Table 11. Comparative Preferred and Undesired Traits of Landraces Selected for PPB, 1998

Female parent	Valued traits	Negative traits to be improved	Male parent
Kaski			
Aanga	• Grows well in dry, marginal, and upland areas • Has medicinal value • soaked rice regarded as coolant in case of heat stress; straw has similar effect on animals	• Improve yield • Increase panicle length • Increase straw yield	NR 10291-6-1
Biramphool	• Fine grain • Aromatic rice • Adapted to *dhab* areas • Good eating quality • Adapted to low hill valley	• Increase panicle length • Improve yield • Reduce sterility	Himali
Ekle	• High yield potential • Tall plant height • High tillering • Good eating quality • Adapted to hillside	• Improve grain density • Improve aptability to warm water • Improve drought tolerance • Reduce crop duration	Khumal-4
Jetho budho	• Cooking quality and taste • Straw quality • Col -water tolerance	• Improve yield • Improve blast disease tolerance • Improve lodging tolerance	Pusa basmati
Mansara	• Adapted to low-input conditions • Rainfed and poor soils	• Improve yield • Improve taste	Khumal-4
Naulo madhise	• Easy for threshing • Grows well under rainfed conditions • Adapted to low hill valley	• Reduce sterility • Poor eating quality • Not responsive to fertilizer	IR36
Pahele	• Very good eating quality • Fetches premium price in the market • Good yield potential • Good straw yield • Health promoter: increases stamina of all age groups of people • Grows well even in moderate fertility and partially irrigated conditions • Adapted to valley bottom	• Improve resistance to stem borer • Improve resistance to blast disease • Improve grain density • Improve resistance to leaf folder • Improve fertilizer responsiveness • Reduce lodging in low-lying areas • Improve resistance to panicle brittleness	Sabitri
Sano gurdi	• Good eating quality • High milling recovery • Soft straw	• Improve tillering • Reduce sterility	Khumal-6
Thulo gurdi	• Tall plant height • Suitable for mat making • Good eating quality of old stock of rice • Good yield potential • Adapted to hillside	• Increase tillering ability • Increase yield potential • Improve responsiveness to fertilizers	NR 10286-20-3-3

Continued on next page

Table 11. Comparative Preferred and Undesired Traits of Landraces Selected for PPB, 1998 (Continued)

Female parent	Valued traits	Negative traits to be improved	Male parent
Bara			
Dudhe saro	• Good eating quality • High market price • Reasonably good yield	• Reduce plant height with improvement in lodging traits • Improve fertilizer responsiveness • Improve tillering ability	Pant 10 BG 1442
Nakhi saro	• Good eating quality • Reasonably good yield	• Improve plant height with improvement in lodging trait • Improve fertilizer responsiveness • Improve yield potential	IR36 Chiate-2
Rato basmati	• Aromatic • Very good eating quality • Fetches premium price in the market	• Reduce plant height • Improve tillering ability • Improve resistance to insects, e.g., stem borer, brown plant hopper, and to disease, e.g., blast	Basmati 385 Sabitri
Lanjhi	• Good eating quality • High market price	• Reduce plant height • Increase panicle length • Improve harvest index • Improve resistance to insect pests and diseases • Incorporate aroma	IR64 KIII
Mansara	• Good eating quality • Fetches premium price	• Reduce plant height • Improve yield • Improve grain quality • Improve resistance to insect pests and diseases	IR64 Rampur mansuli

Source: Joshi et al. (2000).

were carefully chosen to improve bad traits of landraces. These crosses have been made and F_2 generations are being evaluated on-site. Generations will be advanced using the equal-descent method, and heterogeneous fixed materials will be distributed to participating farmers for further selection.

Conclusions

If crop genetic resources are going to be conserved on-farm, it must happen as a spin-off of farmers' productive (development) activities. This means that conservation must be put into the context of development. It is assumed that PPB could contribute to the achievement of development goals and farmers' needs. At the same time, PPB could strengthen the process of on-farm conservation by securing the survival of genetic resources and enhancing biodiversity on-farm, as well as increasing productivity. PPB has the potential to educate humankind (farmers, local politicians, development workers, researchers, and policymakers) about the need for in situ conservation of local crop diversity. At the community level, farmers select their own seed and also exchange, barter, purchase, or hunt new seed from other farmers, relatives, or local traders. This informal seed system harbors relatively large amounts of genetic diversity. It has elements of crop conservation, crop development, and seed supply. Institutional breeders, however, rely on genebanks and exchange pre-breeding materials[11] with international agricultural research centers, whereas local breeders and farmers can rely on the products of PPB as a source of new genetic variation. PPB, therefore, could generate considerable farmer interest in in situ conservation. The PPB process could be a *de facto* interface between germplasm enhancement and utilization.

