertheless, it is still important to find ways of ensuring a minimum of pest and disease problems in PPB materials. To this end, LI-BIRD initiated a collaborative project with the National Rice Research Program (NRRP) and National Maize Research Program (NMRP) of Nepal Agricultural Research Council (NARC) for disease screening and field monitoring of PPB lines.

Conclusions

Participatory Plant Breeding is still an evolving approach. Since different PPB cases indicate substantial variations (Sperling 2000), it is not surprising to find differences among PPB practitioners

6. For a variety to be eligible for formal release, it has to be distinct (D), uniform (U), and stable (S), criteria that a PPB product may not be able to meet.