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# Participatory Plant Breeding: The Attractive Way to Breed for Marginal Farmers

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## Abstract

Participatory plant breeding originated in the early 1980s with a tendency to promote the concept of participatory research, in response to criticisms of the failure of the post-green revolution, on-station-based research to address the needs of poor farmers in the developing countries. The program can be categorized as consultative and collaborative, based on crop and availability of resources; involves scientists, farmers, others, such as consumers, extension worker, supplier, industry, and rural co-operatives. The participatory plant breeding approach represents an alternative aimed to improve local adaptation breeding, to promote genetic diversity, to empower farmers and other rural communities. The key benefit of participatory breeding is that appropriate cultivars are reached in the farmers' field in a shortened amount of time with enhanced the plant genetic diversity and thereby improves agricultural sustainability.

## Introduction

The crop improvement techniques of the green revolution produced input-responsive high yielding varieties that are highly uniform and yielded good results in the high potential environments or in the environment which could profitably be altered through the application of additional inputs. However, most of the low-resource poor farmers in the marginal area who could not modify their environment have not been benefited from these varieties. These marginal farmers continuing cultivation with their well adopted traditional reliable varieties and as a consequence reduced yields, crop failures, malnutrition, famine, and finally poverty still affect a greater proportion of humanity. In fact, around 2 billion people still lack reliable access to safe, nutritious food, and 40% of them are extremely malnourished (Reynolds and Borlaug, 2006). Therefore, as an alternative to centralized breeding, participatory plant breeding (PPB) is being adopted which offers an opportunity for farmers to make decisions which variety(s) they would like to adopt in their field. This approach reduced the time for variety release by half of the conventional method, resulted in higher adaptation rates, attributed to greater farmer ownership over the breeding process and pre-assurance that the varieties satisfy the needs of the farmers and their communities.

## Participatory Plant Breeding

The PPB is an extension of participatory variety selection (PVS), the processes whereby farmers are involved in selecting lines that they judge to be most appropriate for their uses from among a wide range of new cultivars that are being field-tested. In PPB, farmers are actively involved in setting goals, determine specific breeding priorities,

selecting or providing germplasm, conducting trials in their fields, selecting superior plants for further hybridization, make crosses, developing new variety as well as the commercialization of selected variety(s). Thus, participatory breeding is collaborative works between breeders and farmers, marketers, processors, consumers and policymakers. In this approach farmer's involvement is higher and more complex than the PVS and thus it has a higher empowerment effect than PVS.

PPB programs can be observed as consultative and collaborative (Witcombe, 2004). In the consultative approach, farmers are consulted at every stage to set goals and choose parents and involved in joint selections with breeders from the materials grown by breeders in the research station followed by growing the selected materials in the farmer's fields for PVS. The materials that are being tested can be both landraces and modern varieties. Farmers visit the breeders' research plots; comment on the new materials and also consulted to incorporate appropriate traits in the selected materials. In latter, farmers grow the wide range of PPB materials in their fields and select the best line(s) from the given population. The breeders obtain seeds from farmers to test these selections in the research station as well in the participatory trails. The choice of consultative or collaborative method depends on the crop and the availability of resources. The main goal of PPB is to increase the profitability of crop production through enhanced adoption of suitable cultivars among the farmers' community, to educate the farmers to enhance their skill, selection efficiency, and make them experts in quality seed production.

### Why Participatory Plant Breeding?

Conventional plant breeding is carried out by trained breeders in the laboratory or controlled environments, often under favorable farming conditions that lead to the development of high yielding varieties or hybrids. These varieties are suitable for a fairly homogeneous environment and poorly performed in the heterogeneous and risk-prone environment of the poor farmers. This is because; before fixing the research agenda, researchers usually don't discuss with the farmers for their needs as well as the climatic conditions. As a consequence, many varieties are developed and officially released, but only a few of them are adopted by farmers and often grow the varieties that were not officially released. Besides, variety development through these approaches takes longer times for release.

Therefore, the PPB was developed as an alternative and complementary breeding approach to conventional plant breeding to address the need of the poor marginal farmers and to increase the adoption of cultivars among the farmers' community. In PPB, breeders, farmers, and other consumers together involved in the variety development. This enables breeders to better understand the local farming conditions as well as the specific needs and preferences of the farmers.