This case study demonstrates that the farming community could be motivated to participate in developing PPB processes, understanding the value of local crop diversity, and choosing preferred traits and landrace parents for PPB crossing programs. Choosing breeding goals with participatory methods may conflict with conservation goals; therefore, the choice of parents and number of crosses to be made should vary, based on the diversity of uses farmers are looking for. The categorization of local diversity by area covered and the number of growers for each cultivar is helpful for participatory goal setting. Farmers also see the value of maintaining the community biodiversity register because it helps to develop local conservation strategies.

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Cultivating the Landscape:
Enhancing the Context for Plant Improvement

Farhad Mazhar and Daniel Buckles

Abstract

The role of uncultivated plants in local food systems of Bengal is discussed, along with the concept of 'weed.' The authors describe the significance of uncultivated plants in local religious and social systems and their role in the broader context of crop improvement.

Bethua shak (*Chenopodium album* L. of the family Chinopodiaceae)[1] is not a cultivated plant in Bengal, but it's hard to imagine the rural cuisine of Bengal without this vegetable. It is an important leafy vegetable just like any cultivated cabbage or spinach. Its secure position in the food system of Bangladesh can easily be traced through many songs and stories, such as the *bhawaia* from North Bengal. There are few Bangladeshi who have not heard or are aware of the song.

Not long ago, the *bethua* was available in plenty. It used to grow along with winter crops in every field of potato, mustard, or lentil. Farmers considered it a partner crop and part of the total yield of a plot. It was not just consumed by the poor or during stress conditions when food was not readily available. Rather, it was an integral part of the food culture of Bengal.[2]

Consider, for example, the typical Bengali literary epics like "Monosha Mongol" and note what Sanaka, the wife of Chand Sawdagar, is cooking. The major place is given to the vegetables that are uncultivated. One by one she cooks 10 *shaks*, or uncultivated leafy vegetables, including the leaves of *chalta, bethua shak, gima shak, kumra shak*, etc. These are cooked as delicacies, as the supreme expression of her art of cuisine. Also see "Padma Puran" where Tarakasundai is cooking for Lakshmindar. She cooks *nalita shak, gima shak, kumra shak, helencha*, banana flower, and many others. The author says that if he lists all the food items the book will be too long and the poems may fail to describe the subtle elements of the plants and the art of cooking. This old literature clearly indicates that this knowledge belonged to a highly refined and sophisticated rural cuisine, despite deep class and gender differentiations.

In areas of contemporary intensive agriculture, *bethua* is no longer available, or if it is, rural people don't collect it because consuming it would mean consuming the pesticides applied to the field. Yet *bethua* and other uncultivated plants are still an important source of food for the poorest of the poor in the ecologically degraded rural areas of Bengal, once the high points of agrobiodiversity and local knowledge systems. It is clear from what research has been undertaken that the poor and the marginal populations retain the culinary art, knowledge, and skill that took hundreds of years to evolve. This article suggests that we recognize this vital context in our work with communities and when trying to improve crops.

Daniel Buckles is with the International Development Research Centre (IDRC), Ottawa, Canada. Farhad Mazhar is with UBINIG (Unnayan Bikalper Niti Nirdharoni Gobeshana) in Dhaka, Bangladesh.

1. In English *bethua* is known as lamb's-quarters, fathen, dog's tooth grass, goosefoot, etc. A close relative of this plant is *chandan bethua*, or betho (*Chenopodium ambrosioides Linn*). Another local name for this relative is chapali ghash. This is also an important source of uncultivated food for rural people, particularly under stressed conditions. *Shak* is the Bengali term for leafy green.
2. Although we have mostly drawn from our work in Bangladesh, we use the term "Bengal" to include the communities of West Bengal, India, as well, when we believe that similarities exist for cultural and historical reasons.

The concept of weed

Bethua is just one example from the long list of uncultivated vegetables used as food by rural communities in Bangladesh. The same is true of *helencha* (*harkuch*), *Enhydra fluctuaans* (Compositae); *kanaibanshi* (spider wort) *Commelina benghalensis* (Commelinaceae); *kantanote* (spiny pigweed, prickly amaranth), *Amaranthus spinosus*, Fam. Amaranthaceae; *dheki shak* (fern), *Dryopteris filiz-mus* (L.) Schott, Fam. Polypodiaceae; *shaknote* (pigweed, green amaranth) *Amaranthus viridis* L., Fam. Amaranthaceae; *malancha* or *heicha* (alligator weed) *Alternanthera philoxeroides* (Mart) griseb., Fam. Amaranthaceae. These are all leafy vegetables important in rural diets, but none of them are cultivated. Others are used as medicine. For example, the common plant *lazzaboti*, the "touch-me-not" legume, is extremely important in the lives of rural women. Almost all women know how to use it to treat leucorrhoea, a common gynecological problem.

To further highlight the cultural context, consider as well the special role of a particular plant in the life of a child growing up in the rural areas of Bangladesh. Imagine the plant known as *foshka begun* (*Physalis heterophylla* nees.) and its role in babysitting baby brothers. The older sister picks the soft green fruit of *foshka begun* and presses it against her brothers' forehead to make soft, funny sounds to keep him amused. The relationship built by the plant between the brother and sister has been ritualized in the ceremony called *bhai fota*. Sisters use the flower to make a stamp on the forehead of the brothers on a particular day of Bengal's calendar, using sandalwood paste. This is an example of how conservation of a plant having no economic use plays a role in cementing and celebrating the relationship between people.