The farmer's involvement in the early stages of variety development helps to eliminate many lines used in on-farm trials and as a consequence the final product is easily accepted and adopted by the farmers within a short period. Although PPB is particularly known for developing varieties to use in naturally harsh climates, it is equally successful in improving materials for use in high-yielding environments.

### Steps of Participatory Plant Breeding

The conventional breeding starts with the creation of genetic variability and evaluation of variable populations in the research station and select a few superior lines from these populations (Figure 1). Thereafter, these selected lines are evaluated for biotic and abiotic stress followed by yield comparison of the lines in more than one research station. When the number is reduced to around 10 to 20, these are evaluated in the farmer's field.

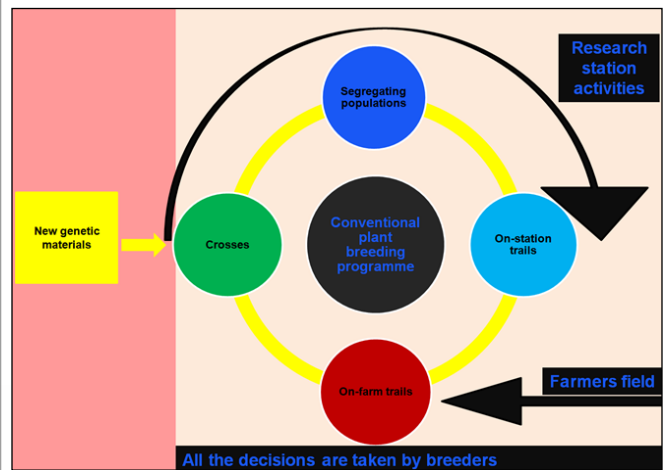


Figure 1: Conventional breeding approach for variety development

The decentralized PPB (Figure 2), breeding for target environment is exactly same as the conventional approach with three major difference viz., most of the activities are take

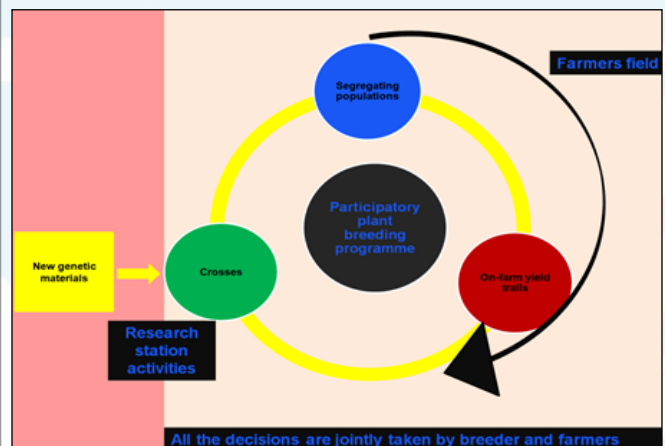


Figure 2: Participatory plant breeding approach for variety development

place in farmers' fields, all the decisions at different stages are taken jointly by the breeder and farmers and different materials can be evaluated by large number of farmers in a number of locations (Ceccarelli and Grando, 2009). Therefore, varieties are released by shorter period of time with higher rate of adoption. Since, different varieties are evaluated in different areas by a number of farmers, the biodiversity within the crop is maintains.

## Future Aspects of Participatory Plant Breeding

The PPB provides farmers with the opportunity to influence the development of technologies toward their specific needs, cultural preferences, and agro-ecological environments. The developed variety(s) meet the farmers' satisfaction, reach in their field quickly with a high adoption rate, resulting in increased yield stability and overall production, high market value, and increase inter- and intra-varietal diversity. However, national laws and policies often significantly limit the full advantage of the farmer's involvement in PPB. In most of the growing countries, a new variety to be registered must fulfill the standards of

distinctness, stability, and, especially, uniformity. Many of the PPB derived varieties can't satisfy these criteria but highly demanding and useful for farmers. As a consequence of the strict rule of plant variety registration limit the ability of farmers to exploit commercial markets for their PPB products. Therefore, to support the participatory approaches in plant breeding and to keep diversity-friendly advantages of the approach, appropriate policy and legal laws may be implemented.

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