Strikingly, *bethua* is classified as a "weed" by Bangladeshi scientists.[3] While it is true that communities identify plants that they do not want in their fields, there is no notion of "weeds" in the Bangla language in the sense that the plants are completely useless or absolutely unwanted. The term *agacha* is used by farmers to refer to plants that are not intended for cultivation, but not to imply that the plants must be totally removed from cultivated fields. The farmer's perspective reflects the ecological, historical, cultural, and spiritual dimensions of agriculture. First of all, each and every being is part of a living reality, with a "place" in the order of the world that constitutes the community. Declaring a plant a "weed" implies that the life experience with that plant is also useless. Keeping these places in the order of the world secured is the first condition by which human communities ensure the conservation of plants, whether they satisfy an immediate need or not. Second, there are always specific individual and community needs different plants can fulfil. Different plants are recognized by different people for collection, or domesticated to meet the needs of human beings and other life forms. What are seen by some agricultural scientists as "weeds" actually make up part of the "harvest" from a piece of land. Equally, there are the needs of animals, birds, and other life forms that use plants that have no direct use to human beings. Third, the human relationship with plants is not static. There are multiple experiments going on with plants within communities in a dynamic relationship. These experiments are not undertaken simply to meet the functional needs of the community. They may be undertaken out of intellectual curiosity, as symbolic inspiration for spiritual and cultural experience, or for ethical reasons, since many communities believe that taking care of plant and animal life forms is a way to seek the meaning of human existence or communion with God. Finally, the notion of "weed" has no technical validity. We now understand from ecology that under most conditions, all plants in agricultural fields play a role in

3. The book *Weeds of Bangladesh* (Karim and Kabir 1995) published by the Bangla Academy lists *bethua* as a weed in agricultural fields, without even mentioning its role in Bengali culture and cuisine.

the recycling and conservation of nutrients and soil moisture. For example, farmers may opt to leave plants undisturbed in the soil during certain stages of crop development to avoid losses of soil moisture that would result from uprooting. In terms of agricultural practice, these plants are managed, not destroyed.

The dynamics of local food systems

The general point raised by the *bethua* illustration is that the boundary between cultivated and uncultivated plants is continuously blurred and redrawn. Botany and zoology, through the taxonomic classification of plants, animals, and aquatic species, have contributed enormously to our understanding of the diversity of life forms in nature. The introduction of an ethnological perspective to these disciplines has added scientific sensitivity to the depth of knowledge held by local and indigenous peoples regarding the characteristics, habitat, and multiple uses of these life forms, as well as non-Western systems of nomenclature and classification. The sharp focus of this perspective on species diversity is a strength because the biological distinctions and the local knowledge of these distinctions enriches our understanding of nature. However, this focus is also a weakness because it overemphasizes the distinction between nature and culture and reinforces the misleading notion of "wilderness" and "wild food." Science is now realizing that both historically and in the contemporary age, few environments and species evolve completely independently of human influence and management. In many settings the forests, savannas, and other landscapes have developed in coevolutionary relationships with human beings. Species that at one time were considered "wild" are now recognized as having been carefully nurtured by people (Leimar Price 1997; CGIAR 1999). This observation tells us that there is no clear division between "domesticated" and "wild" species. It also has a political dimension because it forces us to recognize both the intellectual and material rights local peoples have to all of the resources in the environment where they live and work—and those, such as sacred areas, that they manage through cultural means and practices.

The dichotomy of the domesticated and the wild contributes as well to the misleading notion that agricultural communities are based solely on the production and consumption of a few "staple" foods. While it is often assumed that between seven and 30 crops provide the largest proportion of the world's food, recent analysis suggests that the importance of staple crops in a community's food system is greatly overestimated (Scoones, Melnyk, and Pretty 1992). Research by Christine and Robert Prescott-Allen (1983) suggests that 90% of the world's plant food supply is provided by 103 species. Furthermore, it is now recognized that "partner species" to cultivated crops play a critical role in food and livelihood security, similar to that of semidomesticated livestock, not only during times of stress but as regular sources of nutrition as well.

Understanding the contributions of uncultivated food to food security is crucial to reframing the debate around food production in the context of diverse and dynamic local food systems. One dimension of these systems is the way in which the informal rules, customs, and social and institutional hierarchies within communities and the cultural practices of communities regulate local access to the biological resources of the community for food. These common property regimes are especially vital to the rural poor who depend upon access to common lands and bodies of water for the uncultivated plants, animals, and fish they need for food.

Another dimension of local food systems is that the dominant farming practices have an enormous influence on the availability and safety of uncultivated foods. The extensive use of pesticides to grow a single crop such as rice destroys not only the leafy greens in the field but also the plants